2ND INTERNATIONAL CONFERENCE ON EMERGING TRENDS IN ENGINEERING, MANAGEMENT & SCIENCES (ICETEMS-2016)

BRIDGING GAPS THROUGH MULTI-DISCIPLINARY RESEARCH AND INNOVATION

DECEMBER 28-29, 2016

PROCEEDINGS

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PROCEEDING BOOK OF

2ND INTERNATIONAL CONFERENCE ON EMERGING TRENDS IN ENGINEERING, MANAGEMENT & SCIENCES
(ICETEMS-2016)

PROCEEDINGS of the

Second International Conference on Emerging Trends in Engineering, Management and Sciences (ICETEMS-2016)

"Bridging Gaps through Multidisciplinary Research and Innovation"

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Peshawar, Pakistan

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Organized
by

City University of Science and Information Technology Peshawar Pakistan

in
Collaboration
with

McWhorter School of Building Science
Auburn University
Auburn, Alabama, USA

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Foreword

Today, the developing world is faced with multitude of challenges, which include modernizing infrastructures, enhancing technological resources, and developing human assets to attract more Direct Foreign Investment (DFI). Though the Governments are investing a lot of resources to cater with these problems, yet sustainable and cost effective solutions are still not explored. This certainly requires collaborative and integrated efforts of Engineers, Managers, Scientists, Policy makers, industrialists, business community etc. City University of Science and IT initiated a Conference series under "International Conference on Emerging Trends in Engineering, Managment and Science (ICETEM) in collaboration with East Caroilna University and Aubrun University USA in 2014. The first conference of the series *(ICETEMS-2014)* was held on Dec 28-30,2014 at Pak-China Friendship Centre Islamabad.

It is a mattter of great pleasure for the organizng committee of *(ICTEMS)* that the second Conference of the series *ICETEMS -2016,*is being held at City University Peshawar. ICETEMS, is an endeavor to bring together all major stakeholders of the society for exchange of thoughts and experiences regarding the concepts, trends and practices pertaining to the major areas of Engineering, Management and Sciences. This is also reflected in the theme of the conference *"Bridging Gaps through Multidisciplinary Research and Innovation"*

In this conference, more than200 papers relating to Civil Engineering, Electrical Engineering, Management , Computer Sciences, Mathematics and Education etc will be presented. Key note speakers from USA, UK, Germany, Malaysia, Hong Kong, Afghanistan and Pakistan will share their research and expertise with the audience. It is intended to organize the *ICETEMS* series of conferences worldwide at regular intervals.

We sincerely hope that you will continue to support our these efforts.

Thanks and best regards,

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Peshawar, Pakistan, Dec 28-29, 2016.

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Strength development of Binary cement concrete containing Pulverised Fly Ash as a partial replacement of Portland cement

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Abstract

The use of Binary Cement concrete incorporating Supplementary Cementitious Material (SCM) has been increased to reduce the cement consumption in construction industry. The cement production is the major source for the generation of Green House Gases (GHG) and there is an increasing pressure to reduce its consumption to avoid further Global Warming, Climate Changes etc. In this research, Pulverised Fly Ash (PFA) was used as a partial replacement to cement in concrete. The Portland cement was partially replaced by PFA in three different percentages and was cured in sealed bags at room temperature of 20 $^{\circ}$C to minimise the loss of moisture. Due to low early age strength gain of concrete containing GGBS and PFA, their use in the fast track construction and post tensioned concrete where they are exposed to high early age loads is limited. To overcome this problem, the water/cement ratio of the concrete produced was kept low to achieve higher early age and ultimate strength which also adds to the durability properties of concrete. To achieve the maximum workability, superplasticiser was used.

The strength development characteristics of the blended concrete has been compared with control mix having no PFA The compressive strengths of blended concrete for various levels of cement replacement has been observed as nearly the same as the control concrete mix.

Keywords: Supplementary Cementitious Material, Green House Gases, Pulverised Fly Ash, Blended concrete, Post Tensioned Concrete.

1. Introduction

According to The Concrete Centre (2010), the amount of embodied CO_2 (ECO2) of concrete, is a function of the cement content in the mix designs. Hence more production of concrete will lead to more cement consumption and generation of CO_2. To reduce cement contents in concrete, various Supplementary Cementitious Material (SCM) are used which include Pulverized Fly Ash (PFA) as well.

"Sustainable Development" was defined by Brundtland Commission (1987), as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The extensive emission of Green House Gases (GHG), due to industrialization and use of fossil fuels in automobiles has led to Global Warming, Climate Changes and other environmental degradations, which has further intensified the need for sustainable development. (Struble.L. and Godfrey.J. (2004). Embodied CO_2 (ECO2), is the measure of the amount of CO_2 emissions generated from the energy needed for the raw material extraction, processing, transportation, assembling, installation, disassembly and deconstruction for any system over the duration of a product's life (Sustainable concrete (2011). There is a general understanding that one tonne of cement production leads to almost one ton of CO_2. Concrete as construction material has been one of the major input for socio-economic development of societies. It is the second largest used material after water and it stand at two tonne per capita per year. Harrison, A, J.W (2003) To offset the negative impacts of the cement production and reduce the cost of concrete, construction industry and concrete technologist around the world has been attempting to explore

cementitious and pozzalonic material. In this context, Ground Granulated Blast Furnace Slag (GGBFS) and Pulverized Fly Ash (PFA) has been extensively used during last two decades. Poon [8] used Low Calcium High Volume Fly Ash (HVFA) for high strength concrete and achieved a 28 days compressive strength of 83 MPa. The High loss on Ignition (LoI) value for Fly Ash severely affects the compressive strength and creep of concrete when used as replacement of cement in concrete. The unburnt ash particles increase the water requirement and reduces the compressive strength as well. To reduce this impact, High Range Water Reducers (HRWR) have been used. Malhorta (1980). Lee & Wu(1992).

According to the information given in the United Kingdom Quality Ash Association (UKQAA) (2004), PFA is a by-product obtained at power stations and is a solid material extracted by electrostatic and mechanical means from flue gases of furnaces fired with pulverised bituminous coal. It is carried by the exhaust gases and recovered as fly ash with fine particles. According to Thomas (2010) the use of fly ash as supplementary cementing material in concrete has been known from the start of last century but the first research in fly ash was conducted at the university of California by Davis et al (1937) and the first significant utilization of fly ash in concrete began with the construction of the Hungry Horse Dam in Montana in 1948. The production of the material has been changed to reduce the gaseous emissions in recent years but has not affected the nature of PFA except it has increased the loss on ignition (LOI). The standards and specification of PFA are covered under BS EN 450-1(2012).

PFA has been used widely as cementitious material in construction industry. Dhir et al (1986) found that PFA fineness affects the strength of concrete and the strength of PFA concrete is reduced by using coarser PFA. In order to take care of the effect of PFA fineness on strength they developed a simple procedure of varying the water content, cement content or both. Kayali and Ahmed (2013) prepared concrete mixes by replacing PC with different percentages of Fly ash. The water/cement ratio was 0.38 for all the concrete mixes and the total amount of cementitious material content was kept constant for all the mixes and was equal to 450 kg/m3. The concrete samples were cured with fog for seven days and then they were air dried till the age of 28 days for testing. They reported that there was a decrease in the compressive strength of concrete made with fly ash and this decrease was increased with the replacement level of fly ash.

Fly ash has been extensively used a partial replacement to cement in concrete, firstly to reduce the cement consumption in concrete and thereby making it relatively sustainable material and secondly increasing the mechanical properties of concrete in fresh and hardened forms Malhotra and Mehta (2005).

In this research, the effects of the partial replacement of cement with PFA on strength development of concrete cured at room temperature of 20oC in sealed plastic bags to minimise the loss of moisture. The use of PFA in concrete tends to slow down the early age strength which limits its use in the fast track construction and post tensioned concrete which are subjected to high early loads. Early age strength of concrete containing PFA can be increased by reducing the water/cement ratio.

2. Research Significance

There is limited research work undertaken on effect of compressive strength and strength development characteristics of concrete incorporating PFA. The non-uniform physical properties of PFA found in various parts of the world also affects the performance of concrete produced. It is expected that the results of the research will add to the existing data on use of blended cement in concrete and its performance under controlled curing condition. The early age strength of blended concrete is relatively less than the normal concrete, which restricts its use in many important projects. Based on various trial mixing, the optimal level of water cement ratio, chemical admixtures and replacement of cement by PFA has been established. This will help in further research in standardizing the properties and mixing of the concrete made with blended cements.

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3. Experimental Program

3.1 Material

3.1.1 Pulverised Fuel Ash (PFA)

PFA conforming to BS-EN 450-1(2012) was used as binary cement component in the production of concrete. PFA used in the concrete is commercially available in the UK and is classified as CEM IV according to BS EN 197-1 (2011).

3.1.2 Portland cement

Ordinary Portland cement (OPC) used conformed to BS EN 197-1 and was classified as CEM-I. The Portland cement was stored in the laboratory to avoid exposure to humidity.

3.1.3 Superplasticiser (SP)

High performance liquid superplasticizers conforming to BS-EN 934-2, to achieve the required workability.

3.1.4 Aggregates

Graded natural sand with a maximum particle size of 5 mm and complying with the requirements of BS EN 12620-1 (2009) was used as fine aggregate in the concrete mixes. Thames valley natural aggregates of lime stone were used as coarse aggregate in the concrete mixes. The maximum size of the aggregate used was 20 mm.

3.2 Concrete Mix Proportions

Concrete was designed to achieve an equal 28 days compressive strength of 40 MPa and the strengths of 10 MPa after 16 hours and 25 MPa after 38 hours to meet the practical requirement of post tensioned concrete beams. The concrete mix proportions are shown in Table 1. To achieve a practical level of workability and cohesion, suitable for pumping, concrete was designed for a target slump of 200 mm. Superplasticiser was used to minimise water and cement contents to achieve low free w/c ratio.

Table 1 Concrete Mix proportions

CONSTITUENT MATERIALS, Kg/m³								
Free Water	Cement Constituents		Aggregates			w/c Ratio	Super plasticiser	Calculated Density
Litre	PC	PFA			Coarse	Fine	ml/100kg cement	kg/m³
CEM I (100PC), PC 375 kg/m3 @w/c 0.40								
150	375	-	-	-	1370	520	0.40	500	2415
90PC/10PFA@w/c0.4								
154	345	40	-	-	1360	515	0.40	525	2410
80PC/20PFA@w/c0.35								
150	345	85	-	-	1230	635	0.375	925	2410
70PC/30PFA@w/c0.28								
135	340	145	-	-	1180	635	0.35	1300	2425

3.3 Test Samples

Two batches of concrete were made for each concrete mix, to cast samples. 100 mm cubes were cast for each mix to measure the compressive strength development according to the British standard test method (BS EN 12390) , at the age of 1,2,3,5,7,14,28 and 56 days.

3.4 Curing Environments

Concrete samples were cured soon after casting at a room temperature of $20^oC \pm 2\ ^oC$. The concrete samples were demoulded after 24 hours and then they were sealed in plastic bags for curing. The concrete cubes were sealed in bags to minimise the loss of moisture from concrete.

4. Results & Discussion

The result of the strength for various mixes of concrete are tabulated in Table 2. Strength development for PFA concrete mixes 90PC/10PFA, 80PC/20PFA and 70PC/30PFA cured under the regime explained above are compared in Figure 1.

PFA concrete has shown that the early age strength development is slow due to the apparent slow pozzolanic reactions between PFA and the lime $(Ca(OH)2)$ generated by the PC concrete. The strength of 90PC/10PFA, 80PC/20PFA and 70PC/30PFA concrete mixes are 25.5 MPa, 25.5 MPa and 34 MPa respectively at the age of 3 day as compared to 34 MPa for the, 100PC-control concrete mix. At 14 days of age the strengths increased to 31.5 MPa, 38.5 MPa, 46MPa and 46.5 MPa respectively. At 28 days of age, these strengths further improve to 41MPa, 42.5 MPa, 55 MPa and 51.5 MPa respectively. The difference in the compressive strengths at 28 days for PFA concrete and 100PC concrete is relatively less. For 70PC/30PFA at w/c ratio of 0.28, the blended concrete has achieved the maximum 56 days compressive strength of 65MPa, as compared to 57.5 MPa for 100PC with no Fly Ash. The strength gain in PFA concrete is maximum during 28 and 56 days of age.

Table 2 Strength of concrete at different

Compressive cube strength, MPa							
Age at test, days							
1	**2**	**3**	**5**	**7**	**14**	**28**	**56**
CEM I,(100PC)375 kg/m³@ w/c 0.40							
17.0	25.0	34.0	41.0	45.5	46.5	51.5	57.5
90PC/10PFA@ w/c 0.40							
13.0	22.0	25.5	26.5	29.0	31.5	41.0	44.5
80PC/20PFA@ w/c 0.35							
16.5	24.0	25.5	28.0	30.5	38.5	42.5	46.0
70PC/30PFA@ w/c 0.28							
20.0		34.0	38.5	41.0	46.0	55.0	65.0

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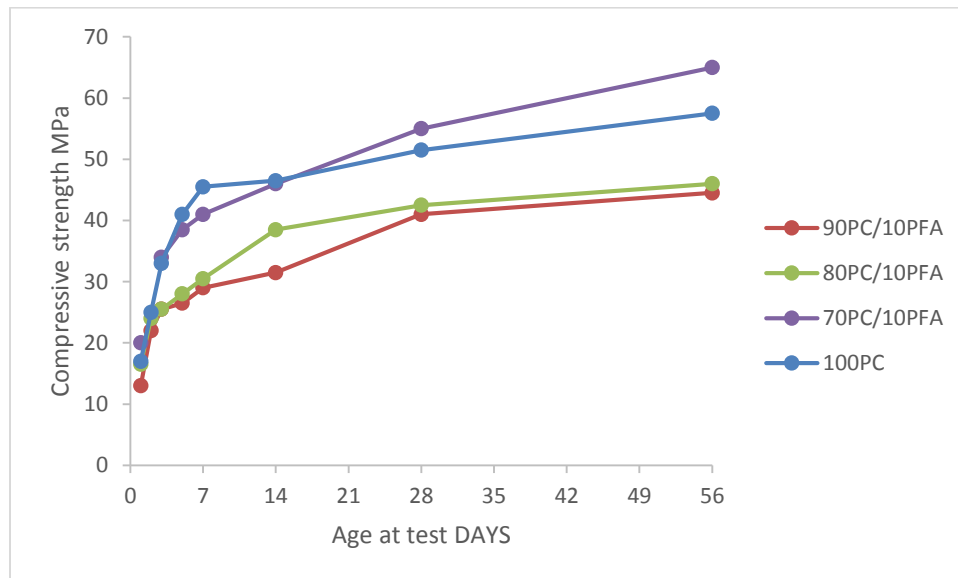
Figure 1 Strength development

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Strength development of High Strength Structural Concrete using Ground Granulated Blast Furnace Slag as a partial replacement

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Abstract

Concrete is the most important building material in the world due to the fact that it is versatile and gives architectural freedom. For sustainable construction solutions concrete is the material of choice if the embodied CO_2 content is considered. In concrete, cement is the main constituent and due to the limit on the availability of natural minerals used, the energy released and the CO_2 emissions produced during its manufacture, it can be partially replaced using industrial by-products e.g. Pulverised Fuel Ash (PFA), Ground Granulated Blast furnace Slag (GGBS) and silica fume. The concrete technology research has demonstrated that GGBS and PFA can be used as PC replacement in composite mixes, without any adverse effect on the strength of structural concrete. On the other hand, carefully designed composite mixes can improve the microstructure of concrete and, hence, its durability of concrete (e.g. structures subjected to chemical attack), and they can also enhance the structural properties of concrete.

Due to low early age strength gain of concrete containing GGBS and PFA, their use in the fast track construction and post tensioned concrete where they are exposed to high early age loads is limited. To overcome this problem, the water/cement ratio of the concrete produced was kept low to achieve higher early age and ultimate strength which also adds to the durability properties of concrete. To achieve the maximum workability, superplasticiser was used.

Keywords: Architectural Freedom, Pulverised Fuel Ash, Ground Granulated Blast furnace Slag, silica fume, Durability, Post Tensioned Concrete.

1. Introduction

According to the Brundtland commission (1987) Sustainable development is the development of the present generation for their needs without jeopardising those of future generations. The main aim of the research is to minimise the embodied CO2 (ECO2) of structural concrete. Concrete is an important structural material composed of cement, aggregate and water. During the last century concrete technology has gained importance, due to which researchers are developing methods for making concrete. In concrete, cement is the main constituent and due to the limit on the availability of natural minerals used for making cement and due to the emission of CO_2 produced in the manufacturing of cement, research is focussed on partially replacing Portland cement in concrete by ground granulated blast furnace slag (GGBS) and silica fume. Processing of this by-products into quality materials avoids the need to landfill. GGBS is a by-product from the manufacture of iron in the blast furnace and PFA is a by-product from power stations, where furnaces are fired with bituminous coal. GGBS is available in large quantities and are mostly used in ready mix or precast concrete. As GGBS is a by- products it reduces the embodied CO_2 of concrete, when added as partial replacement of cement in concrete. According to BS EN 197-1(2011) "Granulated blast furnace slag is made by rapid cooling of a slag melt at suitable composition, as obtained smelting iron ore in a blast furnace and contains at least two-thirds by mass of glassy slag and possesses hydraulic properties when suitably activated. Granulated furnace slag shall consist of at least two-

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thirds by mass of the sum of calcium oxide (CaO), magnesium oxide (MgO) and silicon dioxide (SiO_2). The remainder contains aluminium oxide (Al_2O_3), together with small amounts of other compounds. The ratio by mass $(CaO + MgO)/SiO_2$ shall exceed one. GGBS is obtained by finely grinding granulated blast furnace slag." According to BS EN 197-1(2011), different types and composition of blast furnace slag cement are presented in Table 1.

Table 1 Types and composition (% by mass) of Blast furnace slag cement after BSEN 197-1(2011)

Designation	Notation	Clinker	Blast furnace slag	Minor additional constituents
Blast Furnace Slag	CEMIII/A	35-64	36-65	0.5
	CEMIII/B	20-34	66-80	0.5
	CEMIII/C	5-19	81-95	0.5

According to BS EN 15167-1(2006), the chemical requirements of GGBS shall conform to those given in Table 2. According to clause 5.3.1 the fineness of GGBS shall not be less than 275 m²/kg. These chemical requirements of GGBS are very important for it to be used in concrete.

Table 02 Chemical requirements of GGBS as characteristic values after (Table 1 BS EN 15167-1:2006)

Property	Test reference	Requirements[a]
Magnesium Oxide	EN196-2	≤ 18%
Sulphide	EN196-2	≤2.0%
Sulphate	EN196-2	≤2.5%
Loss on ignition, corrected for oxidation of sulphide	EN196-2	≤3%
Chloride	EN196-2	≤0.1%
Moisture Content	EN196-2	≤1.0%

[a] Requirements are given by mass of ground granulated blast furnace slag

Hooton (2000) found that the slump of GGBS concrete is unaffected compared to PC concrete but slag concrete is much easier to compact by vibration and is therefore considered to be more workable. Due to the improved workability of slag concrete, the entrapped air content is lowered. The GGBS concretes are easy to finish because of the higher fines content but at higher replacement levels and ambient temperatures (< 15 °C) setting times can be extended up to one or two hours. GGBS concrete with higher replacement (50 % and above) or placed at lower temperature needs extra curing, if bleeding and finishing times are extended significantly.

Johari et al (2011) found that at the age of one day, the relative strength of GGBS with 20 %, 40 % and 60 % replacement was 72 %, 45 % and 4.6 % respectively of the Portland cement concrete. The lower early age strength was due to the slower reactivity of GGBS and due to its dilusion effect.

Khatib and Hibbert (2005) found that the early age strength gain of concrete containing GGBS decreases with increasing percentage of GGBS in concrete but the strength between 28 days and up to 90 days increased compared to the PC concrete. The replacement level of GGBS up to 60 % was beneficial and beyond that the strengths were very low.

Chu (2007) concluded that from a structural point of view, GGBS replacement reduces heat of hydration, enhances durability, including higher resistance to sulfate and chloride attack, when

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compared with normal concrete. On the other hand, it also contributes to environmental protection because it minimizes the use of cement during the production of concrete.

Hanson cement (2010) considered that the production of 100 m^3 concrete used 32 tonnes of cement. Replacing 50 % cement with GGBS saves 12.96 tonnes of CO_2 and this is equal to taking 42 cars off the road for one year or equal to 41 years of electricity usage in the average home.

According to Chen (2005) the data published by the Building Material Research Centre of the Aachen University of Technology in Germany, using industrial by products in cement can result in significant savings in energy and reductions in CO_2 emissions. By using 60 % blast furnace slag in blended cement, reductions in energy consumption of around 43 % and in CO_2 emissions of about 50 % in the production of 1 m^3 of concrete of strength class C25/30 can be achieved (Taking account of the transportation of the aggregate over a distance of 40 km and cement over 80 km).

A review of the research on the strength development of concrete containing GGBS is presented in this paper.

2. Research Significance

Very limited data is available on the strength development of high strength concrete containing GGBS and chemical admixture. This research will add data to the current research and provide guidance and motivation to the construction industry for the use of sustainable concrete.

3. Experimental Program

3.1 Material

3.1.1 Ground Granulated Blast Furnace Slag (GGBS)

GGBS is a by-product obtained during the manufacture of iron in the blast furnace. GGBS is economically available in large quantities and suitable for production of large quantities of ready-mix concrete at site in precast product manufacturing. The granulated slag is dried and ground to a fine powder that is called GGBS. It is off-white in colour and has a bulk density of 1200 kg/m^3.

3.1.2. Portland cement

Ordinary Portland cement (OPC) used conformed to BS EN 197-1 [21] and was classified as CEM-I. The Portland cement was stored in the laboratory to avoid exposure to humidity.

3.1.3 Superplasticiser (SP)

High performance liquid superplasticizers conforming to BS-EN 934-2, to achieve the required workability.

3.1.4 Aggregates

Graded natural sand with a maximum particle size of 5 mm and complying with the requirements of BS EN 12620-1 [22], was used as fine aggregate in the concrete mixes. Thames valley natural aggregates of lime stone were used as coarse aggregate in the concrete mixes. The maximum size of the aggregate used was 20 mm.

3.2 Concrete Mix Proportions

Trial mixes of concrete were re designed to achieve the 28 days compressive strength of 60 MPa. In these concrete mixes overall maximum water/cement ratio was kept as 0.35. To achieve a practical level of workability and cohesion, suitable for pumping, concrete was designed for a target slump of 200 mm. A superplasticiser was used to minimise water and cement contents to achieve low free w/c ratio. Mix proportions and details of the mixes are presented in Table 3.

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Table 3 Concrete Mix Proportions

Mix	water	Binder		Aggregates		w/c	Super plasticiser	Density
	Litres	OPC PFA	GGBS	Coarse	Fine		ml/100kg of OPC	kg/m^3
70PC/30GGBS (30% GGBS)	160	320	137	1285	500	0.35	1200	2400
60PC/40GGBS (40% GGBS)	160	274	183	1285	500	0.35	1200	2400
50PC/50GGBS (50% GGBS	160	229	228	1285	500	0.35	1200	2400
100PC-Control (No GGBS)	160	457	-	1285	500	0.35	1200	2400

3.3 Test Samples:

Two batches of concrete were made for each concrete mix, to cast samples. Sixty 100 mm x 100 mm cubes were cast for each mix to measure the compressive strength development according to the British standard test method (BS EN 12390) [23],F at the age of 1,2,3,5,7,14,28 and 56 days cured under different curing regimes.

3.4 Curing Environments

After casting concrete in the moulds, it was stored for 24 hours at a laboratory temperature of about 20 ± 2 ºC and covered with plastic sheets to minimize the loss of moisture. After 24 hours concrete was demoulded and sealed in air-tight plastic bags so that there is no loss of moisture and stored at a laboratory temperature of 20 ºC. This curing environment is shown in Figure 1.

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Figure 1 Test Cubes cured at room temperature 20ºC

4. Observations and Analysis

4.1 Compressive strength development of GGBS concrete

Two cube specimens from each mix and curing regime were tested for compressive strength using an Avery Denison 2500 kN machine as shown in Figure 2. In the case of more than 10 % difference in two results a third specimen was also tested. The specimens were loaded at a rate of 0.4 N/s until failure, following the method described in EN 12390-3 (2009).

Figure 2 Compressive strength Test using Avery Denison 2500 kN machines.

5. Results & Discussion

The strength for various mixes of concrete are shown in Table 4. The strength development of GGBS concrete is compared with PC for different mixes in Figure 3.

5.1. Strength development of GGBS concrete:

- The strength development in GGBS concrete at the early ages decreases with the increase of GGBS content as compared to PC. There is a marked difference in strength gain between the 3, 7 days compressive strength, however this difference is negligible at 28 days. This shows that initially the strength gain of GGBS concrete is slow but it enhances at high speed between 7 and 14 days. The specified strength of GGBS concrete at 28 days is more than PC, which supports its use for structural concrete and other major works. The 56 days compressive

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strength is highest for 60PC/40GGBS , which represents the optimum level of cement replaced by GGBS.

- The maximum cement saving has been achieved for mix 50PC/50BBGS, which has reduced the cement consumption by 50% i.e. 229Kg/m^3. The 28 days compressive strength under summer condition of curing for 50PC/50GGBS is almost the same as 100PC with no GGBS. The gives greater opportunity for saving of cement and thereby reducing the emission of GHG.
- The average 56 days strength of GGBS concrete under summer environment of curing is more than PC for all mixes.
- It can be seen that all the concrete mixes, except 50PC/50GGBS have satisfied the requirement of 25 MPa, compressive strength after 38 hours.
- Except 50PC/50GGBS, all of the other concrete mixes had strengths in the range of 18 to 43 MPa at the age of one day which is enough to be used in fast track construction.
- It can be seen from Figure 5 that all of the concrete mixes have nearly the same 28th day strength but there is a greater increase in the compressive strength of 60PC/40GGBS than the other mixes at the age of 56 days.
- It is concluded that the concrete containing 30 %, 40 % and 50 % GGBS gains more strength than the PC concrete after the age of 28 days which is according to the earlier research [24].
- At the age of 56 days, the strengths of 70PC/30GGBS, 60PC/40GGBS and 50PC/50GGBS are 5 %, 15.5 % and 3.5 % higher than the 100PC-Control concrete mix respectively.

Table 4 Compressive strength development expressed as percentage of 56 days strength

1 D	38 hr	2 D	3 D	5 D	7 D	28 D	56 D	Difference (MPa/%)
70PC/30GGBS								
24.5	32.0	37.0	49.5	-	56.5	68.5	74.0	5 (6%)
33%	*43%*	*50%*	*67%*		*(76%)*	*(93%)*	*(100%)*	
18.5	30.0	38.5	45.5	-	58.5	-	81.5	13.5 (16%)
(23%)	(37%)	(47%)	(56%)	-	(72%)	-	(100%)	
9.0	20.5	28.5	-	46.0	53.5	68.0	73.0	10.5 (15%)
(12%)	(28%)	(39%)		(63%)	(73%)	(93%)	(100%)	
43.5 (62%)	49.5 (70%)	54.0 (77%)	58.0 (82%)	-	67.0 (95%)	69.0 (97%)	70.5 (100%)	0.5 (<1%)
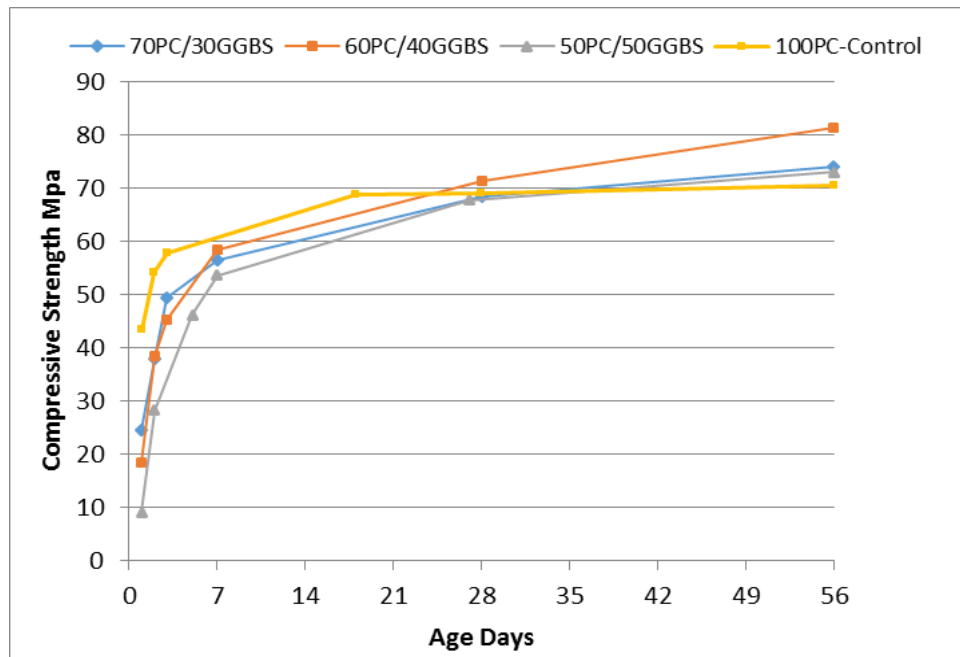
Figure 3 Strength development of concrete mixes

6. Conclusion

- Partial replacement of cement by GGBS up to 50% has little impact on the compressive strength at 56 days, as the compressive strength achieved has a reasonable value for use in structural works. This can offer greater opportunity for saving of cement and CO2 emissions, thereby making concrete relatively sustainable.
- The strength development results show that at low water/cement ratio (0.35), concrete containing GGBS up to 50 % gains enough high early age strength to be used in post-tensioned concrete and fast track construction.
- From the compressive strength development of GGBS concrete results, it is concluded that concrete containing GGBS up to 50 % has almost the same 28 day compressive strength as PC concrete, when cured at (20 ℃) and gains more strength than the PC concrete at the age of 56 days. Concrete containing 40 % GGBS has the highest compressive strength compared to the other concrete mixes at the age of 56 days and is 15.5 % more than the strength of PC concrete.
- The strength gain in GGBS concrete is more obvious between the ages of 28 and 56 day. This supported the earlier research on use 56 days compressive strength of blended concrete.

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Experimental Investigation of Local Scour Dimensions Around Bridge Pier

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Abstract

One of the main causes of bridge failure that is exponentially powerful is the removal of waterway bed material from around bridge foundations. Bridge piers that are located on highly or partially erodible beds are subjected to failure due to scour caused by the structure obstructing flow. Measurement of scour depth around the pier in the field is a difficult task but the same can be modeled in the laboratory on small scale with controlled conditions of flow, fluid, sediment parameters and structure geometry. Since bridge pier scour depth measurement is an important area of hydraulics and needs to be addressed and also in Pakistan no laboratory work has been carried out till date for measurement of pier scour depth around bridge pier, therefore the same was selected in this research.

In this research, the piers for two bridges including Motor Way Bridge on Kabul River and Khairabad Bridge on Indus River are modeled in the hydraulic laboratory of Civil Engineering Department, University of Engineering and Technology Peshawar and the scour depth is measured. In the same study the effect of pier shape and size on the bridge pier scour depth is also investigated. It was found that the scour depth for circular pier is always smaller than the scour depth for square depth keeping the other factors constant. Similarly, it was found that the scour depth increases with the increase in size of the pier.

Keywords: Pier scour, Laboratory modeling, scour hole dimensions.

1. Introduction

The lowering of the streambed at bridge piers is referred to as bridge sediment scour or simply bridge scour. Bridge scour is the biggest cause of bridge failure and a major factor that contributes to the total construction and maintenance costs of bridges. Under prediction of design scour depths can result in costly bridge failures and possibly in the loss of lives; while over prediction can result in wasting billions of rupees on a single bridge. For these reasons, proper and optimal prediction of the amount of scour anticipated at a bridge crossing during design conditions is essential [1].

The pier is an essential component of a bridge, provides an obstruction to the flow of water causing removal of the bed material from around the pier and abutment. This phenomenon is called scouring [2]. Experience has shown that scouring can gradually undermine the foundation of a structure regardless of the water flow depth. In extreme cases of unsteady flows, or under changes in channel conditions, scouring becomes exponentially powerful, potentially leading to the failure of water structures [3].

According to Yanmaz [4], modeling of the scouring mechanism is so complex that no single method for universal conditions concerning flow, sediment, river, and pier characteristics has been developed to date. Therefore, the absence of comprehensive mathematical methods for predicting scour depth for pier design is a significant reason that causes certain bridges to collapse, resulting in adverse financial impact, increased travel time due to the disruption of travel routes, and, occasionally, in loss of life.

The damage caused by the scour around pier was investigated among others by Mueller [5], Breusers [6], Melville [7], Ettema [8] & Sheppard [9]. Different researchers have developed

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different models for the prediction of bridge pier scour using inductive modeling techniques ranging from simple regression based models to more complex AI- based models. These include Azamathulla [10, 11 & 12], Lee [13] & Khan [2]. Prediction and measurement of pier scour depth in the laboratory as well as in field is a difficult task.

No experimental study has been carried out in Pakistan for bridge pier scour depth prediction. According to the National Highway Authority NHA [14] report more than 70 % of bridge in Pakistan failed due to scour. Since overestimation of bridge pier scour depth will be very uneconomical and under estimation will cause damage to property as well as human life, therefore its proper investigation is very essential. In this research project the piers of two different bridges including Motor Way Bridge on Kabul River and Khairabad Bridge on Indus River will be modeled in the hydraulic laboratory of Civil Engineering Department of University of Engineering and Technology Peshawar. The experiments were performed by changing the shape and size of the piers and the resultant scour was noted. The scour depth downstream, upstream and sides of the pier is measured and the results are then compared to check the effect of pier shape and size on the pier scour depth.

2. Local scour mechanism

The removal of sediment from around the bridge piers is called local scour. *Figure 1* presents the basic features and variables that causes local scour in Clearwater when flow is steady and channel bed is uniform and plane. The mechanism of local scour depth at pier as shown in above figure, depends on several variables that characterize the type of fluid, flow conditions, bed sediment properties and pier geometry etc. In this study our focus is on the effects of bed sediment and pier's shape and size on the local scour depth.
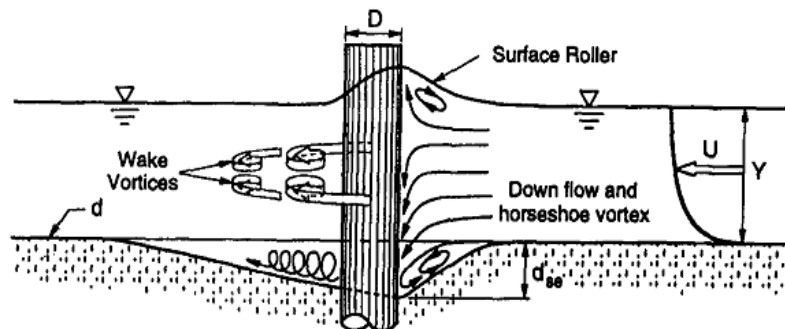
Figure 2: Principal features of Local Scour [8]

3. Experimental Set Up

In this study all the experiments were performed in the hydraulic laboratory of Civil Engineering Department, University of Engineering and Technology, Peshawar.

The experiments were performed in an open channel which was 5.5m long, 0.30m wide and 0.6m high. The channel was made of glass blocks and Aluminum sheet at bed. The water is supplied to the channel from the recirculation tanks through pump. The water after entering to the channel and passing through the test pier fall into the tanks again and is recirculate by the pump. There was a tail gate at the downstream end of the channel which is used to control the flow depth in the channel while there is a valve at the upstream end of the channel for controlling the flow rate. The channel is accompanied by a point gauge for vertical measurements and a streamflo22 velocity meter for measuring velocity. A rectangular notch is installed after the test section for two reasons. First to measure the flow rate in the channel and second to trap the sediment carried away by the flowing water from entering into the tanks and afterwards into the pump which may cause chocking of pump. For the installation of the pier in the channel a test/working section is created. The location of the start of test section was found by using the velocity meter to find the point where the flow is steady and uniform. The test section is created by installing glass u/s and d/s of the test section.

The test section was 1.5 meter long, 0.30m wide and 0.15m high. The test section was filled with sediments of median size sediment d_{50} of 0.35mm and then of 0.55mm to install the pier. The pier was installed at the center of the test section. *Figure 2* shows schematic diagram of the channel and test section. Two different types of models were used for conducting the experiments, circular pier model and square pier model. Circular pier model represent the pier of the Motorway Bridge at Kabul River while square pier model represent the pier of Khairabad Bridge at Indus River.
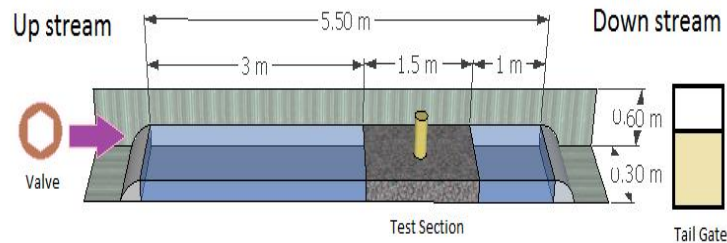
Figure 2: Schematic diagram of channel and test section

4. Objectives of the Research

The main objectives of this research work are to

1. Model the piers of Motorway Bridge at Kabul River and Khairabad Bridge on Indus River in the laboratory.

2. Investigate the effect of sediment size on pier scour depth.

3. Investigate the effect of pier shape and size on pier scour depth and

4. To calculate the scour hole dimensions for all the experiments

5. Experimental Procedure

As discussed earlier the experiments were conducted in an open channel. The channel is cleaned and the test section is filled with the sediments of median size sediment d_{50}=0.35mm. The sand was properly leveled before start of each experiment. Before the start of first experiment the water was allowed to flow over the sand bed and then was allowed to stay for some time to fill the air voids with water. When these are filled and the sand is fully saturated the pier is installed in the center of the test section. After starting the pump the water is allowed to flow over the sand bed and the scour starts. The flow is adjusted through the valve and the time is noted. Before start of the experiment the initial bed level was noted as all the scour depth reading will be taken with reference to the initial level. After running the experiment for specific duration the water is drained out and the scour depth measurement were taken. The scour depth at the upstream, downstream and sides of the channel were measured. The scour hole dimensions were also measured. The scour depth was measured through the point gauge while the dimensions were taken through the ruler. In this research ten different sizes and shapes of pier models including five circular and five square models were selected to investigate the effect of pier shape and size on pier scour depth. The diameter of circular pier models were 3cm, 3.5cm, 4cm, 4.5cm & 5cm and dimensions of square pier models were 3cmx3cm, 3.5cmx3.5cm,4cmx4cm 4.5cmx4.5cm &5cmx5cm. All the experiments were performed for two hours duration, flow rate of 1.61Liters per second and flow depth of 15mm free flow and 30mm obstructed flow. After performing all the experiments, the sediment is replaced by

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sediment of median size sediment d_{50}=0.55mm and all the experiments were repeated again. The results obtained discussed in the following section.

6. Results and Discussions

6.1. Sediment size

For clear water flow conditions, Ettema [8] defined the influence of sediment size on scour depth at circular piers with uniform sediments. From Ettema [8] data it is clear that up to b/d_{50}= 50 scour depth increases with relative sediment size (b/d_{50}), and for b/d_{50}>50 the scour depth around the pier is independent of sediment size. In this study sediment with d_{50}=0.55mm has minimum value of b/d_{50}=54.54 and it will have a small effect on scour depth but sediment size with d_{50}=0.35 mm has its minimum value of b/d_{50}=85.71 so it has no effect on scour depth.
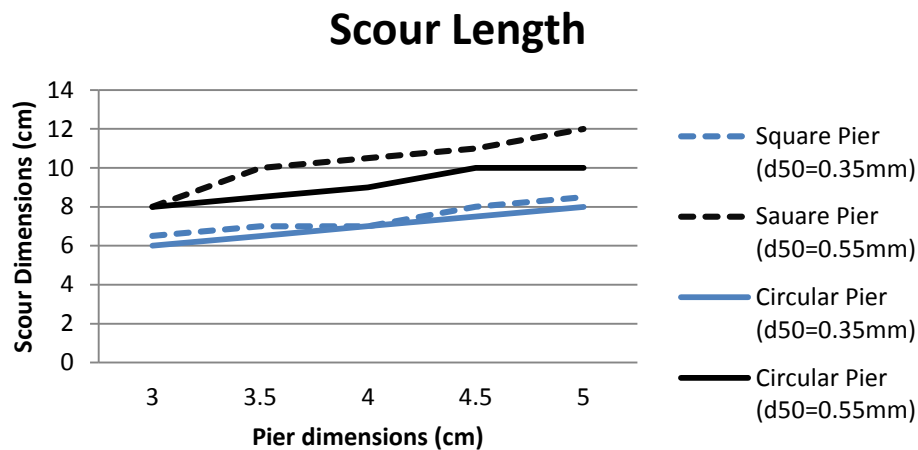
Figure 3: Graphical presentation of scour hole dimensions

Figure 4 illustrates that scour depth for d_{50}=0.35mm is less than scour depth for d_{50}=0.55mm. Normally this is not the situation that scours depth increases with increase in sediment particle size as Kells [15] confirmed that scour depth decreases with increase in sediment particle size. The reason behind this uncertain situation is the behavior of sediment particles inside water as this is discussed by Ettima [8] that the use of cohesion less particle whose sizes are less than 0.6mm has a propensity to ripple. This is because the particles are too small relatively to the viscosity of lower layer of flow formed over the bed of such sediments. So this phenomenon of rippling leads to the situation that under some limits the scour depth may decrease with increase in particles size. Sediments whose size is more than about 0.5mm do not ripple, American Society of Civil Engineers ASCE [16]. This was observed during experiments that sand with d_{50}=0.35mm rippled and sand with d_{50}=0.55mm do not rippled. The same effect is observed in case of scour length on both upstream and downstream side of pier as shown in *Figure 3*. Similarly in case of sand with d_{50}=0.55mm the volume of deposition of eroded sediment around the pier was more than that of sand with d_{50}=0.35mm.

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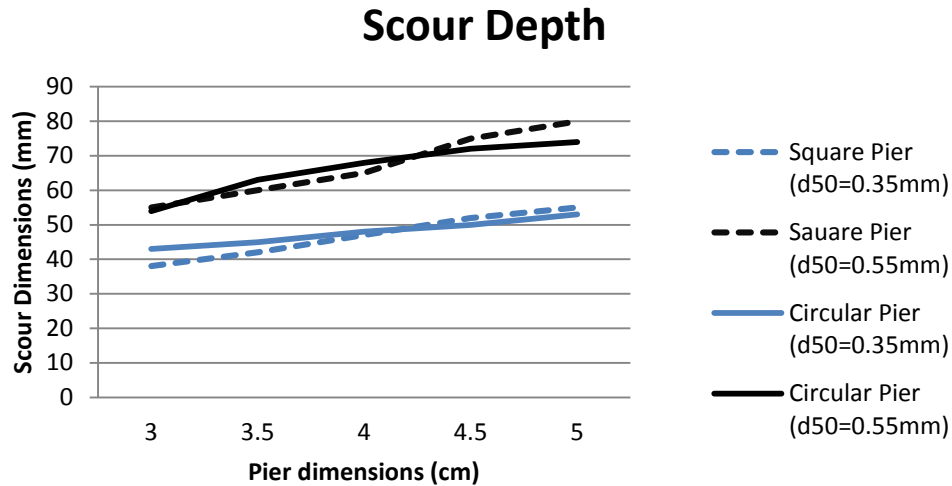
Scour Depth

Figure 4: Graphical presentation of scour depth

6.2. Pier Shape and Size

In this study two different shapes of pier models are used i.e. circular and square. The maximum scour depth was recorded at upstream side for both square and circular piers with observation that erosion on the edges of square pier on upstream side was much faster with respect to its upstream side face. In case of circular pier the geometry of scour hole was like conical, it was circle in shape from three side's i.e. upstream, right side and left side but was elongated on downstream. Unlike circular pier, the scour hole geometry for square pier was not rounded. As stated above that scouring at the edges of square was much faster there for this rapid erosion also affected the shape of scour hole around it. The variation in scour depth verses scour length as shown in *Figure 5* is not linear for both circular and square piers somehow the square pier shows much disturb variation as compare to circular pier. the scour depth for square pier is recorded 10 to 20 % more than that for circular pier for both type of sediments as shown in *Figure 3* and *Figure 4*, that's why according to Melville [7] circular cylindrical shape piers are selected as the primary shapes and therefor they have a shape factor $K_s=1$. Richardson [17], Melville and Sutherland [18], Laursen and Toch [19], Maza Alvarez [20] and Larras [21] give a collection of K_s values. In these values of Ks for circular piers and square, sharp and round nose piers are reasonably constant, which shows that effect of shape on scour dimensions is relatively insignificant. *Figure 3* and *Figure 4* also illustrates that the scour dimensions are directly proportional to the size of piers. As size of pier increases the scour depth as well as scour length is increased. The nature of deposition on downstream is not same for circular and square piers. In case of square pier the volume of sediments deposited at downstream was more than that of circular pier of same size. The downstream length of scour was also recorded more for square pier as compare to circular pier. That is why the erosion or scouring around square shape pier is more than circular shape pier.

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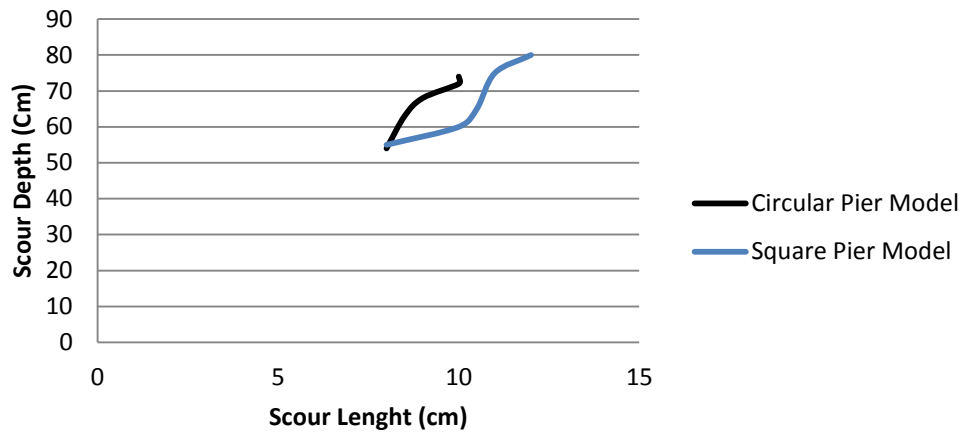
Figure 5: Graphical presentation of scour length verses scour depth data

7. Conclusion

Local scour around bridge piers was investigated using Laboratory based models under controlled Hydraulic parameters such as flow, sediment and pier geometry. From this study the following conclusion and observations are drawn. Scour depth for square shape pier is greater than circular shape pier. As the size of pier increases the scour depth will also increase. The effect of type of bed material and size of pier on scour depth and scour length is more than the effect of pier shape on scour depth and scour length.

8. Nomenclature

d_{50} median size of bed material (mm)

b   pier width

y   flow depth

V   flow velocity

d_s scour depth

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Evaluation of Drinking Water Quality of Different Areas of Lahore, Pakistan

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Abstract

Water is a key human need. It is a fundamental human right to have access to clean water for every day comforts around the world. Five drinking water specimens were selected from five different locations of Lahore city which include Wahga Border, Shalimar Garden, Canal Bank Road, Mughal Pura and Garhi Shahu. Each drinking water sample was analyzed bacteriological parameter (fecal coliforms), three chemical parameters (total hardness, total dissolved solids & chlorides) and two physical parameters (pH & turbidity) in order to compare with NSDWQ (National Standards of Drinking Water Quality). All samples were found out to be satisfactory and all drinking water parameters laid within permissible range specified by NSDWQ. Furthermore, it was suggested that presence of heavy metals must also be analyzed for samples in order to ensure sound and secure drinking water supply.

Keywords: Lahore, Bacteriological, Chemical, Physical, NSDWQ.

1. Introduction

Water is unmistakably key for hydration and a nonattendance of fitting sanitation organizations breeds sicknesses and in addition it can preclude people from securing their major human regard also. With see of immature countries rather than even Pakistan Central governments make huge hypotheses consistently to protect our water consummate and, our water systems still don't get the measure of sponsoring anticipated that would keep them working genuinely (MF Chaplin, 2001).

Water tainting, arrival of effluents and hazardous drinking water are segments among others that speak to a hazard to human thriving and Pakistan's natural framework. While some don't have water to drink, others squander it in huge sums. The way of our water is particularly associated with the

way of our lives. By supporting clean water exercises and near measures that improve our water and wastewater treatment structures, we can every have influence in ensuring spotless, safe water for ourselves, our families and our groups (J Fogden *et al*., 2009, I Ahmad *et al.*, 2010)

With the development in people, obviously the augmentation prevalent of clean drinking water is also extending. More than 90% of contaminations are water borne. This expect was picked so that the regard for clean drinking water can be bolstered and the basic parameters of drinking water will be analyzed to ensure safe drinking water for general prosperity (IH Borts, 1949),

2. Objectives of the Study

The objectives of the study are as follows:
1. To lead water quality examination tests on five drinking water tests from different regions of Lahore.

2. To analyze outcomes by investigating whether drinking water quality parameters of these cases are meeting WHO guidelines or not.

3. Methodology

The study is comprised of three mail steps. First step covers the collection of ground water samples from different five regions of Lahore. The second step covers the preservation and testing (physical, chemical and microbiological parameters) of the collected water samples according to the standard procedures. The third step is comprised of the comparison of the sample's results with that of NSDWQ and WHO guidelines.

The study areas include

1. Wahga Border,

2. Shalimar Garden,

3. Canal Bank Road,

4. Mughal Pura and

5. Garhi Shahu.

Each sample was collected at consumer end (house) and three samples were taken from each location.

The samples were analyzed in the Institute of Environmental Engineering and Research (IEER) at University of engineering and Technology (UET) Lahore for physical, chemical and microbiological parameters. The average value is reported for samples from same location.

A summary of water quality parameters tested on the sample collected is shown in Table 1.

Table 1: Water Quality Parameters

Parameter	Test
Physical	pH
	Turbidity
Chemical	Total Dissolved Solids (TDS)
	Chlorides
Bacteriological	Fecal Coliforms

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4. Results and Discussions

4.1 pH

The results for pH of water samples are given in Table 2.

Table 2: pH Results

Location	pH value	NSDWQ Value	WHO Value	Remarks
Wahga Border	7.8	6.5-8.5	6.5-8.5	Acceptable
Shalimar Garden	7.5	6.5-8.5	6.5-8.5	Acceptable
Canal Bank Road	7.9	6.5-8.5	6.5-8.5	Acceptable
Mughal Pura	7.7	6.5-8.5	6.5-8.5	Acceptable
Garhi Shahu	7.6	6.5-8.5	6.5-8.5	Acceptable

All the samples are within acceptable ranges of pH as provided by NSDWQ and WHO.

4.2 Turbidity

The results for turbidity of water samples are given in Table 3.

Table 3: Turbidity Results

Location	Turbidity (NTU)	NSDWQ Value (NTU)	WHO Value (NTU)	Remarks
Wahga Border	0.6	<5NTU	<5NTU	Acceptable
Shalimar Garden	0.7	<5NTU	<5NTU	Acceptable
Canal Bank Road	0.8	<5NTU	<5NTU	Acceptable
Mughal Pura	0.4	<5NTU	<5NTU	Acceptable
Garhi Shahu	0.5	<5NTU	<5NTU	Acceptable

All the samples are within acceptable ranges of Turbidity as provided by NSDWQ and WHO.

4.3 Total Dissolved Solids (TDS)

The results for TDS of water samples are given in Table 4.

Table 4: TDS Results

Location	TDS (mg/L)	NSDWQ Value (mg/L)	WHO Value (mg/L)	Remarks
Wahga Border	1160	<1000	<1000	Not Acceptable
Shalimar Garden	1245	<1000	<1000	Not Acceptable
Canal Bank Road	1060	<1000	<1000	Not Acceptable
Mughal Pura	1145	<1000	<1000	Not Acceptable
Garhi Shahu	1000	<1000	<1000	Acceptable

All the samples except from Gari Shahu are out of the acceptable range of TDS as provided by NSDWQ and WHO. However, there is no direct health concern of TDS on humans. So,

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in a developing country like Pakistan this out of range values can be ignored as it will cause extra cost to combat these TDS values.

4.4 Total Hardness as CaCO₃ (mg/L)

The results for TDS of water samples are given in Table 5.

Table 5: Total Hardness Results

Location	Total Hardness as $CaCO_3$ (mg/L)	NSDWQ Value (mg/L as $CaCO_3$)	WHO Value (mg/L as $CaCO_3$)	Remarks
Wahga Border	275	<500	<500	Acceptable
Shalimar Garden	300	<500	<500	Acceptable
Canal Bank Road	275	<500	<500	Acceptable
Mughal Pura	288	<500	<500	Acceptable
Garhi Shahu	382	<500	<500	Acceptable

All the samples are within acceptable range of Total Hardness as provided by NSDWQ and WHO.

4.5 Chlorides (mg/L)

The results for chlorides of water samples are given in Table 6.

Table 6: Chlorides Results

Location	Chlorides (mg/L)	NSDWQ Value (mg/L)	WHO Value (mg/L)	Remarks
Wahga Border	90	<250	<250	Acceptable
Shalimar Garden	78	<2500	<2500	Acceptable
Canal Bank Road	102	<250	<250	Acceptable
Mughal Pura	70	<250	<250	Acceptable
Garhi Shahu	85	<250	<250	Acceptable

All the samples are within acceptable range of Chlorides as provided by NSDWQ and WHO.

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4.6 Fecal Coliforms (mg/L)

The results for chlorides of water samples are given in Table 6.

Table 6: Chlorides Results

Location	Fecal Coliforms (MPN/100mL)	NSDWQ Value (MPN/100mL)	WHO Value (MPN/100mL)	Remarks
Wahga Border	0	0	0	Acceptable
Shalimar Garden	0	0	0	Acceptable
Canal Bank Road	0	0	0	Acceptable
Mughal Pura	0	0	0	Acceptable
Garhi Shahu	85	<250	<250	Acceptable

All the samples are within acceptable range of Fecal Coliforms as provided by NSDWQ and WHO.

5. Conclusion

- Total 15 water samples were analyzed from five different locations, three from each location.
- The water from each source is safe to drink as all samples meet the NSDWQ and WHO guideline values reliably.
- However, talking about TDS only Gari Shahu sample meets the criteria.

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Modeling of Quasi-Brittle Materials Using Damage Plasticity Approach: A Literature Review

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Abstract

Quasi-brittle materials like concrete, can retain substantial amount of hardness under different loading conditions. This literature review has been carried out to probe the suitability of a constitutive material model that can efficiently predict damages in concrete and other quasi-brittle materials. Hence, Concrete Damage Plasticity Model (CDPM) is formulated in a way that it can capture the irreversible effects of damage. It can describe different yield strengths in tension and compression, different degradation of elastic stiffness in tension and compression, stiffness recovery effects during cyclic loading and rate sensitivity. For this reason it is also adopted by the most widely used Finite Element Analysis (FEA) package i.e. ABAQUS. This material model can easily be used in both explicit and implicit integration methods of ABAQUS. In the literature it was found that this material model is frequently been used by number of researchers in their work. They all came up with very convincing results and a good correlation between experimental and numerical results were obtained.

Keywords

Quasi-brittle materials, Constitutive material model, Concrete Damage Plasticity Model (CDPM), Finite Element Analysis (FEA), ABAQUS.

1. Introduction

In modern fracture mechanics, the material that retains considerable amount of hardness are referred as quasi-brittle materials. Concrete and up to some extent masonry comes under this category that exhibits an exponential softening behavior in plastic regime. Due to the composition of quasi-brittle materials, it is very difficult to mathematically predict its plastic behavior. Numerous researchers have been developing criterions to model such materials, especially concrete (e.g. Coulomb 1776; Drucker and Prager 1952; Evert Hoek 1980; Menetrey and Willam 1995; von Mises 1913; Mohr 1990; Ottosen 1997). Presently, the most effective method to model numerical behavior of concrete and alike materials is the damaged plasticity model that is able to reproduce key characteristics of concrete, namely its asymmetric strength in tension and compression, its pressure sensitivity associated with yielding and stiffness degradation associated with damage. This model was originally developed by (Lubliner et al. 1989) and further elaborated by (Lee & Fenves 1998). The mostly used commercial and academic finite element analysis tool, ABAQUS has adopted this approach due to its efficient formulation with same name i.e. Concrete Damaged Plasticity Model (CDPM). CDPM is implemented for both Abaqus/Standard and Abaqus/Explicit type of integration methods which provides a general capability for analysis of concrete and also is suitable for masonry and other quasi-brittle materials, under monotonic, cyclic or any other type of dynamic loading. This literature study has been carried out to probe history of the development of CDPM and its use by various researchers in their work.

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2. Damage Plasticity Formulation

2.1. Stress-Strain Relation and Hardening Rule

The elements of any model based on classical plasticity theory are the hardening rule, the yield criterion and the flow rule (Lubliner et al. 1989). Introduced by Kachanov (1958) and further developed by Rabotnov (1969), the constitutive equation of material with scalar isotropic damage takes the following form:

$$\sigma = D^{el}:\left(\varepsilon - \varepsilon^{pl}\right) = (1-d)D_0^{el}:(\varepsilon - \varepsilon^{pl})$$

Where σ is the Cauchy stress tensor, d is the scalar stiffness degradation variable, D_0^{el} is the initial undamaged elastic stiffness of material, D^{el} is the degraded elastic stiffness, ε is the strain tensor and ε^{pl} is the plastic strain tensor.

Thus, the final form of Cauchy stress tensor is related to the effective stress tensor $\bar{\sigma}$ through the scalar degradation parameter $(1-d)$ as under:

$$\sigma = (1-d)\bar{\sigma}$$

Where the effective stress is defined as $\bar{\sigma} \overset{\text{def}}{=} D^{el}:\left(\varepsilon - \varepsilon^{pl}\right)$. The evolution of scalar damage variable is governed by a set of effective stress tensor $\bar{\sigma}$ and hardening/softening variable $\tilde{\varepsilon}^{pl}$ illustrated as follow:

$$d = d(\bar{\sigma}, \tilde{\varepsilon}^{pl})$$

Damage states in tension and compression are characterized independently by two hardening variables, $\tilde{\varepsilon}_t^{pl}$ and $\tilde{\varepsilon}_c^{pl}$, which are referred to equivalent plastic strains in tension and compression, respectively. The evolution of the hardening variables is given by the following expression:

$$\tilde{\varepsilon}^{pl} = \begin{bmatrix} \tilde{\varepsilon}_c^{pl} \\ \tilde{\varepsilon}_t^{pl} \end{bmatrix} \text{ and } \dot{\tilde{\varepsilon}}^{pl} = h\left(\bar{\sigma}, \dot{\tilde{\varepsilon}}^{pl}\right).\dot{\varepsilon}^{pl}$$
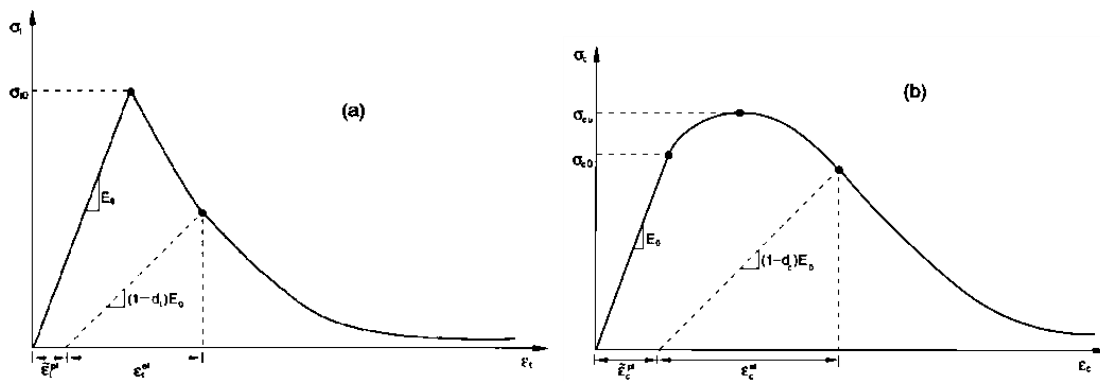
Figure 1: Damaged Response to Uniaxial (a) Tension and (b) Compression (Section 4.5.2 of Theory Guide)

Cracking (tension) and crushing (compression) in concrete are represented by increasing values of the hardening/softening variables, diagrammatically elaborated in Figure 1. These variables control the evolution of the yield surface and the degradation of the elastic stiffness.

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2.2. Uniaxial Cyclic Condition

Under uni-axial cyclic loading conditions, the degradation involves the interaction of the micro-cracks that constantly open and close. The elastic stiffness recovers as the load changes sign and shifts from tension to compression. Under such condition, elastic modulus E is given by following equation as a function of undamaged modulus E_0 and stiffness reduction variable d.

$$E = (1 - d)E_0$$

The stiffness reduction variable d for the model is a function of the uni-axial damaged variables d_t and d_c and is given by equation:

$$(1 - d) = (1 - s_t d_c)(1 - s_c d_t)$$

where s_t and s_c signifies the stiffness recovery effects associated to stress reversals:
$s_t = 1 - \omega_t . r * (\bar{\sigma}_{11}); s_t \geq 0 \ and \ 0 \leq \omega_t \leq 1$
$s_c = 1 - \omega_c . (1 - r * (\bar{\sigma}_{11})); s_c \leq 1 \ and \ 0 \leq \omega_c \leq 1$
and
$$r * (\bar{\sigma}_{11}) = H(\bar{\sigma}_{11}) = \begin{cases} 1 & if \ \bar{\sigma}_{11} > 0 \\ 0 & if \ \bar{\sigma}_{11} < 0 \end{cases}$$
The weight factors ω_t and ω_c describe material properties link to stiffness recovery of the model. Figure 2 shows a default behavior of the material model used in ABAQUS where the compressive stiffness is recovered due to closure of cracks as the load changes from tension to compression ($\omega_c = 0$), while the tensile stiffness is not retrieved as the load changes from compression to tension once crushing of micro cracks happens ($\omega_t = 0$).
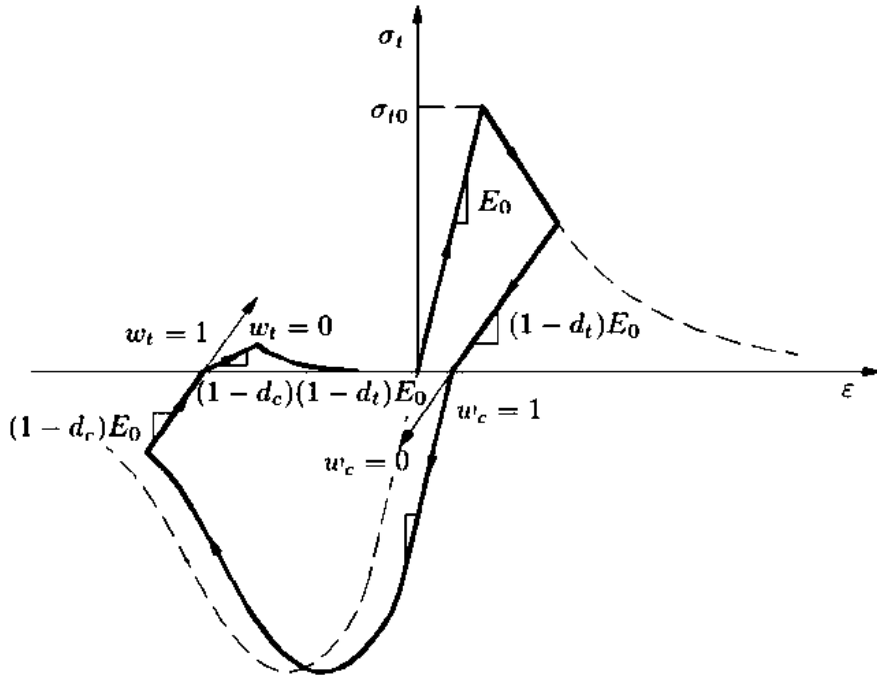
Figure 2: Tension-Compression Cyclic Model with Damage and Recovery Effect (Section 4.5.2 of Theory Guide)

2.3. Yield Function

The state of failure damage in the effective stress space for tension and compression is represented by a yield function given by equation:

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$$F(\bar{\sigma}, \dot{\varepsilon}^{pl}) \leq 0$$

The final form of the plastic damage concrete model is given by following equation, which takes into account the evolution of strength under tension and compression.

$$F(\bar{\sigma}, \dot{\varepsilon}^{pl}) = \frac{1}{1-\alpha}(\bar{q} - 3\alpha\bar{p} + \beta(\dot{\varepsilon}^{pl})\{\hat{\bar{\sigma}}_{max}\} - \gamma\{\hat{\bar{\sigma}}_{max}\})$$

where

$\bar{p} = -\frac{1}{3}\bar{\sigma} : I$ is the effective hydrostatic pressure in the model;

$\bar{q} = \sqrt{\frac{3}{2}\bar{S} : \bar{S}}$ is the Mises equivalent effective stress;

$\bar{S} = \bar{p}I + \bar{\sigma}$ is the deviatoric part of the effective stress tensor $\bar{\sigma}$;

$\hat{\bar{\sigma}}_{max}$ is the maximum eigenvalue of $\bar{\sigma}$.

Let $\bar{\sigma}_c$ and $\bar{\sigma}_t$ be the effective tensile and compressive stresses, respectively, thus the function $\beta(\dot{\varepsilon}^{pl})$ is shown by following equation.

$$\beta(\dot{\varepsilon}^{pl}) = \frac{\bar{\sigma}_c(\tilde{\varepsilon}_c^{pl})}{\bar{\sigma}_t(\tilde{\varepsilon}_t^{pl})}(1-\alpha) - (1+\alpha)$$

The coefficient α can be determined from initial equi-biaxial and uni-axial compressive yield stress, σ_{b0} and σ_{b0} as follow:

$$\alpha = \frac{\sigma_{b0} - \sigma_{c0}}{2\sigma_{b0} - \sigma_{c0}}$$

Typical values of α are between 0.08 and 0.12. The Macaulay brackets are used to describe the ramp function:

$$\{\hat{\bar{\sigma}}_{max}\} = \begin{cases} 0, & \hat{\bar{\sigma}}_{max} < 0 \\ \hat{\bar{\sigma}}_{max}, & \hat{\bar{\sigma}}_{max} \geq 0 \end{cases} \quad and \quad \{-\hat{\bar{\sigma}}_{max}\} = \begin{cases} 0, & \hat{\bar{\sigma}}_{max} \geq 0 \\ \hat{\bar{\sigma}}_{max}, & \hat{\bar{\sigma}}_{max} < 0 \end{cases}$$

Coefficient γ enters in the equation only when the specimen is subjected to tri-axial compression and $\hat{\bar{\sigma}}_{max} \leq 0$ (typical value for concrete is $\gamma = 3$). Figure 3, shows a typical yield surface in deviatoric plane for plane-stress condition.
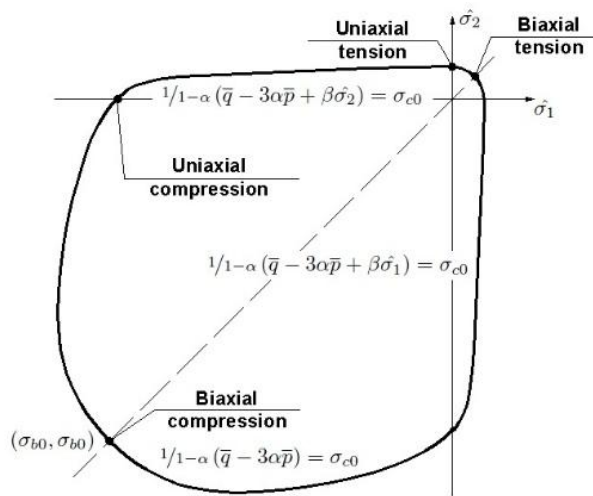
Figure 3: Typical Yield Surface (Section 4.5.2 of Theory Guide)

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2.4. Flow Rule

The flow potential G governs the plastic flow with the flow rule, thus given by following equation:

$$\dot{\varepsilon}^{pl} = \dot{\lambda} \cdot \frac{\partial G(\bar{\sigma})}{\partial \bar{\sigma}}$$

Where $\dot{\lambda}$ is the non-negative plastic multiplier that obey the Kuhn-Tucker conditions, together with yield function F. G is the Drucker-Prager hyperbolic function and is given by following equation:

$$G = \sqrt{(\epsilon . \sigma_{t0} . tan\psi)^2 + \bar{q}^2} - \bar{p} . tan\psi$$

Where ψ is the dilation angle, measured in the $p - q$ plane at high confining pressure, σ_{t0} is the uni-axial tensile stress at failure and ϵ is a parameter that describes the rate at which the function approaches its asymptote. These parameters are thoroughly illustrated by Jankowiak et al (2005).The flow potential tends to a straight line as the eccentricity tends to zero. This flow potential, which is continuous and smooth, ensures that the flow direction is defined uniquely. The function asymptotically approaches the linear Drucker-Prager flow potential at high confining pressure stress and intersects the hydrostatic pressure axis at 90°. For further details readers are referred to Abaqus Analysis User's Guide Section 23.6.3.

3. CDPM Used by Various Researchers

3.1. Jankowiak et al (2005)

They presented a procedure for identifying material parameters that are required for CDPM along with necessary laboratory tests. A concrete beam was tested under three point and four point loading condition. The three point bending single edge notched concrete beam is used to compare the numerical results with the laboratory tests of Davies (1996).
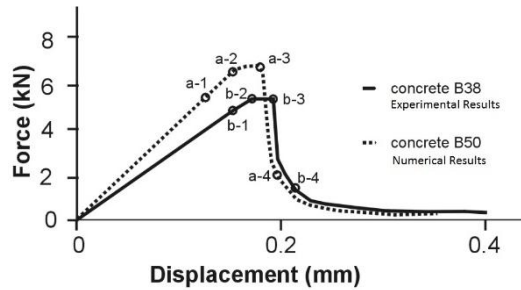
Figure 4: Comparison of Experimental and Numerical Load-Displacement Curves for Three-Point Load (Jankowiak et al (2005) and Davies (1996)).
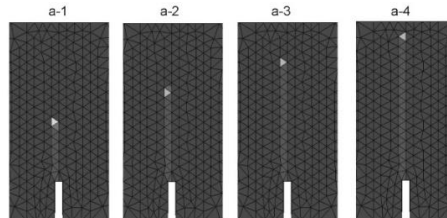
Figure 5: Numerical Crack Propagation (Jankowiak et al (2005)).

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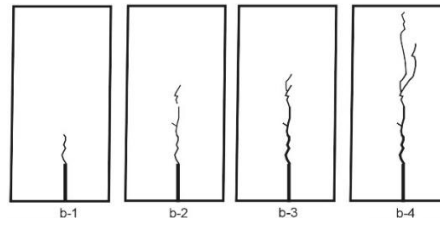
Figure 6: Experimental Crack Propagation (Davies (1996)).

Here we can observe a considerable level of similarity in the crack propagation by using the constitutive law defined by CDPM. We can also see the increment of damage by comparing Figure 4 and Figure 5 with Figure 6.

3.2. Martin, O. (2010)

This report describes numerical missile impact analyses on a reinforced concrete slab performed at Joint Research Center – Institute for Energy, using the Finite Element (FE) solver i.e. ABAQUS/Explicit. Two different build-in constitutive models for concrete in ABAQUS/Explicit, the Brittle Cracking Model and the CDPM are compared with each other and their suitability and limitations for missile impact analyses are explored. Here Figure 7 only illustrates the misses stress distribution of slab when hit with a soft missile at 500m/s velocity.

(a)   (b)
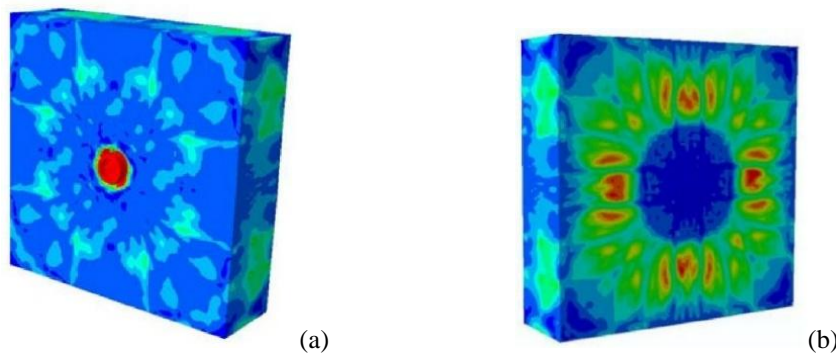
Figure 7: Van Mises stress distribution on (a)Front and (b)Back side of concrete slab at 0.4 milliseconds after impact of soft missile with v = 500 m/s.

Martin (2016) concluded that CDPM of ABAQUS/Explicit leads to reasonable and sound results in terms of strains/stresses of the reinforced concrete slab, overall energy balances and overall deformation of the concrete slab. One obstacle of the Concrete Damage Plasticity Model remains: Due to a missing failure criterion, perforation of the missile, spalling and scabbing of concrete cannot be modelled with CDPM.

4. Conclusions

From previous discussion, it can be concluded that CDPM captures the irreversible effects of damage that occur in concrete and various quasi-brittle materials. It can describe different yield strengths in tension and compression, the softening behavior in tension and initial hardening followed by softening in compression, different degradation of the elastic stiffness in tension and compression, stiffness recovery effects during cyclic loading and rate sensitivity. Beside its use for concrete, this model can also be used for masonry with some limitations. For example in case of anisotropy this model is unable to predict the directional behavior. To cater this problem the same model can be modified for anisotropy using same formulation with some additional parameters for different directions. However this constitutive model can be used without ambiguity if the masonry is to be modeled by assembling brick units and mortar joints. In case of stone masonry, delicate meshing is require initially and the same material model can be used for stone units.

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Hydraulic And Water Quality Modeling Of A Water Supply Scheme Using EPA.NET Software

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Abstract

This study deals with hydraulics and water quality modeling of Ashiyana Housing Scheme situated in Lahore, by using EPA.NET software. Appropriate design criteria were adopted for water distribution system. Hydraulic modeling was performed by designing water distribution system using various alternative methods of water distribution. Water Quality Modeling was performed by determining Bulk Co-efficient (K_b) and Wall Co-efficient (K_w). These coefficients were determined by performing experiments on the water sample taken from the site. Idometric Titration method was used chlorine demand and residual chlorine determination. Using these co-efficients, quality modeling was done through software. Economic evaluation of all design alternatives was made by calculating its capital and energy cost for the design period of 20 years. Bill of Quantities was prepared and then comparison of each alternative was done on the basis of cost. The results of study show that on the basis of hydraulics and economy pumping with storage with 1 pump is more reliable and cost efficient method of water distribution and the results of chlorine modeling show that the amount of chlorine added as dose is more than sufficient. The residual chlorine achieved at the end node is meeting the criteria of WHO 0.2mg/L-0.5mg/L.

Keywords

EPA.NET, PHED, bulk and wall co-efficient, residual chlorine, idometric titration

1. Introduction

Surface of the Earth is composed of 29 % and 71 % water. Total water on the Earth is measured as 1400 Million Km3. Of this, about 97 % lies in oceans and the remaining 3 % forms "ice caps" and surface and groundwater. Practically speaking all the usable surface and groundwater only comprises about 0.5 % of the total water on the Earth - excluding the water trapped in the ice caps [1]. This available, surface and ground, water is used for drinking, washing, cooking, bathing and other purposes. The function of water distribution is to provide safe and adequate quantity of water of desired pressure at each fixture unit. For this purpose, a network of pipes is generated which

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fulfill the above requirement quite safely. Preliminary to the design of any water work project, it is necessary to determine the amount of water that is required. This involves obtaining information as to the number who will be served and their per capita water consumption, together with an analysis of the factors that may operate to effect the consumption. Quality of drinking water plays a pivotal role in the selection, design and implementation of water supply schemes both for urban and rural areas. In order to determine if the water is fit for drinking purposes testing, not only, for color, taste, odor, quantity of total dissolved solids but also tests for bacterial contamination and pollution are to be carried out. The water distribution network is the generally the most expensive components in a community water system which also include collection, transmission and treatment of water. Because of their expense, it is especially important in developing countries that they are well designed and their costs to be minimized [2]. The detailed design of water distribution network is effected by number of factors and these should be kept in mind while design of optimum water distribution system [3].

2. Experimental:

2.1. Study Area

The housing society, Ashiana-e-Quaid is situated on Ferozepur Road, Lahore. Lahore is the capital of the Punjab province. It is the second largest city in the country and is regarded as the most developed city in Pakistan. The designed population of this society, at the adopted household size of 7 people, is 19264 people. The necessary facilities including hospitals, school, mosque, playground and recreational parks are present in this society. The housing society covers a total land area of 57.075 Acres excluding roads. Detailed distribution of area is shown in Table 1. Figure 1 shows the location of study area and Figure 2 shows the map of study area. The overall surface area of the housing society is flat, because the slope of area at almost all the points is between 1 % - 2 %. Its lay between 31°26'37" North and 74°23'22" East. The elevations from the sea level of this area are between the 696 ft–771 ft [4].

Figure 1: Map showing location of study
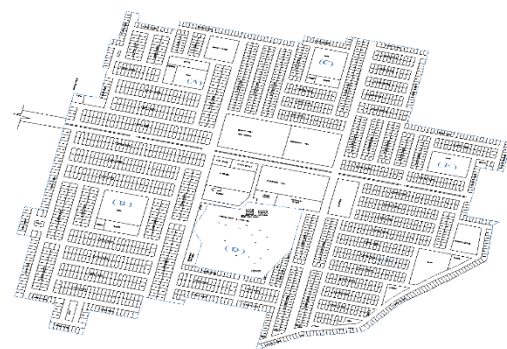
Figure 2: Map of study srea

Table 1: Land use pattern of the scheme

Sr. No.	Land Use	No.	Area ft^2	%
1	Plots			
1.1	Residential. 2 Marla	1714	771300	36.868
1.2	Residential 3 Marla	1032	696600	33.30
2	Public Building		133650	6.388
3	Commercial area	2	133650	6.388
4	Grave yards	1	187650	8.96
5	Parks and open spaces	5	169200	8.09

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2.2. Design criteria

Water distribution is designed on peak hourly demand (peak flow). For the design of water distribution system, equation used is Hazen William equation $H_L = 10.68 \times (Q/C)^{1.85} \times L/d^{4.68}$[3]. Adopted design criteria have been shown in Table 2.

Table 2: Adopted design criteria

Sr. No.	Parameters	LDA Criteria	PHED Criteria [6]	Adopted Criteria
1	Household Size (person)	-	-	7
2	Average day domestic water demand inclusive of domestic unaccounted for (gpcd)	95	20	20
3	Design period (years)	-	20	20
4	Average day domestic inclusive of water unaccounted for miscellaneous uses (gpcd)			
	1.Schools (Gal per day scholar)	-	5	5
	2.Mosque (Gal per person)	-	-	2.6[19]
	3.Public parks (Gal per m^2)	-	7	7
5	Average water demand to maximum water demand conversion factor	-	1.5	1.5
6	Average water demand to peak water demand conversion factor	2.25	2.25	2.25
7	Maximum terminal distribution head (ft)	45.78	39.3	39.3
8	Minimum distribution pipe size (in.)	3	3	3
9	Minimum residual pressure (psi)	-	17.87	18
10	Minimum velocity (ft/s)	0.82	0.98	0.98
11	Cover over pipes (ft)	3	3	3

2.3. Hydraulic Modeling
Different alternatives were designed and compared for the water distribution system of Ashiyana-e-Quaid Housing Scheme. The comparison was made on the basis of hydraulic and economic efficiency of the project. Following alternatives were designed and evaluated.
o **Alternative-1: Direct pumping**

In Direct pumping, water is supplied to the scheme directly through the pump and pump was designed on the peak hourly demand. The distribution network was designed on peak hour demand capacity. To meet the criteria of residual pressure i.e. 17.5 psi at each node, the pump head was increased and the pipe diameters were varied. Variations in diameters of pipes and pump head, were continued until pressures at all nodes were within the PHED criteria.
o **Alternative-2: Pumping with storage**

In Pumping with storage, Overhead Tank (OHT) is provided with pump for the storage of water to overcome demand variations and to have reserve for emergency purposes. The pump, in this type of system, was designed on the maximum daily demand. The capacity of the tank was calculated

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by adopting criteria of PHED. All the diameters of the pipes in the distribution system were kept same as were in the direct pumping for appropriate comparison.

o **Alternative-3: Direct pumping with one pump**

In this design alternative, water distribution is done through pump directly. But instead of providing two pumps of equal head and capacity, only one pump of capacity of peak hour demand is provided.

o **Alternative-4: Pumping with storage with one pump and one OHT**

In this alternative one OHT and one pump is provided in community. One OHT of 50,000 Gal capacity is constructed. The pump used was designed on maximum daily demand of the community. All the pipe diameters were kept same as were in alternative 3, so that comparison can be made economically and hydraulically.

o **Alternative-5: Pumping with storage with two pumps with changed per capita water consumption**

In this alternative, one (OHT) and two pumps were provided. The pump implied was designed on the Average Daily Demand i.e. 1213gpm.

o **Alternative-6: Pumping with storage with one pump and changed pipe material**

In this alternative only pipes material was changed that is Cast Iron. The purpose of this alternative is to evaluate the effect of pipe material on hydraulics, quality and cost of project. Diameters and head of pump were kept same as in Alternative-4 so that hydraulically and economically comparison can be made appropriately.

3. Results And Discussion

3.1.1. Alternative - 1: Direct pumping

In this alternative, no storage was provided and pipe diameters used were shown in the Table 3. Figure 4 shows the pressures at each node and pipe diameters.

Table 3: Pipe categories and their number

Pipe Category		Number of Pipes	
		Individual	Total
Tertiary	3inch	203	226
	4inch	23	
Secondary	5inch	-	21
	6inch	16	
	8inch	6	
Primary	10inch	5	7
	12inch	2	

The pump given was of more capacity in order to meet peak water demand of the community. The Pump implied was of 1cusec-200 ft and its capital cost was 3.6 million rupees. Cost of excavation was 11 % of the capital cost and 3.09 % of the total cost of this alternative. Cost of pipes was 72.45 % of the capital cost and 37.9 % of the total cost of this alternative. Energy cost was 47.7 % of the total cost. Pump installation cost was 3.6 million. Total cost of this alternative was 28.138 million rupees.

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3.1.2. Alternative - 2: Pumping with storage

In this alternative, storage tanks were provided and pipe diameters were kept same as provided in Alternative-1. Pipe cost was approximately the same as for Alternative-1; only two additional pipes were used for OHT connections. Although both the systems were designed on same diameters but in direct pumping the residual pressures achieved were lesser and in pumping with storage, smooth and good residual pressures were achieved at nodes. Figure 5 shows the pressure at each node and pipes diameter. Cost of excavation was 1.98 % of the capital cost and 1.37 % of the total cost. Cost of pipes was 47.8 % of the capital cost and 33.2 % of the total cost. Cost of installation of pumping machinery was 2.350 million. Energy cost was 30.5 % of the total cost. Total cost of this alternative was 33.229 million. The OHT tank was designed on maximum height of 65.5 ft. So, in order to minimize the head losses in the distribution system and to achieve the required residual pressures, elevation of OHT and head of the pump had changed. The cost of alternative was 15 % greater than the Alternative-1, which was due to the additional cost of OHT construction. And this OHT construction cost was 27 % of total cost of the project. On the basis of hydraulics, this option of water distribution system is more reliable but on the basis of cost, direct pumping is more economical option. Red line in the graph shows water supplied from the pump whereas green line shows consumption of water over 24 hrs.

3.1.3. Alternative-3: Direct pumping with one pump

In this alternative, only one pump was installed. Summary of the pipes used in this alternative is listed in Table 4. Cost of excavation was 3.8 % of the capital cost and 1.8 % of the total cost. Cost of pipes was 33.8 % of the capital cost and 8.43 % of the total cost. Energy cost was 13.3 million and it is 53.2 % of the total cost of this alternative. This was equal to the energy cost for Alternative–1. Pump installation cost was 2.8 million and it was 22.22 % lesser than the cost of pumps in alternative-1. The total cost if this alternative was 24.976 million. Although energy cost was equal to direct pumping with two pumps but total cost of this alternative was lesser than alternative 1 and 2. Because pump machinery installation cost was less in this alternative i.e. only one pump installation cost was incorporated in this alternative. Figure 6 shows the pressures at each node and pipe diameters.

Table 4: Pipe Categories and their Number

Pipe Category		Number of Pipes	
		Individual	Total
Tertiary	3inch	225	242
	4inch	17	
Secondary	5inch	-	8
	6inch	6	
	8inch	2	
Primary	10inch	1	2
	12inch	1	

3.1.4. Alternative-4: Pumping with storage with one pump and one OHT

In this alternative, one storage tank and one pump was provided. All the pipe diameters were same as provided in Alternative–3 but two additional pipes of 12 inches were provided for the OHT connection with the distribution system. The pump used in this alternative had been designed on maximum water demand of the system. Cost of installation of pumping machinery was 2.000 million which was 14.9 % lesser than in pumping with storage with two pumps. Overall it was the

least cost of pump installation among four alternatives under study. Cost of excavation was 2.2 % of the capital cost and 1.5 % of the total cost of this alternative. Cost of pipes was 34.5 % of the capital cost and 28.9 % of the total cost of this alternative. Energy cost was 33.2 % of the total cost of this alternative. Energy cost was almost same as in Alternative–2. The total cost of this alternative was 30.851 million. As this alternative is hydraulically efficient as Alternative-2 but on the basis of cost, this alternative was at second priority. Total cost of this alternative was lesser than Alternative-1 and Alternative-2. But it was costly than Alternative-3 due to OHT construction cost. Figure 7 shows the pressures at each node and pipe Diameters. Red line in the graph shows water supplied from the pump whereas green line shows consumption of water over 24 hrs. Figure 3 shows the comparison of capital cost, operation cost and total cost of all alternatives.
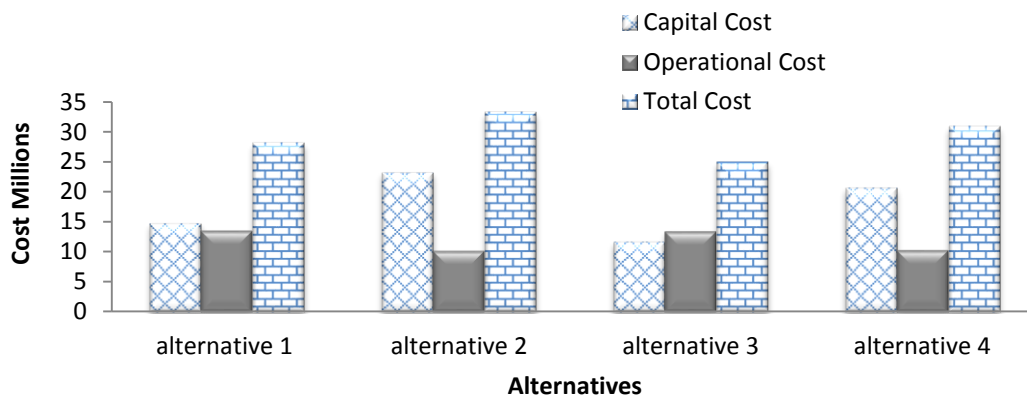
Figure 3: Cost Comparison of Alternatives

3.1.5. Alternative-5: Pumping with Storage with 1 pump and changed per capita water consumption

In this case, per capita consumption of 80 gpcd was used. To meet the pressures of 17.5 psi at farthest point, the pump head and diameters of the pipes were increased. The head of pump was increased by changing the elevation of the tank. Pipes of larger diameters (12-8in) were used nearest to the pumping station as these pipes were the primary pipes and to distribute the water in the system. Then secondary pipes with diameter (6-4in) used and the pipes which were far away in the system are of smaller diameters i.e. 3in as they had to take lesser pressure. Pressures were meeting in the range of 19 psi to 23 psi at the farthest point of the system. Figure 8 shows the output of this alternative. The cost of this system is increased as with increase in per capita consumption the height of the tank and diameter of the tank increased. The capital cost of the system is 143.78 million rupees. Out of which, 11.16 % of cost was the cost of pipes, 4.17 % was the cost of pumps and 84.32 % was cost of the overhead tank. Operational cost of the system is 28.14 million rupees. Although, the cost of this alternative has increased but we are meeting the good demand of water in the system.

3.1.6. Alternative-6: Pumping with storage with 1 pump and changed pipe material

In this alternative, as pipe material was changed so head losses were increased by using Cast Iron pipes and pressure was reduced but this change was very minor. Figure 9 shows the output pressure at each node and pipes diameter. The total cost of pipes in this alternative is 0.416 million rupees and their excavation cost is 0.447 million rupees. The capital cost of pipes is about 95 % less than the Alternative-4. Total cost of pump and OHT was same as Alternative-4. While the total capital cost of this system was 22.36 million rupees that is about 28 % less than the Alternative-4. This change in cost is only due to the change of pipes cost.

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3.2. Chlorine Modeling

3.2.1 Alternative-1: Pumping with storage with 1 pump

By performing the experiments, K_b came out to be -0.0223/hour, which corresponds to -0.5352/day. The values of these co-efficient are less which shows that pipes are in good quality so chlorine decay in pipes due to wall reaction and bulk reaction is very slow which shows that water does not have so much material to decay chlorine.

These co-efficient values were inputted in the software and for 24 hrs. residual chlorine at consumer end are evaluated. The residual chlorine at each user end was in range of 0.2 mg/L-0.5 mg/L as recommended by WHO. During software simulation, at 0:00 hr, initial quality at each node was zero and after that it was varying as the chlorinated flow starts reaching nodes with time. The reaction rate due to pipe material is 13.59 % which is less than total bulk reaction rate. Figure 10 shows the output of this alternative. Bulk reaction rate in tank was 76 % greater than the reaction rate in pipes this was because most of the time the water remained in the tank as tank water was used in only peak hours of the day otherwise it remained in tank and bulk reaction took place. In addition to this, the reaction rate due to the pipe is less because the pipe material used was of greater roughness co-efficient. Due to larger roughness co-efficient, the deterioration of water quality reduced. Figure 11 shows the effect of pipe material on water quality. Quality of water, i.e. residual chlorine decreased with the changed C value because wall co-efficient for CI pipes is very high. And the residual chlorine at each node was coming out to be greater than the required residual chlorine i.e. 0.2mg/L at the near consumer node from pump. While in the farthest point the residual chlorine is less than the required residual chlorine i.e. 0.2 mg/L.

4. Conclusion and Recommendations

On the basis of hydraulics, it is concluded that pumping with storage water distribution system is more feasible option as more appropriate residual pressures are achieved with this alternative because; in pumping with storage, the OHT equalizes the pumping rate i.e. provision of sufficient capacity to permit pumping at constant rate. The stored water in OHT ensures a reliable general purpose flow when power fails. As in direct pumping if power fails then there will be no supply of water. So, in Pakistan as there is shortage of electricity so this option is quite feasible. Comparing direct pumping and pumping with storage, the total cost of alternative–2 is 15 % more as compared to alternative–1 because of provision of OHT which costs about 9.25 million as capital cost. But energy costs involved in alternative–2 are 24.6 % lesser than alternative–1. If it is expected that there will be shortage of electricity in the area, then it is suggested to go for alternative–2. Installation cost of pumping machinery in alternative–2 is 34.72 % lesser than in alternative-1. The amount of residual chlorine achieved at end user nodes is meeting the WHO criteria of residual chlorine of 0.2 mg/L-0.5 mg/L. For the pumping with storage, elevated storage tank should be located so that zones of high consumption lie between the pumping station and tank. Because in such situation during period of high use, the district will be fed from both sides, which reduces the pressure drop to about one-quarter that which would exist if flow were only from one direction.

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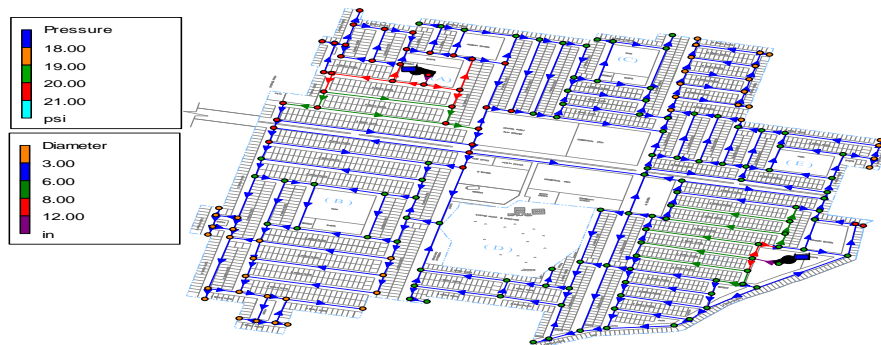
Figure 4: Direct pumping
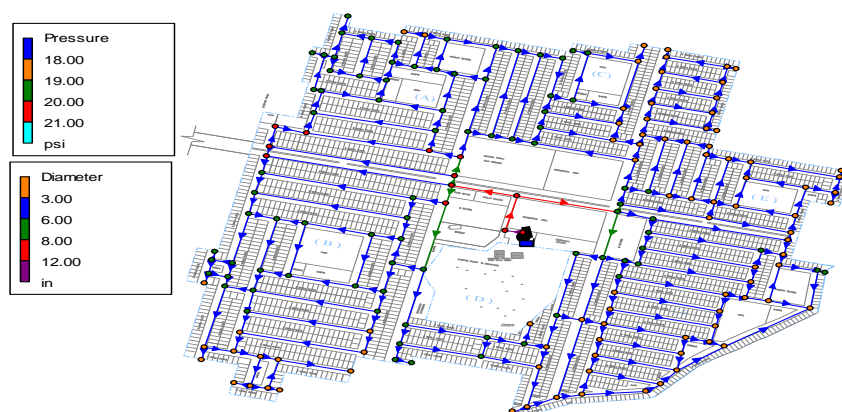
Figure 5: Pumping with storage
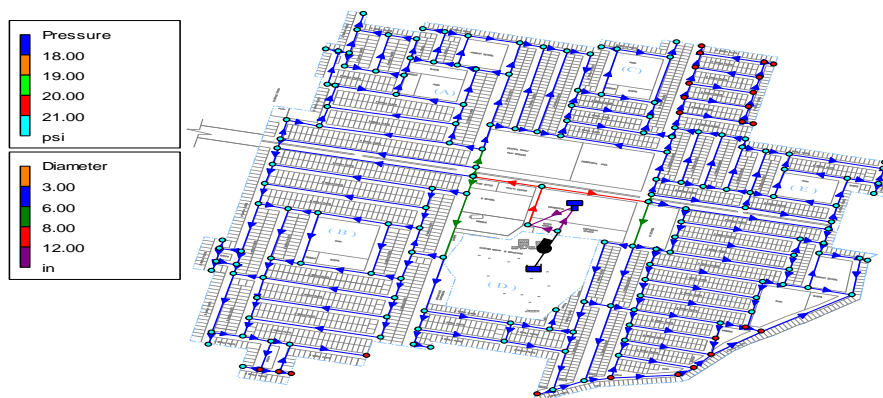
Figure 6: Direct pumping with pump 1

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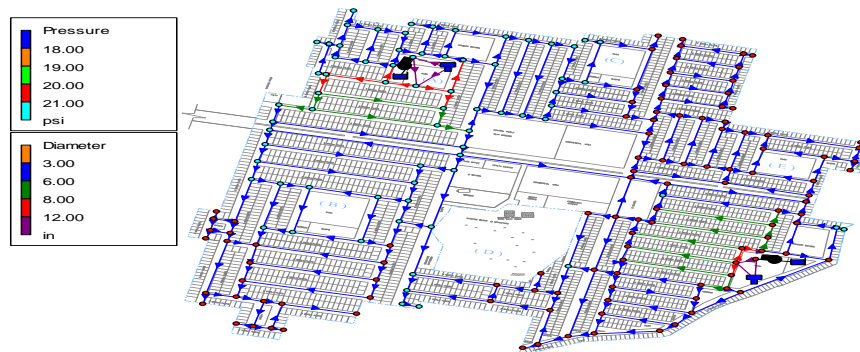
Figure 7: Pumping with storage with 2 pump
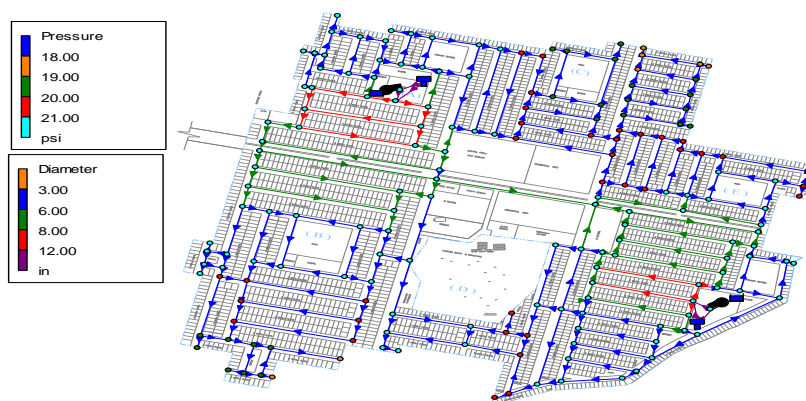
Figure 8: Pumping with Storage with 1 pump and changed per capita water consumption
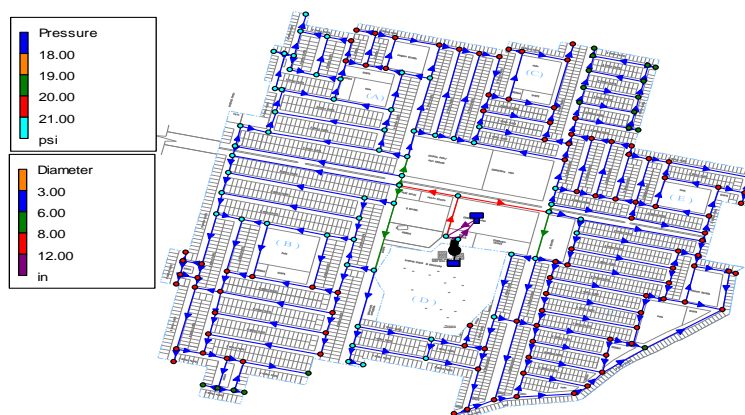
Figure 9: Pumping with storage with 1 Pump Time Pattern – (CI)

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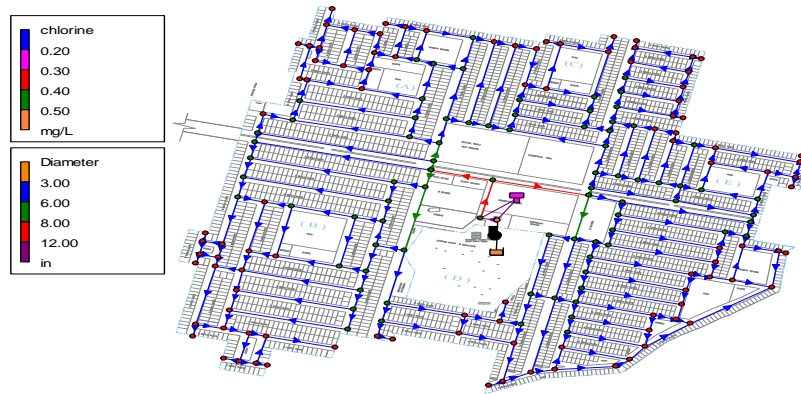
Figure 10: Pumping with storage with 1 pump – Chlorine Modeling
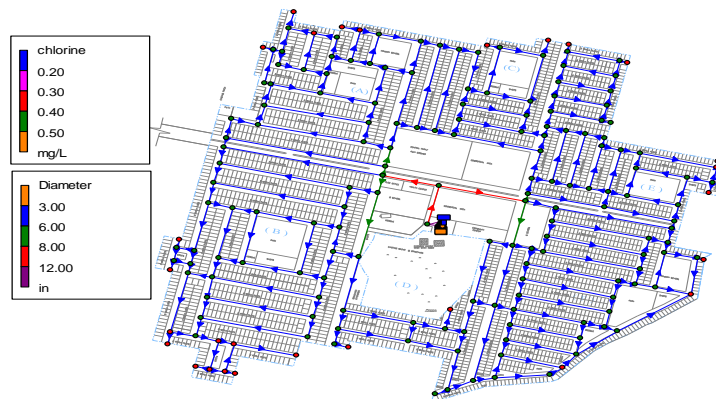
Figure 11: Pumping with storage with 1 pump – Chlorine

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Effect of Transverse Steel Spacing on Confinement of Low Strength Concrete Under Compression

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Abstract

In columns or compression members, lateral reinforcement in the form of hoops, cross-ties, or spirals play an important role in safeguarding the columns, especially when they are subjected to strong earthquakes or accidental lateral loads. They are required in any column-whether they are parts of a moment resistant frame or the gravity system in order for them to deform laterally and provide the required ductility. The development of reinforced concrete structures is continuously studied to improve the strength, ductility, and durability of the component members. It has long been recognized that the strength as well as deformability of concrete substantially increase wherever amount of confinement in the form of closed ties (hoops) is increased. The different characteristic properties of RC member's e.g. compressive strength of columns depend on different factors that are defined by the constituent materials and their properties.

Addressing only the confinement requirements of the above, transverse reinforcement in this case Lateral Confining Reinforcement (LCR) tend to increase the strength and ductility of RC members. It also keeps longitudinal reinforcement in place while concrete is poured. When an axial concrete element (column) is laterally reinforced (e.g. by ties, hoops or spirals) and subjected to axial compression, expansion of the element in the plane perpendicular to the axial compression activates the lateral reinforcement which exerts tri-axial compression increasing member capacity to sustain large compressive stresses and deformations. The locally produced concrete is usually of low strength but the design standards i.e. ACI 318-08 and other modern standards have a minimum strength of 3000 psi.

The result has shown that the strength capacity of column as well as ultimate concrete compression strain has increased in low strength concrete due to confinement.

Keywords: Transverse reinforcement, low strength concrete, compressive strength, confinement

1. Introduction:

Strength and ductility of reinforced concrete column is very important for a structure stability and it can be enhancing through proper confinement. During an earth quake behavior of Column extremely critical. The characteristics of normal confined concrete have been researched extensively, and the primary parameters of confinement have been identified both experimentally and analytically. Analytical models have been developed, for the study of normal concrete, usually on the basics of a specific set of test data. These models, although producing good predictions in many applications in normal concrete the confinement effect of lateral reinforcement, perimeter hoops and intermediate tie bars, is not obvious. This research described an experimental investigation of the confinement effect through transverse reinforcement in low and normal strength concrete square column.

RC structures in developing countries are poor quality due to poor construction practice. Different surveys regarding developing countries revealed that improper use of poor construction material, non-engineered design and poor practice cusses the concrete low strength. These non-engineered low concrete structure are very prone to earth quake such as Kashmir earth quake in October 2005 in Pakistan. The distinctive characteristics of reinforced concrete member's i.e. compressive

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strength of axial columns, depend on properties of constituent materials and their combined effect. These non-engineered RC structures has not been studied in the past and most of the research work has done on the normal and high strength concrete.

Strength and ductility of RC column can be improved by providing proper confinement such as by increasing the number of ties, by increasing the size of ties, by decreasing the space between ties etc. Lateral confining reinforcement is among the basic component quantified in design codes. The advancement in confining of concrete is very important for RC structures in order to achieve large concrete deformation and strength of concrete which depends on the core of confined concrete. There are several factors which can affect the confinement such as Size of ties, Amount of ties, Spacing of ties, Strength of Concrete. The development of reinforced concrete structures is continuously studied to improve the strength, ductility, and durability of the component members. It has long been recognized that the strength as well as deformability of concrete substantially increase wherever amount of confinement in the form of closed ties (hoops) is increased. The different characteristic properties of RC member's e.g. compressive strength of columns depend on different factors that are defined by the constituent materials and their properties.

Transverse reinforcement specified in design codes for columns has three main functions:
1. Prevent buckling of longitudinal bars
2. Resist shear and torsional stresses
3. Confine the concrete core to provide sufficient ductility

Addressing only the confinement requirements of the above, transverse reinforcement in this case Lateral Confining Reinforcement (LCR) tend to increase the strength and ductility of RC members. When an axial concrete element (column) is laterally reinforced (e.g. by ties, hoops or spirals) and subjected to axial compression, expansion of the element in the plane perpendicular to the axial compression activates the lateral reinforcement which exerts tri-axial compression increasing member capacity to sustain large compressive stresses and deformations.

The locally produced concrete is usually of low strength but the design standards i.e. ACI 318-08 and other modern standards have a minimum strength of 3000 psi.

Most of research on confined concrete done lately (shown in literature review) mainly focuses on normal to high strength concrete, which is not easily achieved in our national context due to the following reasons:
1. Quality of workmanship
2. Quality of material and its source
3. Non-engineered design of concrete and structures.

(Canyon Bridge Simi Valley San Fernand)
Failure of column due to Buckling of main bars
Fig: 1

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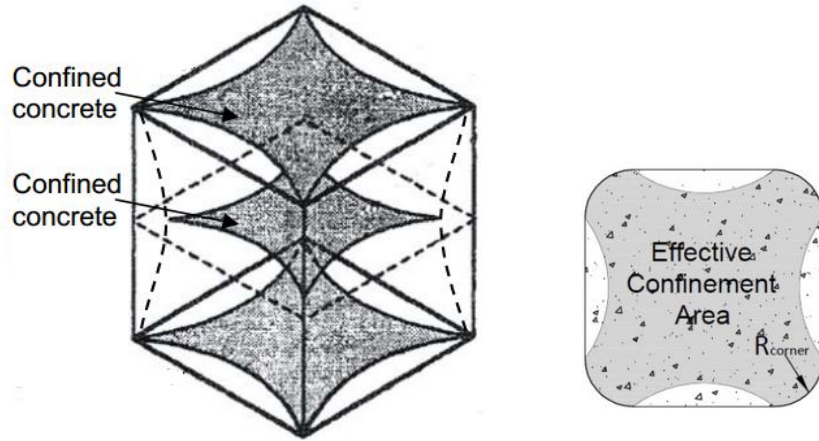
Confined and un-confined Concrete

Fig: 2

2. Materials and Methodology:

36 square column sections for testing under concentric axial compression were cast. The specimen size is adopted from reviewing literature from 1990 to 2012 **(Imran, 2012; Khaleek, Yadav, & Rajeev, 2012; Shafqat & Ali, 2012)**. Confined square columns with longitudinal reinforcement of 0.2 in² were fabricated, and tested under concentric axial load. The samples were made of two different concretes with compressive strengths of 2000 psi and 3000 psi and the detailed fabrication plan is shown in *Table*. The detailed mix design for concrete used is presented. Variables under consideration in this experiment are:

    i.   Compressive strength of concrete

    ii.   Size and geometry of transverse reinforcement used for internal confinement

2.1. Materials properties

Materials used in fabrication of models i.e. concrete and reinforcement are tested for use in different sizes and strengths in both the sample types. The tested materials are mentioned as below:

i.   **Mix design of concrete:** Mix design for 2000 psi and 3000 psi is done. The tests conducted for mix design are as following:

ii.   **Reinforcement:** Tensile strength test**,** Bend test

The mix design used in both beams and column samples is discussed in this chapter so that next chapters solely discuss the samples fabrication, testing, resulting curves and analytical portions of column prisms and beam samples respectively

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2.2. Mix Design of Concrete:

Mix design for concrete strengths of 1800 psi and 3000 psi are done according to ACI recommended practice 211.1.

Specific Gravity of Sand:

Weight of sand sample, S = 200 g
Weight of water, B = 248 g
Weight of water + sand sample, C = 366 g
Specific Gravity = S/ (B+S-C) = 200/ (248+200-366)
Specific Gravity = 2.43

28 Days concrete compressive strength:

Table 2- 28 days compressive strength of concrete

S. No.	Target Strength (psi)	Load (Ton)	Actual Strength (psi)	Avg. Strength (psi)	Standard Deviation
1	2000	22.1	1722.97		
2	2000	23.2	1808.73	1783.39	
3	2000	22.5	1754.16		55.63
4	2000	23.7	1847.71		
5	3000	38.06	2967.67		
6	3000	36.1	2814.45		84.08
7	3000	36.2	2822.24	2891.06	
8	3000	37.96	2959.87		

2.3. Steel Reinforcement:

Three types of deformed steel bars were used in the specimens. Grade 60, #4 bars were used as longitudinal reinforcement, while Grade 40, #3bar bar were used as transverse reinforcement. Their mean values of mechanical properties were determined from tension tests using an UTM in accordance with ASTM A370-03a Standard using a minimum of three samples of each type of steel and are presented in Table: 3

Table: 3

S. No.	Nominal Dia.	Yield Str., psi	Ultimate Str., psi	% Elongation	Actual Dia., inch	Load, lb/ft	Mean Yield strength	Standard Deviation
1	#4	71036.54	89105.07	16.40	0.48	0.595		
2	#4	70178.30	88336.32	17.19	0.48	0.600	70705.45	461.49
3	#4	70901.52	88873.09	16.40	0.48	0.598		
4	#3	80663.44	96111.60	14.06	0.78	1.627		
5	#3	80470.65	95935.09	14.06	0.78	1.625	81553.05	1710.52
6	#3	83525.07	98971.49	16.40	0.77	1.578		

3. Testing of Models:

For pure axial behavior concentrically loaded members (column prisms) are tested. The deflection in prisms is measured along with applied load for strain calculation in samples. For stress strain curve generation, load applied from UTM is collected using DAQ system along with strain from displacement gauge installed at one face of sample.

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Figure showing column prism testing in UTM

Fig: 3

Different mode of failure of confined concrete specimen

Fig: 4

4. Test Results:

This sample was tested to get the pure axial compressive strength of the sample dimension and ties were also not provided for confining effect. The sample curve for sample-2 is discontinued because of some cracking in clear cover of concrete near vicinity of displacement gauge. The graph also shows peak strength and strength at 85% strength degradation after peak (ultimate strain point for unconfined concrete) **(Hognestad, 1951).**

It was experimentally observed by many researchers that specimens with tie spacing more than least core dimension do not develop confinement effect. Also the least ties spacing requirement of ACI 318-08 suggests a tie spacing of 4 in c/c for this sample. But it is experimentally validated that when ties spacing is more than that of core least lateral dimension, confinement do not increase

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ductility, thus ineffective **(Sheikh & Uzumeri, 1982)**. Therefore, samples with tie spacing of 7in cannot be termed as confined concrete samples but some confinement effect will exist as discussed. Also the sample has shown lesser ductility 1.04 than that of no transverse reinforcement samples i.e. 1.66. *Graph-2* shows stress-strain curves for the sample.

These samples were relatively more confined and the ductility is found to be much more than that of unconfined prisms. When strain reaches to the maximum strain capacity of concrete the clear cover spalled, afterwards the confined concrete within the core exhibits load carrying capacity with larger strains. The longitudinal reinforcement got buckled after concrete cover spalling which shows that stiffness of longitudinal reinforcement ratio was not enough. The stirrup stiffness was more than tri-axial expansion pressure as it did not split open as predicted and experimentally validated by most of the researchers. Ductility for confined prisms is found using ultimate axial strain to be $\varepsilon_{cc} = 0.65 f'_{cc}$ for light to moderate confined concrete **(Bouafia, Iddir, Kachi, & Dumontet, 2014)** . The resultant stress-strain curve is as shown in the *Graph-2.*
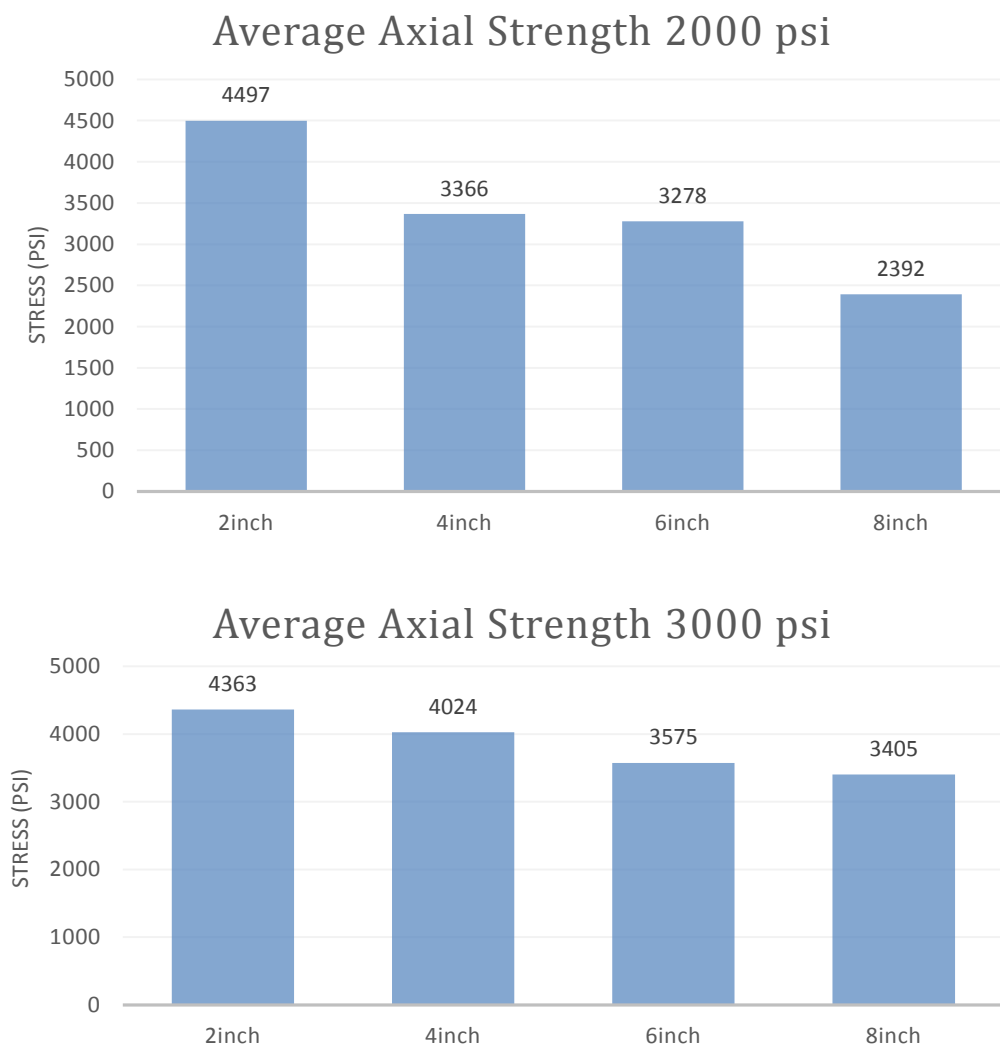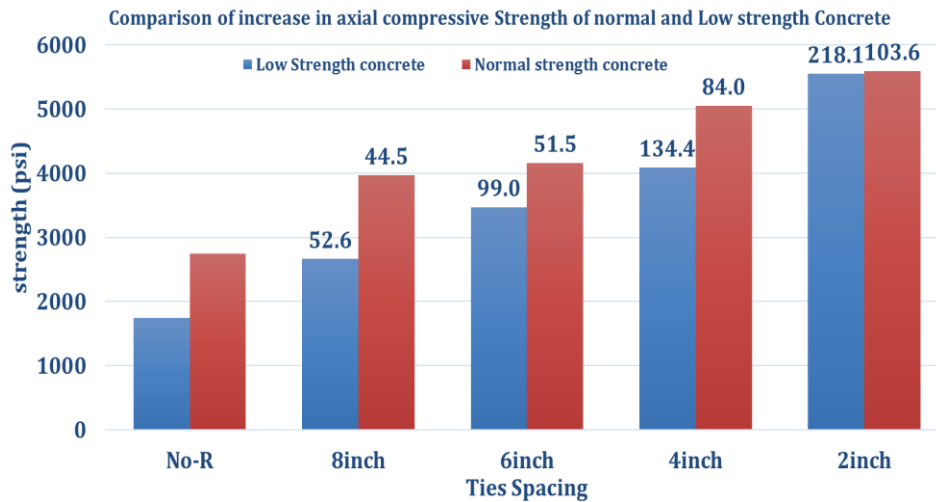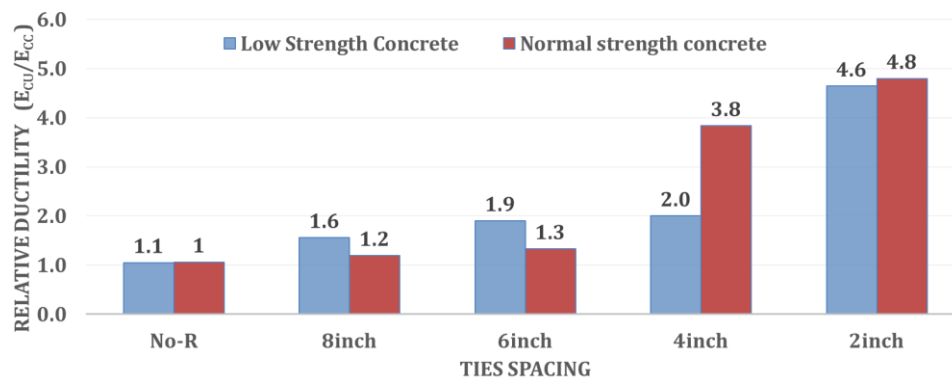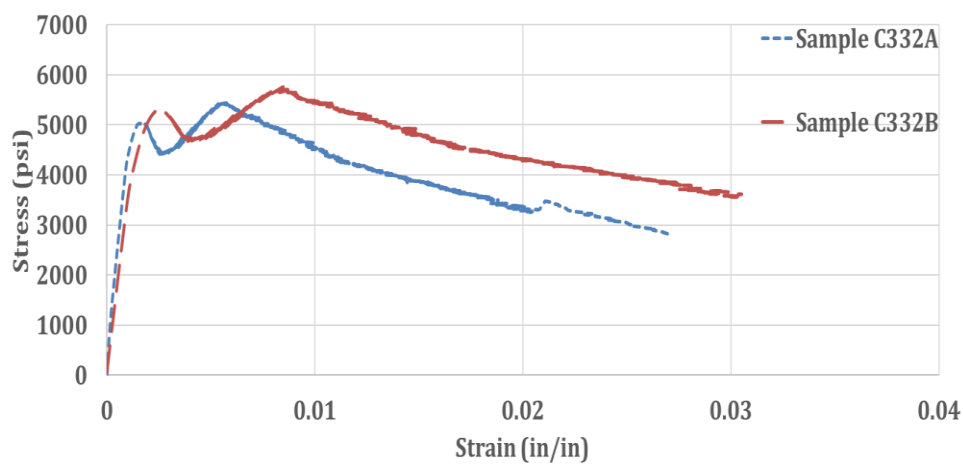
Average Axial Strength 2000 psi

Average Axial Strength 3000 psi

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Graph: 1

Graph: 2

Stress Strain Curve 2in ties spacing specimen of NSC

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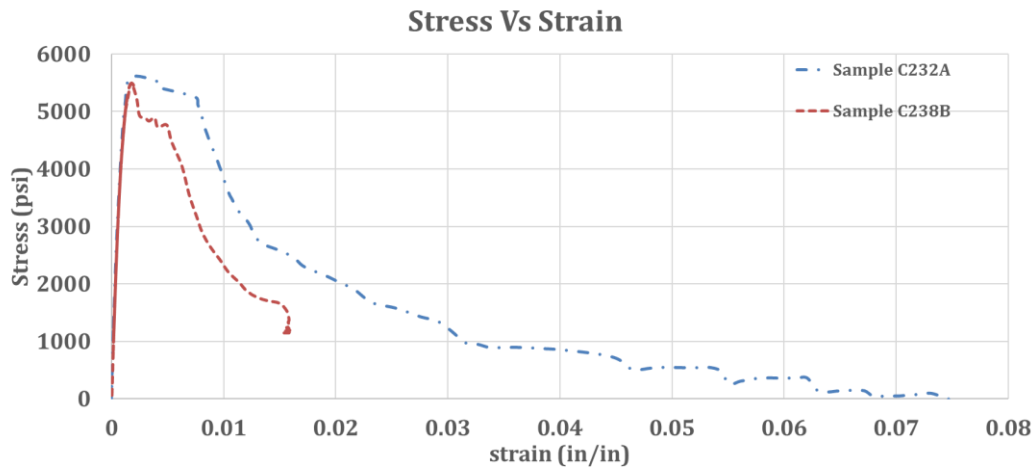
Stress Vs Strain

Graph: 2

Stress Strain Curve 2in ties spacing specimen of LSC

Conclusions:

- Increase in Compressive Strength due to confinement effect was almost twice in case of low strength concrete as compared to normal strength concrete specimens.
- Increase in relative ductility was found equal significant in case of normal and low strength concrete for low spacing of transverse reinforcement (2inch c/c spacing). However, no significant difference was found for the higher spacing.
- For same amount of transverse Reinforcement, the axial compressive strength increases with decrease of spacing.
- In term of compressive Strength, the effect of transverse confinement is more in LSC as Compared to NSC
- Recommendations:
- Increase in Compressive Strength due to confinement effect was almost twice in case of low strength concrete as compared to normal strength concrete specimens.
- Increase in relative ductility was found equal significant in case of normal and low strength concrete for low spacing of transverse reinforcement (2inch c/c spacing). However, no significant difference was found for the higher spacing.
- For same amount of transverse Reinforcement, the axial compressive strength increases with decrease of spacing.
- In term of compressive Strength, the effect of transverse confinement is more in LSC as Compared to NSC

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Evaluation of Asphalt Mixtures using Neat and Modified Binder

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Abstract

Failures of the asphalt pavement may occurs due to high pavement temperature and uncontrolled axle loads throughout Pakistan which leads to high preservation costs. Modification of the asphalt mixtures with crumb rubber improves the properties of binder by making the mixture stiff. The study aims to evaluate the stiffness moduli of crumb rubber modified bitumen (CRMB) mixtures through various laboratory tests including marshall test, resilient modulus and indirect tensile strength (ITS) test. The overall findings indicated that the crumb rubber modified mixtures shows better results in performance tests and stimulate the modification of crumb rubber in asphalt mixtures.

Keywords: Asphalt Mixtures, Resilient Modulus, CRMB, Indirect Tensile Strength Test

1. Introduction

For economic and social development of a country road infrastructure plays an important role by providing the movement of citizens for educational, social, economic, cultural and recreational purposes which directly contributes to the quality of life. The needs of travelling have also been increased rapidly with continuous increase in economic activities. In such situation, poorly constructed pavements affects severely the social and economic development of country and provides inefficient mobility of people. It is quite well known that surfacing of flexible pavements with conventional bitumen does not meet the requirements of performance under heavy traffic and extreme climatic conditions and consequently leads to various distresses such as raveling, rutting, undulations, cracking, shoving, bleeding, and pot-holes of asphaltic concrete surfaces. To overcome these problems certain additives are added with the binder which includes sulphur, organo-manganese compound, thermoplastic rubber, sulphur, crumb rubber etc. **Peiman et al. (2015)** investigated on performance of rubber modified bitumen of varying size, he recommends (0.3-0.15mm) the best crumb rubber size to be used in modification. **Giulio et al. (2014)** conducted a study on crumb rubber in asphalt mixture which contains 100% reclaimed asphalt pavement, he concluded that with the use of crumb rubber instead of fine RAP would results into improved compaction of mixtures and better volumetric properties. **S.E Paje et al. (2013)** concluded that the

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noise ejected by tire would be reduced by using higher content of rubber modifier. **F Moreno et al. (2011)** conducted a research on mechanical performance of HMA modified with crumb rubber.

2. Objective and Scope

This research aims to evaluate the consequence of rubber modification on the efficiency of asphalt mixtures by determining the strength and stiffness of mixtures through (ITS) test and resilient modulus test. Penetration grade 60/70 was used as binder and crumb rubber was used as modifier. ITS test and resilient modulus test on gyratory compacted samples were conducted at 25 and 40ºC.

3. Materials and Testing

The materials were collected and brought into laboratory, three different sizes of aggregates were used 0-5mm, 5-10mm, 10-20mm to obtain the required gradation and the aggregates source were Margalla Quarry. Penetration grade 60/70 and modified with 7% crumb rubber was used as binder and the source for binder was National refinery limited (NRL). NHA class B gradation was used in this research. The optimum binder content for NRL 60/70 is 4.3% and for NRL 60/70 modified with crumb rubber is 4.6%. Gyratory compacted samples were prepared, ITS test and resilient modulus test were conducted in accordance with ASTM D 6931 and ASTM D 7369 respectively. First of all indirect tensile strength test was conducted on gyratory compacted specimen of 6 inch diameter and 2.5 inch thickness for determination of tensile strength of sample. The test was performed by applying compressive load across its vertical diametric plane at controlled deformation rate of 50 mm/min at 25 and 40ºC. The load at which the sample fails was taken as the indirect tensile strength of sample.

After ITS test, resilient modulus test was conducted in universal testing machine (UTM) on gyratory compacted specimen of 6 inch diameter and 2.5 inch thickness at 25 and 40ºC. For determination of resilient modulus of asphalt mixtures 20% of tensile strength of sample is usually taken as the peak loading force this will make the deformation almost recoverable and makes the material elastic.

4. Results and Discussions

The test results of indirect tensile strength is shown in table 1. The results showed that with the modification of crumb rubber the modified mixtures tensile strength significantly increases as compare to unmodified mixtures, similarly temperature has also great influence on indirect tensile strength. The graphical illustrations of test results are shown in figure 1.

Table 1: Improvement in indirect tensile strength of Asphalt Mixtures

Temperature	ITS (N)		Improvement (%)
	Unmodified Mix	Modified Mix	
25ºC	8234	9922	17.01
40ºC	3807	5120	25.64

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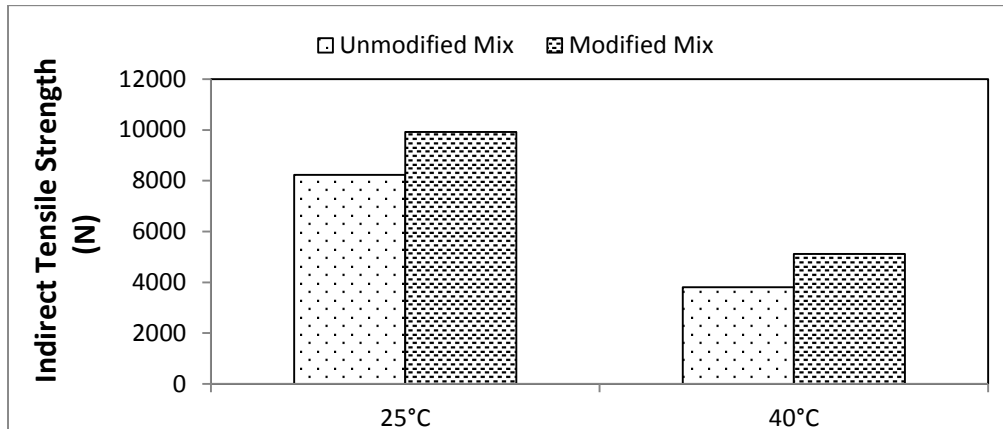
Figure 1: Indirect Tensile Strength of Asphalt Mixtures

The results of resilient modulus are presented in table 2 whereas the graphical illustrations are shown in figure 2. The results showed that the resilient modulus of modified mixtures significantly increases with modification of crumb rubber in comparison with unmodified mixtures likewise there is also a great influence of temperature on resilient modulus. At high temperature, low value of resilient modulus is observed and at low temperature high value of resilient modulus is noted.

Table 2: Improvement of Resilient Modulus of Asphalt Mixtures

	Resilient Modulus (MPA) @ 25ºC		Improvement (%)
Samples	Unmodified Mixtures	Modified Mixtures	
1	6282	11249	44.16
2	6891	12368	44.28

	Resilient Modulus (MPA) @ 40ºC		Improvement (%)
Samples	Unmodified Mixtures	Modified Mixtures	
1	1725	2716	36.49
2	1670	2590	35.52

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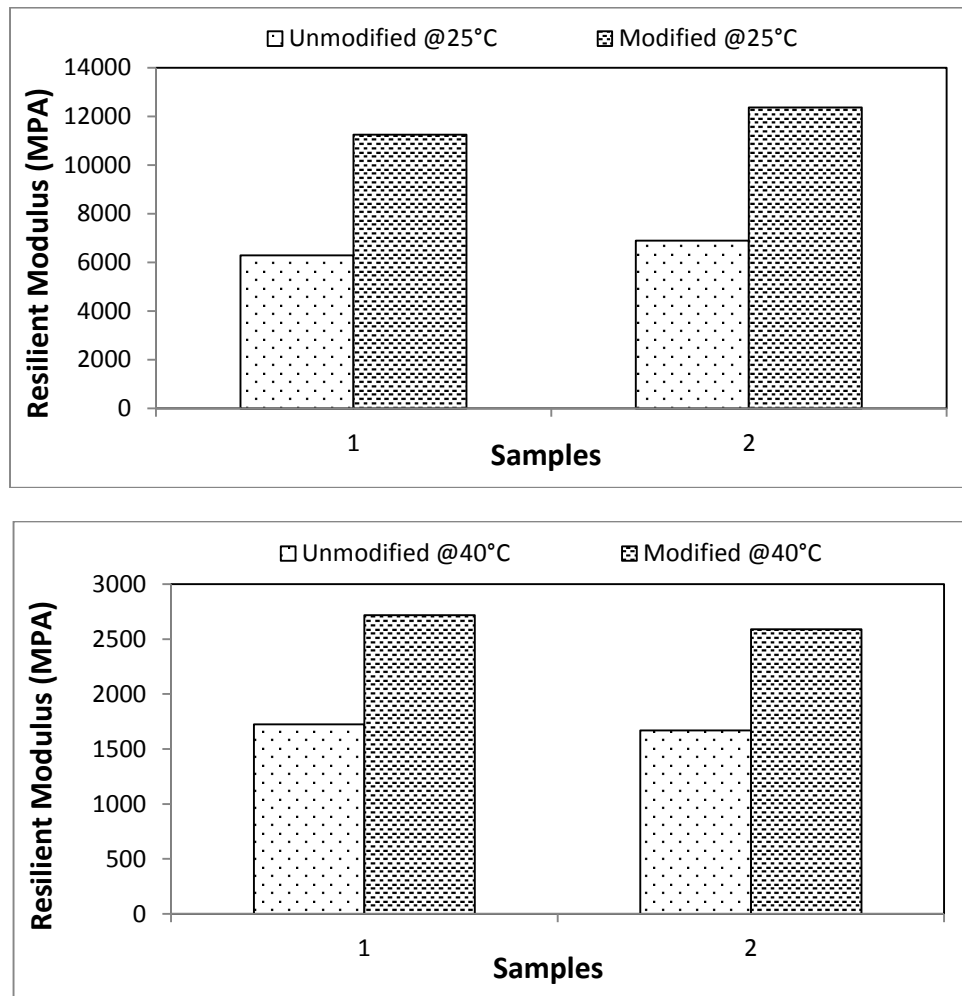
Figure 2: Resilient Modulus of Asphalt Mixtures

5. Findings and Conclusions

From the test results of ITS and resilient modulus it is concluded that with the modification of 7% crumb rubber, 17% increased in indirect tensile strength is noted at 25°C for rubber modified mixtures as compared to unmodified mixtures and 25% increased in ITS is observed at 40°C. Likewise 44% increase in resilient modulus for rubber modified mixtures is noted at 25°C and 36% increase in resilient modulus is observed at 40°C.

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Evaluation of Engineering Properties of Clayey Soils using Lime

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Abstract

Long-term performance of any construction project depends on the soundness of the underlying soils. Soil stabilization is a technique to enhance engineering qualities of soil by modifying its physical and chemical properties by mixing certain additives like lime, cement, fly-ash and asphalt, depending on the soil type. The main objectives of the soil stabilization are to increase the bearing capacity of the soil, its resistance to weathering process and soil permeability. In this study, the clayey soil with high plasticity index from the site of Abdul Ghani Khan Library charsadda, KPK was selected, where a number of structures collapsed in the past due to the problem of settlement of foundations. These types of clayey soils can be stabilized by addition of small amounts of lime. Soils samples were obtained and the test specimens were prepared using various percentages of lime such as 2%, 4%, and 6%. Unsoaked samples were tested after 2 days and 7 days curing, whereas the soaked strength was determined after 24 hour curing of test specimens. The tests results showed that strength and durability of soil increased significantly with addition of lime up to an optimum content of lime. The unconfined compressive strength increased almost 50 times whereas CBR value increased 3 times as compared to unstablized soil.

Keywords: Soil Stabilization, Unconfined Compressive Strength, CBR, Soaked and Unsoaked Strength

1. Introduction

Construction works in soft grounds often encounter problems originating from weak engineering properties of underlying soils such as low bearing capacity, excessive settlements and ground movements. Soil improvement in now widely increasingly needed because more and more land is required for urban or industrial development and good construction sites are difficult to find. Various methods have been now developed to stabilize the soil. Lime stabilization is also a technique used to stabilize the soil chemically. Addition of lime to the soils to improve their use to construction purposes has a long history. For instance, *(Turner and Seago 1985)* reported that stabilized earth roads were used in ancient Mesopotamia and Egypt, and that the Greeks and Romans used soil-lime mixture for construction purposes as mortar. Lime was first used as a stabilizing agent of soil in modern construction practices in 1924. It was extensively used during the Second World War for road and runway construction. In present era, the soft soils are stabilized by incorporation of lime. It is used in roads construction to improve sub-bases and sub-grades, for railroads and airport construction, for embankments, as backfill for bridge abutments and retaining walls, as canal lining, for improvement of soil beneath foundation slabs and for lime piles *(GUTSCHICK 1961)*. When lime is added to soil is has an immediate effect on the chemical

properties of soil as cation exchange begins to takes place between the metallic ions associated with the surfaces of the clay particles and the calcium ions of the lime. Clay particles are surrounded by a diffuse hydrous double layer which is modified by the ion exchange of calcium *(Bell 1996)*. Since most soils contains silica and alumina in sufficient quantity, addition of quick lime (CaO) or hydrated lime (Ca(OH)2), in presence of water, generates a chemical reaction and cementitious products are formed. Various theories have been suggested to explain the reactions between soil and lime. During the application of lime in soil stabilization, an increase in the concentration of OH$^-$ ions will increase the pH level, leading to dissolved alumina and silica in the clay fraction *(Yong and Ouhadi 2007)*.These released alumina and silica interact with calcium ions to produce two cementing agents of pozzolanic reaction. The selection of the percentage of lime as an additive is usually based on three tests: consistency limits, pH levels, and strength tests, where the last of these includes unconfined compression and/or CBR testing *(Kezdi 1979)*. Addition of chemical admixtures, cement and lime improved the engineering properties of soil and liquid limit was decreased with increased cement and lime contents, also significant increase in unconfined compressive strength was noted*(Al-Amoudi 1994)*. *(Negi, Faizan et al. 2013)* worked on stabilization of soil using lime and concluded that lime is an excellent stabilizing agent for highly active soils that undergo through frequent expansion and shrinkage. *(Al-Rawas, Hago et al. 2005)* reported that addition of 6% of lime in soil results reduces the swell potential and shows superior results compared to other stabilizers. *(Singh and Vasaikar)* worked on stabilization of cotton black soil using lime, they added 4% and 6% of lime into the soil and their test results showed that, the plastic limit and the M.D.D of cotton black soil decreased, with addition of lime, no change occurred in the O.M.C of the soil sample, the CBR value showed 8 times increase with lime and the swelling pressure also reduced with lime addition. *(Kavak and Akyarlı 2007)* worked on a road section of 200m located at Yukari Yurtcu village Ankara province where green and brown clays are dominant they used 5% of lime for soil stabilization. From different tests they concluded that from plate load test results, the increase in the modulus of sub grade reaction values as a result of lime stabilization and the definitive decrease in the permanent and maximum settlement values revealed that the deformation of the road under traffic loads would be low. The CBR values had increases significantly, the CBR value of clay increased 21times and that of green clay had increased 16 times compared to the natural state of soil. And the swelling values of both the clays we reduced to below 1%. *(Bell 1996)* studied on stabilization of clay soils with lime. It was reported that Clay soil can be stabilized by the addition of a small percentage, by weight, of lime. This produces an improved construction material. Generally the amount of lime needed to modify a clay soil varies from 1 to 3 per cent, whilst that required for cementation varies from 2 to 8 per cent.

2. Materials

2.1 Soil
The soil sample was collected from site at Abdul Ghani Khan Library located at charsadda district KPK, where the building had collapsed due to settlement of the foundations. The soil sample was collected from depth of one foot to avoid the presence of roots and other organic matter. The physical properties of untreated soil are listed in Table 1.

Table 1 Physical Properties of untreated soil

Plasticity index	26%
Percent Passing Sieve No. 200	27.23%
Unconfined Compressive Strength	11 lb/in^2
California bearing ratio(CBR)	3.23%
Optimum Moisture Content(OMC)	20%
Maximum dry density (MDD)	112.66lb/ft^3

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2.2 Lime

The standard calcium hydroxide lime was used as stabilizer. The chemical and physical properties of lime are given in Table 2.

Table 2 Physical and chemical properties of lime

Chemical name	Calcium hydroxide
Physical appearance	Dry white powder
Boiling temperature (^{0}C)	100
Heat of fusion(^{0}C)	580
Bulk density (kg/m^3)	Max. 500
Specific gravity	1.2–1.5
pH (25^0C)	12.4
Ca(OH)$_2$ (%)	80–86

3. Preparation of Test Samples and Testing Procedure

3.1 Unconfined Compressive Strength (UCS)

ASTM D 2166-00 method was used for Unconfined Compressive strength testing. A special mold having 6inch height and 3inch diameter was fabricated. The compaction effort was calculated on the basis of energy delivered per unit volume of soil during modified compaction procedure. Number of layers, weight of hammer and height of fall was kept constant and only number of blows were adjusted. After preparing the soil-lime (SL) mix at 1% above the OMC, at least 1 hour was allowed for hydration. Each sample was sealed in a plastic sheet to make it air tight. Samples were then placed in an oven at 40°C for the desired curing period. Unsoaked tests were carried out at the end of 2 and 7 days curing periods. For soaked testing, the samples, after the desired curing period, were wrapped in a porous cloth and placed over a porous stone in a container. The container was filled with water till the top of porous stones. As required by NLA (2006) design procedure, direct contact of sample with water was avoided. The samples were allowed to soak for 24 hours and then tested.

(a)   (b)   (c)   (d)   (e)
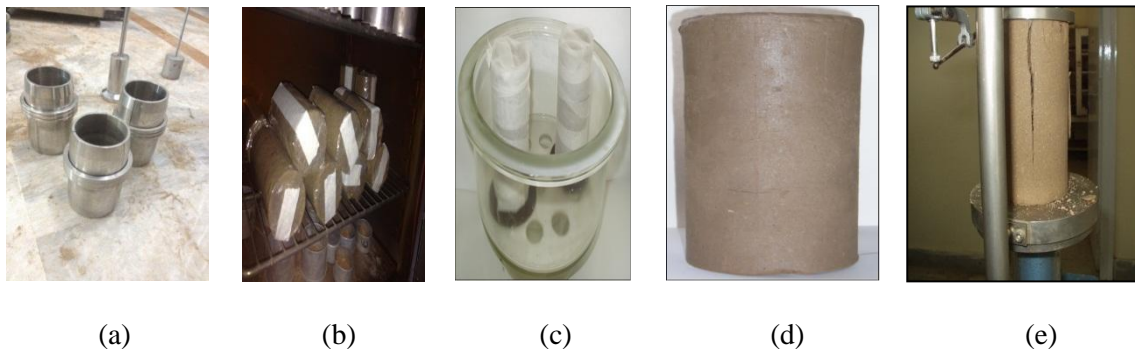
Figure 1: (a) Mold for Soil UCS Samples, (b) Curing of UCS Samples, (c) Soaking of soil Samples (d) UCS Sample after Soaking, (e) failure of UCS Sample.

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3.2 California Bearing Ratio (CBR)

ASTM D 1883-05 procedure was adopted for preparation of test samples for California Bearing Ratio (CBR) test. The test involves applying load to a small penetration piston (3 square inch) at a rate of 1.3mm per minute and recording the total load at penetrations ranging from 0.025 inch up to 0.300 inch. CBR samples for untreated and treated soils were prepared at three moisture levels corresponding to 90% of MDD on the dry side of optimum, at optimum moisture content and 90% of MDD on the wet side of optimum. All the samples were soaked for 96 hours.

4. Results and Discussions

4.1 Atterberg's Limits

Fig.2 illustrate the effect of lime on treated soil. Grain size distribution and consistency limits of lime treated soil were changed after seven days. The PI of SL mix reduced to only 13 from 25 and the fraction passing Sieve No. 200 also reduced to 62% as compared to 79% of the unstablized soil. As a result of these changes the classification of SL mix changed from CL to CL-ML in accordance with Unified Soil Classification System and from   A-6 to A-4 in case of AASHTO soil classification system
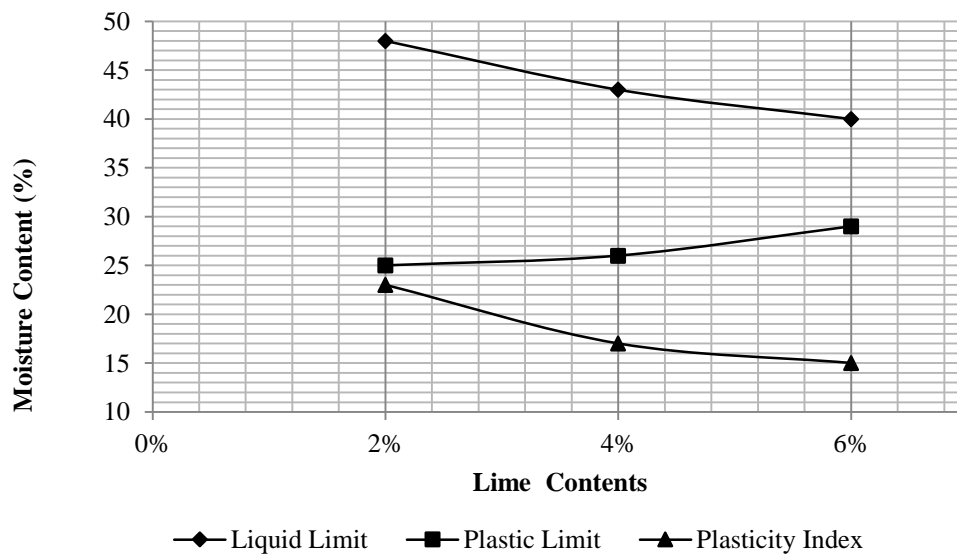
Figure 2: Effect of Lime on Atterberg's limits at 2 days curing period

Fig. 3 showed the variation in pH value with lime addition. It was observed that pH value increased as lime contents increased up to 6% of lime after that no change in pH was noted.

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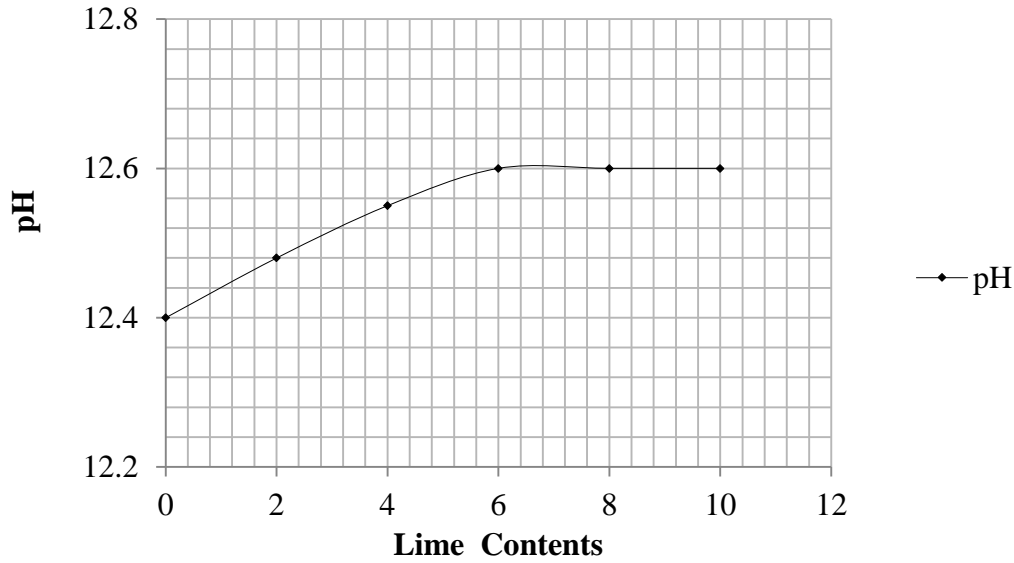
Fig. 3: Influence of Lime addition on pH of Soil

4.2 California Bearing Ratio (CBR)

Fig.3 shows the variation in CBR with the addition of Lime. The test results indicated that the CBR value had increased from 3.23% to 8.10% by adding lime at optimum percentage.
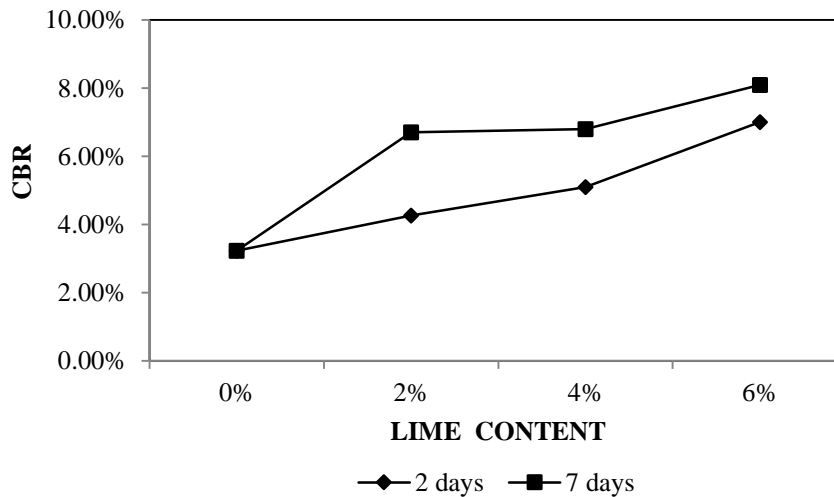
Figure 4: Influence of Lime addition CBR values

4.3 Unconfined Compressive Strength (UCS):

Fig. 5 indicated the variation in soil strength with addition of lime on 2 days & 7 days curing. The UCS value was observed to be increased gradually from 11 lb/in² to 23 lb/in² at 6% lime and 7 days curing, but as the lime content was increased beyond 6% the UCS value started to decrease gradually which shows that the optimum lime content for the soil sample was 6%.

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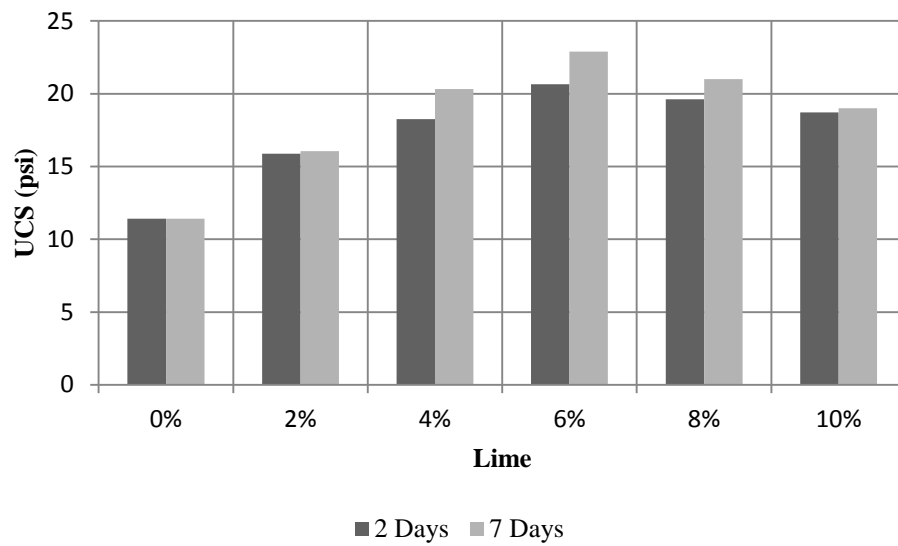
Figure 5: Variation of Unconfined Compressive strength at different lime contents and curing period
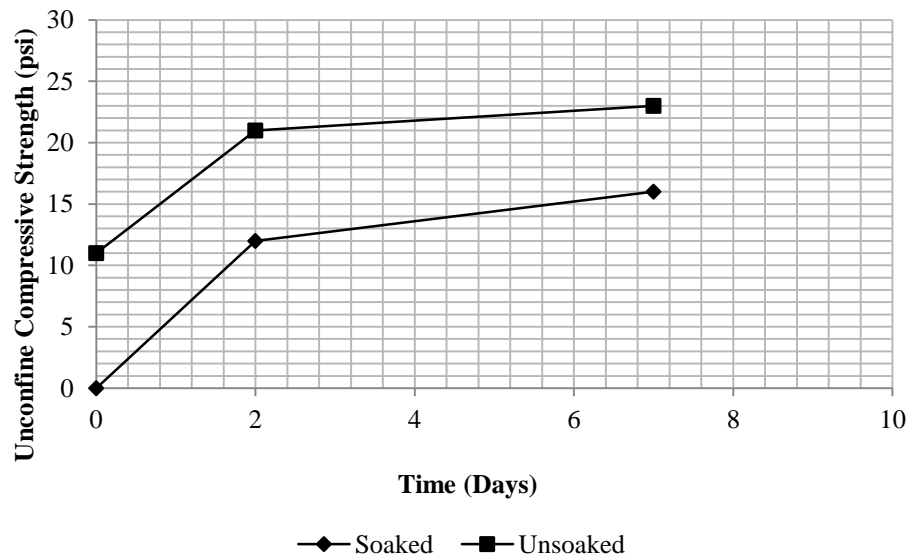
Figure 6: Variation in UCS with time

In case of soil-lime (SL) mix, the loss of strength due to soaking reduced significantly. Loss of strength experienced by lime treated soil at various curing periods is shown in Fig. 4.6. It is observed that the effect of soaking is significantly reduced with curing time and thus there is a corresponding increase in ratio of soaked to unoaked strength with time. The soil experienced a strength loss of less than 30% after 7 days of curing as against a loss of almost 43% after 2 days curing. Correspondingly the ratio of soaked to unsoaked strength increased from 0.57 to 0.70.

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5. Conclusions:

- The soil is reactive with lime. Optimum percentage of lime required for stabilizing the soil is 6% by weight of soil.
- The reaction is very quick and stabilization of soil starts within few hours.
- Lime acts immediately and improves various property of soil such as carrying capacity of soil, resistance to shrinkage during moist conditions, reduction in plasticity index, increase in CBR value and subsequent increase in the in the compression resistance with the increase in time.
- Use of lime as stabilizing agent in conjunction is technically and financially feasible as it increases both the strength and durability parameters of soil. Furthermore it is an environment friendly.

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Stress- Strain Relationship for Low Strength Confined Concrete under Compression

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Abstract:

The development of reinforced concrete structures is continuously studied to improve the strength, ductility, and durability of the component members. It has long been recognized that the strength as well as deformability of concrete substantially increase as the amount of confinement in the form of closed ties (hoops) is increased. The different characteristic properties of RC member's e.g. compressive strength of columns depend on different factors that are defined by the constituent materials and their properties. Addressing only the confinement requirements of the above, transverse reinforcement in this case Lateral Confining Reinforcement (LCR) tend to increase the strength and ductility of RC members. It also keeps longitudinal reinforcement in place while concrete is poured. When an axial concrete element (column) is laterally reinforced (e.g. by ties, hoops or spirals) and subjected to axial compression, expansion of the element in the plane perpendicular to the axial compression activates the lateral reinforcement which exerts tri-axial compression increasing member's capacity to sustain large compressive stresses and deformations. The locally produced concrete is usually of low strength than from the design standard.Most of research on confined concrete done mainly focuses on normal to high strength concrete, which is not easily achieved in our national context due Quality of workmanship, Quality of material and its source and non-engineered design of concrete and structures. Strength enhancement in low strength concrete through confining reinforcement must be determined for design of new and assessment of existing buildings. The result has shown that the strength capacity of column has increased in low strength concrete due to confinement.

Keywords:

Lateral Reinforcement, low strength concrete, transverse volumetric ratio, stress and strain Relationship

1. Introduction:

Column confinement is an important component of earthquake resistant reinforced concrete buildings. The characteristics of confined concrete have been researched extensively, and the primary parameters of confinement have been identified both experimentally and analytically. Analytical models have been developed, usually on the basics of a specific set of test data. These models, although producing good predictions in many applications, have limitations in terms of cross-sectional shape and reinforcement arrangement. The confinement effect of lateral reinforcement, perimeter hoops and intermediate tie bars, is not obvious. This research described an experimental investigation of the confinement effect through transverse reinforcement in low and normal strength concrete short column. RC structures in developing countries are poor quality due to poor construction practice. Different surveys regarding developing countries revealed that

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improper use of poor construction material, non-engineered design and poor practice cusses the concrete low strength. These non-engineered low concrete structure are very prone to earth quake such as Kashmir earth quake in October 2005 in Pakistan. The distinctive characteristics of reinforced concrete member's i.e. compressive strength of axial columns, depend on properties of constituent materials and their combined effect. These non-engineered RC structures has not been studied in the past and most of the research work has done on the normal and high strength concrete. Strength and ductility of RC column can be improved by providing proper confinement such as by increasing the number of ties, by increasing the size of ties, by decreasing the space between ties etc. Lateral confining reinforcement is among the basic component quantified in design codes. The advancement in confining of concrete is very important for RC structures in order to achieve large concrete deformation and strength of concrete which depends on the core of confined concrete. There are several factors which can affect the confinement such as Size of ties, Amount of ties, Spacing of ties, Strength of Concrete. The development of reinforced concrete structures is continuously studied to improve the strength, ductility, and durability of the component members. It has long been recognized that the strength as well as deformability of concrete substantially increase wherever amount of confinement in the form of closed ties (hoops) is increased. The different characteristic properties of RC member's e.g. compressive strength of columns depend on different factors that are defined by the constituent materials and their properties.Transverse reinforcement specified in design codes for columns has three main functions:

1. Prevent buckling of longitudinal bars
2. Resist shear and torsional stresses
3. Confine the concrete core to provide sufficient ductility

Addressing only the confinement requirements of the above, transverse reinforcement in this case Lateral Confining Reinforcement (LCR) tend to increase the strength and ductility of RC members. When an axial concrete element (column) is laterally reinforced (e.g. by ties, hoops or spirals) and subjected to axial compression, expansion of the element in the plane perpendicular to the axial compression activates the lateral reinforcement which exerts tri-axial compression increasing member's capacity to sustain large compressive stresses and deformations.

The locally produced concrete is usually of low strength but the design standards i.e. ACI 318-08 and other modern standards have a minimum strength of 3000 psi.

Most of research on confined concrete done lately (shown in literature review) mainly focuses on normal to high strength concrete, which is not easily achieved in our national context due to the following reasons:

1. Quality of workmanship
2. Quality of material and its source
3. Non-engineered design of concrete and structures

Also the different models like Mender's model (1988), Kent and Park's model (1971), Popovich (1971), Hong K N and Han S H (2005) etc. used for design of confinement reinforcement in concrete are not used/ checked experimentally for low strength concrete (up to 2000 psi). In this experimental instigation the confinement of short concrete column through transverse reinforcement is studied in this research. In code the minimum normal strength of concrete is 3000 psi (ACI 318-08) for the design of RC Structures. In most of developing countries the provision of this minimum strength criteria is difficult to achieve the design compressive strength for RC Structures. In this experimental program, 36 short column specimen with different amount of transverse confinement were tested under constant axial compression. The main variables were spacing of ties, volumetric transverse ratio and concrete strength. In the following sections, the material properties, configuration and construction of specimens, instrumentation and test setup are described in detail.

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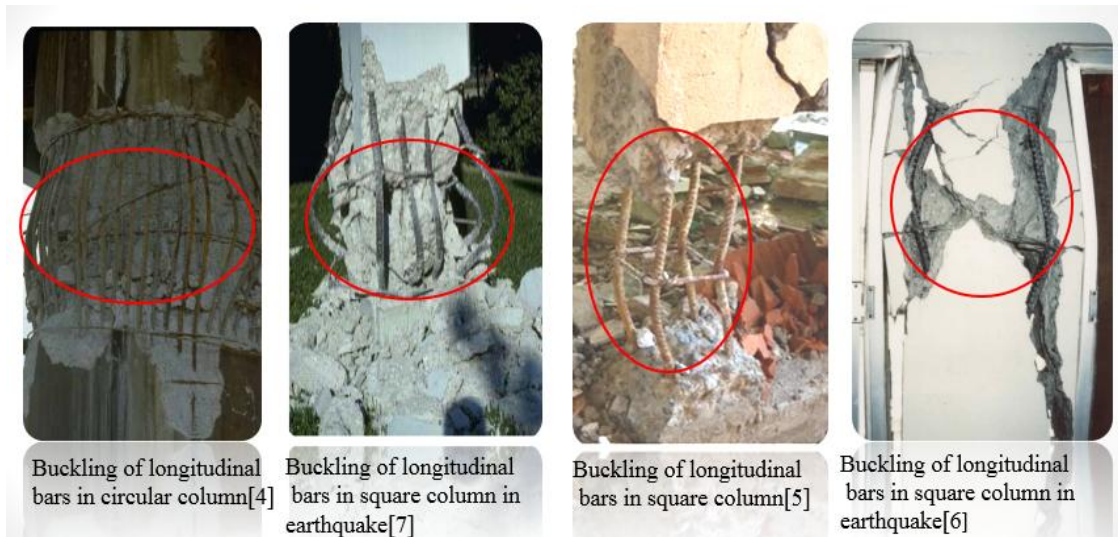
Fig: 1
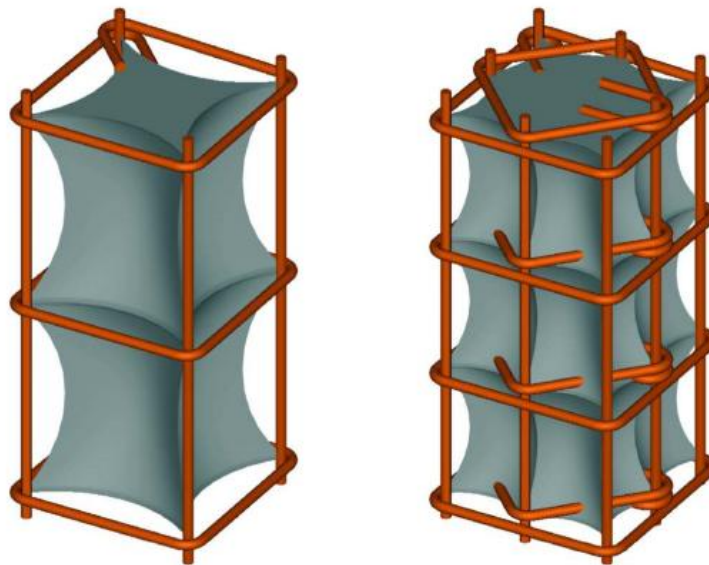
Confined and un-confined Concrete
Fig: 2

2. Materials and Methodology:

Thirty-Six square column sections for testing under concentric axial compression were cast. The specimen size is adopted from reviewing literature from 1990 to 2012 (**Imran, 2012; Khaleek, Yadav, & Rajeev, 2012; Shafqat & Ali, 2012**). Confined square columns with longitudinal reinforcement of 0.2 in^2 were fabricated, and tested under concentric axial load. The samples were made of two different concretes with compressive strengths of 2000 psi and 3000 psi and the detailed fabrication plan is shown in *Table*. The detailed mix design for concrete used is presented. Variables under consideration in this experiment are:

  i.   Compressive strength of concrete

  ii. Size and geometry of transverse reinforcement used for internal confinement

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2.1. Materials Properties

Materials used in fabrication of models i.e. concrete and reinforcement are tested for use in different sizes and strengths in both the sample types. The tested materials are mentioned as below:

i.   **Mix design of concrete:** Mix design for 2000 psi and 3000 psi is done. The tests conducted for mix design are as following:

ii.   **Reinforcement:** Tensile strength test**,** Bend test

The mix design used in both beams and column samples is discussed in this chapter so that next chapters solely discuss the samples fabrication, testing, resulting curves and analytical portions of column prisms and beam samples respectively

2.2. Mix Design of Concrete:

Mix design for concrete strengths of 2000 psi and 3000 psi are done according to ACI recommended practice 211.1.

Specific Gravity of Sand:

Weight of sand sample, S = 200 g
Weight of water, B = 248 g
Weight of water + sand sample, C = 366 g
Specific Gravity = S/ (B+S-C) = 200/ (248+200-366)
Specific Gravity = 2.43

Gradation of Fine Aggregate:

Table: 1

Sieve No.	Weight passed (gms)	Percentage by total weight	Percentage retained	Percentage passing
4	0	0	100	0
8	2	.4	99.6	.4
16	10	2.04	97.56	2.44
30	222	45.49	52.07	47.93
50	206	42.21	9.86	90.14
100	48	9.83	0.03	99.83
Total weight	488			2.40

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28 Days concrete compressive strength:

Table: 2

S. No.	Target Strength (psi)	Load (Ton)	Actual Strength (psi)	Avg. Strength (psi)	Standard Deviation
1	2000	22.1	1722.97		
2	2000	23.2	1808.73	1783.39	
3	2000	22.5	1754.16		55.63
4	2000	23.7	1847.71		
5	3000	38.06	2967.67		
6	3000	36.1	2814.45		
7	3000	36.2	2822.24	2891.06	84.08
8	3000	37.96	2959.87		

Table 2- 28 days compressive strength of concrete

2.3. Steel Reinforcement:

Three types of deformed steel bars were used in the specimens. Grade 60, #4 bars were used as longitudinal reinforcement, while Grade 40, #3bar bar were used as transverse reinforcement. Their mean values of mechanical properties were determined from tension tests using an UTM in accordance with ASTM A370-03a Standard using a minimum of three samples of each type of steel and are presented in Table: 3

Table: 3

S. No.	Nominal Dia.	Yield Str., psi	Ultimate Str., psi	% Elongation	Actual Dia., inch	Load, lb/ft	Mean F_y	Standard Deviation
1	#4	71036.54	89105.07	16.40	0.48	0.595		
2	#4	70178.30	88336.32	17.19	0.48	0.600		
3	#4	70901.52	88873.09	16.40	0.48	0.598	70705.45	461.49
4	#3	80663.44	96111.60	14.06	0.78	1.627		
5	#3	80470.65	95935.09	14.06	0.78	1.625		
6	#3	83525.07	98971.49	16.40	0.77	1.578	81553.05	1710.52

3. Testing of Models:

For pure axial behavior concentrically loaded members (column prisms) are tested. The deflection in prisms is measured along with applied load for strain calculation in samples. For stress strain curve generation, load applied from UTM is collected using DAQ system along with strain from displacement gauge installed at one face of sample.

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Figure showing column prism testing in UTM

Fig: 3

8 Inch Ties Spacing　　6 Inch Ties Spacing　　4 Inch Ties Spacing　　2 Inch Ties Spacing

Different mode of failure of confined concrete specimen
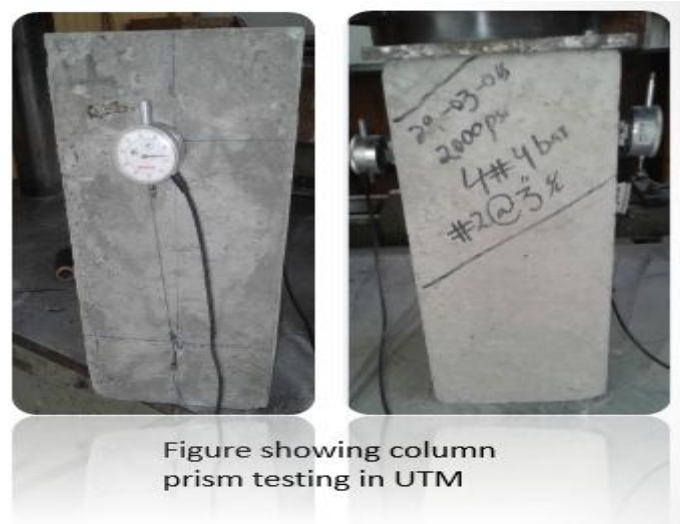
Fig: 4

4. Test Results:

All the samples were tested till complete failure under force controlled half cyclic monotonic single point concentric loading. The samples were loaded with incremental cycles of 3 tons. ASTM standard C-39 is used for loading i.e. @ rate of 35 psi/sec. One displacement dial gauge was attached to each sample to determine the strain. The gauge used has a least count of 0.01 mm and maximum drift of 20 mm. The loading data was collected from UTM machine in real time with the help of National Instruments Data Acquisition System (DAQ) using LabVIEW™ Software. The software generated graphs and plots in real-time which made it easy to monitor and adjust for any changes or stop the testing to make necessary adjustments.

Strain was measured by using deformations from displacement dial gauge for the recorded length of its string. The displacement gauge was connected to Data Acquisition System and recorded using LabVIEW™ software. Sample was tested to get the pure axial compressive strength of the sample dimension and ties were also not provided for confining effect. The sample curve for sample-2 is discontinued because of some cracking in clear cover of concrete near vicinity of displacement gauge. The stress-strain curve for both the samples are shown in *Graph.* The graph also shows peak strength and strength at 85% strength degradation after peak (ultimate strain point for unconfined concrete) **(Hognestad, 1951)**.

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In literature the ratio of strain at ultimate to the strain at yield gives ductility but as yield strain is not properly defined during testing of our samples, thus the ductility is found using ratio of strain at ultimate to the strain at peak load. It was called as "relative ductility" of the sample.

$$\frac{\varepsilon_u}{\varepsilon_y} = Ductility$$

$$\frac{\varepsilon_u}{\varepsilon_{peak\ load}} = Relative\ Ductility = Strain\ capacity$$

AVERAGE AXIAL STRENGTH 2000 PSI

Specimen	Stress (PSI)
2inch	4497
4inch	3366
6inch	3278
8inch	2392

AVERAGE AXIAL STRENGTH 3000 PSI

Specimen	Stress (PSI)
2inch	4363
4inch	4024
6inch	3575
8inch	3405
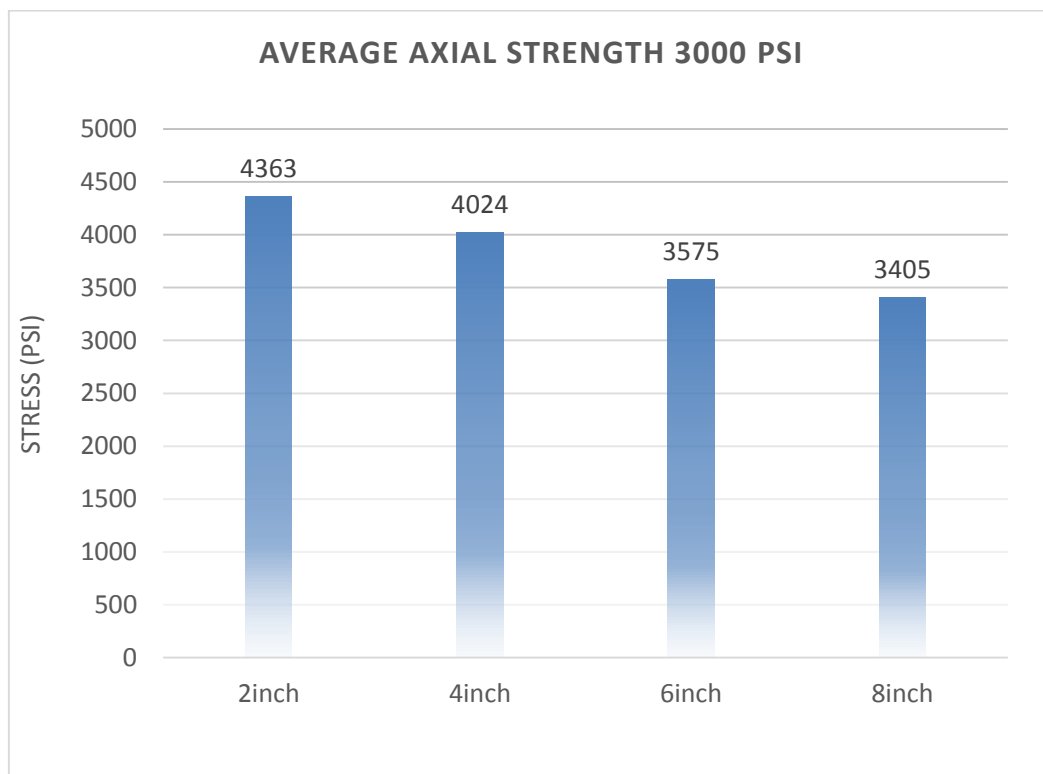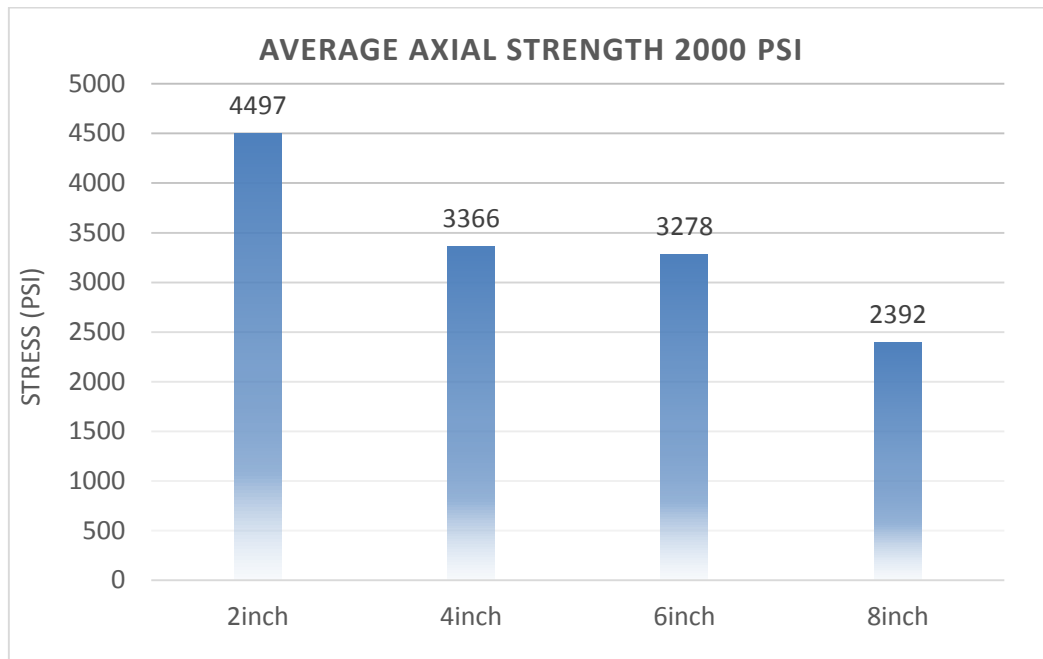
The comparison of compressive strength of different specimen of variable transverse reinforcement is shown and respective stress strain curves are drawn.

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Stress Strain Curve
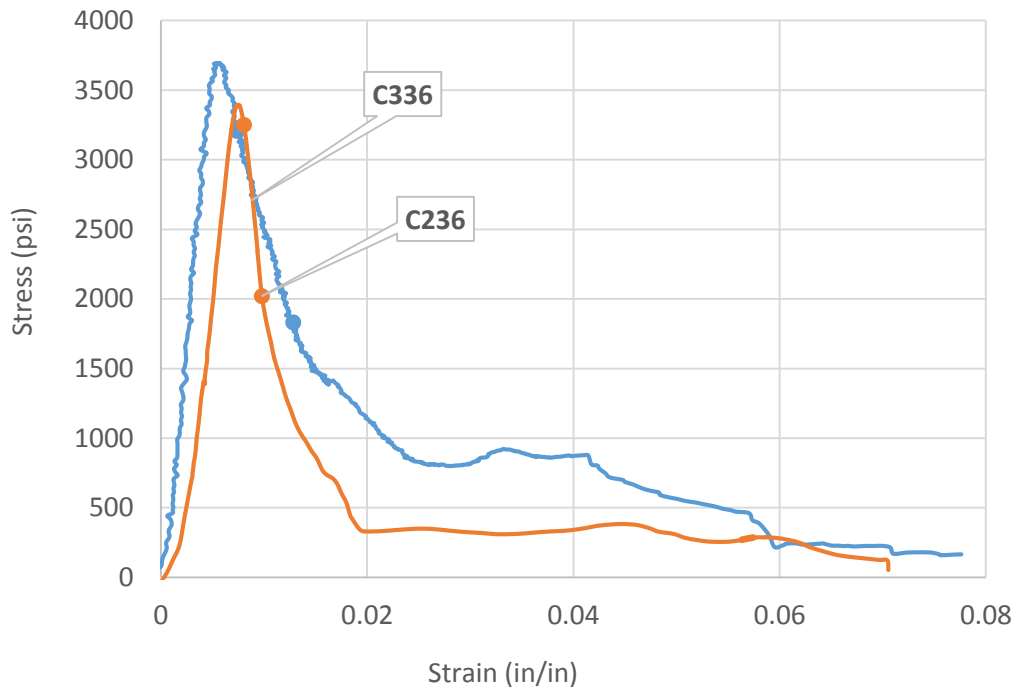
Stress Strain Curve
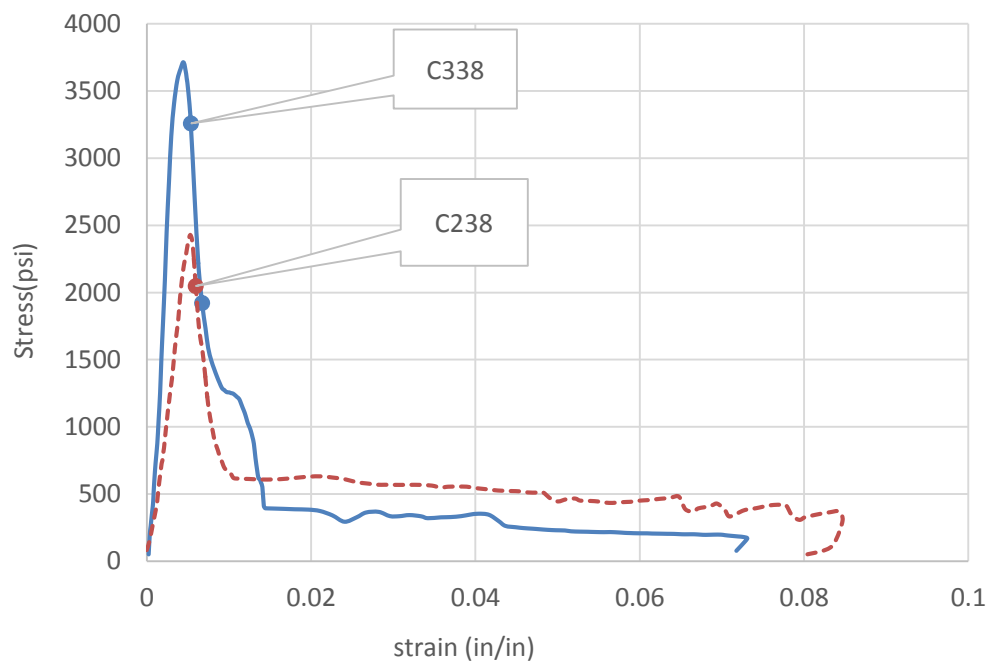
5. Conclusions:

- Strength enhancement and ductility of confined concrete tend to increase as the concrete strength decrease which means that in low strength concrete the confinement effect is greater than in normal concrete.
- The effectiveness of the confining steel diminishes quickly as the tie spacing increases
- Through transverse confinement the peak axial strength of confined concrete is increased from 50% to 100%.

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- The axial strain of confined concrete is 2 to 5 times greater than the normal concrete strain i-e .003.

6. Recommendations:

- To develop the analytical model for low strength confined concrete.
- Further work is required to investigate the confinement effect in long column.

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Shake Table Tests on Reinforced Concrete Structure

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Abstract

This research presents shake table tests on reinforced concrete structure (special moment resisting frame) having construction deficiencies i.e. using low strength concrete and not practicing ties (confinement) in joints. The test was carried out on 1/3ʳᵈ scaled structural model, prepared respecting the similitude requirements for geometric scaling and structural dynamics, performed at the Earthquake Engineering Center of UET Peshawar. The methodology included basic tests on constituent materials and incremental dynamic analysis of model on seismic simulator (shake table) using design spectrum compatible natural accelerogram. The response of the structure is recorded in terms of acceleration and displacement time histories using accelerometers and displacement transducers respectively, which are processed and analyzed to obtain the floor inertial forces, inter-storey shears and base shear force, lateral deflected shape and inter-storey drift profile. The base shear force is correlated with the lateral displacement to derive force-deformation capacity curve. The research shows that the structure, due to the considered deficiencies, can resist only 70% of the design level ground motions.

Keywords SMRF Structure, Building Code of Pakistan, Shake Table Test, Low Strength Concrete, Joint Damage

1. Introduction

Urbanization in many important cities in Pakistan is on the rise due to many fold increase in population, consequently expadning the civil infrastructures (buildings, bridges, roads, etc.) to satisfy the communities. Reinforced concrete structures are abundantly practiced these days, due to the local availability of constitutent building materials and its durability. Reifnorced cocnrete structure is a primary engineered construction, but can result in a catastrophic failure if it is not properly designed and/or constructed, as reveleaed in 2005 Kashmir earthquake (Naseer et al., 2010, Rossetto and Peiris, 2009).

Following the devastation in the 2005 Kashmir earthquake, the Ministry of Housing and Works engaged the National Engineering Services of Pakistan (NESPAK) to develop revised seismic zoning map for the country and design criterion for reconstruction of structures in the region. NESPAK approached the International Code Council (ICC) and a core Group of expert individuals from across the country to help Pakistan develop earthquake provisions to save lives and reduce property losses (Shabbir and Ilyas, 2007). The new code (BCP, 2007), included a new seismic zoning map, five zones are considered, that specifiy the design level ground motions. Furthermore, the BCP-2007 included minimum requirements and detailing specified for different structural systems, based on the recommendations of foreign national codes and guidelines mainly the uniform building code UBC-97, American Concrete Institute Code (ACI 318-2005), American

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Institute of Steel Construction ANSI/AISC 341-05, and American Society of Civil Engineers, SEI/ASCE 7-05 and ANSI/ASCE 7-1993.

Many structural design offices have been adopted the BCP-2007 code in practices, however proper execution in the field as per the design specification is still unachievable. Many deficient reinforced concrete cosntructions can be found in the exisiting building stock with low cocnrete strength and improper reinforcement detailings e.g. large spacing of ties, nonseismic hooks, joint with no ties, among others. This makes essential to assess the seismic performance of these structures within the context of feasibility assessment of existing structures with construction deficiencies.

Many researchers over the past two decades and more, have performed experimental investigation on reduced and full scale reinforced concrete structure models using quasi-static cyclic testing, pseudo-dynamic testing and dynamic shake table testing (Benavent-Climent et al., 2014; Bracci *et al.,* 1995; Calvi *et al.*, 2002; El-Attar *et al.,* 1991; Elwood and Moehle, 2003; Oliver-Saiz and Benavent-Climent, 2014; Pinto *et al.,* 2002; Quintana-Gallo *et al.,* 2010; Sharma *et al.,* 2012; Yavari *et al.,* 2014, among others). However, these studies focused either on the vulnerbaility assessment of gravity designed structures or design and assessment of retrofitting techniques, but none of the study focused on the assessment of special moment resisting frame (SMRF) structures in low stregnth concrete with construction deficiencies. Furthermore, recent quasi-static cyclic tests have been carried out on SMRF beams and beam-column assemblages (Badrashi, 2016; Ahmad *et al.*, 2016), but very few test have been carriedout on recent SMRF structures to understand its bevahvior.

Thus, the present research investigate special moment resisting frame (SMRF) structure for seismic performance evaluation through dynamic shake table tests on seismic simulator in the Earthquake Engineering Center of UET Peshawar. A 1/3rd scaled representative structural model was prepared and subjected to incremental dynamic excitation using natural spectrum compatible accelerogram, scaled to various target levels to deform the structure from elastic to inelastic state and retrieve global structure design parameters (response modification factor R and structure ductility μ). The test structure charactieristics, testing programs, observed behavior and important findings are described in the following sections.

2. Description of Test Structure

Reinforced concrete moment resisting frames are used as part of seismic force-resisting systems in buildings that are designed to resist earthquake induced shaking. Beams, columns, and beam-column joints in frame structure are proportioned and detailed to resist flexural, axial, and shearing actions that develop as building sways laterally through multiple cycles during earthquake excitation. Due to special proportioning and detailing of structrual components, the building resist earthquake shaking without significant loss of stiffness and strength and respond primarily in flexure ductile mode. These moment-resisting frames are called "Special Moment Resisting Frame (SMRF)" because of these additional requirements, which improve the seismic resistance in comparison to the less austerely detailed Intermediate and Ordinary Moment Frames. The design requirements for SMRF are presented in the American Concrete Institute (ACI) Committee 318 Building Code Requirements for Structural Concrete (ACI 318-2005). The present study considered a two storey two-bay by one-bay frame structure (Figure 1) in Zone 2B (0.16g to 0.24g, as per BCP-2007), on site soil B (as per NEHRP soil classfication). The compressive strength of cocnrete is 2000 psi and yield strength of reinforcement is 60,000 psi. The building is analyzed using the static lateral force procedure of BCP-2007 with due consideration of the code specified load combinations. Besides the selfweight of the structuers, the floor loads also included gravity loads due to floor finish (40 psf on first floor and 60 psf on second floor) and live load (60 psf on first floor and 40 psf on second floor). The structure was then designed to the ACI-318 (2005) requirements using the CSI Software ETABS v9.7.4 (ETABS, 2009). The interior frame, was extarcted for the dyanmic shake table test (Figure 2).

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Layout

ETABS Numerical Model

Left Side View

Right Side View
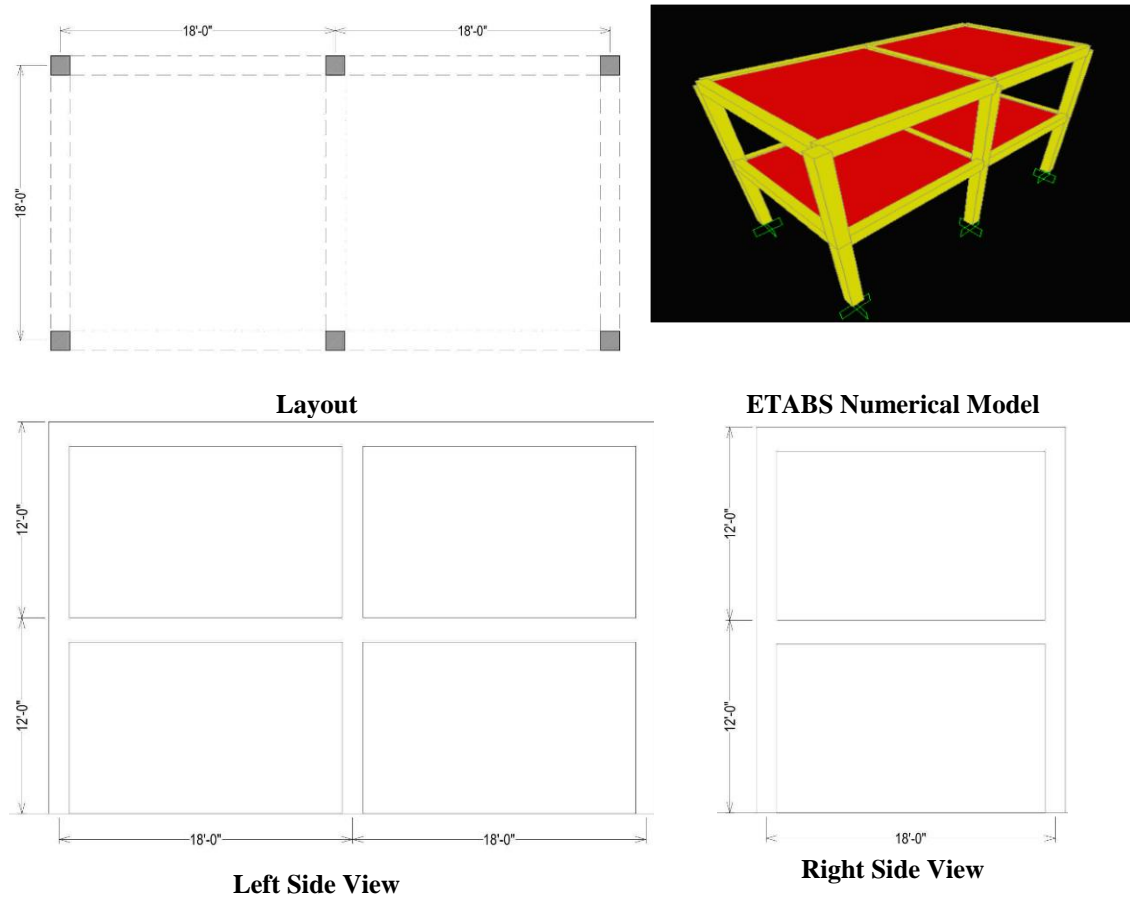
Figure 1: Layout and Geometric Details of the Considered Frame Structure

Frame Section

Beam-Column Cross Sectional Details

Beam Long Section Details
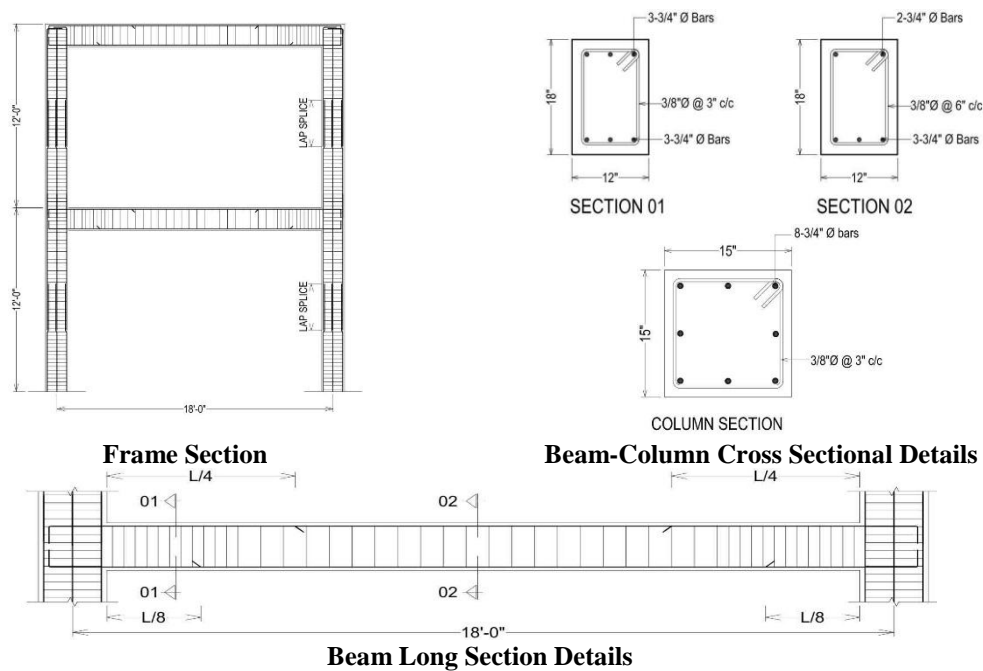
Figure 2: Design Details of the Prototype Frame Structure

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The Earthquake Engineering Center (EEC) has been establsihed in 2006, with the financial support of the Higher Education Commission of Pakistan. The EEC have two seismic simulators; 1.5m x 1.5m (1 degree of freedom, operational) and 6.0m x 6.0m (6 degree of freedom, non-operational). The 1.5m x 1.5m shake table has a payload capacity of 8 tons but can be effectively used for a load less than 5 tons. Looking at the limitation of the seismic simulator, a 1/3rd scaled model of the extracted frame was prepared, meeting all the geometric scaling requirements for member dimensions and reinforcements. Materials density and stress-strain relationships were kept the same, resulting in simple model. The following scaling factors are applicable for model-to-prototype conversion.

Table 1: Scaling Factors, Model-to-Prototype, Applicable to Simple Model

Physical Quantity	Relationship	Scale Factor
Length (L)	$S_L = L_p/L_m$	3
Stress, Strength (f)	$S_f = f_p/f_m$	1
Strain (ε)	$S_\epsilon = \epsilon_p/\epsilon_m$	1
Specific Mass (ρ)	$S_\rho = \rho_p/\rho_m$	1
Displacement (d)	$S_d = d_p/d_m = S_L S_\epsilon$	3
Force (F)	$S_F = F_p/F_m = S_L^2 S_f$	9
Time (t)	$S_t = t_p/t_m = S_L\sqrt{(S_\epsilon S_\rho/S_f)}$	3
Frequency (Ω)	$S_\Omega = \Omega_p/\Omega_m = 1/S_L$	0.33
Velocity (v)	$S_v = v_p/v_m = S_\epsilon\sqrt{(S_f/S_\rho)}$	1
Acceleration (a)	$S_a = a_p/a_m = S_f/S_L S_\rho$	0.33

Since the density and modulus of elasticity of the concrete in prototype and model were kept essentially the same, a mass simulation approach was used to respect the inertial mass modelling, described in Quintana-Gallo *et al.* (2010), which is the extension of what is suggested by Morcarz and Krawinkler (1981). The additional inertial mass on the ith floor level in the model structure is given by following relationships.

$$M_{m1} = \frac{M_{p1}}{S_L^2 \times S_f} - M_{m_0}$$

The model total mass should satify the prototype to mass ratio

$$M_r = \frac{M_m}{M_p} = L_r^2 = \frac{1}{S_L^2}$$

where M_{m1} represents the additional inertial mass, M_{p1} represents the prototype mass, M_{m0} represents the models mass. The additional mass on each floor was simulated through cocnrete blocks uniformly distributed on the floor slab. The construction sequence involved the construction of reinforced cocnrete pad to simulate rigid fixity at the base of frame, provisioned with grided holes to facilitate mounting structure to the shake table top. Concrete were prepared as per the required mix-design (1:3.5:2.87 with water-to-cement ratio of 0.82), using 3/8 inch down aggregate, to achieve the design stregnth, confirmed with the trial cylinder compression strength in UTM. The reinforcement of columns were extended and anchored in the pad. The pad was cured for seven days after concreting and compaction using moist bags. Formwork and scaffolding was prepared to cast beams, columns, transverse beams and slab for the first floor, which were cured for 14 days. The second floor of the structure was prepared in similar fashion. Figure 3 shows the construction sequence of the test model and the final test model mounted on the shake table with the provision of additional floor masses.

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(Preparation & Concreting of Base Pad)

(Formwork and Scaffolding of Floor)

(Scaffolding for Floor Support)

(Concrete Blocks for Additional Floor Mass)

(Preparation & Concreting of Slab and Beams)

(Provision of Additional Mass)

Figure 3: Construction Sequence of Test Model

3. Testing Program

Once the structure was prepared it is lifted with the 40 Ton overhead crane and placed on the shake table, mounted to the table top by means of long bolts. About 1/3rd portion of pad was projected from the tabletop, which is provided with a roller support by means of steel stool, fixed to the ground, provisioned with ϕ25 mm steel rods. About ½ inch clearance was left between the structure pad and steel rod to allow lateral movement of the model but should act as a roller support in case of accidental settlement of the projected portion of the pad.

The model was instrumented with five accelerometers: three in-plane accelerometers that included one at the structure base pad and at the first & second roof levels, one accelerometer was installed on each floor level in the out-of-plane direction (Figure 4). Three in-plane displacement transducers

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were installed; one at the structure base pad and at the first & second floor levels, to measure lateral displacement. Before the model instrumentation, the instruments were first installed on the bare shake table to confirm their functionality under dynamic excitation.

A natural acceleration time history was extracted from the PEER NGA strong ground motion database closely relevant to the considered tectonic regime. The acceleration time history was scaled and matched to the design acceleration spectrum to ensure peak demands (acceleration, velocity and displacement) remain within the allowable range of seismic simulator (Acceleration ±1g, velocity ±1.1 m/sec, displacement ±125 mm,). As per the scaling requirement, the time history time step was reduced by 1/3ʳᵈ (Figure 5) that is used as an input ground motion. The incremental dynamic analysis technique was used for model excitation, the input ground motion was linearly scaled to various intensity levels 5%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%. The model was inspected after each run for damageability and documented through structure snapshots and sketches for damage pattern.

(Instrumentation Scheme)
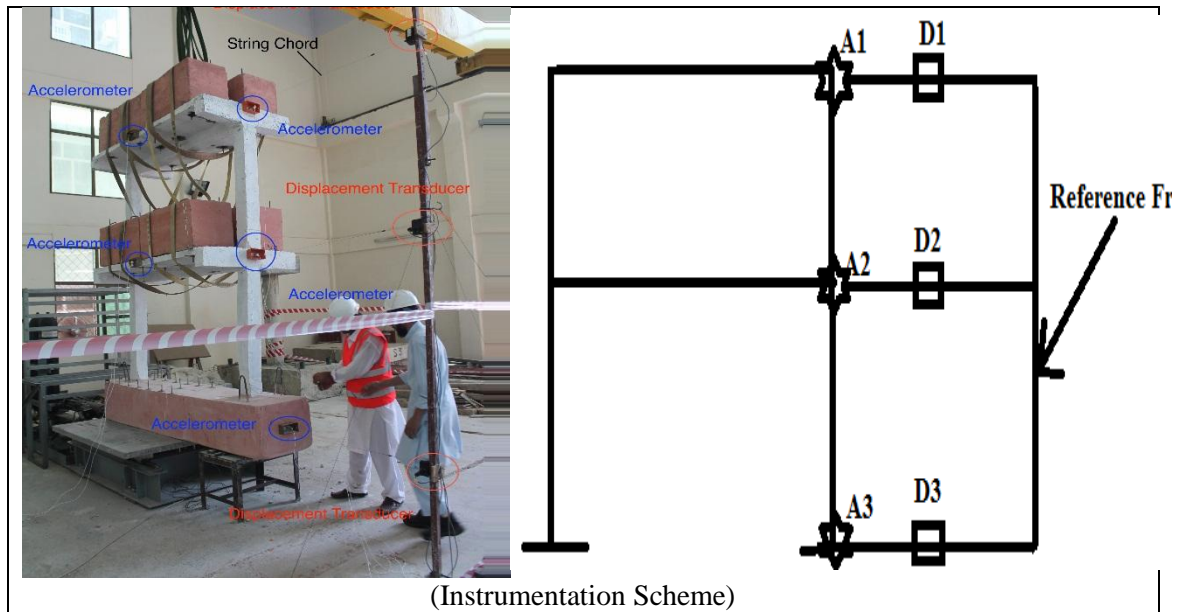
Figure 4: Test Model Instrumentation
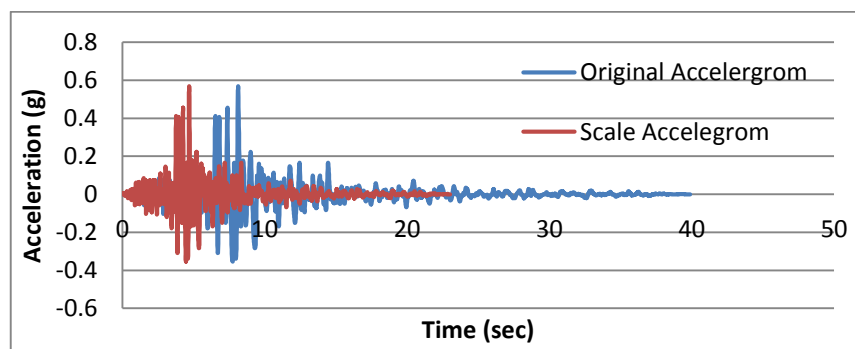
Figure 4: Selected Natural Time History, 1994 Northridge Earthquake Accelerogram

4. Results and Discussions

The structure received diagonal cracks in in-plane beams on the top floor due to longitudinal bar-slip and pullout, which is due to the use of low strength of concrete for construction. This is observed during the self-check of the shake table (which was about 30% of the ground motion), which is an automatic test run whereby the shake table adjust itself for the specified levels of input

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excitations. Further increasing the input excitation caused top-bottom flexure cracking of columns on the first floor. Further increase of excitation caused diagonal cracks on the exterior face of the joints on top floor. The joint damages were further aggravated with increasing excitation, which caused spalling of the cover and core concrete from the joint panel region. Cracks were also developed in joints on the ground storey, however, concrete spalling was not observed. The top storey joints were damaged with concrete spalling due to the fact that confining ties were missing in the joint region. In contrast, joints on the ground storey, although cracked, didn't show any spalling of concrete, which was due to the provision of confining ties in joint region of the ground storey. The structure was able to resist ground motion excitation only up to 70% of the design ground motions. On further increasing the input excitation, the structure also showed out-of-plane deflection. Figure 5 shows the damages observed in various structural components during the test. Displacement and acceleration response data obtained during each test run were processed for the necessary baseline correction and filtering and analyzed to obtain the floor accelerations, floor lateral displacement and inter-storey drift profile. Furthermore, storey shear, base shear and later force-deformation behavior were also calculated. The building code BCP-2007 specified allowable inter-storey drift was achieved during the 70% run.

5. Conclusions

This research study demonstrates the seismic performance of code designed reinforced concrete structure (based on building code of Pakistan, BCP-2007) through fully dynamic shake table testing under natural accelerogram. It has been observed that beam longitudinal reinforcement will be subjected to bar-slip and pullout due to the use of low strength concrete. Concrete structures in which joints are not provided with confining ties will show joint damageability and cover & core concrete spalling during lateral deformation.

The present research highly recommends enforcing the building code BCP-2007 in both the design practices and constructions. Contractors are highly advised to ensure the designer recommended mix-design, proper compaction and practice reinforcement detailing's as per the design specification. In the face of the field deficiencies, the designers are advised to provide conservative design solutions, regarding the concrete strength and column depths.

Furthermore, series of shake table tests on reinforced concrete structures have been planned under the advisorship of the first author to investigate also the effects of other field deficiencies on seismic behavior of reinforced concrete structures and advise accordingly the minimum recommendations for earthquake-resistance of RC structures.

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(Diagonal Cracks in Beams, Top Storey)

(Column Top-Bottom Interface Cracking, Top Storey)

(Joint Ultimate Damageability, Top Storey)

(Joint Ultimate Damageability, Bottom Storey)

Figure 5: Components Damage Mechanism with Increasing Excitation Level

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Comparison of Performance of Basecourse Untreated and Lime Treated Aggregates at Varying Moisture and Gradation

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Abstract:

Unbound Granular Materials (UGMs) are extensively used as base course materials around the world as they are capable to bear high traffic loads and are more economical as compared to bound materials. This research paper presents permanent deformation behavior of untreated and lime treated base course material. Two types of gradations are used in this research NHA-A and NHA-B. This research investigates the effect of moisture changes, lime stabilized and change in gradation on the permanent deformation of unbound granular materials of flexible pavement. The water be able to intrude into the unbound base course layer and in the worst state be able to saturate the layers leading to premature pavement failures. An investigation is required to find the performance of different base course materials at optimum moisture, optimum towards dry condition and optimum towards saturated conditions. Performance test of selected materials was carried out using Wheel Tracker (WT) test. The results indicate that gradation of the materials, percentages fine and percentages moisture considerably affect the Permanent deformation of UGMs. NHA-A indicate higher resistance to permanent deformation as compared to NHA-B gradation. Moisture content has adversely effect on unbound base course material especially when water increase from optimum to wet conditions. Lime stabilization technique has proven to produce good results in reducing the permanent deformation.

Keywords: Permanent deformation, Gradation, Moisture, UGMs, Lime Treated, Wheel Tracker.

1. Introduction

Unbound granular materials are widely used as base and sub-base all over the world in flexible pavements, to contribute in the distribution of stresses applied to pavement surface by traffic

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loadings. Overstressing of unbound granular materials can produce unacceptable level of pavement deflections under moving wheel load-s, or can cause excessive amounts of permanent deformation, ultimately effecting the performance of pavement.

To evaluate the quality of the granular pavement materials, permanent deformation act as a key factor. As permanent deformation is the direct result of dynamic traffic loading, moisture content and percentage fines in gradation.

2. Permanent Deformation

Permanent deformation is the measure of unrecoverable strain. It is accelerated due to repeated loads. The plastic deformation behavior under repeated loading cycles is considered as one of the key performance parameters for characterizing of unbound granular materials of flexible pavement [J. Hussain et al. 2011].

The wheel tracker test is more suitable test for characterization of the deformation of unbound granular materials under thin bituminous surfacing's then the (RLT) repeated load test [G. W. Jameson et al. 2010 and D. Bodin et al, 2012]. One of the main reasons of preferring wheel tracker test over RLT is that in wheel tracker test rotational stresses are produced which are best reflection of stresses produced in the pavements, while in RLT only uni-axial stresses are produced. Thus wheel tracker test is the best laboratory scale model to investigate performance of pavements.

The performance of pavement structure is dependent upon the permeability of unbound granular materials and drainage condition of the structure [A. Austin 2009]. The effect of high moisture content in unbound granular materials in pavement layers in laboratory and in the field with a combination of high degree of saturation and low permeability leads to low effective stresses, low stiffness and deformation resistance (Maree et al. 1982, Thom and Brown, 1987 and Dawson et al., 1996). Aggregates type, particle shape and gradation effects the permanent deformation of unbound granular materials. Angular crushed stones undergo smaller plastic deformation as compared to rounded particles (Allen 1973). The permanent deformation increase in granular materials by increasing the fines content in gradation curve [J. Hussain et al. 2011, N. Thom et al.1988]. Resistance to permanent deformation in unbound granular materials under repetitive loading appears to be highly improved as a result of increased density (Holubec 1969, Barksdale 1991, Allen 1973 and Thom and Brown 1988). The effect of grading on permanent deformation of unbound granular materials is to be more significant than degree of compaction [M. Kamal et al, 1993].

3. Materials and Sampling:

In this research aggregates were obtained from Margalla Islamabad query, mostly used for unbound materials. Two types of gradation were selected as NHA-A class and NHA-B class shown in fig. 1 extensively used as base course gradation all over Pakistan.
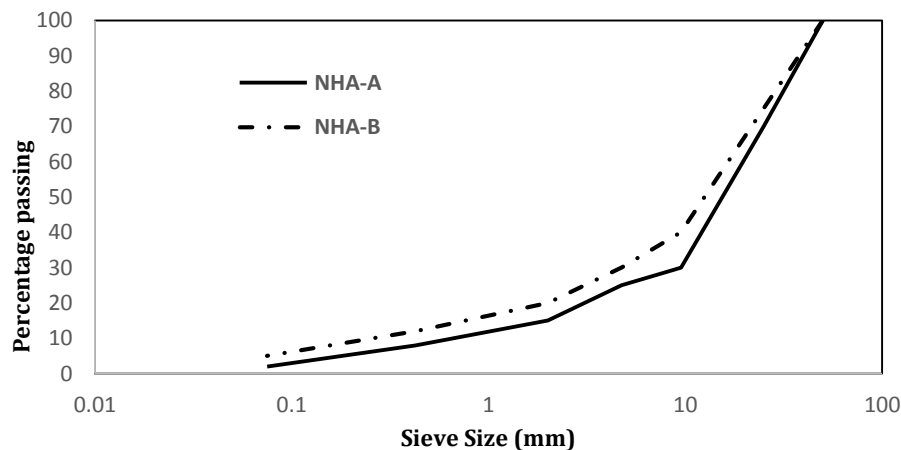
Figure 3: Gradation Curve

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Three levels of moisture contents were selected i.e. optimum moisture content (OMC), optimum towards wet conditions (OMC+1) and optimum towards dry conditions (OMC-1), Untreated and lime treated samples were prepared in order to investigate the effect of moisture content and lime stabilization on permanent deformation behavior of unbound granular materials.

4. Experimental Program

The experimental program is basically consists of two phases.

4.1. Test Program 1:

Aggregate conventional tests were performed on aggregates to determine the physical properties of the material and have been tabulated in Table 1, from which it can be observed that the values falls well within the prescribed allowable values, Modified proctor test was conducted for optimum moisture content.

Table 3: Results of Physical Tests of Aggregates.

S. No	Description	Designation	Result lime stone	Recommended values
1	Aggregate Abrasion Value %	C 131	21.5%	<40%
2	Aggregate Impact Value %	BS 812-112	16.8%	<40%
3	Water Absorption Of Coarse Aggregates %	C 128	1.04%	<2%
4	Specific Gravity Of Coarse Aggregate	C 127	2.74	2.5-2.9
5	Soundness coarse and fine	C 88	9.67&4.66	8% max

4.1.1. Modified Proctor Test:

To obtain the optimum moisture content for well compaction of unbound granular materials modified proctor test was used (ASTM D 1557). Fig. 2 demonstrate the optimum moisture content samples.
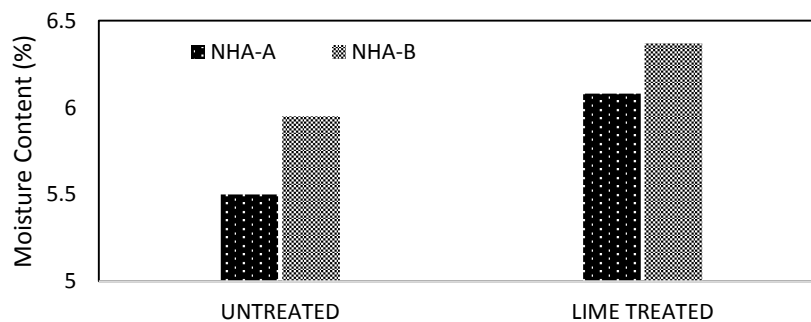
Figure 4: Moisture Contents of Samples

4.2. Test Program 2:

The second stage of testing program is based on the evaluation of the performances of samples under repeated cyclic loadings. To perform this specific testing procedure "Wheel Tracker Test" was used.

4.2.1. Wheel Tracker (WT):

Wheel tracker test is used to measure the rut and deformation, created by repeated passing of wheel on pavement samples. A wheel tracker device with loaded wheel, having a diameter of 200mm and

contact width of 50mm loaded to 700N, is used for tests. A steel mold with dimensions of 300mm x 300mm x 50mm (Length x Width x Depth). Loaded wheel is moving in a simple harmonic motion at a frequency of 12 cycles per minute over a travel distance of 250mm.

5. Results and Discussions

5.1. Effect of Moisture:

Permanent deformation of selected gradations was tested at three moistures (OMC-1%, OMC%, OMC+1%). Fig-3 demonstrates the Permanent deformation at three varying moisture. It has been observed from the results that moisture affects the permanent deformation of unbound granular materials. At OMC the rut depth calculated is 4.73mm and at OMC+1 rut depth is 6.25mm, which is 32% more than rut depth at OMC, whereas at OMC-1 the measured rut depth is 3.1mm, which is 52% less than rut depth at OMC.

Thus from fig-4 it can be observed that permanent deformation of unbound granular materials is in direct relation with moisture content i.e. that when moisture content is increased from OMC the rut depth also increases and vice versa. This is due to, because at OMC sample have maximum dry density and as moisture content is increases the rigidity and stability of sample is disturbed and material will just start to flow due to high water content and low friction between aggregate particles.
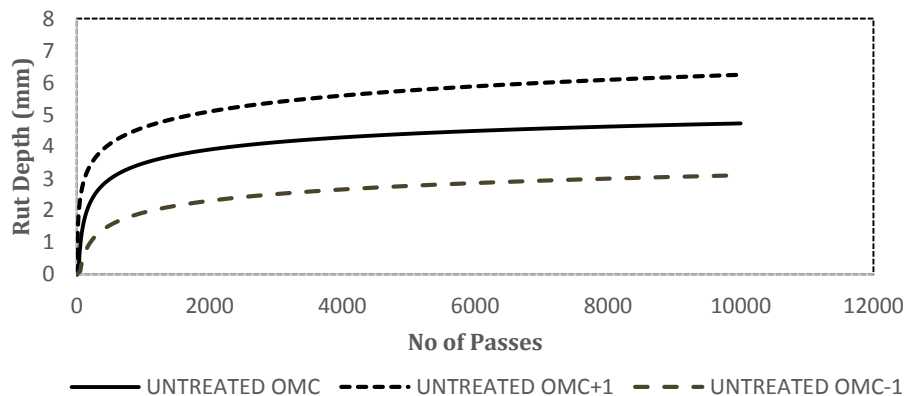
Figure 3: Effect of MC on Permanent Deformation

5.2. Effect of gradations (fines content):

Two types of gradation was selected NHA-A and NHA-B class, NHA-B gradation has more fine content (passing # 200) as compared to NHA-A. The concentration of fine materials effects the permanent deformation of unbound granular materials as shown in fig-5.

From the results rut depth of NHA-A having less fine content in gradation curve is 4.73mm and the rut depth of NHA-B is 6.13mm which is 29 % more compared to NHA-A. Thus from the above figure it is clear that as the percentage of fines is increased in a sample the rut depth is also increased i.e. permanent deformation also increases. As the fine contents are increased in sample (NHA-B), the sample becomes soft and does not sustains its initial rigidity due to which the increase in rut depth is seen, while in coarser gradation (NHA-A) rut depth is less than that of finer gradation (NHA-A) because of its higher rigidity and stiffness. The other main reason is that as the fine contents are increased in the sample its maximum dry density starts to decrease as compare to that of the coarser sample which due to which the permanent deformation of finer sample (NHA-B) is greater than that of coarser sample (NHA-A).

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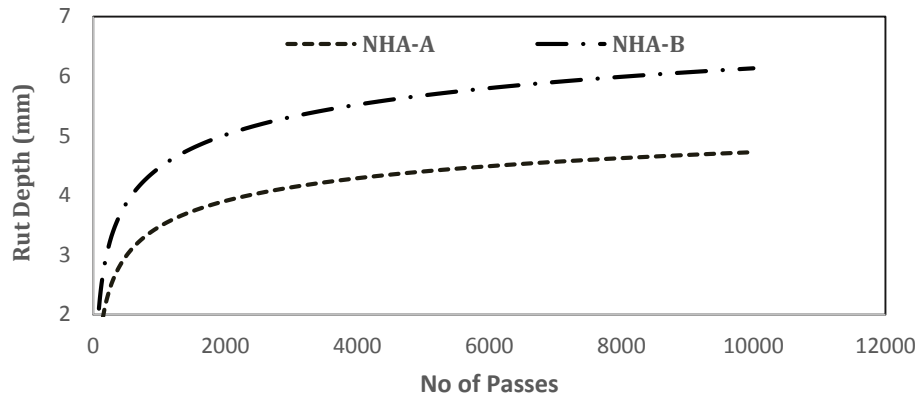
Figure 4: Effect of Gradation (Fine Content) on Permanent Deformation

5.3. Effect of lime:

Lime was used as an additive to improve the strength of the samples. 2% of lime was added to the samples and was tested. The results were compared with untreated samples at both gradations. The figure 5 demonstrate the comparison of lime treated and untreated samples. Thus the results verifies that lime improves the strength of unbound granular materials and decreases their permanent deformation, As shown in figure that resistance to permanent deformation increases upto 80 % by adding 2% lime. Lime, when in contact with moisture becomes stiff and rigid, improves the rigidity and stiffness of sample and increases the friction between particles and develops a bond between particles of sample which helps to reduce the red depth and eventually permanent deformation of sample.
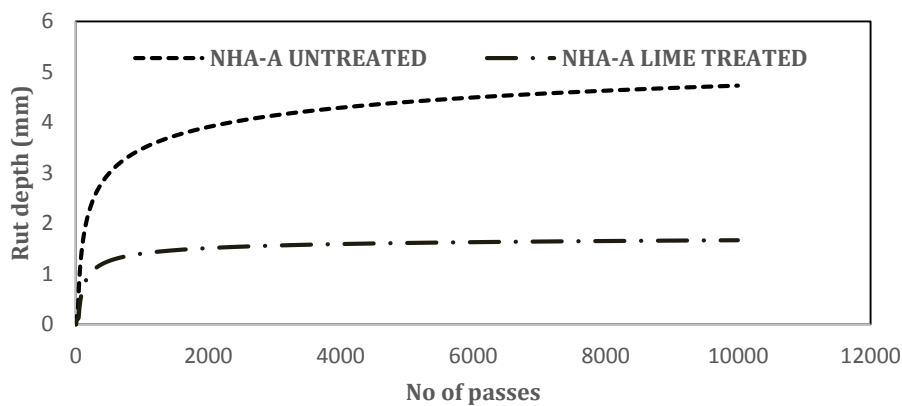
Figure5: Effect of Lime stabilization on Permanent Deformation

6. Summary and conclusion

This research paper documents the comparative results between NHA-A and NHA-B gradations at different moisture conditions and with lime treatment, results obtained from wheel tracking test technique. The prime objective was to study the effect of varying moisture conditions, different gradations and effect of stabilization by lime on the permanent deformation of unbound granular materials.

The following conclusions are drawn from the research:

- Irrespective of gradations, when we move from OMC to wet conditions the permanent deformation also increases due to decrease in stiffness and rigidity and reduction in the friction among particles.

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- As the gradation becomes finer the maximum dry density decreases and OMC increases and deformation is also increases, when moisture is further increased from OMC the deformation also increases.
- The concentration of fines effects the rigidity and stiffness of sample as fine contents are increased the sample begins to soften and friction between particles is reduced which causes the increase in permanent deformation of unbound granular materials.
- Lime stabilization technique has proven to produce good results in reducing the permanent deformation of unbound granular materials to a great extent. Irrespective of gradations or amount of fines, lime provides strength to pavement layers against the cyclic load and improves its resistance to rut and deformation

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Effect of Polypropylene Fibers on Fresh and Hardened Properties of Self-Compacting Concrete

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Abstract

The main precedence in the development of concrete construction is to increase its productivity and also to improve working environment. It is found that these objectives can be achieved by making use of self-compacting concrete (SSC) instead of ordinary or conventional concrete. The major impact of the introduction of self-compacting concrete (SCC) is connected to the production process. The productivity is significantly improved through the elimination of vibration compaction and process reorganization. The working environment is significantly enhanced through avoidance of vibration induced damages, reduced noise and improved safety. Additionally, SCC technology has improved the performance of hardened concrete in terms of its properties like surface quality, strength and durability. The current research was carried out to assess the effects of Polypropylene fiber addition on characteristics of SCC mixes in fresh state and also to investigate the effects of addition of fiber on the properties of hardened SCC. In this study, the concrete mixes were added with fiber of 0%, 1.0%, 2.0 %, and 3.0 %. Fresh characteristics were evaluated based on its passing ability, flow ability, and segregation resistance using, Slump flow, L-Box and V-funnel tests. After 7 days, 14 days, 28 days of curing SCC cylinders, compressive and splitting tensile strengths were tested. Tests results indicated that addition of fibers has enhanced the passing ability of SSC but on the other hand, has decreased filling ability and segregation resistance of SCC. The optimum dosage of polypropylene achieved by this research was 2% of the cement content.

Keywords

Fresh properties, Harden properties, flow ability, viscosity, passing ability, segregation, Self-Compacting Concrete

1. Introduction

In recent years, the utilization of high performance concrete has been the interests of the researchers and structural engineers. As a high performance concrete, SCC is a highly flowable concrete that can fill formwork without any mechanical vibration. SCC's unique property gives it significant economic, constructability and engineering advantages. *(Yu, Tao et al. 2008),(Siddique 2011).* Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fiber that are uniformly distributed and randomly oriented. Fibers include steel fibers, glass fiber, synthetic fiber and natural fiber – each of which lend varying properties to the concrete. In addition, the character of fiber-reinforced concrete changes with varying concretes, fiber materials, geometries, distribution, orientation, and densities.

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As the Self-compacting concrete has some problems to stop these problems to achieve the good result. Self-compacting concretes (SCCs), highly fluid concretes placed without vibration, were introduced into French construction works towards the end of the 1990s. Formulating SCCs is a compromise between sufficiently high fluidity to ensure good casting and an adequate consistency to avoid phase separation problems, segregation or bleeding. SCC is able to flow through even heavy reinforcement and achieve full compaction under its own weight *(Khayat and De Schutter 2013)*.

Micro and macro cracks occur in concrete structures because of their brittle behavior, low resistance to fatigue phenomenon and small toughness. Therefore, fibers are adopted to improve these detrimental properties of concretes. Many studies proved that fibers can considerably improve durability, tensile strength, impact resistance and toughness of the cement matrix, preventing the crack opening and growth in concrete. Fibers are commonly categorized into three groups, natural, metal and artificial (e.g. glass, nylon, polypropylene and carbon) *(Nobili, Lanzoni et al. 2013)*. The utilization of polymeric fibers has gained popularity in the recent years because of their advantages over the metallic ones with special regard to chemical stability, lightness and workability by doing an on-site work showed that the fiber reinforced concrete technology provides an efficient, safe as well as economical design solution for roadways. Moreover, polymeric fibers, particularly the polypropylene-based fibers, were found beneficial in reducing shrinkage cracking and improving abrasion resistance of concrete. Most experimental results indicate that using polypropylene can increase the abrasion resistance by 30-60% *(Shuan-fa 2001)*.

PF is a polymer presented in a fiber format. Previous researches have studied the modification mechanisms of polymers in concrete. The physical filling of polymers in the porosity of concrete is one of the primary modification mechanisms concluded by many researchers. *(Wang, Wang et al. 2005)*,*(Van Gemert, Czarnecki et al. 2005)**(Banthia and Sheng 1996)* illustrated that the interfacial bond between PP fibres and cement paste is weak due to their smooth fibre surface. They explained that there is no strength enhancement with PP fibres even at a volume fraction of 5%. Nevertheless, PP is chemically inert and hydrophobic, thus removing the potential for chemical bonding. Therefore, the fibrillation (the quality of being made up of fibrils) has a considerable effect on the bonding. *(Bentur, Mindess et al. 1989)*suggested that the interfacial adhesion and mechanical anchoring are the two main factors that affect the fibre–matrix interaction

An extensive survey of reported mix constituents and proportions from laboratory and investigations showed that, although there were many variations in mix proportions, several factors were common to a majority of mixes. As with conventional concrete mix design, trial mixing is carried out to 'fine tune' mix proportions and make any adjustments as necessary, particularly when estimating the super plasticizer content and viscosity modifying admixture content *(Khayat 1999)*. Super plasticizer dosage should be determined from mortar tests using the flow spread test and the V-funnel test, where the flow of a known volume of mortar through the apparatus is timed and expressed as an index. These tests carried out on mortar minimize the need for trial mixing of concrete.

2. Materials and Mix Design

2.1 Materials:

Ordinary Portland Cement of Type I was used for this study which was locally available in market. As per ASTM C150-85A: 2006 standards, various tests were performed on cement to determine its properties. Locally available crush stone with 18mm maximum size were used as coarse aggregates..

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Table 1: Physical Properties of Coarse Aggregates

Fineness Modulus	Specific Gravity	Water Absorption %	Impact Value %	Crushing %	Specific Surface Area cm^2/g^{-1}
2.4	3.15	2	10	2.075	2910

Fine aggregates from different mineralogical sources, but of similar fineness modulus, were used. Natural siliceous sand having rounded and smooth particles were used as reference sand. Crushed sands were selected with different petrographic characteristics but similar grading curves were used. Fineness modulus of Fine aggregates used in this study was 2.4.

2.2 Mix Proportion

During the investigations, only cement was replaced by polypropylene fibers keeping other mix design variables, like water–binder ratios, quality of ingredients, mix proportions, including the aggregate–binder and coarse–fine aggregate ratios, dosage of SP, mixing procedures, curing conditions and testing procedures, constant.

The mix proportion is adopted as mentioned in table 2. The experimental program included six sets of concrete mixes, prepared by partial replacement of cement by equal weight of fibers. The %age replacement of fibers was 0% (control mix), 1%, 2%, and 3% of the total cementitious materials.

To cope with the workability issues super plasticizers (SP) were used whose dosage was also kept constant for all mixes because of the reason that if the dosage of SP is varied with the fibers replacement %age, then the variations in the concrete strength will occur not only due to variations in the fibers contents but also due to change in the dosage of SP. The mixing procedure and time were kept constant for all the concrete mixes.

Table 2: Mix Design of Self-Compacting Concrete with addition of Polypropylene Fibers

Concrete Mix	Water (kg/m3)	Cement (kg/m3)	Fibres (kg/m3)	Fine Aggregate (kg/m3)	Coarse Aggregate (kg/m3)	Super-Plasticizer (%)	VMA (%)	W/C
SCC1(N)	165	408	0	790	675	7.33	7.33	0.44
SCC2 (1% F)	165	408	4.08	790	675	7.33	7.33	0.44
SCC3 (2% F)	165	408	8.16	790	675	7.33	7.33	0.44
SCC4 (3 % F)	165	408	12.24	790	675	7.33	7.33	0.44

3. Casting of Concrete Specimens

Cylindrical concrete specimens with 150mm diameter and 300mm high were prepared to determine compressive strength and split tensile strength. The concrete constituents were mixed in a revolving drum type mixer for approximately three to six minutes to obtain uniform consistency. After mixing, the cylindrical molds were filled in three layers.

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4. Tests Results and Discussions

4.1. Fresh Properties

Figure 1(a) illustrates the relationship between PP fibers and slump flow. It was observed that with an increase in %ages of PP fibers, there is a decrease in slump flow which is related to the existence of the fiber that can increase the friction between the flowing concrete and the surface of contact in slump flow test. In figure 1 (b), the variation in T50 of the slump flow is shown with PP fibers addition, the time increased with an increase in the %age of PP fibers. Furthermore, PP fibers with respect to the V-Funnel test show an increase in the time to empty the V-Funnel as the %age of PP fibers increases fig. 1(c) & 1(d).
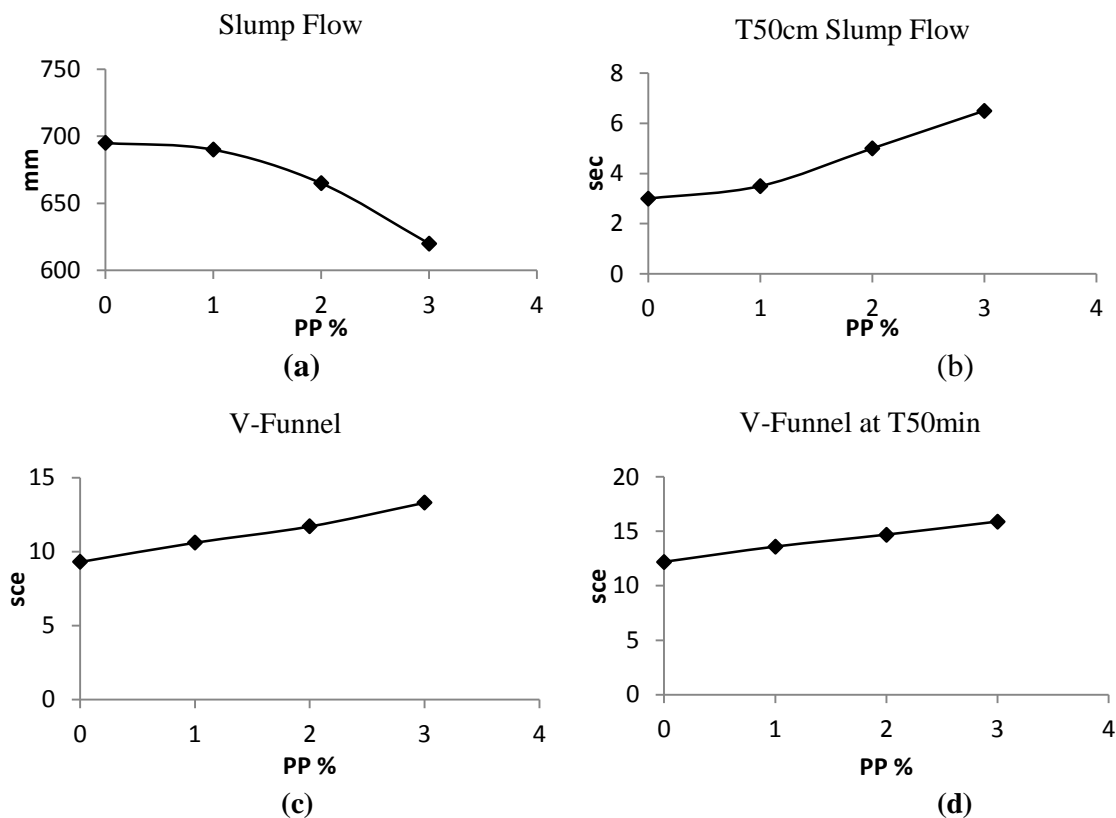
Fig.1: Effect of Polypropylene Fibers on Flowability of fresh SC Concrete.

4.2. Hardened Properties

4.2.1. Compressive Strength of the Concrete Cylinder:

Fig 2: Compressive Strength

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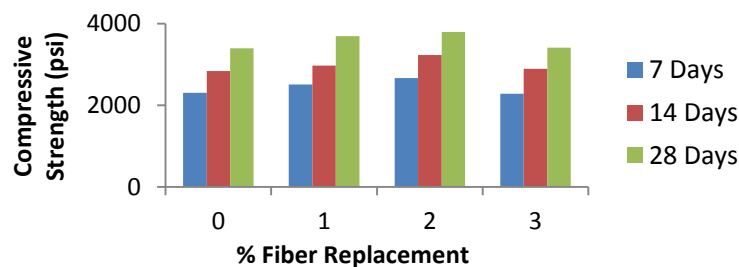
Fig 2 Illustrates the Compressive Strength of Concrete with fibers. The effect of polypropylene fiber on the compressive strength of concrete has been discussed in many literatures and observed that polypropylene fiber either decreases or increases the compressive strength of concrete, but overall effect is negligible in many cases. In fact, the effect of a low volume of polypropylene fiber on the compressive strength of concrete may be concealed by the experimental error. It is necessary that there should be a good bond between the fiber and the matrix. If the critical fiber volume for strengthening has been reached, then it is possible to achieve multiple cracking. This is a desirable situation because it changes a basically brittle material with a single fracture surface to fracture into a pseudo ductile material which can absorb transient minor overload and shocks with little visible damage. So the aim is to produce large number of multiple cracks at as close spacing as possible so that the crack widths are very small, almost invisible to naked eye so that the rate at which aggressive materials can penetrate the matrix is reduced. High bond strength helps to give close crack spacing but it is also essential that the fibers should give sufficient ductility to absorb impacts. Polypropylene Fibers were added with different %age in normal concrete. The strength achieved after 7 days curing was 8% and 15% increased at 1% and 2% fiber respectively, while using 3% fiber the strength decreased to -1.04% as compared to normal concrete

The strength achieved after 14 days curing was 4.76% and 13.49% increased at 1% and 2% fiber respectively, while using 3% fiber the strength decreased to -1.8% as compared to normal concrete. This happened, due to the fact that polypropylene fiber bridges micro-cracks of which growth can be controlled. This leads to a higher strength of the composite. When the fibers addition passes over 2.0 % by concrete volume, the instability of the concrete specimens which was realized earlier in the fresh concrete tests could have probably lead to a decrease in concrete strength.

4.2.2. Split Tensile Strength
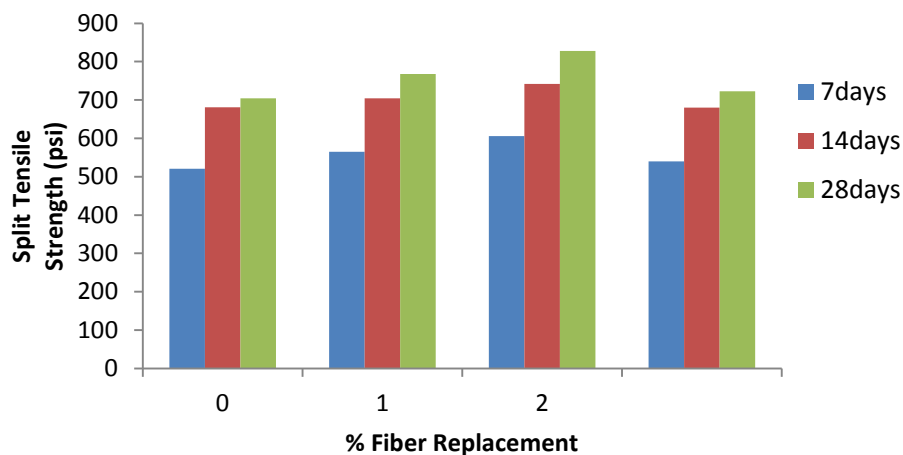
Fig 3: Split Tensile Strength

Fig 3 illustrates the split tensile Strength of Concrete with Fibers. The split tensile strength increases with increase in volume fraction of fiber. It is also observed that there was increase in strength for with the increase in aspect ratio of fibre. Polypropylene Fibers were added with different %age in normal concrete. The strength achieved after 7 days curing was 3.34% and 15.93% increased at 1% and 2% fiber respectively, while using 3% fiber the strength again increased to 18.71% as compared to normal concrete. The strength achieved after 14 days curing was 3, 33% and 9.01% increased at 1% and 2% fiber respectively, while using 3% fiber the strength decreased to 0.07% as compared to normal concrete. Direct tension test of concrete is seldom made because of difficulties in mounting the specimens and uncertainties as to the secondary stresses induced by the holding devices. An indirect test for tensile strength of concrete.

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5. Conclusions

Based on the tests results of the fresh and hardened state of self-consolidating concrete added with polypropylene fiber, the following conclusions were drawn:

1. In the fresh state of SCC, the presence of fiber caused lower flowing ability (Slump Flow) of SCC mixes. On the other hand, passing ability and the segregation ratio of the mixes increasing in accordance with the volume fraction of fibers content.
2. The concrete mixes still meet the requirement of flow ability, viscosity and passing ability of SCC with fiber addition up to 2.0 % by volume of cement.
3. The compressive strength of concrete specimens improved proportionally with the addition of fiber up to 2.0 % by cement volume, and then tend to decrease on 3.0 % of addition.
4. The splitting tensile strength of concrete specimens also improved in accordance with the addition of fiber up to 2.0 % by cement volume, and then tend to decrease on 3.0 % of fiber addition.
5. According to the evaluation of fresh and hardened properties of SCC, it seems that fibers allowed to be added into the concrete mixes up to 2.0 % by cement volume.

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Measurement of Subgrade Properties of G.T Road, Pir Pyai Area

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Abstract

Arrangement of the diverse black-top layers is all that much subject to the nature of the subgrade earth over which they will be laid. Subgrade quality is for the most part conveyed similarly as CBR (California Bearing Ratio). Weaker subgrade fundamentally obliges thicker layers however more grounded subgrade runs well with thinner black-top layers. The black-top plus the subgrade usually must backing the development volume. Despite the way that a black-top's wearing course is most detectable, the accomplishment or frustration of a black-top is when in doubt subordinate upon the concealed subgrade i.e., the material whereupon the black-top structure is fabricated. Subgrade be made out of a broad mixture of materials but some are immeasurably enhanced than others in regards to kind of earth. The examination focus tests were performed for the determination of planning properties of earth, of Pir pyai area, Nowshera. Consequently, the earth example was assembled structure "Pir pyai range, Nowshera" & passed on to CECOS earth mechanics research office. The example was protected from sunlight & air so that its moistness substance did not

Keywords

Earth Density, Atterberg's Perimeters, Earth Gradation, Proctor Compaction Tests, California Bearing ratio

1. Introduction

The sub assessment is the layer of typical earth whereupon the dark top or sub base is made. Sub assessment earth offers sponsorship to whatever is left of the dark top structure. The method for the sub audit colossally influence the dark top design plus the certifiable imperative vicinity of the dark top that is made. The significance of a container is not at all that awful quality sub assessment to the entire arrangement presence of the dark top container's be downplayed. Sub grade properties are vital dark top format parameters. Materials routinely experienced in sub assessments are delineated by their quality plus their impervious to mutilation under weight (endurance).

2. Investigational Procedure

The following tests were used to characterize subgrade materials.
1.   Atterberg's Perimeters
2.   Earth gradation
3.   Proctor compaction tests
4.   California Bearing Ratio (CBR)

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3. Testing Stage

3.1. Atterberg Parameters#

The investigation was executed to focus the flexible plus molten contravention facts of a well porous earth. Past what numerous would consider conceivable (LL) is self-unequivocally depicted as the liquid gratified, in out of each hundred, at which a touch of earth in a typical compartment plus censored by a despairing of typical estimations will stream collected at the disreputable of the wrinkle for a parcel of 13 mm (1/2 in.) when exposed to 25 abstractions from the glass presence fallen 10 mm in a typical liquid most far off point device worked at a rate of two stuns reliably. Past what numerous would consider conceivable (PL) is the liquid at ease, in out of each hundred, at which an earth container never again be contorted by moving into 3.2 mm (1/8 in.) width strings without separating.

3.1.1. Typical Orientation:

ASTM D 4318 - Typical Investigation Technique for Fluid Perimeter, Flexible Perimeter, plus Malleability Catalogue of Earths

3.1.2. Equipment:

Fluid most great gadget, Chinaware (scattering) bowl, Level cutting gadget by instrument, eight saturation containers, Sense of balance, Crystal bowl, Spatula, Wash compartment stacked with refined water, Exposure to air stove fixed on 105

3.2. Determination of Particle Proportions Investigation

The investigation was done to focus the rate of grouped particle proportions controlled inside of a dirt

3.2.1. Equipment

Parity of perimeter 15 Kg plus affectability 1 gram. Strainers 100mm, 75mm, 19mm, 4.75mm, 2mm, 425microns plus 75 microns fitting in with IS: 460 (Part 1) 1978, Non-corrodible trays, Bucket 1no

3.2.2 Typical Orientation:

ASTM D 422 – Typical Test Technique for Element-Proportions Investigation of Earths

3.3. Typical Proctor Compaction Test

Proctor (1933) developed an examination focus compaction test framework to center the most great dry unit weight of compaction of earths, which container be used for determination of field compaction.

3.3.1. Equipment

Compaction form, No. 4 U.S. strainer, Typical Proctor pound (5.5 lb), Balance delicate up to 0.01g, Balance touchy up to 0.1g, large level dish, Jack, Steel straight edge, Moisture jars, drying broiler, Plastic press bottle with water

3.3.2 Typical Orientation:

Orientation AASHTO method (ASTM D 698)

3.4. Density of Earth by Core Cutter Method

To focus the field or in-situ thickness or unit weight of earth by center cutter

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3.4.1. Equipment

Special: Tube shaped center cutter, Steel rammer, and Steel dolly b) General: Parity of capacity 5Kg plus affectability 1 gm, Balance of perimeter 200gms plus affectability 0.01 Gms, Scale, Spade or pickaxe or crowbar, Trimming Knife, Oven, Water content holders, Desiccators.

3.4.2 Mathematical Representation

Field density is defined as weight of unit volume of earth present in site. That is

$$\gamma_b = W/V$$

Where, γ_b = Density of earth
          W = Total weight of earth
          V = Total volume of earth

$$\gamma_d = \frac{\gamma_b}{1 + w}$$

Where,   rd = dry density of earth
          rb= Wet density of earth
          w = moisture content of earth.

Hear we use core cutter method, the equipment arrangement is shown as fallows
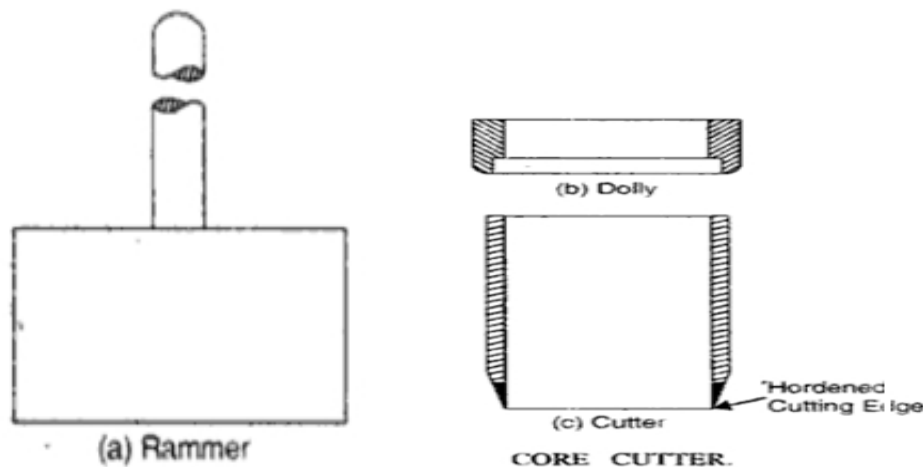
Figure 1: Core Cutting Apparatus

3.5.1 Equipment

Moulds 2250cc perimeter with base plate, stay shaft plus wing nut declaring to 4.1, 4.3 plus 4.4 of IS: 9669-1980, Collar demplusing to 4.2 of IS: 9669-1980, Spacer Disk acknowledging to 4.4 of IS: 9669-1980, Metal rammer ensuring to IS: 9189-1979, Extension calculating mechanical party with the versatile stem, punctured plates, tripod bearing witness to plus to weights affirming to 4.4 of IS: 9669-1980, Packing device having a most extreme of no under 5000kg plus furnished with an adaptable head or base that goes at a uniform rate of 1.25mm/min for use in convincing the intrusion plunger into the case, Penetration plunger demplusing to 4.4 of IS: 9669-1980, Dial gage two numbers inspecting to 0.01mm, IS sifters 37.50 or 22.50 or 19mm plus 4.75mm, Miscellaneous device, for occasion, blending dish, straight edge, scales, soaking tank, drying stove, channel paper, dishes plus balanced measuring holder. IS sifters 37.50 or 22.50 or 19mm plus 4.75mm,

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Miscellaneous contraption, for occasion, blending dish, straight edge, scales, sprinkling tank, drying stove, channel paper, dishes plus adjusted determining compartment

4. Results

4.1 Atterberg limits:

4.1.1 Fluid Limit Determination

Table 1 : Fluid Limit Determination

Sampling No.	1	2	3	4
MC = Bulk of void, hygienic container + top (g)	22.23	23.31	21.87	22.58
MCMS =Bulk of container , top, plus damp earth (g)	28.56	29.27	25.73	25.22
MCDS = Bulk of container , cover, plus dehydrated earth(g)	27.40	28.10	24.90	24.60
MS = Bulk of earth objects (g)	5.03	4.79	3.03	2.02
MW = Bulk of minute opening liquid (g)	1.16	1.17	0.83	0.62
w = Percentage of Water Quantity	23.06	24.43	27.39	30.69
No. of droplets (N)	31	29	20	14

4.1.2 Malleable limit Determination

Table 2: Fluid breaking point Determination

Sampling no.	1	2	3
MC = Bulk of empty, hygienic container + cover (g)	7.78	7.83	15.16
MCMS = Bulk of container , cover , plus wet earth (g)	16.39	13.43	21.23
MCDS = Bulk of container , cover , plus dry earth (g)	15.28	12 .69	20.43
MS = Bulk of earth and cover s (g)	7.5	4.86	5.27
MW = Bulk of minute opening liquid (g)	1. 11	0.74	0.8
w = Liquid content, w%	14.8	15.19	15.09

Malleable limit (PL)
= Typical w %
$$= \frac{14.799 + 15.199 + 15.0.099}{3} = 15.0$$

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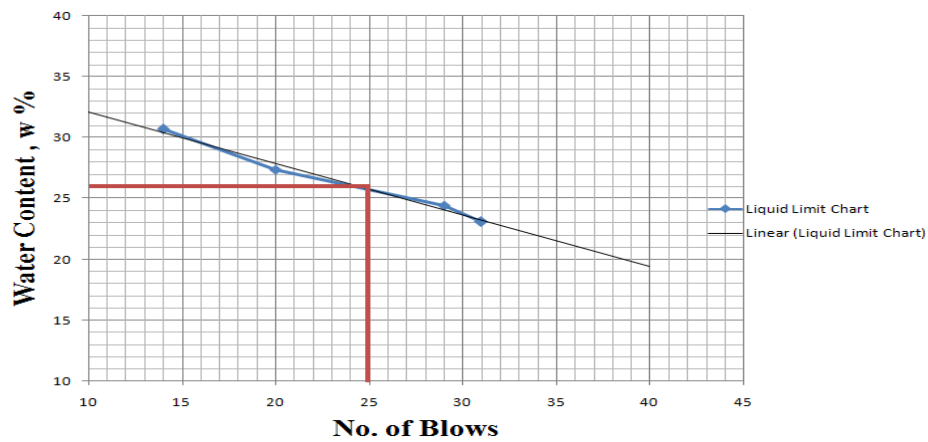
Graph 1: Liquid Boundary Graph

According to the graph above

Fluid Boundary = 25.999 %

Flexible Boundary = 14.999 %

Malleability Alphabetical listing =10.999

AASHTO Classification: Group: A-6

Earth Type: Clayey

General Rating as a Subgrade: Fair to poor

The earth was classified as CL according to Unified Earth Classification System.

4.2 Determination of Grain Size Analysis

Weight of sample=1000 gm

Table 3: Sieve Analysis Data

Sieve No	Sieve size (mm)	Wt of Earth (gm) retained	% wt retained	Cumulative % wt retained	% passing
#4	4.76	280	28	28	72
#10	2.00	150	15	43	57
#40	0.425	200	20	63	37
#50	0.300	80	8	71	29
#60	0.251	30	3	74	26
#100	0.150	50	5	79	21
#120	0.125	110	11	90	10
#200	0.075	15	1.5	91.5	8.5
PAN		85	8.5	100	0

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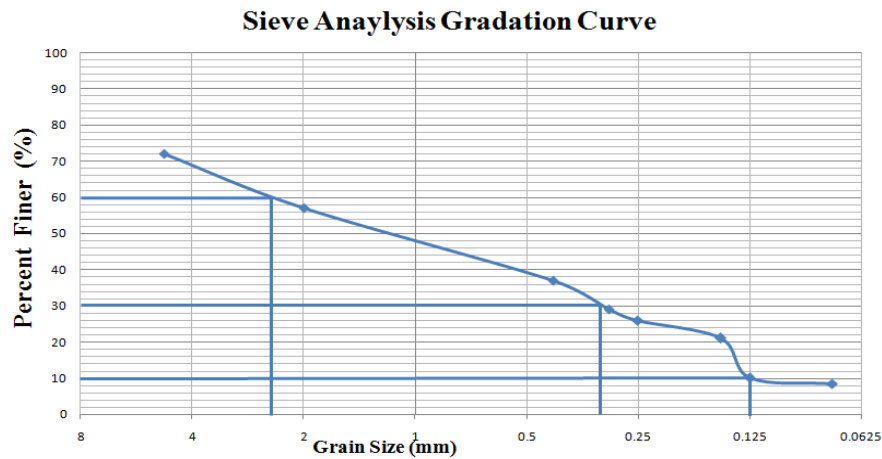
Garph 2: Sieve Analysis Gradtion Curve

Coefficients of Uniformity, C_u:

$$C_u = \frac{D_{60}}{D_{10}}$$

D_{60} = 2.6mm D_{10} = 0.125 mm

C_u= 20.8

Coefficient of curvature, C_c:

$$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

D_{30} = 0.3 mm

C_c= 0.276

4.3 Orientation Proctor Compaction Test:

4.3.1 Determination of water content:

w % (w = Ww/Wd x 100)

Table 4: Water Content

Sample No.	1	2	3	4
Wt of empty Container (gm)	23.3	24	27.3	25
Wt of empty Container + compacted earth (gm)	55.8	56.2	58.1	57
Wt of Container + Dry earth (gm)	52.3	51.7	53.8	51.7
Wt of water (gm)	3.5	4.5	4.3	5.3
Wt of Dry earth (gm)	30	33.1	26.5	26.7
Water content , W %	11.66	13.6	16.22	19.85

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4.3.2 Determination of Dry Density:

Table 5: Dry Density

Sample No.	1	2	3	4
Wt of empty mould (gm)	3395	3395	3395	3395
Wt of empty mould + Compacted Earth (gm)	4970	5215	5385	5235
Volume of mould(c.c)	945	945	945	945
Wt of Compacted Earth (gm)	1575	1820	1990	1840
Bulk Density , Ws/V (g/cc)	1.67	1.93	2.11	1.95
Dry density (pcf)	93.43	105.88	112.74	101.53
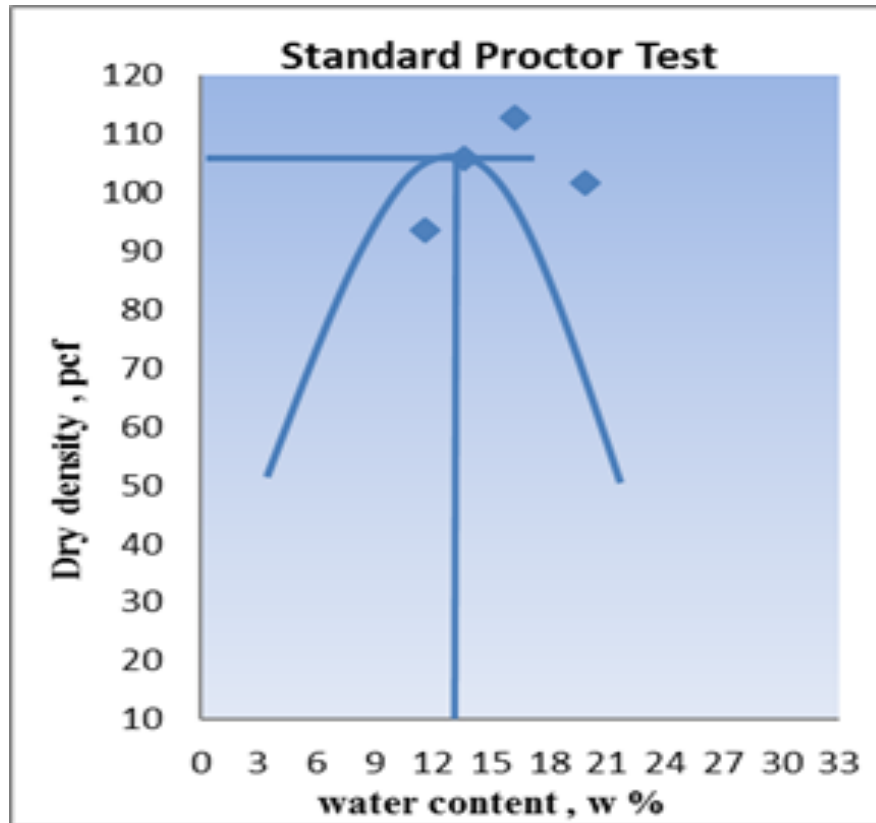
Graph 3: Orientation Proctor Test

4.4 Determination of filed Density by Core Cutter Method:

Internal diameter of cutter: 10cm

Height of the cutter: 11.5 cm

Cross sectional area of the cutter: 78.54cm2

Volume of the cutter, V: 903.2cm3

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Table 6: Field Density by Core Cutting Method

Sample	1	2	3
Wt of empty Cutter (W1)	735 g	735 g	735 g
Wt of Cuter + Wet Earth (W2)	2200 g	2350 g	2500 g
Volume of Cutter , V	903.2 cm^3	903.2 cm^2	903.2 cm^2
Wt of Wet Earth , W3 = W2-W1	1465g	1615 g	1765 g
Bulk Density = W3/V	1.62 g/c.c	1.79 g/c.c	1.95 g/c.c
Wt of empty Container	25 g	24.8 g	24.3 g
Wt of Container + Wet Earth	100 g	105 g	110 g
Wt of Container + Dry Earth	89 g	96 g	102 g
Wt of Water , Ww	11 g	9 g	8 g
Wt of Dry Earth , Wd	64 g	71.2 g	77.7 g
Water Content , W	17.2 %	12.6 %	10.3 %
Dry Density	1.38 g/c.c	1.59 g/c.c	1.77 g/c.c
	Average dry density = 1.58 g/c.cor 98.41 pcf		

4.5 Determination of California Bearing Ratio
4.5.1 CBR Sample 1

Table 7: CBR Test Sample 1

No. Of Blows	10	30	65
Mould + Sample (gm)	11205	11640	11870
Wt Of Mould (gm)	6775	6750	6730
Volume (c.c)	2115	2110	2120
Wet Density (gm/c.c)	2.095	2.318	2.425
Dry Density (g/c.c)	1.80	1.991	2.083
Wt Of Earth (gm)	4430	4890	5140

Area of plunger=11.66 cm^2
Providing Ring Reading
Ring Factor=2.28

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Table 8

Penetration (mm)	10 blows	load for 10	stress 10
0.64	5	11.4	0.97770
1.27	10	22.8	1.95540
1.91	18	41.04	3.51972
2.52	27	61.56	5.27958
3.81	45	102.6	8.79931
5.08	60	136.8	11.7324
7.62	95	216.6	18.5763

Penetration (mm)	30 blows	load for 30	stress 30
0.64	10	22.8	1.95540
1.27	19	43.32	3.71526
1.91	30	68.4	5.86620
2.52	40	91.2	7.82161
3.81	60	136.8	11.7324
5.08	81	184.68	15.8387
7.62	125	285	24.4425

Penetration (mm)	65 blows	load for 65	stress 65
0.64	21	47.88	4.106346
1.27	48	109.44	9.385935
1.91	119	271.32	23.2693
2.52	183	417.24	35.78388
3.81	313	713.64	61.20412
5.08	403	918.84	78.80274
7.62	520	1185.6	101.681

5. Results:

The results of laboratory tests on earth of Pir Pyai area, Nowshera is summarized in the table 5.1

Table 5.1: Summary of the Results

S. no	Test description	Result
1	Fluid breaking point	25.999 %
2	Plastic point of confinement	14.999 %
3	Pliancy list	10.999
4	Type of earth, as per USCS plus AASHTO	Cl
5	Optimum moisture content	16.4 %
6	Maximum dry density	114.3 lb/ft^3
7	Field density	98.41 lb/ft^3
8	Wet Density	110.9 lb/ft^3
9	CBR	7.65 %

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Dynamics of Rock-Fill and Concrete Gated Weir by Using SEEP/W

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Abstract:
Weir is one of the necessary river training structure. It plays an important role for canal water divergence. Different types of weirs are used for different purposes and so results in different seepage flows under river bed. The type of seepage and its flow rate depends upon the head of water, material and other soil and water parameters. By keeping all the Soil and water parameters constant, it has been seen that the seepage flow rate greatly varied for different water level and type of weir. This difference is about 100% between two prototypes (Porous rock-fill weir and non-porous concrete made weir) by using SEEP/W under steady state conditions.

Key words: Gabion weir, non-porous weir, seepage, velocity, sedimentation, flow net, hydraulic model.

1. Introduction

The natural rivers are flowing at their particular way. One can get benefits by constructing different hydraulic structures like weir, dam etc. The natural equilibrium of the river is being disturbed by constructing these barriers. The turbulences affect different soil and flow parameters like porosity, permeability, water table, velocity, discharge, sedimentation, etc. All hydraulic structures assist its unique functions. The main persistence of weir structure is to rise the flow level and divert it into the off-taking canal.[1] Surface water in rivers and streams are directly associated with glaciers. When temperature is low, small quantity of water is coming from hilly area. In order to easily divert maximum quantity of water, it is necessary to provide an impermeable weir.[2] A concrete weir is impermeable while a gabion weir is permeable one. Concrete weir shows maximum resistance to the flow of water as compared to gabion weir[3]. For same flow rate, the head of flowing water is high in concrete weir and low in gabion weir. The common equation for concrete weir is, $Q = (2/3C_d B \ (2g)^{0.5}H^{1.5})$, this is not applicable for gabion weir.[4] The concrete weir does not allow physical or chemical constituents through its frame therefore it causes harmful impact on aquatic environment. The rock fill weir can divert water in low stream period but for high flow period, it will be blush out with water.[5] This paper mainly describe the seepage comparison between two prototypes constructed at 3 km downstream of Warsak Dam Peshawar. The seepage addressed is the foundation seepage. The seepage analyzed is assumed to be two dimensional, the flow is steady

state and the Darcy's Law following is in an isotropic and homogeneous porous saturated medium.[6]

2. Background

Kabul River Main Canal off-takes from Kabul River 3-KM downstream of Warsak Dam. The Main Canal bifurcates into two branches at RD. 15+00, Kabul River Canal and Jeo Sheikh Canal. Jeo Sheikh Canal was constructed much earlier in the 17th century and was incorporated in the Kabul River Canal System after its construction during 1872 and onwards.

Figure. 1. Existing facilities of weir site

The system provides Irrigation facilities to a CCA of 75320 Acres (Kabul River 48700 Acres, Jeo Sheikh 26620 Acres) located in Peshawar and Nowshera Districts. Before the construction of Warsak Dam the diversion into the system was dependent on the water level in the river. After the construction of Warsak Dam a rock fill weir was constructed in 1960 along with a head regulator for diverting flow into the system. The system faced many problems thereafter and one of the main problems was that the water level in the river could not be maintained and the diversion of designed discharge into the system was not possible due to frequent damages due to floods and excess seepage from the body of the weir. M/S NESPAK carried out the feasibility study during 1981 and recommended to restore the rock fill weir and to construct a new head regulator including silt exclusion arrangement.

3. Problem Statement

Weir is one of the Important hydraulic structure, its main purpose is the divergence of water from the Mother river into the canals. The quantity of water divergence mainly depend upon the type of weir used. According to (Bakry and Award, 1997), the depth of water is associated with the seepage of water. In this research paper, Seepage analysis is done on two materially different prototypes by using SEEP/W.

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4. Laboratory Work

Figure. 2. Soil sample collection

The soil sample for laboratory experiments was collected at Prototype location. It was collected at 5.5 feet depth. It was found that the soil is Coarse grained. A number of experiments were performed to explore its geotechnical properties. Details for soil parameters are given below.

Parameters	Saturated WC (%)	D_{10} (mm)	D_{60} (mm)	Liquid Limit (%)	Hydraulic Permeability 'K' (m/s)
Lab Values	21	0.15	12.5	24	1.049e-7

5. Cross-Sectional Details
6.

The cross-sectional detailed drawings for Concrete weir is provided by irrigation department Peshawar. There is no cross sectional drawing available for gabion weir. Only the width and height of weir are known.
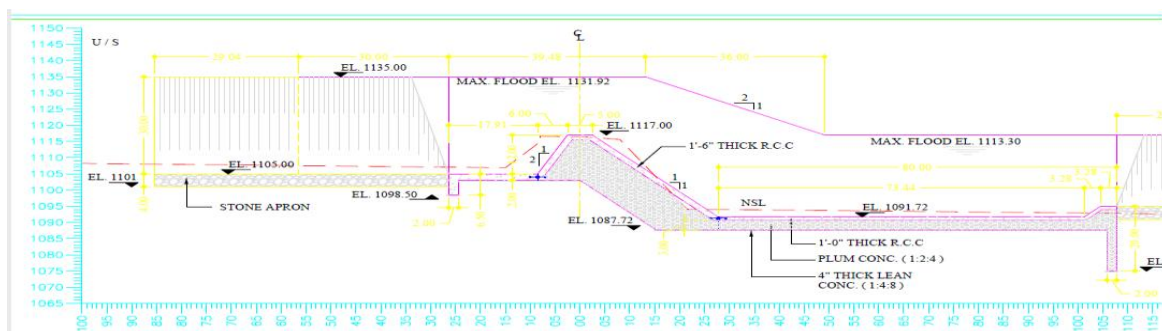
Figure. 3. Cross-sectional detail for concrete weir

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7. Analysis And Discussion

The seep/w software is run on steady state flow. The basic input parameters are soil and water parameters. It includes hydraulic conductivity, saturated water content, diameter at 10% finer, diameter at 60 % finer, liquid limit and residual water content. Residual water content values for different materials is provided by Mark et al.[7]

The hydraulic conductivity for concrete material is taken as zero. For gabion weir, K_x is taken as 0.2 ft/sec. (suggested by field experts). The seep/w identify the hydraulic conductivity function for gabion and concrete weir by Fredlund & xing method while for foundation soil, it follows the Van Gunechten method.

7.1 Gabion Weir

The software results for Rock-fill weir is given below.
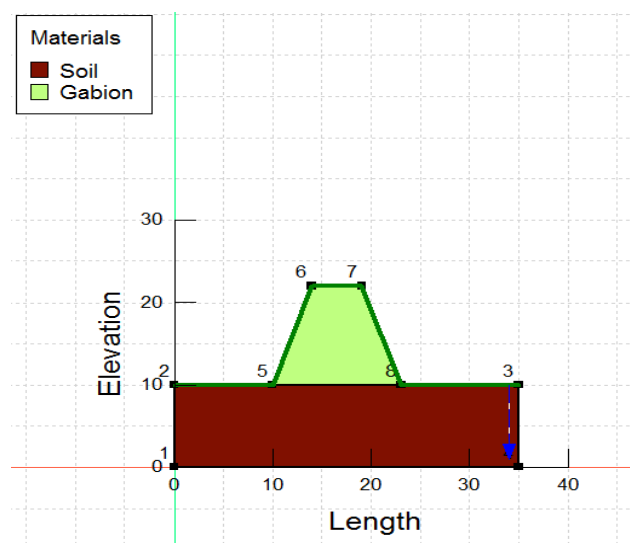
Figure. 4. Gabion weir analysis
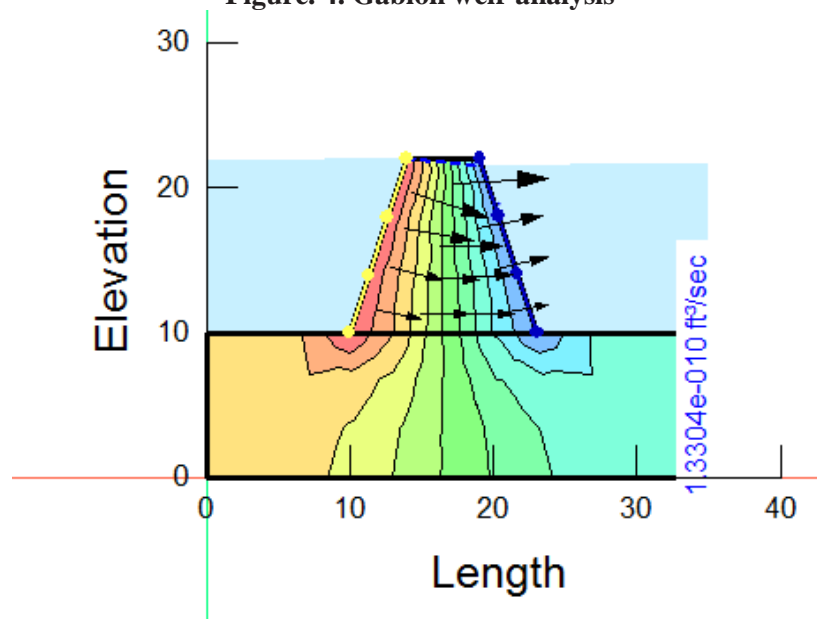
Figure. 5. Gabion weir result

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7.2 Concrete Weir

Figure. 6. Concrete weir analysis

Figure. 7. Seepage flow diagram

8. Conclusion

It is concluded that soil seepage through river soil greatly depend upon the type of weir. The research work show that by replacement of gabion weir over concrete weir, the seepage is reduced about 100% under the same soil and water parameters. This is because of the Cut-off wall and the increased creep length provided in concrete weir.

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Comparative Performance Evaluation of Effects of Modifier in Asphaltic Concrete Mix

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Abstract

The gradual increase in traffic volume, poor design and construction practices during the last few decades in combination with lack of attention to highway maintenance has caused an accelerated and continuous deterioration of the road network in Pakistan. Compromise on quality of construction, in addition to the above factors, is the main cause of pavement failures, especially rutting. Rutting failure occurs when the pavement surface exhibits wheel path depressions as a result of compaction/mix design problems. The asphalt binder starts to become softer and eventually into viscous state with the increase in temperature causing rutting. In this research, we have used different modification in bitumen to reduce rutting, and compare with unmodified bitumen. We have used Low Density Polyethylene (LDPE) and crumbed rubber as modifiers. These modifiers were used to examine the potential prospects for improving asphalt binder properties against rutting. The compacted asphalt mixes were tested for resistance to rutting by subjecting all the specimens to 10,000 repetitions of a loaded wheel. The rut depth for each specimen was determined using wheel tracking machine. These samples were tested at 25°C & 55°C temperatures. From this research, it is concluded that the crumbed rubber modified bitumen is a better option than LDPE, especially at high temperatures. However, conventional (unmodified) bitumen gives satisfactory performance at low temperatures.

Keywords Crumbed Rubber, Polymer, Rutting.

1. Introduction

Hot Mix Asphalt (HMA) is the common material for road surface. It consists of crushed stone aggregates, asphalt binder and mineral filler. The asphalt binder acts as glue and binds the aggregate particles together to form a relatively stable cohesive mass. The stone skeleton to resist the traffic load applications is provided by the aggregates. Due to viscoelastic nature of asphalt binders,

temperature susceptibility and aging are the important characteristics which greatly affect the asphalt binder performance (Shen & Kirkner, 2001).

Chen (2009) identified rutting and alligator cracking as the root causes of pavement failures. Rutting (permanent deformation) is characterized by the surface depression along the wheel path with or without the pavement uplift along the sides of the rut. Each time when a load is applied to the pavement, a small amount of permanent deformation occurs in it. The accumulation of these small deformations after many load applications causes pavement failure. Rutting depths are also dependent upon pavement temperatures. Ruts, if not very severe, are noticeable only when they are filled with water after rainfall which is known as hydroplaning. Rutting can also be caused due to permanent deformation in the pavement subgrade or any other layer due to the consolidation or lateral movement of the materials. Severe rutting in the pavement is an indication of its structural failure (Brown and Cross, 1992).

Rutting has become one of the major flexible pavement distresses in Pakistan in the recent years. There are many factors that contribute to the premature failure of pavement due to rutting including heavy illegal axle loading, high local temperatures, and poor quality control during construction and limitations of mix design procedures to meet the requirements of Pakistani climate (Khan and Kamal, 2008). Many modifiers are able to improve the properties of asphalt and to increase its rut resistance. Therefore, we add modifier (crumbed rubber and Low Density Polyethylene (LDPE)) to improve resistance to rutting in a flexible pavement. Both these modifiers are waste products of many industries in Pakistan.

Polyethylene is a thermoplastic polymer and the most commonly used plastic in the world. It is obtained by the polymerization of ethane. It is a semi-crystalline material having a very simple structure. It has a wide range of properties including good chemical, fatigue and wear resistance (Malpass, 2010). Crumbed rubber is usually applied to recycled rubber from automotive and truck scrap tires.

The objectives of this research are; (i) study and comparison of the performance of polyethylene and crumbed rubber modified bitumen against HMA and (ii) propose the rutting resistant asphalt mixture suitable for local climate and loading conditions.

2. Literature Review

Hesp and Coomarasamy (1997) used crumbed rubber as modifier to test the performance of pavement against rutting at 60°C using the wheel tracking machine test. They used thermal restrained specimen test for low temperature cracking. The 30 and 80 mesh crumbed rubber was used in this research and they concluded that the crumbed rubber modified bitumen performance is significantly better at high temperatures as compared to traditional bitumen. They also observed moderate improvements in low temperature thermal cracking resistance.

Huang *et al.* (2002) tested paper crumb rubber in laboratory as well as field and concluded that the conventional mixtures exhibited higher initial strength characteristics in the laboratory testing than the crumb rubber mixtures. However, the pavement sections constructed with crumb rubber asphalt mixtures showed overall better performance indices (rut depth, fatigue cracks, and IRI numbers) than the corresponding control sections after five to seven years of traffic.

Hinishoglu and Agar (2004) used the waste high density polyethylene (HDPE) as polymer modified bitumen. They used 4, 6 and 8% HDPE by weight of bitumen content at temperatures varying from 145 to 165⁰C. They concluded that the HDPE modified bituminous binder provide better resistance against permanent deformation due to their high stability. Another study by Attaelmanan *et al.* (2011) confirmed the results of the previous study. They extended in their study that performance of HDPE is better than conventional mixtures in terms of tensile strength, flexural strength and resilient modulus as well.

Gawel et al, (2006) concluded that benefits of using crumb rubber with asphalt binders include improved temperature susceptibility, reduction in reflective cracking of the pavement, noise reduction and reduce propensity for failure at low pavement temperature.

Al-Hadidy & Yi-qiu (2008) used low density polyethylene (LDPE) as modifier in their study. The results indicated that the inclusion of LDPE in stone mastic asphalt mixtures can satisfy the

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performance requirements of zones falling in extreme weather conditions including high temperature, low temperature and heavy rain fall zones.

Kalantar *et al.* (2009) used the waste polyethylene as modifier at different content by weight of bitumen at 150°C. They concluded that polyethylene terephthalate (PET)-modified bituminous binders provide better resistance against permanent deformation due to their higher complex shear modulus.

Shankar and Prasad (2009) investigated the use of crumbed rubber modified bitumen for pavement. They used different rubber content at specified temperatures. They concluded that the characteristics of the crumbed rubber modified bitumen were better than the conventional bitumen.

Pareek *et al.* (2012), in their research used the polymer as modifier to test performance of asphalt mixture against low temperature cracking and high temperature permanent deformation. They observed that the polymer modified bitumen performed well in both extreme low and high temperatures.

Akinpelu *et al.* (2013) in their research used Polythene waste as the modifier for asphalt concrete. They varied the proportion of modification from 2.5 to 15%. They found that the obtained optimum proportion of the modifier is 12.5% by the weight of the optimum bitumen content. It was observed to increase the stability, reduce the density and slightly reduce the flow of asphalt concrete specimen.

The research on modification of bitumen using crumb rubber and LDPE has been carried out rigorously by the researchers. Hassan *et al.* (2013), Ibrahim *et al.* (2013), Room *et al.* (2014) and Hussain *et al.* (2015) have investigated the effects of using crumb rubber on different performance aspects of asphalt pavement. The performance measures included resistance to rutting, creep, viscosity, softening point, loss modulus, and storage modulus. The addition of crumb rubber has generally resulted in improvement of asphalt pavements' performance for the above characteristics. However, Hassan *et al.* (2013) have reported that the use of fine rubber in stone mastic asphalt mixture cannot provide enough binder modification to perform as good as conventional stone mastic asphalt mixture with polymer modified bitumen.

Researchers who have used polyethylene for asphalt pavements in Pakistan has mainly shown their concern over the disposal of this material in the environment hence its use is suggested as a recycling option (Nasir *et al.*, 2014). The following properties of asphalt pavement have been investigated with the addition of polyethylene; resilient modulus, strength, flow, creep and rutting (Hussain *et al.*, 2015a; Hussain *et al.*, 2015b; Nasir *et al.*, 2014). The observations have been in favor of its use in asphalt pavement with a positive improvement in these parameters. This modification has also been compared with other modifications including lime and polymer for rutting and crumb rubber for resilient modulus. It was observed that the resistance against rutting for polyethylene is approximately equal to lime and polymer modifications (Hussain *et al.*, 2015a). Its resilient modulus was found to be close to crumb rubber modification with their proportion is kept 0.4% by weight of sample (Hussain *et al.*, 2015b).

The above literature review showed that asphalt modifications have been found to increase the resistance of HMA against rutting, high temperature permanent deformations and low temperature cracking. This suggests their universal use in hot as well as cold climate. However, comparison between these modifications is scarcely found in the present body of literature, especially for comparing the rutting resistance. The present study addresses this gap in the research.

3. Methodology

Preparation of samples involves sieve analysis to have adequate gradation of aggregates. Sieve analysis was performed manually in according to National Highway Authority (NHA) Class-B gradation which is recommended standard for flexible pavement design in Pakistan. The size distribution according to this standard is shown in Figure 1.

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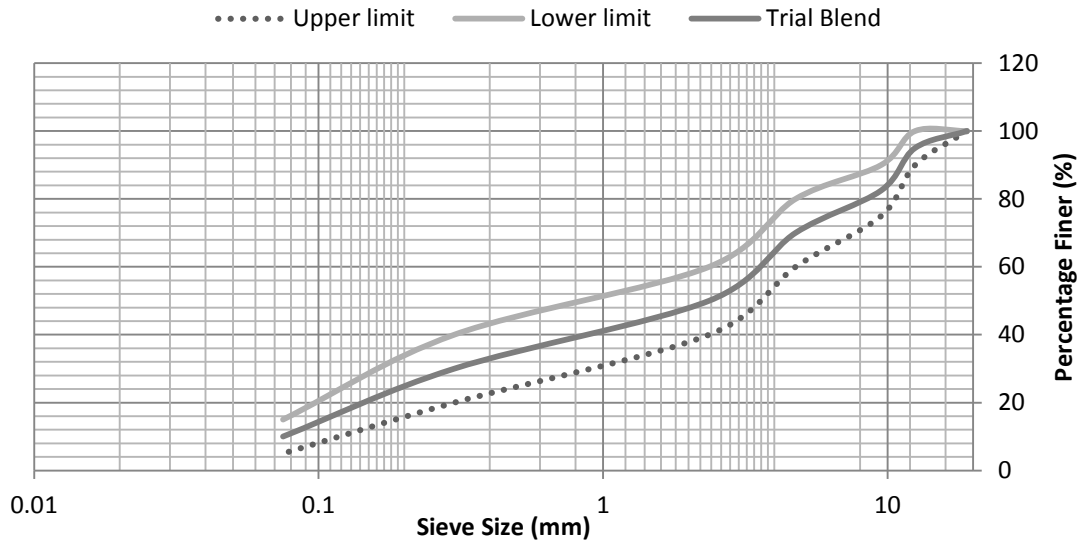
Figure 1: Gradation Curve of Sieve Analysis

The proportions of modifications were made equal to 0.2% by weight of sample. Marshall Mix Design test procedure was used for finding optimum binder content (OBC). In this mix design process, four (04) measures are used to determine OBC which include; Bulk Specific Gravity, Marshall Stability and Flow Test and Theoretical Maximum Specific Gravity. The OBCs determined for samples with different types of asphalt binder, used in this study, are shown in table 1. It can be observed that the modification have not resulted in significantly affecting the OBC. Specimens for rutting test through wheel tracker were prepared using the OBC determined by Marshall Mix Design process. Four (04) samples for each type of asphalt binder (normal, polyethylene, and crumbed rubber modified) were prepared at the compaction temperature of 140^0C. These test specimens were compacted in the laboratory using roller compactor in four stages. In the first stage, the specimens were compacted under a pressure of 2 bar (200kPa) with 10 cycles of passes. In the second stage, the specimens were further compacted under a pressure of 5 bar (500kPa) with 10 cycles of passes. In the third stage, the specimens were further compacted under 4 bar pressure (400kPa) with 5 cycles of passes. In the fourth and final stage; the specimens were compacted under a pressure of 3 bar (300kPa) with 5 cycles of passes. Temperature of mix during compaction was 140^0C.

After the compaction, the specimens were placed in wheel-tracking machine to evaluate the rutting depth of all the mixtures. All the asphalt concrete samples were subjected to 10,000 passes of a loaded wheel at the rate of 26.5 revolutions per minute i.e. 53 passes per minute. The specimens were tested at two (02) different temperature levels (25°C and 55 ^{0}C).

4. Results and Discussion

The comparison of rut depth according to temperature 25^0C & 55^0C between the conventional (unmodified) bitumen (CB), polymer modified bitumen (PMB) and crumbed rubber modified bitumen (CRMB) is shown in the table 2. The values are shown for average of two (02) samples tested in each scenario.

The data presented in table 2 shows that the modified samples show initial high deformation as compared to CB samples especially at low temperature. At higher temperature (55^0C), CRMB samples have shown lesser deformation compared to the others.

As shown in Figure 2, conventional bitumen gives better performance against rut depth due to the higher stability at 25^0C. The maximum rut depth of CB is 1.3 mm at this temperature. Comparatively, CRMB samples have shown the highest rut depth (1.70 mm) while it was 1.60 mm

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for PMB samples. All samples show a rapid increase in deformation for the first 1,000 passes, after which the deformation curve shows a relatively mild slope.

Table 1: Details of Test Specimens

Name	OBC	Aggregate Content	LDPE Modifier Content	Crumbed Rubber Content	Temperature (^{0}C)
CB	4.5%	95.5%	-	-	25, 55
PMB	4.3%	95.5%	0.2%		25, 55
CMB	4.3%	95.5%	-	0.2%	25, 55

Table 2: Ruth Depths

Rut Depth (mm)						
Temperature		25^0C			55^0C	
No. of passes	CB	CRMB	PMB	CB	CRMB	PMB
0	0	0	0	0	0	0
1000	0.50	1.01	0.55	1.61	1.10	1.75
2000	0.65	1.19	0.73	1.98	1.34	2.01
3000	0.74	1.30	0.90	2.32	1.58	2.29
4000	0.83	1.37	1.02	2.72	1.79	2.5
5000	0.89	1.45	1.13	3.12	1.99	2.76
6000	0.97	1.50	1.24	3.47	2.16	2.96
7000	1.05	1.56	1.35	3.82	2.32	3.10
8000	1.13	1.62	1.46	4.17	2.58	3.29
9000	1.20	1.67	1.52	4.47	2.56	3.42
10000	1.26	1.70	1.60	4.75	2.66	3.61

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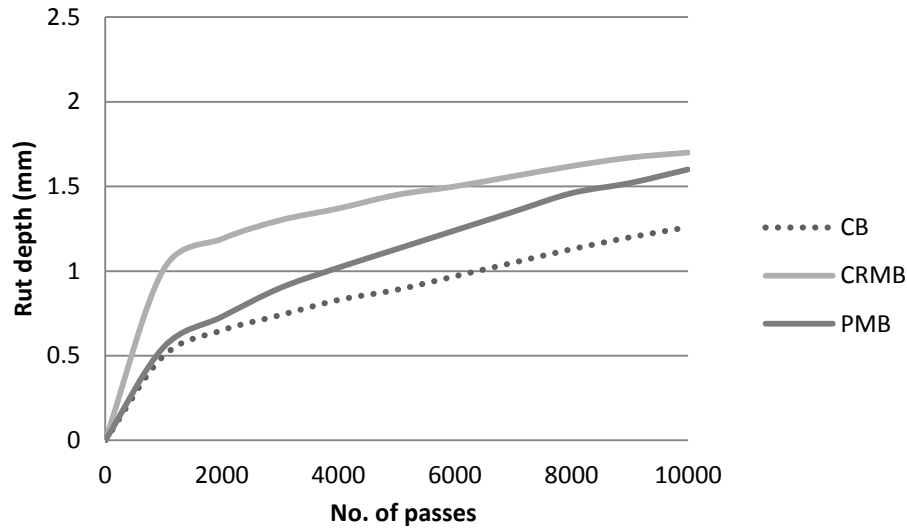
Figure 2: Rut Depths at 25^0C
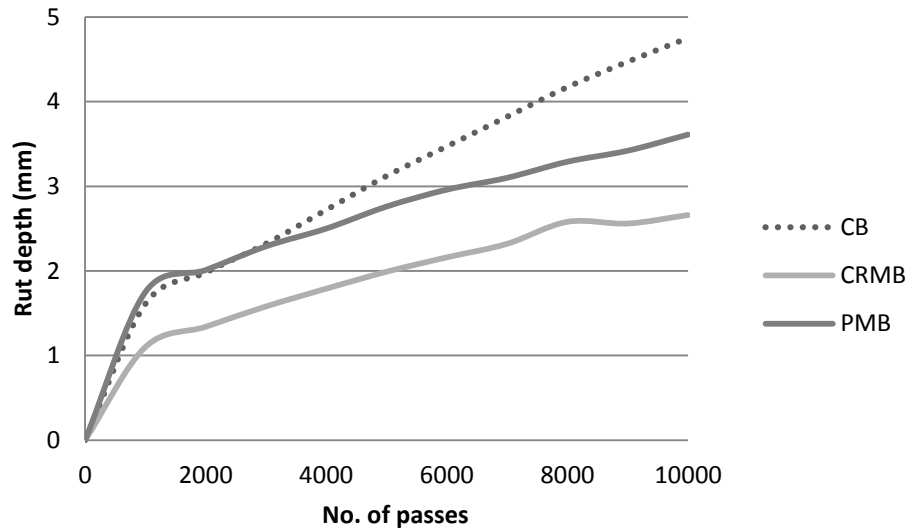
Figure 3: Rut Depths at 55^0C

The data plotted in Figure 3 shows that CRMB samples show the least rut depths initially as well as after the completion of 10,000 passes at 55^0C. The initial rut depths in the other samples were very close to each other. However, PMB samples showed lesser rut depths as compared to CB samples.

Figure 4 shows the comparison of performance of CB samples against rutting at the tested temperatures. It can be observed that the change in temperature has a large impact on the rut depths irrespective of the number of repetitions. The change in temperature changed the rut depths by 2.5 times approximately. Fig. 5 shows the comparison of rut depths for CRMB samples at different temperatures. The initial rut depths are almost the same at both temperatures and difference between them increases gradually with the increase in number of passes. The rut depths at 55^0C were approximately 33% higher, on average, than those at 25^0C. However, the difference in initial rut depths (up to 2000 passes) was approximately 10%.

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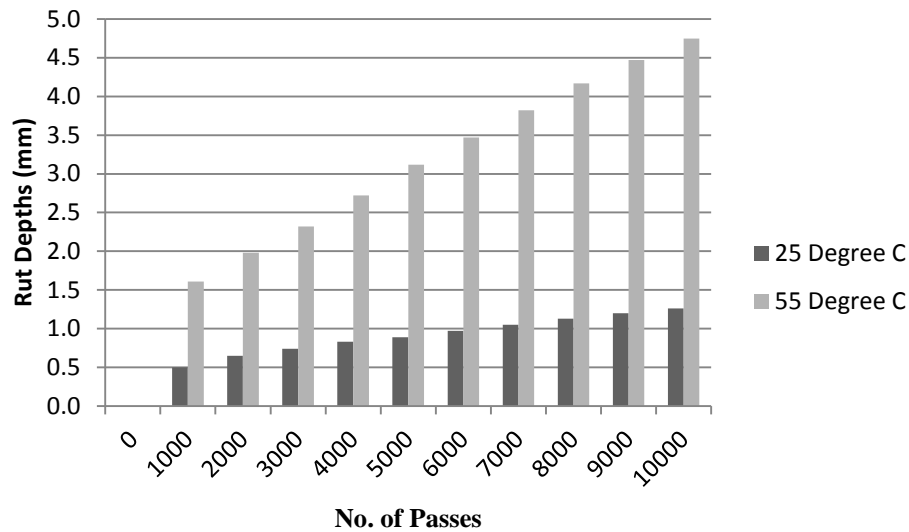
Figure 4: Rut Depths of CB Samples
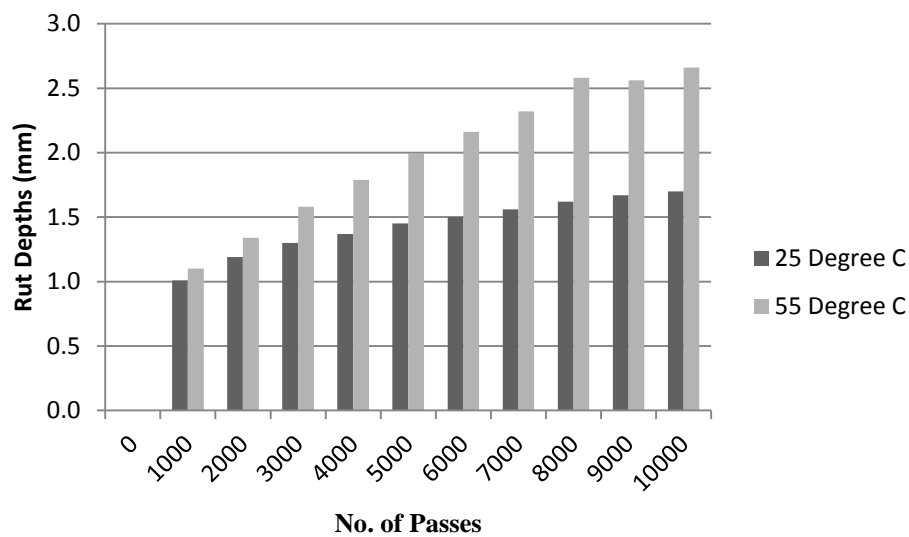
Figure 5: Rut Depths of CRMB Samples

The data plotted in Figure 6 shows the comparison of rut depths for PMB samples at the tested temperatures. These samples show behavior similar to CB samples with large differences in rut depths at different temperature levels irrespective of number of passes. The average increase in rut depths at 55^0C was found to be 1.5 times than those at 25^0C.

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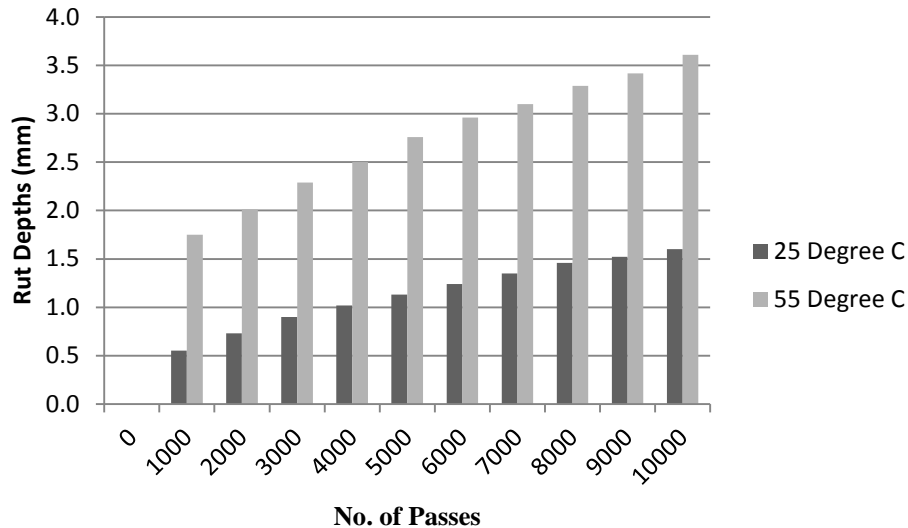
Figure 6: Rut Depths of PMB Samples

5. Conclusions

The rutting resistance of HMA samples, prepared with different modifications of bitumen, was tested in this study using a wheel tracking device. The samples were prepared using standard gradation of NHA and OBC was found using Marshall Mix Design procedure. Bitumen was modified with the addition of polyethylene and crumbed rubber. It was found that the modifications in the bitumen did not have a large impact on the OBC content which was found to be approximately 4.5% for all samples. A positive effect in terms of rutting resistance was observed only at high temperature levels with the modification. Crumb Rubber modification was found to have resulted in higher rutting resistance in pavement specimens. Moreover, these specimens also showed lesser sensitivity to changes in temperature, in terms of rutting, as compared to the other specimens. Earlier local studies have shown that CMRB pavements can have similar resilient modulus to that PMB. Therefore, it can be said that CRMB flexible pavements are more preferable for the conditions in Pakistan.

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Critical Analysis of Force-Based Procedure for Seismic Design of RC SMRF Structures

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Abstract

This paper presents research carried out on the critical evaluation of force-based seismic design procedure, given in the Uniform Building Code (UBC-97) and Building Code of Pakistan Seismic Provisions (BCP-SP 07), for the Special Moment Resisting Frame (SMRF) structures. The investigation was carried out on 2D special moment resisting frame prototype structures (3,5,7,9,12,15 storeys), which were designed to FBD (Force Based Seismic Design) equivalent lateral load method. The case study structures were then analyzed using Non-Linear Time History Analysis (NLTHA) in finite element based non-linear analysis software SeismoStruct, employing a suite of seven spectrum compatible natural accelerograms extracted from the Pacific Earthquake Engineering Research Center (PEER) database. It is observed that structures designed to force-based design procedure can exceed the code specified design drift limits, though it is highly dependent on the load combinations. Furthermore, the SMRF frame modelling idealization effect is investigated on the response of structures, the drift response shows significant variation and thus point to the importance of realistic modelling of frame structures for design verification.

Keywords SMRF Structure, Building Code of Pakistan, Force-Based, Seismic Design, SeismoStruct

1. Introduction

Observations from previous earthquakes have shown that the code designed buildings often show poor performance in achieving its anticipated design objectives (Priestley, 2003). Force based seismic design procedure which is the current seismic design procedure in the codes are based on the elastic period of the structure. The elastic period in the FBD is estimated from the initial gross stiffness of structural members. The base shear is calculated from the design acceleration response spectrum which is given by the code. For ductile structures this base shear is reduced by the introduction of response modification factor (R-factor) to account for the ductility of the structures. The design base shear is distributed along the height of structure which follows the fundamental mode shape of the structure. For tall structures the higher mode effects are accounted by the application of an additional lateral force at the roof level. The structure under the action of this force vector is analyzed and subsequently the members are designed for shear and moments. Structural designs are also checked for the maximum allowable drift given by the seismic codes. BCP-SP 07 and UBC-97 put a maximum limit of 2.5% for the structures having fundamental time period less than 0.70 sec and 2.0% for structures with periods greater than 0.70 sec. This research was carried out to critically analyze the performance of force-based designed structures, using non-linear time history analysis, to help assess the feasibility of the designed structures against earthquake loading and to identify the shortcomings in the current code based designs.

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2. Case Study Structures

Fixed bases were modelled at the column bases to ignore the effect of soil flexibility on the case study structures. The concrete strength was taken as 3 ksi and steel reinforcement strength was taken as 60 ksi. A total of six structures with 3, 5, 7, 9, 12 and 15 stories were designed according to BCP-SP 07. All the structures had three bays with a bay width equal to 19 ft. and a story height of 11 ft.

3. Design of RC Frame Structures

The design of these structures were performed using the finite element based software ETABS. These structures were designed for seismic zone 4 and soil type S_D. The structures were designed and detailed according to the requirements of special moment resisting frames (SMRF) given in BCP-SP 2007.

4. Modelling Technique Adopted

The NLTHA of the case study structures were performed in the finite element based non-linear structural analysis software SeismoStruct. The modelling technique adopted in SeismoStruct for the case study structures is shown in Fig. 1. The fiber section modelling was adopted for beams and columns (using the inelastic force based frame element), while the beam-column joints were modelled as elastic panels. Since the fiber section modeling does not account for the bar slip of beam longitudinal reinforcement, therefore zero-length rotational springs were modelled at the interface of joints and beams. The backbone curve of the bar-slip spring was calibrated to the experimental results on beams using Asymmetric Takeda Model. (Takeda et. al., 1970).

4.1. Material Modelling

In fiber section modelling each fiber is assigned a uniaxial stress-strain relationship and the response of each fiber is numerically integrated to give the sectional response. For modelling the material behavior, the well-known Menegotto-Pinto (1973) steel model and the Mander et. al. (1988) concrete model was used for reinforcement and concrete respectively.
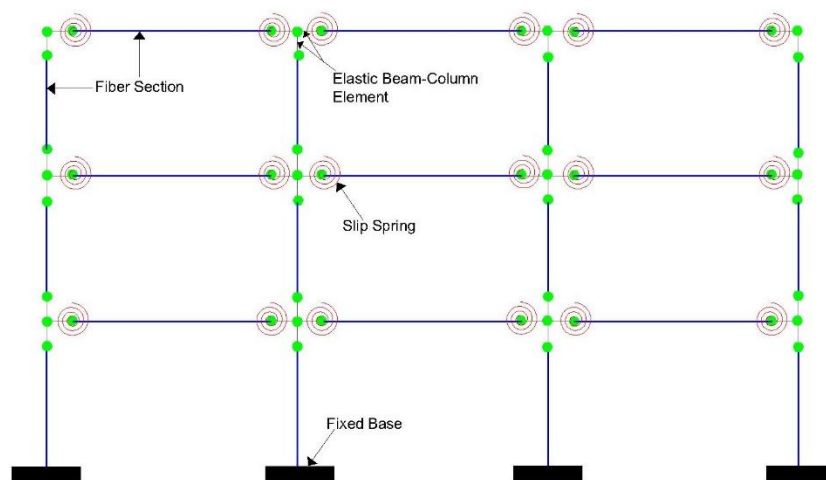
Figure 5: Modelling Technique Adopted in SeismoStruct

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4.2. Selected Ground Motions

The ground motions that were used for NLTHA of case study structures were acquired from the Pacific Earthquake Engineering Research Center (PEER) database for the seismic zone 4 and soil type S_D. The details of these records are shown in Table 1 below.

Table 1: Details of Earthquake Records Selected for NLTHA

S. No.	Year	Event	Station	Moment Magnitude (M_w)	PGA (g) of original record	PGA (g) after matching
1	1971	San Fernando	LA - Hollywood Stor FF	6.90	0.225	0.529
2	1989	Loma Prieta	Hollister - South & Pine	6.93	0.370	0.428
3	1978	Tabas_Iran	Boshrooyeh	7.35	0.422	0.432
4	2007	Chuetsu-oki_Japan	Joetsu Kita	6.80	0.441	0.455
5	2004	Niigata_ Japan	NIG022	6.64	0.345	0.578
6	1994	Northridge	LA - Centinela St	6.69	0.449	0.555
7	1988	Spitak_Armenia	Gukasian	6.77	0.400	0.426

4.3. Matching of Ground Motions

The ground motions were matched to the design acceleration response spectrum of UBC-97 and BCP-SP 07 for seismic zone 4 and soil type S_D in SeismoMatch which is summarized in Figure 3. The PGA (Peak Ground Acceleration) of the matched records are given in Table 1 above.
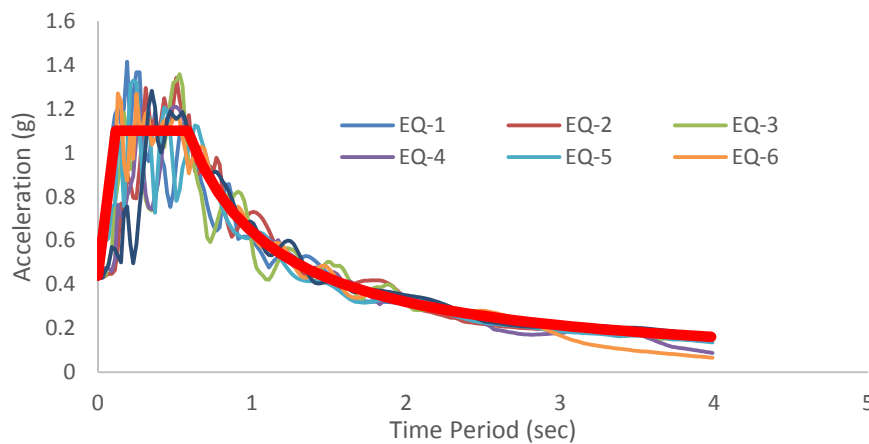
Figure 2: Matching of Ground Motions with the Target Spectrum

5. Non Linear Time History Analysis (NLTHA)

Two load combinations were considered for this study which are:

Load Combo-1: $0.9D + 1.0E$
Load Combo-2: $1.2D + 0.5L + 1.0E$

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The damage of the structures can be directly related to the displacements or drifts of the structures, so in this study the drifts ratios were compared with the allowable drift limits given in BCP-SP 07. Fig. 3 shows the inter-storey drift ratios of the structures for the two load combinations which are the average values of the NLTHA using the seven ground motions. The 2 % code limit on drift ratio is also shown.

This figure shows that the lower stories are more critical as compared to the upper stories. It also shows that the load combo-2 which includes the live load is more critical as compare to load combo-1.
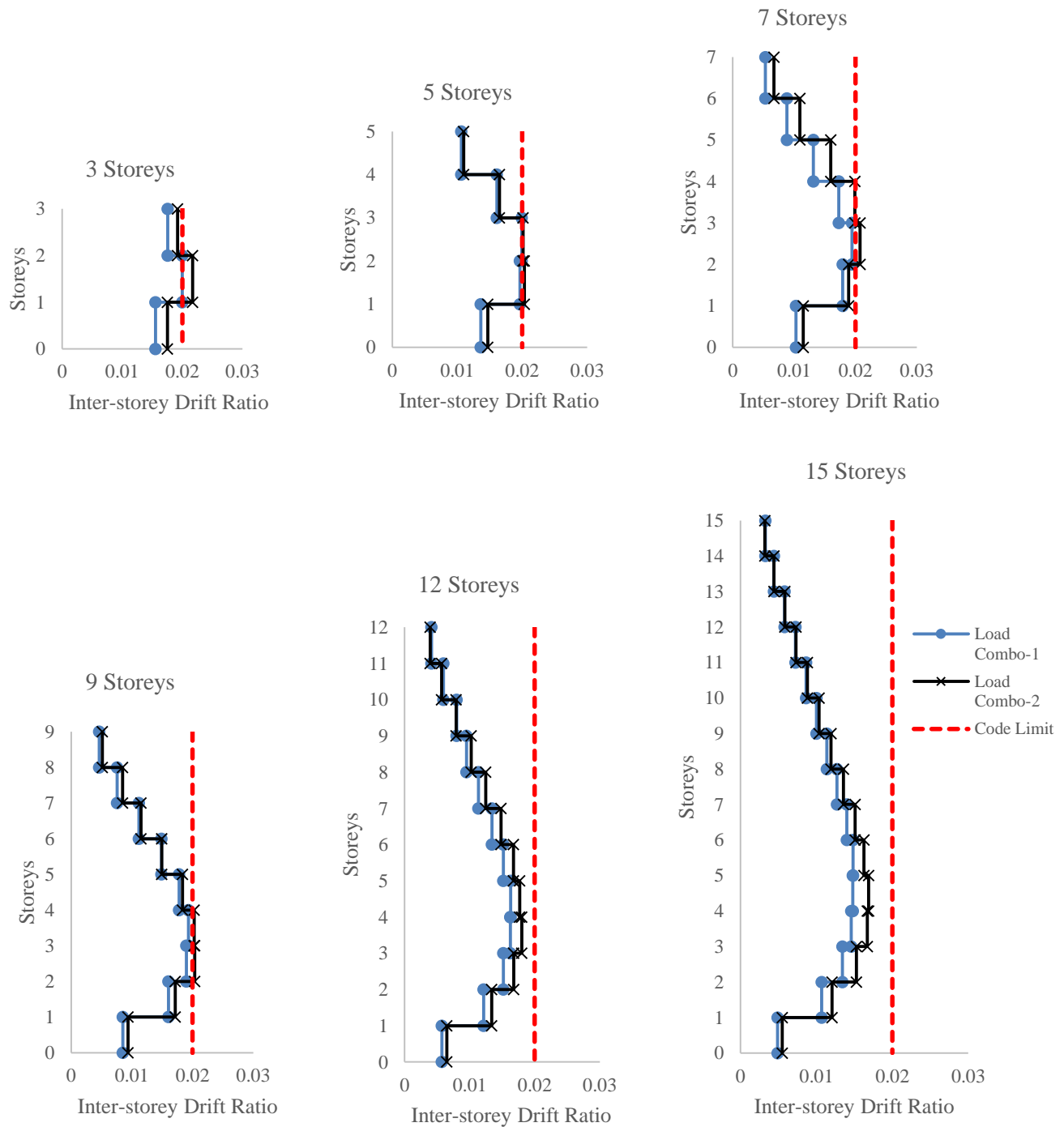
Figure 3: Inter-storey Drift Ratios for Load Combo-1 and Load Combo-2

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6. Effect of joint flexibility and bar slip on the drift response of frame structures

A parametric study was carried out to check the effect of joint flexibility and bar slip on the drifts of case study structures. Four modeling assumptions were compared in this study. In the first modeling assumption, the joints were modelled as elastic panel joints and bar slips were taken into account. In the second modeling assumption joints without elastic panel and having bar slips were modelled, the beam and columns were directly attached to the central node. In the third modeling assumption elastic panels at joints without bar slips were modelled. In the fourth modeling assumption joints without elastic panels and without bar slips were modelled. The details at the joints are shown in the Fig. 4 below.
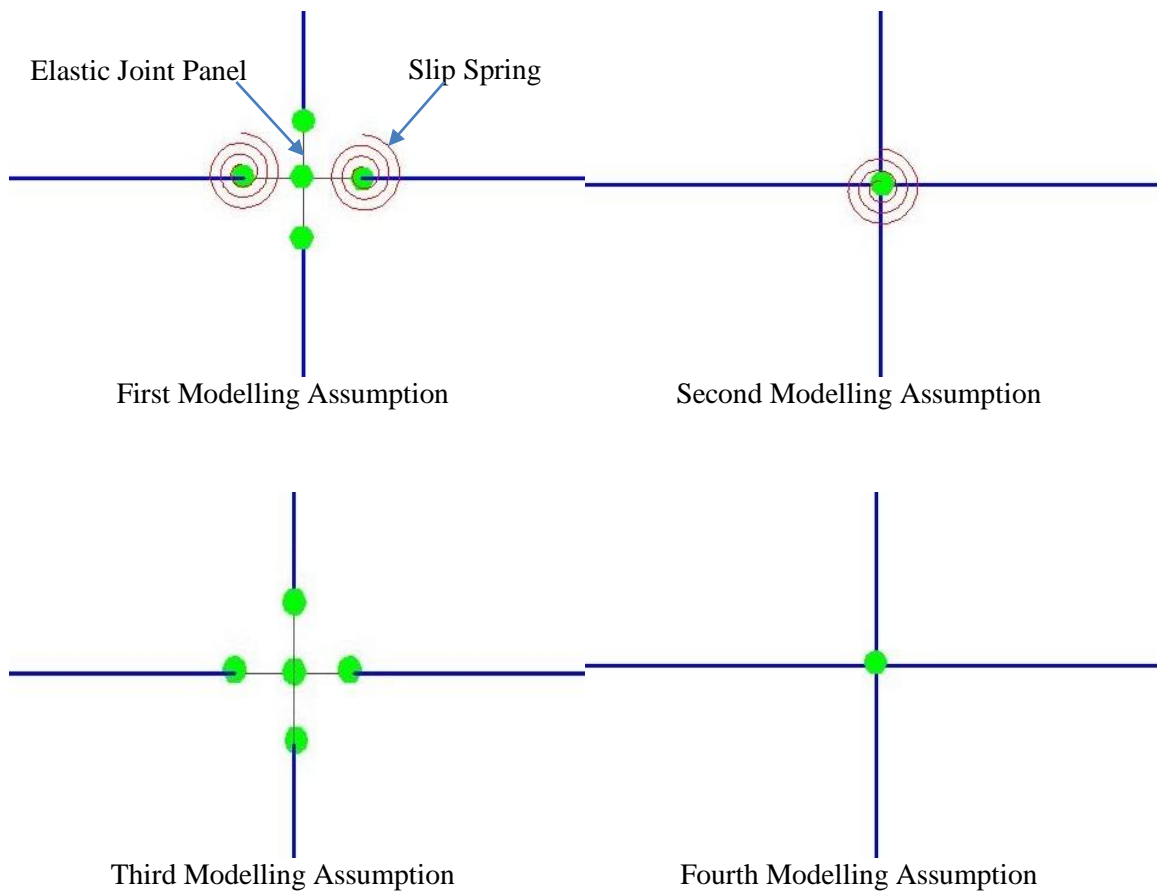
Figure 4: Modelling Techniques for Frame joints

For the NLTHA only the critical load combo-2 was considered for the comparison between these modelling techniques. The average inter-storey drift ratios from the NLTHA using the seven spectrum compatible earthquake ground motions are shown in Fig. 5 below. This figure shows that the elastic joint panel and bar slip imparts more flexibility to the structural lateral displacement response. The structures without the elastic joint panel and with the bar slip are more flexible as compare to others as can be seen in the Fig. 5 below.

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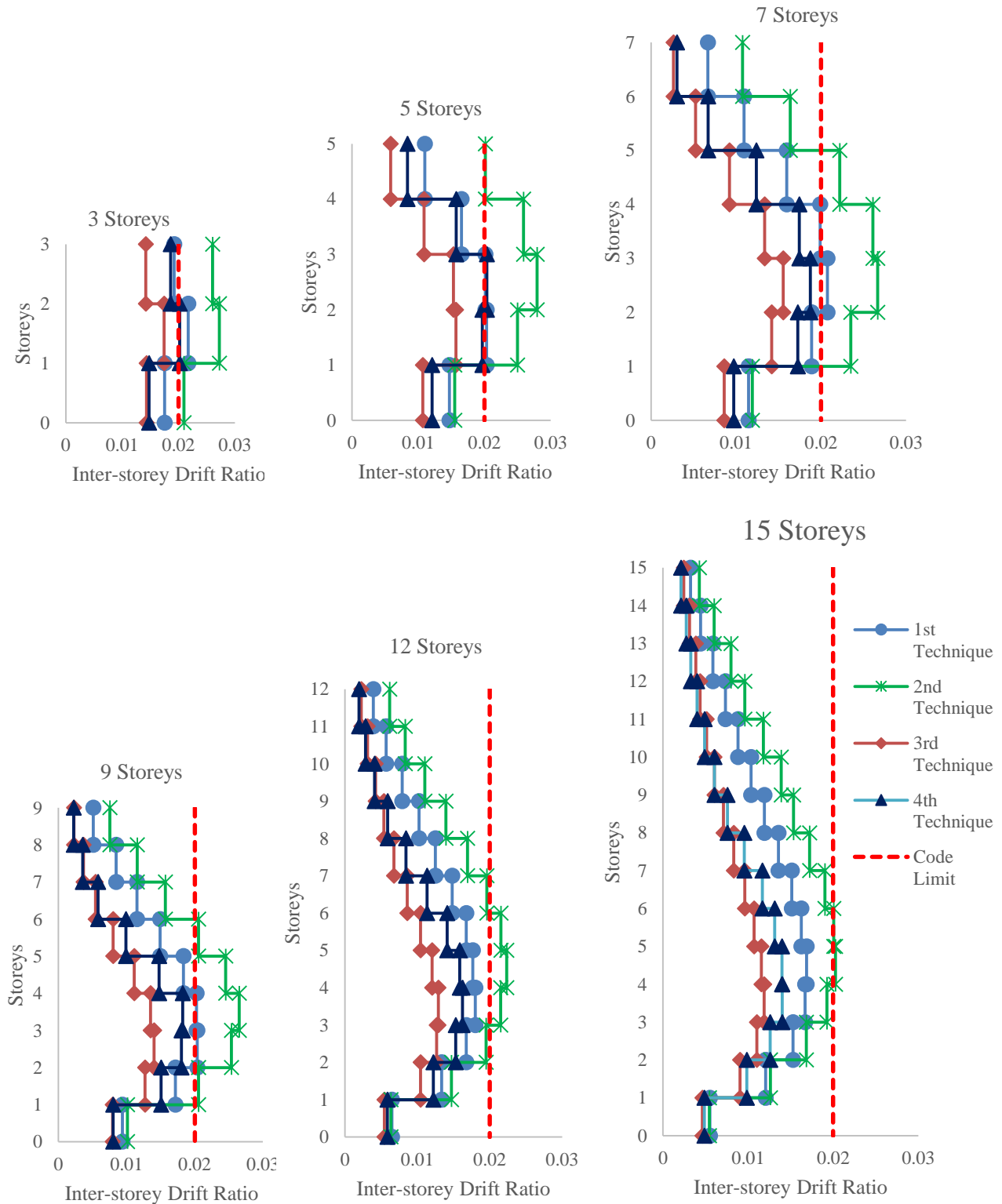
Figure 5: Modelling Effects on Drift Response of Frame Structures

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7. Conclusion

The non-linear time history analysis of the case study structures showed that the codal limit on the inter-storey drift ratio was exceeded by short and medium rise structures. It can therefore be concluded that structures designed to the current force-based design procedures given in seismic codes might not perform according to the requirements of the code. Additionally, the response of structure is highly dependent on the modeling technique adopted.

8. Acknowledgments

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Exploratory Study on the Effect of Fly Ash in Cement Mortar

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Abstract

Pozzolans are silicate based materials incorporated in cement and concrete to produce additional cementitious materials by reacting with the excess lime produced during the cement hydration. Locally available Fly ash is used in the range of 0-25% is a partial replacement of cement (by mass) in mortar to check the compressive strength, packing density, permeability and durability. Cube mortar of dimensions $2^{''} \times 2^{''} \times 2^{''}$ were casted at 1:3 with a water to cement ratio of 0.50 for 0%, 5%, 10%, 15%, 20%, and 25% and were cured for 3, 7, 14, 28, 56 and 90 days. The hardened specimens were tested for compressive strength after 3, 7, 14, 28, 56 and 90 days. The results shows that the partial replacement of cement by fly ash, increases the packing density, decreases permeability which ultimately decrease the water demand and hence increase the compressive strength at later ages. Also fly ash blended mortar increase the durability of cement mortar.

Keywords: Portland cement, Fly Ash, Strength, Durability, Packing Density

1. Organization of Research Work

This research work is organized as:
1. Organization of Research Work
2. Introduction
3. Background
4. Problem Statement
5. Objectives
6. Experimental Detail
7. Results and Discussion
8. Conclusions
9. Recommendations
10. References

2. Introduction

Ordinary Portland Cement (OPC) being used in larger quantity on earth in construction industry after the use of water. OPC being the most significant binding material in construction but an energy intensive material and is liable for the emission of carbon dioxide gas. According to Valdez (2007), an amount of 1 tone carbon dioxide is released from 1 ton of cement production. This one ton of

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carbon dioxide is released due to the burning of OPC clinkers at a temperature of 1400~1600℃ (Shetty, 2005). The use of coal to gain such high temperature not only increase the cost of cement but also limiting the resources of coal. In recent decade, research is carried out on the use of pozzolonic materials such as ground granulated blast furnace slag, rice husk ash (RHA), fly ash (FA), silica fume etc.to be used as a partial replacement of cement in mortar and concrete, in order to reduce the production of cement and also for the purpose to add extra engineering properties to mortar and concrete. The perfomance and qualitative importance of mortar can be enhanced with the addition of pozzolanic materials such as FA. The pozzolonice materials (FA) enhances the strength ,density, homogenity and quality of the mortar used (Demirboğa et al,.2001). In fresh state, it increase th eworkability of mortar due to its sphericals particals. In hardened state, it increae the compressive and flexure strength by reacting with the free lime produced during the hydration process. However the amount of cement used may cause different side effects. In mortar, use of high amount of cement can cause shrinkage cracks and produce high heat of hydration. This undesirable and unconditional situation is then balanced by the presence of additional cementing materials such as FA. An amount of 5% to 30% of cement is replaced by FA that results in more workable and denser mixture. Mixture containing cavities are also filled with fine-sized pozzolonic materials.

This research is deeply conducted on the use of pozzolonic material like FA in cement mortar to improve its engineering properties.

3. Background

The word "cement" can be traced back to the Roman term *opus caementicium.* Cementing materials were first widely used in ancient world. Romans found cement as construction material (Shetty, 2005). This cement was made by adding crushed volcanic ash to lime and was later called a "pozzolonic" cement, named after the village of Pozzuoli near Vesuvius. The most common type of cement is Portland cement or OPC. This cement is made by heating limestone (calcium carbonate) with other materials like clay up to 1450 degree centigrade in a kiln (Skedros et al,.2005). In 2010, the world production of hydraulic cement was 3,300 million tons. Manufacture of cement causes highly impact on environment.

FA is a burnt and powdery derivative of inorganic mineral matter that generates during the combustion of pulverized coal in the thermal power plant. It is known as the pulverized fuel ash (Phan and Carino,. 1998). FA was generally released into the atmosphere in past but air pollution control standards now require that it be captured prior to release by fitting pollution control equipment.

4. Problem Statement

The main problem statements are:
- Use of high cement content in mortar causes shrinkage cracks, extra heat of hydration in mortar and concrete especially in mass concrete.
- Manufacturing of cement in huge amount reduce the resources of minerals like lime, gypsum etc.
- Also it reduce the sources of coal.
- Industrial wastes like FA, causes environmental pollution.

5. Objectives

The main objectives of this research program are:
- To reduce the manufacturing of cement by conserving energy.
- To save the mineral resources like coal and utilize these minerals in other beneficial projects.

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- To utilize the industrial byproducts and wastes as a partial replacement of cement in construction industry.
- To investigate the pozzolonic behavior of FA in mortar for early and later ages.
- To optimize the use of FA in mortar

6. Experimental Program

6.1 Materials
6.1.1 Fly Ash
Fly ash (Class F) used in this research was obtained from Sika chemicals Islamabad. The chemical composition is shown in **Table 1** and physical properties are shown in **Table 2.**

Table 1: Chemical Composition of FA

Oxides	%age	ASTM C150 Specifications
CaO	6.3	
SiO_2	64.2	
MgO	1.50	
Na_2O	1.02	1.5% (Max)
LOI	8.9	12% (Max)
SO_3	2.6	5.0 (Max)
Moisture	2.5%	3.0 (Max)

Table 2: Physical Properties of FA

Property	Result	ASTM Standards
Specific Gravity	2.1 to 2.3	
Color	Grey	
Geometry	Spherical (Glassy)	
Fineness by Sieving (retained on Sieve No.325)	23%	34 % (max)

6.1.2 Cement
Ordinary Portland cement were used in this experimantal work with chemical composition shown in **Table 3** and physical properties in **Table 4**.

Table 3: Chemical Composition of OPC

Constituents	% Contents	ASTM C150 Specifications
CaO	62.18	60-67%
SiO_2	20.78	20% (min)
Al_2O_3	5.81	6.0 (max)
Fe_3O_2	2.99	6.0 (Max)
MgO	1.52	6.0 (Max)
LOI	2.31	3.0 (Max)
SO_3	1.89	3.0 (Max)

Min= minimum, Max= maximum

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Table 4: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	135	C 191
Final setting time (minutes)	234	C 191
Standard Consistency (%)	28	C 187
Fineness by Sieving (No. 200 Sieve)	4%	C786
Soundness	0.039 in (1mm)	C 189

6.1.3 Aggregates
The fine aggregate used in this research program was obtained from the locally available sources. The physical properties of fine aggregates are shown in **Table 5.**

Table 5: Physical Properties of Aggregate

Characteristics	Fine Aggregate	ASTM Standards
Type	Normal	
Specific Gravity	2.51	C 128
Dry Rodded Bulk Density	144 lb/ft^3	C 29
F.M	2.31	C 136
Absorption %	1.3	C 128

6.2 Mortar Preparation
Cement mortar with a w/c ratio of 0.50 was prepared with a standard ration of 1:3. In modified mortars, the cement is partially replaced by 5%, 10%, 15%, 20% and 25% FA. The control mortar and the modified mortar are mixed dry thoroughly and then water is added to achieve the mortar of well consistency. After that, mortar cubes mould of $2" \times 2" \times 2"$ were prepared and keep at room temperature for 24 hours. When 24 hours completed, then these prepared specimens were placed in curing tank for 3, 7, 14, 28 and 56 days. The prepared mortar cubes are shown in **Figure 1.**

Figure 6: Mortar Cubes

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6.3 Tests

6.3.1 Compressive Strength

After the completion of the specified duration of curing, the control mix mortars and the modified mortars were tested in universal testing machine. All the results are shown in **Table 6** and is presented in **Figure 2.**

Table 6: Compressive Strength of Various % of FA (Psi)

MIX ID	3 Days Strength (Psi)	7 Days Strength (Psi)	14 Days Strength (Psi)	28 Days Strength (Psi)	56 Days Strength (Psi)	90 Days Strength (Psi)	% Increase (after 90 days)
CM	1096	1036	1284	1577	1772	2024	0
FA5	912	989	1172	1889	2104	2263	10.56
FA10	826	845	1156	1787	1985	2205	8.21
FA15	742	817	1087	1713	1911	2133	5.11
FA20	605	792	986	1503	1690	1865	
FA25	565	705	911	1322	1485	1683	

CM= Control Mix,   FA5= Fly Ash 5% and vice versa
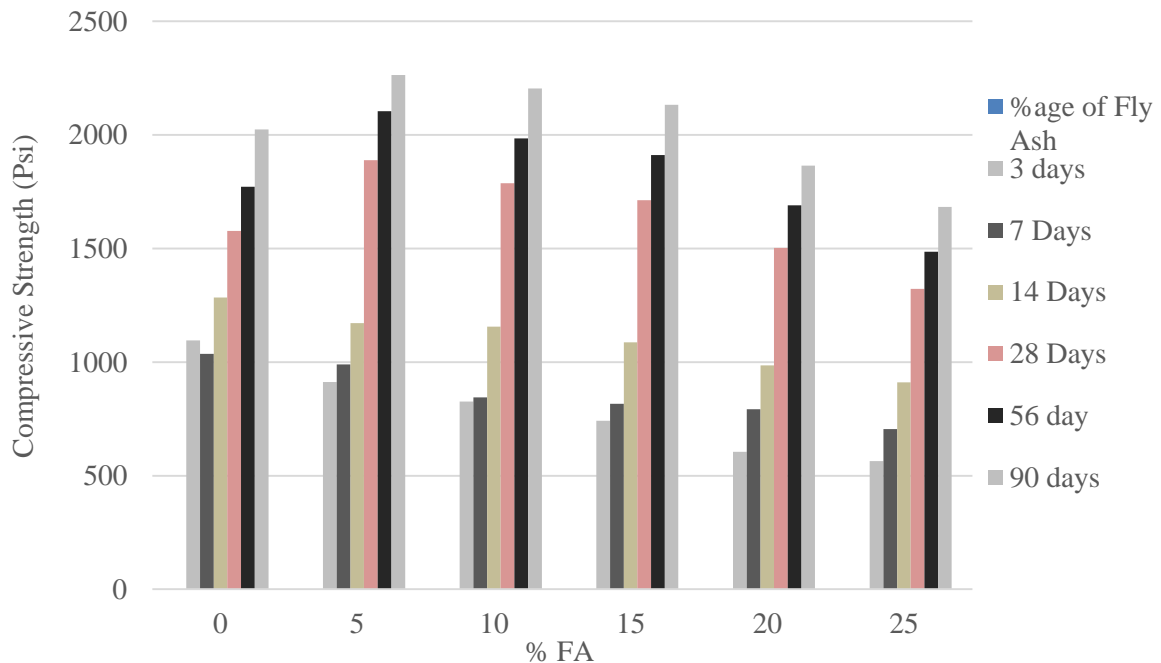
Figure 7: Compressive Strength for various % FA

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6.3.2 Water Permeability Test

The HS-4 type concrete permeability device was used to measure the permeability of the mortar. This device was manufactured by Sheng Fei Testing Mechanical Factory, China (Ji,. 2005). In this test, tapered cylinders of height 6 inches, dia of 6.89 inches at one end and 7.25 inches at the other end was used to determine the permeability of water for normal mortar and modified mortar. Six tapered cylinders were prepared for all type of mixes. The cylindrical specimens were demolded after 24 hours and then place in a curing tank for 28 and 90 days. After 27 days of curing, the tapered cylinders were air dried and the sides of cylinders were sealed with an epoxy. Also similar procedure was adopted at 89th day for the testing specimens at 90 days. The cylinders were heated in an oven at 110^{0}C for an hour and then set in the permeability test rigs of HS-4 device. The prepared rigs was installed in permeability device for testing. At the start of the test, 0.1 MPa water pressure was applied at the cylinder bottom. Then after every 8 hour, an additional water pressure was added up and this increase is continuous till visible penetration of water. The water penetration at the top of the cylinders were thoroughly observed. When a penetration of water is observed at least in three cylinders, then the test stopped and the water pressure at that time was recorded. All the specimens were removed and split into two halves. The penetration of water through the top layer of the mortar was measured and an average penetration was reported.

The permeability grade S is calculated as

$$S = 10H - 1$$

Where H= water pressure in Mpa

The permeability results were obtained for all mixes of FA. The results of permeability are shown in **Table 7** for 28 days and **Table 8** for 90 days

Table 7: Water Permeability after 28 days

MIX ID	Water Pressure H (Mpa)	Average Penetration depth (in)	Permeability grade (S)	% Decrease (after 28 days)
CM	2.5	3.1	S=24	0
FA5	2.9	2	S=28	14.28
FA10	3.1	2.4	S=30	20.00
FA15	2.8	2.9	S=27	11.11
FA20	2.46	3.35	S=23	-
FA25	1.6	3.2	S=15	-

Table 8: Water Permeability after 90 days

MIX ID	Water Pressure H (Mpa)	Average Penetration depth (in)	Permeability grade (S)	% Decrease (after 28 days)
CM	3.4	2.5	S=33	0
FA5	3.6	2	S=35	5.71
FA10	4.1	2.1	S=40	17.5
FA15	3.9	2.6	S=38	13.15
FA20	3.6	2.8	S=35	5.72
FA25	3.2	3	S=15	-

7. Results and Discussions

7.1 Compressive Strength

The compressive strength of the modified mortar increases with the passage of time. This is due to the pozzolonic behavior of FA in later ages. Results in **Table 6** revealed that increase in strength

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gain for modified mortar was observed at 28 days and after that. Also a maximum strength gain after 90 days was observed as 10.56% more than control mortar. The 15% gives 5.11% more strength after 90 days.

7.2 Water Permeability

The results in **Table 7** and **Table 8** revealed that permeability decrease with the addition of FA in cement mortar. A maximum decrease of 20% after 28 days and 17.5% after 90 days was observed for a replacement of 10%FA. Also 15%FA gives much better result i.e. 11.11% more than CM after 28 days and a 20% FA gives 5.72% more than CM after 90 days.

7.3 Packing Effect

Due to pozzolonic behavior of FA in mortar, it filled the pores and voids, because FA react with the free lime, making portlandite, which enhance the pore filling effect of the mortar. Due to this effect, the mortar become denser at later ages and hence become more impermeable. Table 7 and 8 indicate that permeability decreases due to its packing phenomenon.

8. Conclusions

The following conclusions were drawn from this paper:
- Increase in FA content up-to 15% increase the compressive strength at 28 days and it is also increases with later ages.
- 15% FA gives better results against permeability at shorter ages and 20% FA decrease the permeability at later ages.
- Incorporation of FA in the range of 15-20% makes the mortar more compact by reducing the pores inside the mix.

9. Recommendations

The following recommendations were made from this research work:
- Incorporation of FA in cement mortar is recommended up-to 15% for compressive strength.
- A partial replacement of 20% FA is recommended for good impermeability of mortar.

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The Evaluation of the Microstructure in Metakoline Modified Cement Mortar

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Abstract

The utilization of wastes and industrial products has received a substantial concerns in construction industry now a days. In this study, Metakoline (MK) as used as a pozzolonic materials in mortar and the compressive strength and microstructure was investigated. Mortar cubes of dimensions $2^{"} \times 2^{"} \times 2^{"}$ were casted at 1:3 with a water to cement ration of 0.5 for 0%, 5%, 10%, 15%, 20%, and 25% and were cured for 28 days. The microstructure of Metakoline (MK) blended cement mortar at the age of 28 days has been observed using Scanning Electron Microscope (SEM). The results shows that the Metakoline influence the microstructure by reacting with the free lime produced due to cement hydration and form pozzolonic compounds which improve the pore structure of mortar. At 15% replacement of cement by MK, the microstructure analysis demonstrates a compact mortar, with less voids, perfect bonding with constituents and good compressive strength.

Keywords: Mortar, Cement, Metakoline, Compressive Strength, Microstructure

1. Paper Organization

The paper is organized in the following sections:
1. Paper Organization
2. Introduction
3. Background
4. Problem statement
5. Experimental work
6. Tests and Results
7. Conclusion
8. Recommendations
9. References

2. Introduction

Cement composite properties mainly dependent on the characteristics of constituents. Composite mixtures of balance properties can be obtained by using cement in a quantified amount proper way.

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Use of cement in such amount makes the composite mixture economically expansive especially in Pakistan, due to energy crises. As the manufacturing of cement required enormous amount of coal to achieve a temperature of $1400 - 1600℃$ to get clinkers of cement, which increase the cost of cement. Also the use of coal in manufacturing of cement causes environmental pollution which is also a great hazard for human life. According to Valdez (2007), an amount of one tone of CO_2 is released to atmosphere from the production of one tone of cement.

A probable approach of blended cement is used to overcome these problems. Accordin to ASTM C-595, a blended cement is the combination of ordinary portland cement (OPC) and pozzolonic materials. Many researchers have worked on different type of blended cement (Mojumdar, 20011, Janotka et al,. 2008).

An approximated value of 7% of total carbon dioxide was observed due to OPC production. This production of carbon dioxide can be reduced by partially incorporating pozzolonic materials (PM) in OPC (Heikal,. 2000). Researchers have proved that use of supplementary cementitious materials can increase the impermeability of concrete.

Metakoline is one of pozzolonic material obtained from a fine clay minerals kaolin. Research work was carried out on Metakoline proven that practice of Metakoline in mortar and concrete has significantly   improved the engineering properties of mortar and concrete (Wild et al,. 1996).

3. Background

Metakoline is obtained from the calcination of kaolin at a definite temperature range. Kaolin is mineral clay generally used in porcelain production. Kaolin term is derived from Kaoling, the name of a Chinese mountain. The name of Kaolin clay is commonly used for Kaolinite, which is hydrated aluminum disilicate $Al_2Si_2O_5(OH)_4$. On calcination of kaolinite, the following reaction taken place at a temperature of $650℃ - 800℃$.

$$Al_2Si_2O_5(OH)_4 \xrightarrow{yields} Al_2Si_2O_7$$
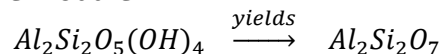
The resulting Metakoline $Al_2Si_2O_7$ has pozzolonic properties with large surface area and fineness, which enable it to use as a supplementary cementitious materials in mortar and concrete. The more fineness of Metakoline gives better results in packing density of concrete. Metakoline react with the free lime $Ca(OH)_2$ of cement hydrated product, to produce new cementitious compounds (Moujmdar et al,.2010). Pozzolonic admixture like calcined clay was used in cement since Romans time, but recent work in the construction industry enhance the use of Metakoline as an additive in cement (Shvarzman, et al,.2003).

4. Problem Statement

Manufacturing of cement
- Is high energy consuming, causes energy crises.
- Causes environmental pollution due to release of high amount of carbon dioxide.
- Reduce the minerals resources like lime, gypsum.
- Is out of the range of low paid salary (poor) people especially in Pakistan.

5. Experimental Work

5.1 Materials
5.1.1 Cement
Cement is the basic constituent of mortar due to its adhesive properties. An ordinary Portland cement of Type-I was used in this research. The chemical composition of cement is given in **Table 1**, physical properties are presented in **Table 2** and Mineralogical composition (%) or Bogue's composition is shown in **Table 3**.

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Table 4: Chemical Composition of Cement

Constituents	% Content	ASTM Standards
SiO_2	20.78	20% (min)
Al_2O_3	5.81	6.0 (max)
Fe_2O_3	2.99	6.0 (Max)
MgO	1.52	6.0 (Max)
SO_3	1.89	3.0 (Max)
CaO	62.18	60-67%
LOI	2.31	3.0 (Max)
IR	0.75	
$Free\ Lime$	0.68	

Table 5: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	135	C 191
Final setting time (minutes)	234	C 191
Standard Consistency (%)	28	C 187
Fineness by Sieving	4%	C786
Soundness	0.039 in (1mm)	C 189

Table 6: Bogue's Compounds

Compounds	% Content
C_3S	45.29
C_2S	26.45
C_2A	11.02
C_4AF	8.89

5.1.2 Metakoline
Metakoline (MK) is used as a partial replacement of cement in the range of 0 to 20%. The chemical composition of Metakoline is presented in **Table 4**.

Table 7: Chemical Composition of Metakoline

Constituents	**% Content**
SiO_2	51.2
Al_2O_3	34.98
Fe_2O_3	3.89
MgO	0.39
Na_2O	-
CaO	2.78
LOI	-
IR	-
TiO_2	0.68
K_2O	0.96

5.1.3 Fine Aggregate (Sand)
Nizampur (KPK, Pakistan) sand was used in this research work. **Table 5** presented the physical properties of sand.

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Table 8: Physical Properties of Fine Aggregate

Characteristics	Fine Aggregate	ASTM Standards
Type	Normal	
Specific Gravity	2.52	C 128
Dry Rodded Bulk Density	$145\ lb/ft^3$	C 29
F.M	2.3	C 136
Absorption %	1.1	C 128

5.2 Mix Proportions

Mortar mixes of 1:3 by weight were made. Metakoline was used as a partial replacement of cement for 5%, 10%, 15% and 20% for a constant water to binder ratio of 0.5. Mortar specimens were casted in a steel moulds of $2'' \times 2'' \times 2''$ cubes. After 24 hours, the cubes were de moulded and place in a curing tank for 3, 7, 14 and 28 days at room temperature.

3.3 Tests of Specimens

5.3.1 Compressive strength

Mortar cubes of different blends of Metakoline were tested for the compressive strength after 3, 7, 14 and 28 days. Results obtained are presented in **Table 6**.

Table 9: Compressive Strength of MK blended mortars

%age of MK	Strength in Psi			
	3 days	7 days	14 days	28 days
0%	815	1030	1456	2512
5%	872	1227	1581	2729
10%	992	1190	1503	2697
15%	931	1012	1376	2603
20%	761	956	1298	2441

5.3.2 SEM (Scanning Electron Microscopy) analysis

The SEM analysis of MK blended mortar was carried out after 28 days to check the morphology, positioning and orientation of materials i.e. MK in the specimen. The SEM analysis for different blend of MK i.e. 5%, 10% and 15% are shown in **Figures 1, 2, 3** for $10\mu m$ ($Magnification\ of\ 1000$), **Figure 4, 5 and 6** for $5\mu m$ ($Magnification\ of\ 5000$) and **Figure 7,8 and 9** for $1\mu m$ ($Magnification\ of\ 10,000$).
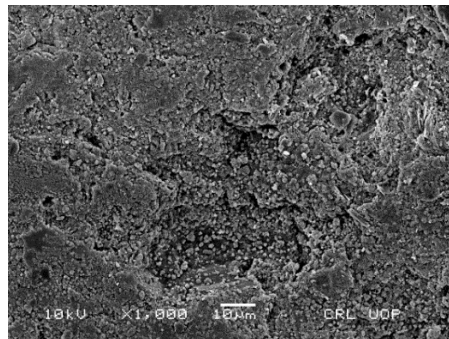
Figure 8: SEM Micrograph of MK 5% for $10\mu m$

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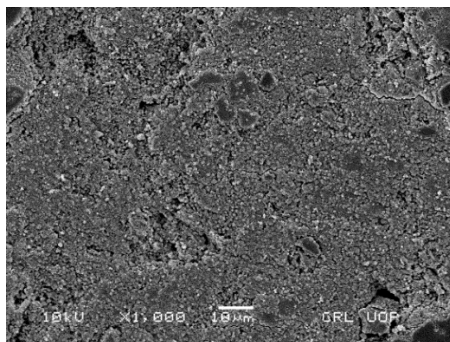
Figure 9: SEM Micrograph of MK 10% for $10\mu m$
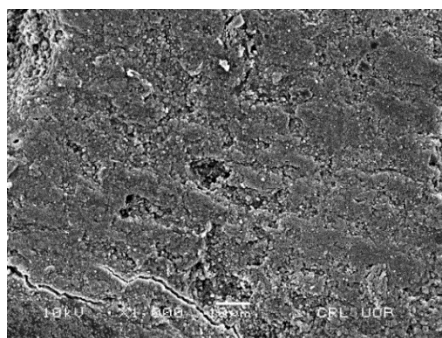
Figure 10: SEM Micrograph of MK 15% for $10\mu m$
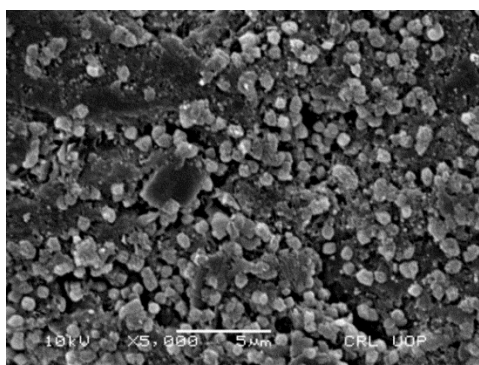
Figure 11: SEM Micrograph of MK 5% for $5\mu m$
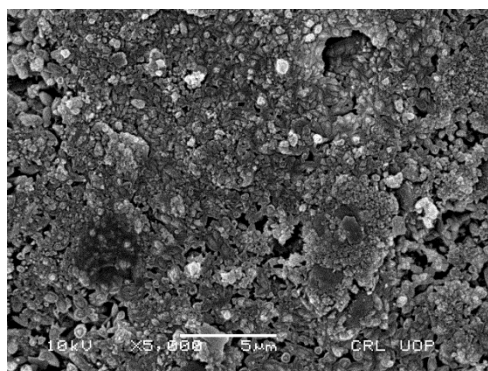
Figure 12: SEM Micrograph of MK 10% for $5\mu m$

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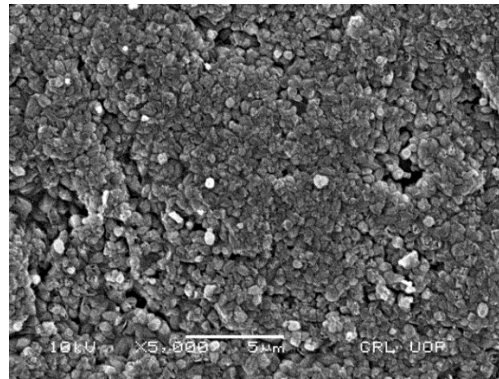
Figure 13: SEM Micrograph of MK 15% for $5\mu m$
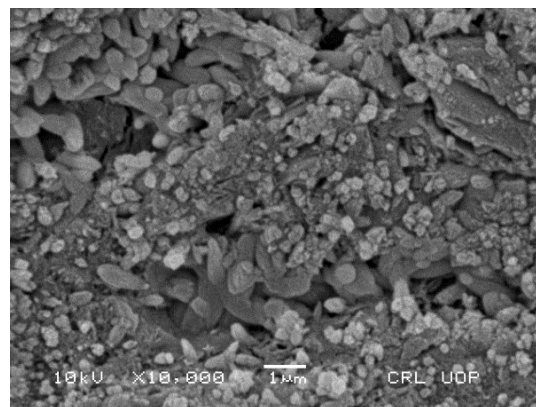
Figure 14: SEM Micrograph of MK 5% for $1\mu m$
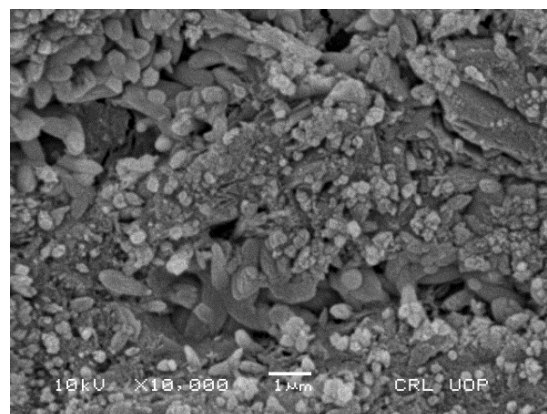
Figure 15: SEM Micrograph of MK 10% for $1\mu m$

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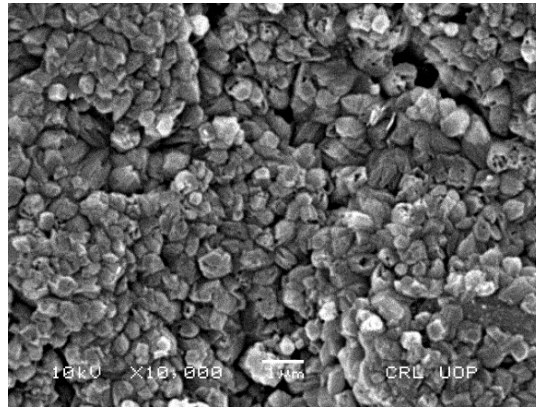
Figure 16: SEM Micrograph of MK 15% for $1 \mu m$

6. Results and Discussion

6.1 Compressive Strength
Compressive strength of mortar increases as the percentage of MK increases in mortar. An optimum strength was observed at 15% replacement of MK in cement as shown in **Table 6**. At 20% MK, the compressive strength get decreased due to insufficient amount of w/c ratio (i.e. 0.50), because particles of MK are very fine as compared to cement and hence required more amount of water due to its larger surface areas.

6.2 Microstructure
The SEM analysis show that increase in percentage of Metakoline reduce the pore size after 28 days. For 5% and 10 % replacement, the pore size reduce to the range of $5 \mu m$ as shown in **Figure 4 & 5** and for 15% replacement, this size reduce to $1 \sim 2 \ \mu m$ as shown in **Figure 9.**

6.3 Portlandite $Ca(OH)_2$ Formation
The 5% and 10% partial replacement of MK shows the clear portlandite of $(Ca(OH)_2)$ formation in crystalline form after 28 days as presented in **Figure 7, 8 and 9**. At 15% replacement, there was no visible portlandite as compared to 5 and 10% due its pore filling effect. Also increase in MK amount fills the pores in mix and enhance the pozzolonic properties (i.e. increase amount of pozzolans continue its behavior for longer time).

7. Conclusions

The following conclusions are drawn from this research program:
- Compressive strength increases up-to 15% replacement of MK in cement mortar.
- The fine particles of MK enhance the pore filling effect of mortar at later ages.
- MK contribute to strength development due to its reaction with the hydration product i.e. free lime to form portlandite.

8. Recommendation

- A partial replacement of 15% MK is recommended for mortars.

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Effect of Rice Husk Ash on the Strength and Properties of Bricks

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Abstract

Utilization of Burnt clay bricks in construction is famous from few decade around the world. The use of waste materials in the manufacturing of bricks not only enhance the properties of bricks but also utilize the waste materials in a sophisticated way. This aims of this study is to investigate the effect of the waste materials obtained from rice as a rice husk ash in manufacturing of bricks. Rice Husk Ash (RHA) was obtained from the local mill. Standard size bricks were prepared at an industrial brick kiln plant using the several dosages of RHA as a partial replacement of clay by weight i.e. 5%, 10%, 15%, 20% , 25% and 30%. Discrimination of the quality of bricks were studied and also mechanical and physical properties were checked. Replacement up-to 15% of RHA gives good compressive strength which fulfills the requirements of Pakistan Building code requirements (i.e. > 5 MPa). It also gives good sound, smooth surfaces, perfect edges, lesser efflorescence, lighter weight and less absorption.

Keywords: Burnt Bricks, Rice Husk Ash, Clay, Efflorescence, Absorption**.**

1. Paper Organization
This paper organization is:
1. Paper Organization
2. Introduction
3. Research significance and objectives
4. Experimental Work
5. Methodology
6. Results and Discussions
7. Conclusions
8. Recommendations
9. References

2. Introduction

Clay is the most significant construction materials used in construction industry since 8000 BC. (Kazmi et al,. 2016). In construction materials clay bricks are one of the oldest construction material used in the construction of exterior & interior partition walls, load bearing walls and the construction of footings etc.

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History of bricks revealed that it is clay bricks are approximately 6000 years old. Some traces of clay bricks have been found in Babylonia (Khoso et al,. 2014). In the early ages, bricks were manufactured roughly through hands and there was no proper machineries or moulds but at the start of 1600, clay working machine was introduced in brick industry (Manandhar et al,. 2013). The bricks were fired in the simple kiln before 1958 (Khoso et al,. 2014). In 1858, Hoffmann introduced a proper kiln for burning the bricks, and later on, this was also used for other ceramics as well. This kiln was also used for lime burning in the later ages and was named as Hoffmann continuous kiln. This was the first and excellent improvement in the manufacturing of bricks in large amounts. Later on, Bull trench kiln was introduced by a Britain Engineer named Bull, which is the modified form of Hoffmann kiln.

The composition of raw materials and the production techniques is very important for the properties of clay bricks. To develop a proper bond between the clay particles, the burning period and temperature are considered very important. At high temperature, the silica content melts which contribute to the bond between the clay particles.

Researchers start working recently on the properties of brick that how it can be improved. Industrial by products and wastes was used as an additives to check the beneficial aspects of it. These was materials was also used as a partial replacement of cement for a long time. Fly ash, waste glass powder, marble powder, silica fume and Baggas ash was used in bricks as a partial replacement of clay. The main aim of these materials in bricks was to improve the properties like strength, durability, fairness, less efflorescence, lightweight etc. Waste glass powder is used in bricks as an additive to improve the strength, lower the pore volume, porosity and initial rate of absorption. Also the use of FA increase the compressive strength up-to 15% and marble powder up-to 10-20% replacement of clay in bricks are considered good. Nowadays, the large number of clay bricks are used in the construction which ultimately reduce the natural source of clay. To overcome such hazard, some alternate materials like rice husk ash is also introduced in as a partial replacement of clay in bricks. Rice hush ash is one of the waste materials which used in the preparation of. Rice husk is the hard protecting coverings of grains of rice. In Pakistan, about one million ton of rice husk is produced annually. The husk is about 20-25% of rice paddy. Disposal of rice husk in such large extent as used in brick kiln as a fuel source. Rice husk ash (RHA) is produced from the burning of rice husk at different high temperature. The use of rice husk ash in manufacturing of bricks is not useful in enhancing the engineering properties of bricks but also reduce the environmental pollution.

3. Research significance and objectives

Now-a-days the research scholar and engineer are interested to find new source for the manufacturing of bricks to control the consumption the natural source of clay. The continuous use of bricks increase the demand of clay and hence cause decrease in the sources of clay. Main objectives of this research program are:

- To check the effect of rice husk ash on the properties of bricks.
- To investigate the optimal amount of rice husk ash in bricks.
- To minimize the environmental pollution due to the industrial wastes and by products.
- To save the resources of clay by replacing it with the partial replacement of RHA.

4. Experimental work

4.1 Materials
4.1.1 Raw materials
4.1.1.1 Clay
The chief raw materials used in this research program are clay, which is obtained from the Brick kiln located Near Pashtakhara (Peshawar, Pakistan). The chemical composition and physical properties of clay are given in **Table1** and **Table 2** respectively.

Table 10: Chemical Composition of Clay & RHA

Constituents	Clay (Soil)	RHA
SiO_2	49.25	75.96
Al_2O_3	15.28	1.01
Fe_2O_3	6.01	2.76
MgO	2.68	3.30
CaO	7.91	3.02
Na_2O	3.56	1.26
K_2O	2.19	2.56
LOI	8.79	11.98

Table 11: Physical Properties of Clay and RHA

Constituents	Clay (Soil)	RHA
$Liquid\ Limit$	29.68	-
$Plastic\ limit$	21.24	1.01
$Specific\ gravity$	2.60	2.41
$Unit\ weight\ (Kg/ft^3)$	31.65	15.37

4.1.1.2 Rice Husk Ash

Rice husk was obtained from swat (Pakistan) and then after prolong burning at a temperature of $570℃$, the rice husk is converted to Rice Husk Ash. The chemical composition and physical properties of RHA are shown in **Table 1** and **Table 2** respectively.

4.2 Mix Proportioning and Preparation
4.2.1 Proportioning of Materials

Separate proportions of materials i.e. clay and RHA were made. RHA was mixed with clay at various percentage from 5% to 30% by volume in dry state. Then water was added to all type of mixtures and were left for few hours (3-4 hours) so that clay get maximum consistency. Dry mixing of clay and RHA as shown in **Figure 1.**

Figure 17: Dry Mixing of Clay and RHA

4.2.2 Preparation of brick specimens

Moulds of dimensions 9" $\times$ 4.5" $\times$ 3" were properly oiled from inside. Then the clay mix is properly kneaded with hands and a lump was mad of it. The clay mix were properly shaped to the mould size and through with force to the mould so that the tempered clay cover all the corners of the mould properly. After that, the clay in the mould was press hard by hands so that all the void should be removed from inside the clay specimen. Extra clay was removed. The mould is then turned on the ground forcibly, then mould is lift up and a raw brick is obtained on the ground.

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4.2.3 Drying

After molding process the bricks contain some amount of moisture in it. So, drying is to be done otherwise they may cracked while burning. The drying of raw bricks is done by natural process. The period of drying may be 3 to 10 days. It also depends upon the weather conditions.

4.2.4 Burning

The bricks is then transported to kiln after the drying .the bricks specimen is continuously fired with 25-30 days in kiln with the temperature of $700 - 800°C$ in Pakistan. The burning process as shown in **Figure 2.**

Figure 18: Burning of Bricks in Kiln

5. Methodology

Different tests were performed on the burnt clay bricks of different proportions of RHA. All the tests were performed according to ASTM standards.

6. Results and Discussions

6.1 Water Absorption

Water absorption of all the specimens for all the percentages of RHA were find out using ASTM C67. The results are presented in **Table 3.** Results revealed that absorption increases as the percentage of RHA increases but can be considered satisfactory up-to 25% for moderate weather according to ASTM C62.

Table 12: Water absorption & Efflorescence for various %age of RHA

Mix ID	Water absorption %	Efflorescence
CCB	16.02	2.3%
RHA5	16.18	Nil
RHA10	16.85	Nil
RHA15	17.64	Nil
RHA20	20.81	Nil
RHA25	21.64	Nil
RHA30	23.26	Nil

CCB= Control Clay Brick, RHA5= Rice husk Ash of 5 % Bricks and vice versa.

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6.2 Efflorescence

Efflorescence was checked for all specimens and the results in **Table 3** shown that incorporation of RHA have shown no efflorescence at all. A 2.3% efflorescence was observed for Control specimen.

6.3 Compressive Strength Test

Compressive strength were find out for all the replacements of RHA as shown in **Table 4.** The results revealed that compressive strength decreases as the percentage of RHA increases.

Table 13: Compressive Strength & Modulus of Rupture of Bricks with various %age of RHA

Mix ID	Compressive Strength (psi)	Modulus of Rupture (psi)
CCB	1836	335
RHA5	1787	324
RHA10	1733	305
RHA15	1691	276
RHA20	1639	231
RHA25	1522	197
RHA30	1417	156

6.4 Modulus of Rupture

Modulus of rupture for all the RHA contents are presented in **Table 4.** The results shown that modulus of rupture decreases with the increase in RHA content. The testing procedure is shown in **Figure 3.**

Figure 19: Modulus of Rupture Test

Table 14: Density & Weight/Unite Area for Various %age of RHA

Mix ID	Density (Kg/ft^3)	Weight/Unit area (Kg/ft^2)	Pitch of Bricks
CCM	41.863	10.36	2142.6
RHA5	41.864	10.36	2125.45
RHA10	41.918	10.37	2106.55
RHA15	42.449	10.50	2091.85
RHA20	42.75	10.58	2073.65
RHA25	42.06	10.66	2032.7
RHA30	42.43	10.71	19956

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6.5. Weight per Unit Area

Weight per unit of all the mixes of RHA is shown in **Table 5.** The results revealed that incorporation of RHA beyond the limit of 5% increase the weight per unit area of bricks. This is due to the filling effect of RHA in clay of bricks.

6.6 Density of Bricks

Similar to weight per unit area, the density of modified bricks as same to that of control specimen but increases beyond this limit as shown in **Table 5**. As the density is dependent on mass, so increase in mass increase the density of bricks.

6.7 Pitch of Bricks

The pich of all replacemenet of RHA ws found by using emperical **equation (1)**, developed by Obata (1927). The results are shown in **Table 5.**

$$Compressive\ strength\ (psi) = \frac{100}{35} \times n - 1500 \qquad (1)$$

$$Pitch\ (n) = \frac{35}{100} \times Compressive\ strength\ (psi) + 1500$$

7. Conclusions

The following conclusions were drawn from this study:
- Increase in RHA content, decrease the compressive strength and modulus of rupture.
- Incorporation of RHA increase the water absorption for all the percentages, but it 30% RHA, it crosses the limitation of ASTM standards.
- RHA remove the efflorescence at all percentages.
- Incorporation of RHA gives better pitch up-to 10% replacement of clay.
- Incorporation of RHA increases the density and weight per unit area beyond 5%.
- Increase in RHA content decrease the pitch of the sound.

8. Recommendation:
- RHA up-to 20% is recommended because it gives better results for compressive strength.
- Also it provide resistance to efflorescence.
- Due to its lightweight, it can be used in multistory buildings.

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Evaluation of Impermeability and Soroptivity of Rice Husk Ash & Wheat Straw Ash in Concrete

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Abstract

Dampness in concrete structure is a very serious issues nationwide. The main cause of dampness is moisture which is due to capillary action in floor and due to permeable concrete in slab. This study is devoted to investigate the use of pozzolonic materials in concrete to make the concrete impermeable and damp proof. Two type of pozzolans i.e. rice husk ash (RHA) and Wheat straw ash (WSA) was used in concrete as a partial replacement of cement. Concrete cubes of 6"×6"×6" and hollow cubes were casted and cured for 28 days for the various percentages of RHA and WSA, for permeability and Sorptivity test. The results shows that RHA concrete up-to 20% and WHA up-to 15% gives much better results than normal concrete.

Keywords: Wheat straw ash, Rice Husk Ash, Permeability, Sorptivity, Concrete

1. Introduction

Impervious concrete is a sustainable material which have the properties of less interconnected pores or even no interconnected pores to retain water or pass through it. The interconnected pores with in the matrix can be completely filled by introducing the fine cementitious powders or fine aggregate proportions in such a way that all the coarse aggregates are intertwined in cement paste. The design of impervious concrete mainly depends on the properties of pores, compact density, water cement ratio, grain size of aggregate and its distribution and impermeability in matrix.

Generally, impervious concrete is used in structural elements like water tank, Top roof slab, flooring of bathrooms, channel bed, piles, raft footing in waterlogged areas etc. in order to minimize the flow of water through or to control the capillary action of water. Carelessness in such areas of structural members not only reduce the service life of the structure but also increase the severity of using such structures in daily life e.g. if seepage in bathrooms of multistory buildings takes place, it will damp the nearby structure which reduce the strength and durability. Also in channel beds, if water seeps to pores in concrete, deterioration of bed will start shortly, and hence causes the failure of such members.

Impervious concrete is required worldwide to end the dampness that wrap the aesthetic look of the building. In maximum cases, admixtures of high quality are used to achieve impervious concrete, but these are very costly and economically very expensive. Use of very fine aggregates, or fine

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powder will also enhance the imperviousness of concrete (Yu et al,. 1987, Kronlof, 1994) Industrial wastes and byproducts like wheat straw ash, rice husk ash, fly ash, silica fume, Metakoline, marble powder and waste glass powder, which have also pozzolonic properties can be used in impervious concrete. These materials can also be used as a partial replacement of cement in concrete, which not only enhance the imperviousness and Sorptivity of concrete, but also improve the durability of the matrix.

The pozzolonic materials like wheat straw ash (WSA) and Rice husk ash (RHA) has particles size less than cement particle can improve the compact density, reduce or even eliminate the pores or voids and enhance the adhesiveness of aggregates. The fine particles of pozzolonic materials not only react with the free lime produced during the hydration process of cement but also work as a filler materials in concrete mix. This filler effect of fine particles of pozzolans gain special attention in recent decade both experimentally and theoretically. Normally the fillers particles of pozzolans like WSA and RHA have a positive effect in producing particle packing and also have critical enhancement of physicochemical reaction at the interface zone of aggregates (Kronlof, 1994).

2. Problem Statement

- Dampness is a big issue especially in high rise and multistory buildings. It is controlled a little bit by using special type of damp proof admixtures in concrete, but these materials are very costly, which is out of the rang of low paid salary people.
- Use of huge amount of cement in concrete to avoid the dampness and capillary rise in construction industry, is economically very expensive.
- Industrial byproducts and wastes like WSA, RHA, FA, etc. causes environmental pollution.
- Manufacturing of cement require a huge amount of fuel, which reduce the resources of minerals.

3. Experimental Work

3.1 Materials

3.1.1 Cement

Fresh Ordinary Portland cement (OPC) was collected from locl market and was use in this research program. The chemical composition, Bogue's compound and physical properties of OPC are shown in **Table 1**, **Table 2** and **Table 3** respectively.

Table 15: Chemical Composition of Cement

Constituents	% Content	ASTM C150 Specifications
SiO_2	20.78	20% (min)
Al_2O_3	5.81	6.0 (max)
Fe_2O_3	2.99	6.0 (Max)
MgO	1.52	6.0 (Max)
SO_3	1.89	3.0 (Max)
CaO	62.18	60-67%
LOI	2.31	
IR	0.75	
$Free\ Lime$	0.68	

Table 16: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	135	C 191
Final setting time (minutes)	234	C 191
Standard Consistency (%)	28	C 187
Fineness by Sieving (No.200 Sieve)	4%	C786
Soundness	0.039 in (1mm)	C 189

Table 17: Bogue's Compounds

Compounds	% Content
C_3S	45.29
C_2S	26.45
C_2A	11.02
C_4AF	8.89

3.1.2 Rice husk ash

Rice Husk ash is the most frequently known artificial pozzolans and which is obtained from the prolong burning of Rice Husk at a temperature of 577±5°C. **Table 4** and **Table 5** shown the chemical composition and physical properties of RHA.

Table 18: Chemical Composition of RHA

Oxides	%age
CaO	3.06
SiO_2	76.66
MgO	3.28
Na_2O	1.1
LOI	12.02
SO_3	1.6

Table 19: Physical Properties of RHA

Property	Result
Specific Gravity	2.02
Color	Grey
Geometry	Spherical (Glassy)
Fineness by Sieving (retained on Sieve No.200)	21%

3.1.3 Wheat Straw Ash

Wheat straw was obtained from Peshawar, and prolong burning was carried out to get WSA. The burning temperature was 570℃. The physical and chemical properties of WSA are shown in **Table 6** and **Table 7.**

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Table 20: Chemical Composition of WSA

Oxides	%age
CaO	8.02
SiO_2	51.01
MgO	2.9
Na_2O	0.91
LOI	8.92
SO_3	1.74

Table 21: Physical Properties of WSA

Property	Result
Specific Gravity	2.3 g/cm³
Color	Light grey
Geometry	Spherical
Fineness by Sieving (retained on Sieve No.200)	9%

3.1.4 Aggregates

Locally available fine aggregate was obtained from sand stock for this research program. The coarse aggregate in crushed form was obtained from Islamabad, Margalla hills. Some physical properties of the aggregates are shown in **Table 8.**

Table 22: Physical Properties of Aggregate

Characteristics	Fine Aggregate	Coarse Aggregate
Type	Normal	Crushed
Specific Gravity	2.51	2.65
Dry Rodded Bulk Density	$144\ lb/ft^3$	$97.61\ lb/ft^3$
F.M	2.31	6.8
Absorption %	1.12	0.25

3.1.5 Concrete mix proportion

Concrete mixes were prepared according to ACI recommended practice for the different proportion of WSA and RHA with a water cement ratio of 0.54. Triplet cylinders and cubes of all the proportion i.e. for Control Mix (CM), RHA and WHA of 5%, 10%, 15%, 20% and 25% were filled for 28 days compressive strength and penetration tests (permeability) respectively. Also hollow cubes of external dimensions $6" \times 6" \times 6"$ *and internal dimensions of* $4" \times 4" \times 4"$ was filled from all the above mentioned mixes. The specimens were de moulded after 24 hours and were cured for 28 days at room temperature. After 28 days, the specimens were removed from water to test.

3.2 Tests

Tests were perormed to evaluate the properties of Rice husk ash and Wheats straw ash in concrete.

3.2.1 Compressive strength

The compressive strength tests were carried out on triplet of cylinders after 28 days curing at room temperature. The results are shown in **Table 9.**

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Table 23: Compressive Strength of RHA & WSA

%age of RHA	28 day strength (Psi)	%age of WSA	28 day strength (Psi)
0%	2556	0%	2556
5%	2533	5%	2612
10%	2512	10%	2541
15%	2476	15%	2420
20%	2319	20%	2371
25%	2203	25%	2187

3.2.2 Sorptivity (ASTM C1585)

The Sorptivity is a material property that characterizes the tendency of a material to absorb and transmit water by capillarity. Lower the value of Sorptivity, the higher the resistance of concrete towards water absorption. The schematic arrangement of the Sorptivity test is done. Cubical specimens were placed in tray such that their bottom surface up to a height of 3–5 mm is in contact with water. In order to maintain accuracy of the results, the lower parts of the sides of the specimens adjoining the in flow face were sealed with an adhesive tape up to the height of 35–40 mm from the bottom of the cube. This procedure was considered to allow free water movement through the bottom surface. The total surface area of water within the tray should not be less than 10 times that of the specimen cross sectional area. Specimens were removed from the tray and weighed at intervals of 3, 5, 7, 9, 12, 15, 20, 25 and 30 minutes. The volume of water absorbed per unit cross-sectional area at each time interval was evaluated and the Sorptivity determined from the slope of the graph of the water absorbed against the square root of time. The following formula is used to investigate the sorptivity of all the mixes.

$$S = \frac{I}{\sqrt{t}}$$

S=Sorptivity in mm, t= elapsed time in minutes, $I = \frac{\Delta W}{AD}$, $\Delta W = change\ in\ weight = w_2 - w_1$, $w_1 = Oven\ dry\ weight$, $w_2 = Weight\ of\ cylinder\ after\ capillary\ rise$, A=surface area of the specimen subjected to penetration, d=density of water

It was conducted at the age of 28 days after curing. The results of Sorptivity for RHA and WSA are shown in **Table 10.**

Table 24: Sorptivity for various % RHA and WSA after 28 days

%age of RHA	Sorptivity (mm/min$^{0.5}$)	%age of WSA	Sorptivity (mm/min$^{0.5}$)
0%	0.0067	0%	0.0067
5%	0.0065	5%	0.0067
10%	0.0066	10%	0.0068
15%	0.0066	15%	0.0070
20%	0.0078	20%	0.0081
25%	0.0105	25%	0.0083

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3.2.3 Porosity

Porosity of the material i.e. aggregate or concrete is the ratio of pore volume to the total volume of the specimen (Matko,.2003). The porosity of concrete for different mixes are shown in **Table 11.**

3.2.3 Permeability

Generally, Different method were used to find the permeability of concrete but here the permeability is find out as per German Standard DIN 1048 (Part 5) for the penetration of water in concrete. Concrete cubes were tested for all the mixes of CM, RHA and WSA. The results obtained are shown in **Table 11.**

Table 25: Permeability and Porosity

% Content	Penetration (mm)	% Increase/Decrease	Porosity (%)	% Increase/Decrease
CM	3	0	0.0790	0
RHA5	2.5	16.67 % Decrease	0.0767	2.93% Decreases
RHA10	1	66.67% Decrease	0.0783	.83% Decreases
RHA15	1.25	58.33% Decrease	0.0808	2.17% increases
RHA20	2.5	0	0.0812	2.709% increases
RHA25	2.9	3.33 % Increase	0.0829	4.70% Increases
WSA5	2.8	6.6% Decrease	0.0782	1.01% decreases
WSA10	3	0	0.0980	13.76 Increases
WSA15	3.2	6.25% increase	0.1010	17.52 Increases
WSA20	4.8	37.50% increase	0.1150	25.90 Increases
WSA25	5.9	49.1% increase	0.2010	59.60 Increases

RHA5=RHA 5%, WSA5=WSA 5% and vice versa

4. Results and Discussions

4.1 Compressive Strength

Compressive strength of the concrete was good for 5% RHA contents and increases by 2.18% for 5% WSA in concrete. A good compressive strength was observed for RHA and WSA contents within the range of 10-15% in concrete as shown in **Table 9**.

4.2 Sorptivity

The results of Sorptivity for the various percentage of RHA and WSA is shown in **Table 10.** The results revealed that Sorptivity decreases for the replacement of RHA up-to 15 % and provide good results at 20%. Also the WSA contents up-to 15% provide good results for Sorptivity as shown in **Table 10.**

4.3 Permeability

The incorporation of RHA up-to 20%, decreases the rate of penetration i.e. permeability in concrete as shown in **Table 11** where the permeability of concrete with WSA content up-to 10% replacement of cement gives better results as shown in **Table 11.**

4.4 Porosity

 Results of porosity in **Table 11** show that partial replacement of RHA by cement in concrete up-to 10% and WSA up-to 5% decreases the porosity of concrete.

5. Conclusions

The following conclusions were drawn from this experimental work:

- Incorporation of RHA is a partial replacement of cement in concrete;
  - 10-15% RHA in concrete gives better compressive strength.
  - Up-to 20% RHA in concrete, decrease the permeability of concrete.
  - Up-to 10% RHA in concrete, decreases the porosity of concrete by 0.83%.
  - RHA up-to 15% is recommended for good Sorptivity results.
- Partial replacement of cement by WSA in concrete gives;
  - 5-10% WSA in concrete enhance the compressive strength of concrete.
  - Up-to 10% WSA in concrete, show good decrease in permeability and Sorptivity.
  - WSA have no significant role in porosity, as its replacement of 5% gives only 1% decrease in porosity.

6. Recommendations

The following recommendations were made on the basis of this experimental work.
  - Partial replacement of cement by RHA with in the range of 10-15% gives better result for compressive strength, sorptivity, permeability, and porosity.
  - 5-10% repalcement of cement by WSA in concrete is recommended for good compressive strengt, sorptivity,permeability, and porosity.

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Strength Behavior of Concrete for Differrent Sources of Aggregates used in Peshawar

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Abstract

Characteristics of aggregates have substantial effect on the performance of concrete. The selection of aggregate have a vital role in the mix design of concrete. This study is dedicated to investigate the effect of aggregates (fine and coarse) of different sources on the compressive strength of concrete and compare it with the standard strength of concrete (i.e. 3000 Psi for a 1:2:4 concrete with a water to cement ratio of 0.5) generally used in Peshawar. Coarse aggregate of one source is mixed with fine aggregates of different sources and similarly the fine with different coarse aggregate of different sources in concrete mixes. Concrete cylinders for different mixes were casted and were cured for 7 and 28 days. Tests results shown 20-30% deviation from the standered strength for some sources.

Keywords: Aggregate, Concrete, Fineness Modulus, Strength, Coarse Aggregate

1. Organization of Paper

The organization of the paper is in the following sequence;

1. Paper Organization
2. Introduction
3. Problem Statement
4. Objectives
5. Experimental Work
6. Results and Discussions
7. Conclusions
8. Recommendations
9. References

2. Introduction

Concrete is a composite material composed of aggregates, cement and water. Actually concrete occupies a maximum volume of concrete. The cement in the presence of water make a paste which coats the surface of aggregates and convert it to a solid mass. All the constituents of concrete have their own significant role in the composition of concrete. Aggregates act like an inert filler in concrete. The aggregates normally cover approximately 60 to 70 percent volume of the concrete

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(Aïssoun et al, 2016). There are two types of aggregates, i.e. fine and coarse aggregates. The coarse aggregates have a size greater than 4.75 mm (retained on No.4 sieve) and fine aggregates have a size lesser than 4.75 mm (passed on No.4 sieve). The properties of aggregates like size, texture, shape, specific gravity, soundness etc. have an important role in the workability, strength and durability of concrete (Shetty, 2005). The smooth and rounded aggregates increase the workability but decrease the bond characteristics and hence gives not enough better strength. Also large size aggregates decrease the water cement ratio in concrete (Ibragimov, 1989). On the other hand, the crushed aggregates not only increase the amount of water but also contribute to better bond characteristics and strength.

The fineness modulus of both types of aggregates have significantly affect the rheology of concrete (Aïssoun et al, 2016). Increase in the fineness modulus of fine aggregates decrease the plastic viscosity especially in the case of self-consolidating concrete. The elongated particles of coarse aggregates can vary the workability of fresh concrete (Report, 1968)

3. Problem Statement

It is common practice in Peshawar, to prepare the concrete with 1:2:4 with a water cement ratio of 0.5 with the aim to get 28 days compressive strength of 3000 Psi without proper mix design. A general survey of some multistory buildings and complexes was carried to investigate the variation of sources of coarse and fine aggregates. Generally it was observed that there is a lot of variation in the types of fine and coarse aggregates. Some of the coarse aggregates were directly collected from quarry without any purification and were used in concrete. In many cases, the fine aggregates have much more fine particles then the normal. At last, it is observed that three sources of fine and three sources of coarse aggregates mostly used in the construction industry of Peshawar.

4. Objectives

The main objectives this research program are:
- To investigate the 7 and 28 days compressive strength for all sources of fine and coarse aggregates in normal strength concrete of 3000 Psi.
- To investigate the variation in concrete compressive strength.
- To check the standard deviation of all type of sources in concrete.

5. Experimental Program

5.1 Materials
5.1.1 Cement
Ordinary Portland cement of various factories are used in Peshawar construction industry but according to our survey, cement of Kohat cement factories is used in many construction sites. The chemical composition of Kohat cement is given in **Table 1** and the physical properties of cement is shown in **Table 2**. The Bogue's compounds of Kohat cement are shown in **Table 3**

Table 26: Chemical Composition of Kohat Cement

Oxide	% Content	ASTM Specification C150
SiO_2	20.78	20% (min)
Al_2O_3	5.201	6.0 (max)
Fe_2O_3	3.18	6.0 (Max)
CaO	60.88	60-67%
Na_2O	0.87	
MgO	3.02	6.0 (Max)
SO_3	1.75	3.0 (Max)
LOI	2.32	3.0 (Max)
IR	0.648	

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Table 27: Physical Properties of Kohat Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	139	C 191
Final setting time (minutes)	241	C 191
Standard Consistency (%)	28.5	C 187
Fineness by Sieving (No. 200 Sieve)	3.6%	C786
Soundness	1mm	C 189

Table 28: Bogue's Compounds

Compounds	% Content
C_3S	45.29
C_2S	26.45
C_2A	11.02
C_4AF	8.89

5.1.2 Fine aggregates

Fine aggregates of different sources were collected for this research program. Actually three sources of fine aggregates generally used in the construction industry of Peshawar. The sources of fine aggregates are Nizampur, Lawrencepur and Hesko. The physical properties of these aggregates are shown in **Table 4**.

Table 4: Physical Properties of Fine Aggregates of Various Sources

Properties	Nizampur	Lawrencepure	Hesko
Fineness Modulus	2.3	2.54	1.75
Moisture Content	2.12%	1.25%	3.5%
Absorption	1.12%	0.89%	1.78%

5.1.3 Coarse Aggregates

Coarse aggregates have a significant role in the strength of concrete. Mostly coarse aggregates of three sources are used in Peshawar. These sources of the coarse aggregates are Basaie (Peshawar), Margalla (Islamabad) and Bahader Kaley (Peshawar) sources. The coarse aggregates of Margalla (Islamabad) source have negligible amount of flakey and spherical particles whereas the remaining two sources contain spherical and flakey aggregates particles. The physical properties of all the sources aggregates are shown in **Table 5.**

Table 5: Physical Properties of Coarse Aggregate of Various Sources

Properties	Basaie	Margalla	Bahader Kaley
Fineness Modulus	3.75	2.87	2.92
Moisture Content	0.5 %	0 %	0.62%
Absorption	1.03%	0.23 %	0.97 %

5.2 Concrete Mixture and proportioning

The usually used ratio of concrete i.e. 1:2:4 was used with a w/c ratio of 0.5 to in this experimental work.

The concrete mixes of different sources were prepared. Fine aggregate of one source was mixed with the all source of coarse aggregates and similarly process was repeated for all sources. The mixes are shown in **Table 6.** The mixes are given an ID for identification purpose. Triplets of

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cylinders with a height of 12″ and 6″ diameter were prepared for each 7 days and 28 days compressive strength test. The cylinders were properly filled according to ACI recommended practice. The cylindrical specimens were demolded after 24 hours and were placed in curing tank till testing day.

Table 6: Representation of Different mixes with IDs

Mix ID	Source of Fine Aggregate	Source of Coarse Aggregate
A	Nizampur	Bahader Kaley
B	Nizampur	Basaie
C	Nizampur	Margalla
D	Heshko	Bahader Kaley
E	Heshko	Basaie
F	Heshko	Margalla
G	Lawrencepur	Bahader Kaley
H	Lawrencepur	Basaie
I	Lawrencepur	Margalla

5.3 Tests

Cylinders of all types of mixes were removed after 7 days and 28 days from curing tank for the compressive strength of the concrete. All the specimens were tested in Universal Testing Machine.

6. Results and Discussion

Compressive strength of all the mixes were obtained from the tests. The results are shown in **Table 7** and plotted in **Figure 1**. The results shown that Mix "C" (Nizampur sand and Margalla crush) has approximately nearest value to that of standard strength of 3000 Psi whereas the Mix "I" (Lawrencepur sand and Margalla crush) has an increase of 2.57% from the standard strength. It shows that the Margalla crush gives better strength then the remaining type of coarse aggregates due to its angular particles and high strength. As we know that angular particles have more compactness as compared to spherical and flaky particles. Also it was observed from the results that as the fineness modulus of the fine aggregates decreases, the compressive strength decreases as it is clear from the Mixes D, E and F where Hesko sand was used with the lowest fineness modulus. Another factor which was observed during the mixing period of concrete, that fine aggregates with more fineness require more water due to increase in surface area. The Mixes B, E and H gives approximately similar results, show that increase in size of coarse aggregates increase the workability but decrease the compressive strength.

Table 7: Compressive Strength of Different Mixes and their variation from Standard Strength

Mix ID	7 Days Compressive Strength (Psi)	28 Days Compressive Strength (Psi)	Standard Strength (Psi)	% Decrease	% Increase
A	1465	2129	3000	29.03	-
B	1556	2395	3000	20.17	-
C	1725	2903	3000	3.23	-
D	1488	2256	3000	24.80	-
E	1522	2402	3000	19.93	-
F	1665	2676	3000	10.80	-
G	1587	2486	3000	17.13	-
H	1416	2366	3000	21.13	-
I	1795	3077	3000	-	2.57

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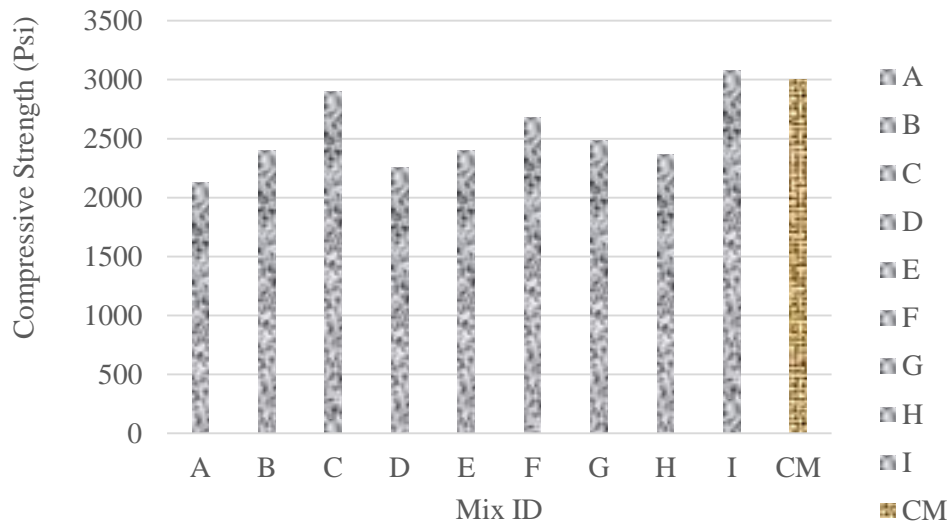
Figure 1: Compressive Strength of Different Mixes and their variation from CM(Control Mix)

7. Conclusions

The following conclusions were drawn from this experimental work:
- It was concluded that concrete of 1:2:4 with a w/c ratio of 0.50 will not surely gives 3000 psi strength at the age of 28 days.
- Large size coarse aggregates provide better workability in fresh state of concrete but with more voids decrease the compressive strength of concrete.
- Fine aggregates with more fineness increase the demand of water and decrease the compressive strength of concrete.
- Angular aggregates with good texture provide better compactness to concrete and hence increase the compressive strength of concrete.
- The crushed aggregates require more water as compared to spherical or flaky aggregates in concrete.

8. Recommendations

Recommendations from this research program are:
- Lawrencepur and Nizampur sand with Margalla crush is recommended for a concrete of 1:2:4 with a w/c ratio of 0.50.
- Proper mix design should be performed for all types of aggregates prior to concreting, as the strength of concrete varies with the source of fine and coarse aggregates.
- Fine aggregates with more fineness should be avoided when there as an issue of concrete strength.
- Angular aggregates is recommended as it gives good compactness and hence better compressive strength.
- Large size aggregates is recommended as it give better workability at the initial fresh stage of concrete but increase the chance of voided concrete.

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Relationship Between Seepage and Discharge for River Indus in District Swabi (KPK)

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Abstract

Seepage from rivers in the nearby areas cause waterlogging which is a major problems for construction industry especially in populated regions. This study is used to invistigate the seepage and discharge relationship of River Indus at District Swabi. The river indus received many tributaries and the quantity of discharge varies along its length. To find the discharge, a monthly data of Nine years (2002 to 2010) was collected from the hydrological department and the seepage losses were calculated by using different emperical equations (i.e Nazir Ahmad, Indian, Pakistanian formula and Molesworth and Yennidunia formulea). Discharge of river indus is plotted against the average values of these equations and a relationship of discharge and seepage is established.

Keywords: Seepage, River, Waterlogging, Discharge, Monthly data

1. Introduction

Seepage is the movement of water to soil from the sides and bed of the rivers and canal.(1). The seepage of water to the ground vary from place to place, depending upon the geology of area. Also seepage depends upon the water stages of the adjoining area. Water shortage mainly takes place due to seepage of water. This seepage of water contribute mainly to the ground water, but in some cases, the seepage may cause very serious problems to the adjoining areas. Seepage from river or canals mainly depend upon the nature of soil, silt deposition, water depth in river and canal, hydraulic conductivity, porosity of soil etc. (Bakry and Awad, 1997).
It is very harder to find the alternate solution of water, due to its increasing demand in the earth and its supplies become rare. Seepage losses can be estimated by using quantitative knowledge of direct measurement, indirect method of measurements, or by any random method of prediction (an expert can made such prediction). For the use of direct measurement of seepage losses, discharge are measured along the length of the river or canal at various stations. In the indirect method of seepage losses, generally the steady state and canal closure method is preferred to be used. Water table profile is observed from the site and then seepage loss rate are calculated from the obtained observation. Field seepage losses estimation for canal was carried out by Davis and Wilson from the relation:

$$S = 0.45C \frac{PL}{4 \times 10^6 + 3650\sqrt{V}} d^{\frac{1}{3}}$$

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In this relation S=seepage losses (m^3 per length of canal per day), P= wetted perimeter, L= length of canal in m, d is the water depth, V is the velocity of flow in m/sec and C has a value of 1-10, normally depends upon the lining of canal. In Pakistan, about 10 cusec per million ft^2 seepage losses occur. The persistence of Pakistan economy is mainly dependent on the solution of water shortage. Increase in demand of available resources of water due to increase in population and shortage of rainfall in many areas of Pakistan like Balochistan and lower Punjab is getting the condition worse day by day. The River Indus is one of the largest river in Pakistan. Its tributaries also contribute a lot to the resource of water in Indus. Seepage losses due to high discharge may causes some serious issues to the resources of water, causes the erosion of the banks areas, the chance of piping phenomenon due to seepage in the soil and lowering the bearing capacities of the adjoining areas. Theses seepage losses need special attentions in civil engineering. As many construction project like multistory buildings, high rise buildings and mass structures need good bearing capacity which may be obtained only, if seepage losses are reduced. Also seepage losses reduce the cultivated areas. In this research study, the seepage and discharge relationship was investigated for River Indus at District Swabi (KPK, Pakistan).

2. Background of River Indus

Indus River is one of the largest rivers with a length of 3000 km and Coordinates 23°59′40″N 67°25′51″E, that has attracted the scholars since the time of Alexander the Great in the region since 325 BC. The 970,000 km^2 drainage basin of the Indus ranks the 12th largest in the World. Its 30,000 km^2 delta ranks 7th in size globally. The source of Indus River lies in Tibet, Mount Kailas and to some extent the upper parts of India however, it mostly runs in Pakistan (Pakistan (93%), India (5%), and China (2%)). About 45 million years ago (Clift et al, 2001), the Indus River System was initiated because of the collision between the India and Eurasian Plates as per view the recent geological and geophysical information. Number of large tributaries caused water and sediment in the River Indus. These tributaries are Shyok, Shigar, Gilgit and Kabul from the North and Jhelum, Chenab, Ravi, Beas and Sutlej from the eastern Punjab. The South Western Monsoon rains of Asia largely fill the Indus River. However, most of the run-off north of the Tarbela Dam comes from Glacier melting (Ahmad 1993, Asianics, 2000) states that Seasonal and annual river flows both are highly patchy. Annual peak flow of the Indus River occurs between June and late September, during the Southwest monsoons. The high flow of summer monsoon is increased by snowmelt in the north that also conveys a large volume of the residue from the mountains. A satellite view of River Indus is shown in **Figure 1.**

Figure 20: Satellite image of River Indus in Pakistan, India and China

3. Problem Statement

- Underground seepage cause the settlement of engineering structures
- Seepage losses reduce the water resources for using in many engineering projects like power production.
- Seepage losses in the lower bed and sides of rivers cause the erosion of the sides of rivers, increase the silt production which increase sedimentation in dams reduce the storage capacity of dams.
- High discharge in the river increase the possibility of high seepage losses due to high head of water.
- High discharge in the canal deteriorate the lining of the canals.
- Seepage in the upward direction reduces the effective stress with in the soil.
- The collapse of river banks due to seepage around the world has caused widespread damages to land and property.
- Loss in strength due to upward seepage is a common contributor to leave failure.
- Seepage through the foundations and abutments of dams containing soluble rocks may produce settlements and redistribution of pore pressures which could intimidate stability or cause leakage and waste of water sufficient to render the dam uneconomic.

4. Estimation of Seepage Losses by Empirical Equations

Generally, there are so many equation used to find the seepage losses. Some special of them are presented here.

4.1 Molesworth and Yennidunia Formula
Mowafy (2001) use the equation of Molesworth and Yennidunia. This equation is:
$$S = C \times L \times P \times R^{0.5}$$
$Where$
$S = Seepage\ losses\ for\ a\ specified\ length\ in\ m^3 s^{-1}$
$L = Length\ of\ canal\ in\ Km$
$P = wetted\ perimeter\ of\ the\ canal\ in\ m$
$R = hydraulic\ radius\ in\ m$
$C = constant\ factor, which\ depend\ on\ the\ type\ of\ soil, for\ clay$
$\qquad = 0.0015, for\ sand = 0.003$

4.2 Nazir Ahmad Formula
To calculate seepage losses, Nazir Ahmad develop an empirical formula for a specified section of a canal. The formula is
$$S = \frac{0.04 \times Q^{0.08}}{56.81}$$

$S = Seepage\ losses\ for\ a\ specified\ length\ in\ m^3 s^{-1} Km^{-1}$
$Q = Discharge\ of\ channel\ in\ \ m^3 s^{-1}$

4.3 Pakistani Formula
To find seepage losses in canal, Kavita and Khasiya (2014) has quoted this formula. The formula is:

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$$S = \frac{5 \times Q^{0.0652} \times P \times L}{10^6}$$

$S = Seepage\ losses\ for\ a\ specified\ length\ in\ ft^3 s^{-1}$
$Q = Discharge\ of\ channel\ in\ ft^3 s^{-1}$
$L = Length\ of\ channal\ in\ ft$
$P = wetted\ perimeter\ of\ the\ section$

4.4 Mortiz Formula USSR

To find seepage losses, Mortiz (USSR) formula was quoted by Adnan (2015). The formula is:

$$S = 0.2 \times C \times \left(\frac{Q}{V}\right)^{0.5}$$

Where
$S = Seepage\ losses\ in\ ft^3 s^{-1}/mile$
$Q = Discharge\ of\ channel\ in\ ft^3 s^{-1}$

$V = mean\ velocity\ ft/sec.$
$C = Constant, for\ clay\ C = 0.34\ and\ for\ sand = 2.2$

4.5 Indian Formula

For Indian channel, Kavita and Khasiya (2014) has developed a formula. The formula is:

$$S = C \times d \times a$$

$S = Seepage\ losses\ for\ a\ specified\ length\ in\ m^3 s^{-1}$
$a = Area\ of\ wetted\ perimeter\ in\ million\ m^2$
$d = depth\ in\ meter$
$C = constant\ factor, \quad C = 1.1\sim1.8$

5. Methodology

5.1 Seepage losses

The movement of water in the bed or sides of rivers or canal is called seepage. Seepage losses not only contribute to the recharge of water to the ground but also decrease the bearing capacity of soil adjacent to the river or canal hence increase the risk of settlement in engineering structures. An investigative study is carried out to find the seepage losses of River Indus at Hund station Swabi District.

5.2 Data Collection

As it is not possible to find the different hydrological data at River Indus, therefore, all the six year (2005-2010) hydrological data was collected from the hydrology department at Swabi Hund station. The data includes Discharge, area, perimeter, velocity, slop, depth, hydraulic radius and roughness coefficient.

5.3 Seepage Calculation

Different empirical formulas was used to calculate seepage from the collected data. There are so many formulas used to find seepage, but only five are used here. These are Molesworth and Yennidunia formula (Kavita and Khasiya, 2014), Nazir Ahmad Formula (Ahmad et. al., 2007), Pakistani Formula quoted by (Kavita and Khasiya, 2014), Mortiz Formula USSR quoted by (Mowafy, 2001) and Indian Formula quoted by (Mowafy, 2001).

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6. Results and Discussions

6.1 Seepage Losses

Several empirical formulas are used to seepage losses. Some of them are reported in the literature. To estimate the seepage losses in River Indus at Swabi, four empirical formulas was used in this research work. The results are shown in **Figure 2.** Pakistanian Formula gives maximum seepage losses.
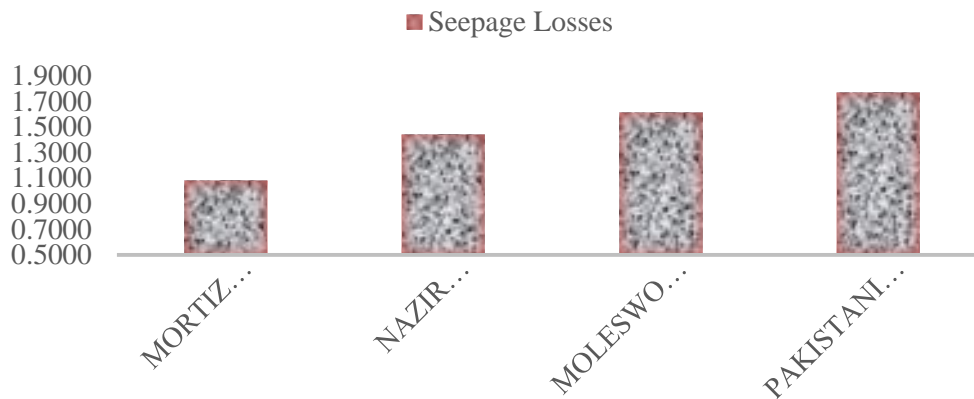
Figure 2: Seepage Losses Estimation

6.2 Seepage and Discharge

The average monthly results of seepage of six years were calculated. These results were plotted against discharge at Swabi (Hund station). A practical equation if derived from the six year data, which is used to calculate the seepage against discharge of River Indus. **Figure 3, 4 and 5** represent the seepage and discharge relationship for River Indus.
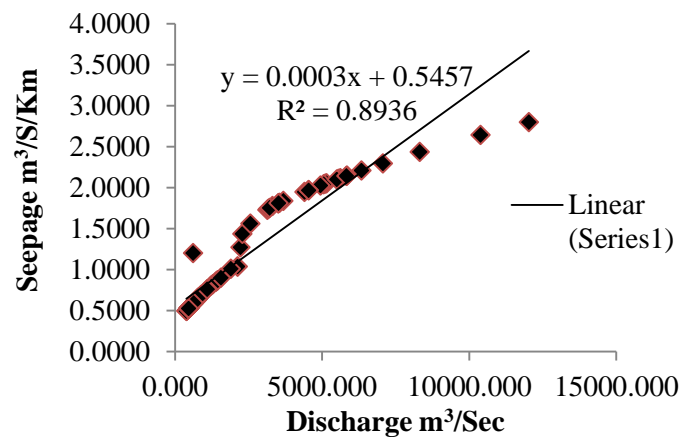
Figure 3: Seepage & Discharge Relationship (Linear)

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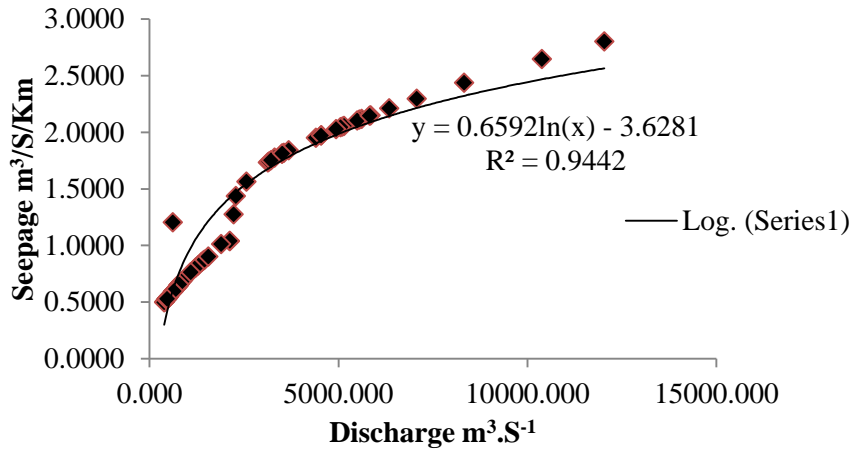
Figure 4: Seepage- Discharge Relationship (Logarithmic)
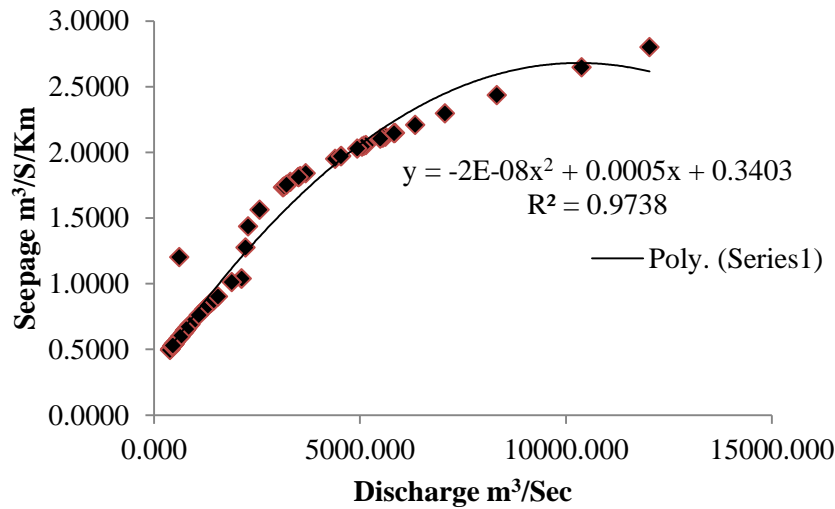
Figure 5: Seepage and Discharge Relationship (Polynomial)

The polynomial equation in **Figure 5** have close correlation between seepage and discharge.

7. Conclusion

The following conclusions were drawn from this experimental program.

- A maximum seepage losses was observed for River Indus which is 1.7662 m^3/sec/Km. (Pakistanian Formula)
- The Logarithmic and Polynomial equations have shown high positive correlation between seepage and discharge.
- The value of seepage for higher discharge can be calculated by using linear equation.

8. Recommendations

The following recommendations are made on the basis of this research program:

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- The Pakistanian formula gives good results for seepage losses, so it is recommended for seepage losses in river/
- The maximum seepage losses of 1.7662 m^3/sec/Km is observed from calculation. Such a large seepage losses causes serious issues like erosion of river banks, waterlogging in the nearby areas, lowering the bearing capacity of soil and piping etc. so seepage should be minimized by stone pitching in the rivers in the affected areas.

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To Improve the Performance of Concrete by Using Fly Ash

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Abstract

The disposal of industrial wastes like Fly Ash is one of the main challenging problems worldwide. This study revealed the effect of Fly Ash(FA) as a partial replacement of cement by mass on the consistency, setting time of cement and compressive strength of concrete. The ordinary Portland cement(OPC) was partially replaced by 5 to 30 % FA and was compared with the control mix. The normal consistency, setting times and the compressive strength for all specimens were determined. The results shown that increase in FA content rises the demand of water and hence increase the consistency but the increased FA content delayed the setting time of cement. Also the incorporation of FA in concrete affects the compressive strength.

Keywords: Fly Ash, Concrete, Strength, Consistency, Setting time

1. Paper Organization

This paper include the following sections:
1. Paper Organization
2. Introduction
3. Background
4. Problem Statement
5. Experimental Work
6. Results and Discussions
7. Conclusion
8. Refrences

2.Introduction

Engineering properties of concrete can be improved by using mineral admixtures like Fly Ash (FA), Silica fume, Metakoline, ground granulated blast-furnace slag etc. as a pratial replacement of cement or as a mineral additives.
Reasearch has been carried out on raw materials and industrial wastes that may be used as a partial replacment of cement in mortars and concretes, in order to utilize these products in a benificail

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way. Pozzolonic materials like FA is one of the best product used as an additive in cement (Pedraza et al., 2015). FA is obtained as a byproduct from thermal power plants. Use of FA as a partial replacement in concretes reduce the manufacturing of cement,conserve energy and also reduce the hazard of environmental pollution. The production of one tone of cement released one tone of CO_2 to the atmosphare (Valdez et al., 2007). One major disadvantag of FA in concrete is the presence of unburnt quantity of carbon in it (Burgos et al., 2012; Valderrama et al., 2011), which increase the demand of mixing water and also have significant effects on durability of concrete (Burgos et al., 2012). Properties of FA varies from source to source due to carbon content, combustion process and temperatures (Valderrama et al., 2011; Burgos et al., 2012; Molina et al., 2008; Shi et al.,2008). In Pakistan, the total coal-ash production was increased day by day. To increase the use of fly ash (FA), and to improve the properties of concrete, many investigations on fly ash concrete have been made at University of Engineering and Technology Lahore and all over the world. In general, some classified high-quality fly ash has been used in concrete. Many other kinds of fly ash, due to their low quality, are still unused (Kraiwood.et al., 2001). The total usage rate of fly ash in concrete is very low in Pakistan (Marwat, 2002). It is, therefore, necessary to investigate and develop a concrete incorporating large volumes of low quality fly ash. The main objective is to increase considerably the utilization of fly ash in concrete and to conserve energy by using fly ash as a partial replacement of cement . This work reports the results of setting time and compressive strength test of FA concrete. The work is part of a research project on FA concrete.

3. Background

Cement based materials are used abundantly in the con-struction industry. These are the most abundant man made materials and it is mostly expected that they will maintain their importance in the future. However, these construction materials necessarily meet the required demands of the human being. Also these construction materials must compete in the construction industry with steel, plastic and wood when facing issue of productivity, economy, environment and quality. In this evaluation, High performance concrete (HPC) is actually a modified industrialized product that, offer adequate flowability, workability and consolidation without the use of additional dynamism. The HPC not only decrease the unsafe task for the labors, but it can also reduce the technical cost of the in-situ concrete construction due to their Improved workability, flowability, quality, durability, surface finish and sustainability of the concrete structures. Though, HPC is a simple mix, mostly dependent on the composition and the characteristics of its ingredients. HPC has to have the incompatible properties of segregation resistance and high flowability. These properties can be achieved by introducing water reducing admixture like fly ash to increase the cohesiveness of the concrete mix. Regarding the worth of the High performance, it is viewed that HPC due to the smallest spherical particles not only reduce the voids with in the mix but also provide high fluidity and cohesiveness to the concrete. HPC characterizes one of the best and most important advancement in the field of concrete technology. Due to the addition of high quantity of the fine particles of fly ash in the HPC, the internal material structure of the HPC show some resemblance to the Self consolidating concrete (SCC) having self-compact ability in fresh stage, no preliminary faults in initial stage, and protection against exterior causes after hardening (Mehta, 1997)

4. Problem Statement

- Cement production is one of the largest Carbon dioxide emitters..
- Environmental issues resulted from cement production have brought worlds concern into a novel concrete technology.
- Fly ash is a waste material and economic utilization of this by-product is highly desirable.

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5. Experimental Work

5.1 Materials

5.1.1 Cement

Cement as a general is considered as such type of materials which have adhesive and cohesive properties and when react with water form stone like mass. The main constituents of the hydraulic cement are silicate and aluminate(Neville,. 1987). Ordinary Portland cement with a specific gravity of 3.15 was used in this research work. The chemical composition of Ordinary portland cement are presented in Table 1 and physical properties are presented in Table 2.

Table 29: Chemical Composition of OPC

Constituents	% Contents	ASTM C150 Specifications
CaO	62.18	60-67%
SiO_2	20.78	20% (min)
Al_2O_3	5.81	6.0 (max)
Fe_3O_2	2.99	6.0 (Max)
MgO	1.52	6.0 (Max)
LOI	2.31	3.0 (Max)
SO_3	1.89	3.0 (Max)

Min= minimum, Max= maximum

Table 30: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	135	C 191
Final setting time (minutes)	234	C 191
Standard Consistency (%)	28	C 187
Fineness by Sieving (No. 200 Sieve)	4%	C786
Soundness	0.039 in (1mm)	C 189

5.1.2 Fly Ash

Fly ash is the most frequently known artificial pozzolans and which is obtained from the burning of pulverized coal in thermal power plants. In Fly Ash the amorphous glassy spherical particles are considered the active pozzolonic materials. Fly ash (Class F) used in this research program was obtained from Sika Chemicals, Islamabad. Table 3 and Table 4 shown the chemical composition and physical properties of FA.

All the composition of FA are within the limits of ASTM C618.

Table 31: Chemical Composition of FA

Oxides	%age	ASTM C150 Specifications
CaO	6.3	
SiO_2	64.2	
MgO	1.50	
Na_2O	1.02	1.5% (Max)
LOI	8.9	12% (Max)
SO_3	2.6	5.0 (Max)
Moisture	2.5%	3.0 (Max)

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Table 32: Physical Properties of FA

Property	Result	ASTM Standards
Specific Gravity	2.1 to 2.3	
Color	Grey	
Geometry	Spherical (Glassy)	
Fineness by Sieving (retained on Sieve No.325)	23%	34 % (max)

5.1.3 Aggregates

The fine aggregate was natural sand from Nizampur (KPK, Pakistan) and the coarse aggregate was crushed and was obtained from Margalla hills, Islamabad with a maximum size of $\frac{3}{4}''$ inches. Some physical properties of the aggregates are shown in Table 5.

Table 33: Physical Properties of Aggregate

Characteristics	Fine Aggregate	ASTM Standards	Coarse Aggregate	ASTM Standards
Type	Normal		Crushed	
Specific Gravity	2.52	C 128	2.65	C 128
Dry Rodded Bulk Density	145 lb/ft^3	C 29	97.61 lb/ft^3	C 29
F.M	2.3	C 136	6.8	C 136
Absorption %	1.1	C 128	0.25	C 127

5.1.4 Concrete mixtures and specimen

Cement pastes specimens of various percentages from 0% to 30% were prepared for normal consistency and setting time tests. Also 3, 3 cylinders of 12 inches height and 6 inches diameter were casted for the same % ages of FA in concrete. The mixture proportions for the concrete are given in Table 6.

Table 34: Mix Proportion for Various %age of FA in Concrete (lb/yd^3)

S No.	Mix ID	Cement	Fine Aggregate	Coarse Aggregate	Fly Ash	Water	W/B
1	CM	812	966	1784	0	335	0.39
2	FAC1	776	966	1784	42.56	335	0.39
3	FAC2	735	966	1784	82	335	0.39
4	FAC3	694	966	1784	122	335	0.39
5	FAC4	653	966	1784	153	335	0.39
6	FAC5	612	966	1784	200	335	0.39
7	FAC6	572	966	1784	245	335	0.39

CM= Control Mix, FAC1=Fly Ash Concrete for first blend of 5%, FAC2= FA concrete for 10% and so on.

5.1.5 Tests

The normal consistency and setting time tests were conducted on Vicat apparatus in laboratory at a temperature of 25℃ and a 65% relative humidity. For all % ages of FA (i.e. 0% to 30% FA), 3 specimens were prepared according to ASTM C-191-04A and were tested in Vicat apparatus. Also concrete cylinders for various percentages of FA were prepared according to ASTM C-39 for the compressive strength of concrete. The cylinders are removed from the moulds and were cured for 3,7,14 and 28 days and were tested in a universal testing machine respectively.

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6. Results & Discussion

6.1 Normal Consistency

The normal consistency results are given in **Table 7** and presented in **Figure 1** shows that the normal consistency increases linearly with the increase in the % age of FA in cement.

Table 35: Normal Consistency for various percentage of FA

Type of Paste	Normal Consistency %	% Increase
P0	27	
P5	27	0
P10	27.5	1.81
P15	28	3.57
P20	31	12.90
P25	31.7	14.82
P30	33	18.18
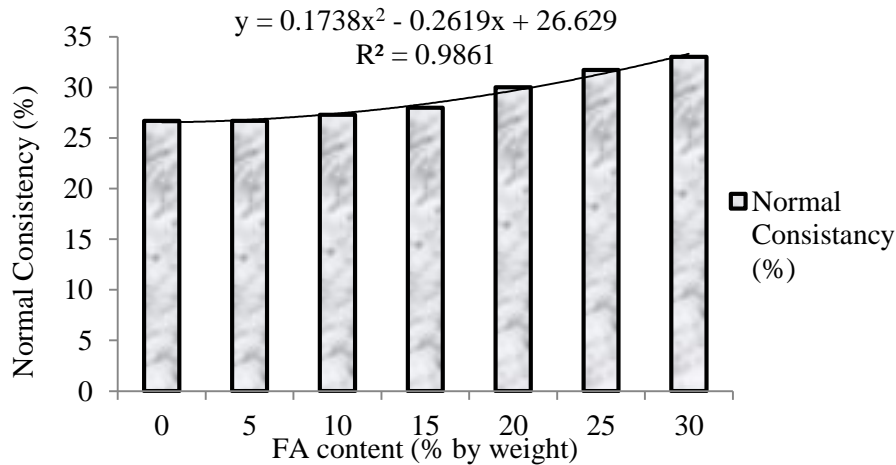
Figure 21: Normal Consistency for various %age of FA

6.2 Initial & Final Setting Time

The initial and final setting time tests results are given in Table 8 shows that increase in % age of FA increase the setting time of cement. Up-to 10% FA, there is a slighter increase in setting time but for the greater amount of FA, the retarding tendency was found to be greater. The results are shown in Fig.2.

Table 36: Setting Time for Various %age of FA

%age of Fly Ash	Initial Setting Time	Final Setting Time
0	135	235
5	138	237
10	148	242
15	153	248
20	164	253
25	177	260
30	192	269

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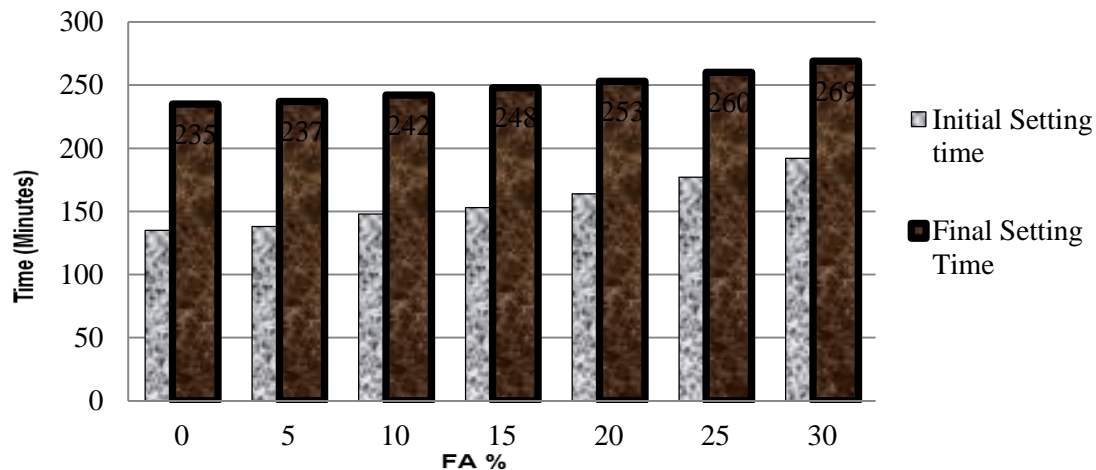
Figure 22: Setting Time for Various %age of FA

6.3 Compressive Strength of Concrete

For compressive strength determination, cylinders are crushed at 3,7,14 and 28 days. An average of three cylinders was taken as the final reading. Concrete cylinder having different % age of FA content are tested. The results are shown in Table 9 indicate that increase in FA content up-to 15% increase the later age strength of concrete but decrease the initial strength rate of the concrete. Also a maximum 28 days strength was recorded for 15% FA content in concrete. Increase in later age strength indicate that FA has pozzolonic properties. Figure 3 shows the clear increase in strength up-to 15% but after that a gradual decrease with the increase in FA contents.

Table 37: Compressive Strength for various % age of FA

%age of FA	Strength in Psi				% Increase/decrease after 28 days
	3 days	7 days	14 days	28 days	
0%	2007	2607	3300	4169	
5%	1835	2693	3493	4209	0.95 (Increase)
10%	1504	2768	3581	4291	2.84 (Increase)
15%	1372	2702	3598	4315	3.38(Increase)
20%	1242	2603	3019	3821	9.1 (Decrease)
25%	1189	2198	2544	3259	23.81 (Decrease)
30%	1169	1949	2323	2658	45.56 (Decrease)

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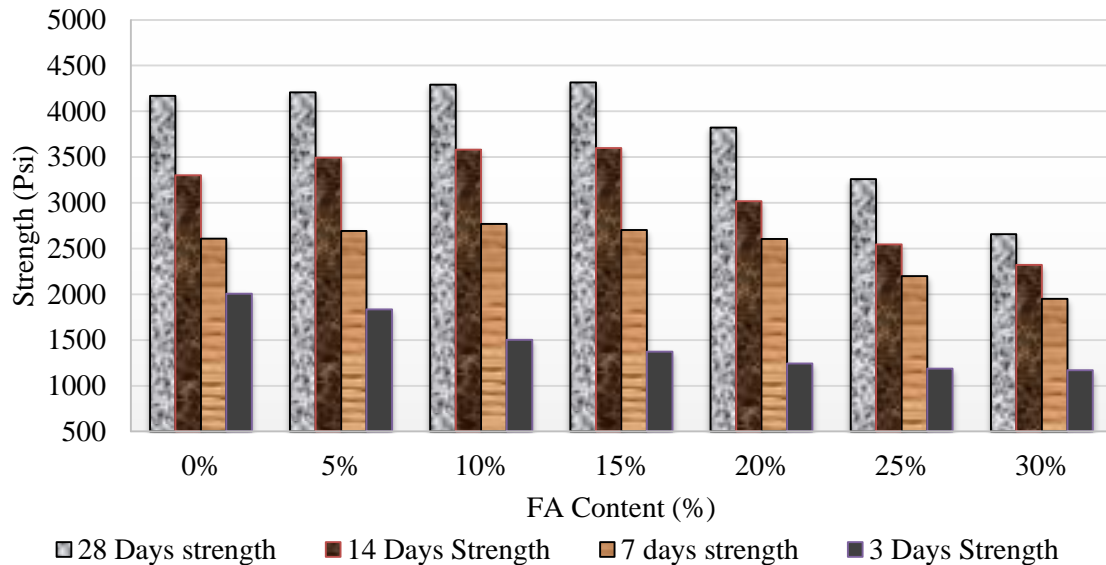
Figure 23: Compressive Strength for Various % age of FA

7. Conclusions

The following conclusions are drawn from this study:
- The water demand increases with higher percentage of FA.
- The setting time of all the blended pastes extended linearly with the increase in the percentage of FA.
- The incorporation of FA decrease the Compressive strength at early age (i.e. 3 & 7 days) but increase the later age strength (28 days).
- At 15% FA, the concrete gives maximum strength then the normal concrete.

8. Recommendation

Some recommendations from this research program are:
- The FA can be used in concrete up-to 15%, as it gives maximum strength in concrete.
- Use of FA can be carried out up-to 30 with superplasticizer, as increase in FA increase the demand of water.

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Effect of Fiber Glass on the Compressive Strength of Concrete

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Abstract

Concrete is a most plentiful of all man made materials, weak in tensions and stronger in compression. An attempt has been made in this research to investigate the effect of glass fiber on the compressive strength and ductility of concrete. Glass fiber (GF) is added in the range of 0 to 1% of the total volume of concrete, also glass fiber is checked with the addition of fly ash (FA) in concrete. Concrete cylinders were casted and cured for 28 days and tested for compressive strength. Tests results revealed an enhancement in the compressive strength and ductility by providing a confinement effect. Moreover, the incorporation of FA increase the packing effect of concrete.

Keywords: Concrete, Glass fiber, Ductility, Compressive strength, Fly Ash

1. Introduction

Concrete is a most widely used construction materials worldwide due to its usage in dams, buildings, highrise constructions etc. Higher popularity of concrete over other construction materials is due to its durability. Initially, serveice life of Reinforced cement concrete(RCC) structures was estimated to be approximatly 100 years with out proper maintanance but concrete structure require major maintannce after about 30 years (Deo, 2015). This is due to the exposer of concrete to harsh environment. In many cases, deterioration of RCC structures start due to the progressive development of cracks. Some specific reasons of deterioration in concrete are: sulphate attack, alkali silica aggregate reaction (ASR), corrosion of steel and freeze and thaw. Recently, researchers prove that alternate drying and wetting, causes degradation of concrete (Deo, 2015). In tropical regions, alternate drying wetting cycles due to rain causes volume changes in concrete which may produce minor or larger cracks in concrete surface. Through these cracks, the water enter in the core of concrete and cause the corrosion of reinforcement. Use of glass fiber in concrete could reduce these cracks. With the aim to minimize the early micro cracks, fiber reinforced concrete gives better service life. Volumetric changes in concrete due to some reasons and drying shrinkage may produce micro cracks before loading. These micro cracks gets opened up after loading and additional defects produced in the concrete. Such type of cracks can be reduced by incorporating glass fiber in concrete which enhance the properties of concrete against these micro cracks. Use of glass fiber with mineral admixtures like Fly ash (FA) not only enhance the properties

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of concrete but also increase the durability and stability of concrete. FA work as a retarder and reduced the shrinkage cracks which also help in reducing the deterioration of concrete. Fly Ash is an artificial pozzolans, obtained from thermal power plants as a byproduct. Manufacturing of cement require high energy cost, and one tone of CO_2 released to atmosphere from one tone of cement (Valdez et al., 2007).

2. Paper Organization

This paper include the following sections:
1. Introduction
2. Paper Organization
3. Background
4. Experimental Work
5. Results & Discussion
6. Conclusions
7. Recommendations
8. Acknowledgment
9. References

3. Background

In the history, there are many examples of using fiber as a reinforcement in weak and brittle materials. Use of straw in mud mortar, in sun-dried mud bricks and horse hairs in fancy gypsum plasters, plastic fibers in ceiling materials has been used from few decades. Similarly some inorganic fibers like asbestos was also used as a fiber in composite materials (Swamy, 1975).
Portoer (1910) suggested that addition of short pieces of steel enhance the strength properties of concrete.
The properties of reinforced concrete may be enhanced by using steel fiber in addition to conventional reinforcement. (Graham, 1911). Similar enhancement was also observed by Ficklin (1914) in reinforced concrete structures and road wearing surfaces.
Meischke-Smith (1920) used flat twisted fibers and check the bonding effect of fibers in concrete. Also Etheridge (1933) used the different diameters of annuli fibers to enhance the crack resistance of concrete. Romualdi and Batson (1963) have done revolutionary work on the fiber reinforcement in concrete.

4. Experimental Work

4.1 Materials
4.1.1 Cement
Ordinary Portland cement (OPC) was used in this research program. The chemical composition of OPC is shown in **Table.1** and Physical Properties **Table 2**.

Table 38: Chemical Composition of OPC

Constituents	% Contents	ASTM C150 Specifications
CaO	62.18	60-67%
SiO_2	20.78	20% (min)
Al_2O_3	5.81	6.0 (max)
Fe_3O_2	2.99	6.0 (Max)
MgO	1.52	6.0 (Max)
LOI	2.31	3.0 (Max)
SO_3	1.89	3.0 (Max)

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Table 39: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	135	C 191
Final setting time (minutes)	234	C 191
Standard Consistency (%)	28	C 187
Fineness by Sieving (No.200 Sieve)	4%	C786
Soundness	0.039 in (1mm)	C 189

4.1.2 Aggregate

4.1.2.1 Fine aggregate

Fine aggregate used in this research program was obtained from Nizampur (KPK, Pakistan). The physical properties of fine aggregates is shown in **Table.3**.

Table 40: Physical Properties of Fine and Coarse Aggregate

Characteristics	Fine Aggregate	ASTM Standards	Coarse Aggregate	ASTM Standards
Type	Normal		Crushed	
Specific Gravity	2.52	C 128	2.65	C 128
Dry Rodded Bulk Density	$145\ lb/ft^3$	C 29	$97.61\ lb/ft^3$	C 29
F.M	2.3	C 136	6.8	C 136
Absorption %	1.1	C 128	0.25	C 127

4.1.2.2 Coarse aggregate

Coarse aggregate used in this research program was obtained from Margalla (Islamabad, Pakistan) in crushed form. The physical properties of coarse aggregates is shown in **Table.3**.

4.1.3 Fiberglass

Fiberglass used in this research program as shown in Figure 1. Also the Properties of Glass fibers used is shown in **Table 4**.

Figure 24: Glass Fiber

Table 4: Glass Fibers Properties

Material	Geometry	Length	Width	Aspect Ratio
Glass fiber	Straight	$20-30mm$	$1{\sim}2mm$	$10{\sim}15$

4.1.4 Fly Ash (FA)

Fly ash (class F) was provided by Sika Chemicals, Islamabad for this research work. The chemical composition of FA is shown in **Table 5**. The physical properties of FA is shown in **Table 6.**

Table 5: Chemical Composition of FA

Oxides	%age	ASTM C150 Specifications
CaO	6.3	
SiO_2	64.2	
MgO	1.50	
Na_2O	1.02	1.5% (Max)
LOI	8.9	12% (Max)
SO_3	2.6	5.0 (Max)
Moisture	2.5%	3.0 (Max)

Table 6: Physical Properties of FA

Property	Result	ASTM Standards
Specific Gravity	2.1 to 2.3	
Color	Grey	
Geometry	Spherical (Glassy)	
Fineness by Sieving (retained on Sieve No.325)	26%	34 % (max)

4.2 Concrete Mixtures and Specimens

Control mixes (CM) of concrete without glass fiber were design according to American Concrete Association (ACI) 211.1. GC1 (Glass Fiber concrete), GC2, GC3, GC4 and GC5 were concrete mixes with 0%, 0.2%, 0.4%, 0.6%, 0.8% and 1% by volume of glass fiber of whole volume of concrete without fly Ash. Also another set of mixes i.e. GFC1, GFC2, GFC3, GFC4 and GFC5 were prepared for the same percentages of Fiber glass with a partial replacement of cement by 15% FA (Sujivorakul et al,.2011) for all mixes. A mix ratio of 1:2.40:2.50 and a W/B (water to binder) ratio of 0.54 was used for all mixes.

4.2.1 Preparation and curing of concrete specimen

Nine (9) Concrete cylinders of dimensions 12"*height and* 6"*dia* were casted for each mix (i.e. 3 for 3 days, 3 for 7 days, 3 for 28 days) without FA and similarly another set of specimens for Glass Fiber with FA. After 24 hours, concrete specimens were de moulded and placed in a curing tank at room temperature for 3, 7 and 28 days.

4.2.2 Slump tests

Slump tests were performed for all the concrete mixes. The results are shown in **Table 7** for glass fiber **and Table 8** for glass fiber with FA.

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Table 7: Slump Test Value for Mixes without FA

Mix ID	Slump (inches)	Mix ID	Slump (inches)
CM	3	CM	3
GC1	2.5	GFC1	2.1
GC2	2.1	GFC2	1.8
GC3	1.6	GFC3	1.3
GC4	1.3	GFC4	1.1
GC5	1.1	GFC5	1

CM= Control Mix, GC1= Glass fiber concrete for 0.2% and vice versa.

Table 8: Slump Value for Mixes with FA

Mix ID	Slump (inches)
CM	3
GFC1	2.1
GFC2	1.8
GFC3	1.3
GFC4	1.1
GFC5	1

CM= Control Mix, GFC1= Glass fiber concrete with FA for 0.2% and vice versa.

4.2.3 Testing of concrete specimens

Cured specimens of concrete were tested for compressive strength of concrete after 3, 7 and 28 days. The results of all the specimen are presented in **Table 9** and also shown in **Figure.2** without FA and in **Table 10** with FA and also shown in **Figure 3**.

Table 9: Compressive strength of Glass fiber Concrete without FA

S.No.	Identification (%)	3 Days Strength (Psi)	7 Days Strength (Psi)	28 Days Strength (Psi)
1	0	1714	2190	4002
2	0.2	1732	2201	4010
3	0.4	1745	2267	4089
4	0.6	1761	2376	4110
5	0.8	1752	`2287	4012
6	1	1722	2171	3928

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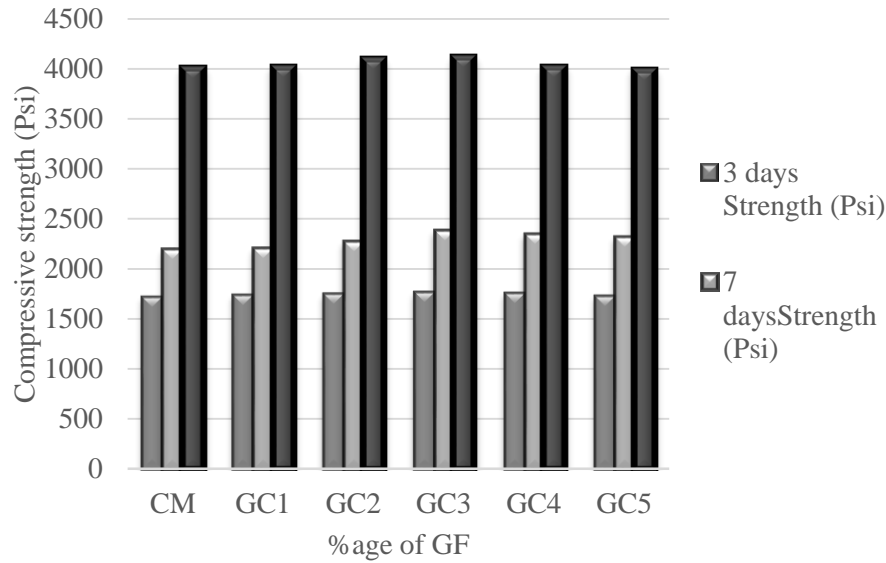
Figure 25: Compressive Strength of FGC

Table 10: Compressive Strength of Glass Fiber Concrete with FA

S.No	Identification	3 days Strength (Psi)	7 days Strength (Psi)	28 Days Strength (Psi)
1	0%	1714	2190	4002
2	0.4	1533	2207	4297
3	0.6	1538	2197	4241
4	0.8	1576	2101	4191
5	1	1584	2058	4120
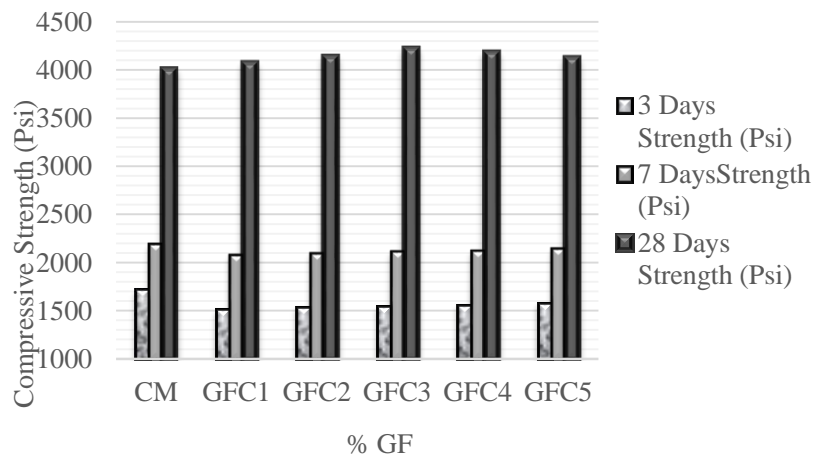
Figure 26: Compressive Strength of GFC

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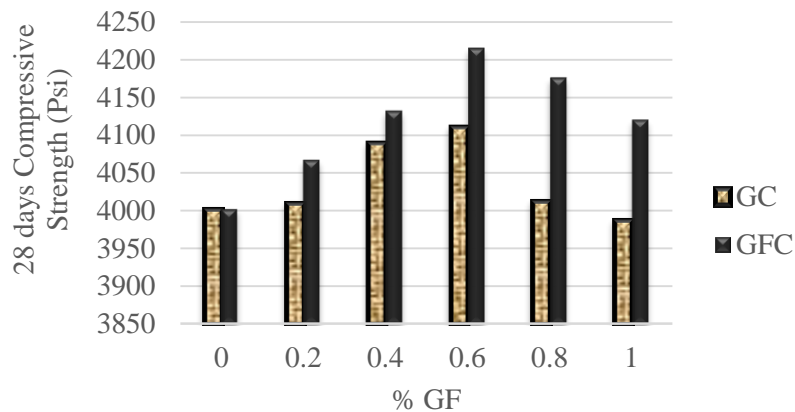
Figure 27: Comparison of 28 Days Strength of GC & GFC

5. Results & Discussion

5.1 Compressive Strength without FA

Tests results shown in **Table 9** revealed that increase in percentage of GF in concrete increase the compressive strength up-to 0.8% due to its confinement effect. At 0.6% GF, the concrete gives maximum compressive strength i.e. about 2.5-2.6% more than control mix. The GF make a skeleton around the aggregates of concrete, decrease the brittleness effect and increase the ductility behavior of concrete. At 1% replacement of GF in concrete reduced the strength by 2% from Control specimen. This may due to the lower workability i.e. reduction of slump at 1%.

5.2 Compressive Strength with FA

Compressive strength increases linearly with the increase in percentage of GF with an addition of 15% FA up-to 1% as shown in Table 11. Even at 1% of GF in concrete with FA, the compressive strength increases up-to 3 % from Control Mix. Also it was observed that initial strength of GF Concrete with FA is less than the GF Concrete due to the fact that FA is a pozzolonic material and gain strength at later age.

Also the fine particles of FA filled the voids in the hydration process by reacting with free lime, which increase the packing effect of concrete, hence contribute to increase in strength. Also **Figure 4** show the increase in 28 days compressive strength due to the addition of FA in GC.

5.3 Workability

Slump test was used to measure the workability of concrete. The results in Table. 8 revealed that increase in the percentage of glass fiber decrease the slump value. Also the slump value decreases with the addition of FA in concrete due to its larger surface area.

6. Conclusions

The following conclusion could be drawn from this research work:

- The compressive strength of concrete increases with the addition of GF up-to 0.8% of total volume of concrete. However a maximum increase in strength was observed at 0.6% of GF.
- Compressive strength increases up-to 3% for an addition of GF of 1% in the presence of 15% FA, which is used as a partial replacement of cement in concrete.
- Decrease in early strength of GFC at 3 and 7 days in presence of FA in concrete was due to the pozzolonic behavior of FA.
- The workability of GFC decrease as the percentage of FA increases.

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7. Recommendations

The following recommendation were made on the basis of the above drawn conclusions:

- GF increase the compressive strength in the range of 0.4%-0.6%
- GF with 15% FA increase the compressive strength of concrete in the range of 0.4%-1%.

8. Acknowledgment

I express my deep sense of gratitude to Mr. Younas Khan, Lab Assistant. Concrete Lab, CECOS University Peshawar for his helping effort during my research work.

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Comprehensive Investiagtion on the Pull-Out Strength of Tar Bars in Normal and High Strength Concrte

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Abstract

In reinforced concrete, many parameters have significant influence on the transferring of force from steel bars to concrete.This research is used to check the influence of bar diameter and embedded length on the pull-out strength of of normal and high strength concrete(HSC). Concrete cylinders were casted for pull out tests, using Grade 40, tar bars of dia $\#3, \#4\ and\ \#5$ and for different embedded length i.e. $12'', 8''\ and\ 4''$. The pullout tests were performed after 28 days curing. Tests results demonstrate that HSC increase the bond strength. Tar bar of #5 cause spliting of concrete cylinders both in normal and HSC. This shows that pullout strength decreases as the bar diameter increases. Also the pull out strength increases with the increased embedded length for Normal and HSC.

Keywords: Concrete, Steel, Bond strength, Stress, Slip

1. Paper Organization

The paper organization is:
1. Paper Organization
2. Introduction
3. Objectives
4. Experimental Program
5. Results and Discussions
6. Conclusions
7. Recommendations
8. References

2. Introduction

Behavior of bond strength of steel bars in reinforced **concrete** (RC) structure has a definite impact on the design of anchorage of steel rebars and their embedded lengths and on the structural ductility. There are several factors that affect the properties of steel-concrete bond which included density of concrete, type of aggregates, strength of concrete, lateral confinement condition, concrete cover, space between two adjacent bars, size of rebar, orientation and location of the rebar, state of stress in both concrete and steel bars. Various research studies have been reported on the significance of

deformity patterns and geometry on bond *(Rehm, 1961; Goto, 1971).* According to Neville and Brooks, Bond in composite materials like reinforced concrete structures usually comes from friction and adhesiveness and is affected by the properties of steel rebars as those of concrete and the reliant movement due to the volume changes, such as shrinkage occurs in concrete. Several attempt were made to recognize the influence of bond strength on comprehensive nature of reinforced concrete members. Though, the knowledge for bond strength of high strength concrete (HSC) is inadequate. Bond is usually the measurement of bond stress at the interface of steel rebar and concrete, along the total embedment of rebars. Cairns (2003) defined that bond stress is the ratio of applied force and reinforcement bar area. The steel rebar area is the total surface area over which this axial force is applied. To establish the integrity of several additive or composite actions of steel rebar and concrete reinforcement, capable bond should be developed between reinforcing bars and the concrete.

 Steel-concrete bond strength is achieved due to the following mechanism.
1. Friction between the ingredients of surrounding hardened concrete and the inserted steel bars.
2. Mechanical interlocking between the Tar bars and concrete.
3. The adhesion of the mix components i.e. steel-to-concrete which is due to the interlocking behavior of cement particles to the embedded steel (Lundgren,. 1999).

 Now a days due to the advancement in the production, application and usage of reinforced concrete have led to the development of High Strength Concrete (HSC). Elfgren and Noghabai [8] and Hamad et al. [4] recorded no precise result about the influence of the reinforcement bar size on its bond strength.

2.1. Normal Strength Concrete (NSC)

The concrete having ingredients i.e. aggregate, cement, water and have 28 days strength less then 6000psi is called normal strength concrete(NSC)   (Shetty,2005). It is also known as normal concrete or normal weight concrete. The setting time of normal strength concrete ranges from 30 - 90 minutes depending upon fineness of cement, moisture in atmosphere etc.

2.2 High Strength Concrete

High strength Concrete is those in which Compressive strength usually greater than 6,000 psi. It is made by reducing the water-cement (W/C) ratio to 0.35 or lower. Aggregate must be chosen precisely for high strength mixes, since weak aggregates may not be able to maintain the loads placed on the concrete member which cause failure in the aggregate.

3. Objectives

As we have been discussed above in the introduction, there are a number of parameters which are involved in terms of bond strength of normal concrete and high strength concrete for different sizes and embedment, and there is a need to study all the variable together. The purpose of this research is to study the bond capacity of normal strength concrete (NSC) and high strength concrete (HSC) from a different relation. The central objectives of this research program are:
- To investigate the bond strength of normal and high strength concrete
- To check the effect of embedment of steel on the bond strength of concrete
- To check the variation in bond strength with the variation in bar size

4. Experimental Program

There are various approaches used to check the bond-slip relationship. We have been performed all the tests on direct pull out apparatus which is a simplest method. The specimens used in the experiment of our recent study were 6 inches diameter and 12 inches height cylinders. The Tar or Twist steel rebar having sizes of 3/8, 4/8 and 5/8 inches were used to check out the bond strength and their stress-slip relation between the reinforcement bars and normal(NSC) and high strength concrete (HSC).

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4.1 Materials

4.1.1 Aggregate

Local fine aggregate was used in this research work. Coarse aggregate was collect from Margalla hills (Islamabad, Pakistan). The physical properties of Fine aggregates and coarse aggregates are shown in
Table 1.

Table 41: Physical Properties of Aggregate

Characteristics	Fine Aggregate	Coarse Aggregate
Type	Normal	Crushed
Specific Gravity	2.54	2.64
Dry Ridded Bulk Density	$148 \, lb/ft^3$	$96.53 \, lb/ft^3$
F.M	2.4	6.75
Absorption %	1	0.10

4.1.2 Steel bars

Tar or Twist bars of 36 inches length was obtained from Peshawar (Pakistan). The properties of Tar reinforcement bars are shown in **Table 2.**

Table 42: Properties of Tar Bar

Type	Dia	Grade	Length 1	Length 2	Length 3
	$\emptyset$ 3	40	32"	28"	24"
Tar bars	$\emptyset$ 4	40	32"	28"	24"
	$\emptyset$ 5	40	32"	28"	24"

4.1.3 Cement

Ordinary Portland cement(OPC) of Type I is used in this research work. **Table 3** and **Table 4** shows the chemical composition and physical properties of Ordinary Portland cement of Type 1 respectively.

Table 43: Chemical Composition of OPC

Constituents	% Contents
CaO	62.18
SiO_2	20.78
Al_2O_3	5.81
Fe_3O_2	2.99
MgO	1.52
LOI	2.31
SO_3	1.89

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Table 44: Physical Properties of Cement

Property	Result
Specific Gravity	3.15
Initial setting time (minutes)	131
Final setting time (minutes)	240
Standard Consistency (%)	31
Fineness by Sieving	4.3 %
Soundness	0.039 in (1mm)

4.1.4 Superplasticizer

Sika viscocrete 3110W was used in HSC to achieve the specified slump range. A dosage of 0.45% by weight of cement was used in this research program.

4.2 Mix proportion of concrete

Concrete mix was prepared with a water cement ratio of 0.50 and 0.35 for NSC and HSC respectively. For the workability of concrete, Slump test were performed, and the slump value with in the range of specified value of 3 inches was found. Concrete cylinder of $6\ inch$ diameter and 12 inches $height$ was properly filled in three layers for 28 days compressive strength of concrete. After 24 hour the cylinders were demolded and then placed for curing at room temperature in curing tank for 28 days.

4.3 Nomenclature of the Test Specimens for Pull-out Test

In this research work, the tar bars for different embedment was properly placed in concrete cylinders. The details of different cylindrical molds with the embedment length for different sizes of rebars are shown in **Table 5.** After 24 hour the cylinders were demolded and then placed in curing tank in such a way that only concrete was completely immerse in water**.**

Table 45: Specimens detail for embedment length

No. of Specimens	Dia of Bar	Embedment length 1	Embedment Length 2	Embedment Length 3
3 per embedment	Ø3	$10.5d_b = 4"$	$21d_b = 8"$	$31.5d_b = 12"$
3 per embedment	Ø4	$8d_b\ \ = 4"$	$16d_b = 8"$	$24d_b = 12"$
3 per embedment	Ø5	$6.4d_b = 4"$	$12.8d_b = 8"$	$19d_b = 12"$

4.4 Tests

Specimen of different sizes of tar bar and for different embedment as shown in **Table 5** were tested after 28 days curing, in Universal testing machine (UTM)**.** The result of pull out load were obtained from the UTM and bond strength was found by using the following formula:

$$f_b = \frac{P}{\pi d l}$$

Where $f_b = Bond\ strength\ of\ concrete,\ \ P = applied\ pul\ out\ load,\ \ d = dia\ of\ bar,$ $l = embedment\ length$ (Ahmed et al, 2007)

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The results of pull out load are shown in **Figure 1, Figure 3** for NSC and HSC and Bond Strength in **Figure 2, Figure 4** for NSC and HSC respectively.
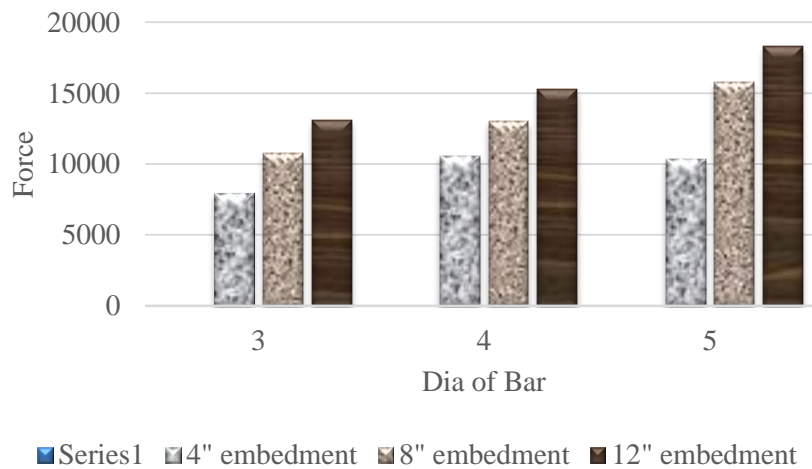
Figure 28: Pull out Loads for Different Dia of Bars and embedment (NSC)
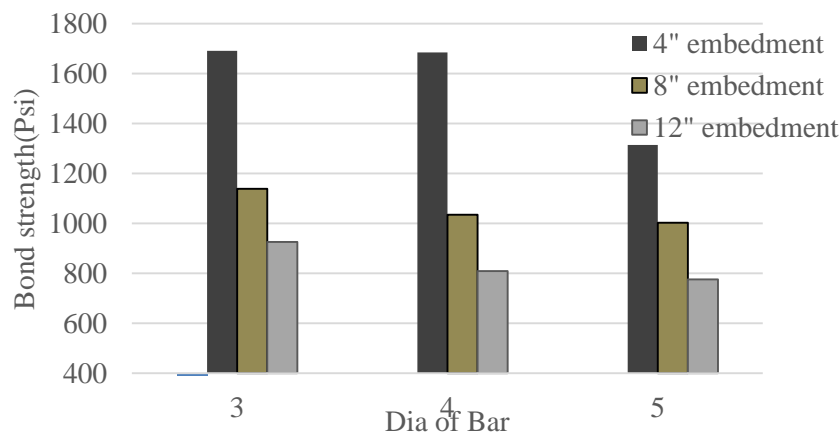
Figure 29: Pull out Strength for Different Dia of Bars and Embedment (NSC)
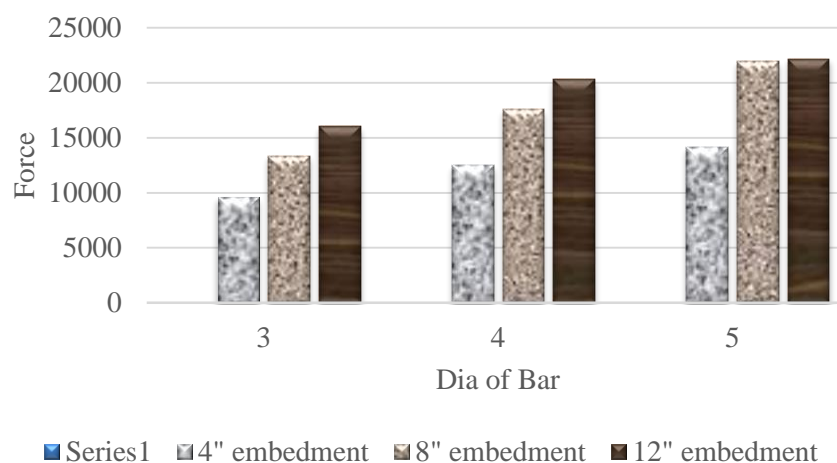
Figure 3: Pull out Loads for Different Dia of Bars and embedment (HSC)

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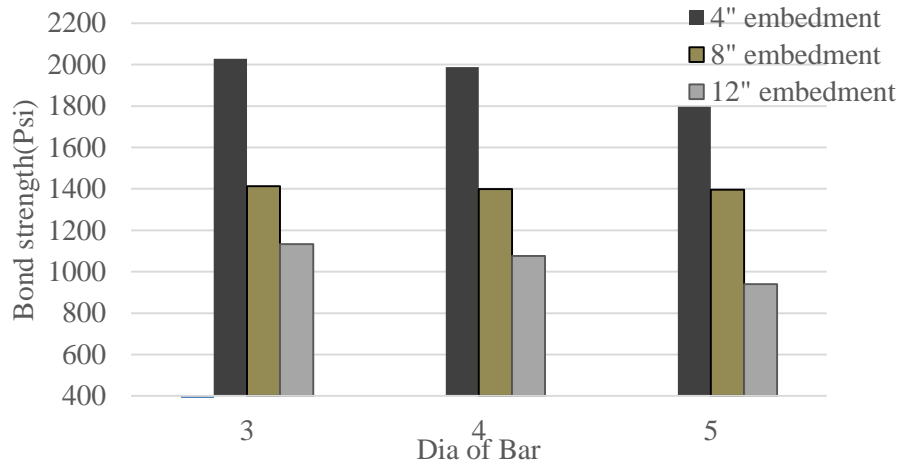
Figure 4: Pull out Strength for Different Dia of Bars and Embedment (HSC)

Table 6: Comparison of Bond Strength of NSC and HSC

Dia of Bar	Type	Grade	Embedment (inches)	Bond Strength NSC (Psi)	Bond Strength HSC (Psi)	% Increase in Bond strength
3	Tar	40	4	1690.22	2028.51	16.68
4	Tar	40	8	1683.93	1987.098	15.26
5	Tar	40	12	1314.17	1796.632	26.85
3	Tar	40	4	1138.53	1413.563	19.46
4	Tar	40	8	1034.43	1399.066	26.06
5	Tar	40	12	1002.45	1395.42	28.16
3	Tar	40	4	925.68	1132.409	18.26
4	Tar	40	8	809.46	1075.558	24.74
5	Tar	40	12	775.81	940.4033	17.50

5. Results and Discussion

Results obtained from the tests shows that the pull out load increases as the embedment and dia of the bar increases but the bond strength decreases as the embedment and dia of bar increases as shown in **Figure 1, Figure 2, Figure 3** and **Figure 4** for both NSC and HSC. Also **Table 6** shown an increase in the range of 15% to 28% for various embedment of HSC.

6. Conclusion

The following conclusions were drawn from this research program:

- The pull out force increase as the dia of bar and embedment of bar in concrete increases for both NSC and HSC.
- The bond strength decreases as the dia of bar and embedment increases in both cases of concrete.
- The HSC gives more bond strength as compared to NSC. An increase in bond strength of 15% to 28% was observed for HSC.
- The stress slip relationship in HSC is more as compared to NSC.

7. Recommendations

The following recommendation were made from this research program:

- HSC should be used for good bond strength of concrete with larger size of bar and with a least embedment of 4 inches.
- For better bond strength in the case of NSC, an embedment of 4 inches for a bar size of 5/8 inches is recommended.
- HSC is preferred over NSC for better bond strength.

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Effect of Wheat Straw Ash on Mechanical Properties of Concrete

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Abstract

An experimental work was carried out to investigate the influence of wheat straw ash (WSA) on the mechanical properties of concrete. The mechanical properties of concrete include Compressive and flexural strength. WSA was used as a partial replacement of cement from 0% to 25% in concrete mixes. Concrete cylinders of $6"$ $diameter\ and$ $12"$ $height$ were casted for compressive strength tests and cured for 3, 7, 14, 28 and 56 days. Also concrete beams of $6" \times 6"$ with a length of 18" were casted for flexural strength. Tests specimens shown approximately equal compressive strength at a level of 10% and 15% WSA for 28 and 56 days respectively. The flexure strength decreases for the increased in WSA contents and shown 6% less strength for 10% WSA.

Keywords: Wheat straw ash, Cement, Flexure strength, Compressive Strength, Concrete.

1. Paper Organization
The paper organization as follow:
1. Paper Organization
2. Introduction
3. Problem Statement
4. Objectives
5. Experimental Work
6. Results and Discussions
7. Conclusions
8. Recommendations
9. References

2. Introduction
Numbers of materials are used to develop new type of concrete in construction industry. Also the vast use of concrete in various projects like buildings, roads, bridges, dames, harbors etc., enhance the manufacturing of cement as well. Production of cement in such large amount not only reduce the resources of beneficial siliceous or siliceous and argillaceous materials but also cause the environmental pollution due to the direct release of large amount of carbon dioxide to the environment. Normally, the manufacturing of one tone of cement release one tone of carbon dioxide directly to the environment (Valdez, 2007). To reduce the manufacturing of cement, researchers works on the use of industrial wastes in concrete. Some of the industrial wastes are Fly ash, silica fume etc. are generally used in mortar and concrete. Also the use of some of the agro

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wastes like Baggas ash, rice husk ash are also used in concrete as partial replacement of cement and concrete. At the growing age, the plants absorbed various minerals from the earth like silicates. The annually grown trees have a maximum amount of silicates. Therefore, sunflower, rice, tobacco and wheat have a maximum percentage of silica contents in the cuticle parts. These silica and other inorganic materials in these plants are found in free salt form (Biricik et al, 1999). The process of burning of organic materials is an exothermic process, due to which the organic materials loss weight and converted to ash. The entire process of burning is called thermal decomposition (James & Rao, 1986). The thermal decomposition of wheat straw ash is carried out at a temperature of $600℃ - 650℃$. The ash produced have pozzolonic properties. Wheat is grown in most areas of Pakistan and all over the world. Generally wheat is considered as an essential diet for many people in Pakistan. Also Pakistan is the largest producer of wheat in the world, i.e. 4th in Asia and 11th in the world. (PAR, 2015). When the seeds are obtained from the wheat plants, the plants (usually cut pieces, called as straw) are used as a fodder in many region and in many areas, these are used as a wheat straw in mud mortar but in some region, these wheat straws are burnt due to unavailability of spaces or of low quality straw. The ash obtained is called as wheat straw ash (WSA). This WSA is used as a pozzolonic material in cement mortar and in concrete.

3. Problem Statement

The manufacturing of cement produce a large amount of carbon dioxide which cause environmental pollution. Also on the other hand, the low quality of wheat straw or due to unavailability of space, the WS is burnt under high temperature, which also cause environmental pollution.

4. Objectives

The main objectives of this research program are:
- To reduce the production of cement as it causes environmental pollution due to release of large amount of carbon dioxide to environment.
- To save the sources of fuel by the least production of cement, as cement production requires huge amount of fuel.
- To use the WSA as a pozzolonic materials in mortar and in concrete as a partial replacement of cement.

5. Experimental Work

5.1 Materials

5.1.1 Cement

Ordinary Portland Cement (OPC) was used in this research program. The chemical composition of OPC is shown in **Table 1** and the physical properties of OPC is shown in **Table 2**. The Bogue's compound of the cement are shown in **Table 3.**

Table 46: Chemical Composition of Cement

Oxide	% Content	ASTM Specification C150
SiO_2	20.78	20% (min)
Al_2O_3	5.201	6.0 (max)
Fe_2O_3	3.18	6.0 (Max)
CaO	60.88	60-67%
Na_2O	0.87	
MgO	3.02	6.0 (Max)
SO_3	1.75	3.0 (Max)
LOI	2.32	3.0 (Max)
IR	0.648	

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Table 47: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	139	C 191
Final setting time (minutes)	241	C 191
Standard Consistency (%)	28.5	C 187
Fineness by Sieving (No. 200 Sieve)	3.6%	C786
Soundness	1mm	C 189

Table 48: Bogue's Compounds

Compounds	% Content
C_3S	45.29
C_2S	26.45
C_2A	11.02
C_4AF	8.89

5.1.2 Wheat Straw Ash

Wheat straw was collected from the locally available source and then was burnt at a temperature of $570°C \sim 600°C$ in an incinerator. The chemical composition and physical properties are shown in **Table 4** and **Table 5** respectively.

Table 4: Chemical Composition of WSA

Oxides	%age
CaO	8.02
SiO_2	51.01
MgO	2.9
Na_2O	0.91
LOI	8.92
SO_3	1.74

Table 5: Physical Properties of WSA

Property	Result
Specific Gravity	2.3 g/cm^3
Color	Light grey
Geometry	Spherical
Fineness by Sieving (retained on Sieve No.200)	9%

5.1.3 Aggregates

The fine aggregates was collected from the local source in Peshawar. The coarse aggregate of size $\frac{1}{2} inch\ down$ in crushed form was obtained from Margalla hills source, Islamabad. The physical properties of fine and coarse aggregates are shown in **Table 6.**

Table 6: Physical Properties of Aggregate

Characteristics	Fine Aggregate	Coarse Aggregate
Type	Normal	Crushed
Specific Gravity	2.51	2.65
Dry Rodded Bulk Density	$144\ lb/ft^3$	$97.61\ lb/ft^3$
F.M	2.31	6.8
Absorption %	1.12	0.25

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5.2 Concrete Mix Proportion

According to ACI recommended practice, the concrete mixes were prepared for the different proportion of WSA as a partial replacement of cement in concrete. WHA of 5%, 10%, 15%, 20% and 25% were used as a partial replacement of cement by weight in these mixes. A w/c ratio of 0.59 for a compressive strength of 2000 psi was used in this research program. The mixture compositions are shown in **Table 7.** Triplets of cylinders were prepared for 7, 14 and 28 days from all the percentages. These specimens were prepared and removed from the cylinders after 24 hours and placed in water for the specified period of curing. Also beam of dimensions 6″ × 6″ × 18″ were casted according to ASTM C-78 and were cured for 28 days. The beam specimens were prepared for the purpose to investigate the effect of WSA on the flexural strength of concrete.

Table 6: Mix proportion of WSA (Kg/ft³)

WSA %ages	Cement ($\frac{Kg}{ft^3}$)	Fly Ash ($\frac{Kg}{ft^3}$)	F.A ($\frac{Kg}{ft^3}$)	C. Aggregate ($\frac{Kg}{ft^3}$)	Water ($\frac{Kg}{ft^3}$)	W/B
0	8.65	-	17	34.61	5.19	0.59
5	8.22	0.43	17	34.61	5.19	0.59
10	7.79	0.87	17	34.61	5.19	0.59
15	7.35	1.30	17	34.61	5.19	0.59
20	6.92	1.73	17	34.61	5.19	0.59
25	6.06	2.60	17	34.61	5.19	0.59

5.3 Tests

Tests were performed to evaluate the properties of Wheats straw ash in concrete.

6. Results and Discussions

6.1 Compressive strength

The compressive strength tests were carried out after the specified period of curing. The results are shown in **Table 8** and plotted in **Figure 1.** The results shown that the compressive strength for all the percentages of WSA increases as the time passes. The compressive strength increases up-to 15 % replacement of WSA in concrete. At later ages, i.e. at 56 days, the compressive strength increases linearly as shown in **Table 8** and **Figure 1**.

Table 8: Compressive Strength for various %ages of WSA

%age of WSA	3 days strength (Psi)	7 days strength in Psi	14 days strength (Psi)	28 days strength (Psi)	56 days compressive strength (Psi)
0%	1039	1598.67	1856	2038.67	2445
5%	1008	1485.33	1784	1968.67	2355
10%	981	1408.33	1776	1856.02	2238
15%	932	1322.67	1695	1752.96	2100
20%	891	1171.74	1602	1554.49	1840
25%	833	1072.62	1388	1323.11	1506

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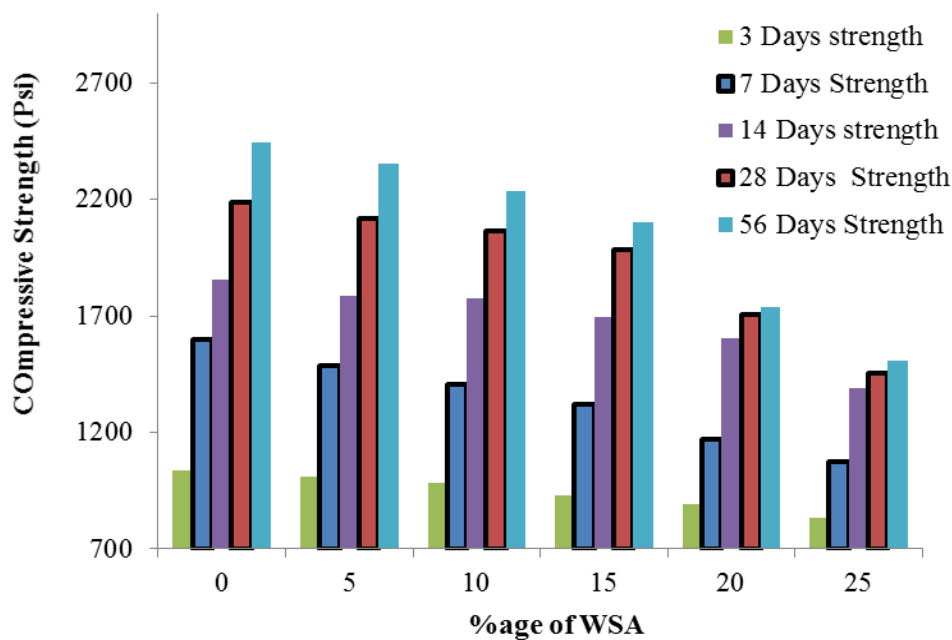
Figure 30: Compressive Strength for various %ages of WSA

6.2 Flexural Strength

The flexural strength test were performed on the beam specimens for all the percentages of WSA in concrete. The results are shown in **Figure 2** indicate that flexural strength decreases as the percentages of WSA increases. At 10% WSA, the flexural strength decrease up-to 6%.
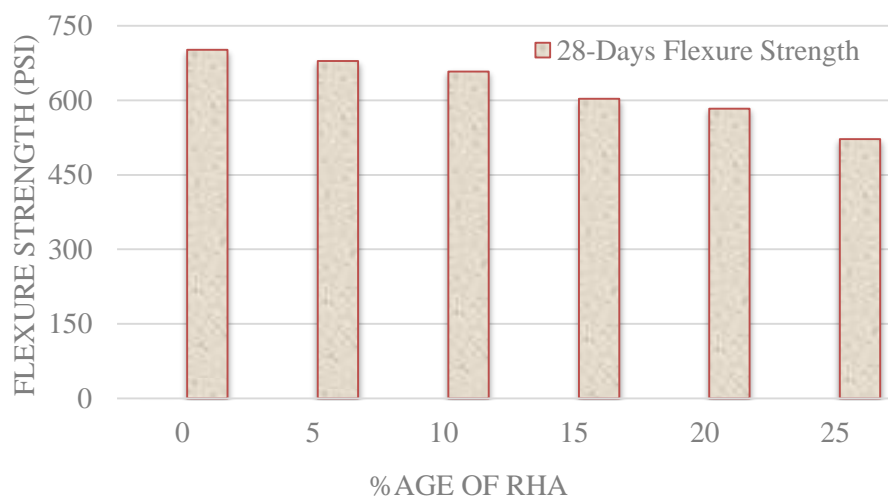
Figure 2: Flexural Strength for various %ages of WSA

7. Conclusions

The following conclusions were drawn from this experimental program:

- The WSA content up-to 15% replacement gives approximately equal compressive strength to the designed value of compressive strength (i.e. 2000 psi in this research program).
- The flexural strength decreases as the percentages of WSA increases in the mixes. The WSA content of 10% gives 6% less flexural strength to that of Control mix.

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8. Recommendations

10 -15% WSA content is recommended for the compressive strength of concrete.

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Use of Overburnt Brick in Asphalt Pavement

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Abstract

Asphalt pavement comprises of about 95% aggregates. A large amount of quarried aggregates frequently used in construction of highways causing significant losses of energy and environment. The use of wastes like over burnt bricks (OBB) as aggregates in asphalt pavements might sluggish down the harmful effects on the environment. In this experimental program, OBB obtained from brick kilns as a waste material were used in asphalt pavements. Different tests like Aggregate impact value, Loss Angeles abrasion and Marshal Stability flow tests were conducted on these OBB aggregates. Tests results revealed that physical properties OBB aggregates are within the standard limitations of pavements and can be used in light to medium trafficked asphalt pavements.

Keywords: Aggregates, Over Burnt Bricks, Brick Kiln, Pavement, Asphalt.

1. Introduction

Use of coarse aggregate in most of the engineering structures like roads, buildings, dams, bridges etc. increase the demand of it. According to White (1992), about 90% of aggregates like are used in Asphalt Cement (AC) mix and in flexible pavement, aggregates not only used in the wearing layers but the entire foundation of the road is aggregates. An approximate amount of 12500 ton per kilometer of virgin aggregates are consumed in pavements construction. (Zoorop and Suparma, 2000). Also, good quality coarse aggregate become infrequent. Presently, the natural resources turned out to be decreases with the development of industrial production. Also, the industrial wastes and byproduct makes a big hazard to the environmental pollution. Researchers all over the world focus on the matter that how these industrial wastes can be utilized for beneficial purposes and how the environmental pollution can be reduced. Some industrial products like Fly ash, waste glass powder, waste plastic bottles, Rice husk ash etc. are now a days introduced in cement, bricks and concrete to enhance the engineering properties of the construction materials.

On the other hand, the over burnt bricks are also rejected in building construction due to its irregularities and bad shape. Therefore such type of over burnt bricks are dumped in open areas near the brick kilns. These over burnt material cannot be disposed of like the ordinary ash. So engineer start works on these waste materials as a coarse aggregate in construction industry. Many researches has been carried out on the use of over burnt bricks as a partial replacement of coarse aggregate in concrete and the results proven that these materials can improve the engineering properties of concrete. In Pakistan, about 15 billion bricks are produced annually according to SAARC energy report (2013). Many of these bricks are over burnt due to high temperature in the

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kiln. In this research program, an effort is made to use over burnt bricks aggregates in roads layers as a partial or fully replacement of coarse aggregates. This technique will enhance the development of ideas about over burnt to be used where the coarse aggregate are uneconomical.

2. Problem Statement

Solid waste increased day by day due to unavailability of knowledge of its proper handling. Over burnt bricks are normally dumped at the adjacent areas of the brick kiln. Such waste materials consumed space in any congested or low space kiln.

3. Objectives of the Research Program

Main objectives of the research works are:
- To use the over burnt bricks aggregates in road
- To utilize the industrial wastes in construction industry
- To minimize the use of natural resources
- To compare the results of natural aggregates with the over burnt brick aggregates in asphaltic road

4. Materials and Methods

4.1 Aggregates

Two types of aggregates were used in this research program

4.1.1 Coarse aggregate (Natural)

Locally available coarse aggregates were used in this research program. The physical properties of coarse aggregates are shown in **Table 1.**

Table 49: Physical Properties of Aggregates

Fraction	Specific gravities		Absorption %	ASTM Standards
	Apparent	Bulk		
Coarse Aggregate	2.78	2.71	1.01	ASTM C127
Over burnt Bricks (Peshawar)	1.97	1.98	2.204	ASTM D 2041
Over burnt Bricks (Matani)	2.01	2.12	1.87	ASTM D 2041

4.1.2 Over Burnt Bricks

Over burnt bricks were collected from Peshawar and nearby area Matani, where most of the bricks kiln available.

4.1.3 Asphalt

The Grade 60/70 bitumen is used (ASTM D946). The specific properties of the bitumen is presented in **Table 2.**

Table 50: Properties of Asphalt Cement

Properties		ASTM Standards
Source	Peshawar	
Specific gravity	1.60	ASTM D 70
Loss on heating (%)	2	ASTM D 6
Softening Point (℃)	72℃	ASTM D 36
Flash Point (℃)	180℃	ASTM D 92
Penetration Grade	60/70	
Fire Point	187℃	

4.2 Experimental Work

This section include the following tests:

4.1.1 Aggregate test

Gradation tests and specific gravity tests were performed on aggregate. **Table 3** presented the design gradation limits for hot mix of asphalt. **Table 1** show the results of specific gravity.

4.1.2 Loss Angles Abrasion test

Loss angles abrasion test is used to measure the deterioration of aggregates. The Loss Angles Abrasion values are shown in **Table 3**. The obtained values shows that the obtained data is within the limitation.

Table 51: Tests for Properties of Aggregates

Source	Loss Angles Abrasion value (%)	Aggregate Impact Value (%)	Flakiness Index value (%)
Natural Aggregates	12.62 %	10.26%	7.2%
Over burnt Bricks (Peshawar)	20.52%	18.54%	4.56%
Over burnt Bricks (Matani)	17.20%	16.21%	3.20%

4.1.3 Aggregate Impact value test (ASTM D5874)

The ability of aggregates to resist shock and impact are calculated by Aggregate impact value test. Aggregates passed through sieve no. $3/8''to\ 5/8''$ Sieve used in this test. The mould of the test apparatus is filled from the aggregates passed through $3/8''to\ 5/8''$ sieve. The aggregates are filled to the test mould and tested to the standard method accordingly. The impact value of natural aggregates and over burnt bricks aggregates are presented in **Table 3.**

4.1.4 Flakiness index test

Flakiness index tests is used to determine the proportion of flaky particles. Flaky particles have thickness less than 0.6 time the proper aggregates (nominal aggregates). To determine the flaky particles, special sieves with slots for flaky particles are used. Flakiness index is the proportion of weight of flaky particles to the bulk weight of aggregates. The flaky particles percentage can be obtained by:

$$\frac{M_2 \times 100}{M_1}$$

$M_1 = Bulk\ weight\ of\ aggregate$
$M_2 = Weight\ of\ flaky\ particles$

The flakiness index of aggregates and over burnt bricks are shown in **Table 3.** The flakiness index value of used aggregates are within the standard limitations.

4.2 Marshal Mix Design

Marshal Mix design was used to determine the optimum Asphalt cement. To find the optimum content, an increase of 0.5% was used for tests. For each asphalt cement contents, different asphalt cement concrete specimens were prepared in sequence. All the specimens were heated to a temperature of $60℃$, then specimens are placed in special tests head and load is applied at a constant rate of 2in/minutes. For stability determination, the vertical deformation in the specified specimen was measured through dial gauge. At the point of load failure, the obtained value of

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deformation was recorded in unit of 0.25 mm. this obtained value is called Marshal Flow value. Test were repeated till the optimum value for the normal and over burnt aggregate was determined.
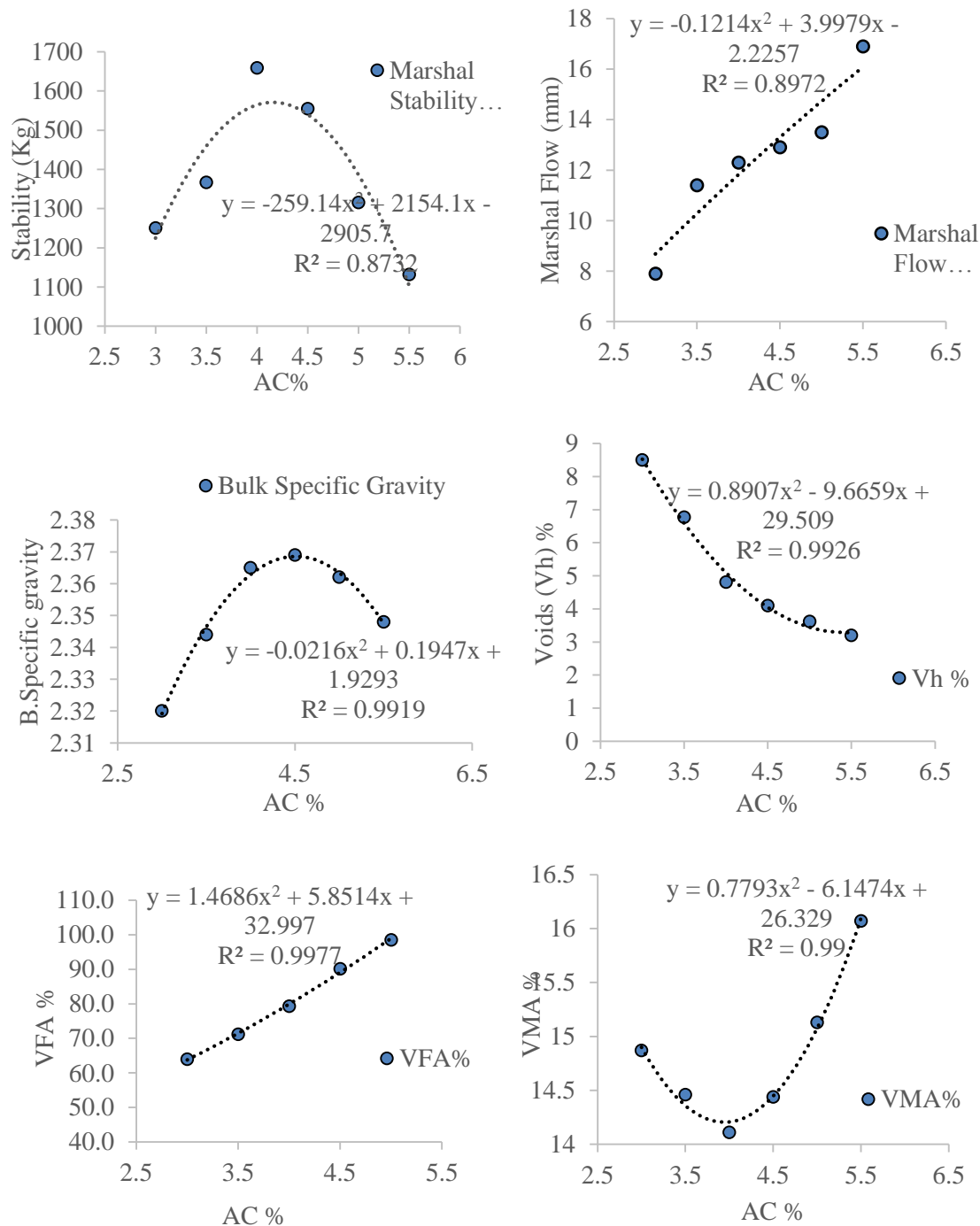
Figure 31: Marshal Mix Design Value for Natural Aggregate

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ISBN No: 978-969-23044-2-9
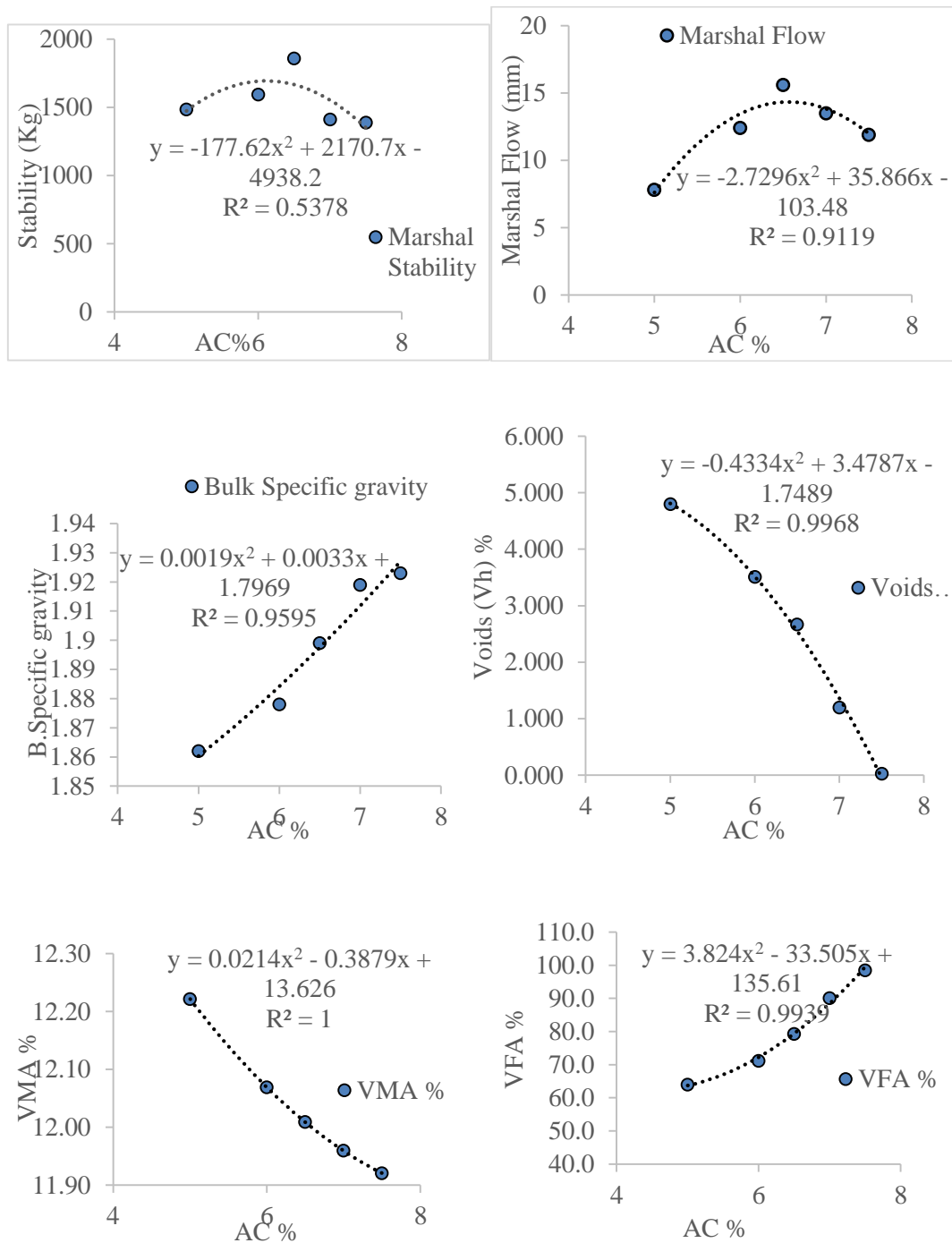
Figure 32: Marshal Mix Design Value for OBB Peshawar

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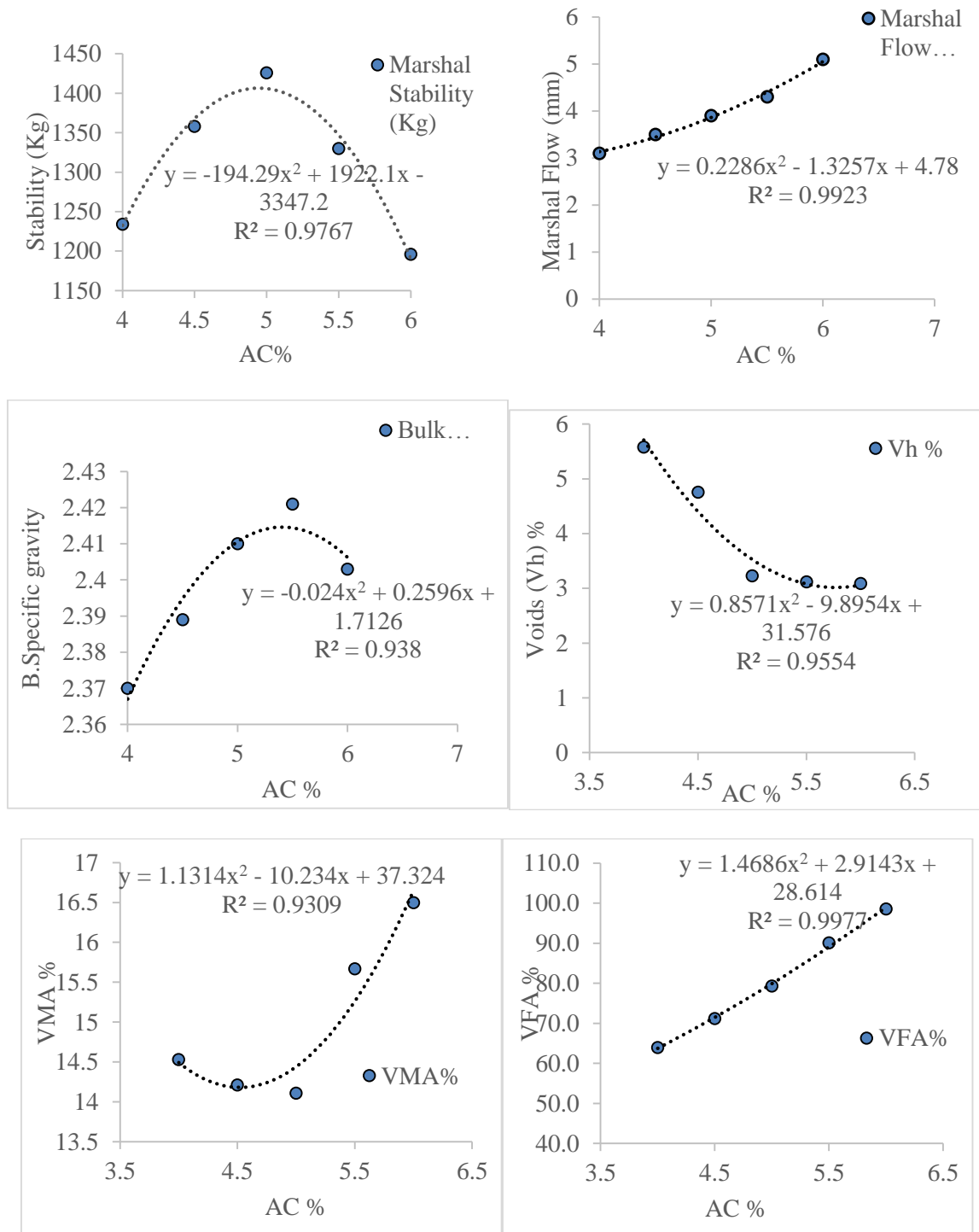
Figure 33: Marshal Mix Design Value for OBB Matani

5. Conclusion

In this research work, a comparative study was performed on over burnt bricks were compared with the control aggregates. To compare these aggregates, all the necessary tests of pavement aggregates and the tests of Marshal Stability was performed. The following conclusions were drawn from the research work.

- The coarse aggregate of wearing course should have better response to wear and tear in roads, so they must be of best quality. According to Los Angles Abrasion

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(LAA) test, the OBB of Matani have a LAA value of 17.20% and that of OBB Peshawar is 20.52% which is within the specification limits of standards.

- The aggregate impact value of OBB Peshawar was 18.54% and OBB Matani was 16.21% which is within the limitation. The best quality aggregates have an average aggregate impact value of lower than 18% (Akbulut & Gürer, 2007).
- Form the Marshal Mix Design tests, it was observed that the stability value of OBB Peshawar was much higher than the Natural aggregate. The high stability value and high flow value of OBB Peshawar makes a brittle asphalt concrete, which decrease the durability. The relationship of Stability and flow is shown in **Figure 1.**
- The optimum value of Asphalt content of OBB Matani was near to the natural aggregates value.

6. Recommendations

From the different tests of aggregates, OBB of various sources of Peshawar and from their Marshal Mix Design, the following recommendations were made;

- OBB of Peshawar may be used in the inferior layers of roads because it is economically expensive due to its higher stability in wearing course but it can be used in light trafficked to medium trafficked asphalt courses.
- OBB of Matani as recommended for wearing course because it have less LAA values, stability in limitations and less value of Marshal flow.

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Effect of Aggregates Grain Size on Modulus of Elasticity of Concrete

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Abstract

In experimental work was performed on ordinary concrete to check the modulus of elasticity by using different sizes of fine and coarse aggregates generally used in Peshawar, with a w/c ratio of 0.55. Concrete cylinders of diameter $6"\ and\ height\ 12"$ were casted and cured for 28 days for all six types of aggregates (three fine and three course from different sources). Uniaxial loading tests were performed on cylindrical specimens after curing to obtain $stress\ (\sigma) - strain(\varepsilon)\ curve$ and to find the static modulus of elasticity. The analysis of $\sigma - \varepsilon\ curve$ shown that aggregates grain size have significant effect on the static modulus of elasticity of concrete.

Keywords: Aggregate, Concrete, Stress, Strain, Modulus of elasticity

1. Paper Organization

The paper is organized in the following sequence:
1. Paper organization
2. Introduction
3. Objectives
4. Experimental Work
5. Results
6. Discussions
7. Conclusions
8. Recommendations
9. References

2. Introduction

Use of concrete as a construction material worldwide in the construction industry has not alleviate the engineers from further research on this composite material. The research question I, "which factor is essential to contribute to the properties of this composite material? (Neville, 1973). The heterogeneity and non-linear behavior of the concrete under load makes it a very challenging issues for engineers to estimate the effect of the ingredients on the fresh and hardened properties of concrete. Four phases of hardened concrete can be illustrated as:
- Aggregate grain size, the non-reactive constituents of concrete

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- Cement particles, a reactive component of concrete, contribute in gel formation
- Water, used in micro pore filling
- Water, used as a hydrated components for concrete(Bochenek & Prokopski 1989)

Concrete with high Young's modulus and low deformation can be obtained by designing a dense concrete mix. Such concrete have low porosity and specific gravity. Mix with high content of cement increase the strength. Increase in the size of aggregates have significant effect on the disturbing of homogeneity of concrete mix. To measure the resistance of concrete materials to axial deformation, modulus of elasticity of the concrete is determined. The value of modulus of elasticity can be obtained from the stress-strain curve of concrete in elastic region. The $\sigma - \varepsilon$ curve in **Figure 1** shows the behavior of hardened cement paste, concrete and aggregates. This curve revealed that unlike cement paste and aggregates, concrete have non-linear elastic behavior (Malešev et al,2014).
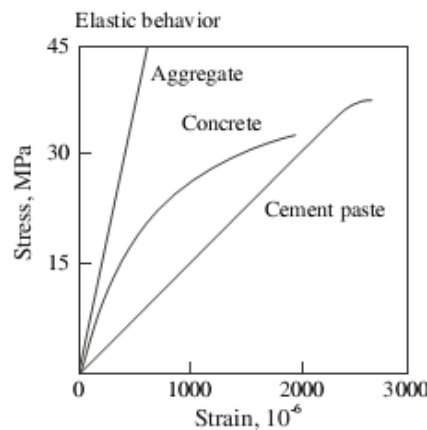
Figure 34: Typical Stress-strain relationship of Cement paste, Concrete and Aggregate
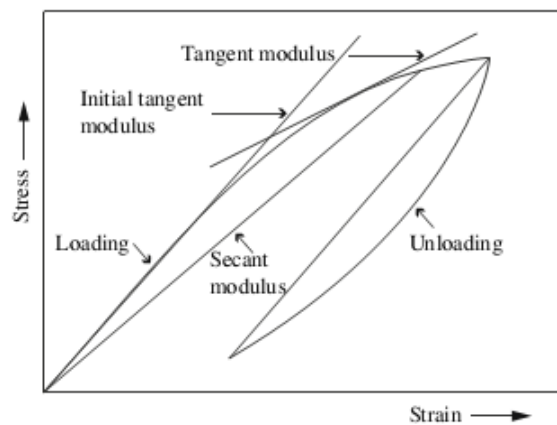
Figure 35: Stress-Strain Curve

The $\sigma - \varepsilon$ curve for concrete is shown in **Figure 2** under uniaxial loading. The static modulus of elasticity is determined from this $\sigma - \varepsilon$ curve. Due to non-linear behavior of concrete, it have two type of elastic modulus, the secant modulus and tangent modulus of elasticity (Malešev et al,2014). It is clear from **Figure 2,** the secant modulus is represented with a straight line originating from the origin of the $\sigma - \varepsilon$ curve and meet the curve at the point where stress become constant and strain increases (i.e. at the end of straight stress-strain relationship), whereas the secant modulus is the slope of a line started at the point on the $\sigma - \varepsilon$ curve where the line of secant modulus ends. The $\sigma - \varepsilon$ curve is approximately linearly elastic within the range of $0.3\ to 0.5$ times the compressive strength of concrete (Malešev et al,2014). For this linear region, the following expression can be used.

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$$E = \frac{\sigma}{\varepsilon}$$

The modulus of elasticity is determined through a general compression test of concrete specimens, like cylinder or cubes.

3. Objectives

The main objectives of this research program are:

- To determine the static modulus of elasticity of concrete for different sources of fine and coarse aggregates.
- To investigate the effect of grain size on the modulus of elasticity of concrete

4. Experimental Work

The materials and methods used in research program is described below.

4.1 Materials

4.1.1 Cement

Ordinary Portland cement (OPC) of Type-III according to ASTM C 150 was used in this research program. The chemical composition and physical properties of are shown in **Table 1** and **Table 2.**

Table 52: Chemical Composition of Cement

Oxide	% Content	ASTM Specification C150
SiO_2	20.78	20% (min)
Al_2O_3	5.201	6.0 (max)
Fe_2O_3	3.18	6.0 (Max)
CaO	60.88	60-67%
Na_2O	0.87	
MgO	3.02	6.0 (Max)
SO_3	1.75	3.0 (Max)
LOI	2.32	3.0 (Max)
IR	0.648	

Table 53: Physical Properties of Cement

Property	Result	ASTM Standards
Specific Gravity	3.15	C 77
Initial setting time (minutes)	139	C 191
Final setting time (minutes)	241	C 191
Standard Consistency (%)	28.5	C 187
Fineness by Sieving (No. 200 Sieve)	3.6%	C786
Soundness	1mm	C 189

4.1.2 Fine Aggregates

Fine aggregates was obtained from three different sources locally used in construction industry of Peshawar (Pakistan). These sources are Nizampur, Hesko and Lawrence pure. The physical properties of Fine aggregates are shown in **Table 3.**

Table 54: Physical Properties of Fine Aggregate

Properties	Nizampur	Lawrence pure	Hesko
Fineness Modulus	2.3	2.54	1.75
Moisture Content	2.12%	1.25%	3.5%
Absorption	1.12%	0.89%	1.78%

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4.1.3 Coarse Aggregates

Coarse aggregate of three sources was used in this research work. The physical properties of coarse aggregates are shown in **Table 4.**

Table 55: Physical Properties of Coarse Aggregate

Properties	Basaie	Margalla	Bahader Kaley
Fineness Modulus	3.75	2.87	2.92
Moisture Content	0.5 %	0 %	0.62%
Absorption	1.03%	0.23 %	0.97 %

4.2 Concrete Mixture and proportioning

A normal concrete with a ratio of 1:2:4 was used in this research with a w/c=0.50. As this ratio was generally used in the construction industry of Peshawar (KPK) for all type of aggregates. Concrete mixes were prepared for different fine aggregates with different coarse aggregates with the same ratio for the purpose to check the effect of various aggregates sizes on the modulus of elasticity of concrete. Different IDs were given to different mixes. The list of IDs are given in **Table 5.**

Table 56: Representation of Different mixes with IDs

Mix ID	Source of Fine Aggregate	Source of Coarse Aggregate
A	Nizampur	Bahader Kaley
B	Nizampur	Basaie
C	Nizampur	Margalla
D	Heshko	Bahader Kaley
E	Heshko	Basaie
F	Heshko	Margalla
G	Lawrencepur	Bahader Kaley
H	Lawrencepur	Basaie
I	Lawrencepur	Margalla

Triplet cylinders were casted from all these mixes independently for 28 days. All the cylinders were properly cured for 28 days at room temperature.

4.3 Tests

After the complete curing, triplets of cylinder were tested for stress-strain observation. Compressive load were applied on cylinders and the stress- strain curve was plotted.

5. Results

Stress strain results were obtained from the compressive loading of the tests for all mixes. The stress-strain curve for all mixes as shown in **Figure 3**. Modulus of elasticity was determined from the results of stress strain curve. The modulus of elasticity was then calculated from the following equation.

$$E = \frac{\sigma_0 - \sigma_u}{\varepsilon_0 - \varepsilon_u}$$

Where σ_0 and ε_0 represent the stress and strain at upper loading level and σ_u and ε_u represent the loading at lower loading level.

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A

$y = -58623x^2 + 5355.2x - 110.49$
$R^2 = 0.9585$

B

$y = -37120x^2 + 3337.3x - 61.724$
$R^2 = 0.9805$

C $y = -324428x^2 + 21572x - 347.11$
$R^2 = 0.8651$

D $y = -174964x^2 + 12692x - 223.83$
$R^2 = 0.9796$

E

$y = -230325x^2 + 9733.7x - 92.747$
$R^2 = 0.9374$

F

$y = -169854x^2 + 11668x - 189.85$
$R^2 = 0.804$

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G

$$y = -114425x^2 + 7745.8x - 121.88$$
$$R^2 = 0.9646$$

H

$$y = -247538x^2 + 10408x - 99.22$$
$$R^2 = 0.9375$$

I

$$y = -264762x^2 + 17645x - 283.38$$
$$R^2 = 0.8748$$

Figure 36: Stress Strain Curve for Mix A, B, C, D, E, F, G, H and I

Modulus of Elasticity
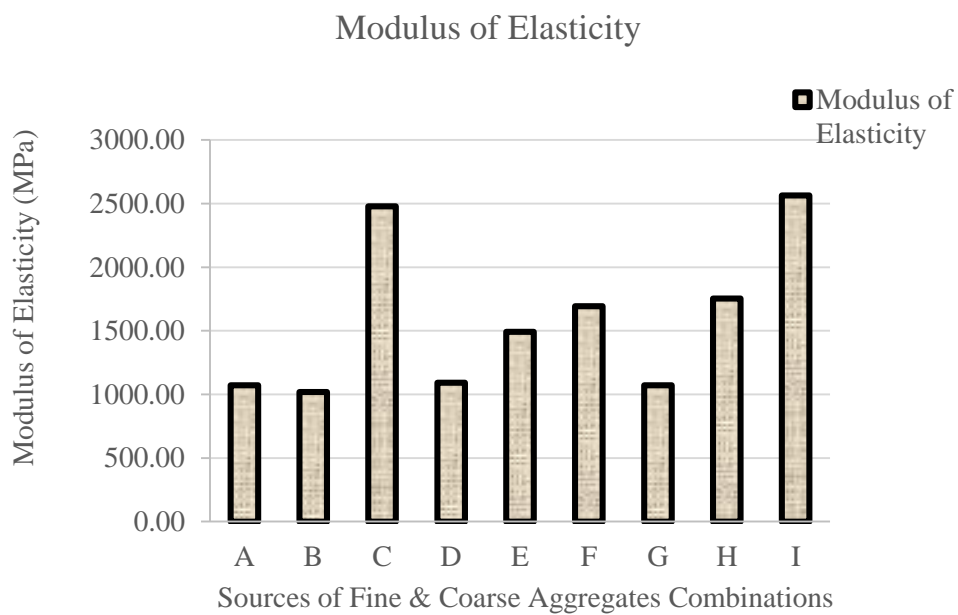
Figure 37: Modulus of Elasticity for Various Sources of Aggregates

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6. Discussions

6.1 Modulus of Elasticity

The modulus of elasticity of concrete depends upon the following:

6.1.1 Type of aggregates

Type of aggregates have a significant role in the modulus of elasticity of concrete. The concrete gives maximum resistance to the applied load, when all the constituents of concrete have a solid unit mass. When well graded and angular aggregates are used in concrete, it will gives excellent results as shown in the case of **mix C** and **I** in **Figure 4** as in these cases, the aggregates are quarried from the source and then crushed. On the other hand, the concrete with more circular or flaky aggregates have less value of modulus of elasticity as in case of mix **A, B, D and G** and up-to some extent in mix **E and H in Figure 4,** as in these cases, the aggregates were queried from the source.

6.1.2 Size of Aggregates

Finer aggregates gives less strength as compared to coarser one. The fine aggregates have high surface areas and hence required more water for proper workability. **Mix D, E and F in Figure 4** gives a lower modulus of elasticity due to much finer particles of fine aggregates and with a w/c of 0.5, which was not sufficient for the perfect workability of **mix D,E and F.**

6.1.3 Stress Strain Curve

The stress strain curve for all type of mixes are shown in **Figure 3 (A, B, C, D, E, F, G, H and I).** Concrete specimens with well graded, crushed coarser aggregates and with not too finer aggregates gives better stress strain curve as shown in **Figure C and I** and hence better modulus of elasticity.

7. Conclusion

The following conclusions were drawn from this research study:
- Well graded aggregate gives better results for modulus of elasticity.
- Finer aggregates increase the water demand and decline the stress-strain curve and hence decrease the modulus of elasticity of concrete.
- Crushed type of aggregate produced excellent concrete mass and hence increase the modulus of elasticity as shown in Figure 3 (C & I).
- Spherical or flaky aggregates directly obtained from quarries when used in concrete, increase the workability but decrease the bearing ability against applied loadings.

8. Recommendations

The following recommendations are made from this research program;
- A general ratio of 1:2:4 with a w/c ratio is used generally in Peshawar to get better result is not applicable to all type of aggregates. Only Mix C and I are recommended for good results.
- Increase W/C ratio should be used for finer aggregates in concrete.
- Circular/ spherical and flaky particles should be avoided in concrete of higher strength as these aggregates decline the stress strain curve.

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- Well graded fine and coarse aggregates should be used to gain best results for modulus of elasticity.
- More fine aggregates only recommended in concrete with increase w/c ratio.

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Survey on Driving Behaviour and Motivational Factors Causing Agressive Driving: A Case Study of Peshawar, Pakistan

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Abstract

Peshawar is experiencing an upsurge in traffic related accidents due to an extensive transformation into a city of mobbing, traffic queues, road rage and other traffic related setbacks. This state of mismanagement is owed to several factors, among those driver behavior is one of the most imperative subjects to discuss. Studies on driving behavior are of great assistance for diverse tasks in transportation engineering. This paper endeavors to present a broad insight in to current driving trends and behaviors that are practiced locally. A large survey is conducted through pen-paper DBQs (Driving Behavior Questionnaires) on several spots in the city and driver behavior is observed. Surveys are statistically analyzed and info-graphics are presented based on data collected through 350 DBQs. Drivers are clustered into several groups designating their sex, age, driving experience, valid license , education and income etc. Spot speed studies of raged drivers are observed through Speed Radar Gun on highways and arterials to investigate the proportion of over speeding vehicles. In addition, the paper suggests effective measures for the concerned authorities to take in order to drop traffic crashes due to aggressive driving.

Keywords

Road Safety, Transportation Engineering, Driving Behavior, Data Collection, Intelligent Transportation System, Accident Analysis and Prevention.

1. Introduction

The global elevation in the frequency of road crashes has become a distressing and growing concern in recent times. Road crashes cause 1.24 million avoidable fatalities and between 20 and 50 million injuries annually (WHO, 2013). Previous studies have suggested that driver behavior is a prominent factor in more than 90 percent of crashes (Adrian *et al.,* 2015). Similarly, errors related to drivers also trigger vehicle accidents. Driver behavior is associated with driver's nature and socio-economic background. It is one of the components of human factors in driving and is also named as the ''driving style'' that is mostly affected by motives, attitudes and personality traits (Elander et al., 1993). Drivers frequently involve in behaviors that cause a hazard to both themselves and to on-road users. Several of these unsafe actions are a result of errors owing to paucity in experience,

transitory mistakes, momentary slipups or inattention, deliberate actions or not, both disregard to rules and weakness of memory, judgmental faults, or situational awareness that substantially contribute in traffic collisions. Yet, this behavior may be improved through education, publicity campaigns, awareness, training and traffic police enforcement. Consequently, comprehending as well as improvement in driver behavior plays a key role in the improvement of road safety. A major setback in presenting the relations between drivers' character and their driving behavior is the paucity in steadfast and reliable tools that can collect exhaustive information comprehensively concerning individuals. For instance, the level of skill and driving faculties and to supervise and interpret their driving behavior, as captured for example by acceleration and spot speed studies across both time and space. There is an imperative advantage in spotting drivers who involve in hazardous driving practices, causing a risk of involvement in a crash for not only themselves but to other on-road users as well. The majority of crashes have been attributed to either one or a blend of driver, road, vehicle and environmental factors. Studies in diverse countries have proven that, 90% of all crashes are owed to road user behavior characteristics (Bener et al., 2008). However, decent driving behavior demonstrated by drivers could have a flow effect to recover the overall safety on roads. This necessitates drivers to comply with the standard norms and regulations in driving. Correspondingly, it may be a requisite for drivers to abstain from unsafe driving behavior (hard acceleration and braking). It shall be noted that unsafe driving is a component of human behavior in the context of driving. Its repercussions on roads can be devastating, with extreme cases leading to damage to properties, injuries and deaths. A relevant studies on why society is complex was performed by Ball (2012) which signified that, one cannot tell how big any particular conflict will become. In the context of safety, one cannot also tell how somber unsafe driving behavior could mark minor or major damages. Each road accident could be a result of unsafe driving behavior. With recorded DBQ surveys, enforcement records and speeding studies employing speed radar guns, a simple measure is typically computed from each observation. Certainly, achievement of road safety hinges on driver attitudes and behaviors in controlling the vehicle on roads.

2. Background

Peshawar stands as the capital city of Khyber Pakhtunkhwa, the North-Western province of Pakistan. The subject is currently witnessing an intense elevation in congestion, raged driving and traffic associated problems owing to growing number of vehicles coupled with lack of expansion in the existing road network and effective traffic management. During 1998-2009, the proportion of elevation in number of vehicles was 126.4 % whereas that of road network expansion was only 0.85 %. The vital cause of exponential increase in the number of vehicles is private cars, which constitute 75.35 % of the total registered vehicles and has shown 228.98 % increase during 1998-2009 (Zulfiqar *et al.,* 2012). In addition, the excessive number of road-blockages with New Jersey barriers and check posts created by the security personnel in the wake of intimidating terrorism in the region is yet another root cause of aggressive driving behavior. These factors have caused occurrence of raged driving trends and a surge in the frequency of vehicle crashes in the city. Nevertheless, there is no establishment of a responsible institution or a regulatory body to promote road safety particularly on monitoring driver behaviors and reporting aggressive driving keeping in view that largely 90 % of RTAs are caused by human behaviors and 65 % are attributed to speeding and overtaking violations, acting as major aspects contributing highly in more than 90 percent of road crashes. (Adrian *et al.,* 2015).

3. Literature Review

A good deal of research has been pursued lately that observes that driving behavior is significantly dependent on drivers' perceptions, traits and self-estimation. Research conducted in this filed is usually centered on responses to self-reporting questionnaires, where drivers are probed to assess their driving trends, behaviors and acuity, for instance risk taking and law-compliance, as well as report their preceding safety record (e.g. crashes, criminal offends) (Daly *at el,*. 2014). This study possess several imperative benefits. Primarily, it can be applied to gather varied data that conserves time and money. Consequently, this method has been executed widely for many applications, including the study of raged driving (Parker *et al.*, 1998), driving under influence such as alcohol,

narcotics and drugs, socio-economic characteristics that affect driver behavior and more. At present, considerable research effort has been done to monitor driver behavior so as to acquire desirable road safety. The literature appraises the use of self-reported questionnaires (SRQs) that helps to indicate driver behavior. However, they are discerned to hold biases caused by the respondents' propensity to misjudge their driving abilities since drivers mostly underestimate their inaccuracies and slipups.

In-Vehicle data recording systems (IVDR) are seen as a new and state-of-the-art source of recording accurate and comprehensive data on driving behavior. They are an easy, yet effective way to record varied data on driving trends. However, thus far they are not available in Pakistan and Peshawar in particular. The original research was conducted by (Reason *et al.,* 1990) in which a sample containing over 500 drivers with at least 20 years of age were observed. Three major factors are witnessed in aforementioned research that held 33 % of variance in responses; these responses are labelled as violations, errors and lapses. Violations are believed to be "intentional deviations from those acts that are imperative to maintain a safe operation of a possibly hazardous system". In the same vein, violations can be described as the defiance of a law or socially prevalent code of behavior. Over speeding and driving under influence are the common examples of traffic violations. On the contrary, errors are explained as "the failure of intentional actions to achieve their planned consequences". Errors are divided into mistakes, slips/lapses, both of which are unintentional deviations of action from intention. Slips are considered as those actions that were not planned (for instance switching on left turn signal while turning right or turn on the wipers instead of headlights) whereas, lapses are associated with glitches/failure in memory (for instance, locking key inside the vehicle etc.). Mistakes are considered as judgmental faults or defective decision-making (for instance, misjudging the speed of an approaching vehicle or misconstruing car following during night hours). Since the creation of DBQs by (Reason et al, 1995), they have been amended, improved and upgraded for representing a diverse range of environments and populations. In the present studies conducted on driving behavior in Peshawar, the DBQ is amended to meet local driving trends by incorporating a well-built sample of driving behaviors (N=350) and by updating test items to be suitable for those population of drivers that hail from Peshawar.
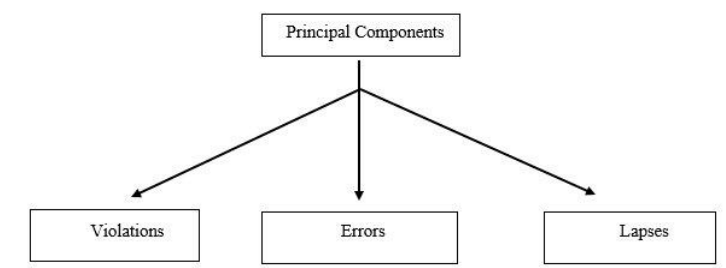
Figure 1: Principle components of responses

4. Methodology

A total of 350 pen paper DBQs were distributed and responses were recorded. In these DBQs, 47 particulars were taken for insertion. (Parker et al., 1995; Parker et al., 2000; Reason et al., 1990). In these particulars, items that showed complacency to driving tendencies in Peshawar were taken and some were retained that didn't comply with local conditions. Few among these particulars were modified to guarantee lucidity and relevance for Peshawar's driving context. For example, one item was modified as "Attempt to speed up the vehicle when you find traffic police following you". Few items were left out since they showed non complacency, recurrence, indistinct statement, or non-relevance to indigenous trends of driving followed in Peshawar (e.g., How frequently do you drive under influence of alcohol?) since alcohol is completely prohibited in Pakistan for being a Muslim country. Several items were introduced that effectively captured behaviors related to driving trends, which were lately lacking in their earlier versions. DBQs showed that total male respondents constituted 87.71 % and female constituted 12.28 %. Among 350 surveys, 75 were assorted from students, teachers and employees of Peshawar University, 173 from G.T road, 79 from shopping malls and recreational amenities while 173 from major arterials, parking's and business hubs.

Similarly, to get a discernable picture of over speeding trends that are practiced in Peshawar, Spot

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speed studies were also performed. These spot speed studies were performed on highways, major arterials, minor arterials, collectors and local streets. Among common methods that are applied for measuring spot speed studies, i.e. stopwatch, radar meter or pneumatic road tube method, speed radar gun was selected to record speed data. Speed data of almost 3000 vehicles were taken and it was observed that 697 (23.23%) among them were over speeding. In the same way, 50th and 85th speed percentiles were recorded. Responses from those drivers were taken that were over speeding and it was perceived that 89.43 % of the time, over speeding drivers weren't charge any fine for violating speed legislation.
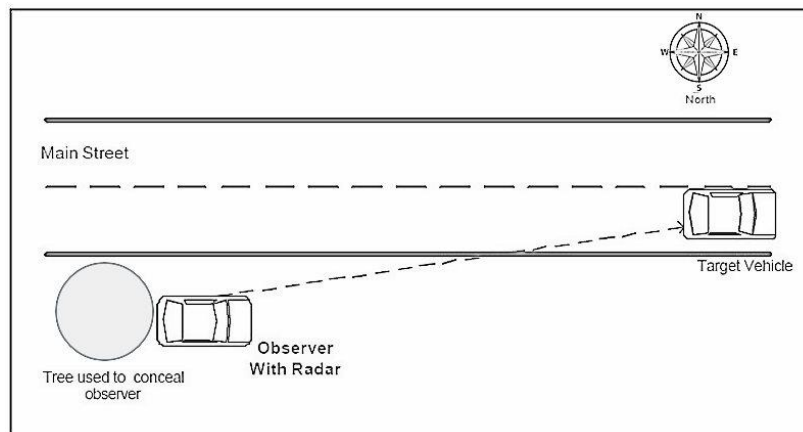
Figure 2: Illustration of Radar Meter/Gun spot speed study layout

Table 1: Contributors of DBQs clustered by age and gender

	Sample Size (N =350)								
Age	18-19	20–29	30–39	40–49	50–59	60–69	70–79	80+	Total
Male	5.65%	9.47%	33.05%	27.64%	18.12%	10.50%	9.60%	1.32%	87.71%
Female	0.37%	0.38%	6.75%	4.57%	0.21%	0.00%	0.00%	0.00%	12.28%
Total	6.02%	9.85%	39.80%	32.21%	18.33%	10.50%	9.60%	1.32%	100%

Table 2: Modified Reason's DBQs items complying local trends of Peshawar Pakistan

Brief items / Particulars	Mean	(SD)	Reason's factors
Over speed vehicle due to hot climate or scorching sun	1.12	(.49)	V
Can't judge the distance of approaching vehicle	1.34	(.51)	M
Furiously overtake auto rickshaw or taxi	1.31	(.54)	V
Offended by another driver's insolent attitude and use slang	1.32	(.44)	V
Over speed when late for office or educational institute	1.24	(.47)	V
Honk furiously while following slow moving truck/cart/motorcycle	1.35	(.54)	V
Over speed before Aftaar timings in Ramadan (Muslims Holy month)	1.24	(.43)	V
Over speed when develop eye contact with an opposing impolite driver	1.76	(.77)	V
Honk with no purpose in queues	1.34	(.51)	V
Attempt to run vehicle when you find traffic police following you	1.25	(.53)	V
Drive under the influence of Narcotics (local name; Chars)	1.62	(.75)	V
Get engaged in unofficial races	1.26	(.35)	V
Fail to notice pedestrians crossing	1.51	(.57)	S
Block the path of an approaching vehicle buy turning left	1.12	(.47)	M
Don't change gears because of inconvenience on speed breakers or declivities	1.62	(.75)	S

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Apply brakes vigorously on roads that are slippery (low skid resistant)	1.62	(.75)	S
Fail to notice someone stepping out from behind a bus/ Mazda /wagon	1.48	(.58)	S
Misjudge the speed of an approaching vehicle	1.63	(.64)	S
Ignore a yield sign and almost collide	1.14	(.58)	V
In order to avoid collision, slam on brakes	1.79	(.68)	S
Get into the wrong lane when approaching	1.72	(.75)	M
Almost hit a car forward-facing when following a line	1.39	(.59)	S
Switch on one thing instead of another	1.43	(.72)	S
Couldn't figure out if a person is waiting at a crosswalk	1.82	(.64)	V
While exiting from a highway miss exist ramp and drive forward	1.79	(.69)	S
Hit something when backing up	1.33	(.53)	M
Get the wrong idea about space when parking your car	1.27	(.52)	M
Unable to remember the spot where your vehicle is parked	2.12	(.83)	S
Leave your high beams on after switching engine	1.71	(.64)	S
Try to overtake a signaling vehicle	1.20	(.48)	S
Over speed when listening to loud music	1.61	(.74)	S
Almost hit a motorcycle/cycle while maneuvering right	1.20	(.45)	S
Block the way of another parked car while parking your own	1.18	(.44)	S
Arrive at a wrong destinations that wasn't planned to drive to	1.73	(.43)	S
Forget to set your mirrors when start the vehicle to drive	1.46	(.62)	S
Deliberately disregard the speed limit	1.85	(.87)	V
Continuously flash a front slow traveling vehicle and drive close to get a way	1.32	(.65)	V
Try to pass in risky circumstances	1.47	(.72)	V
Disobey road signals (red or stop) when there is no police around	1.23	(.58)	V
Misbehave with a traffic warden/officer when getting a ticket	1.76	(.57)	V
Over speed in village roads	1.65	(1.07)	M
Consider over speeding to be more exciting	1.87	(.89)	V
Don't give way to a following ambulance	1.23	(.23)	V
Observe speedometer when feel like you are over speeding	2.13	(.98)	V
Deliberately violate the right of way On intersections	1.49	(.81)	V
Drive oppositely in a one-way unpopulated local street	1.11	(.35)	V
Feel afraid of a side Collision when a heavy duty trucks overtakes	1.92	(.76)	V

DBQs taken From Reason et al. (1990); Different factors abbreviated as Slips/Lapses (S), Mistakes (M) and Violations (V).
.

4.1 Attitude and Raged Driving

Safe driving practices absolutely impact the safety of drivers and passengers on the road. Greater driver education and potential enforcement of penalties on violations, may be required to address drivers who express raged behavior while driving. There existed significant differences between drivers on attitude relating statements, some among them believed that it is fine to violate these rules since the system in the city i.e. Peshawar is already damaged and everyone is abandoning road laws to be properly adhered to. Other believed that the violations need to be addressed appropriately in order to make the existence of a safe and efficient transportation system possible in the city.

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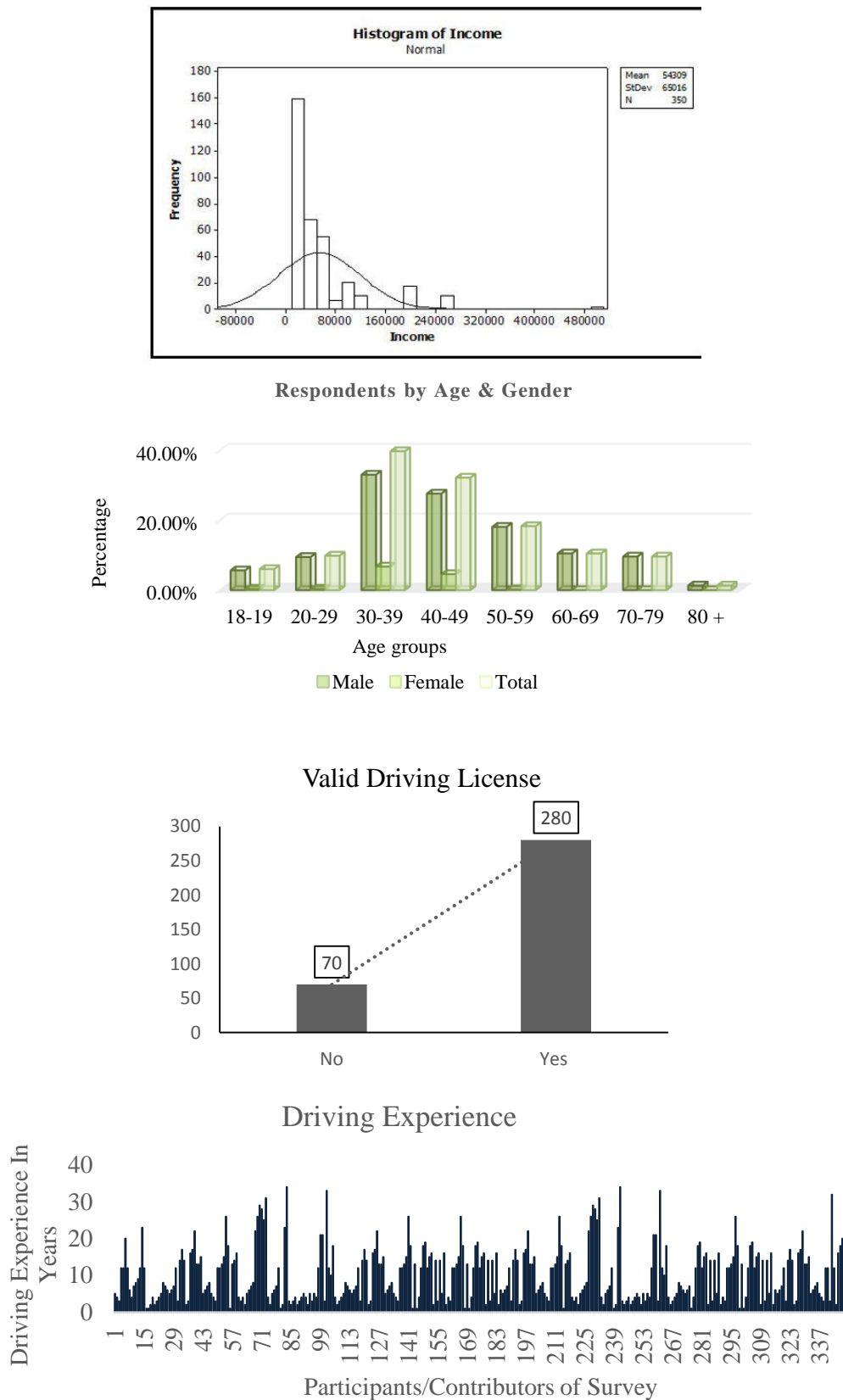
Figure 3, 4, 5, and 6: Demographics of respondents by age, income distribution, driving experience and valid driving licenses

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Table 3: Contributors of DBQs clustered by Marital Status, Work Status & Education

Categorization of sample N=350		
Marital status	Single or not married	31.6%
	Married or in relationship	60.2%
	Other	8.2%
Work status	Full time worker	55.8%
	part time Worker	25.9%
	Student	11.7%
	Not working/retired	6.6%
Education	Secondary	12.1%
	Technical or Vocational School	14.8%
	University degree	34.9%
	Higher degree	38.2%

4.2 Strengths and Limitations

This study delivers first handed insight into driving behaviors in relation to safely interacting with road users in Peshawar city. The survey offered an opportunity to discover the relationships between driving behavior, attitudes and knowledge. The finding of this research may aid the growth of behavior change and road users awareness campaigns to increase both driver's and road user's safety.

There existed methodological restrains due to unavailability of neoteric electronic tools such as: In-Vehicle Data record system (IVDR) in a technically outlined city, Peshawar; that can accurately record driving behavior data by taking into account every aspect e.g. Attitudes, speed, braking, acceleration, time, and temperature etc. Expectantly, upon advent of these techniques in Peshawar, the research in the areas of driving behavior and factors causing raged driving may be recognized considerably.

5. Discussion

Considering the WHO's most recent Global Status report on Road Safety (2015), many interventions are yet to be taken to address the problems that are causing traffic crashes such as violations to local traffic laws, incompetent law enforcing bodies, lack of awareness and safety campaigns, paucity of funds to be allocated for proper functioning of traffic regulatory authorities, political upheavals and vested interests. In the context of Pakistan, it has been witnessed that we have a unique political context where every new government attempts to shun the policies of the previous government that causes setbacks in the way of progress to improve traffic safety. It is anticipated that this research will identify the relation between driving behavior, socioeconomic conditions, climate, age, education and other vital demographic factors. Future studies aim to broaden the area of research to surrounding cities of Peshawar so that a clear statistics may be grasped for an effective comparison and generalized conclusion.

6. Conclusions

Seeing that Peshawar is encountering huge congestion in traffic and habitual incidents of road rage, examination of driving behaviors and attitudes conducted in this survey for the first time in the city, may play a key role in devising counteractive measures to be taken by concerned authorities and policy makers. The introduction of DBQs by (Reason *et al.,* 1990) has helped tremendously to record driving behaviors that pose risks to on-road hazards to the road users and has assisted in

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forecasting risks causing crashes. The modification of the DBQs according to local driving trends of Peshawar has helped to rationalize Reason's research in compliance with driving propensities practiced by drivers in Peshawar. The research explicitly witnesses that aggressive driving is one of the root causes of on-road traffic accidents that results in several fatalities and unrecoverable injuries.

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Stabilizing a Failed Slope in Islamabad

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Abstract
This paper is based on a research carried out on a failed slope in Defence Housing Authority (DHA) Phase I, Islamabad. The use of three dimensional (3D) slope stability analysis in conjunction with two dimensional (2D) analysis was used in determination of slope conditions. Slope stability softwares, Rocscience Slide 6.0 and Clara-W were employed for 2D and 3D Analyses respectively which have the ability to solve complex mathematical functions. Results of the analyses were used to confirm site conditions. The results of 2D analysis were verified by the 3D analysis. It was found that failure zone indicated by 3D analysis was similar to that actually existing on ground. This paper should be helpful to Geotechnical engineers, design engineers and the organizations working with slope stability and provide with a methodology to analyze them.

Keywords: slope stability; 2D analysis; 3D analysis; landslides

1. Introduction

A landslide is defined as a downward movement of rock or soil mass which occurs dominantly on a surface of rupture or on a relatively thin zone of intense shear strain (Cruden and Varnes, 1996). Land sliding is one of the most dangerous geological hazards. They cause damages to both human life and their properties. It has been reported that average loss in Oregon due to landslides is over $10 million/year which exceeds $100 million in years of heavy storms (Wang et al., 2002). Slope stability is therefore a subject of crucial importance in engineering practices. It was reported by an eminent housing authority in Pakistan i.e. Defence Housing Authority (DHA), Islamabad that a slope has failed in their area which is causing huge losses to them and the inhabitants of the area. Failure has caused damage to the house that is present at the base of the slope. Construction of a link road that had been planned at the foot of the hill has been postponed indefinitely. The slope's failure endangers feasibility of other plots that are in the vicinity of the slope. Three houses that have been built are, at present, vulnerable because of potential slope failure. Damage to these plots, houses and transport routes will in turn damage feasibility of the society for DHA. As the slope is massive, immediate action needs to be taken in order to avoid any major damages. Once the analyses have been performed, the best remedial measures can be suggested according to their feasibility and economy. A sound solution to the problems faced by the nearby residents can thus be reached. This particular slope was hence a platform to solve a physically existing problem, the solution which could

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benefit the people. The slope is about 100-125 ft high and in the state of constant motion. With each rain a large amount of mass slides down the adjoining houses. The residents of the area also reported seepage of water in their houses. Boulders of massive sizes that were on the verge of falling were found on the site. Many tension cracks were also observed at a height of about 50ft. The slope offers not only the opportunity of 2D analysis, but 3D analysis as well ; 2D analysis to determine the current conditions of the slope and its tendency towards further failure and 3D slope stability analysis for back analysis to determine the site conditions that led it towards failure. This particular slope was hence a platform to solve a physically existing problem, the solution which could benefit the people.

Figure 38: Slope at DHA Islamabad

Limit Equilibrium methods are mostly used to analyze the factor of safety of slope as per Mohr-Coulomb criteria. All methods establish an analysis based on an assumed failure surface, and proceed to determine whether the Mohr-Coulomb failure criterion is satisfied along this surface. All limit equilibrium methods of slope stability analysis use the same method to calculate the factor of safety of the slope as shown in Equation 1 (Duncan and Wright, 1980)

$$\boldsymbol{Factor\ of\ Safety} = \frac{s}{\tau} \qquad \text{Equation 1}$$

Where,

s is the shear strength of soil

τ is the shear stress required for equilibrium

To compensate for the variation of pore water pressure and normal stresses along an assumed failure surface, different methods of slices divide the sliding mass into a number of slices, evaluating their proportional contribution to the process. These methods employ assumptions to render the problem statically determinate. The most critical of these assumptions typically deals with the side forces (Vajirkar, 2004) . Different methods of slices are:

- Ordinary or Fellinius Method
- Simplified Bishop Method
- Spencer's Method
- Janbu's Method
- Morgenstern-Price Method

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According to Duncan (1996) the difference between results of these methods is less than 6%. Therefore for sake of ease in reporting, in this study however, results of Morgensten price method have been considered. Three-dimensional analysis methods consider the 3D shapes of slip surface. Unlike 2D analysis, 3D analysis incorporates a number of slope cross-sections in order to gain the combined effect of failure on a given slope area. This practice results in a higher factor of safety than 2D factor of safety, as forces induced due to neighboring sections are also taken into account for each of the cross-sections in the 3D failure area (Han et al., 2012). Like 2D methods, 3D methods also require considerable assumptions to achieve a statically determinate condition for the problem. As in 2D methods, some 3D methods do it by decreasing the number of unknowns, and others by increasing the number of equations, or both, such that the two numbers can be equal and the solution achievable. The three-dimensional analysis becomes important when the geometry of a slope is complex, making it difficult to select a 2D section to analyze, the geometry of the slope and slip surface varies significantly in the lateral direction, the material properties are highly inhomogeneous or anisotropic, the slope is locally surcharged, the slope with a complicated shear strength and/or pore-water pressure which requires combining the effects of slope geometry and shear strength to determine the direction of movement that leads to a minimum factor of safety, or to back calculate the shear strength of the failed slope. In these situations, a 3D analysis may be necessary (Chakraborty and Goswami, 2016). Type equation here. A large number of three-dimensional slope stability analysis methods based on the limit equilibrium concept have been developed since 1960s. Many of them are valid only under certain conditions. Hungr (1987) proposed a 3D method that is a direct extension of the assumptions associated with Bishop's (1954) 2D simplified method. It assumes that vertical shear forces acting on both the longitudinal and the lateral vertical faces of each column can be neglected in the equilibrium equations and the vertical force equilibrium equation of each column and the summary moment equilibrium equation of the entire assemblage of columns are sufficient conditions to determine all the unknown forces. This method has been employed in the 3D analysis in this study.

2. Methodology

To determine the fundamental geotechnical properties of the slope, investigation reports were collected from different houses situated in DHA and also from the authorities governing the area. DHA authorities have made mandatory for its residents to submit the soil testing reports before starting the execution of construction. It was the first preference to collect the soil reports of the houses that are situated at the toe of the slope or near to it. Fortunately, these reports were easily obtained from the respective houses. The reports collected indicated the fundamental soil parameters of plots at the toe and front of the slope and two slopes situated at a distance of three hundred meters and two kilometers from the subject area. The values obtained from these reports did not show much variation. An average of these values was taken to be used in further analysis. The survey of site was a basic requirement as it is used to create a model of the site, in order to perform analysis. Conventional methods of survey were not applicable on the site for a number of reasons; it is a dangerous area prone to constant failure and land sliding; it was not possible to take staff readings on slope as they are steep in many areas; one base point was not enough to cover all points due to elevation differences that tend to cause interference. This led to the use of combination methods to obtain all the required data. The basic purpose of survey was to prepare a complete 3D map of the slope area. Methods employed for detailed survey were RTK – Real Time Kinematic Survey and Total station (Laser).RTK is the latest and most accurate technique for land survey (Mina and Aziz, 2009). It involves a base and a carrier. A pre-established base point was initially used, and other base points were created for further survey using the same base point. A database was created in RTK base system. The carrier was manually carried on site area, recording the coordinates of point around the slope and its base area. Not all site area was covered by this technique, mainly because it was hazardous to take the carrier on slope as it is not stable. Keeping safety

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considerations in mind, carrier was taken to areas where it was safe to move around. For parts of higher elevation, Total Station (Laser) was employed to gain the entire range of coordinates for an accurate model. Total station has a laser mounted on top of it. Once aimed at an object, the instrument can measure its x, y and z coordinate. This technique was useful and more practical since it did not require climbing the slope in order to record elevations. Readings obtained from the total station were coupled with those from RTK to create a complete model of the site area.

A model representing the slope geometry and material properties acts as a prime element on which different types of analysis can be applied before making final decisions. The model created, thus provide the basic template for carrying out the analysis. Several techniques were available for creation of models from the survey data, but Surfer 8 was chosen to serve the purpose. Using the data collected via RTK and total station, Surfer was used to create a 3D surface which helps in better visualization of the area. To create the model, first of all the survey data collected via RTK and total station was integrated and arranged in spreadsheet. This data was used to create a grid which acts as a base for the creation of different types of maps, including the 3d-surfaces. A map showing contour lines of the surveyed were generated in Surfer 8 was used in creation of cross-sections of the area. Section lines were marked on the contour map which and the area was divided into several compartments. The resulting section line was digitized in surfer. After digitization, base map was generated using that data which represents the cross-section of the slope. The next step was to carry out 2D analysis for which Rocscience Slide was employed. The cross sections were exported from Surfer to Rocscience to carry out the analysis. For this purpose, the base map was digitized and the resulting excel sheet was adjusted to bring it in a format accepted by slide. The spreadsheet imported in slide produced the cross-sections ready for analysis procedures to begin.

A preliminary 2D Analysis was performed by considering assumed values from the available ranges, to determine the most critical section. To determine the exact soil parameters for the slope, "Sensitivity Analysis", a feature available in Rocscience, was employed. This feature allows the user to input a range of desired parameter. Each parameter is then varied in uniform increments, between the Minimum and Maximum values, and the safety factor of the Global Minimum slip surface is calculated at each value. While a parameter is being varied, all other input parameters are held constant, at their MEAN values. This results in a plot of safety factor versus the input parameters, and allows one to determine the sensitivity of the safety factor to changes in the input parameters. A steeply changing curve on a Sensitivity Plot indicates that the safety factor is sensitive to the value of the parameter. A relatively "flat" curve indicates that the safety factor is not sensitive to the value of the parameter (Rocscience Manual). After carrying out 2D analysis, 3D analysis was performed.

3D analysis considers a 3D failure surface, incorporating the effects of forces in lateral directions.3D analysis is performed if the geometry of the slope does not allow the selection of a critical 2D cross section. It can, however, be employed to perform a back analysis in order to confirm the failure conditions and parameters of a failed solve.3D analysis was employed for the latter reason, in order to confirm the material properties determined via sensitivity analysis. For 3D analysis Clara W software was used in this study.

1. **Results And Analysis**

The fundamental geotechnical properties were determined by taking an average of the values obtained from geotechnical reports (Table 1).

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Table 57: Geotechnical properties as indicated by soil reports

Location	Liquid Limit	Plastic Limit	Plastic Index	Angle of Internal friction	Bulk Density(lb/ft^3)
PLOT # 3 SECTOR G PHASE II	25	21	4	18.5-20	104.25
H.No 338 Sector B1 PHASE I	36	28	8	18	104.87
H.No 313 Sector B1 PHASE I	22	19	3	18	124.48
H.no 8 Street 29 Sector C DHA Phase I	15	7	8	25	127.52
Slope at Bahria Town Garden City	23	18	5	18	105.52

Based upon these values the following were taken for initial analysis

LL=24,   Plastic Limit=18, Plastic Index=6, Angle of Internal Friction(ϕ) = 18°
Bulk Density = 110pcf, Cohesion = 400-460 psf.

Soil was classified using Unified Classification System (Based on ASTM-2487). The strata indicated by the soil reports contained silt and clay. LL<50 and PI was 6 which indicated that the data lies in the hatched portion of plasticity chart and defines our soil to be of silty clay (ML-CL) type. The cohesion values were determined based upon those proposed by Lindeburg (2012) for Silty Clay soil which was initially taken to be 460 lb/ft^2. But before 2D analysis could be carried out using these values it was necessary to create cross sections of the slope. For which model of the slope was created after carrying out a detailed survey.
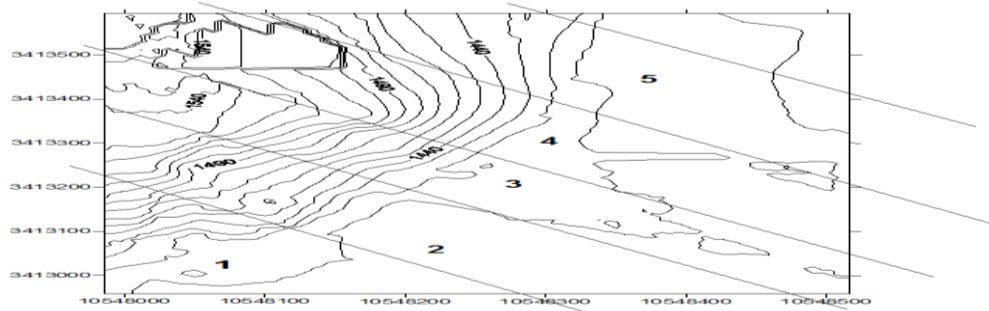
Figure 39: Contour map in Surfer 8

The next step was to export the cross-section produced in surfer to Rocscience slide. For this purpose, the base map consisting of 5 compartments each further consisting of cross sections a to f were digitized and transferred to Rocscience. 31 cross sections were created, along the whole length of the slope. There was an ambiguity in the definition of material properties. Due to the failure of the slope, the slope strata are not discernible, making it increasingly difficult to define material boundaries and properties. An assumption was therefore made, considering homogenous strata, the property ranges for which were selected to reflect the effect of the conditions prevalent at the slope. These properties used were those indicated by the soil reports that were obtained earlier in the research. A preliminary 2D Analysis was performed by considering assumed values from the available ranges, to determine the most critical section (Table 02). These values were:

Unit Weight = 110 lb/c.ft

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Cohesion = 460 lb/sq.ft
Friction angle (ϕ')= 18°

Upon analysis in Rocscience a FOS of 0.786 was encountered at the mid of compartment 3.This FOS was not only inconsistent with the visible conditions of the slope, but also very low indicating that the slope should currently be failing. This, however, was not the scenario and the slope, despite failing at a slow pace, was not as dangerous. The visual inspection of the slope after several visits indicated that it is in continuous motion and constant failure i.e. it has not yet achieved stability, and is still mobilizing its shear strength. Thus a Factor of safety slightly less than 1 should be observed on the critical section, which could be identified on the ground in the failing premises. Upon complete failure this motion should stop .The sensitivity analysis was so performed on this section to obtain the effects of the ranges on FOS in order to select better slope parameters consistent with the site conditions.The sensitivity analysis was done using the parameters indicated keeping in view the range of properties provided by soil reports and (Lindeburg (2012)). The results showed that the FOS was not sensitive to unit weight, but got affected by changes in values of phi and cohesion. The parameters were than altered to obtain values consistent with the slope conditions; however the range was still consistent with literature and soil reports. These values resulted in a sensitivity plot indicating FOS most sensitive to cohesion. The results showed that 82.39% of cohesion values result in a factor of safety lesser then 1. Also, the FOS for the critical cross section is 0.977, which is quiet realistic when the conditions of slope are observed. The FOS increases to 1.5 – 2 in the areas not prone to failure. With the following soil parameters, a final 2D analysis was performed for each of the 31 sections of the slope the slope.

Unit Weight = 105 lb/cft
Cohesion = 410 lb/sft
Phi = 25°

Section 1(a), 1(f), 5(e) and 5(f) exhibit FOS values of 0.739, 0.849, 0.960 and 0.937 respectively, but these indicate cross sections at either ends of the slope (Table 2). Actual and more prominent failure exists at mid-sections of the slopes. Section 3(d) was therefore considered to be the most critical section(Table 03). Back Analysis by 3D slope stability methods was therefore carried out for section 3(d) of the slope.
To build a model for performing 3D analysis, cross-sections of the slope, already created in slide, were transferred to Clara-W. The slope cannot fail to such an extent under normal conditions, therefore failure may have been triggered by presence of water. To cater for a worst case scenario, fully saturated surface was assumed, defining a piezometric surface similar to the ground surface.3D analysis was performed on the section corresponding the most critical 2D section, section 3(d). This section lies more or less about X = 440 according to the contour map. Based on field observations of the failure, parameters were defined to perform a grid search to establish that such conditions could trigger failure. The results of the grid search indicated that the assumptions were in the right range. Lowest FOS of 1.024 was experienced. Final analysis was then performed, adjusting the failure or critical circle according to the observed failure dimensions of the slope and the pre-failure factor of safety was found out to be 1.01, which confirmed the material properties determined from sensitivity analysis. The region of failure indicated by 3D analysis coincided with the ground conditions and the could be physically verified on site. A comparison between the 3D models of the rendered failed condition of prefailure model and present post-failure condition of the slope, and the circles indicate the failed region is shown in Figure 3. This validates the results of analysis.

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2. **Conclusion**

A slope failure was reported in DHA Islamabad which was causing a damage of millions of rupees. On the subject slope 2D and 3D analysis was performed. The results of 2D analysis were re confirmed by the 3D analysis. Failure occurred on the same region in 3D analysis as the that taking place on ground. The results of sensitivity analysis were verified by 3D analysis and it was determined that the assumptions taken in the 2D analysis were correct.

Table 02: FOS obtained after the final analysis

SECTION	FOS	SECTION	FOS
Section 1 (a)	0.739	Section 3(d)	0.977
Section 1(b)	0.997	Section 3(e)	1.001
Section 1(c)	1.541	Section 3(f)	0.987
Section 1(d)	1.836	Section 3(g)	1.023
Section 1(e)	2.695	Section 4(a)	1.983
Section 1(f)	0.849	Section 4(b)	1.995
Section 2(a)	1.127	Section 4(c)	2.684
Section 2(b)	1.152	Section 4(d)	2.189
Section 2(c)	1.116	Section 4(e)	2.658
Section 2(d)	1.021	Section 5(a)	1.620
Section 2(e)	1.023	Section 5(b)	1.465
Section 2(f)	1.125	Section 5(c)	1.226
Section 2(g)	1.156	Section 5(d)	1.039
Section 3(a)	1.026	Section 5(e)	0.960
Section 3(b)	0.993	Section 5(f)	0.937
Section 3(c)	0.986		
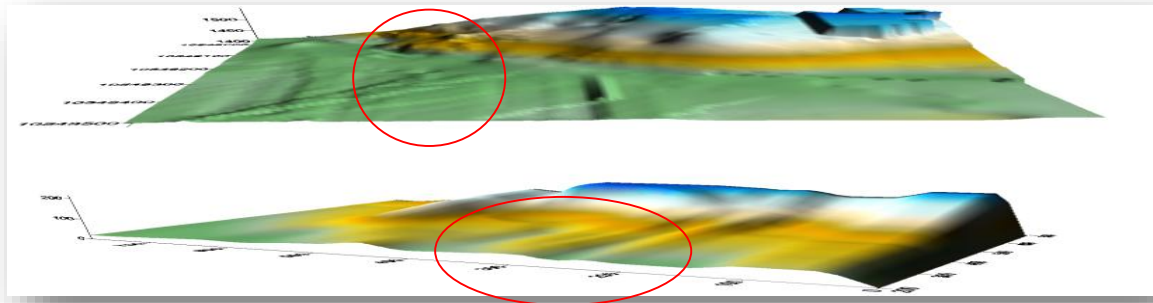
Figure 3: Comparision between pre and post failure surfaces

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Bond Strength Behavior of Deformed Bars in Normal Concrete

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Abstract

Experimental works was carried out to evaluate the pull out behavior of deformed bars in normal concrete. Pull out tests on cylinders of dimensions 12" height and 6" *dia* with deformed steel of #3, #4 and #5 bars for an embedment of 12",8" and 4" were performed. The main variables of this work was the embedded length (i.e. 12",8" and 4") and steel grade i.e. Grade 40 and Grade 60. Tests results revealed that for larger dia of bars, i.e # 5, all the embedment length gives comparatively equal strength for Grade 40 & Grade 60. (i.e same for 4,8 and 12") but yielding was observed for #3 and #4 bars at an embedment of 12". Also Grade 60 gives better results then Grade 40.

Keywords: Concrete, Steel, Bond strength, Grade, Pull out

1. Paper Organization

The organization of this research work is:
1. Paper Organization
2. Introduction
3. Problem Statement
4. Objectives
5. Experimental work
6. Results and Discussions
7. Conclusions
8. Recommendations
9. References

2. Introduction:

In the case of reinforced concrete, the measurement of bond between the reinforcement and concrete is carried out by measuring the shear stress or bond stress, which takes place at the periphery of embedded length of rebars. According to Cairns (2003), the bond stress may be defined as the ratio of the change in the axial force applied along the length of the bar to the surface area of the bars through which the change in axial force takes place. In case of deformed bars, some other parameters also contribute in the bond strength of concrete. These parameters are:

- Normal Shear
- Radial Shear

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Normal shear takes place along the length of the bars when a tensile load is applied on the bar. Normal shear is always parallel to the bar where as the radial shear is takes place along the ribs of the deformed bars (Gambarova, 2012) as shown in **Figure 1**. In case of deformed bars, multi axial stresses are produced with in the ribs which increase the possibility of pulling out load for the bars. The ribs provide wedging action, which cause the crushing of concrete when pull out load is applied. This pull out load produced micro cracks in the concrete. The production of micro cracks in concrete cause the loss of strain compatibility in reinforced concrete. With these micro cracks and an increase in the axial loads, slippage of bars occur, which initiate the bond strength of concrete (Garcia et al, 2016).
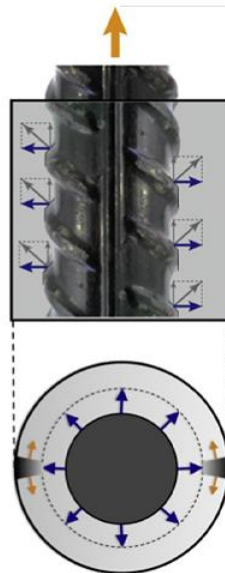
Figure 40: Bond Stresses and Radial Stresses Produced at the Interface of Deformed Bar and Concrete

It is a common practice that the magnitude of steel-concrete bond can greatly be increased by the use of deformed reinforcing bars. There are three main parts to determine the steel-concrete bond strength between the neighboring ribs of a reinforcement bar. These components are bearing stresses opposed to the faces of ribs (mechanical interlock), the shear stresses due to adhesion along the rebar surface, and the friction between the surrounding concrete and bars with concrete in the rib dales. The outmost contribution to bond strength comes from mechanical interlocking (Bamonte & Gambarova, 2007). The main characteristics of the steel-concrete bond stress vs. slip evolution and the maximum bond stress are clearly dependent on material, geometrical or loading limitation. The positive response of the height of ribs and spacing was investigated by Viriyametanont & François (2006).

3. Problem Statement
The bond between the steel bars and the concrete have no specific limitation in the construction industry, as how much embedment of the steel bar in the concrete will provide sufficient bond strength to act against the axial pull. As different shape and size of steel bars are used in reinforced concrete in the field. Also in this modern era, the earth quack design changed the design parameters to facilitate the people and to provide safety in the construction field. Due to this, the existing buildings are rehibilited by the process of retrofitting. This new technique needs the embedment length of the steel bars. So for the perfect bond strength, there is a need of research.

4. Objectives
The main objective of this research program are:
- To check the bond strength of concrete
- To check the variation in bond strength due to

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- Embedment length of deformed bars in concrete
- Grade of steel (i.e. variation due to yielding strength of bars)
- Size of deformed bars

5. Experimental work

Many researches have worked on the bond strength by using various techniques. In this research program, pull out technique was used to investigate the bond strength of concrete. Cylindrical specimens of 6 inches diameter and 12 inches height were casted and deformed bars of different sizes i.e. 3/8, 4/8 and 5/8 inches were used. The steel bars were embedded in the concrete. For pull out load, different embedment were used.

5.1 Materials

5.1.1 Aggregate

Fine aggregates of locally available sources was selected for this research program. The properties of the fine aggregates were according to ASTM C33. All the required properties of the fine aggregates were checked for better results. As we know that natural fine aggregates have silt contents, but in this case, silt contents were less than 3% which is recommended value according to ASTM standards. The basic physical properties of fine aggregates are given in **Table 1**.Coarse aggregates in crushed form of Margalla hills (Islamabad) were selected to be used in this research program. The coarse aggregates have a maximum size of ½ inches and down sizes. The spherical and flakey particles were negligible in the specified coarse aggregates source. The standard physical properties of the coarse aggregates are shown in **Table 1.**

Table 58: Physical Properties of Aggregate

Characteristics	Fine Aggregate	Coarse Aggregate
Type	Normal	Crushed
Specific Gravity	2.54	2.64
Dry Ridded Bulk Density	$148\ lb/ft^3$	$96.53\ lb/ft^3$
F.M	2.4	6.75
Absorption %	1	0.10

5.1.2 Steel bars

Deformed steel bars of Grade 40 and Grade 60 was obtained of from the market at Peshawar. Cut pieces of the specified length were cut and the detailed is given in **Table 2**.

Table 59: Properties of Tar Bar

Type	Dia	Grade	Length 1	Length 2	Length 3
	Ø 3	40 &60	32"	28"	24"
Deformed bars	Ø 4	40 &60	32"	28"	24"
	Ø 5	40 & 60	32"	28"	24"

5.1.3 Cement

Ordinary Portland cement(OPC) of ASTM Type I was used in this research program. The freshnes of cement was cheked according to the standard practice of ACI, then the chemical

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composition and physical properties of cement was determined. The chemical composition and physical properties of Ordinary portland cement are shown in **Table 3** and **Table 4** respectively.

Table 60: Chemical Composition of OPC

Constituents	% Contents
CaO	62.18
SiO_2	20.78
Al_2O_3	5.81
Fe_3O_2	2.99
MgO	1.52
LOI	2.31
SO_3	1.89

Table 61: Physical Properties of Cement

Property	Result
Specific Gravity	3.15
Initial setting time (minutes)	131
Final setting time (minutes)	240
Standard Consistency (%)	31
Fineness by Sieving	4.3 %
Soundness	0.039 in (1mm)

5.2 Mix proportion of concrete

A general w/c ratio of 0.50 was used to prepare concrete of 1:2:4 for the strength of 3000 psi. Concrete mix were prepared according to ACI recommended practice. Concrete cylinder of $inch$ diameter and 12 inches $height$ was filled from the concrete mix in three layers for 28 days compressive strength of concrete. After 24 hour the cylinders were demolded and then placed for curing at room temperature in curing tank for 28 days.

5.3 Nomenclature of the Test Specimens for Pull-out Test

Deformed bars were placed in concrete cylinders exactly in the center by using proper arrangement. The details of different cylindrical molds with the embedment length for different sizes of rebars are shown in **Table 5.** After 24 hour the cylinders were demolded and then placed in curing tank in such a way that only concrete was completely immerse in water**.**

Table 62: Specimens detail for embedment length

No. of Specimens	Dia of Bar	Embedment length 1	Embedment Length 2	Embedment Length 3
3 per embedment	Ø3	$10.5d_b = 4"$	$21d_b = 8"$	$31.5d_b = 12"$
3 per embedment	Ø4	$8d_b = 4"$	$16d_b = 8"$	$24d_b = 12"$
3 per embedment	Ø5	$6.4d_b = 4"$	$12.8d_b = 8"$	$19d_b = 12"$

5.4 Tests

Deformed bar with the specified embedment as shown in **Table 5** were tested after 28 days curing, in Universal testing machine (UTM)**.** Pull out load was obtained from the UTM and then the bond strength was found by using the following formula:

$$f_b = \frac{P}{\pi dl}$$

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Where f_b = Bond strength of concrete, P = applied pul out load, d = dia of bar, l = embedment length (Ahmed et al, 2007)

The results of pull out load are shown in **Figure 2** and Bond Strength in **Figure 3.**
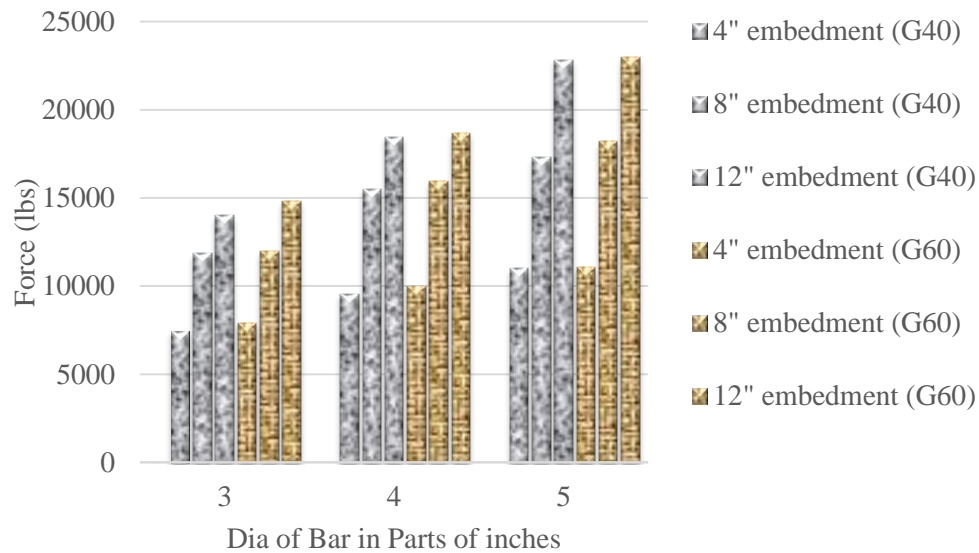
Figure 41: Pull out Load for Different Dia of Bars and Embedment (Grade 40 & 60)
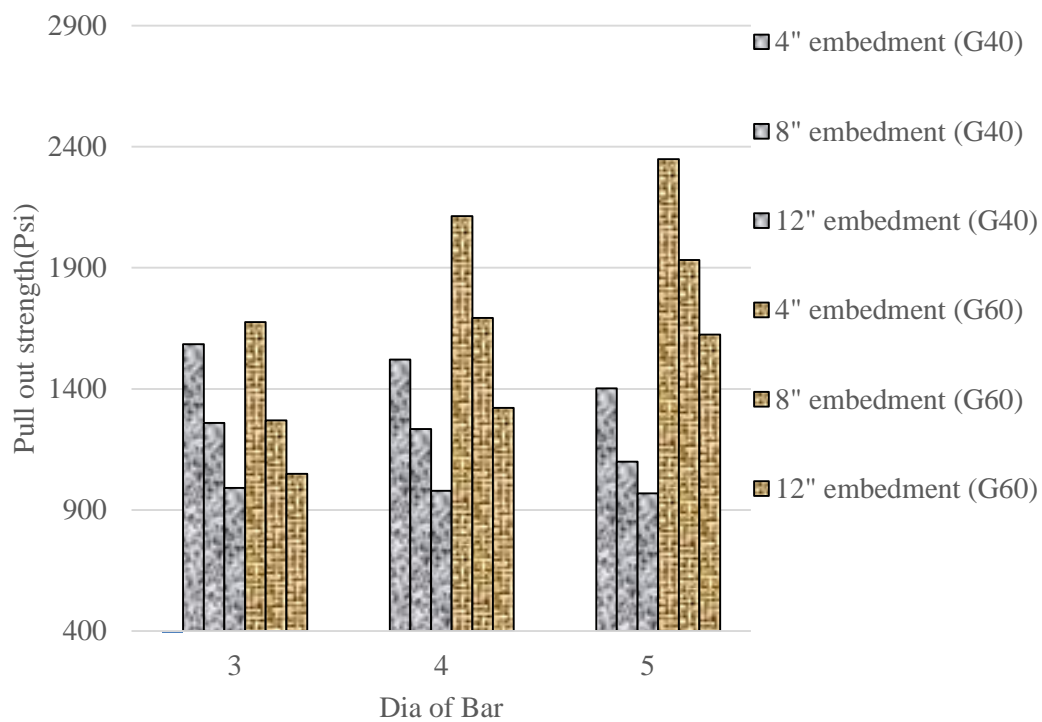
Figure 42: Pull out Strength (Bond Strength) for Different Dia of Bars and Embedment (Grade 40 & Grade 60)

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6. Results and Discussions

The results obtained from the tests are shown in Figure **2 and 3**. The **Figure 2** shows that as the embedment increases, the pull out load increases for all type of bar sizes. It shows that embedment have significant role in the composite action of steel and concrete. The ribs of deformed bars contribute in the bond strength of concrete. But from **Figure 3,** it is clear that increase in embedment decrease the bond strength of the concrete. This is due to the enlargement of length with in the concrete, as the embedment length increases, the surface area of the bar increases which decreases the pull out strength of concrete. Also increase in dia of bar increase the surface area and decrease the bond strength. Also it is observed from the results that there very less increase in the pull out load for Grade 60. The bond strength increases a little bit when the grade of the bar increases as shown in **Figure 3**.

7. Conclusions

The following conclusions are drawn from this research program:

- To get better pull out load, more embedment is required.
- To get good bond strength for reinforced concrete, at 4″ embedment gives better result.
- Increase in grade of steel cause a slight increase in the pull out load but increase the bond strength as compared to grade 40.

8. Recommendations

Some recommendation from this research work are:

- More embedment is recommended for excellent pull out load.
- Less embedment is recommended for good bond strength.
- Grade 60 is preferred as it gives better results in bond strength of concrete.

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Use of Pet Bottles (Fibers) as a Partial Replacement of Fine Aggregates in Concrete

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Abstract

Concrete is a composite, the most abundant and the most important construction material. Concrete is mainly made of aggregates, water and binding material. Its production involves batching, mixing, transporting, proper placing, compacting and finishing. To achieve a good quality concrete the constituents of concrete should satisfy the international or local standards. Waste plastic bottles is an environmental issue and are major cause of solid waste disposal, polythene Terephthalate (PET, PETE or polyester) is commonly used for carbonate fed beverage and water bottles. It is difficult to biodegrade and involves process either to recycle or reuse. This work presents the performance of pet bottles fibers as partial replacement of fine aggregates in concrete in a controlled environment. The purpose of this work is to solve the environment issue and to make the concrete economical, light weight and up to the desired strength of normal concrete. Cylinder specimens of concrete with 3%, 5%, 7% and 9% replacement of PET fibers are casted, cured and tested for compression at 3, 7, 14, 28 and 90 days. Beams are cast, cured and tested for flexural strength at 14 and 28 days. The experiments show that for replacing PET bottles fibers as a fine aggregate in concrete increases compression strength against normal concrete and shows flexural strength upto the ordinary concrete. The compression strength increases for 3%, 5%, 7% and 9% replacement is 53%, 53.5%, 55% and 57% against normal concrete for 28 days. The pet bottles fibers can be used partially as a fine aggregates in concrete structures subjected to compressive load and flexural load.

Keywords: PET bottle fiber, replacement, compression strength, Flexural strength

1. Introduction

The consumption of concrete in construction industry is increasing continuously; its consumption is ten times more than steel. Concrete properties mainly depend on its production process, quality control and proper mix designs. Due to this high rate of consumption, many wastes are added as a replacement or as an additive material in concrete.

There are different waste fractions available in environment, but the plastic waste creating a lot of problems in environment due to its non-biodegradable property. In Pakistan millions tons of solid waste are produced annually which results pollution in environment and also causes severe drainage and sanitation problems.

PET is the abbreviation of polyethylene terephthalate and its molecular formula is $C_{10}H_8O_4$, its waste is increasing at a rate of 2% every year in each country in all over the world. Its structural composition is composed of Polyester of terepthalic acid and ethylene glycol. (Ramadevi, 2012). Researchers have found that plastic materials can remain on earth for 4500 years without degrading. The rate of plastic waste quantity of municipal solid waste is become double for every 10 years due to rapid growth of population, urbanization and development activities. (Maneeth, 2014). One of the best methods for the disposal of PET wastes is to use it in construction industry. Many researches were carried out in advanced countries on this topic, but in Pakistan it is very limited. Hence an attempt is done on the use of PET bottles fibers as a fine aggregate in concrete and its engineering properties is investigated.

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2. About the Project

2.1 Objectives

The main objective of this project is to evaluate the possibility of using plastic waste materials. The following objectives are also proposed.

- ➢ As partial substitute of fine aggregate in concrete.
- ➢ Reduce the unit weight of concrete due to low unit weight of waste shredded pet granules.
- ➢ Investigate the mechanical behavior of concrete containing PET bottles fibers.
- ➢ To determine the percentage of plastic fibers that gives more strength as compared to normal concrete.
- ➢ Solve environmental issue indirectly.

2.2 Project Importance

The problem of disposing and proper management of solid waste materials in the world has become one of the major environmental, economic and social issues. The waste management system including land-filling, recycling, reuse and source reduction needs to be implemented to control the waste disposal problems. The chemicals released by plastic alter hormones, effects human health and causes animals death. Infants and young children have also lost their lives due to suffocation due to these plastics. Plastic bottles makes 11% of the content land fill, causing severe problem in environment. It is estimated that 100 million tons of plastic are produced each year. Plastic packaging comprises 42 % of total consumption and very little of this is recycled every year. The solutions currently available to reduce these impacts of waste is to recycle it; using these wastes in other industrial areas and burning PET produce only carbon dioxide and water means that there is no emission of harmful gases. The aim of this research is to use the PET bottles fibers as a partial replacement of fine aggregate (sand) in concrete due to its need of alternative material in construction. The PET bottles are easily and cheaply available in environment is shredded by any method and added into normal concrete to investigate the compression strength and modulus of rupture of concrete.

2.3 Methodology

The flow chart shown in Figure 1 describes the methodology of the project.

Figure 1 Methodology

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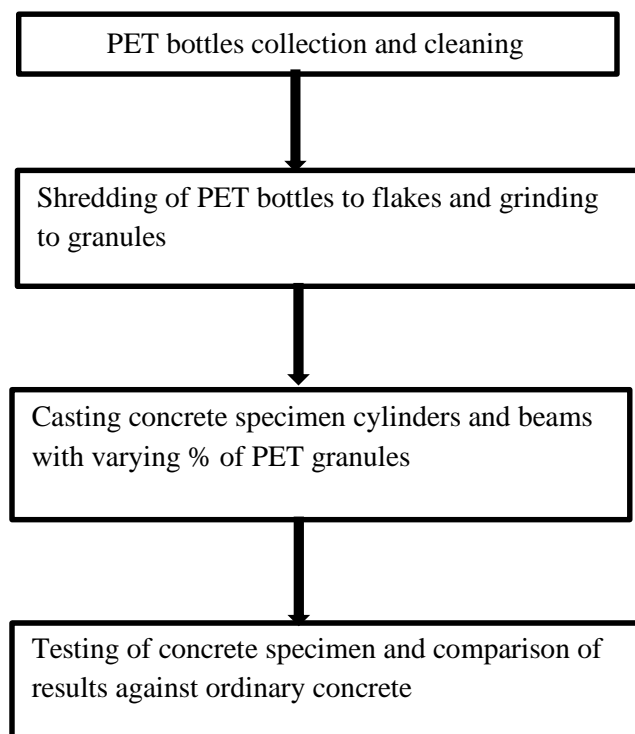
2.4 Materials Used

Cement   : Ordinary Portland cement.
Fine aggregate   : River sand.
Coarse aggregate: 20mm – 60% and 10-13mm – 40%
Plastic fibers   : PET bottles.

2.5 Experimental Plan

In this project, Fine aggregate is replaced by 3%, 5%, 7% and 9% PET bottles fibers for M150 grade concrete with w/c ratio 0.6%. The replacement percent is by volume of total aggregate content derived from the mixture proportioned. Various concrete mixes are prepared and designated as M_0, M_1, M_2, M_3 and M_4 contains 0%, 3%, 5%, 7% and 9% of PET, which is shown in table 1 and 2

Table 1 Quantities of various materials per cylinder compression strength

S.No	Mix type	Cement(kg)	Fine Aggregates	Coarse Aggregates	PET fibers	W/C ratio(Lit)
1	M_0	2	4	8	0	1.2
2	M_1	2	3.88	8	0.12	1.2
3	M_2	2	3.80	8	0.2	1.2
4	M_3	2	3.72	8	0.28	1.2
5	M_4	2	3.64	8	0.36	1.2

Table 2 Quantities of various materials per beam for flexural strength

S.No	Mix type	Cement(kg)	Fine Aggregates	Coarse Aggregates	PET fibers	W/C ratio(Lit)
1	M_0	3.64	7.28	14.56	0	2.2
2	M_1	3.64	7.062	14.56	0.218	2.2
3	M_2	3.64	6.92	14.56	0.364	2.2
4	M_3	3.64	6.77	14.56	0.51	2.2
5	M_4	3.64	6.62	14.56	0.655	2.2

The properties of materials used are:

Specific gravity of coarse aggregates	= 2.714
Specific gravity of fine aggregates	= 2.64
Water absorption:	
Coarse aggregate	= 1%
Fine aggregate	= 0.6%
Fines modulus of coarse aggregate	= 2.643
Fines modulus of fine aggregate	= 2.45
Bulk density of coarse aggregates	= 0.02572kg/in
Bulk density of fine aggregates	= 0.02479kg/in

Cylinder specimens of size 6*12 inches and beam specimens of size 21*6*6 inches were casted for each proportion with PET bottles and compared against ordinary concrete. Slump test was conducted on fresh concrete to determine the workability. Compression tests are performed on hardened concrete after 3, 7, 14, 28 and 90 days, and flexural test are performed at 14 and 28 days. The collected PET bottles are shown in figure 2 and its fibers is shown in figure 3

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Figure 1 Collected PET bottles and crushing machine

Figure 3 Waste plastic fibers

3. Experimental Procedure
3.1 Testing On Specimen

All specimens were de-molded after 24 hours, and placed in curing tank for curing. After curing period, the specimens were taken for testing. The specimens were tested in the universal testing machine. For each replacement ratio, three samples were tested and its average value is calculated. The results were then compared and analyzed with ordinary concrete with no replacement. The test setup and the failure of samples for compression test and flexural strength test are shown.

Figure 3.1 Compression test

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Figure 3.2 Flexural tests

3.1.1 Compression Strength Test

The compression strength of the cylinder specimen is calculated by using the following formula:
Compression strength (psi), fc = Failure load (tons)*2204/ (36*PI ()/4)
The variation of the compression strength of cylinder specimens with different replacement percentage of fine aggregate by PET fibers of different curing time is shown in graph figure 3.3
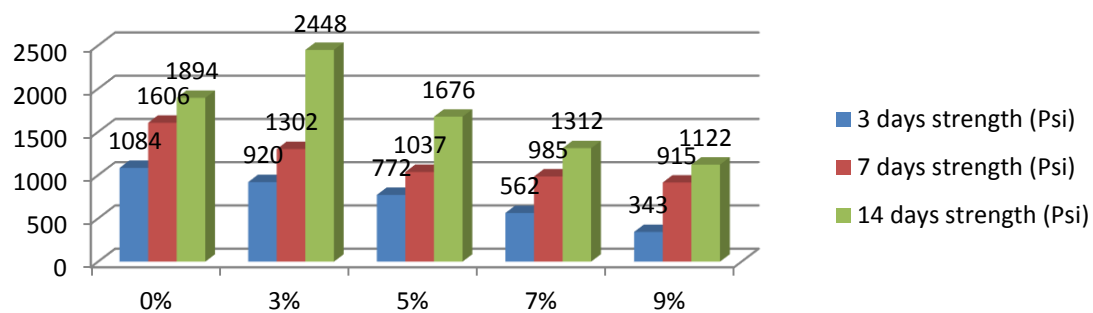
Figure 3.3 Compression strength VS PET fibers (%)

Increase in the compression strength is observed for 14 days strength as compared to 3 and 7 days results. Also 3% replacement of PET fibers as a fine aggregate shows abrupt increase in compressive strength against other replacement ratios. The compression strength of 28 and 90 days cylinder specimens are also investigated which is shown in graph figure 3.4.
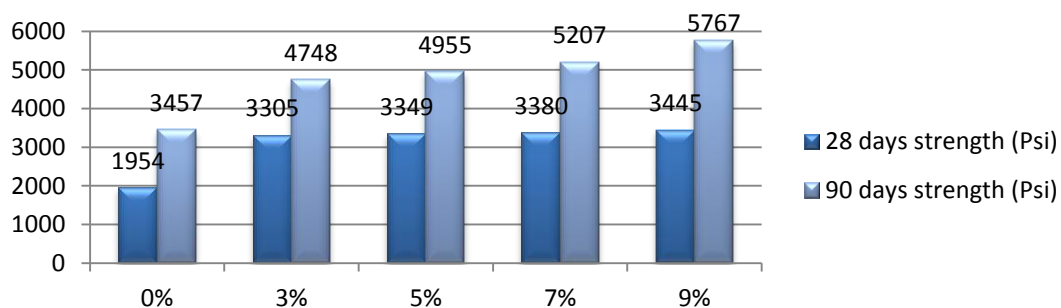
Figure 3.4 Compression strength VS PET fibers (%)

When the PET fibers are added with above ratios as a fine aggregate in concrete, the compression strength is increased at 28 and 90 days test results.

3.1.2 Flexural Strength Test

The modulus of rupture is calculated by the following formula:

Modulus of rupture = $\dfrac{2204 * \text{failure load} * L}{B * D^2}$

L = length of the beam
D = depth of the beam
P = failure load of the specimen

The variation of the modulus of rupture for beams samples with varying replacement % of fine aggregate by PET fibers of 14 and 28 days curing time is shown in the graph figure.
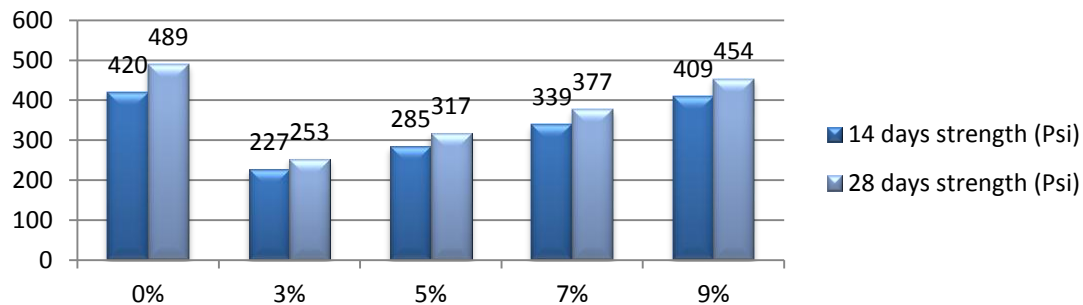
Figure 3.5 Compression strength VS PET fibers (%)

From the above results we can conclude that by using PET bottles fibers as a partial replacement of fine aggregate in concrete give decrease in strength on 3% but then starts increasing and on 9% gives modulus of rupture upto the ordinary concrete.

4. Conclusions

- Concrete with PET bottles fibers gives a good workability, smooth finish and observation on outer side.
- Compression cylinders of 3%, 5%, 7% and 9% PET bottles fiber as a partial replacement of fine aggregate in concrete tested after 3 days, 7 days and 14 days gives a considerable reduction in strength against ordinary concrete, however repeating the same ratios of PET bottles fibers in concrete when tested after 28 days gives a considerable increase in strength against ordinary concrete with no replacement.
- Compression cylinder tested after 90 days with different ratio of PET fibers gives up to 2000 psi extra strength as compared to 28 days test result, means that strength is continuously increasing with time.
- In terms of modulus of rupture it has been found that beams tested after 14 and 28 days with different ratio of PET bottles fibers as a fine aggregate gives a strength almost equal to the modulus of rupture of normal concrete.
- It has been found that use of PET bottles fibers as partial replacement of fine aggregate in concrete increases strength with time.

5. Scope for Future Research

- Pet bottles fibers can be used as a partial replacement of coarse aggregates in concrete for investigation of its mechanical properties.
- The effects of PET fibers in concrete under high temperature can be checked.
- PET fibers in concrete can be checked in terms of thermal conductivity.
- The effects of PET fibers in concrete with different admixture can be investigated.
- The combination of PET fibers and other waste material in concrete can be analyzed.

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2nd International Conference on Emerging Trends in Engineering, Management and Sciences ,December 28-29, 2016 (ICETEMS-2016) Peshawar, Pakistan

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Fabrication of Large Scale Direct Shear Test Apparatus

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Abstract
This paper presents the Fabrication of Large Scale Direct Shear Test Apparatus. During Shear Testing the materials are test in conventional Direct Shear Box of 60mm x 60 mm x 20mm. Because of limitations of small scale of direct shear test apparatus, materials with larger particle sizes cannot be tested in this apparatus. Usually materials in laboratory are sieved through sieve No. 4 and the passed materials are tested in small scale direct shear apparatus. It results in change in gradation and natural condition of soil and soil strength parameters become erroneous. In order to solve this problem, Large Direct Shear Testing Machine with the shear box dimensions of 600 mm x 600 mm x 600 mm is fabricated keeping in view the guidelines of ASTM D-3080 (90). It can test the materials with larger particles and can find the shear characteristics of gravely materials under constant normal load. This apparatus is being developed and fabricated at University of Engineering &Technology Peshawar Pakistan. The Normal load is applied through dead load weight and shear load is applied through an Electro hydraulic actuator unit. The displacements are measured by LVDT. The shearing load and displacement data is recorded through data logger connected to computer. The load and deformation values are recorded at desired intervals for plotting graphs. The built apparatus has three main parts including Loading system, Hydraulic power system, and Data logging system. Further each part has its own different parts. With this apparatus experiments on gravely soil would be conducted in next phase of research.

Keywords
Direct shear test, Sand, Gravel, Small scale, Large scale

1. Introduction

Direct shear test is a common and widely used test for the determination of shear strength of soil because of its simplicity and accuracy of results. A conventional direct Shear test is usually used for clayey, silty and sandy soils. For soil with larger particles like gravels, the soil is passed through sieve and the over-sized particles are removed. In this research paper an effort has been made to fabricate a shear box that can test soils with larger particles up to 60 mm in diameter as per ASTM standards in which the maximum size of particle is1/10th of the size of box and up to 1/6th in thickness of the sample maximum particle size. The apparatus has lower shear box of size 600 mm x760 mm x 300 mm while the upper box has a size of 600 mm x 600 mm x 300 mm. The apparatus can test 10 times larger particles in diameter than the conventional small scale apparatus thus allowing the liberty of testing material as exists in real form. For this purpose the research work of

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previous researchers were thoroughly reviewed and the guidelines of ASTM for small scale direct shear testing apparatus were incorporated in the fabrication of Large scale direct testing apparatus of size 600mm x 600mm where soils mixed with larger particles can be tested. The components and relevant details of this apparatus are described in this paper.

2. Background and literature review

Direct shear test was used first time by Coulomb in 1776 and it is one of the oldest shear strength determination tests for cohesive consolidated soil. Determination of Shear strength of soil with larger particles (sand and gravel mixture) is sometimes required in geotechnical engineering. But because of effects of dimension of experimental specimens and size of conventional shear box, most studies are performed by elimination of coarse particles. In order to have an understanding and possible solution to this problem, the work of other researchers was reviewed to get the idea of fabrication of large scale apparatus. R.A Jewell (1988) conducted Direct Simple Shear Testing and highlighted the practical significance of the unreinforced direct Shear test for assessing the shear resistance of fill material [1]. E.M Palmeira (1989) in his research work on Leighton Buzzard Sand conducted tests with different types of geo-grids in a Large Scale Direct Shear Testing Apparatus and observed that the influence of reinforcement bending was negligible. He observed that the reinforcement layer inclined to central plan caused reduction in strain and increased the shear strength of soil [2, 3]. American Society of Testing and Material (ASTM) also developed Standard Test Method for direct shear test of soil under consolidated drain conditions with the code of D 3080 (90). This test method covers the determination of the consolidated drained shear strength of a soil material in direct shear. The test is performed by deforming a specimen at a controlled strain rate on or near a single shear plane determined by the configuration of the apparatus. Generally, three or more specimens are tested, each under a different normal load, to determine the effects upon shear resistance, displacement, and strength properties. This is for the small scale direct shear test of shear box (60mm x 60mm x 20 mm). Guidelines of this testing apparatus and testing procedure have been followed for the large scale direct shear test [4]. Cerato A.B., Lutenegger A. J. (2006) worked on the specimen size and scale effect of direct shear Box test on sand in three different sizes of shear box and showed that the friction angle can be dependent on specimen size and that the influence of specimen size is also a function of sand type and relative density [5,6].Tongachai Boonklung (2013) in his research work conducted tests on large scale direct shear test (190.5 mm and 156 mm dia.) apparatus for the determination of shear strength of compacted waste rock in a mine. The results were used in the determination of slope stability. He showed that particle size, water content and size of specimen influences the shear strength of soil [6]. Yarmahmoudi (2010) designed and constructed a direct shear apparatus in large scale of size 400 mm x 400 mm and tested Almond gravel that is used in building [8]. R. Alias, A. Kasa, M. R. Taha (2014) studied the effect of particle size on shear strength of granular materials while using direct shear test. Small direct shear test (60 mm by 60 mm by 24 mm deep) were conducted for particles passing the sieves with opening size of 2.36 mm. Meanwhile, particles passing the standard 20 mm sieves were tested using large direct shear test (300 mm by 300 mm by 200 mm deep). The large direct shear tests and the small direct shear tests were carried out using the same shearing rate of 0.09 mm/min and similar normal stresses of 100, 200 and 300 KPa. The results show that the peak and residual shear strength increases as particle size increases [9]. Omar Altaf et al (2016) studied the effect of specimen shape and remolding characteristics of sand both in square and circular shear box of conventional type small scale direct shear testing apparatus presented the results of disturbed and undisturbed soil samples and evaluated the basic difference, effect and reliability of two apparatuses [10]. In the light of above literature review there is a need that a large scale direct shear apparatus be developed and fabricated to test the gravels up to the size of 60 mm in dia. and the results obtained from this test are more near to actual ground conditions in which the soil consists gravely particles. The same results could be interpreted with small scale testing and a correlation could be obtained.

3. Large scale direct shear apparatus

A large scale direct shear apparatus is designed and fabricated for testing the material with large particles. Main focus was on the design and fabrication of large scale direct shear box. The

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apparatus is set up with other units which already exist in the laboratory such as normal loading unit, the hydraulic actuator, hydraulic unit and data acquisition unit. The set up and the units are further elaborated as below:

3.1 Loading Unit

Loading unit of apparatus consist of shear box, dead weights system for normal load, Hydraulic actuator for shear load, displacement measurement. In the loading unit the systematic description of each component is as below:

3.1.1 Shear Box

The large scale direct shear apparatus consist of two steel box i.e. upper shear box and lower shear box. The size of upper moveable shear box is 600 mm x600 mm x300 mm, while size of fixed lower shear box is kept as 600 mm x 760 mm x 300 mm. The size of the lower shear box is kept 160 mm more in length so that during shearing in horizontal direction, the shearing area remains the same and more than 20% shear could be achieved. The gap of 5 mm between the two boxes is maintained by putting groves in length wise direction and putting spikes in the these groves to achieve a frictionless movement of upper box over the lower box during shearing of sample. At the center of the upper shear box the head of the actuator machine is fixed, so that the actuator machine could apply shearing to the shear box. Figure 1 shows the schematic sketch of shear box set up. The upper shear box is movable while lower box is firmly anchored with the strong floor in the laboratory
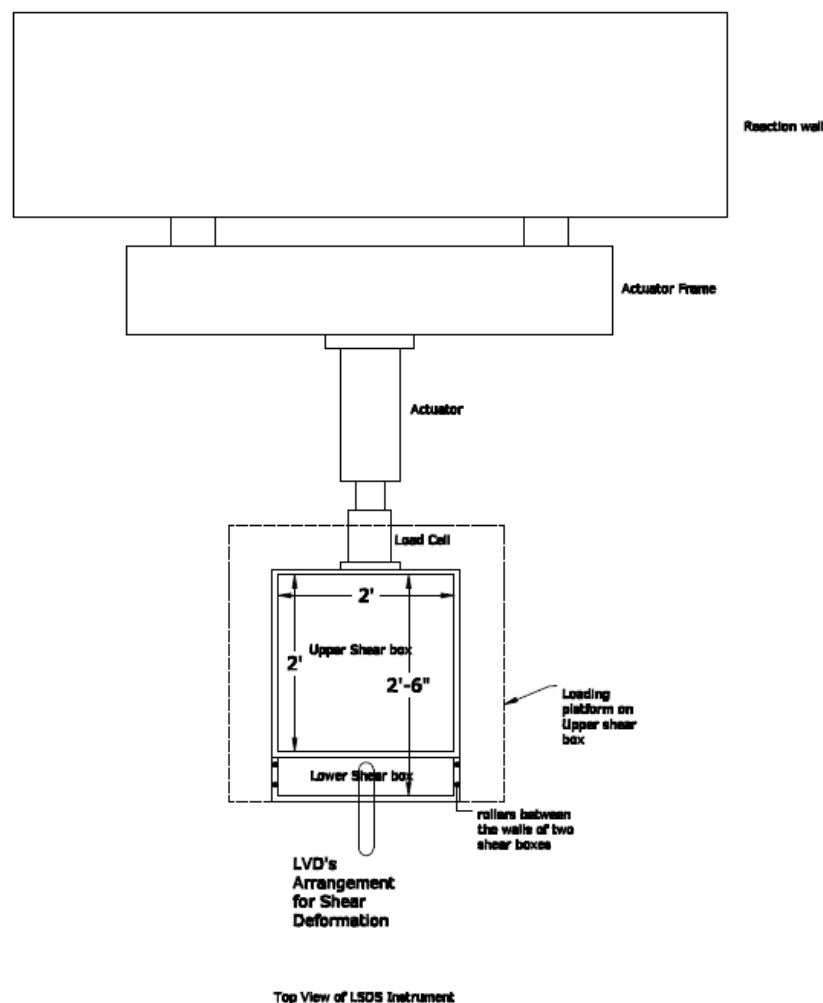
Fig.1 Schematic View of Large Scale Direct Shear Apparatus

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3.1.2 Seating Lid

The seating lid is provided to apply uniform normal load to the sample over which dead weight is loaded and an LVDT is fixed to it for the measure of the vertical displacement of the sample beneath.

3.1.3 Load Cell

The apparatus is fitted with the actuator for shearing load. The actuator is loaded on to produce Stress in the shear box by pushing the shear box. The load cell is also connected to data logger through cables where it could record the applied load with the specific time intervals. The Shear box is loaded with the sample the lid is placed over the sample and required normal load which dead weight blocks are put on the lid through crane system which transmit this load directly to the sample without touching with the sides of shear box. The normal load applies almost uniform normal stress on the shear plane. The displacement of the sample is recorded through a LVDT of 100 mm capacity. The shear load is applied through transverse load cell (actuator) of loading capacity 25 tons and displacement capacity of 100 mm. The shearing load and displacement are recorded at specific intervals and the rate of shearing is kept as 1 mm/min

3.1.4 Displacement Measurement

Displacements of the sample are monitored and measured through LVDTs which are linear variation displacement transducers. Total of two numbers of LVDTs are used for the measurement of horizontal as well as vertical displacement of the sample. The available displacement devices have sufficient range so that it can accommodate the displacements up to 20% horizontal shear and vertical settlement of the sample during testing. The available devices can accurately record up to 0.001 mm displacements both in horizontal and vertical directions.

Fig-2Large Scale Direct Shear Box Set up

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Fig-3 Overview of set up

3.2 Hydraulic Power Unit

The Hydraulic power Unit used in this set up can provide the required hydraulic pressure to the actuator. It is connected to the actuator through flexible cables. This unit has an oil tank and the oil is pumped through an electric motor. Further is it is connected to computer which can control the required pressure to the load cell

Fig-4 Hydraulic Power Unit

3.3 Data Acquisition through Data Logger Unit

Acquisition of data is done through computer which store data in data acquisition card. The horizontal shearing load and displacement are recorded through this system. The output signal is

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connected to CPU of computer through a cord and the load and deformation values are recorded at desired intervals. The Computer software can collect data and can display load and displacement readings. It can also plot graph between load and displacement.

Fig-5 Hydraulic Power Unit

4. Methodology of further work and testing on large scale direct shear apparatus

A further testing on this apparatus would be conducted to study the effects of fraction of coarser material and sand gradation on the shear strength and angle of internal friction. The samples will prepared with varying percentage of coarse material and testing both in small and large scale direct shear test. The particle with smaller grain size will be tested in small scale direct shear test according to ASTM D 3080-90 while material with larger grain size will be tested in large scale direct shear testing machine. Basic soil properties like unit weight, moisture content and soil gradation will be determined before testing. According to USCS (Unified Soil Classification System), mixtures will be classified accordingly. The index properties of gravel used (diameter specific gravity coefficient of uniformity Cu, Coefficient of curvature) will be determined. The sand used will be local sand and the index properties of sand (average diameter, specific gravity Gs, coefficient of uniformity Cu) would also be determined. The sand samples will be sheared both in loose as well as dense state under effective normal stresses of 50, 100 and 150 KPa at speed of 1 mm/min The uniform, clean sand with sub-rounded to sub-angular grains from the Nizampur will be used as the base material in the tests. Rounded gravel grains with maximum grain sizes of 10 mm and 30 mm will be used as oversized particles for mixing with base soil. As a result two sand-gravel mixtures with different gravel grain sizes will be considered in testing program. The gravel grains will be mixed with the base sand in four weight percentages of 10, 30, 50 and 70. A series of direct shear tests would be performed to assess the shear strength behavior of sand as the increased percentage of gravely material is added to it. The specific gravity values for sand and sand-gravel mixtures will be determined according to ASTM-D854. Drained direct shear tests will be conducted on consolidated sand samples with 10, 30, 50 and 70% gravely materials. The samples to be tested will have different percentages by weight of sand and gravel. Gradation will be done for all the mixture types of sand. The sandy soil will be first completely dried in oven and then 500 grams of specimen was taken for the purpose of test. Different size sieves will be laid down on each other in accordance with their mesh openings. Shaking will be given to the sample. Weight retained on each sample will be noted. Cumulative weight retained on each sieve will be calculated. Curve will be plotted between mesh size and percent passing each sieve. Effective sizes of D10, D30, D60, Co-efficient of uniformity and Co-efficient of curvature will be determined from the data obtained from graph.

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Table 1: Test program summary:

Description	Unit	Value to be used
Gravel content	% by weight	0, 10, 30%, 50%, 70%
Gravel sizes (maximum)	mm	10,30 mm
Density	%	Loose state, Dense state
Overburden / Normal pressure	K pa	50, 100, 150

5. Summary and Conclusion

The results of small scale and large scale direct shear testing would be compared and possible relation of sand with larger particles would be sought and that relation would be used for testing in small scale conventional direct shear test which is simple and easier.

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Evaluating the effect of Nylon fibers In Self-Compacting Concrete

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Abstract

Self-Consolidating Concrete (SCC) is a special concrete which is highly flow able, non segregating and by its own weight spread into place, completely fill the formwork even in the presence of dense reinforcement . SCC also has a brittle characteristic. This project conducted to evaluate the effects of nylon fiber addition on fresh state characteristics of SCC mixes, and investigate the effects of nylon fiber on some hardened properties of SCC. In this project, concrete mixes were added with nylon fiber of 0%, 1.0%, 2.0 %, and 3.0 %. Fresh characteristics were evaluated based on its passing ability, flow ability, and segregation resistance using , Slump flow, L-Box and V-funnel tests. After 7 days, 14 days, 28 days of curing SCC cylinders, compressive and splitting tensile strength, were tested. Tests results indicate that nylon fibers tend to increase the passing ability but will decrease filling ability and segregation resistance of SCC. Furthermore, it can be concluded after 7 days, 14 days, 28 days of curing, concrete specimens tests indicate that nylon fiber addition up to 2.0 % of volume cement tend to improve the compressive strength, tensile strength, of hardened SCC but the 3.0 % of nylon fiber decreases the compressive strength, tensile strength, of hardened SCC. It also can be suggested that nylon fibers allowed to be added into SCC mixes up to 2.0 % Fiber by volume of cement.

Keywords: Self-Compacting Concrete, Nylon fibers

1. Introduction

Concrete is a composite material composed of water, coarse granular material (the fine and coarse aggregate or filler) embedded in a hard matrix of material (the cement or binder) that fills the space among the aggregate particles and glues them together. Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fiber that are uniformly distributed and randomly oriented. Fibers include steel fibers, glass fiber , synthetic fiber and natural fiber – each of which lend varying properties to the concrete. In addition, the character of fiber-reinforced concrete changes with varying concretes, fiber materials, geometries, distribution, orientation, and densities .As the Self compacting concrete has some problems to stop these problems to achieve the good result. Considering lower water-cement ratio and higher content of cementitious materials compared to conventional concrete, SCC should have improved durability and strength. However, similar with other types of cement-based materials,

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SCC also has a brittle characteristic. This characteristic can be improved by adding fibers in to the concrete mix. The term fiber added concrete can be defined as concrete containing dispersed randomly oriented fibers. Inherently concrete is brittle under tensile loading and mechanical properties of concrete may be improved by randomly oriented discrete fibers which prevent or control initiation, propagation, or coalescence of cracks. Fiber added concrete properties and performance change, depending on the properties of concrete and the fibers. The properties of fibers that are usually of interest are fiber concentration, fiber geometry, fiber orientation, and fiber distribution. Moreover, using a single type of fiber may improve the properties of fiber added concrete to a limited level. Shortcut type of fiber can be added to bridge micro cracks of which growth can be controlled. This leads to a higher tensile strength of the composite. Unlike its effects to hardened concrete, the presence of fibers in concrete mixes can cause significant deterioration to the concrete workability. On the other hand, workability is very important for SCC to achieve its requirement to flow, pass through tight openings without blocking, and completely consolidate by its own weight. Based on those reasons, this research was designed to investigate effects of Nylon fibres addition on some fresh and mechanical properties of SCC.

Self-compacting Concrete (SCC) is creative concrete that does not require any type of vibration and agitation for placing and compacting the concrete. This special type of concrete is able to flow under its own weight completely filling and achieving full compaction even in heavily reinforced structure. The self-flowing ability of this concrete reduces the man power or labour on the field. The hardened concrete is more dense, homogeneous and has the same

Self-Compacting Concrete (SCC) provide speedy rate of concrete placement at site. The SCC provides the ability to pass through the congestion, and occupy complete space in the form. The fluidity and the segregation resistance of SCC assure the high level of homogeneity and minimize the voids and gives the uniform concrete strength. The difference between conventional concrete and self-compacting concrete according to material are:

1. Limited aggregate content

2. Low water-powder ratio

3. Use of superplasticizer.

The Self compacting concrete was named as "High Performance Concrete ". At the same time " High Performance Concrete " was explained as a concrete with high durability due to low water cement ratio. Therefore Okamura has changed the term for proposed concrete to "High Performance self-compacting concrete". SCC can be also explained as a high performance material which flows under its own weight without requiring vibrators to achieve consolidation by complete filling of formwork even when access by narrow gaps between reinforcement bars .(Zhu et al. 2001). The self-compacting concrete is also be used in places where the machine of vibration are agitation does not reaches their such as columns or wall of heavily reinforced concrete. The high flow ability of SCC makes it possible to fill the formwork without vibration (Khayat et al 2004).

1.2 Problem Statment
This research conducted for investigating effect of Nylon fiber addition on four main characteristics of SCC in the fresh state: flow ability, viscosity, passing ability and segregation resistance. Effect of Nylon fiber addition on compressive strength and splitting tensile strength of SCC also wanted to be known. Based on the results of fresh and hardened SCC tests.

1.3 Objective
Paper size: 8.5 inch x 11 inch
Top: 0.75 inch., Bottom: 1 inch, Left: 1.25 inch, Right: 0.75 inch. The final text area must be 6.5 inch x 9.25 inch.

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1.4 Scope Of The Project

Improve mix cohesion, improving pumping ability over long distances.
Improve freeze-thaw resistance.
Improve impact resistance.
Increase resistance to plastic shrinkage during curing.
Fibers used in self compacting concrete are used in pre-cast concrete.

1.5 Literature Review

As the name suggests, it does not require to be vibrated to achieve full compaction, so there is no need of vibrator. The highly fluid nature of SCC makes it suitable for placing in difficult conditions and in sections with congested reinforcement. And also its placing takes less time and ease than conventional concrete. An important improvement of health and safety is also achieved through elimination of handling of vibrators and a reduction of environmental noise on and around a site. When the construction industry in Japan experienced a decline in the availability of skilled labor in the 1980s, a need was felt for a concrete that could overcome the problem of defective workmanship. This led to the development of self-compacting concrete, primarily through the work by Okamura. A committee was formed to study the properties of self-compacting concrete, including a fundamental investigation on workability of concrete, which was carried out by Ozawa et al. at the University of Tokyo. The first usable version of self-compacting concrete was completed in 1988 and was named "High Performance Concrete", and later proposed as "Self Compacting High Performance Concrete". Three basic characteristics that are required to obtain SCC are: high deformability, flow ability and a high resistance to segregation (Khayat, et al., 2004). The composition of SCC mixes includes considerable proportions of fine-grained inorganic materials and this gives possibilities for utilization of mineral admixtures, which are currently waste products with no practical applications and are costly to dispose of (St John, 1998).

1.5.1 Nylon Fibers

The term nylon refers to a family of polymers called linear polyamides. Nylon is a synthetically-produced fiber. Because it has strong fibers that are also stretchy, nylon is used to make many different things including clothing, rope etc. In nylon fibers, there are many types depending on the raw materials. The fiber most manufactured in Japan is "Nylon 6" fibers. In addition, "Nylon 66" fibers, rather resistant to heat, are also manufactured. Recently, "Nylon 46" fibers, improving their resistance to heat with higher melting point, are put into practical application. Chemically, nylon fibers are extremely versatile. Nylon is a very strong but lightweight material. It stretches but also regains its original shape easily. It is difficult to tear or damage. One of the very strong fibers. Extremely resistant to abrasion and flexing.The specific gravity is 1.14 Very light.Since nylon fibers absorb little water even though they are wetted. Excellent in elasticity and resistant to wrinkle.If properly set, nylon textiles little shrink/ extend or little deform their shape due to thermo plasticity. Resistant to chemicals and oil. Non-attackable by sea water. Non-attackable by molds and insects.

1.5.2 Tests

Many different test methods have been developed in attempts to characterize the properties of SCC. So far no single method or combination of methods has achieved universal approval and most of them have their adherents. Similarly no single method has been found which characterizes all the relevant workability aspects so each mix design should be tested by more than one test method for the different workability parameters. Alternative test methods for the different parameters are listed in Tables 2.1 and 2.2

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Table 2.1 List of test methods for workability properties of SCC

S.NO.	Test Method	Property
1	Slump-flow	Filling ability
2	T50cm slump flow	Filling ability
3	J-ring	Passing ability
4	V-funnel	Segregation resistance
5	V-funnel at T5minutes	Segregation resistance
6	L-box	Passing ability
7	U-box	Passing ability
8	Fill-box	Passing ability
9	GTM screen stability test	Segregation resistance
10	Orimet	Filling ability

2. Tables
2.1 Fresh properties tests on self-compacting concrete:
On the basis of above experimental work we performed different type of tests. We mix concrete in a mixer in order to achieve standard consistency. After mixing the concrete casting is done and finally then harden property test is done. The tests we have performed are as follows.
.1.1 Slump flow

2.1.2 V-funnel

2.1.3 L-box

Table 2.1.1 :Result of slump flow and T50 cm slump flow

Name of test	Normal SSC	1% fibers SSC	2% fibers SSC	3% fibers SSC
Slump flow test	695mm	680mm	665mm	640mm
T50 cm Slump flow test	3 sec	4.5 sec	4.7 sec	5.8 sec

Table 2.1.2:Results of V-funnel and V-funnel at T5 minutes tests

Name of test	Normal SSC	1% fibers SSC	2% fibers SSC	3% fibers SSC
V-funnel test	9.3 sec	10.6 sec	11.7 sec	13.3 sec
V-funnel at T5 minutes tests	12.2 sec	13.6 sec	14.7 sec	15.9 sec

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Table 2.1.3:Results of L-box tests

Name of test	Normal SSC	1% fibers SSC	2% fibers SSC	3% fibers SSC
L –box (H2/H1)	0.83	0.89	0.93	0.99

2.2 Hardened properties tests on self-compacting concrete:

Following are the tests carried on the concrete cylinder:

    2.2.1   Compressive strength of the concrete cylinder.

    2.2.2   Split tensile Strength of the concrete cylinder.

Table 2.2.1 : Results of compressive strength of SCC cylinders

After Curing	Normal SCC	1 % Fiber SCC	2 % Fiber SCC	3 % Fiber SCC
Strength after 7 days (Psi)	2305	2507	2667	2281
Strength after 14 days (Psi)	2836	2971	3228	2888
Strength after 28 days (Psi)	3392	3621	3792	3411

Table 2.2.2 : Results of Split tensile strength of SCC cylinders

After Curing	Normal SCC	1 % Fiber SCC	2 % Fiber SCC	3 % Fiber SCC
Split tensile Strength after 7 days (Psi)	521.33	538.76	604.39	618.91
Split tensile Strength after 14 days (Psi)	681.43	704.11	742.86	680.93
Split tensile Strength after 28 days (Psi)	704.71	778.14	803.91	723.41

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3. Figures

Figure 1: Slump Flow Test

Figure 2: V-Funnel Test

Figure 3: L-box Test

Figure 4: Split tensile strength

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Subgrade Stabilization using Cement and Rice Husk Ash

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Abstract:
Subgrade acts as foundation for a pavement structure. Soil strength can be increased through addition of chemical additives like cement, lime, Rice Husk Ash, Fly Ash etc. depending on the availability of additives. Stabilization of soil using cement or lime only is not cost effective. The use of Rice Husk Ash may minimize cost as it can act as a stabilizing agent. The present study is carried out on the soil of Islamabad-Murree-Muzaffarabad Expressway near Shawala to investigate its stabilization potential. A small amount of cement is mixed with different percentages of Rice Husk Ash (RHA). The results obtained show that the increase in RHA content increases the Optimum moisture content (OMC), but decreases the Maximum dry density (MDD),. There is a considerable increase in the California bearing Ratio CBR value and unconfined compressive stress (UCS) UCS of soil with RHA content. After increase in a certain percentage of RHA content the strength of soil starts decreasing. Addition of 6% cement and 15% RHA content is recommended as an optimum amount to gain maximum improvement in strength.

Keywords: Soil-Stabilization, Subgrade, Rice Husk Ash, Cement.

1. Introduction

Transport and communication infrastructure acts as a backbone for the economic and industrial development of a country. The pavement subgrade acts as an understructure for pavement. The strength of a subgrade layer is directly related to the life of pavement. If the subgrade is strong the overtopping layers thickness can be reduced which also saves cost. Cement is used as a main stabilizing agent but the rapidly increase in price because of the sharp increment in the expense of vitality is presently deterrent in utilizing the cement. In this manner the utilization of agricultural waste, (for example, rice husk powder RHA) will impressively lessen the expense of development and also decreases the environmental hazards they causes. RHA cannot be used alone with the soil because of scant cementious properties. Small amount of cement is mixed with RHA and the effect on soil properties like maximum dry density (MDD), optimum moisture content (OMC), unconfined compressive stress (UCS) and California bearing Ratio (CBR) is observed. In Pakistan, where there is weak soil, such stabilization can prove very effective `both in terms of engineering and cost. The repeated overlaying and maintenance of pavement can be circumvented and focus can be shifted to new alignments and roads.

2. Research Objectives

The main objectives of this research are the stabilization of soil to improve subgrade layer of the pavement. The Target of study was to:

- Strengthen and escalate the load carrying capacity of subgrade soil using soil stabilization techniques.
- Reduce the swell potential of subgrade soil.
- Increase the durability of soil.
- Analyze the use of cement and RHA as a stabilizer.

3. Literature Review

Sub-base dependability is the strengthening of soil qualities under the rehashed stacking. In the properties of soil every property significantly influences the long haul capacity of asphalt under the street. Soil ought to be sufficiently stable to give such quality against weight improvement from asphalt at later times. It ought to additionally control the perpetual and over the top rutting of subsoil because of the weight advancement in the life time of asphalt. At the point when unique soil doesn't have such properties it is important to make that soil fit for this sort of result for the advancement of asphalt. The fuse of cement alone in the soils is indistinguishable to (Kedzi, 1979) and (Brown, 1996) announcement that cement would get an expand Maximum Dry Density (MDD) and demonstrate a decrease impact in Optimum Moisture Content (OMC). It is associated that the expansion with cement clearly improved the fondness of cement for water and collection of particles which had come about the arrangement of bigger full scale pores inside of the soil. Regarding compressive quality, cement yields unmistakable enhancement for the common soils. Quality increments continuously with period of curing. This is in concurrence with what had been accounted for by (Bergado et al, 1996) that the rate of expansion of quality is by and large fast in the early stages and from there on reductions with time. Due to its protecting properties, RHA has been utilized as a part of the assembling of obstinate blocks. Several studies have been completed to sanitize RHA for utilization in silicon chip fabricate. The systems are as yet being created, however seems promising. It is realized that ranchers in Asia will utilize RHA to avoid bug assault in put away nourishment stuffs, and a few investigative studies have been done to test the viability of this. Greenwich University are examining little scale paddy processing in Bangladesh and Vietnam, and the likelihood of utilizing RHA for water refinement. An organization in the USA have delivered a proto sort plant for assembling actuated carbon from RHA, and the real market for this is in water cleansing.

4. Methodology

The soil used in the research work was collected from Islamabad-Murree-Muzaffarabad Expressway near Shawala. Details are covered in section 3.3 of this chapter. All tests were performed on oven dried soil. Cement was used in the research as stabilizing agent. Bestway cement was used throughout the research work. Rice Husk Ash was obtained from Faisalabad. The Ash was in the fine form originally and was kept in airtight bags to avoid any moisture addition. Chemical analysis of Rice husk ash was carried out at School of Chemical and Materials Engineering NUST H-12, Islamabad. Soil was collected from area near shawala. Different tests were conducted to determine the characteristics of soil such as Grain Size Distribution, Atterberg's Limits, Moisture – Density Relationship of Untreated Soil

4.1 Moisture–Density Relationship of Cement Ash Treated Soil

Moisture-Density relationship of Cement Ash treated soil was determined to find optimum moisture content of the mix for different percentages. Modified proctor compaction test was performed according to ASTM 1557-10. Four percentages of RHA were used i.e. 5, 10, 15, 20% along with two percentages of cement 3 and 6% as shown in Table 1. Optimum moisture content (OMC) and maximum dry density (MDD) were found out for eight different mixes.

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Table 1: Proportion of different mixes

Serial No	Mixture	With addition of Cement (C)
1	Soil+5%RHA	Soil + 05% RHA + 3%C
		Soil + 05%RHA + 6%C
2	Soil+10%RHA	Soil + 10%RHA + 3%C
		Soil + 10%RHA + 6%C
3	Soil+15%RHA	Soil + 15%RHA + 3%C
		Soil + 15%RHA + 6%C
4	Soil+20%RHA	Soil + 20%RHA + 3%C
		Soil + 20%RHA + 6%C

4.2 Sample Fabrication

The test specimens were prepared following ASTM D 5102-09 for unconfined compressive strength (UCS) testing. The samples were fabricated using a mould having 6 inches height and 3 inches diameter. After calculations it was found 22 blows were needed for the compaction of single layer on the basis of energy delivered per unit volume of soil during modified compaction procedure. The cement-ash-soil mix was prepared at OMC and kept for at least 1 hour for hydration. The specimen prepared after 2 hours of mixing developed cracks after removal from mould. Two specimens were prepared for each cement-ash-soil percentage.

4.3 Curing of Samples

Samples were sealed in plastic sheets making them air tight to avoid removal of moisture. Samples were cured for the period of 7 days in an oven at 40°C. Curing arrangements are shown in Figure 1. and Figure 2.

Figure 1 and Figure 2: Curing arrangements for sealed samples

4.4 Soaking of Samples

After the curing of samples for 7 days, they were wrapped in porous cloth and placed over a porous stone in a container to apply soaking. The samples were kept in the container for 24 hours. After removing from container, samples were tested and the average of results was considered.

4.5 Unconfined Compressive Strength (UCS) Testing

Unconfined compressive strength tests were carried out following ASTM D 5102-09. The machine applies the load to produce an axial deformation rate of approximately 0.5 to 2% per minute. The values of load (KN) and displacement (mm) were noted at equal time intervals. The sudden drop

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in load value indicated the failure of specimen. The peak values were noted down. The test arrangements are shown in Figures 3, 4, and 5.
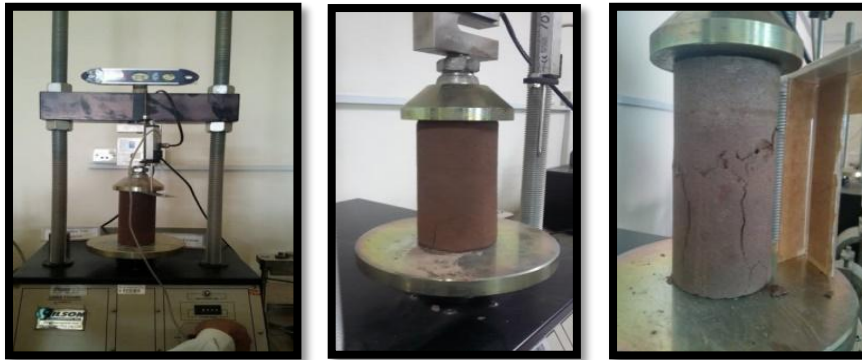
Figures 3, 4 and 5: Unconfined compression testing of samples

4.6 CBR Testing of Untreated and Treated Soils
CBR is a simple penetration test performed for the assessment of subgrade strength. The plunger used for penetration has an area of 3 square inch. The load was applied at the rate of 1.3mm per minute. The load readings were taken at the penetration ranging from 0.025 inch to 0.3 inch.

4.6.1 Untreated soil
The test was carried out according to ASTM D 1883-07. Three CBR samples were prepared for untreated soil. 1st at 90% of MDD on the dry side of optimum, 2nd at optimum moisture content (OMC) and 3rd at 90% of MDD on the wet side of optimum. Samples were soaked for 96 hours. Swelling gauge was attached with samples to note the swell after soaking.

4.6.2 Treated soil
CBR samples were prepared according to the mix percentages including soil cement and Rice Husk Ash. Three samples were prepared in the same way as that for untreated. The samples were cured in the oven for 7 days at 40°C. After curing, samples were soaked for 96 hours. Swell was noted for each sample.

5. Test Results and Discussions
Subgrade soil along Islamabad-Murree-Muzaffarabad Expressway N-75 near Shawala represents a nonstop issue to the performance of highway. Total 20 samples were prepared according to the specified percentages of mix to find the unconfined compressive strength. Two samples were tested for each combination and the average strength was considered. Similarly 12 tests were performed to find the CBR value for different combination of mix. These tests included both treated and untreated soil. All tests were carried out after soaking. Soil reacted well to both stabilizing agents. There was a considerable increase in the unconfined compressive strength and CBR value with the addition of stabilizing agents. Soaked strength increased almost 42 Times (from 6.55 psi to 278 psi) when stabilized with both cement and rice husk ash. The swell potential of soil was reduced to almost zero.

5.1 Soil Characterization
Different test results for unstabilized soil are condensed in Table 2. And detailed discussion on test outcomes is given in resulting sections.

5.1.1 Soil classification
Sieve analysis and Atterberg's limits helped in the classification of soil. The results obtained from above tests classified the soil as Silt as per Unified Soil Classification System and A-4 as per AASHTO classification system.

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Table 2: Summary of Soil Characterization Result

Soil as per USCS		Silt
Soil as per AASHTO		A-4
Liquid limit (%)		14
Percent Passing Sieve No. 200		26.6
Specific Gravity		2.91
Maximum Dry Density, (g/cm^3)		2.13
Optimum Moisture Content, (%)		7.1
Unconfined compressive strength, UCS, psi	Soaked	6.55
	Un-soaked	42
California bearing ratio CBR, %	Soaked	12
	Un-soaked	25
Swell, (%)		2.1

5.1.2 Strength and durability characteristics of soil

Unconfined compressive strength tests results indicate that there is a large decrease in strength of soil after soaking for only 24 hours. Swell of soaked sample came out to be 2.1 %. Soil under soaked conditions gets so weak that it is unable to even manage its self-weight. There were little cracks developed after soaking. CBR test outcomes demonstrate that the soil has an incredible CBR when compacted to 90% of MDD on dry of optimum. On the other hand, the CBR value was reduced when the soil was compacted at OMC. The CBR further dropped when the soil was compacted to 90% of MDD on the wet side of optimum. Fig. 4.1 demonstrates the impact of dampness on CBR of characteristic soil. As the soil belongs to the area of high rainfall and snow in winters, drainage also a problem, therefore appropriate measures should be taken before constructing any pavement in particular area.

5.2 Stabilization with Rice Husk Ash and Cement

5.2.1 Pozzolanic Properties of Rice Husk Ash

Rice husk was considered as valueless by-result of rice processing. Despite the fact that, the ashes have been potential pozzolanic materials suitable for utilization in lime–pozzolana blends and for Portland cement substitution .The ashes utilized as a part of this study are acquired from blazing of rice husk in the incinerator. Chemical composition of Rice Husk Ash is given in Table 3.

Table 3: Chemical Analysis of Rice Husk Ash

Constituent	Percentage
Silicon Dioxide, (SiO_2)	79.91
Aluminium Oxide, (Al_2O_3)	2.50
Magnetite, (Fe_3O_4)	0.17
Calcium Oxide, (CaO)	1.41

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Magnesium Oxide, (MgO)	2.26
Phosphorus pentoxide (P_2O_5)	4.71
Carbon (C)	6.87
Potassium Oxide, (K_2O)	2.17

5.3 Moisture-Density Relationship for Soil Cement RHA Mix
5.3.1 Effect of RHA on OMC

Figure 6. Show the effect of Rice Husk Ash on the optimum moisture content (OMC) of mix. Increase in the RHA content resulted in the increase of OMC. This behavior is due to the water used by the pozzolanic material (RHA) in the hydration process. Therefore OMC would be the highest for the mix containing 6% cement and 20 % RHA as both stabilizing agents plays an important part in hydration process.
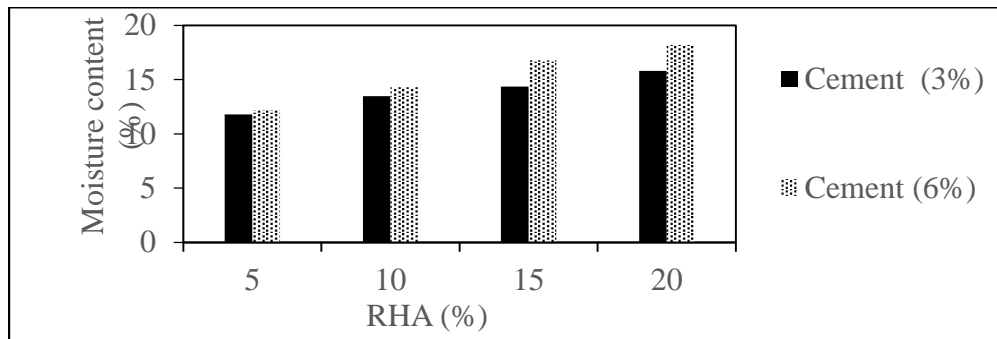
Figure 6: Variation in moisture content with increase of RHA

5.3.2 Effect of RHA on MDD

Figure 7. shows the effect of Rice Husk Ash on the MDD of mix. Increase in the RHA content resulted in the decrease of MDD. This trend is due to the lower specific gravity of RHA as compared to the soil and cement.
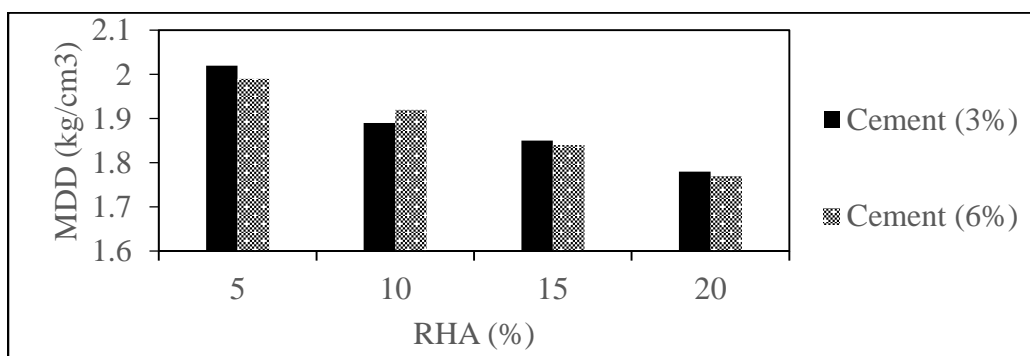
Figure 7: Variation in maximum dry density with increase of RHA

5.3.3 Unconfined Compressive Strength of Treated Soil

UCS is the most common and versatile technique for assessing the quality of stabilized soil. Variation of UCS with increment in RHA from 5% to 20% along with 3 & 6% cement was investigated and the results are indicated. The gain in strength with the addition of cement and rice husk ash is shown in Figure 7. The maximum strength is achieved at the addition of 6% cement and 15% RHA. The UCS is increased 42 times. Further increase in RHA content decreases UCS,

because after the addition of 15% RHA may results in forming weak bonds between the soil and the cementitious compounds.
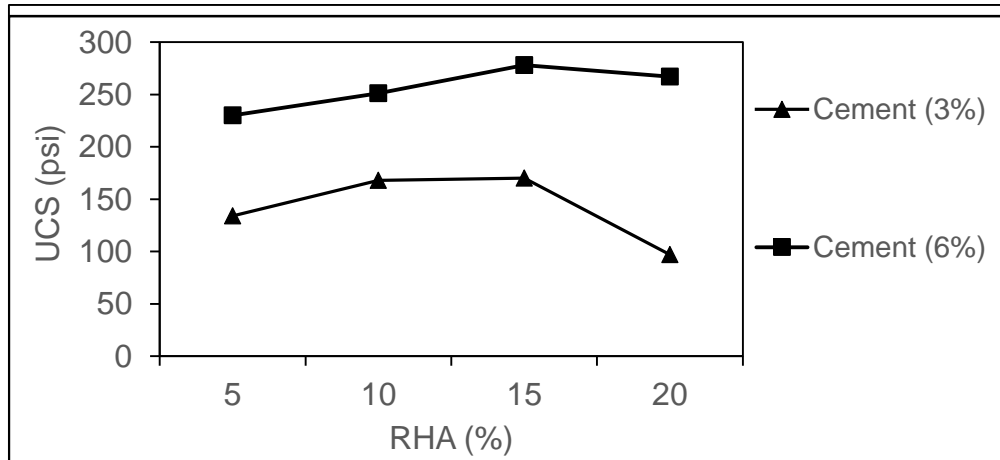
Figure 7: Variation in UCS with increase of RHA

5.3.4   California Bearing Ratio Of Treated Soil

The variation of CBR with increase in RHA from 5% to 20% mixed with soil and 3% to 6% cement is shown in Figure 8. The maximum value of CBR is obtained at 6% cement and 15% RHA. Gain in strength is due to the reactions between the RHA and CaOH present in the soil and cement. The CBR value is increased 21 times at optimum percentages of stabilizing agents. Further increase in RHA content reduces the CBR value which may be due to the formation of weak bonds in the mixture.
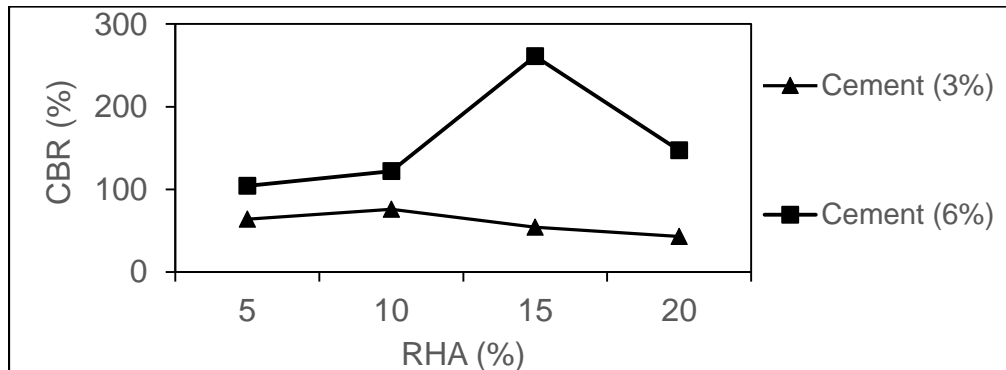
Figure 8: Variation in CBR with increase of RHA

6   Conclusions and Recommendations

6.1 Conclusions

Based on the test results, following conclusions are drawn:

- Soil is very reactive to both stabilizing agents i.e. cement and RHA, therefore better strength results have been achieved.
- A large improvement in UCS and CBR is noted. UCS and CBR of soaked soil is increased up to 42 times and 21 times respectively after treating with 6% cement and 15% RHA.
- For achieving maximum strength, soil stabilization using 15% RHA Content with 6% cement is suggested as an optimum amount.

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- Compaction of soil within two hours after mixing is likely to provide maximum strength in the field and swell potential of soil is also reduced to almost zero.

6.2 Recommendations

- Use of soil stabilization procedures in expressway development is not exceptionally basic in Pakistan. Soil stabilization offers in fact and monetarily practical solutions for some highway designing issues. This technique needs to be utilized all the more as often as possible to enhance the quality properties of silty subgrade.
- Composition of agro-based waste items differs with soil (because of silica accessible in soil). There is have to analyze the Rice Husk Ash from different sources everywhere throughout the nation to institutionalize its utilization as a pozzolan in soil stabilization.
- Comparison of cost may additionally be mulled over to find out the monetary impacts of stabilizing out granular soil utilizing cement RHA.

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Review on Municipal Solid Waste Generation in Pakistan: A Viable Source of Revenue Generation

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Abstract

This paper is related to the review of the Municipal Solid Waste (MSW) generated in different cities of Pakistan. The MSW generated in the cities of Pakistan consist of many types of waste being generated such as industrial waste, institutional waste, construction and demolition waste and domestic waste etc. In this paper, we are focusing on the domestic municipal solid waste being generated across the country. As MSW is one of the major environmental issues of the cities of Pakistan. An attempt has been made to provide a detailed review on the characteristics, composition and efficient utility of this waste in order to generate revenue. Around 1.8 billion Pakistani Rupees can be generated on a monthly basis from five major cities of Pakistan by selling out the readily saleable items present in the MSW stream to the respective industries. The readily saleable items would not only generate revenue from the MSW, but would also flourish industrialization, increased employment opportunities and prevent the environment from deterioration.

Keywords

Municipal Solid Waste Pakistan, MSW Composition of Pakistan,Revenue Generation from MSW in Pakistan.

1. Introduction

Pakistan is a country situated in southern Asia. It comes next to Iran, India and Afghanistan. It covers a total area of 880940 sq-km (Brecher&Wilkenfeld 1997). On a world map, Pakistan is located on a latitude and longitude of 30 00 N and 70 00E respectively (U.S. Studies 2008). The total population of Pakistan is around 180 million with an average annual growth rate of 2.6% making it the sixth largest country with respect to population. Currently 65 million people are living in the urban areas whereas 112 million people are living in the rural areas. The rapid pace of urbanization trend has flourished the industrial and infrastructure development which in turn is responsible for high rate of municipal solid waste generation (M. Rahman 2013). The solid waste management practices are unfortunately not up to the mark in most of the cities of Pakistan. The solid waste generated in Pakistan is not managed in a proper manner. This is one of the main reasons for the environmental and sanitary conditions becoming more serious year by year (A. Mahar et al.

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2007). The annual solid waste generated in Pakistan is around 20 million tons (Katchi 1996). The collection efficiency of the municipalities of Pakistan is around 51% to 69%. The remaining waste finds its way on open streets, roads and in sewers (A. Mahar et al. 2007). The scavengers collects the valuable items from this waste and the revenue is generated informally. The municipal authorities spend large amount of money on the collection and disposal of this waste, which not only result in over expenditures but also occupy a lot of areas of the valuable lands eventually causing environmental degradation and unhygienic conditions in the surrounding localities.

2. Literature Review

(Farwa et al. 2015) reveals the composition and recycling potential on MSW generated in Lahore. In this study, the author has reported the qualitative and quantitative assessment, generation of MSW in Lahore and characterization of MSW of Lahore city. The study concluded with positive outcomes, which are beneficial to encourage the researchers and the concerned authorities to work further to improve the current system. Figure 1 shows the typical waste composition of Lahore city. The figure shows the percentage composition of different waste components.
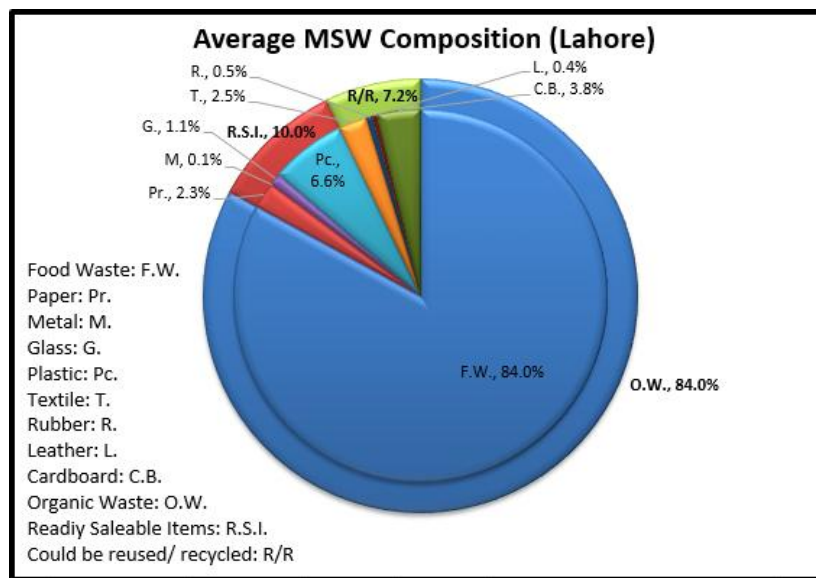
Figure 43: MSW Composition of Lahore (2015)

(FWMC 2015) reported the implementation of the integrated solid waste management plan to the entire city of Faisalabad. The existing organizational structure, City District Government Faisalabad (CDGF) was unable to manage the solid waste collection and disposal process adequately resulting in public health serious environmental concerns. Later, the province allowed the formation of Faisalabad Waste Management Company (FWMC) to manage the municipal solid waste effectively. Initially FWMC started providing its SWM services in 113 union councils (4 Towns i.e. Iqbal Town, Laylpur Town, Jinnah Town and Madina Town) of Faisalabad. After the positive outcomes from the services of FWMC, the company started expanding its services to the entire city. The total daily amount of MSW generated in Faisalabad is around ranges 900 tons/day. The CDGF was operating at a collection rate of 40% only whereas after the establishment of FWMC, the company collection efficiency has reached up to 63%. The study aims to improve the solid waste management services at divisional level, extending the coverage of the services to entire city and initiating environmentally friendly MSWM system by reinforcing the 3R hierarchy. Figure 5 shows the overall composition of the municipal solid waste of Faisalabad city.

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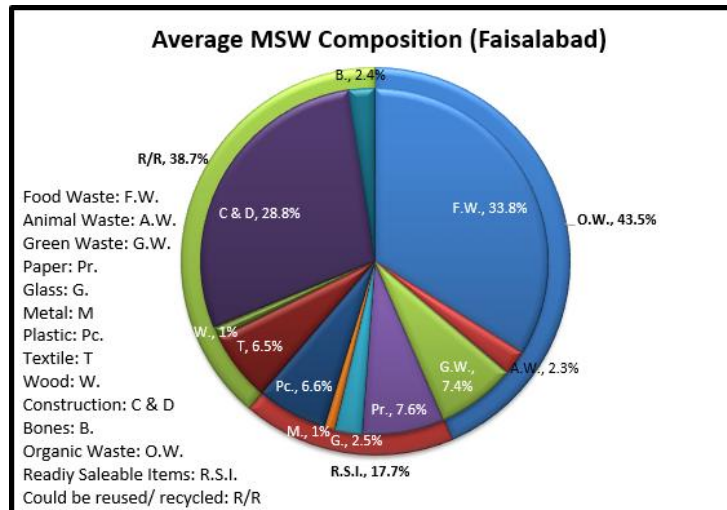
Figure 44: MSW Composition of Faisalabad (2015)

(DOS 2008) reported on the waste composition of the MSW and improvement of directorate of sanitation for the waste disposal services in Islamabad, the capital of Pakistan. CDA is responsible for the collection, transportation and disposal of the solid waste generated in Islamabad. The total daily amount of MSW generated in Islamabad ranges from 500 to 550 tons. The average waste generation rate is 0.28 kg/capita/day to 0.61 kg/capita/day. The waste reported in the study is a mixed type waste including kitchen waste, green waste, domestic waste, commercial waste, demolition waste and other wastes. The aim of the study is to implement the organizational structure for better waste collection and disposal systems. Figure 4 shows the average composition of the municipal solid waste being generated in the capital of Pakistan.
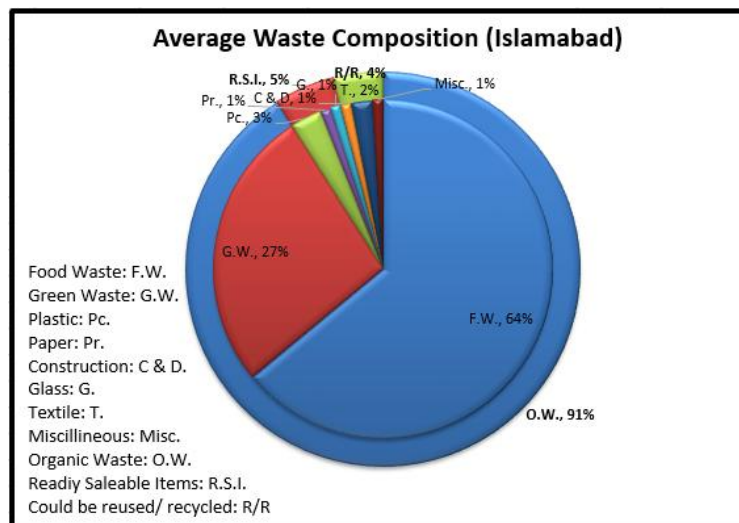
Figure 45: SWM Composition of Islamabad (2008)

(K. Plan 2006) studied the generation rate of solid waste in different areas of Karachi city. The study reveals that the projected average population of Karachi city for year 2005 was around 15 million and around 8000 tons of municipal solid waste is generated in the city every day. The Municipalities spend around Rs. 390/ton on the collection, transportation and disposal of the solid waste. There is already a huge market for the readily saleable items present in the solid waste stream. These dealers are purchasing these items from the local scavengers who segregate the valuable items from the waste stream and earn bread for themselves. The study shows fruitful outcomes. The municipal authorities will step ahead towards sustainable solid waste management and will be able to generate revenue from the solid waste and hence will be capable of managing

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the MSW if the Solid waste management system is organized in a proper manner. Figure 3 shows the characterization of the municipal solid waste being generated in Karachi.
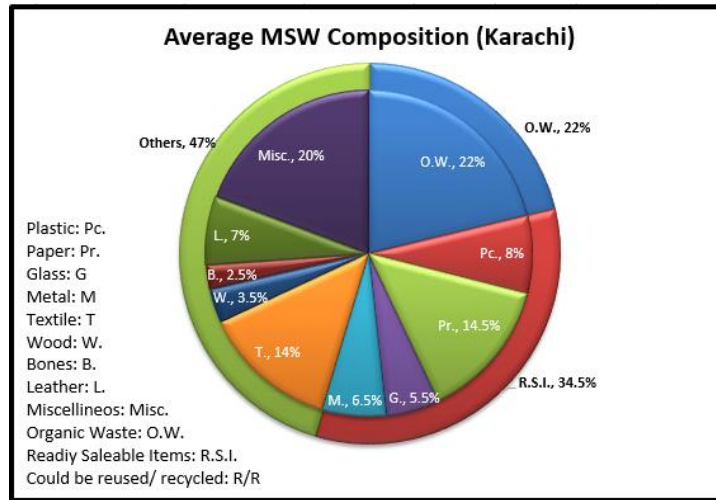
Figure 46: MSW Composition of Karachi (2006)

(M. Harper et al. 2004) assessed the MSW generated in Lahore. Lahore produces around 5000 tons of solid waste every day. The study reveals the composition of the MSW in Lahore, which helped the team of Waste Busters to launch a community based program in 1996. Initially, the project was started with a coverage of 1000 households which by June, 2002 extended up to 10,000 houses. For developing the vision of the citizens towards efficient utility of the MSW, the team started public awareness programs, and better waste management technique programs in collaboration with the city government. The households taking the services of the Waste Busters were charged with very nominal fee ranging from 30 Rs./ month to 100 Rs./ monthfor the collection of the MSW. The waste busters program consisted of door to door collection of the MSW from the domestic target areas. This waste was further sorted out to segregate the organic waste from the MSW stream and this organic waste was then converted into a compost fertilizer. As agricultural sector is the back bone of the economy of Pakistan, the natural compost fertilizer is not only a step towards the utilization of MSW in Lahore but it also leads to an increased the yield of the crops. Moreover, the program was a viable source of sustainable composting as one can easily make a compost fertilizer even at home with a very small investment rather than spending huge amount of money on artificial fertilizers for their crops. Figure 2 shows the MSW composition of Lahore city based on sampling done from the waste collected at source.
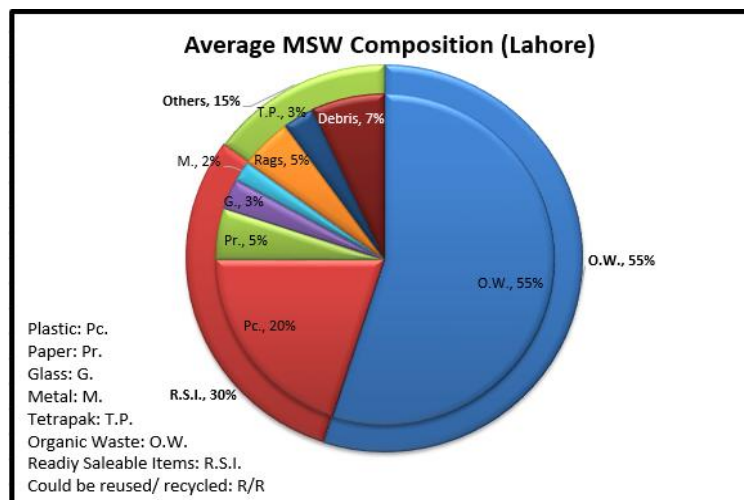
Figure 47: MSW Composition of Lahore (2004)

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(Pak-EPA 2004) reveals the characteristics and composition of MSW generated in Hayatabad Township, Peshawar.The study discusses the urban environmental problems due to the improper disposal of the MSW of Hayatabad.The township is spread over an area of 3299 acres with an equal area of around 388 acres for phase – I and phase – VI. Moreover, Phase – II covers an area of 615 acres whereas phase – V for offices and colonies for government organizations. Hayatabad generates around 100 tons of MSW on daily basis. The MSW of Hayatabad is generally collected by the cart owners on daily basis who are working voluntarily. They are not getting paid fromPeshawar Development Authority (PDA) for the waste collection but they segregate the readily saleable items from the MSW stream and sold it to the scrap dealers to earn their living. The food waste is utilized as a cattle feed by the scavengers and the remaining material finds its way in street dust bins, open plots and an open dumping site reserved for waste disposal at Phase – VII. Figure 6 shows a typical composition of the MSW of Hayatabad, Peshawar.
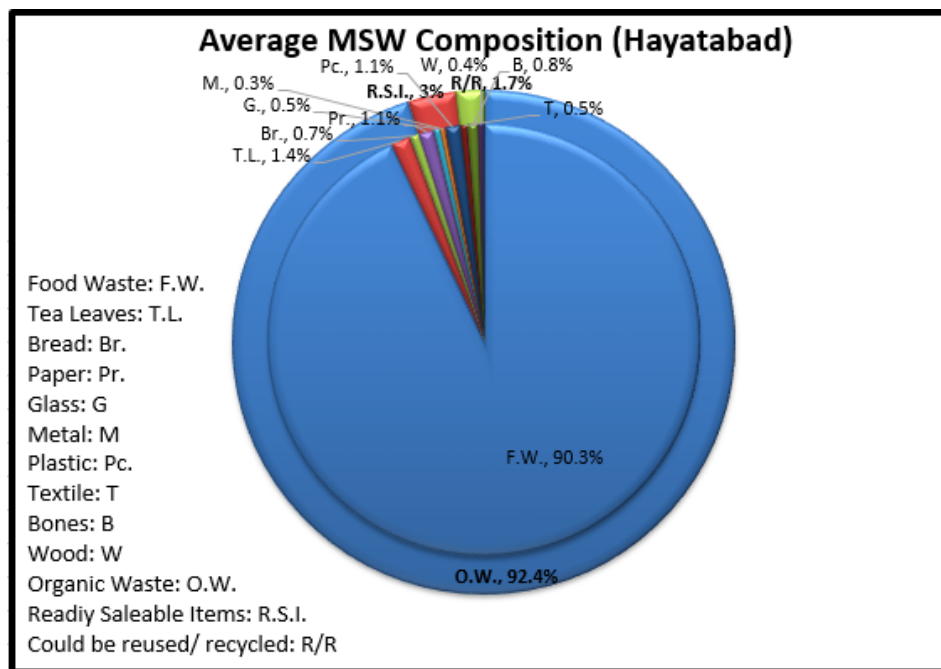
Figure 48 MSW Composition of Hayatabad, Peshawar (2004)

3. Discussion

All of the Solid Waste is not garbage, but if utilized in a proper way. Currently in most of the cities of Pakistan, the MSW is collected and disposed of on the valuable lands of the cities, which not only possess serious environmental concerns but also a major loss of the revenue that could be generated from this waste. A significant revenue can be generated from most of the solid waste items shown in the literature. This review focusses on the revenue generation from the readily saleable items in the MSW stream from the major cities of Pakistan. For this purpose an extensive survey has been done at the scrap dealer shops who are purchasing these readily saleable items from the local people. The MSW generation is highly linked with the population of the region. The more the population is, the higher is the MSW generation. For example, Karachi is the largest city of Pakistan, producing around 2700 tons of readily saleable items (34% of the total MSW) every day, whereas Islamabad is a city producing around 27.5 tons (5% of the total MSW) each day. Table 1-1 below shows the average unit rates based on a survey being done in 30 scrap dealer shops.

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Table 1: Assessment of revenue generation from the Readily Saleable Items (R.S.I.)

R.S.I. in MSW (Tons)	Unit Price (Rs. / Tons)	Lahore	Karachi	Islamabad	Faisalabad	Hayatabad, Peshawar
Metal	26	100	520	-	9	0.3
Plastic	14	1000	640	16.5	59.5	1.1
Paper	12	250	1160	5.5	68.5	1.1
Glass	1.6	150	440	5.5	22.5	0.5
Total Tonnage	-	1500	2750	27.5	160	3
Daily Revenue (PKR)	**-**	**19,840,000**	**37,104,000**	**305,800**	**1,922,400**	**37,200**

4. Conclusion

The whole conclusion of the study on the current status of Municipal Solid Waste of Pakistan is as follows:

- The Municipal solid waste in Pakistan has a greater potential of revenue generation.
- The municipal authorities spend a lot of funds only the collection and disposal of the waste.
- No formal practice of revenue generation by the authorities is done from the municipal solid waste generated in the cities of Pakistan.
- Around 1.8 billion Pakistani Rupees can be generated on a monthly basis only from the above mentioned cities waste by selling out the readily saleable items present in the MSW stream.
- The remaining organic waste generated from these cities which comprises of an average of about 60% can be utilized for converting into animal feed or compost fertilizer.
- The Municipal authorities mainly focus on the collection and disposal of the solid waste generated in the cities.
- The collection efficiency of only 50 to 60% is achieved.
- The remaining 30% to 49% of the uncollected waste possess serious hygienic concerns in the nearby localities.

5. Recommendations

- The involvement of private sector and people could bring improvement to the efficiency of Solid waste management.
- Public awareness could help the society to know the worth of the solid waste if utilized properly.
- Segregated waste disposal.
- Implementation of formal revenue generation practices
- Ensuring door to door collection to improve the collection efficiency.

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The Effects of Recycled Concrete Aggregate (RCA) and Styrene Butadiene Rubber (Sbr) Latex on Mechanical Properties of Concrete

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Abstract:
Sustainable development is gaining popularity around the world nowadays. For the conservation of natural resources, reuse and recycling of construction and demolition waste (CDW) is the most obvious way to achieve sustainability in the construction sector. Currently, recycled aggregate (RA) is produced from CDW in modern recycling facilities, under good quality control provisions which could lead to improve its performance. An investigation into the properties of RCA is made using crushing and grinding of concrete rubble collected from different demolition sites and landfill locations. However, to increase the use of RA for the cost effectiveness, it is believed that the quality of RAC should be improved by using quality-improving admixtures i.e. new generation polymer-based Super Plasticizers (SP) are deemed to be a good option. Aggregates used in the study were: natural sand, natural aggregate and crushed concrete obtained from different sources. A total of 72 concrete mixes forming four groups were cast. Groups were designed to study the effect of recycled coarse aggregates (50%, 75%, and 100%), cement dosage and use of Super-Plasticizer in various quantities by weight of cement (0.5%, 1%, 1.5%). Tests were carried out for compressive and modulus of rupture. It has been observed that there is a decreasing trend of 25% in compressive strength. The results showed that the concrete rubble could be transformed into useful recycled aggregate and then can be used in concrete production with properties suitable for most structural concrete applications. A significant reduction in the properties of recycled aggregate concrete (RAC) made of 100% RCA was seen when compared to natural aggregate concrete (NAC), while the properties of RAC made of a blend of 75% NA and 25% RCA showed no significant change in concrete properties and RAC made of 50% NA and 50%RA showed an optimum change in concrete properties.

Keywords: Concrete, Styrene Butadien Rubber, Recycled Aggregates, Natural Aggrgates, Demolition Waste.

1. Introduction:

One of the major challenges of our present society is the protection of environment. Some of the important elements in this respect are the reduction in the consumption of energy and natural raw materials and the consumption of waste materials. These topics are getting considerable attention under sustainable development nowadays. The use of recycled aggregates from construction and demolition wastes is showing prospective application in construction as an alternative to primary

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(natural) aggregates. It conserves natural resources and reduces the space required for the landfill disposal. Construction and demolition waste (CDW) has a huge potential for recycling, and this can contribute towards reducing the economic and environmental costs of removal to dumping grounds and more importantly, the excessive demand for natural resources, especially natural aggregates (NA), for construction work. Recycling of CDW is of paramount importance because it reduces environmental pressure. Environmental impacts caused by the extraction of non-renewable raw materials include extensive deforestation, soil loss, air pollution and pollution of water reserves.

1.2. Demolition
The main reasons for increase of volume of demolition concrete and masonry waste are as follows:
- (i)   Many old buildings, concrete pavements, bridges and other structures have overcome their age and limit of use due to structural deterioration beyond repairs and need to be demolished.
- (ii)   The structures, even adequate to use are under demolition because they are not serving the needs in present scenario.
- (iii) New construction for better economic growth.
- (iv)   Structures are turned into debris resulting from natural disasters like earthquake, Cyclone and floods.
- (v)   Creation of building waste resulting from manmade disaster and war.

In addition to the resource management aspect other than usefulness of recycled aggregate concrete there are some serious issues with recycled concrete aggregates. According to Malesev, (2012), recycled aggregates absorb a large amount of carbon dioxide from the surrounding environment. The natural process of carbonation occurs in all concrete from the surface inward. In the process of crushing concrete to create recycled concrete aggregates, areas of the concrete that have not carbonated are exposed to atmospheric carbon dioxide.

1.3. Comparison between RCA and NA
Recycled aggregate concrete (RCA) compared to natural aggregate (NA) has following properties:
- (i)   Increased water absorption.
- (ii)   Decreased bulk density.
- (iii)   Decreased specific gravity.
- (iv)   Increased abrasion loss.
- (v)   Increased crushability.
- (vi)   Increased quantity of dust particles.
- (vii)   Increased quantity of organic impurities if concrete is mixed with earth during building demolition.
- (viii) Occurrence of existence of contents of chemically substance, depending on service conditions in building from which the demolition and crushing recycled aggregate is obtained.

1.4.   Contriving Factors of RCA to Environment
There is a general misconception about the negative influence of using recycled concrete aggregates in concrete production. Evangelism (2007) and Matias (2013) have studied the mechanical and durability properties of (RA) concrete, and the results contradict this idea. To better understand the mechanical and fresh-state properties of concrete, it is essential to study its durability because this measures its long-term performance.

According to Nitro (1998) there are following major factors which highly depend on the environment on the basis of recycling aggregate during any type of construction: (i) Dust and (ii) Noise.

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1.4.1. Dust

The Dust sources associated with mineral, waste and construction type activities fall into two types:

(i) Material crushing, screening and segregation plant and conveyor transfer of material, large stockpiles and spoil heaps with no containment where the surface is vulnerable to wind erosion. Vehicles travelling over unmade surfaces, particularly at high speeds, cause particle tube elevated with the finer particles capable of being carried long distances beyond site boundaries. Transportation and handling of material using loaders, excavators, and Lorries can produce dust through spillage and wind erosion as shown in Figure-1.3.

(ii) Crushers and screeners operating inside would need specialist dust collection and filtration equipment for the working environment and to reduce dust escaping through material entry and exit from the building. Free falling fine material can be taken by the wind and larger material can fragment on compaction. Therefore discharge of the material from chutes should be as close as possible to the stockpile.

1.4.2. Noise:

Noise created through the process of aggregate recycling crushing process can have a significant impact on the environment.It is therefore important to recognize this and manage it carefully noise from the production of recycled aggregates is normally not sufficiently high to cause physical damage to property or hearing, but it may well be high enough to cause disturbance. Noise is therefore a nuisance issue for recycled aggregates operations. Crushing and screening plants are normally hydraulically activated with the hydraulic pressure generated by a diesel engine, which is one source of noise. The crusher produces noise from the impact of the jaws or hammers on the material.In screens, the movement of the material across the screen surface can cause noise.These effects of dust and noise do accumulate the vulnerability of construction waste. Due to this increase in the ratio of construction waste on per year basis, various studies have been done in order to recycle this construction waste within our construction processes.

2. Experimental Program, Results & Discussion

Materials: The following materials were used for the various tests conducted in the Lab.

Cement: Ordinary portland cement was used for experimental work.

Water: Normal drinking water is used for experimental work.

Admixture: Styrene Butadiene Rubber (SBR) was used as admixture in various combination with RCA and cement.

2.1. Bulk Density Test:

Table 1: Test Data Observed for the Estimation of Bulk Density

Type of Aggregate	State	Cylinder Weight (Kg)	Cylinder Weight + Aggregate (Kg)	Aggregate Weight (Kg)	Cylinder Volume (m³)	Bulk Density (Kg/m³)
NA	Compacted	5. 895	13. 97	8. 075	0. 00556	1452
	Loose	5. 895	13. 44	7. 545	0. 00556	1357
RA	Compacted	5. 895	13. 22	7. 325	0. 00556	1317
	Loose	5. 895	12. 585	6. 69	0. 00556	1203
FA	Compacted	0. 875	2. 45	1. 575	0. 00103	1529
	Loose	0. 875	2. 26	1. 385	0. 00103	1345

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2.2. Specific Gravity and Water Absorption:

Table 2: Test Data observed for the Estimation of Specific Gravity

Calculations	(CA)	(FA)	(RA)
Wt. oven dry sample (g)	982	496	1950
Wt. SSD sample (g)	990	500	1980
Wt. of vessel + water (g)	2754	1540	2795
Wt. of water soaked sample (g)	3372	1826	4050
Specific Gravity	2.64	2.32	2.7
Apparent Weight	2.67	2.36	2.8
Absorption (%)	0.81	0.8	1.5

2.3. Fineness Modulus:

Fineness modulus of sand = 3.47
Fineness modulus of natural aggregates = 5.95
Fineness modulus of recycle aggregates = 6.26

2.4. Compressive strengths of concrete using various dosages of SBR latex & RCA.

Table 3: Compressive Strengths according to ASTM C469

SBR Dosage	Days	Compressive Strengths (f′c) (MPa)			
		100%NA	50%NA+50%RCA	25%NA+75%RCA	100%RCA
	7	16. 5	15. 4	15. 3	14. 3
0%	14	23. 1	19. 7	19. 5	18. 2
	28	26. 3	22. 0	21. 7	20. 2
	7	15. 43	14. 8	14. 3	13. 2
1%	14	23. 7	21. 7	20. 4	16. 5
	28	27. 4	23. 2	22. 6	17. 7
	7	17. 53	16. 6	15. 9	14
1. 50%	14	24. 4	23. 2	22. 6	17. 7
	28	28. 6	27. 2	25. 2	22. 1

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2.5. Modulus of Rupture of Concrete using various dosages of SBR latex & RA.

Table 4: Modulus of Rupture (MOR)

SBR Dosage	Days	Modulus of Rupture (fr)			
		100%NA	50%NA+ 50%RA	25%NA+ 75%RA	100%RA
	7	5. 14	3. 14	3. 07	2. 44
0%	14	5. 65	3. 49	3. 16	2. 70
	28	6. 28	4. 33	3. 33	2. 95
	7	4. 77	4. 00	3. 44	2. 34
1%	14	5. 76	4. 21	3. 65	3. 10
	28	6. 45	4. 23	3. 79	3. 27
	7	6. 09	3. 99	3. 53	2. 37
1. 50%	14	6. 46	4. 24	3. 67	3. 20
	28	6. 75	4. 96	4. 18	3. 37

3. Conclutions:

General relation between Compressive Strength (CS) and Modulus of Rupture (MOR) and strength characteristic were checked for regular concrete and recycled concrete specimens. The natural aggregates (NA) and recycled aggregates (RA) materials were collected from Sargodha Quarries and Makki Complex Plaza, Lahore, respectively.

72 specimens belonging to 4 groups with variable composition were tested for Modulus of Rupture (MOR) and Compressive Strength (CS) and specimen samples containing SBR LETEX performed better by showing high strength as compared to the regular concrete cylinders.

These specimen comprised of regular 1:2:4 ratios with following percentages by weight: (i) 100% NA, (ii) 50% NA + 50% RA, (iii) 25% NA + 75% RA and (iv) 100% RA, where SBR LETEX (Chemrite NN) was added in each group at a ratio of 1.5% of cement weight. Standard procedure **ACI 211 1-91** was followed to prepare standard concrete cylinders at UCEST Laboratory with 1:2:4 by weight ratio (cement, sand and aggregate).

Subsequent to the setting of concrete, all the samples were removed from the cylindrical molds and concrete samples were given water bath and were submerged in water for 3 days to 28 days. These four groups of specimens were test, after 7 days, 14 days, and 28 days, respectively, and were tested at UCEST Laboratory. The details of test results performed on the samples are given below:

Table 5: Compressive Strength and MOR Relation

Aggregates %	Compressive Strength and MOR	Increase in MOR
100 % NA	$F_r = 1.11/f'_c = 0.038$	79 %
50 % NA + 50 % RA	$F_r = 0.93/f'_c = 0.034$	50 %
25 % NA + 75 % RA	$F_r = 0.88/f'_c = 0.032$	42%

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To Study the Effect of Locally Available Additives on Subgrade Soil in Water Logged Areas of KPK

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Abstract

This paper presents experimental work to study the effect of various locally available additives on different strength parameters of subgrade soil in water logged areas of KPK, To avoid problems associated with weak water logged subgrade soil, engineers often recommend removal and replacement of weak subgrade soil which is too costly and time consuming process, so it was necessary to look for ways to make existing weak subgrade soil suitable for pavement construction. The objective of this research was to chemically stabilize the weak water logged subgrade soil of KPK mostly A-6 soil using different locally available additives like cement, bentonite, and stone dust, using some basic laboratory tests like CBR test, Atterberg's limits, swell value, and Modified Proctor test. Soaked CBR tests were performed to simulate the conditions of water-logging and excessive moisture content. Soil samples were prepared with different percentages of different additives and correlations were developed between strength parameters. The performance of stabilizers/Additives modified soil was compared with the performance of virgin soil. From this study it was found that the CBR and dry density increased with increase in cement content, while swell value decreased, at optimum value of 8% cement CBR increased from 3% to 52%. Increase in CBR was also observed for higher content of bentonite, but it showed decrease for Stone dust.

Keywords: CBR, OMC, KPK, cement, bentonite

Introduction

The importance of Transportation in the development of country is multidimensional, a country's economic status depends upon how well served the country is by different modes of Transportation. In Pakistan motorways like M-1, M-2, M-3 are the marked developments in the field of transportation engineering. Because of premature failures 50% of the roads require rehabilitation or re-construction, failure is mostly due to increased traffic volume, axle load and complicated road materials mostly the subgrade. In case of pavement engineering, the Subgrade serving as pavement foundation is a major element possessing a very complex composition and nature. The sub-grade soil, which supports the pavement layers and traffic, should be strong enough to maintain the integrity and smoothness of the pavement structure [1] Sub-grade soil is

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classified as (very poor, poor to fair, fair, good, and excellent) depending on the CBR (Bowles, 1992) [2]. For example, soil of CBR 0-5 % and compressive strength up to 50 KN/m2 is considered as poor and soft, such type of soil is considered unsuitable to be used as road subgrade and need to be stabilized. Subgrade soil may be stabilized by various methods like chemical stabilization, mechanical stabilization, using reinforcing elements like geotextiles. In this research work we focused on chemical stabilization being the cheapest and effective method of soil stabilization of subgrade soil keeping in view the effect of water logging, using different additives. We collected different additives like cement, slag, bentonite, stone dust etc mixed with subgrade soil and performed different Lab tests to evaluate strength potential of stabilized subgrade soil by comparing with untreated soil.

Problem Statement

Most of the roads in KPK are constructed on natural ground/soil which are either unsuitable to be used as subgrade, or may be water logged. Road failure due to subgrade is prominent in KPK particularly in water logged areas for example Peshawar-Mardan section of NCC (Nowshehra-Chakdara-Chitral), Mardan-Charsadda, Nowshera-Swabi via Jehangira, and Warsak roads. To overcome the problems associated with weak subgrade soil, it is often recommended to remove the weak soil and replace with suitable granular materials, which is too costly and time consuming process. Therefore for economical and efficient use of in-situ clayey material to be used as subgrade even in water logged areas, its stabilization is necessary. In this way the weak clayey materials (A-6) available in abundance in KPK can efficiently be utilized.

Scope and objectives of the Project

Main objectives of our research work are:
- Studying the strength potential of additives modified clayey soil particularly in water logged areas of KPK.
- To determine the optimum content of different additives like cement, bentonite and stone dust.
- To develop correlation between different strength parameters like CBR, MDD, and OMC against percent use of additive.
- Minimize road construction cost by reducing overall pavement thickness.

Literature Review

Although there has been state of the art practices for road design and methods for calculation of Resilient modulus which is an important parameter in the design of pavement, but in developing countries like Pakistan there is still use of CBR for getting Mr value. Hence it is necessary to use CBR as strength parameter in our research work to study the effect of stabilization on subgrade soil of KPK. Soil stabilization improve the strength parameters of soil such as cohesion and stiffness hence constructability is improved, performance is increased and ultimately decreasing the cost of project construction and maintenance (Aaron S.Budge) [3]. Qubain et al. (2000) for the first time in Pennsylvania incorporated the benefits of sub-grade lime stabilization into the design of major interstate highway pavement [4]. Materials and soils obtained from the Feuerletten (Keuper) and Amaltheenton (Jura) formations (Germany) were were treated using lime, cement, and combination of lime/cement by Ismail (2004) [5]. Khazanvoich et al (2006) reviewed the characterization of sub-grade material in ME Design Guide 2002 and applied it to Minnesota fine-grained soils [6]. Saad Ali Aiban (1994) worked on assessment of the strength properties of cement stabilized granular soils and on evaluation of the behaviour of these stabilized soils [7].

Class F fly ash cannot be used in separate for stabilization purposes because it don't possess cementing quality itself but only in the presence of activator like cement (Arora S and Adylik 2005) [8].

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Methodology of Work
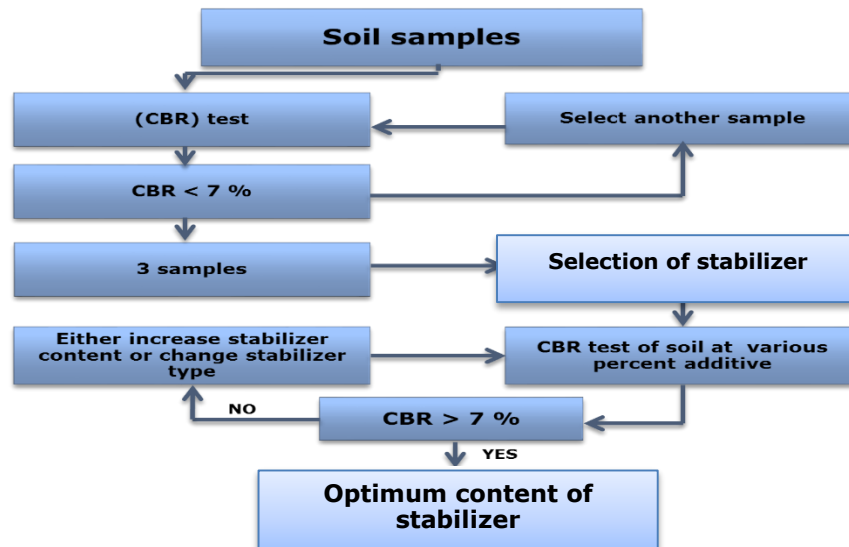
Subgrade soil samples were collected from different locations of District Peshawar which are affected with water logging. All the additives used in our research are locally available and are easily available at low cost. Bentonite was collected from Kati gari (District Mardan) which is available in abundance, stone dust from sawaldher, and cement was obtained from local stores.
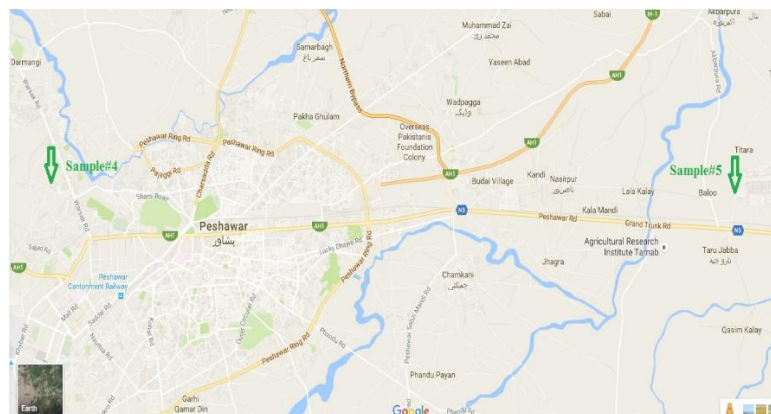
Figure 1 Site map of samples (District Peshawar)

Laboratory testing

Following lab tests, described in tabulated form, were performed during our research work

S No	Test description	Relevant standard
1	Atterberg's limits	ASTM D-4318
2	Sieve Analysis	ASTM D-421-22
3	Modified Proctor Test	ASTM D-1557
4	CBR Test	ASTM D-1883

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After performing the above mentioned basic tests on two soil samples of virgin soil, different properties were calculated, both the soil samples collected comes under the category A-6 of AASHTO soil classification, because L.L=<40; P.I=>11 and F200>36, results are tabulated as;

Table 63 Properties of virgin soil

Properties	Virgin soil
Natural moisture content %	17.26
Liquid limit %	29.10
Plastic limit %	16.70
Plasticity index	12.40
F200 (passing #200) %	60
O.M.C %	12.00
MDD	1.916
C.B.R %	3.4

Specimen preparation and testing

For CBR test specimens were compacted and prepared in standard proctor mould at optimum moisture content, prepared specimens were soaked for 96 hours to depict the effect of water logging. Glimpses of lab work are shown below;

Figure 2 sample preparation and performing CBR test

Summary of test results

Different additives were mixed with virgin soil and the effect of additives were analysed in terms of different strength parameters, which are described in tabulated form.

A. Effect of cement on different strength parameters

Summary of test results for different %ages of cements is as shown in table:

Properties	%age of cement								
	0%	0.7%	1.0%	2.0%	4.0%	6.0%	8.0%	10%	12%
O.M.C %	12	11.8	11.5	11	10.2	9.5	9.1	8.3	8.7
MDD g/cc	1.916	1.915	1.918	1.959	2.058	2.125	2.203	2.207	2.196
C.B.R %	3.40	5.80	10.40	21.80	29.60	41.50	51.20	56.10	57.30

The effect of cement on different properties can be well explained from the following graphs

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% age of cement vs OMC

$$y = -0.3662x + 11.876$$
$$R^2 = 0.9865$$

% age of cement vs MDD

$$y = 0.0286x + 1.9161$$
$$R^2 = 0.9201$$

% age of cement vs CBR (%)

$$y = 4.8247x + 7.3288$$
$$R^2 = 0.9481$$
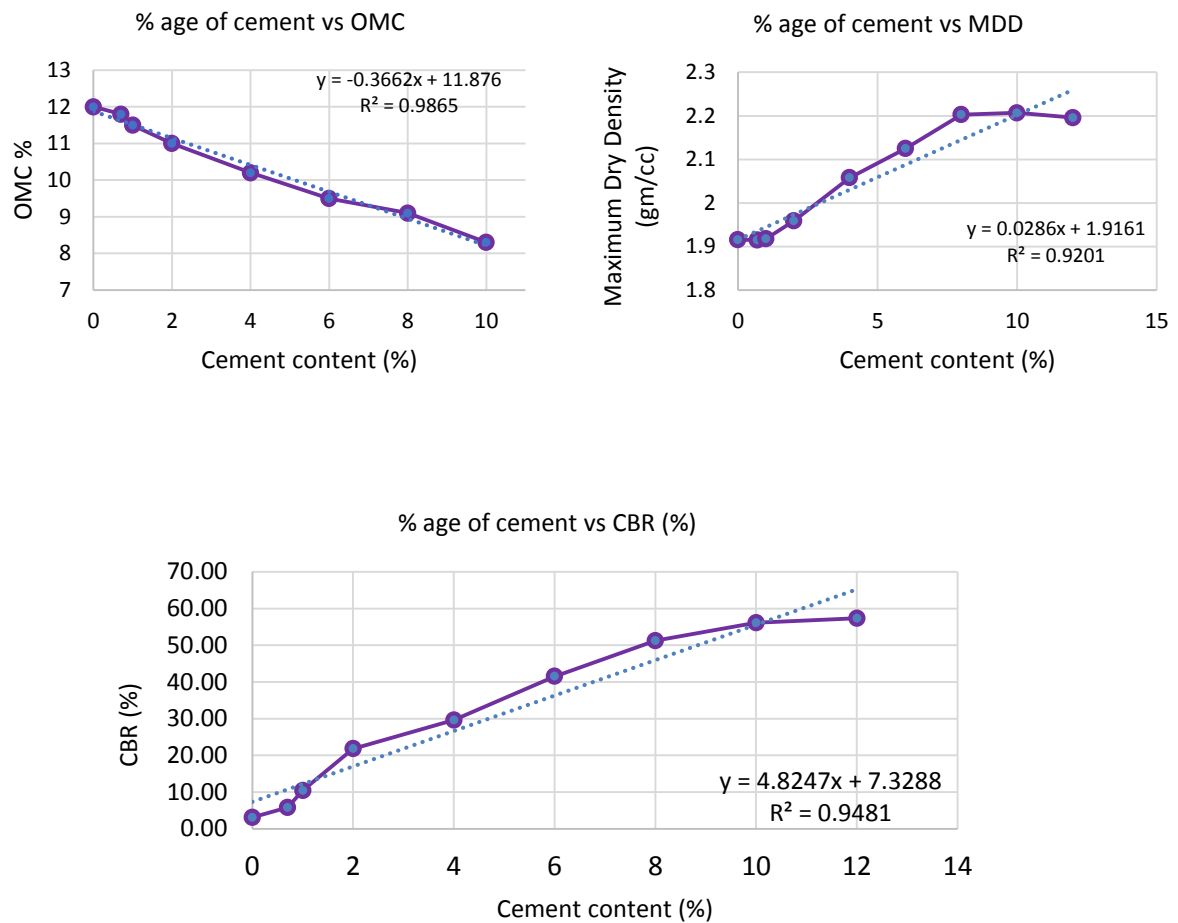
Figure 3 Graph showing effect of cement content over CBR

B. Effect of Bentonite on different strength parameters

Summary of test results for different %ages of Bentonite is as shown in table:

Properties	%age of Bentonite					
	0%	2.0%	6.0%	10.0%	14.0%	18.0%
O.M.C %	12	12.1	12.7	13.5	13.8	13.8
MDD g/cc	1.916	1.917	1.933	1.94	1.945	1.947
C.B.R %	3.40	3.10	8.70	12.20	15.00	13.30

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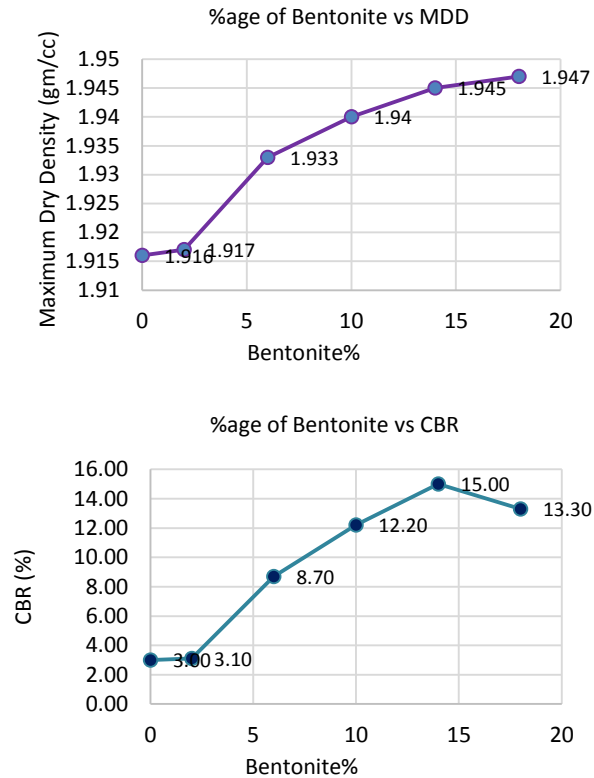
Figure 5 Graphs showing effect of bentonite content on Dry Density and CBR

C. Effect of Stone dust on different strength parameters

Summary of test results for different %ages of Stone dust are as shown in table:

Properties	%age of Stone Dust				
	0%	5.0%	10.0%	20.0%	30.0%
O.M.C %	12	12.1	11.8	11.5	10.9
MDD g/cc	1.916	1.918	1.921	1.937	1.951
C.B.R %	3.40	2.80	3.31	8.20	9.12
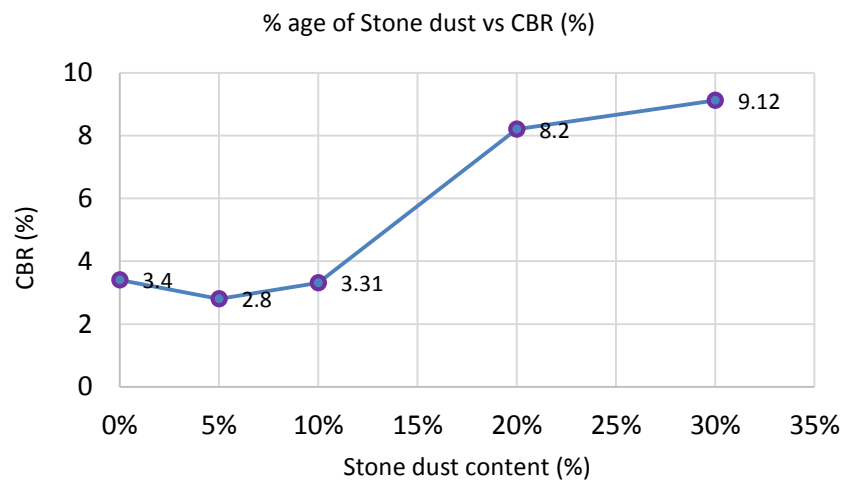
Figure 6 Graph showing effect of Stone dust on CBR

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Correlation between different parameters, and additives vs CBR

After performing all required tests of dry density, moisture content and CBR, correlations were developed amongst different strength parameters and dosage of modifiers/additives, through regression analysis.
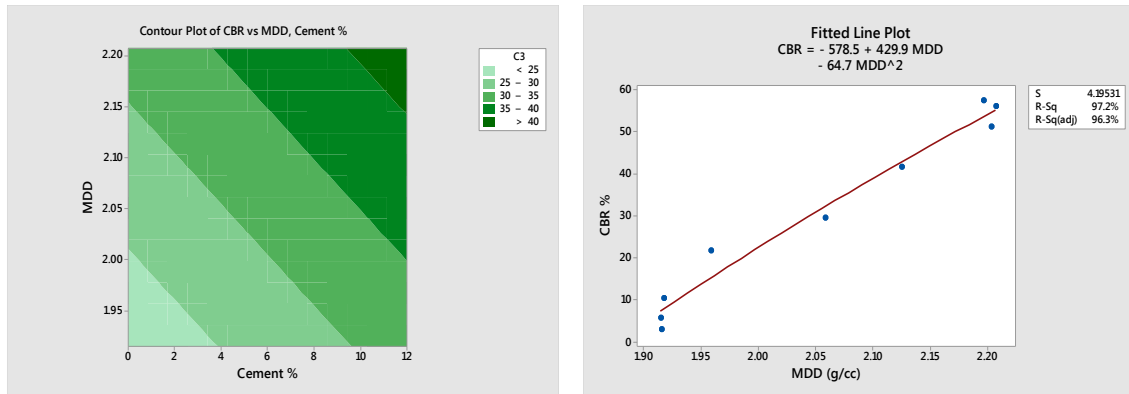
Correlation of CBR with cement and other variables

CBR = 52 + 0.868 Cement% + 35.0 MDD - 9.55 OMC   (Equation 1.7a)

Correlation between CBR and MDD is also developed, as shown

$CBR = -578.5 + 429.9\ MDD - 64.7\ MDD^2$ (Equation 1.7b)

Correlation of CBR with bentonite and other variables

CBR = -530 - 0.294 Bentonite% + 250 MDD + 4.52 OMC   (Equation 1.7c)

Correlation of CBR with stone dust and other variables

CBR = 23.433 Stone dust + 2.3197   (Equation 1.7d)

Conclusions And Recommendations

The following conclusions were derived from test data obtained for each strength parameter.

  A. Optimum Moisture content (OMC):
  1. From the analysis it is concluded that the use of cement greatly improve the engineering properties of the weak subgrade material, OMC value decreased with increase in cement content, the lowest value been observed at 10% cement content resulting in OMC of 8.3%.
  2. Use of Bentonite also showed an increasing trend towards OMC but there was very slight increase, the maximum OMC obtained was 13.8%.
  3. Stone dust also showed a similar trend as that of bentonite.

  B. Maximum Dry Density (MDD):
  1. From the analysis it is concluded that the use of cement greatly improve the maximum dry density of the virgin soil, maximum dry density (MDD) increased with increase in cement content the optimum value been observed at 12% cement content resulting in MDD of 2.207 g/cc.
  2. Bentonite shows an increasing trend towards MDD but was very slight, the maximum MDD obtained was 1.947 g/cc.
  3. Stone dust also showed increase in dry density with maximum 1.951 g/cc.

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C. California Bearing Ratio (CBR):

1. The CBR value increased with increase in cement content, the maximum CBR value of 57.3% was observed at optimum value of 10% cement content, use of 0.7% cement content did't increased CBR value, the lowest %age of cement content required to make the soil suitable for subgrade construction was 1% cement giving 10.4% CBR, but we will recommend 2.0 % as there are losses in field.
2. Bentonite is not effective at smaller amount upto 6%, but strength gain was observed at higher contents above 6%. Maximum CBR of 15% was observed at 14% bentonite.
3. For stone dust the CBR was decreased initially for amount of stone dust upto 10% and only a slight increase was observed at 30% value.

Also the equations developed through correlation can be effectively used for calculating the modifier content, CBR and other strength parameters.

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Coupled Soil-Atmosphere Interaction Model for Abbottabad's Clay

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Abstract

Most of the civil engineering structures belong to near ground surface, their design necessitate the evaluation of moisture transfer between the ground surface and atmosphere. The main purpose of this work was to develop a soil atmosphere interaction model for predicting the variation of degree of saturation and suction stress with respect to time and depth in the clayey deposits of Abbottabad city. A one dimensional numerical model was developed for the homogeneous inorganic low plasticity clay (CL) of Abbottabad city, by coupling material properties with climate conditions. Results showed high water absorption and retention capacities for the investigated soil deposit. The degree of saturation and suction stress variation with respect to time extended to 4m depth below the ground surface. Recurring variations in the degree of saturation and the corresponding suction stress were highest at and near the ground surface and gradually decreased with depth. A maximum suction stress of 485kPa corresponding to the minimum degree of saturation of 53% was predicted on 6th July, 2015. The coupled soil atmosphere interaction model developed in this study can be used with confidence to predict the pore water pressure variation in unsaturated soils.

Keywords

Coupled soil atmosphere interaction, saturated-unsaturated soil, pore water pressure.

1. Introduction

The unsaturated soil is the most common type of natural soil on the earth's surface. An unsaturated soil may be defined as a soil with negative pore water pressure (Fredlund and Rahardjo, 1993). Additional shear strength to the unsaturated soil is contributed by the negative pore-water pressure. In an unsaturated soil the negative pore-water pressure is highly influenced by the flux boundary condition changes (i.e., evaporation and infiltration) which is a consequent of the variation in climatic conditions. The combined effect of atmospheric parameters results in periodic water deficit and water excess in the surface layer of the clay. This phenomenon leads to cyclic variation in the shear strength, bearing capacity, and hydraulic characteristics of the soil near the ground surface. Field monitoring of ground condition such as the measurement of pore water pressure have been attempted for important construction projects (Vu et al., 2007). However, such measurements are generally prohibitive because of the associated sensor installation cost and the long time and huge effort required in analyzing the collected data. Nonetheless, a clear understanding of soil-atmosphere interaction is critical for all types of construction in, on, or with clayey soils.

Surface evaporation is one of the main processes in the soil–atmosphere interaction. This process is not only a function of soil physical and hydrologic parameters such as moisture content, location of water table, pore diameter, hydraulic conductivity and soil water characteristic curve but also a function of the climate factors like precipitation, temperature, relative humidity, wind speed and net radiation. Therefore, prediction of wetting and drying rates from soil surface remains a challenge. In geotechnical engineering, the potential evaporation (PE) has been traditionally used to estimate evaporation or evapotranspiration for several decades (Wilson et al., 1997). The evaporation that would occur when there is an abundant availability of water is known as PE, and it can be explicitly determined by meteorological indexes (Penman, 1948). However, for the design of near ground surface structure the actual evaporation (AE) is required, which is generally lower than the potential evaporation (PE) except for the beginning of drying process when the soil is nearly saturated. However, AE has not been reasonably demonstrated so far due to complex interaction between soil properties and atmospheric conditions. Therefore, Wilson 1997 limiting function is a useful way to convert the potential evaporation (PE) into actual evaporation (AE). The goal of this paper is to build up a coupled soil-atmosphere interaction model for envisaging the variation of degree of saturation and pore water pressure with respect to time and depth. The model was developed from two types of inputs; (i) material properties from laboratory tests of undisturbed samples, (ii) boundary conditions obtained from one year climate data (i.e. from 1st January, 2015 to 31st December, 2015).

2. Modeling Process

The coupled soil atmosphere interaction model requires soil properties like soil water characteristic curve (SWCC), hydraulic conductivity function (HCF), and climate data like temperature, precipitation, wind speed, relative humidity and net radiation. The soil water characteristic curve was estimated by Eq. 1 (Fredlund & Xing, 1994).

$$\theta w = \left[\frac{\theta s}{\left[\ln \left\{ \exp(1) + \left(\frac{\Psi}{a} \right)^n \right\} \right]^m} \right] \left[1 - \frac{\ln \left(1 + \frac{\Psi}{hr} \right)}{\ln \left(1 + \frac{10^6}{hr} \right)} \right] \tag{1}$$

Where θw is the volumetric water content, θs is the saturated volumetric water content which is equal to the porosity of the soil, Ψ represents the matric suction and a, m, n, hr are the fitting parameters. The fitting parameters can be determined by the semi empirical correlations which require the plasticity index and percentage of soil passing sieve no. 200 (Zapata et al., 2000). The estimated SWCC and saturated hydraulic conductivity Ksat can be used to estimate hydraulic conductivity function (Fredlund et al., 1994). The mentioned model is shown in Eq. 2.

$$k_w(\Psi) = k_{sat} \frac{\int_{ln(\Psi)}^{10^6} \frac{\theta(e^y) - \theta(\Psi)}{e^y} \theta'(e^y) dy}{\int_{ln(\Psi \, at \, a)}^{10^6} \frac{\theta(e^y) - \theta(\Psi)}{e^y} \theta'(e^y) dy} \tag{2}$$

Where $k_w(\Psi)$ is the hydraulic conductivity depends on matric suction, k_{sat} is the laboratory determined saturated hydraulic conductivity of the soil, θ is volumetric water content and y is a dummy integration variable.

Surface evaporation is one of the main processes in the soil–atmosphere interaction. This process is not only a function of soil properties such as the soil water characteristic curve (SWCC) and the hydraulic conductivity function (HCF), but also a function of atmospheric parameters such as precipitation, temperature, wind speed, relative humidity, and net solar radiation. In geotechnical field, the potential evaporation (PE) has been traditionally used to estimate evaporation or evapotranspiration for several decades (Wilson et al. 1997). Let Δ is the slope of the saturation vapor pressure curve with respect to temperature (mmHg/°F), Q_N is heat budget (m/day), h is psychrometer constant (0.27 mm Hg/°F) and Ea (m/day) is the function of wind speed and relative humidity then the potential evaporation (PE) can be calculated by using modified Penmen method as shown in Eq. 3 (Gitirana et al., 2006a).

$$PE = \frac{\Delta Q_N + E_a h}{\Delta + h} \tag{3}$$

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The PE is then converted to actual evaporation (AE) by using the following Eq. 4 in commercial software like SVFlux and VADOSE/W.

$$AE = PE \left[\frac{P_v - P_v^{air}}{P_{vsat} - P_v^{air}} \right] = PE \left[\frac{RH_s - \left(\frac{P_{vsat}^{air}}{P_{vsat}}\right) RH_a}{1 - \left(\frac{P_{vsat}^{air}}{P_{vsat}}\right) RH_a} \right] \qquad (4)$$

Where P_v, P_v^{air} and P_{vsat} are vapour pressure of the material surface, of air near ground and under complete saturation respectively, RH_s is the relative humidity of the material surface.

3. FEM Model and Boundary Conditions

In order to compute the exfiltration, infiltration and volumetric water content in the soil profile a one dimensional transient seepage analysis was performed with a finite element based software (Vadose/w, a package of Geostudio 2007). The analysis was limited to vertical direction only, neglecting the horizontal water flow. A 40 m deep soil column was simulated with boundary condition of zero at bottom and sides of the column and Abbottabad climate boundary at the top surface as shown in Fig. 1. Initial condition was specified by providing the water table at a depth of 20 m from top surface as depicted from the water level in the local wells.
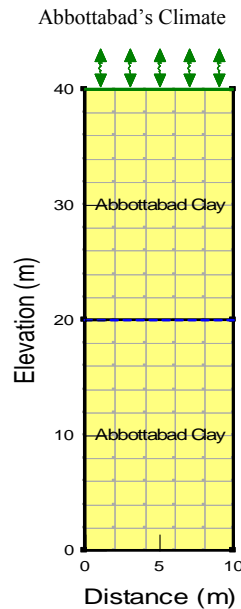
Figure 49: Soil Column with finite element meshes.

4. Input Parameters

4.1 Material Properties

To determine the soil properties required for the soil atmosphere interaction modeling 19 undisturbed samples were collected from different locations of Abbottabad. Thin Walled Tube Samplers were used to retrieve undisturbed samples. To save the field water content, the samples were wrapped with plastic sheets and covered with wax as per the ASTM D5079-08. All the samples were transported to the Soil Mechanics Laboratory at the Sarhad University of Science & Information Technology Peshawar, Pakistan. Table 1 summarizes the soil properties indicating the soil type and its field condition. Figure 2 illustrates the soil water characteristic curve and hydraulic conductivity function. The estimated SWCC curve showed an air entry value of 16 kPa and a residual suction of 1800 kPa at volumetric water contents of 0.46 and 0.12, respectively. Concerning to inflection points on the curve, these values were found by drawing tangential lines to the three straight-line portions of the curve.

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Table 64: Material Properties

Property	ASTM Standard	Mean Value
Liquid limit, LL (%)	D4318 - 10	33.8
Plastic limit, PL (%)	D4318 - 10	18.9
Plasticity index, PI (%)	D4318 - 10	14.9
Percent passing sieve # 200, W (%)	*	79.6
Gravimetric water content, w (%)	D2216 - 10	23.48
Field dry unit weight, Υ_d (kN/m3)	D2937 - 10	14.4
Volumetric water content, θ (%)	*	34.44
Specific gravity, Gs	D854 - 10	2.71
Void ratio, e	*	0.85
Porosity, n (%)	*	45.79
Saturated hydraulic conductivity, k_{sat} (m/sec)	D5084 - 03	7×10^{-9}
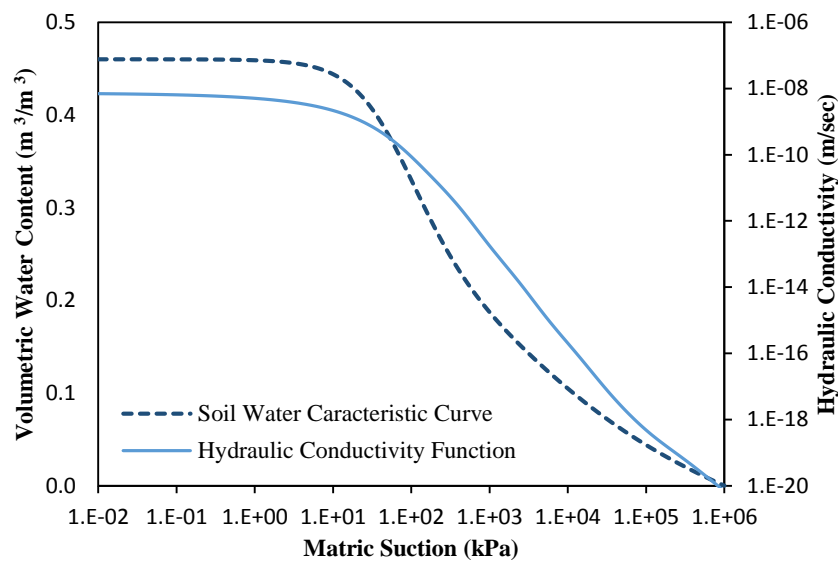
Figure 2: Soil Water Characteristic Curve (SWCC) & Hydraulic Conductivity Function (HCF).

4.2 Climate Data

The soil atmosphere interaction modelling required climate data in addition to soil properties. The climate of Abbottabad is generally warm and temperate. The climate data include Temperature, Precipitation, Wind Speed and Relative Humidity. The climate data from 1st January, 2015 to 31st December, 2015 was collected from one of the PMD (Pakistan Meteorological Department) station located at Kakul (Abbottabad).

Abbottabad's temperature starts to ascend in the month of May, and by July the mean maximum and minimum temperatures recorded are 31 ºC and 16 ºC respectively. Temperatures are lowest in the months of December, January and February. In December, which is by a wide margin the coldest month, mean maximum and minimum temperatures stand at 16 ºC and 2 ºC respectively. In 2015, the lowest and highest temperature recorded was 36 ºC and -3.5 ºC respectively as shown in Fig. 3(a). Abbottabad region lies within the dynamic monsoon zone. In 2015, a total of 1573.2mm of rain with an average of 131.1mm a month was recorded. Total precipitation during driest (January) and wettest (July) month of 2015 was recorded as 24mm and 344.6mm respectively, shown in Fig. 3(b). The wind speed of Abbottabad shown in Fig. 3(c) was found to be independent of the time of the year and varied between 0.7 and 9.2 m/sec with an average value of 2.5 m/sec. Figure 3(d) shows that Abbottabad experiences relatively high humidity throughout the year 2015 with an average of 77.42% at 8:00 AM and 55.67% at 5:00PM. Humidity is highest between July and September, coinciding with the peak precipitation period.

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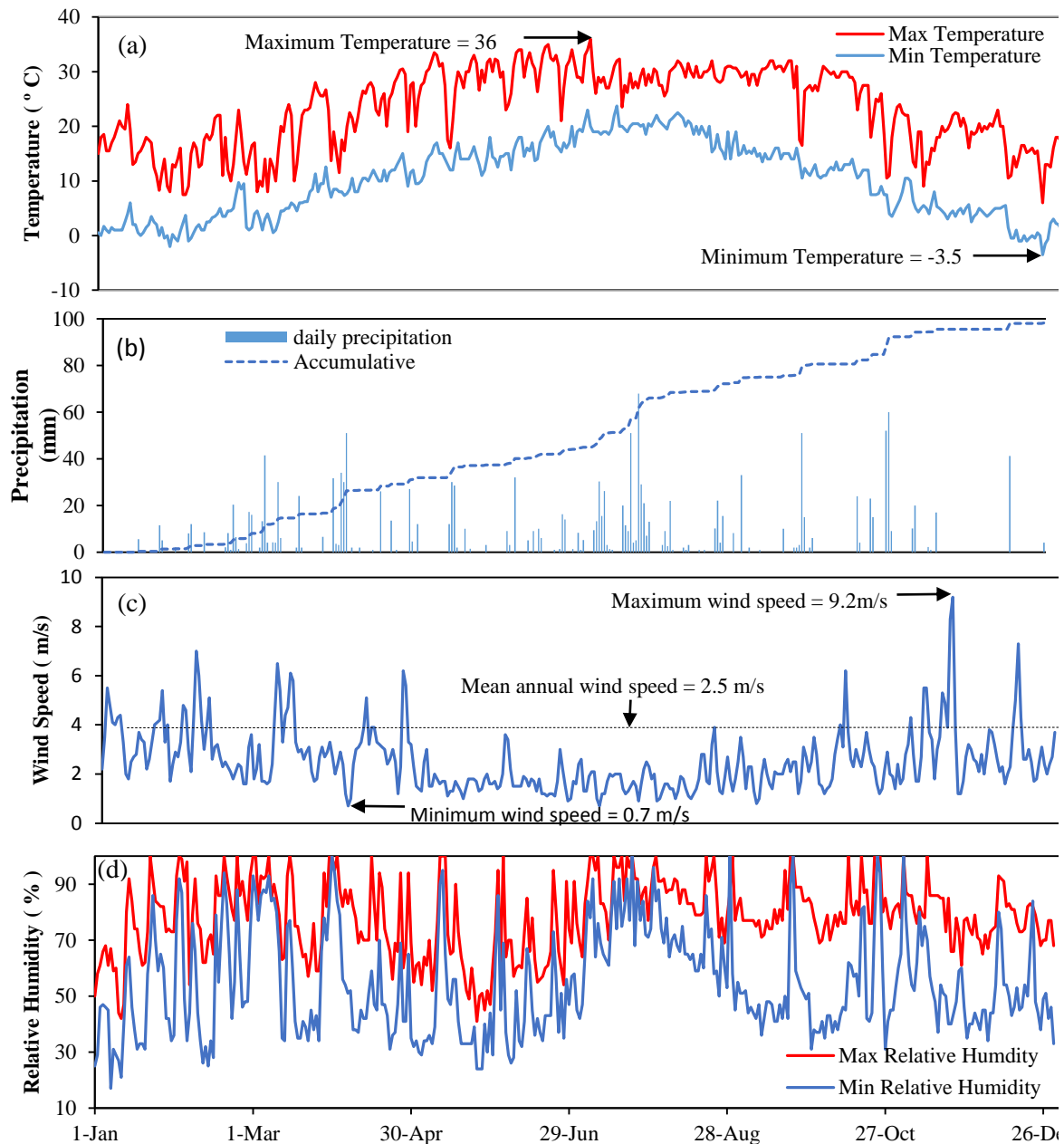
Figure 3: Climate Data Daily Variations; (a) Temperature, (b) Precipitation, (c) Wind Speed and (d) Relative Humidity.

5. Results & Discussion

The finite element based transient seepage analysis of the model shows that the degree of saturation (DOS) of the top surface of Abbottabad clay varies according to the climatic variation. Figure 4(a) shows the daily variation of the degree of saturation for the year 2015. A variation of only 10% was observed during January and February due to low precipitation in these months of the year. A rapid increase in the months of March and April was due to a few episodes of heavy rainfall. The degree of saturation decreased to a minimum of 53% from the start of May till the end of June due to relatively low precipitation and high temperature and net radiation. The degree of saturation increased up to 98% due to high precipitation, despite the fact that the temperature was high during the month of July. During the month of August and September, there was a little rainfall but due to certain net radiation the degree of saturation decreased from 98% to 85%. Due to negligible precipitation in the 1st two weeks of October, the DOS drops to 73% but the degree of saturation increases up to 99% after mid-October corresponding to heavy rainfalls.

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The suction stress (negative pore water pressure) was calculated at the top most left node of the model. Figure 4(b) shows the daily variation in the suction stress, corroborated well with existing climate condition at the top boundary. A maximum suction stress of 485 kPa was observed on 6th July, 2015.
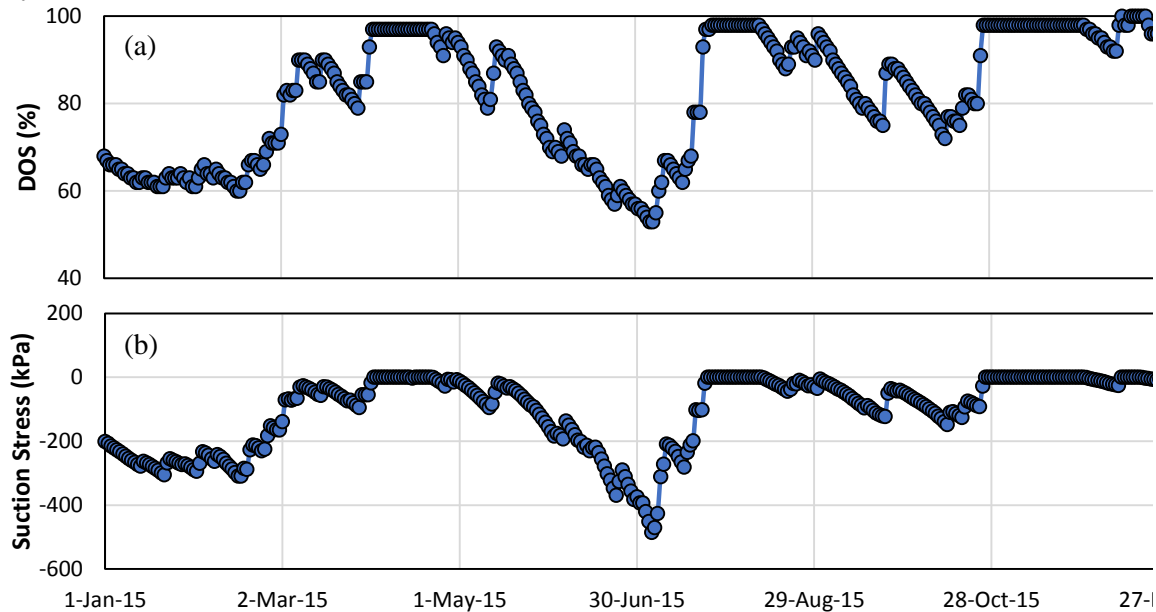
Figure 4: Simulated Results; (a) Degree of Saturation vs Time and (b) Suction Stress vs Time.

The pore water pressure and degree of saturation variation was observed along depth and time. Results showed that both the degree of saturation and pore water pressure vary with depth and time. The variation in the degree of saturation and pore water pressure decreases with depth and beyond 4m depth no considerable variation was observed. Below 4m depth the degree of saturation increases almost linearly becomes 100% at water table, similarly the pore water pressure increases linearly and becomes zero at the water table as shown in Fig. 5(a).
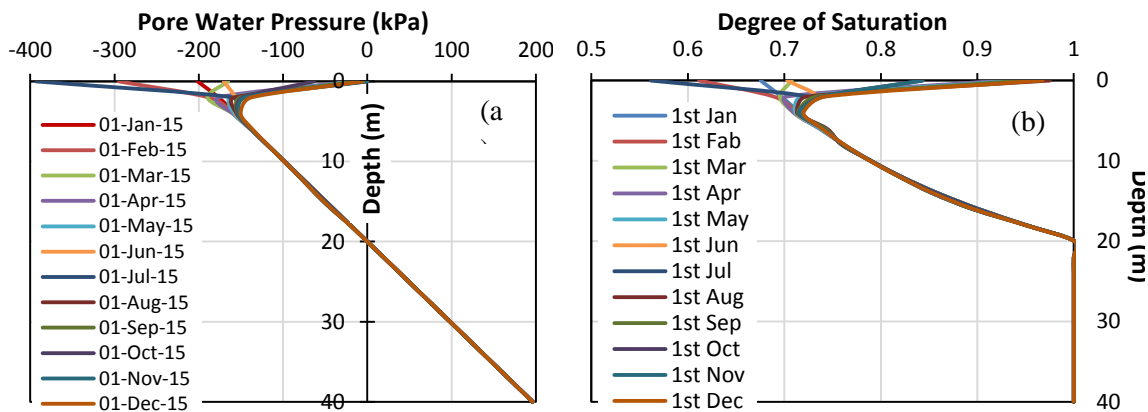
Figure 5: Simulated Results; (a) Pore Water Pressure variation vs depth and (b) Degree of Saturation variation vs depth.

6. Conclusions

The soil atmosphere interaction is governed by the materials properties, seasonal climatic variations and boundary conditions. The model investigated saturation (due to infiltration) and desaturation (due to evaporation) of the soil by coupling material properties with atmospheric parameters. The model reasonably estimated the soil-atmosphere interactions for the investigated clay and was found to depend on an effective capture of site conditions and material properties. Based on the

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laboratory determined soil properties, the 2015 climate data, and the specified site conditions, the main results of this research can be concluded as follows:

1. Complete climate parameters should be considered for more accurate analysis of rainfall infiltration into and seepage through the soil. The model can be used to predict actual evaporation from the ground surface.
2. The soil suction was found to vary with depth and time. The suction at the ground surface fluctuated widely and these fluctuations reduced with depth.
3. The results showed that the fluctuations in suctions correlated well with the environmental conditions on the surface boundary.
4. Clayey soil tends to form full saturation near the ground surface and allows less water to infiltrate into the soil.

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Comparative Study on Compressive Strength of Concrete Using Brick Aggregates as Partial Replacement of Stone Aggregates

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Abstract

Concrete is the most undisputable and indispensable material being used in infrastructure development throughout the world. The present investigation shows the performance of brick aggregates in concrete with a view of achieving the target compressive strengths specified in concrete mix design. It will also explore the performance of burnt brick aggregates in comparison with the natural granitic aggregates. The production of natural aggregates and building stones through quarry is an expensive process. Kiln burnt bricks when crushed to the required nominal sizes provide a rough and irregular surface which aids in bonding of cement paste and the aggregate. Therefore the bond strength of concrete is likely to be increased when these aggregates are used.

From all the results and experimental approaches it is concluded that concrete formed with over burnt brick aggregates showed considerably beneficial performance as compared to the concrete made up of natural aggregates obtained from local resources. It was observed that compressive strength of concrete was increased by 10% with brick aggregate and tensile strength was increased by 18%. This project encourages the recovery of waste materials to be used in production of aggregates for concrete hence conserving the environment.

Keywords
Brick aggregate, compressive strength, concrete, kiln

1. Introduction

Use of waste material as aggregates in civil engineering applications is beneficial because it reduces the environmental impact and economic cost of quarrying operations, processing, and transport. Reuse of construction and demolition waste is becoming increasingly desirable due to rising hauling costs and tipping fees for putting this material into landfills(Kutegeza & Alexander, 2004; Robinson & Hyun, 2004; Tam & Tam, 2006). In recent years, sustainable construction initiatives have also made reuse of construction and demolition debris (as aggregates and otherwise) an appealing option when considering design alternatives for many types of structures (Taylor & Morrissey, 2004). Incorporating these aggregates into cementitious materials is practical, as cementitious materials are non-homogeneous composites that allow material of different sizes and compositions to be bound in a cementitious matrix.

Aggregates impart higher volume stability and better durability than hydrated cement paste in concrete and provide around 75 per cent of the body of concrete. The aggregates are usually derived from natural sources but in regions such as central Punjab and certain parts of Sindh, where natural rock deposits are scarce, burnt-clay bricks are used as an alternative source of coarse aggregate. Here, construction of rigid pavements and local house buildings using crushed brick (brick aggregate) concrete is quite common.

Typical structural clay products are building bricks, paving bricks, roofing tiles etc. These products are made from commonly occurring natural materials (aggregates), which are mixed with water, formed into the desired shape, and fired in a kiln in order to give the clay mixture a permanent bond. With the large amount of brick masonry or ceramic waste produced in the country with 6,000 brick kilns operating in the country (Tahir et al., 2010), this material may provide a significant source of aggregates that can be used to produce more sustainable concrete. Concrete that incorporates brick aggregates is also lighter than normal weight concrete, and would therefore reduce the self-weight of a structure. Brick aggregates also have the potential to enhance the fire performance of concrete due to their thermal expansion and conductivity properties.

The study majorly dealt with clay products i.e. over burnt bricks. One of the waste products of clay products and brick producing industries is brick waste which can be utilized as aggregates in concrete. This research project investigated the properties of brick aggregate and its possibility of being used as aggregates in production of concrete economically. The main focus of experimental program was on investigating the effect on compressive strength which is the key characteristic for structural use of concrete. This research aimed at provision of economically and locally available aggregates for the production of low cost concrete which would be beneficial for use in low cost housing. The research is limited to studying the brick aggregate properties in this context.

One of the development goals of Pakistan's vision 2030 is to provide affordable housing to all citizens especially those in the slums and shanties. This may be accomplished by provision of quality alternative building materials such as clay aggregates. Thus from economical point of view, this research is an important step in the right direction in concrete technology. This study is an extension of previous research done in this field as in this study replacement of brick aggregate was done 100% without any admixture. Such study is important as the stone aggregate reserves are getting deficient while stone aggregate could easily be available as a waste of kiln or waste of demolished buildings.

In concrete technology, aggregates have been depicted as hard, inert material added in concrete mixes to add strength to the overall composite material. In a typical concrete mix, aggregates account for up to 75% of the total volume of concrete.Use of bricks as aggregates in concrete has gained increased interest in recent years for reasons related to both economics and environmental sustainability. Concrete that contains brick aggregates is called brick aggregate concrete (BAC).

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Venta & Eng (1998)advocated the use of brick aggregates in concrete, for USA, based upon the fact that there are 9 million bricks produced in USA each year. 11.4 kg/ton of those bricks are dumped in landfills and are not recycled back into production.

increased environmental awareness during the past decades and economic motivations to re-use waste, use of brick as an aggregate is once again receiving attention from the technical community (Khalaf & DeVenny, 2005).In most of the studies, bricks have been used as both fine and coarse aggregate substitutes, and as partial and complete substitutes for natural aggregates (Silva, et al., 2014).

There have been several investigations into the possibilities of using crushed brick as an aggregate in concrete. The first use of crushed brick with Portland cement was recorded in Germany 1860 for the manufacturing of concrete products(Devenny & Khalaf, 1999).But the first use of crushed brick as aggregates in concrete at a larger scale has been recorded for reconstruction after the World War II. Economic conditions and lack of suitable natural aggregates seems to have resulted in bricks being used as aggregate in developing nations before being used in developed ones.

Akhtaruzzaman & Hasnat(1983) carried out some research using well burnt brick as coarse aggregate in concrete. They found that it was possible to achieveconcrete of high strength using crushed brick as the coarse aggregate. Their researchwas mainly concentrated on determining the mechanical properties of brick aggregateconcrete, rather than the properties of the brick aggregate itself.Khaloo(1994) used crushed clinker bricks as the coarse aggregate in concrete. He reported only a 7% loss in concrete compressive strength compared with concrete made with natural aggregates. In contrast to this decrease in strength, there is a decrease in the unit weight of crushed brick concrete of 9.5%.

Use of brick aggregate in concrete has become common in locations where sources of natural aggregate are not available and the cost of importing natural aggregate is infeasible. An example is Bangladesh, where the land primarily consists of a deltaic plain(Mazumder, et al., 2006). Demand for low cost non-quarried aggregates continues to promote research into brick aggregate concrete in Bangladesh (Ahmad & Roy, 2011).

China is another country which has undergone construction boom in recent years and thereforetaking increased interest in alternative sources of building material. Huang, et al(2013) presented a comprehensive for the use of brick aggregates for concrete in China. The proceedings sections present a categorical review of studies conducted for different aspects of BAC.

There was a single study found in this regard in Pakistan which was done at University of Lahore. In this research, they carried out the replacement of aggregate with BAC from 0 to 15% and they used admixture to enhance the strength. They found that strength is directly proportional to the proportion of replacement with the use of admixture.

2. Brick Aggregates Concrete

2.1 Properties of Brick Aggregates

From the information gathered, it is apparent that the porosity and absorption of brick aggregates is higher than that of most of the natural aggregates. Due to this reason, it is suggested to soak the brick aggregates in water prior to adding to the concrete mix(Khalaf, 2006; Cachim, 2009). Bricks aggregates show variations in their compressive strengths which can be attributed to different manufacturing methods of bricks and impurities that are part of the nature of aggregates(Khalaf & DeVenny, 2005). If bricks were to be used as a substitute for natural aggregates in concrete, quality control measures will be necessary to ensure that bricks being use satisfy strength requirements.

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2.2 BAC Strength

Previous studies, show that the use of brick aggregate as a substitute for granite aggregate results in a loss of compressive strength(Khalaf, 2006; Cabral, et al., 2010; Adamson, et al., 2015). In general, this loss of strength is to the order of 10–35% for coarse aggregates and 30–40% for fine aggregates, depending on the rate at which the brick was substituted for natural aggregates. However, with this decrease in compressive strength, a gain of about 11% is made for tensile strength, compared to normal weight concrete(Akhtaruzzaman & Hasnat, 1983).

However, due to advances in brick making technology and their lack of impurities, it is shown that 28 days compressive strength of concrete made with these brick exceeded that of concrete made with natural granite aggregate. The same observation is true for for high strength concrete as well (Mansur, et al. , 1999).

Cachim(2009) reported a 10% increase in tensile and flexural strengths when using crushed brick as the aggregate in concrete compared with normal aggregates. He also reported that flexural strength increased linearly as compressive strength increased when using crushed brick aggregate to produce concrete.

2.3 Crushed Brick Aggregate ConcreteFire Resistance

In general, concrete is considered to have good properties with respect to fire resistance. The material is able to perform for a relatively high period of time and no toxic fumes are emitted when in contact with fire. In a typical fire, the temperature reaches about 500°C in about 10minutes and 950°C in 1 hour. So the concrete must be able to withstand rapid temperature rises as well as a high final temperature(Khalaf & DeVenny, 2004).

Kesegićet al., (2008)reported results of experimental study for BAC subjected to high temperatures. The tests revealed that concrete containing brick aggregate exhibited no loss in residual (i.e. after cooling) compressive strength for test temperatures up to 600°C. On the other hand, traditional concrete, revealed a significant loss in compressive strength for test temperatures above 300°C.

2.4 BAC Absorption

The water absorption of crushed brick is relatively high compared to natural aggregates (Bektas, et al., 2009). As a result, it is recommended that aggregates should be considered to be in saturated condition when preparing a mix design (Debieb & Kenai, 2008).

2.5 BAC Freeze/Thaw

The high porosity of brick particles contribute to higher permeability, the porosity of the particles can potentially improve the performance in freeze/thaw cases. Most studies in this area have been performed on very small brick particles used as a partial replacement for fine aggregate. (Rao, et al., 2007; Bektas, et al., 2009). It was found in these studies that incorporation of small brick particles (0.4 mm to 0.8 mm) with high porosity to mortar and concrete mixtures improved the freeze/thaw resistance of the mixtures.

In spite of the above studies, Adamson, et al. (2015) stated that generally, lack of knowledge of performance of brick aggregate concrete is an obstacle for reuse of brick waste. Hence, the present study was conducted as a step forward to fulfill this gap.

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3. Experimental Program

The constituent materials used in this program were tested to comply with the relevant standards. Given under are the details of the materials properties evaluated through various tests conducted upon them.

The cement used was the Ordinary Portland Cement of Grade: 42.5 and Type: CEMl. The consistency of the procured cement was equal to 60% which is taken as the standard value.

3.1 Aggregate Tests

Brick aggregates were used as the replacement of coarse aggregates in concrete for this study. Hence, the properties of brick and stone aggregates, available in Pakistan were compared. The comparison was made in terms of absorption, specific gravity, impact value, and abrasion. These properties for both brock and stone aggregates are given in table 1.

It can be observed from table 1 that, apart from specific gravity, brick aggregates produced in Pakistan are inferior in quality as compared to natural stone aggregates. However, there performance as a composite material of concrete is found advantageous in previous studies.

Table 1. Comparison of aggregate properties

Aggregate type	Water absorption (%)	Impact Value(%)	Specific Gravity	LA abrasion value (%)
Over burnt brick aggregate	4.4	18.5	2.17	24
Natural stone aggregates	2	10	2.44	18

3.2 Concrete Tests

BAC was compared with traditional concrete samples in terms of its workability, tensile and compressive strength. The main factors affecting the workability of concrete are, water cement ratio, size of aggregates, shape of aggregate, surface texture of aggregates grading and air entraining agents. Angular aggregates reduce the workability, rounder and smoother aggregates requires less water for lubrication than angular and rougher aggregate.

Slump test, as specified in ASTM C 143-90a and BS 1881 Part 102:1983 was used to measure workability of concrete samples. Mix proportions and other properties of concrete samples prepared in this study are given in table 2.

Table 2. Properties of concrete samples

Property	Desired compressive strength	Mix proportion	W/C	Assumed slump
Value	2400 psi	1:2:4	0.57%	2.5 in

As per the given proportion, the quantities of cement, aggregate and water were determined by weight, to an accuracy of 0.l % of the total weight of the batch. The quantity of concrete to be prepared was about 10 % excess of the volume of the desired number of test specimens to account for losses. Concrete cylinders, cured for 28 days, were used for testing the compressive strength.

For this study, 11 batches of concrete samples were prepared, each batch consisted of 4 samples with an increment of 10% replacement for stone aggregate by brick aggregate. Three (03) samples

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were used for compressive strength testing and one (01) sample for tensile strength. The major focus of this study was on determining the effect of using brick aggregates on compressive strength of concrete as it is used in structures for this property. Hence, batch 1 had 0% replacement, batch 2 had 10% replacement, batch 3 had 20% replacement and so on.

Analysis of Variance (ANOVA) was performed to determine whether addition of brick aggregates has a significant effect on the compressive strength of concrete. It is a statistical test used to analyze the differences among group means and their associated procedures (such as "variation" among and between groups), developed by statistician and evolutionary biologist Ronald Fisher. A one-way ANOVA is performed when there is only one independent variable while a two-way ANOVA is used when there are two independent variables in the experiment (Cohen and Cohen, 1988). In this research, one-way ANOVA was more suitable since the variation among batches was caused by proportion of brick aggregates only. The statistic tested in ANOVA is known as f-statistic (named after Fisher). The null hypothesis that all samples have equal means is accepted if the f-value is less than critical f-value or its p-value is less than the confidence level.

4. Results and Discussion

4.1 ANOVA

Table 3 represents the results of ANOVA test for the compressive strength of concrete in different batches with varying proportions of brick aggregates.

Table 3. ANOVA results

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	532340.7	10	53234.07	22.3952	2.84E-09	2.296696
Within Groups	52294.67	22	2377.03			
Total	584635.3	32				

It can be observed from table 3 that the F-value for this test is greater than F-critical while P-value is less than the critical P-value (confidence level) of 5%. Hence, it can be said that the use of brick aggregates in concrete has a statistically significant impact on its compressive strength. This conclusion becomes the basis for further exploration of experimental results as given in the proceeding section. ANOVA was only performed for compressive strength, since only one sample in each batch was tested for the tensile strength and slump of concrete which is not sufficient to apply this statistical test.

4.2 Experimental Results

For each batch, average values of slump, tensile and compressive strength were calculated. These values are compared graphically as shown in figures 1 to 3.

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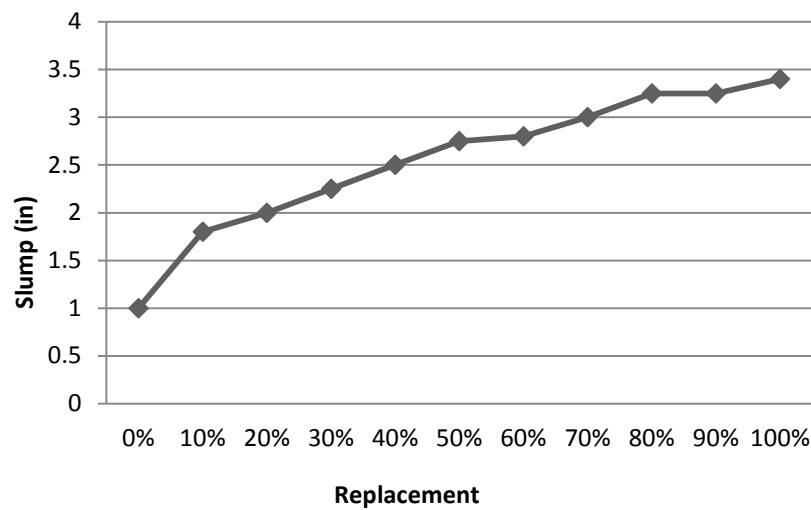
Figure 1. Relation between slump and replacement

Figure 1 shows that the slump increases with the increase in partial replacement of brick aggregate.This trend may be due to the reason that brick aggregates were pre-soaked and fully saturatedresulting in increase of water content leading to higher workability and higher slump. On the other hand, stone aggregatesare dense and impermeable material so slump was the lowest at 0% replacement.
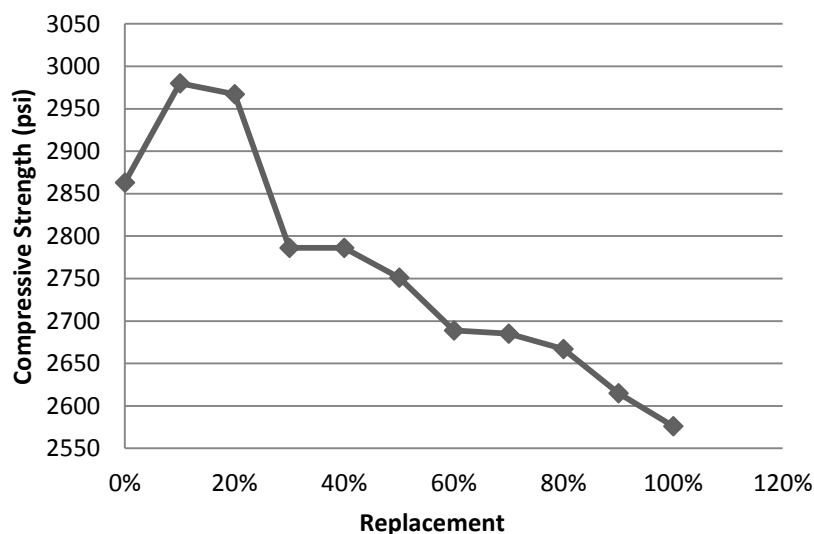
Figure 2. Relation between replacement and compressive strength

Figure 2 illustrates that average compressive strength at 0% replacement is 2863psi which is less than the strength of 10% and 20% replacement. This might be possible that increase in strength at 10% and 20% is due to stiff bond between cement and brick aggregate, since brick aggregate has rough texture ensuring better bond than stone aggregate with binding material. But as the brick aggregate proportion in concrete increases, the strength of concrete decreases due to large abrasion and impact values of brick aggregate than stone aggregate. Moreover, the highest strength is achieved at 10% replacement of stone aggregates.

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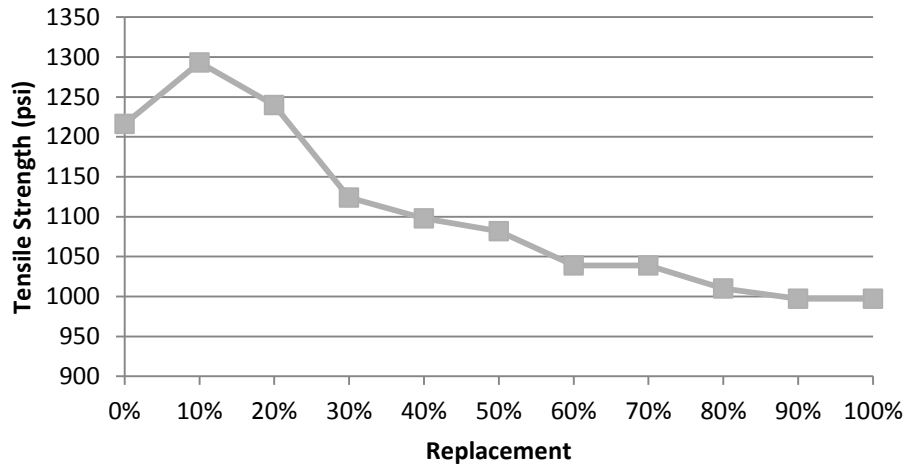
Figure 3. Relation between replacement and tensile strength

Figure 3 shows a behavior which is comparable to that for compressive strength. Hence, the highest tensile strength is achieved at 10% while it decreases below the strength of control samples when the proportion is increased above 20%.

5. Conclusions and Recommendations

This study addresses the effectiveness of over burnt brick as coarse aggregate for compressive strength of concrete. Although other properties including slump, and tensile strength were also observed and compared but the number of samples taken for these were not sufficient for statistical analysis. A comparative experimental investigation was carried out to study the effect of brick aggregate on normal grade concrete. Based on the results the following conclusions were drawn from this experimental investigation.

ANOVA performed on the compressive strength of concrete samples showed that the use of brick aggregates significantly affects this property. Workability of concrete samples, identified by its slump value, increases with the increase in content of brick aggregate. This may be attributed to the fact that these aggregates were used in fully saturated condition.

At constant water – cement ratio, increase in replacement of stone aggregate by brick aggregate increases compressive and tensile strength initially and then decreases gradually. 4% increase in compressive strength and 6.5% increase in tensile strength was observed when 10% replacement of stone aggregate was done by brick aggregate.

Based on the above mentioned conclusions it is found that 10% replacement of stone aggregate by brick aggregates can be effective for concrete. It can increase its workability and strength without increasing water – cement ratio or using admixture. Moreover, BAC is quite useful to construct lightweight and fire resistant structures.

It is recommended that future research studies may be done on aging effect of BAC. Another possible direction of research could be to evaluate effectiveness of BAC strength in comparison with admixtures i.e. super plasticizer.

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Study of New Austrian Tunnelling Method (N.A.T.M.)

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ABSTRACT:
This paper presents a study on New Austrian Tunnelling Method (N.A.T.M.). Various aspects of this method are described in this paper. Case Study of Construction of Pir Panjal Tunnel in India where NATM method was adopted for the design and construction of the tunnel. Geotechnical and Geological condition of the site has also been addressed.

Keywords: Tunnelling, NATM.

Introduction:

Tunnels have played a vital role in the evolution and sustenance of mankind through the ages. History has seen the evolution of tunneling starting with cave formation, for water management, under ground transportation, mineral extraction and for warfare purposes. The oldest reference of a tunnel was in Persia where tunnels were built to connect wells called Qanats which were used to provide a reliable supply of water during hot, and semi-arid climates.
New Austrian Tunnelling Method (N.A.T.M.) is a support method to stabilize the tunnel perimeter by means of sprayed concrete, anchors and other support and uses monitoring to control stability. This method got its name from Salzburg (Austria). It was first used by Prof. Dr. L.v. Rabcewicz in 1962 and got worldwide recognition in 1964. It was first used in soft ground tunnel in Frankfurt (Europe) Metro in 1969. The basic aim of this method is to get stable and economic tunnel support systems. This method is flexible to adopt different excavation geometries and very large cross sections. It is flexible to install additional support measures, rock bolt, dowels, steel ribs if required. In this method it is easy to install a water proof membrane and a primary support i-e shotcrete. New Austrian Tunnelling Method (N.A.T.M.) is more effective method as compared to Tunnel Boring Machine (T.B.M.).

Methodology of New Austrian Tunnelling Method (N.A.T.M.):

The New Austrian Tunnelling Method constitutes a design where the surrounding rock or soil formations of a tunnel are integrated into an overall ring like support structure. Thus the formation will themselves be part of this support structure. With the excavation of a tunnel the primary stress

field in the rock mass is changed into a more unfavorable secondary stress field. Under the rock arch we understand those zones around a tunnel where most of time dependent stress rearrangement processes takes place. This includes the plastic as well as the elastic behaving zone. Under the activation of a rock arch we understand our activities to maintain or to improve the carrying capacity of the rock mass to utilize this carrying capacity and to influence a favorable development of the secondary stress field.

The main principles of NATM are as:

- The main load bearing component of the tunnel is the surrounding rock mass. Support consists of earth or rock anchors and shotcrete, but support and final lining have confining functions only.

- Maintain strength of the rock mass and avoid detrimental loosening by careful excavation and by immediate application of support and strengthening means. Shotcrete and rock bolts applied close to the excavation face help to maintain the integrity of the rock mass.

- Rounded tunnel shape avoid stress concentrations in corners where progressive failure mechanisms start.

- The primary support shall be thin walled in order to minimize bending moments and to facilitate the stress rearrangement process without exposing the lining to unfavorable section forces. Additional support requirement shall not be added by increasing lining thickness but by bolting. The lining shall be in full contact with the exposed rock. Shotcrete fulfills this requirement.

- Statically the tunnel is considered as a thick walled tube consisting of the rock and lining. The closing of the ring is total periphery including the invert must be applied with shotcrete.

- Observation of tunnel behavior during construction is an integral part of NATM. With the monitoring and interpretation of deformations, strains and stresses it is possible to optimize working procedures and support requirements.

Construction Process:

In urban areas, tunnel construction starts from a previously constructed vertical shaft usually which is used for access by persons and plant for the removal of excavated material out of the tunnel. The cross section is divided into a number of smaller faces. There are typically three, the crown, bench and invert as shown in Fig.1. This can be increased to six as shown in Fig.2 by adopting designs with a temporary central wall and advancing first one half of the tunnel, called the slide gallery, around 15 meters ahead of the remainder, the enlargement. The temporary wall is constructed as part of the side gallery and is then removed as the enlargement is formed.
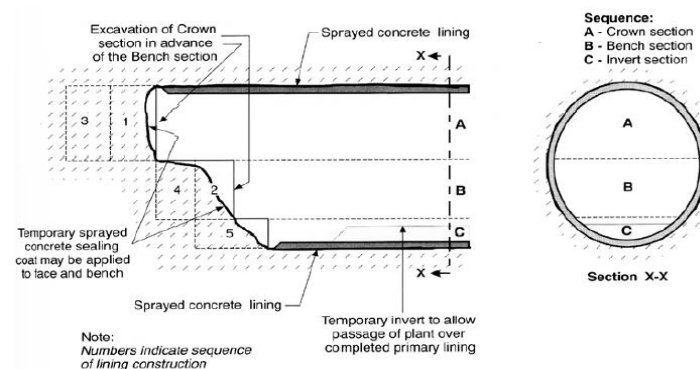
Fig.1. Tunnel excavated in 3 partial cross sections

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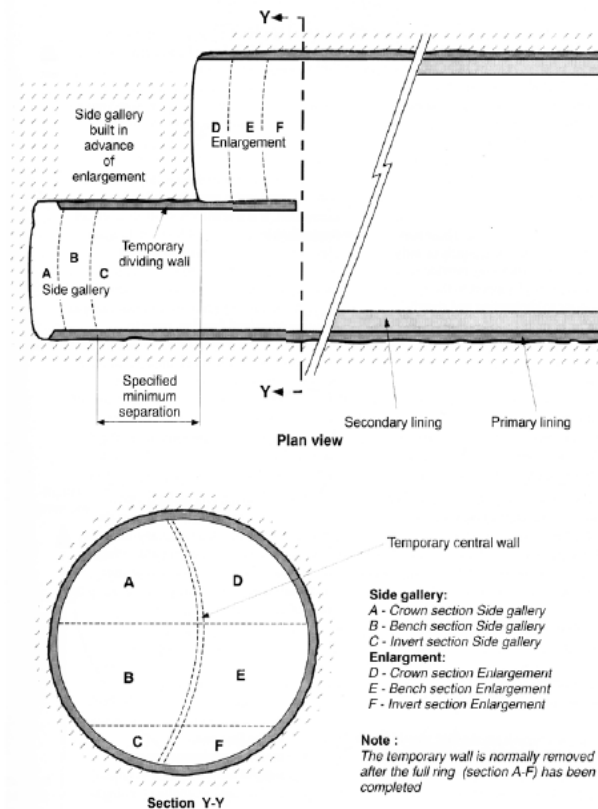
Fig.2. Tunnel excavated in 6 partial cross sections

Excavation is incrementally advanced in steps, or rounds, of about, of about one metre to a fixed pattern. Shotcrete, a special quick setting concrete mix sprayed at high pressure is used after each incremental excavation to form a new panel to the lining. A 50 mm sealing layer is generally first applied to the excavated face on which the new panel is to be formed. Shotcrete is then generally applied in two layers, each reinforced by steel mesh, to form a N.A.T.M. lining typically 200 to 400 mm thick. The second layer may be applied before advancing the excavation or it may be delayed until a later stage in the cycle.

Steel lattice girders can be incorporated into the lining. These may typically be in the crown panels of fully circumferential. They may provide some limited measure of support to the excavated crown prior to shotcreting and shortly thereafter when the shotcrete is weak. They also provide assistance in profiling the tunnel and in achieving the correct shortcrete thickness. Excavated material is generally placed temporarily on the completed tunnel invert to provide a running surface for plant during further construction.

The speed of construction is important in limiting ground settlement as once the ring is closed significant ground movement normally ceases. The ring is closed when the last panel of shotcrete in an advance is formed. A secondary or final tunnel lining is usually added at a later date inside the primary sprayed concrete N.A.T.M. lining. The secondary lining is usually formed of cast in-situ or sprayed concrete, but may also be of cast-iron segments.

The whole construction procedure is summarized as

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Step 1: Cutting a length of tunnel with a road header (Fig.3)

Fig.3. Cutting a length of tunnel with a road header

Step 2: Applying layer of shotcrete on reinforcement mesh (Fig.4)

Fig.4. Applying layer of shotcrete

Step 3: Primary lining applied to whole cavity which remains under observations (Fig.5)

Fig.5 Primary lining applied to whole cavity which remains under observations

Step 4: Final lining applied running tunnels continued (Fig.6)

Fig.6 Final lining applied running tunnels continued

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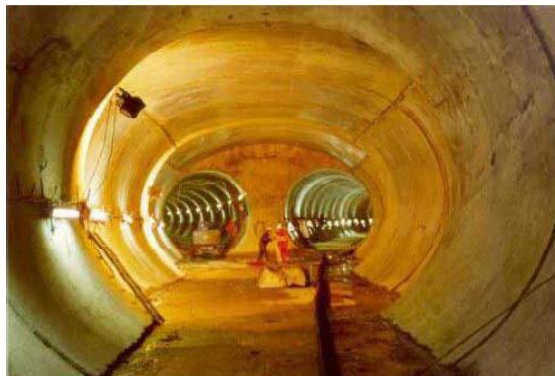
Step 5: Completed underground transition (Fig.7)

Fig.7 Completed underground transition

Case History – Pir Panjal Tunnel India:

Location Map:
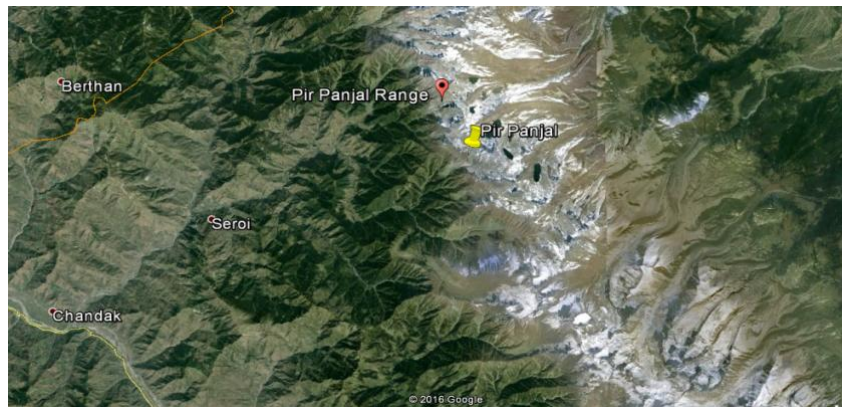
Fig.8 Location Map of Pir Panjal Tunnel, India

Introduction:

Indian Railway earmarked upon this important project of connecting Udhampur – Quazigund – Srinagar – Baramulla with the broad Guage rail link Jammu – Kashmir Railway Line. Under the first phase of the project implementation, the Kashmir Valley portion of the project was taken up and is under final stages of construction. The Udhampur to Quazigund section was the more difficult portion and had been taken up under the second phase and is presently in the early stage of construction. The 10, 960 m long tunnel through the mighty Pir Panjal Range of the Himalayas was the longest tunnel and one of the key structures of the new railway line.
The main tunnel was a single track railway tunnel for operation of passenger and freight trains and runs almost parallel to north- south direction. The tunnel was a mountain tunnel with an average elevation of approximately 1750 m and a maximum overburden of approximately 1100 m.

Alignment:

The alignment of the new railway tunnel crossed the National Highway No.1 which was the only road connection between banihal and Quaziguard. The crossing was near the south portal of the existing twin single lane highway tunnels which extended in direction from southwest to northwest. The elevation of these tunnels was more than 450m higher at about 2200m and their length was

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approximately 2500 m. The vertical alignment of the tunnel had been designed to suite heavy haul trains to pass through and at the same time to facilitate the construction activities as well.

Access Tunnel:

For an intermediate driving access an approx. 800 m long access tunnel with a downward gradient of 10% was constructed which intersected the main tunnel at approx 2.75 km from the south portal. The access tunnel was used to shorten construction period of the main tunnel. During operation the access tunnel was used for emergency and maintenance entrance and exit. If required it could be used also for ventilation.

Access Shaft and Cross Passage:

Another intermediate access was provided by a 55m deep access shaft and an approximate 35 m long cross passage. With a second start of the main tunnel drive form the cross passage, driving of the main tunnel towards the south will be independent from the approx. 600 m long soft ground portion at the north portal and the effect of delays in this section to the overall program.

Geotechnical & Geological Conditions:

The tunnel alignment traversed through the mountainous Pir Panjal Range, which is part of the young Himalayas. The Geology of the Pir Panjal mountain range included a mixture of very hard and soft to moderately hard rock strata. Hard rock types included andesite / basalt quartzite, silicate limestone and agglomerates while the soft to moderately hard rock types included shale, limestone, agglomeratic shale and tuff. The portal areas were situated in fluvioglacial sediments which cover at both portals a length of more than 500 m. The basic tectonic setting of Pir Panjal range in the area of tunnel alignment is dominated by a folding structure which led to different dipping directions on both sides of the range. Contacts between the rock units were often faulted. Folding was also common especially in central areas. Bedding of rock is striking sub perpendicular to Pir Panjal tunnel axis.

Variable water conditions are expected. Joint acquifer would provide continous water inflow to the tunnel is expected in the in the hard rock types and with minor amount in the shale. High water inflow was expected in the fault zones, of which some could be mapped and are predictable. Extreme water inflow may occur in karstic limestone on northern side of the tunnel where cavities could not be predicted and water encounter could be at any place. Particular problems are expected for the shale section at the highest overburden of 1100 m were heavily squeezing rock and large deformations might occur.

Tunnel Cross Section:

In accordance with NATM design two separate tunnel linings were installed. Thickness and layout of the outer and the inner lining depended on the geotechnical conditions. As such the dimensions of the theoretical excavation section are developed from the minimum clearance of the tunnel cross section, the dimensions of the primary and secondary lining and the space requirements for drainage.

Tunnel Cross Section:

The geotechnical design used a rock classification system of the Austrian Standard. The result is the development of a rock mass model (geotechnical masterplan)

Step 1: Determination of Rock mass Types.

Step 2: Establishment of the Rock mass Behavior Types.

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Step 3: Excavation sequence and support is determined and described in different Rock Class Types

Step 4: Based on the results of steps 1-3 the alignment is divided into sections with similar excavation and support requirements and the respective rock class is allocated. The estimated distribution provides the basis for the cost and time estimate.

Tunnel Drainage & Waterproofing:

As per contract requirement a "semi-dry" tunnel was designed where local wet patches and dripping of water can be accepted.

The drainage system includes two side drainage pipes which can be omitted at dry tunnels sections, and a main collector, which runs all along the tunnel. Seepage water collected in the side drainage pipes and surface water from spill off or from dripping seepage water or similar and collected throughout the tunnel in shallow ditches, was conveyed at regular distance to the main collector. Where required an areal waterproofing system is installed between the primary and secondary lining in the tunnel roof and the tunnel sidewalls. This will be the case where water ingress over large areas occurs.

Construction Method:

All tunnel construction was carried out in accordance with the principles of the New Austrian Tunnelling Method (NATM) using a cyclic sequence of excavation with subsequent installation of a primary support followed by the delayed installation of a secondary lining.

Tunnel excavation was carried out by means of drill and blast and by header. For the soft ground sections at both portals, tunnel excavators and hydraulic breakers will be used. A subdivision of the tunnel cross sections into top heading and bench will be used in unfavorable geotechnical conditions. Along the soft ground sections at the portals as well as in tunnel sections of unfavorable geotechnical conditions.

Conclusions of Case History – Pir Panjal Tunnel India:

The tunnel traversed through much diversified geology experiencing high ground stresses. Time dependent behavior of tunnels in squeezing rock was investigated using closed form methods. Stresses and displacements were obtained before and after the installation of support measures. Nominal shotcrete and rock bolting proves ineffective to control squeezing in shales.

Conclusions of Study:

1. New Austrian Tunnelling Method (NATM) approach of design and execution of the tunnelling in varied geology and especially in soft ground tunnelling is advantageous and scientific way of tunnelling in comparison to the old and conventional way of tunneling.
2. This method monitors the rock mass deformation and designs the support sytem with reference to the rock mass type and derformation.
3. The horizontal anchoring of the tunnel face may become a very suitable technological supplement reducing deformations of the excavated opening and the lining, as well as the magnitude of the settlement through which makes it particularly suitable for shallow tunnels in urban areas

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ELECTRICAL ENGINEERING

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Laser Bounce Listening System (LBLS)

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Abstract
A Laser Bounce Listening System (LBLS) is a surveillance device that is used for listening private discussions from a far-off distance. It uses a laser beam to detect sound vibrations from a nearby reflecting surface and returns to a receiver that converts the beam to an audio signal. LBLS is designed to allow eavesdropping with a minimal chance of exposure. LBLS can be an effective gadget against terrorism and can be used by intelligence agencies as a spying tool for the places where it is difficult to reach.

Keywords – laser, eavesdropping, sound vibrations, spying tool

1. Introduction

Laser bounce listening system eavesdrops on a private or confidential conversation from a far-off distance. This seems unethical to snoop into someone's discussion but for the sake of spying on doubtful people ethics can be put aside; even our forces don't knock the doors of criminals and then enter, they just break-in.Terrorism is a major problem of many countries. Image of a country gets filthy because of these extremists, our country is also facing this problem, sleeper cells are operating which are not easily traced neither their devastating planning nor actions are stopped on time. Something is needed that captures them red handed doing planning without them knowing, something that cannot let them flee or hide when raided. A technique or a technology is required that catches their voice while making evil strategies and which can be used as a proof in courts to get them sentenced and major harm can avoided. Listening operations can generally be done by three methods i.e. by pickup devices like a microphone, video camera or other pickup devices that can be installed before the room to be targeted [7][8]. Second method is the transmission link that may be done by a radio frequency transmission or by wire [6]. Available wires might include the active telephone line, unused telephone or electrical wire, or ungrounded electrical conduits. Third method is having a listening post where there is a secure area where the signals can be monitored,

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recorded, or retransmitted to another area for processing. The listening post may be as close as the next room or as far as several blocks [1].

Eavesdropping can also be done using laser light as a medium, laser being similar like an ordinary light bounces back after striking the shiny surface. The bounced angle is according to the nature of the surface and the angle at which laser was thrown. It will try to make that angle back but as there can be rough surfaces or some surfaces can disperse light too, so the bouncing angle is quite unpredictable. The advantage of using laser as medium is that it can travel a longer distance without the loss of signal or low frequency attenuation [2]. Another advantage of using laser is that it is easy to target rather than placing a microphone to the targeted room and is virtually undetectable [3].

One of main thing required for this system to work is having a reflecting surface near the conversation to be caught. The reflecting surface has two roles; it reflects the laser as well as acts as a diaphragm and modulates the laser [4]. Later the modulated laser after reflection reaches the receiving unit where the audio is processed to make it clear and understandable.
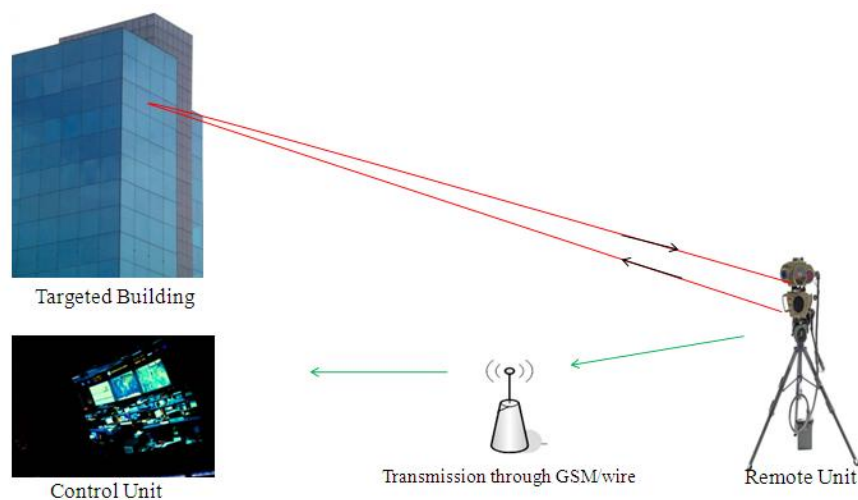
Figure 1: Pictorial Representation

The working of the system can be explained using the block diagram of our project is shown:

Figure 2: System Block Diagram
Our system consists of five parts:

Input: It contains a photodiode which receives the laser and converts light energy into electric energy.

Controller: This part contains a microcontroller IC whose function is to control the current, display of LCD and make all the parts to function together. Filter: The low pass filter, filters out the noises to receive a good response by removing the distortions and further the audio amplifier LM386 to increase power and signal.

Switching: Relays perform its general function of switching when current flows through the coil, it turns it into an electromagnet and completing the circuit in which they are attached.

Output: This part consists of a speaker which outputs the sound reached after processing.

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2. Things required for LBLS

The two obvious things required for an LBLS is a laser and a reflecting surface from where the laser can bounce. Another question arises that which laser to choose? There are many lasers available in market with different colors and frequencies. The laser we used which gave us the best results was a green colored one with a wavelength of 532nm.

Figure 3: Picture of our laser

Secondly a good reflecting surface for testing our system, we used an ordinary CD. The rests were audio amplifiers, a LCD for showing the ON and OFF status of system, relays, photodiode that will receive the laser and a microcontroller IC.

3. Is it legal to use?

Eavesdropping devices are illegal in majority of the countries so before you buy one, you should know the problems you can face because eavesdropping on someone's privacy is a crime. We propose our device to be used by the intelligence agencies only, rather than easily accessible by a common person just like not all weapons are given license to civilians [2]. So should it be legal to use by the intelligence agencies also? Do they have the right to break someone's privacy? The answer is yes, for the sake of security and easy spying on doubtful people it can be a very useful gadget for them.

4. System Installation:

Our system consists of two parts:
- Hardware
- Software

4.1 Hardware:

Hardware consists of a 532nm laser of green color as a source of receiving sound by hitting with a reflecting surface such as looking-mirror so that it is received to the control unit where sound processing is done. The laser after reflection meets the photodiode where it converts light into electrical energy which further goes to the controller and filters.
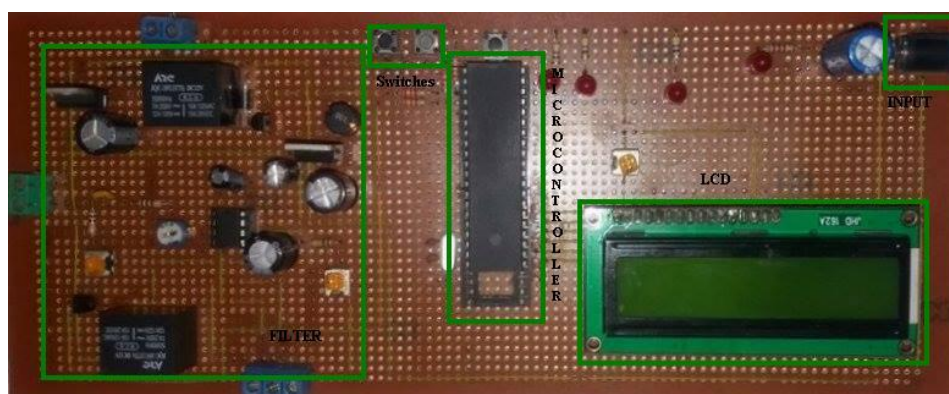
Figure 4: Receiver Picture

When sound reaches the other end, it passes through the audio jack connected to the laptop where audio recording software plays it along with the display of waveform.

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Figure 5: Audio jack connected to laptop [5]

4.2 Software:

The software we used is Audacity. It is recording software, free and easy to use with audio editor and recorder. Any other recording software can also be used.

5. Working:

The project is supplied with a voltage of 12V. The two switches turn on and off the power supply of laser and the system. The LCD displays the name of project at first and then the status of laser and power. Microcontroller IC regulates the current, controls the output of LCD and make the components work together. When the laser light strikes the photodiode after reflection, it converts light into current, further the amplifier IC increases the power and signal, low pass filters stops the high frequency distortion and gives away clean sound. Relays perform its function and cause switching. Voltage regulator IC regulates the voltage and finally the filtered and processed sound achieved is received to us from the speakers and the waveform and voice recording can be done using audio software.
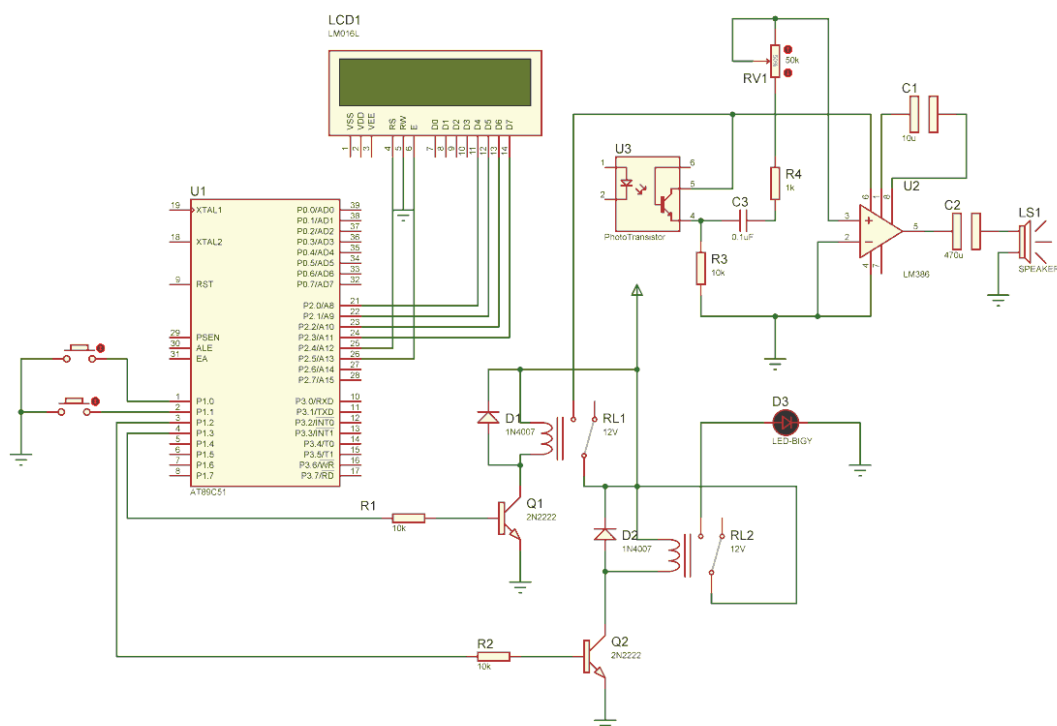
Figure 6: Circuit Diagram (Made in Proteus software)

6. Advantages:

Our system has many advantages regarding security like it will help in reducing criminal activities which in result will reduce terrorism. It will allow easy spying on doubtful people. Counter attack can be done very well, when we can know the enemy's strategies already. It can reach out of range places very easily like mountainous areas or where there is signal or climbing issues. Eavesdropper's chances of getting caught are very low as it is operated from a far off place. It cannot be jammed or hacked, since it uses its own medium (laser).

7. Conclusions:

This paper explains about the system that allows eavesdropping. While developing this system many things were achieved and a few which can be done like wireless voice transmission to the control unit which can be made to a more far off distance, voice recognition software that can be used to detect specific voices of specific targeted person, white colored laser can be used as compared to colored for less chances of getting caught, automatic laser angle adjustment can be done instead of manual adjustment to save time, system can be made more sensitive to retrieve sound from more thick reflecting surfaces.

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RIP and OSPF performance analysis using OPNET simulation

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Abstract

The protocols we will be using here are famous in the routing of computer networks. A network arrangement is formed to test the efficiency of these two protocols. The scenarios that we have created are the two routing protocols i.e. RIP (Routing Information Protocol) and OSPF (Open Short Path First). We will compare both these protocols by transferring a high load (data) in the form of audio, video and file transfer (FTP) on the same network arrangement. This comparison will be made on the basis of the Network convergence duration and Traffic dropped (packets per second). The results of both these factors will show us about the performance of the protocols. The tool used to compare the results of both the protocols is OPNET.

Keywords

Computer Networks, Routing Information Protocol, Open Short Path First, OPNET

1. Introduction

Computer networks have brought a revolution to the human lives in terms of the connectivity. In the early days, all the communication on networks was wired. Then the improvement in technology made it possible to went wireless. Now we are living in the most advanced world where an improvement in wireless networking has introduced us to the Wireless sensor networks [1]. Routing is always an important area where the researchers have kept their focus from the very beginning. Many routing protocols were introduced and still a search is going on to find the new and efficient ways of routing. Different routing algorithms are designed to achieve the flawless routing in the networks. Routing has two topology schemes; the first one is known as static routing while the second one is known as dynamic routing. Static routing protocols cannot be applied to big networks. On the other hand, dynamic routing can be differentiated into two kinds of algorithms. They are known as distance vector algorithms and link state algorithms. Distance vector algorithms assign a cost number to every link in a communication. It uses a bellman ford algorithm [2].

Routing Information Protocol (RIP) is an old example of the Distance vector algorithm which takes hop count as a metric. RIP has introduced its three versions. They are known as RIP V1, RIP V2, and RIPing. RIP V1 is obsolete now and it is because the availability of its new versions which are better in performance than its first version. The timely update is an important factor in Distance vector algorithm, therefore the second version is made in a way to timely update the changes made in the network. The most efficient version is RIPing which is designed to support IPv6 extension [3]. Open short path first (OSPF) is a protocol which works on the link state algorithm. This

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protocol always finds a path which is least in distance. A Dijkstra algorithm is used to find the shortest path between the nodes [4]

Both the routing protocols have their advantages and disadvantages. OSPF is usually considered as a better routing protocol than the RIP. OSPF is thought to be an efficient protocol in terms of packet delay and throughput. It is also considered to be better than RIP in terms of adjusting the link and coverage. The performance of the RIP is associated with the size of the network. The small size network will result in good results of the RIP [5]. We have also tested both the protocols under a few circumstances in OPNET and the results are discussed below.

2. Simulation Environment

The simulation environment used to carry out that project is OPNET. The OPNET stands for Optimum Network Performance. It is a popular Network simulation tool. It is highly used in the research based activities which are carried out in the field of Computer Networking. OPNET provides an environment which includes hundreds of pre-built models which are used to study the performance of your networks. It has three suites available for the researchers. An academic version is also available which is used by the students to perform their lab tasks and to build their own protocols.

3. Evaluation

Two scenarios are created in this project and are tested on the basis of two factors. We have used five numbers of Cisco routers and two numbers of PCs. These PCs and routers are connected as shown in Figure 1.

Click on the object palette and open the utilities. Select Application configuration to configure the applications that will be running over these two scenarios. We define the applications in three rows, this means that we will be running three applications in both the scenarios. These applications will be Video (High-resolution video), File transfer using FTP (High load), and voice (PCM quality speech). All these three applications are running with the highest possible load. We also selected profile configuration from the object palette to configure the profile of the selected applications. These profile configurations are operation mode, starting time and duration of the activity.
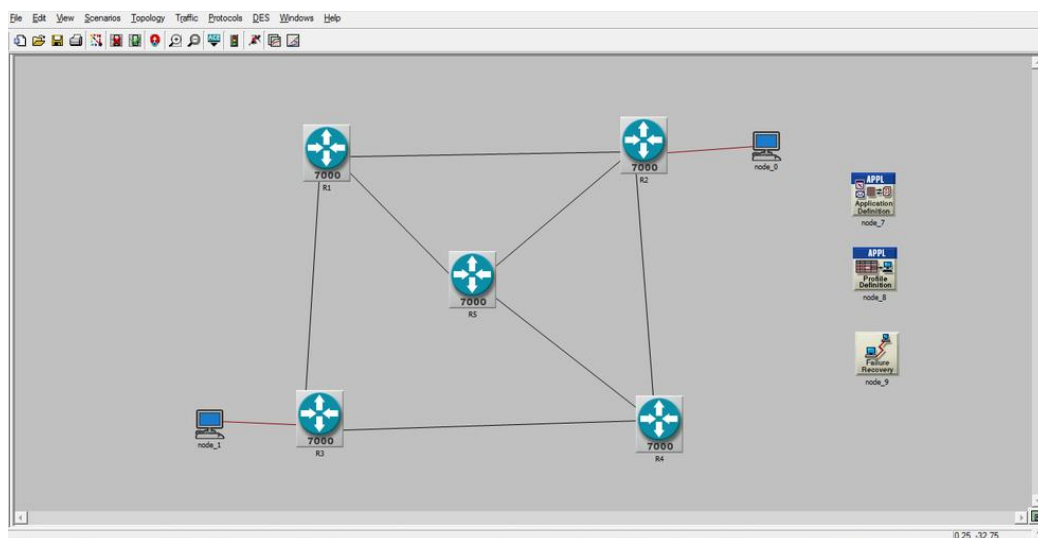
Figure 1. Showing the arrangement of network in OPNET

Another utility known as link failure/recovery is also selected from the object palette. This is used to fail and to recover the link at some given times. The time of failure and recovery is given as per

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your choice. You can even change the time of failure and recovery again and again to see the changes of performance in both the scenarios. We added 10 rows here in the link failure/recovery, which means that this link will fail for five times and it will recover for five times too. We have added the failure and recovery time in specifications. As already discussed, the two routing protocols are implemented here are RIP (Routing Information Protocol) and OSPF (Open Short Path First). They will be tested by their results on the following two parameters

    1. Network convergence duration

    2. Traffic dropped (packets per second).

4. Results

4.1 Network Convergence

Network convergence is a measure of how fast the group of routers gets information of the whole network. In other words how quickly the group of routers reaches the state of convergence is known as network convergence. Figure 2. Shows the behaviors of both the routing protocols used in the two scenarios. RIP does not show any convergence activity for a few seconds but shows higher convergence after a few seconds. Then we can see the decrease in convergence with an increase in after the ninth and a half minute. This increase in convergence continues till ten and half minutes while a drop in convergence can be clearly seen afterward in figure 2.
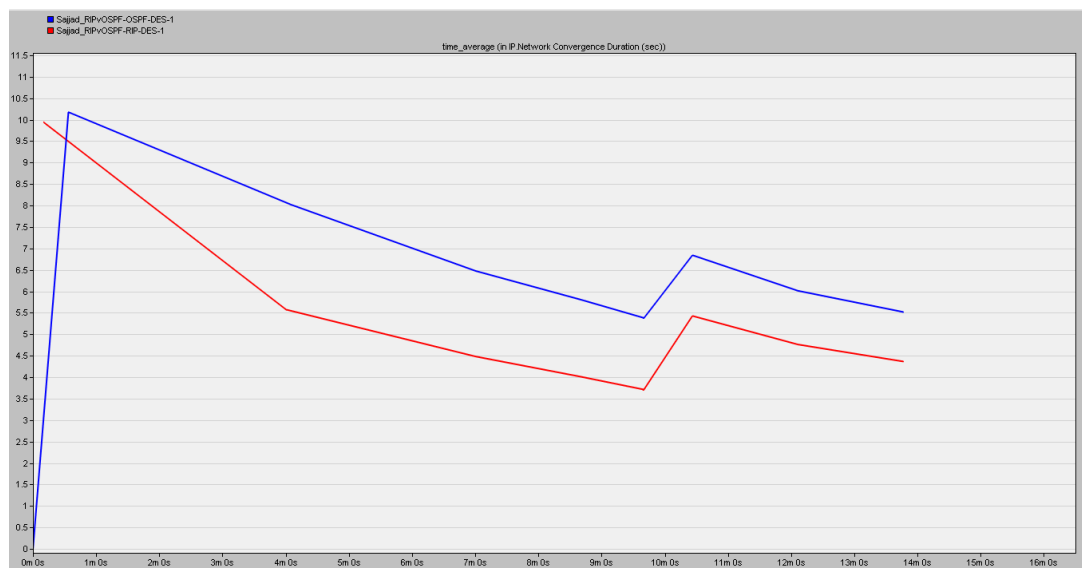
Figure 2. The comparison of Network convergence in both scenarios

The other routing protocol is OSPF which shows convergence from the very first second. The increase in convergence can be seen from the Figure 2. This increase remains effective before the end of the first minute which is then followed by a sudden decrease in convergence. An increase in convergence can again be witnessed from the figure 2 which starts before the tenth minute and remains effective till approximately the ten and half minutes. After that time a decrease in the convergence can be seen again.

From the above discussion and from the figure it is clear that the convergence in OSPF routing protocol is better than the RIP. RIP initially shows good convergence but a decrease in the convergence can be seen later and overall the OSPF is better than the RIP.

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4.2 Traffic dropped

It is very much clear from the Figure 3. that RIP has extraordinarily good performance when it comes to dropping of the packets in the current network arrangement. RIP did not drop a single packet starting from the first second till the last second. On the other hand, OSPF has dropped many packets starting from the very first second. This dropping of packets at a high pace continued approximately to the four and half minutes. Then an exponential decrease in the packets drop can be seen from the Figure 3. In this case, RIP has not dropped a single packet and unanimously outclassed its rival i.e. OSPF.
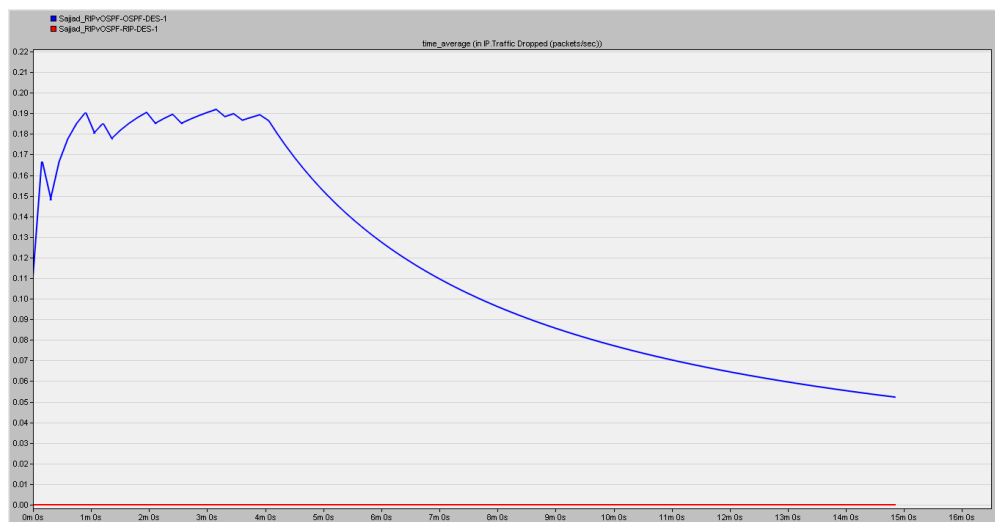
Figure 3. The comparison of traffic dropped in both the scenarios (packets/second)

5. Conclusion

The two protocols named RIP and OSPF are tested under two conditions. Both the protocols behaved differently as far as the results of these two are concerned. When it came to the convergence, OSPF performed quite better in contrast with the other one. RIP is thought to be slow converging protocol and here it is proved in our case too. When we compared both these protocols in terms of traffic dropped (packets/seconds), we get totally changed results. In this area, RIP performed exceptionally well and did not drop a single packet. On the other hand, OSPF dropped few packets and hence the results shown by the RIP, in this case, are outstanding.

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Improved Linear Quadratic Gaussian Control for Aircraft Dynamics in Uncertain Environment

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Abstract

The designing and control of fixed wing aircraft is difficult and challenging because aerodynamic forces and moments are subjected to variations affecting them. This work deals with modeling and controller design for aircraft dynamics. The non-linear model is obtained using first principle approach and linearized using small perturbation theory. The obtained model is employed in design of a controller named Linear Quadratic Gaussian (LQG) control. The simulation results with and without LQG are compared and it is observed that LQG performance is very efficient. The aircraft lateral dynamics is used as a case study and Lockheed F-104 is used as a reference aircraft model.

Keyword: Aircraft, LQG, Lateral dynamics, Lockheed F-104

1. Introduction

The complex dynamical systems of aircraft consists of different types of systems and smaller subsystems. Each of these have their own control strategy and procedure. The performance of aircraft is within the atmosphere of earth which mainly depend upon wing generated lift and engine's thrust as studied by Zarchan [1]. Aircraft plays important role in accomplishing different types of missions like attacking fixed or moving targets on land, in water and air. In normal flight conditions thrust balances resistance to main engine and gravity balanced by lift. The controller design approaches and techniques developed for aircraft systems and subsystems are shifting toward automation resulting in facilitation of both pilot and other members as studied by Nelson [2] and Cook [3].

Tischler et al. [4] studied that tools like simulation and modeling are quite useful for understanding dynamics of complex systems. The mathematical models obtained for different aerospace systems helps in understanding dynamic characteristics of these vehicles and also proving useful in controller design, navigation and guidance. Steven [5] studied that aircraft being highly non-linear is very difficult to be modeled accurately. The aerodynamic model of aircraft deals with development of mathematical model describing forces and moments acting on aircraft. The modeling of aircraft can be carried out in two ways: first method is known as first principle approach and second is called system identification. First principle approach is a theoretical modeling technique which make use of basic laws of physics such as Newton-Euler equations and is based on different types of assumptions. The second method is based on input-output measurements for extraction of mathematical model and is more accurate as compare to second. This work considers modeling of lateral dynamics using first principle approach.

Different control strategies and techniques are presented and implemented in flight controllers for improving performance. Proportional-integral-derivative (PID) control technique is simple, low cost and easy in designing and implementation and used in different types of flight control systems design as studied by Rinaldi et al. [6]. Linear quadratic regulator (LQR) is an optimal control technique preferred for multi-input multi-output (MIMO) systems as described by Moore et al. [7]. It helps in improving performance for aircraft and also maintain trim state in different situations.

Mani et al. [8] described the use of robust design technique such as LQR/LQG and H∞ control in flight controllers. Neural network and dynamic inversion control technique can also be implemented in different control systems of flight as studied by Mota et al. [9] and Smit et al. [10]. Bing et al. [11] discussed control techniques named linear quadratic Gaussian/loop transfer recovery (LQG/LTR) for flight control system design.

2. Aircraft Model

The aircraft used as reference model in this work is Lockheed F-104. The top and 3D view of aircraft is shown in figure 1. The geometric and flight conditions data is shown in table 1.
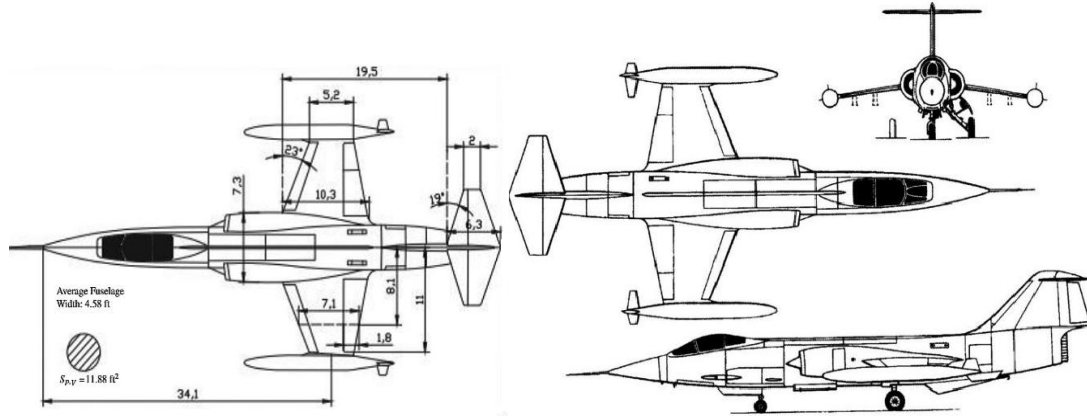
Figure 1: Top and 3D view

Table 1: Flight Conditions and geometric data

Altitude (ft)	55,000	Mach Number	1.8
True Airspeed (ft/s)	1,742	Dynamic Pressure (lbs/ft^2)	434.5
Location of CG % of MAC	0.07	Steady state angle of attack (deg)	2
Wing Surface (ft^2)	196	Mean Aerodynamic Chord (MAC)	9.6
Wing Span (ft)	21.9	Mass (lbs)	16,300

The non-linear equations for aircraft can be derived using first principle approach. In order to reduce complexity, aircraft is assumed to be a rigid body with constant mass. The conservation of linear momentum with respect to body axes yield following equations

$$\begin{bmatrix} F_{ax} + F_{tx} \\ F_{ay} + F_{ty} \\ F_{az} + F_{tz} \end{bmatrix} = \begin{bmatrix} m\,(\dot{u} + qw - rv) - mg_x \\ m\,(\dot{v} - rv + pw) - mg_y \\ m\,(\dot{w} - uq + vp) - mg_z \end{bmatrix}$$

(1)

Where u, v and w are components of translational velocity, p, q and r are components of rotational velocity, m is mass of aircraft and g_x, g_y and g_z are components of gravity along x-, y- and z-axes. The forces, moments, linear velocity and angulare velocity components are shown in figure 2.

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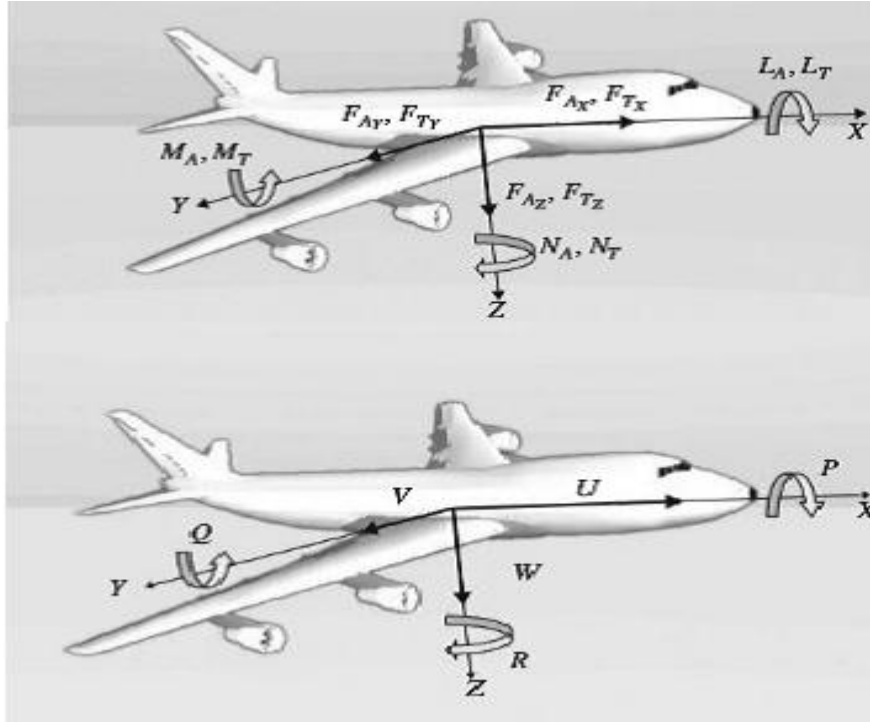
Figure 2: Forces, moments, linear and angular velocity components

The conservation of angular moment yields following equations

$$\begin{bmatrix} L_{ax} + L_{tx} \\ M_{ay} + M_{ty} \\ N_{az} + N_{tz} \end{bmatrix} = \begin{bmatrix} I_{xx}\dot{p} - I_{xz}\,(\dot{r} + pq) + rq\,(I_{zz} - I_{yy}) \\ I_{yy}\dot{q} + pq\,(I_{xx} - I_{zz}) + I_{zz}\,(p^2 - r^2) \\ I_{zz}\dot{r} - I_{xz}\dot{p} + pq\,(I_{yy} - I_{xx}) + qr\,I_{xz} \end{bmatrix}$$

(2)

Where L, M and N are rolling, pitching and yawing moments along x-, y- and z-axes. Euler angles describes the aircraft motion in inertial space and equations for $\dot{\theta}$, $\dot{\phi}$ and $\dot{\psi}$

$$\dot{\theta} = \text{q}\cos\phi - \text{r}\sin\phi \tag{3}$$

$$\dot{\phi} = \text{p} + \text{q}\sin\phi\,\tan\theta + \text{r}\cos\phi\,\tan\theta \tag{4}$$

$$\dot{\psi} = \text{q}\frac{sin\phi}{cos\theta} + \text{r}\frac{cos\phi}{cos\theta} \tag{5}$$

The linearization of non-linear equations is carried out using small perturbation theory and linearized equation are converted to state space representation. The generalized state model is given as

$$\dot{x} = \text{Ax} + \text{Bu} \tag{6}$$

$$\text{y} = \text{Cx} + \text{Du} \tag{7}$$

Where A, B, C and D describes system matrix, control matrix, output matrix and feed forward matrix. In case of lateral model of aircraft x = [β p r ϕ]ᵀ. The control surface affecting lateral motion are aileron and rudder deflection. For lateral model the system and control matrix are given as

$$A = \begin{bmatrix} -0.0315 & 0.0442 & 0.0221 & -0.0265 \\ -0.0545 & -0.0526 & 1.9040 & 0.1757 \\ -0.0337 & -1.9325 & -0.0925 & -0.2338 \\ 0.0863 & 0.1140 & 0.0176 & -3.0892 \end{bmatrix}, \quad B = \begin{bmatrix} 2.1586 & -1.4959 \\ 0.8843 & -1.6881 \\ -0.3264 & -2.4509 \\ -3.9814 & 0.5189 \end{bmatrix}$$

2.1 Open Loop Analysis

The lateral model obtained for aircraft is implemented using Matlab\Simulink and its response is studied without controller implementation. Quite diverging behavior is observed for different

states of lateral model which is undesirable. The eigenvalues obtained for aircraft are -3.10e+000, -3.26e-002, -6.83e-002 + 1.92e+00i and -6.83e-002 – 1.92e+00i. The simulation results obtained are shown in figure 3.
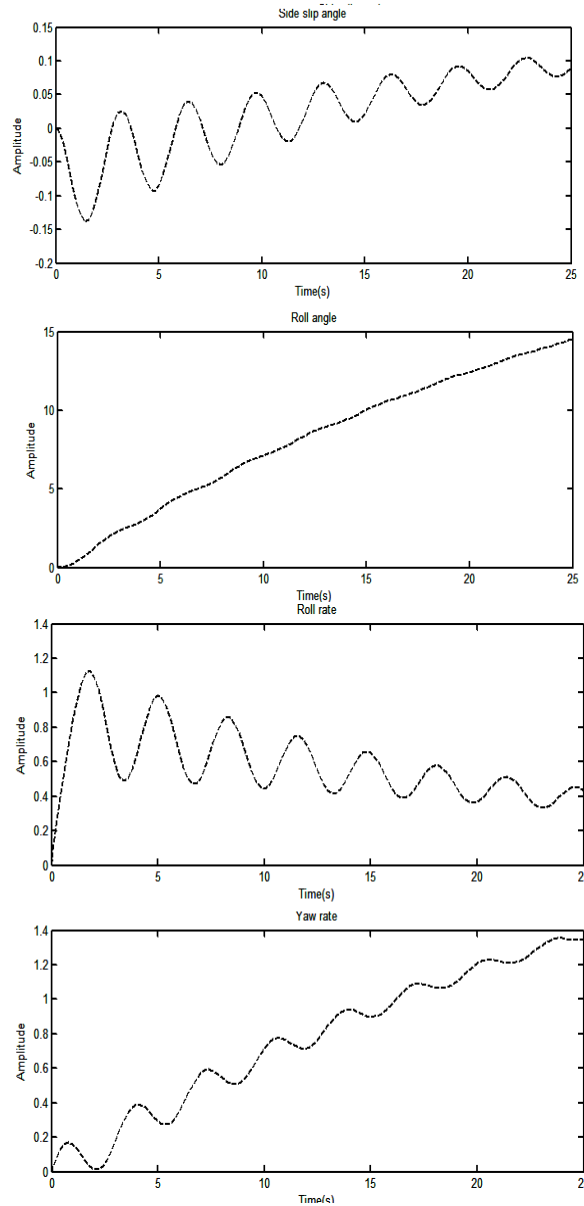
Figure 3:   Open loop simulation results

2.2 Uncertain Environment Modeling

   Writing model equations of aircraft dynamics as linear discrete equations

$$\begin{bmatrix} x_j \\ z_j \end{bmatrix} = \begin{bmatrix} Mx_{j-1} + Nu_{j-1} + w_j \\ Tx_j + v_j \end{bmatrix} \tag{8}$$

Where x_j represents state vector, u_j describes control input, w_j and v_j are zero mean white noise. If the plant model is struck by the wind disturbance, then the system equation can be written as

$$\begin{bmatrix} x_j \\ z_j \end{bmatrix} = \begin{bmatrix} Mx_{j-1} + Nu_{j-1} + w_j + L_j \\ Tx_j + v_j \end{bmatrix} \tag{9}$$

Where disturbing foce L_j size in different direction and $L_j = [L_{1j} \ L_{2j} \ \dots \ L_{jl}]^T$.

3. LQR Introduction

Linear quadratic regulator (LQR) is a controller design technique in control systems that has been widely used in different control applications. It shows effective performance for multi-input multi-output (MIMO) systems and its block diagram is shown in figure 4.
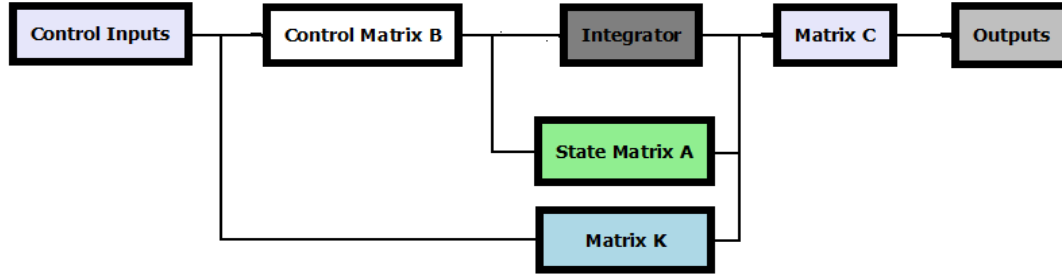
Figure 4: LQR block diagram

It works on principle of minimizing energy required to control aircraft lateral dynamics. For designing and proper tuning of LQR, the value of feedback gain is chosen such that performance index J is minimized and J is given by

$$J = \frac{1}{2} \int_0^\infty [x^T Q x + u^T R u] \, dt \tag{10}$$

4. Kalman Filter Estimation

If all states of aircraft lateral model cannot be observed in case of using LQR method, then states are estimated. Kalman filter (KF) carry out state estimation for plant model in presence of noise. Signal and noise combined in state space plant model make use of previous time (estimated value) and present instant (observed value) values for updating estimates for state variables and then calculating current time estimates. The state estimate is calculated as

$$\hat{x}_j = M\hat{x}_{j-1} + Nu_{j-1} \tag{11}$$

The error covariance matrix is given by

$$P_j = M \, P_{j-1} \, M^T + Q \tag{12}$$

The filter gain matrix calculated as

$$K_j = P_j T^T \, [T_j \, P_j T^T + R] \tag{13}$$

The updated state estimated is given as

$$\hat{x}_j = \hat{x}_j + K_j \, [z_j - T \hat{x}_j] \tag{14}$$

Error covariance matrix updated as

$$P_j = [1 - K_j \, T] \, P_j \tag{15}$$

5. LQG Controller

The estimated states passing through feedback gain combines with optimal state estimator gain of Kalman filter forming LQG for plant dynamics as shown in figure 5.
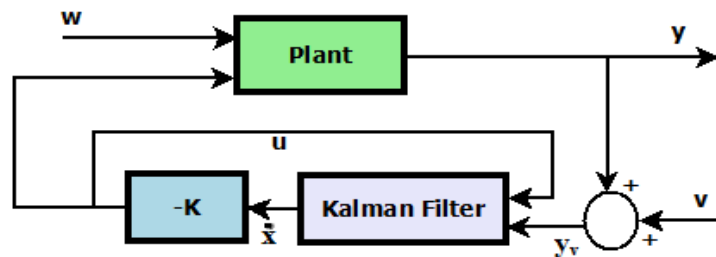
Figure 5: LQG block diagram

The state space equations for the plant are given as

$$\dot{x}_k(t) = A_i \, x(t) + B_i \, u(t) + \tau \, w(t) \tag{16}$$

$$y_k(t) = C_i \, x(t) + v(t) \tag{17}$$

Where w(t) is white noise associated with process and v(t) is white noise associated with measurements. The matrices A_i, B_i, C_i are state matrix, input control matrix and state measured matrix respectively. The covariance matrices for w(t) and v(t) are W and V respectively. Initial values of states i.e. x(0) are assumed to be uncorrelated with W and V.

$$E[ww^T] = W, \qquad E[vv^T] = V, \qquad E[vw^T] = 0, \qquad E[wv^T]= 0 \tag{18}$$

The problem is then to derive a feedback control law which minimize cost

$$J = \frac{1}{2} \int_0^\infty [z^T Q z + u^T R u] \, dt \tag{19}$$

Where z = Mx, $Q = Q^T \geq 0$, $R = R^T > 0$. The solution of LQG problem is given by the separation theorem, which states that optimal result is obtained when optimal estimate of state x(t) is obtained along with solution of linear quadratic control.

6. Simulation Results

For Kalman filter design, initial values of estimated state and initial condition of estimated covariance taken are zeros(4,1) and eye(4), w(t) = 0.01 and v(t) = 0.01. For LQR controller Q and R are chosen to meet performance criterion. For LQR values of Q and R taken are: Q = C^T*C and R = 1.

The algebraic Ricattic solution matrix P and gain matrix K obtained for LQR are given as

$$P = \begin{bmatrix} 0.0022 & -0.0093 & -0.0044 & -0.0074 \\ -0.0093 & 0.1492 & 0.0540 & 0.0640 \\ -0.0044 & 0.0540 & 0.0221 & 0.0310 \\ -0.0074 & 0.0640 & 0.0310 & 0.0697 \end{bmatrix}, \quad K = \begin{bmatrix} -0.2300 & 0.0496 & 0.0937 & 0.0820 \\ 0.1331 & -0.0035 & -0.1929 & -0.0198 \end{bmatrix}$$

The error covariance matrix E_c and Kalman filter gain matrix KF_G are given as

$$E_c = \begin{bmatrix} 542.1883 & -0.5897 & 2.0435 & -0.1100 \\ -0.5891 & 5.4652 & 3.7488 & -1.2682 \\ 2.0435 & 3.7488 & 5.8527 & 0.6936 \\ -0.1140 & -1.2682 & 0.6936 & 6.3052 \end{bmatrix}, \quad KF_G = \begin{bmatrix} -0.5897 & -0.1140 \\ 5.4652 & -1.2682 \\ 3.7488 & 0.6936 \\ -1.2682 & 6.3052 \end{bmatrix}$$

The simulation results obtained using LQG controller for lateral dynamics of the aircraft are shown in figure 6.

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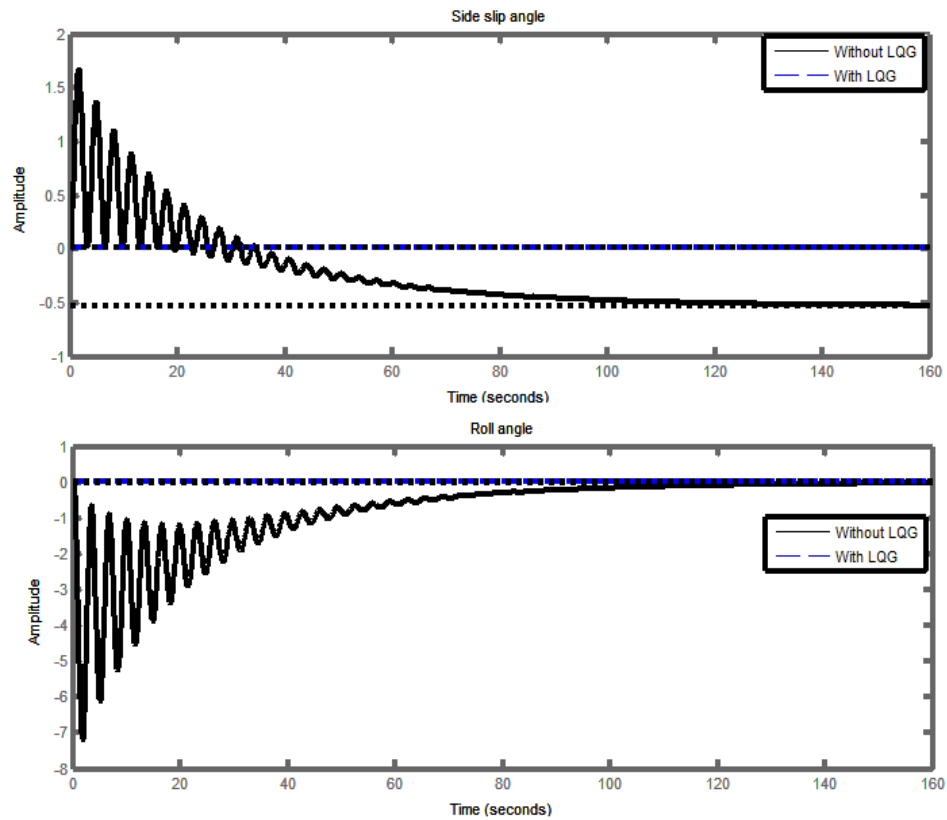
Figure 6(b): LQG simulation results
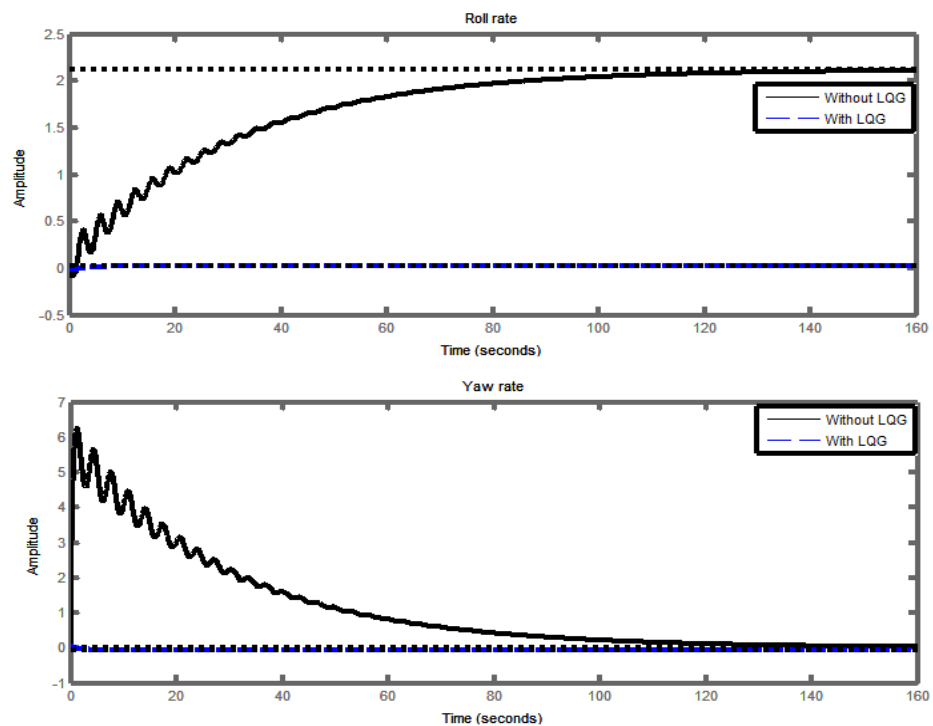
Figure 6(a): LQG simulation results

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7. Conclusion

Non-linear model of aircraft is obtained using first principle approach. These non-linear equations are linearized using small perturbation theory; converted to state space model and implemented in Matlab/Simulink. The behavior and performance is analyzed without controller approach and it is observed that quite improvement necessary for the model. Uncertain environment factor is modeled and discussed. Linear quadratic regulator and Kalman filter are discussed. The LQG performance is analyzed from simulation results which shows effectiveness of the design approach.

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Device to Device Communication in 5G

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Abstract

5G the new name of mobile communication is the enhanced version of 4G.The previous four generations of cellular technology have been a paradigm to break the compatibility. 5G will need paradigm shifts that will also with more requirements of higher bandwidth, more number of users, Multiple number of antennas, Extreme dense network and will be integrative also. To achieve much of the challenges for 5G in next era of cellular communications some new technologies is now introduced in the standard defined by 3GPP. One of these is Device to Device Communication. In first D2D was proposed for relaying but with time research showed that we can achieve highest spectral and energy efficiency as well much higher data rate using D2D. For the high dense networks Pico cells idea can also be replaced by D2D as we can adjust much more users and devices in a single cell by introducing the D2D for relaying, off-loading, M2M communications and content distributions. Here in this paper we provide a taxonomy based survey on D2D.Also will explore some of the open research problems that can be extensively reviewed and explored for further research in the field of D2D communications.

Keywords

Device to Device Communications, Energy Efficiency, Spectrum Efficiency, Power Control, Cluster.

1. Introduction

The Demand of mobile broadband is increasing very rapidly. In just a decade the number of users is increased about 100 times. In CISCO visual network reports(VNI), They released that wireless data explosion is real and will continue. And the VNI reports analyzed that largely driven data by smartphones, tablets and video streaming cannot be well managed by the entire networks by 2020. A survey report released by METIS(A academia Research organization working on the requirements, challenges and standardization for 5G) in 2013 give a quantize evidence that the need of traffic volume will increase 1000x in upcoming era due to large number of connecting devices that is expected as to be 50 Billion in 2020. The requirements for higher data rates is also of much interest as today or in future everything is going to be IP based equipment's i.e. M2M, Wireless sensor networks, Industrial automations, and Ubiquitous communications. And all these applications need a high rate and greater percentage of reliability as well. The Expected delay will

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be reduced 5x of the current that is 15ms because of the more realistic communications. Some of the requirements for 5G networks defined by METIS[1] are given in the following table 1

Table1: Requirements for 5G Defined by METIS[1]

Data rates	1-10Gbps
Spectrum	Higher Frequency and Flexibility
Energy Consumption	Less 10% than today
Capacity/Month	36TB
Capacity/User	500GB
Latency	1-3ms
Reliability	99.999%
coverage	>20dB of LTE
Battery	10 Years

To achieve and come up with these challenges new technologies that result in spectrum efficiency, Energy efficiency, good coverage and high capacity is adopted in 5G. Massive MIMO, mm-Wave communication and Device to Device Communication of which is very familiar. Here in this paper we will take into account D2D communications and discuss taxonomical based literature as well as some of the challenges and research problems.

In conventional cellular technologies the communication is network centered. Means that every user equipment (UE) has to communicate with the Base station. If a user is far away from the BS s/he may not achieve the minimum rate and QoS no any relay or other solution is part of these networks. The D2D Communication was first proposed as a relay. That will help out the user to access the BS more prominently. Later the research and exploration realized that D2D also can give much higher spectral efficiency, lesser energy consumption and good coverage.

D2D communication in cellular network can be defined as a device centric technique in which the nodes can communicate directly without approaching the base station. D2D can use licensed band i.e. Outband D2D or can use the same band as cellular band i.e. inband D2D. A survey shows that more than 70% of mobile users are in close proximity of one another so most of the users can use other mobile user to reach the base station and achieve the required rate. In D2D communication the BS and D2Dm user may rely on other D2Dr user that forward the signal to BS.

In First Four generations of cellular communications the service provider were not attracted towards D2D communications. But now with increasing number of users and real time applications. As some of the location aware applications are introduced and now its number is increasing rapidly these services need communication with the neighboring devices. So in this case D2D can reduce the cost of communication.D2D also can play a vital role in cloud computing for the users in closed proximity. In rush areas like stadium or any congested area, D2D communications can be used to achieve the higher rate and QoS. One of the most important features of D2D communication is that we can use it natural disaster conditions like earthquakes or hurricane. Where a new network can be build up in no time while replacing the damaged network infrastructure[2]. Can be also used in wireless sensor networks for to provide better services and access to all the nodes.

In Current market Bluetooth or Wi-Fi etc. providing some D2D communications functionality but these are uncontrollable and a cannot guarantee security and QoS. Now D2D communication sparked into interest of cellular service providers because of its higher flexibility and better performance. Therefore D2D communication is practiced in LTE-A. And now in 5th generation of cellular networks D2D will play an important role in the formation of the network.

Here in this article we provide a brief overview of available literature. Will also discuss some of the available techniques and its performance in terms of spectral efficiency energy efficiency, coverage and capacity. In the rest of the article research problems is discussed. Specially the focus in this article is on the open research problems.

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2. Classification of D2D Communication

In[3], author classified the D2D communication in four different types. The Cellular communication is defined as macrocell tier and D2D communication system is named as device tier. This classification is based on pricing and full/partial control on resource allocation or no control.
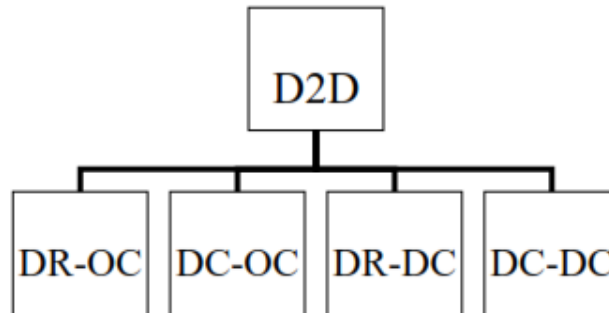
Figure 1: Classification of D2D Communication

DR-OC, Direct relaying and Operator control link in this type of D2D communication if any device is on edges of a cell it can be relayed by other device for achieving better QoS or good battery life. The operator may control full or partially the link establishment between the devices.

DC-OC, referred as direct communication via operator controlling. In this D2D communication type the one device is communicating the other device without traversing the BS but the link establishment is the responsibility of Base station.

DR-DC is direct relaying but in link establishment BS or network is not involved. Both devices are responsible for coordination of link establishment for relaying propose.

DR-DC, referred as direct communication with device controlling, in this type the direct communication between two devices is based on the link which is also established by the mutual coordination of the D2D devices. While the avoidance of interference in device tier as well macrocell tier is also the duty of the devices[3].

The multiple tier system if planned carefully can results in significant improvements over conventional cellular networks. Security and Interference management are the key challenges before practical implementation of D2D technology. As the user data is routed through other device so security must be maintained to achieve privacy.one of the possible solution is closed access. In closed access a list of trusted devices is defined. Only the devices in the list can directly communicate with the first device. If the device is not in the list must communicate through the core network with the first device. The devices in a group can use a proper encryption to avoid eavesdropping. on the other hand in open access all the devices can communicate directly. But in open access security achievement is a challenge and a open research problem.

In this type of communication, interference is one of the most important issues. Different authors have proposed many different algorithms that can help reduce this interference problem in D2D communication. One of such authors [4] has proposed the technique which uses the resources used for cellular uplink communication for device to device communication. This technique itself causes interference between the cellular users and the BS when the resources for cellular uplink are reused. To overcome this problem, the D2D users monitor the power received from the downlink control signal and estimate the path loss between D2D user and the Base Station. After this estimation, the D2D user maintains the transmission power so that the power is below a certain threshold that will result in minimum interference between the cellular users. If during the transmission, required power is higher than the threshold than no device to device communication is allowed.

The author of [4] taken a brief survey on device to device to communication. He classified the D2D communication in further 2 branches.

Inband D2D is the type of D2D Communication in which we use the same licensed band for both D2D and Cellular communications. Most of the literature is based on this method as some of the

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researchers thinks that the interference caused by unlicensed band is uncontrollable. So using of this technique can avoid that type of interference. In [5] and inband D2D Technique is proposed that use dynamic source routing for multihop communications. Path loss component is a main factor that will increase the use of D2D as we know if the path loss is stronger less will be the interference caused by D2D communications.

The inband D2D is further divided into two categories one is underlay while the other is Overlay Inband D2D.
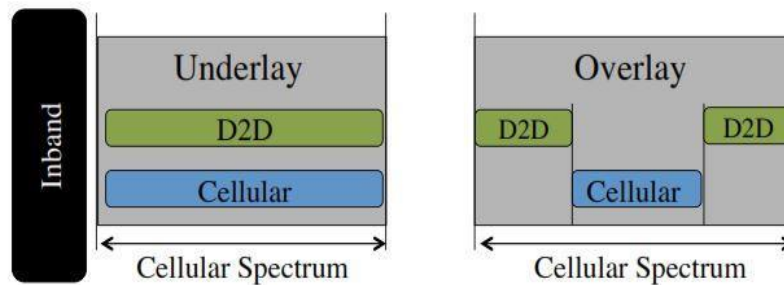
Figure 2: Representation of Overlay and Underlay D2D[4]

In inband underlay D2D we use the same band for both cellular and D2D communication. As shown in figure 2 The band assigned to both D2D and Cellular is same. In this technique the interference caused by the same band is a huge problem. But that can also avoided by some complex planning and band allocation techniques.

In this technique the controlling of unlicensed band is a key challenge for practical implementation. In contrast autonomous Outband D2D communication proposed in [6] leave the control on the devices. This technique is using Industrial, Scientific and Medical (ISM) Spectrum for D2D communication [7]. The proposed technique in [7] state a simultaneous channel allotment for both D2D and WLAN users which result in reduction of network performance, therefore a group based D2D link assignment is proposed where only one user can use WiFi in a single group. Similarly the channel management is in such a way that multiple groups cannot sense same channel at a time. It increases the throughput by 25%[7]

Cluster based technique for D2D communication is proposed in [8], [9]. In this article other supposed to form a cluster of the users in the range of D2D to one another.

In inband overlay the D2D and cellular communication is assigned a dedicated band of frequency. Overlay technique overcome the interference problem that was caused by using the same band for both D2D and cellular communication simultaneously but spectral efficiency is also affected on the cost of avoiding interference.

On the other hand in the Outband D2D communication technique we use licensed band for cellular communication while unlicensed band is used for D2D communication. This technique results in good performance in terms of interference between D2D and cellular links. This technique is also very effective in terms of spectral efficiency. In this technique an extra interface is introduced and adopted for the purpose to communicate directly. That interface can use WiFi[10], Zigbee [11]or Bluetooth [12]etc. One of the noted disadvantages of this technique is that devices supporting single interface cannot adopt this technology.

In figure 3, BS is the base station, CU is the cellular user, D is the Device to Device user. h is the channel response. The subscript shows the channels between different nodes. Because of using TDD the channel responses are reciprocal. Two time slots are assigned. In the first time slot, the BS communicates with Dn, CU communicates with Dn and Dn1 communicate with Dn. While in the second time slot, Dn communicates with BS, CU and Dn1. It is to be noted that BS and CU are far apart from one another that the CU cannot achieve the minimum required rate otherwise if the CU and BS link is good and in a position to achieve the minimum required rate then direct communication between BS and CU will be preferred.

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Figure 3: Time slots of proposed protocol
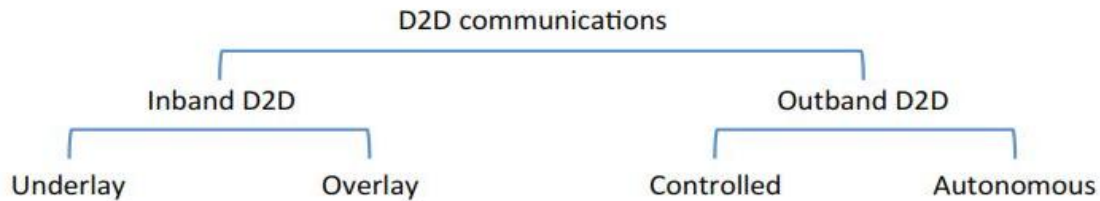
Figure 4: Classification of Device to Device Communication

Figure 4 shows the complete protocol communication pattern. In the start a training signal is transmitted to all of the users. As Dn receives the training signal it also estimates the quality of the channel in terms of channel response.Both the device to device users transmit the training signal to CU. Similarly the channel is estimated. Device to device user compute the rate. The timer is set down by both device to device users which is inversely proportional to the rate. The highest rate Dn timer will reduce to zero first and that Dn is assigned as relay node. In the signal with information of relay is transmitted again to all the users.

3. Analysis and discussion

Most of the papers proposed to reuse cellular band for device to device communications i.e. Inband D2D communication [16], [17]. But the Outband D2D communication attracted more and more attention in the last years. Some of the pros and cons observed as discussed in this section. Inband D2D increases the spectral efficiency. Any device can adopt this technology as no other interface is required. Quality of Service QoS management is much easier as compared to other techniques because resource allocation fully in control of the BS. Some of the disadvantages noted were wastage of resources in overlay inband D2D. Interference management in underlay D2D is very challenging. Power control and interference avoidance techniques can be implemented but it will increase the complexity and user cannot use both D2D and cellular communication at a time.

Outband D2D gives us very good results in terms of interference. Also no need of dedicated resources for D2D users saves cellular resources. Resource allocation is much easier and manageable as compared to inband D2D communication. Simultaneous cellular and D2D communication is implementable. On the other hand the interference between unlicensed bands in uncontrollable this is the key disadvantage of this technique. Multiple wireless interface support devices is compulsory to tune on this technology. Power consumption may increase if the power management is not implemented in a proper way. One of the key advantage of D2D communication is its easy implementation in case of natural disasters like earthquakes etc. where we can easily implement a new network while in case of damage of already available network.

4. Conclusion

In this article, a brief survey on D2D communication is provided. D2D communication is categorized on the basis of the available literature. Taxonomy on the available research is also discussed that divide device to device communication in inband underlay D2D, inband overlay D2D, Outband Control D2D and Outband autonomous D2D. Some of the available techniques are also summarized. In the end all the techniques are compared with one another. As a result we concluded that spectral efficiency, interference management, quality of service guarantee, control

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and assignment on resources, power control, pricing and cellular coverage are open issues for research in this field.

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Few Decades Survey on Renewable Energy and Smart Grid Approach

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Abstract

This paper presents in detail survey on renewable energy resources and smart grid approach. Particularly in the sense that how much potential Pakistan has to produce energy from renewable energy resources. How Pakistan can cut short energy losses especially by implementing smart grid approach. Smart grids with information technology (IT) such as sensors digital meters and communication networks will help in increasing power transfers and reducing energy losses. Photovoltaic (PV) and wind power have been getting particular attention as they are cheap, environment friendly and do not emit greenhouse gas.

Grid we know today is insufficient to serve us in the future, that's why we need an intelligent grid that supports the future needs of society. This paper presents demerits of existing power delivery system and suggests the better power management system.

Keywords*:* GHG, T&D, BPL, ARE, AEDB, SERC

1. Introduction:

Any energy source that is naturally regenerated over a short time scale and derived directly or indirectly from the sun or from the other natural movements and mechanisms is called "Renewable Energy". Energy resources derived from fossil fuels (Oil, gas & Coal) are called Non renewable energy sources. Renewable energies (i.e., Wind, Solar, Biomass, Hydro, Nuclear, tidal and Hydrogen) are clean sources of energy that have a much lower environmental impact than conventional energy technologies(Fossil fuels which emit greenhouse gas).

Over the last few decades, Asia has become a major player on the global scene. China and India are developing more rapidly than anyone had expected. Pakistan is also in good position to exploit renewable energy.

1.1 Wind Power:

Pakistan has huge potential of wind power. Many people do not realize that wind energy first came about in Asia between 500 and 900AD, a vertical azics turbine was developed in Persia to grid grain and pump water.These wind turbines were made from wood.However in recent years Europe and North America have led in terms of installing wind capacity. Only wind energy source in fact

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has capacity to collectively produce over 150,000MW of electricity in Pakistan. An average acceptable wind speed in most parts of the world lies from (6.2-6.9)m/s (fair category) and (7.0-7.4)m/s (good category). Interestingly, wind speed in some parts of Pakistan (e.g., Sindh corridor, Baluchistan and some northern areas) touches even excellent category of wind speed (i.e. more than 7.4m/s). India and China currently have the fourth and fifth largest number of wind turbines installed respectively. It is interesting to note that India has 45,000MW of wind energy potential and Pakistan has atleast 50,000MW of potential. Pakistan is fortunate to have somwthing that other countries don't have especially high wind speed near major centres. Near Islamabad wind speed is (6.2-7.4) metres/second and near Karachi it is (6.2-6.9) meters/second. Pakistan is also fortunate that in India the company Suzlon manufactures wind turbines that will decrease the transportation cost. Its turbine starts to run at 3 meters/sec wind speed. Vestas which is one of the largest wind turbines manufactures company; its turbines start to run at speed of 4meters/second. In addition to Islamabad and Karachi there are other areas in Pakistan that have significant amount of wind. Renewable energy potential in Pakistan is as under

Table 1: Renewable energy and its electrical potentia

Renewable Energy	Electricity Potential
Wind	0.346 Million MW
Solar	> 2 million MW
Biogas	1800 MW
Hydal	2000 MW
Geothermal	550 MW

In Balochistan and Sindh province sufficient wind exists to power every village in the country. There exists a cooridor between Gharo and Ket Bandar that alone could produce (40,000-50,000)MW of electricity. In Mirpur Saro, 85 micro turbines have been installed to power 356 homes. In recent years, government has completed several projects to demonstrate that wind energy is viable in the country but that was only for demonstration. In Kund Malir, 40 turbines have been installed which power 111 homes. Alternative energy development board (AEDB) has acquired 18,000 acres for the installation of more wind turbines. In addition to high wind speed areas Pakistan is also very fortunate to have many rivers and lakes.Wind turbines that are situated in or near water enjoy an uninterupted flow of wind. In Southern Sindh and coastal Balochistan there is a wind speed of 7-8m/s and energy potential of (10,000-50,000)MW. In Gharo, Khutti Kun and Jhimpir, Sindh, there has been estabilished some wind energy projects that added upto 255MW of electricity to the national grid so far.Wind turbine takes less space on the ground other than any energy conversion system.

1.2 Solar Energy:

Most renewable energies either directly or indirectly come from the sun. Pakistan is ideally placed within the geographical area to acquire advantage of solar power because it receives 2 Mwh/m2 radiations and 3000 hrs of sunshine a year. Average ammount of daily sunlight is 9 and half hrs in Pakistan. Balochistan has highest annual sunshine duration in the world. If 0.25% of Balochistan was covered with solar panels with an efficiency of 20% enough electricity would be generated to cover all of the Pakistani demand.Solar energy in Pakistan makes much sense because of 70% of population lives in 50,000 villages that are very far away from the natural grid according to the report of Solar energy research centre (SERC). Connecting these villages with the natural grid will be very costly. If each house is given a solar panel that would empower people both economically and socially.

In many Pakistani villages, wood and animal dung is used as cooking fuel, however this causes widespread deforestation. AEDB completed the project in which villagers were given solar panels and solar cookers. Due to this deforestation decreased 80% near the villages and cookers are also made in Pakistan which generated local economic growth.

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Leveled cost of electricity generation from different sources of energy as of today(4) are
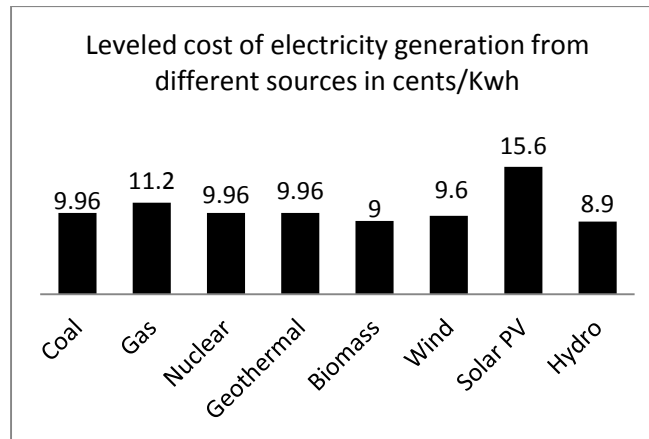
Figure 1: Leveled cost of electricity generation from different sources of energy

In Cholistan desert(Bahawalpur,Punjab), Quaid-e-Azam solar park, with the capacity of 1000MW has been estabilished over the area of 5000 acres. Where 100MW of electricity has already been added to the grid so far. Once it will be completed, it will be the largest solar park in the world.

1.3 Hydroelectricity:
Because of the presence of many rivers and lakes, large hydro electric dams were built around the world. In China one million people were relocated and 62,000 acres of farmland were flooded (1). Dam reservoirs contain billions of tons of sewage. In Pakistan the Kalabagh dam was put on hold for political reason in the 1980's and since then there has been very little activity in this area.

1.4 Tidal Power:
Tidal power has not yet been operational in Pakistan but in near future it may play a key role. The coastalline of Pakistan, which is about 1,045km long with dominant features is the best resourse for harvesting tidal energy. In Sindh, two sites, creek system of Indus delta of 170km and (2-5) meters tidal heights at the korangi creek are available to exploit the tidal energy. In Balochistan, sonmiani beach and kalamat are also good prospects of tidal energy. GoP has issued license to private companies to take measures to build tidal power stations in February 2013. Since then the engineering work is under process. Initially a 10MW plant is proposed at Sonmiani Bay. This sourse of energy is environment friendly causing no harm to the existing ecosystem.
GoP has tasked AEDB to ensure 5% of total national power generation capacity, to be generated through renewable energy technologies by the year 2030. In addition AEDB has been directed to electrify 7,874 remote villages in Sindh and Balochistan provinces through ARE technologies.

1.5 Nuclear Energy:
Pakistan Atomic Energy Commission (PAEC) is responsible for planning, construction and operation of nuclear power plants. Karachi nuclear power plant (KANUPP) is adding 98MW of power in national grid. and Chashma Nuclear Power Plant is adding 650MW of power in natinal grid. Construction of two more nuclear power plants is in progress. PAEC has in-house educational and training institutions that encompass all major facets of nuclear science and technology. GoP has mandated PAEC for the installation of 8,800MW nuclear power capacities by the year 2030.

1.6 Fossil Fuels:
It is not so popular resource in Pakistan but still is being tested several times on large scales and in the commercial zones. It is the energy which is being acquired by the natural process of anaerobic decomposition of the buried dead organisms. Biogass can be generated from waste (dung) of cows, horse and similar because they contain in them many gases. Fossil fuels are non-renewable, that is,

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they draw on finite resources that will eventually become too expensive or too environmentally damaging to retrieve. In contrast, the many types of renewable energy resources such as wind and solar energy are constantly replenished and will never run out.

Renewable energy cannot supply 24/7 electricity as the sun goes down or the wind stops. The key to generate constant supply is to have a mix of solar, wind and biogas.

1.7 Coal power:

In addition to the wind and solar Pakistan has fifth largest coal deposits in the world at Thar(largest desert of Pakistan in Sindh). There is a claim that coal quality is inferior having low BTU (British thermal unit) however technology and boilers are available that can burn any coal. Negative impacts of coal also have been well documented. When power is produced from the coal, sulphur dioxide and nitrous oxides are produced which causes ozone deplesion and acid rain.Nitrous oxide is also a powerfull greenhouse gas. Transportation of coal also impacts health due to the coal dust and emissions from the vehicles. Lastly the heavy metals from the coal mine waste can seep into groundwater and rivers. India is producing bulk of its power from coal (69%) while gas has a small portion of 12% in power sector.

1.8 Natural Oil & Gas:

Pakistan also have some natural gas deposits in Potwar Plateau region and near the border between Balochistan and Sindh. But these are likely to disappear within 20 years and are non-renewable energy sources. Oil and gas are the world's two top energy sources accounting for about 60% of global demand. World liquid fuel consumption is 89.0 million barrels per day (bbl/d) in 2012. Thus developing secondary energy source has gained much focus across the world. Pakistan's total oil resource potential is 27 million barrels with production of 66,032 barrels per day within Pakistan and 134,280 barrels per day crude oil is imported. Likewise 8,395 thousand tonnes of petroleum is produced domestically while 11,507 thousnad tonnes was imported in 2012.
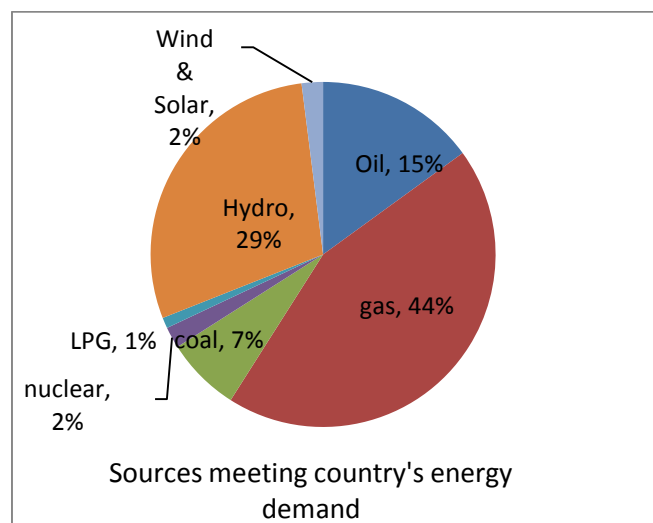
Figure 2: Sources meeting Pakistan's energy demand today

4. Electrical Grid Stations:

The first AC Power grid system was installed in 1886 in great Barriington,Massachusetts. An electrical grid is a centralized unidirectional system of electric power transmission, electricity distribution, and demand-driven control. An electrical grid means a network that carry electricity from the plants where it is generated to customers. The grid includes wires, substations, transformers, switches and much more. By the 1960's, an electrical grid of the developed countries had become very large, mature and highly interconnected network with thousands of central power generating stations for delivering electricity from suppliers to consumers via high capacity power lines which were further branched and divided. It consists of generating stations, high-voltage

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transmission lines that carry power from distant sources to demand centers, and distribution lines that connect individual customers (6). Various grid elements are generation, transmission, distribution and loads. The lack of investment for the new installations combined with aged network components (older than 40 years) has resulted in ineffent and increasingly unstable electric systems(5).

The electrical grid is expected to evolve to a new grid paradigm: "the smart grid", an enhancement of the 20th century electrical grid. It is an intelligent energy network.

5. The Smart Grid Technology:

An electrical grid with smart meters, smart appliances, renewable energy resources, computer-based remote control and automation, control of production and distribution of electricity is called "Smart Grid". The traditional electrical grids are generally used to carry power from a few central generators to a large number of users or customers. In contrast, the new emerging smart grid uses two way flow of electricty and information to create an automated and distributed energy delivery network. It offers many benefits to consumers.

In the 21st century, some developing countries like China, India and Brazil were seen as pioneers of smart grid deployment. Many countries are putting forward the smart grid development plans. "Smart phone" means a phone with a computer in it and "Smart grid" means computerizing the utility electric grid.

5.1 Features of the Smart Grid:

Followings are key features of smart grid system

5.1.1 Outage detection & Response:

The smart grid makes use of the technologies, such as state estimation (8), that improve fault detection and allow self healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disasters or attack. Smart grid provide better outage detection and response by using distribution intelligence.

5.1.2 Two way power flow:

Two way power flow from distributed energy resources and other assets, such as rooftop solar panels, electric vehicles and energy storage devices will be possible however classic grids were designed for one way flow of electricity.

5.1.3 Efficiency:

Due to demand-side management and advanced metering infrastructure systems, overall efficiency of grid station is improved with less redundancy in transmission and distribution lines, and greater utilization of generators, leading to lower power prices with increased power quality and reliability of supply and delivery. It saves consumers money and help reduce CO_2 emissions.

5.1.4. Load Adjustment / Balancing / Sharing:

Load connected to the power grid can vary significantly over time. Traditionally, to respond to rapid increase in power consumption, some spare generators are put on a standby mode and the failure rate can only be reduced at the cost of more standby generators. However in smart grid technology, few of the customers may be warned to reduce the load temprarily or continuously, so load reduction by even a small portion of the clients may eliminate the problem of power failure or putting extra generators on stand-by mode. Depending upon the user need it may share load from the adjacent feeders as well.

5.1.5. Peak Leveling and time of use pricing:

To reduce demand during the peak usage periods, communication and metering technologies inform smart devices in the home and business when energy demand is high and track how much electricity is used and when it is used. It also gives the customers the ability to reduce consumption by communicating to devices directly in-order to prevent system overloads.

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5.1.6. Market Enabling:

Smart grid allows systematic communication between suppliers and consumers and permits them to be more flexible and sophisticated in their operational strategies. Only critical loads will pay the peak energy prices, and consumers will be more strategic when they use energy. At the domestic level, appliances with energy storage such as (refrigerator, heat banks and heat pumps) will minimize energy cost.

5.1.7. Sustainability:

Flexibility of smart grid permits greater penetration of renewable energy resources such as solar and wind even without the energy storage. Current infrastructure of grid is not built to allow for many distributed feed-in points. However smart grid technology provides the facility to accommodate many feed-in points both at the generationa and transmission points.

5.1.8. Demand Response Support/Demand side Management:

It allows generators and loads to interact in an automated fashion in real time, coordinating demad to flatten spikes with two way flow of information. It helps to eliminate the cost of adding reserve generators, cuts wear and tear and helps to improve the life of eqipment. It also helps consumers to cut their energy bills by telling low priority devices to use energy only when it is cheapest. It helps to reduce power consumption at the consumer side during peak hours. (9).

6. Smart Grid Technologies:

Bulk of technologies being used in manufacturing and telecommunications are now adapted for use in grid operations. Some of these technologies are as under.

6.1. Integrated / Data Communications Technology:

It allows real time control, information and data exchange to optimize system reliability, asset utilization, and security (10). There would be huge benefits of data communication if made possible in grid system such as enhanced syber security, handling sources of electricity like wind and solar power and even integrating electric vehicles onto the grid.

6.2. Sensing & Measurement Technology:

Grid stability, monitoring of equipment health and energy theft prevention is possible by using smart meters(advanced microprocessor meters) and meter reading equipment, advanced switches and cables, backscatter radio technology and digital protective relays.

6.3. Distributed Power Flow Control Technology:

In this technology, power flow control devices are clamped onto existing transmission lines to control the flow of power within it. By doing this transmission lines support greater use of renewable energy by providing more consistent, real time control over how that energy is routed with in the grid. This technology enables the grid to store the energy more effectively from renewables for later use(11).

6.4. Smart Power generation Technology using advance Components:

Smart power generation is the concept of matching electricity generation with demand using multiple identical generators which can start, stop and operate efficiently at chosen load. Matching supply and demand is called load balancing which is essential for a stable and reliable supply of electricity. Short term deviations in the balance lead to frequency variations and a prolonged mismatch results in blackout. Load balancing task has become much more challenging as variable generators such as wind turbines and solar cells are added to the grid (12).

6.5. Power system automation Technology:

It provides rapid diagnosis of and provide precise solutions to specific grid disruption or outages. Power systems automation is done by

- Control systems (distributed intelligent agents)

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- Analytical Tools (Software algorithms & high speed computers)
- Operational applications (SCADA, substation automation, demand response)
- Programming Techniques (Artificial Intelligence)

Automation technology lets the utility adjust and control each individual device or millions of devices from a central location.

7. Smart Grids Research Topics:

Followings are the top priorities of smart grid research topics (13)

7.1   Standards & Protocols
7.2   Grid observability & Control:
7.3   Wide area monitoring systems (WAMS)
7.4   Advanced integrated communication and control system
7.5   Network management and control
7.6   Advanced sensors on network equipment.
7.7   Widespread Storage within the Grid:
7.8   Self healing:
7.9   Modelling Power systems and ICT together:
7.10   Observability at Distribution level:
7.11   Power Electronics Technologies:
7.12   Long-term assets management
7.13   Smart grid Security & privacy
7.14   Communication & networking in smart grid and smart metering
7.15   Distribution control algorithms to manage highly distributed generation & distributed storage capacity (electric vehicles)

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Towards Cooperative Diversity in Wireless Sensor Networks (Coop-WSN)

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Abstract
Energy efficiency is one of the major concern for wireless sensor network as the replacement of batteries is cumbersome. Introduction of cooperation in sensor networks effectively decreases the energy consumption as well as the loss of information due to channel fading is reduced by using cooperative path. Adaptive cooperation makes the nodes capable to communicate via direct link or through the relaying links and mode of communication depends on the residual energy and signal to noise ratio. A new scheme is presented named as Coop-WSN. Performance analysis is done via simulation and comparison is done with the Cooperative Power and Energy efficient routing protocol (COPE) and Space-Time WSN. Simulations have been done to validate the performance of proposed scheme with the other protocols. Results show that Coop-WSN protocol has better performance with respect to the Packet delivery, energy consumption and stability period. Presented scheme enhances the net end-to-end delay having a tradeoff with network life time.

Keywords—COPE, Space-Time WSN, Adaptive cooperation, stability period, throughput, end-to-end delay. Signal to noise ratio

Introduction

Wireless sensor network composed of sensor nodes from few to hundered in numbers and are capable of sensing , transmitting and receiving the data. The sensor nodes are used for the monitoring the environmental and physical conditions such as humidity, temperature, noise, vibration, pressure and movement of objects etc and forward the data to the desired location. WSN is an emerging technology with new ideas for enhancing the field of medicine and process control in industries. It also enhances the military surveillance as well as designing new systems that can be used to monitor the environmental parameters, for precise agricultural and building smart homes [1]. WSN have many routing protocols that allows the node to communicate and have better energy efficiency. A comprehensive survey of routing protocols in WSN is given in [2]. In WSN, nodes energy consumption is the most discussed and focused topic. The sensor node is very small in size and after the deployment of the sensor nodes, it is very difficult for an individual to recharge or

replace the battery. For single-hop transmission, larger distance nodes from the BS will need more transmitting power to forward its data and will die earlier while in multi-hop communication, node that are near to BS will die earlier due to constant transmission of data. The link between the nodes are wireless and data will face fading issue. The fading will cause the error in data and retransmission of data is required which will cause the delay in network and hence decrease the overall network performance.

Cooperation is one of the promising solution to these problems. In cooperation, the nodes share the resources of other nodes to transfer their data to the desired location. Different copies of the same packet is transmitted to the destination node as well as the relay nodes and if there is a need of retransmission, the other node will forward the data packet. This will increase the system reliability in case of worst channel conditions and also increase the network throughput and performance. The process of cooperation have two different step. In first step, data transmission is done to the destination node directly as well as to the relaying node by the data originating node. Relay node can also be called as the cooperative nodes. In Step two, the cooperative node will send the data to the destined node. If the direct link failed to transmit the packet to destined node then there is no need of retransmission from the source node rather the destination will get the packet via the relay node. This will enhance the network performance.

Adaptive cooperation is another approach in WSN to achieve the energy efficiency. In non-cooperative communication, all node directly communicate with each other. Nodes that are far from the BS will die earlier due to high transmission power. In cooperative mode, communication take place with the help of relay nodes. Nodes near to BS will die earlier due to constant data transmission. Nodes that are near to BS instead of direct communication, it will also follow the cooperative path. Adaptive cooperation is the technique that will help node to select either the direct path or to do cooperation. The path selection depends on the residual energy as well as the SNR. This will enhance the network energy efficiency.

Rest of the paper organized as follow. Section II is the related work. Section III discuss the motivation. In section IV, performance parameters are discussed. Section V discussed the proposed scheme. Section VI contain the simulation results and discussion. Conclusion given in section VII.

Related work

There are several routing protocols that are designed for WSNs but all the aspects of WSN cannot be accomplished by them. Some protocols only focus on energy efficiency and some of the focus on delay and network performance. Furthermore, these protocols were assessed in different aspects. Some of them are discussed below.

Energy efficiency is one of the most targeted area for WSN as the size of node is very small and have the battery constrained. A three node model of WSN having cooperation is discussed in [2] and is formulated accordingly. In [4], Low Energy Adaptive Cluster Hierarchy (LEACH) is discussed. The LEACH protocol consider to be one of the most efficient routing protocol for WSNs in term of energy efficiency. In [5], a clustering based protocol Distributed energy-efficient clustering is discussed. It is the enhanced form of LEACH protocol. Based on energy level, nodes were categorized as Advance node and normal node. The advance node have higher energy level than the normal nodes and so for relaying purpose, advance nodes will always be selected. An advance version of LEACH protocol is proposed in [6] that will take in account the node location information and its residual energy to enhance the energy balancing of the nodes. The improvement in LEACH protocol have been discussed in [7] and the comparison of LEACH and modified LEACH protocols are done. Simulation was on the basis of the cluster head selection and energy efficiency of the network and result shows that the modified LEACH is better in performance than the LEACH. In [8], LEACH based WSN is discussed and improvement in LEACH protocol have been made and analysis of network was done.

Robust routing protocol is discussed in [9] different types of nodes and different types of links are discussed. Nodes are intended nodes and guard nodes and the links are intended link and guard links. The link for direct communication of source and destination node is the intended link and the nodes on these links are the intended nodes. Nodes are considered to be the guard nodes which are neighbor of at least two intended nodes and guard link is the link between them. This scheme

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introduce the guard link which can send the data when the intended link failed to transfer it. The scheme result shows that the failure probability of guard link much smaller than the intended link and enhance the network performance by selecting the best path for data forwarding. Adaptive cooperation in WSN is another trending technique to enhance the network performance and overall network lifetime. In paper [10], adaptive cooperation in WSN with three different scenarios are discussed. The non-cooperative one, the cooperative communication with single relay and cooperative communication with multiple relays. The simulation result shows that in any type of communication either less distance or far distance, the cooperation with multiple relays outperform the other two scenarios also the paper discuss the selection of mode of communication. The direct path is more suitable when the source and destination are at very low distance and when they are far from each other the best communication mode is the cooperative communication.

Motivation

WSN is the network which are formed by the combination of small nodes. Senor nodes are smaller in size and power source is limited so the main focus in WSN operation is the energy efficiency of the network. Secondly, the power constrain of the sensor nodes made them to have a very low transmission power and have very small communication range. Cooperation allows the nodes to share the resources with each other and exchange the long and weak links with short and strong links. There are many routing protocols which are discussed but most of the protocol lacks to consider the noise, fading and channel condition. Some protocols are on the basis of node load balancing and node localization. The adaptive cooperation technique allows the nodes to select the mode of communication [10] but did not discuss the parameters on which the selection of route will be done. In this paper two protocols, COPE [11] and Space-Time WSN [12] were selected. COPE addresses the stability period and enhancement of energy efficiency but did not consider the path loss and outage probability. Space-Time WSN considered the node localization but mostly transmission done over the direct path and channel noise and path loss are not taken in consideration.

Performance metrics.

The proposed scheme Coop-WSN is analyzed on the basis of the performance metrics which are discussed in the subsections

Stability period

Stability period is the time duration from the start of the network till the first node dead is the network stability period.

Throughput

Throughput can also be called as the delivery ratio of packets. The number of successful packet delivery at the destination is the throughput.

End-to-End Delay

The time taken by the packet from source to destination

Residual Energy

The energy of the node left after every round and data transmission.

Network Lifetime

The time for which the sensor network is operational till the last node

Coop-WSN: Proposed Scheme

Coop-WSN is the proposed scheme which will be analyzed and evaluated with the COPE and Space-Time WSN. The nodes in the proposed scheme are considered to be randomly deployed and they are immovable and fixed. The number of nodes are denoted by m and they are equal to 200.

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The channel condition also taken in account. For fading in channel, the Rayleigh fading model is used and additive white Gaussian noise is used for the noise effect. Rest details of the proposed scheme are discussed in the subsection.

Network Toplogy

The network topology in sensor network is of great importance. The network capacity and energy consumption is dependent on network topology. Overall network energy depends on the network topology. In the proposed scheme, there are two types of nodes which are deployed over an area, the normal node and the advance node. The advance node have more power than the normal node [7] so advance node will be selected for the cooperation purpose.

Initialization Phase

In this phase, the nodes will do the two different task. The first one is the information of neighbor nodes and share it with the other nodes. The second task is the determination of the base station or destination node to which the data will be forward. The nodes broadcast the hello packet which contain the information of the nodes which are node id, distance and energy of the node. It should be kept in mind that the number of relaying nodes selected by the source will not be more than the number of relaying links.

Energy Model

The first order energy model is proposed for the cooperative WSN [4]

$$E_{TX}(k, d) = E_{TX\ radio}(k) + E_{TX\text{-}amp}(k, d) \qquad (1)$$

$$E_{TX}(k, d) = E_{radio} * k + \text{\euro}_{amp} * k * d^2 \qquad (2)$$

These are the equations for the transmission energy and for the reception energy

$$E_{TR}(k) = E_{radio} * k \qquad (3)$$

Where E_{TX} and E_{TR} are the energies for transmission and reception. $\text{\euro}_{amp}$ is the amplifier gain, d represents the distance between the TX and RX and k represents the size of the information message.

Channel Condition

For real time simulation and analysis of the WSN, channel condition must be taken in the account. For fading in channel, Rayleigh fading model is used and for noise, AWGN is used. Path loss also taken and modeled according to the log-distance model. Detailed discussing are in following subsection.

The capacity of the channel that follows the AWGN model will be

$$C = \frac{1}{2} log \left(1 + \frac{P_S}{P_N}\right) \qquad (4)$$

Where P_S is the signal power and P_N is the noise power.

The signal strength gets attenuated by increasing the distance source and destination. The attenuation here is the free space and so the equation can be express as

$$Attenuation = 10log\ (P_t/P_r) = -10log\ (\lambda^2/\ (4\pi)^2\ (d^2)) \qquad (5)$$

Where λ represents wavelength and d represents the distance between the nodes. The path-loss can be expressed as [13]

$$P_L = P_{TX}\ (dBm) - P_{RX}\ (dBm) \qquad (6)$$
$$P_L = P_{L0} + 10\gamma log\ (d/d_0) \qquad (7)$$

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Where P_L represents the path-loss at distance d and P_{L0} represents reference path-loss at reference distance d_0. Y represent exponent of path-loss

Cooperation Phase.

A three nodes simple cooperative model is considered .The cooperation phase have two steps. In first step, the source node will forward data directly to the destination node as well as data sent to the relaying node. In second step, the relay node will forward the data after some process to the destination node. A 3 nodes cooperation model is consider for sake of simplicity. The step one can be mathematically represented as

$$F_{SY} = \sqrt{P_{T1}} \, Q_{SY} \, T_{XS} + N_{SY} \qquad (8)$$
$$F_{SD} = \sqrt{P_{T1}} \, Q_{SD} \, T_{XS} + N_{SD} \qquad (9)$$

Where P_{T1} is the transmission power from the source. Q_{SY} and Q_{SD} are the channel coefficient for S to Y and S to D. N_{SY} and N_{SD} are the noise from S to Y and S to D and T_{XS} is the transmitted signal from the source. In step 2, amplification of signal is done via relay node will and forward it to the destination. It can be represented as

$$F_{YD} = \sqrt{P_{T2}} \, Q_{YD} \, T_{XS} \, f \, (F_{SY}) + N_{YD} \qquad (10)$$
$$F_{YD} = \sqrt{P_{T2}} \, Q_{YD} \, T_{XS}` + N_{YD} \qquad (11)$$

Where P_{T2} is the power at the receiver node. Q_{YD} is the channel coefficient of relay and destination. N_{YD} is the noise factor between the relay and destination. These noises are modeled as the zero-mean complex Gaussian random variable with variance σ^2 (with unity).

No. of Availabale nodes in overlapping region and node desntiy

The numbers of relay nodes need to be find in the transmission overlapping region of source and destination node. Let consider the total number of relaying node will be **m** and the node density will be **ρ**. Before calculating the relaying nodes, we need to find the cooperative region and to find the region, subtracting the triangle SEG area from the sector area denoted by AS and AS can be found from the equation.

$$AS = (\theta/2) \, r^2 \qquad (12)$$

Where r represents the range of transmission of source and destination nodes and θ is the angle of sector in radians. Fig 1 shows the area calculation of overlapping region. S is the source, D is the destination. d_{SD} is the distance between source and node. r is the transmission range for S as well as D. The height of triangle SEG is $d_{SD}/2$. Now to find the θ, we use the half angle identity.

$$\cos\left(\frac{\emptyset}{2}\right) = \frac{d_{SD}/2}{R} = \frac{d_{SD}}{2R} \qquad (13)$$
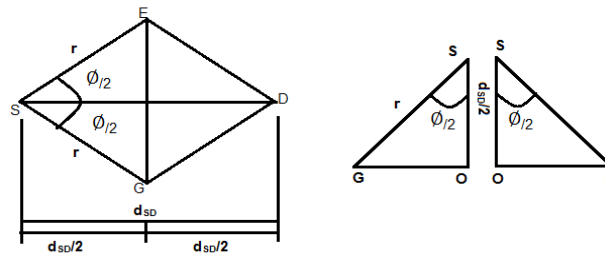
Fig 1. Area of triangle SEG

$$\cos\left(\frac{\emptyset}{2}\right) = \frac{d_{SD}/2}{R} = \frac{d_{SD}}{2R} \qquad (13)$$
$$(\emptyset) = 2\cos^{-1}\left(\frac{d_{SD}}{2R}\right) \qquad (14) \qquad\qquad (\emptyset) = 2\cos^{-1}\left(\frac{d_{SD}}{2R}\right)$$
$$\qquad (15)$$

Now putting the value of θ in equation 12 will give the area of sector

$$AS = R^2 \cos^{-1}\left(\frac{d_{SD}}{2R}\right) \qquad (16)$$

The area of triangle SEG can be calculated now which will be

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$$AT = \frac{d_{SD}}{4} \sqrt{4R^2 - d_{SD}^2} \qquad (17)$$

And A represent the region of overlapping and can be calculated from the equation.

$$A = 2 * [AS - AT] \qquad (18)$$

$$A = 2R^2 \cos^{-1}(d_{SD}/2R) - \frac{d_{SD}}{2} \sqrt{4R^2 - d_{SD}^2} \qquad (19)$$

$$m = \left[\rho * \left[2R^2 \cos^{-1}(d_{SD}/2R) - \frac{d_{SD}}{2} \sqrt{4R^2 - d_{SD}^2} \right] \right] \qquad (20)$$

And the number of nodes lying inside overlapping region can be found from the Equation (20).

$$\text{Density of nodes} = \rho = \frac{\text{total nodes}}{\text{Area}} = \frac{m}{A} \qquad (21)$$

$$m = \rho * A \qquad (22)$$

As we have source and destination node involved in calculation of overlapped region so.

$$m = \left[\rho * \left[2R^2 \cos^{-1}(d_{SD}/2R) - \frac{d_{SD}}{2} \sqrt{4R^2 - d_{SD}^2} \right] - 2 \right] \qquad (23)$$

So by this we can find the total number of nodes available for relaying purpose in overlapping region.

Selection of Relay and Routing Phase

Data transmitting source node is have many neighbor nodes in its surrounding. The source node gets the information regarding the neighbor nodes by broadcasting a message. The source transmit the info message to the destined node as well as the relaying node. The selection of relaying path depends on the channel condition of the source and relaying node. If retransmission of information packet occurs, the relay node will send the packet to the destination node instead of retransmission done by the source node. Till the hold time, the info packet will be held by the relaying node and packet will be discarded when the same info packet will be received from the other neighbor node. When the source node transmit the information to the destined node and information reception is correct, the destination node will broadcast ACK to avoid the retransmission of the same packet from the relaying node. If the information packet received is corrupt, the destination node broadcast NACK and the relay node will forward the packet to the destination node. Source node get the information of nodes distance and the residual energy by originating a broadcasting message. For adaptive cooperation, the path selection depends on the residual energy of the node. For direct path

$$E_{R.E}(S) \geq E_{R.E}(Y) \qquad (24)$$

For relaying path

$$E_{R.E}(S) < E_{R.E}(Y) \qquad (25)$$

On the basis of residual energy, path selection is done. The packet transmission will be done after the SNR analysis. If the SNR of the link is more than the threshold or equal to it, then transmission occur.

Outage Probability

The outage probability is the non-availability of the signal at the destination node. It occurs when direct path failed to transmit data correctly. For sake of simplicity we consider retransmission till three nodes. Calculation of probability can be done as

$$P_{R_{out}} = P_R(\mu_{SY_3D} + \mu_{SY_2D} + \mu_{SY_1D} + \mu_{SD} \leq \mu_0) \qquad (26)$$

The SNR at the D node is the sum of all the SNR from S to D and S to Y to D so for calculation of link of indirect cascade [14].

$$\mu_{SY_jD} = \frac{\mu_{SY_j} * \mu_{Y_jD}}{\mu_{SY_j} + \mu_{Y_jD} + 1} \qquad (27)$$

A tight upper bound for μ_{SRjD} is given [15].

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$$\bar{\mu}_{Y_j} = \bar{\mu}_{SY_jD} = \min(\bar{\mu}_{SY_j} + \bar{\mu}_{Y_jD}) \qquad (28)$$

Where μ_{Y_j} represents the minimum value of the two SNR and by this P_{Rout} can be calculated

Relaying Strategy

Relaying strategy used is the Amplify and Forward AF. Amplification of received signal will be done by relaying node and transmit it to the destined node. β represents the amplification factor by which the received signal is amplified and it can be formulated as [16].

$$\beta = \sqrt{\frac{PW_Y}{PW_S|T_{d(SY)}|^2 + Z^2}} \qquad (29)$$

PW_Y and PW_S is the power of source and relaying nodes and Z is the noise. The power can be expressed as the energy per unit time so the β can be now represented as [14].

$$\beta = \sqrt{\frac{EN_Y}{EN_S|T_{d(SY)}|^2 + Z^2 . \, \Delta t}} \qquad (30)$$

Where ENS and ENY is the energy of source and relay nodes. The fading channel in general is independent of time so it can be assumed that $\mathbf{Z. \Delta t \cong Z}$ and β can be now represented as

$$\beta = \sqrt{\frac{EN_Y}{EN_S|T_{d(SY)}|^2 + Z^2}} \qquad (31)$$

So the equation of phase two of cooperative communication can be formulated as.

$$F_{YD} = \sqrt{P_{T2}} \, Q_{YD} \, T_{XS}` + N_{YD} \qquad \text{Where } T_{XS}` = \beta T_{XS} \qquad (32)$$

Combining Strategy

Maximal Ratio Combining MRC is the combining strategy used in the presented scheme. For SNR computation, MRC is considered to be the best. For single relay, the MRC output will be.

$$X_D = W_1 X_{SD} + W_2 X_{YD} \qquad (33)$$

X_D is the output and weight of the signal is denoted by W_1 and W_2. This equation can be used to calculate SNR to any number of relays. For general

$$X_D = A \sum_{i=1}^{N} W_n X_n + \sum_{i=1}^{N} W_n Z_n \qquad (34)$$

SNR output can be calculated and applying the Cauchy -Schwartz equality rule will simply the calculation for output SNR. The condition to maximize the output SNR is

$$W = \frac{X_n}{\sigma^2} \qquad (35)$$

The combiner will give the best result by following the condition in (33). The combiner output can be represented as.

$$\mu_{out} = \sum_n \mu_n \qquad (36)$$

Where the μ_n can be found from the equation.

$$\mu_n = \frac{A^2 |X_n|^2}{2\sigma^2} \qquad (37)$$

Where **A** is the amplitude of the signal and $\mathbf{X_n}$ is the channel gain.

Simulation and Results

Coop-WSN is simulated and result are discussed in this section also the comparison is done with the other schemes.

Stability period comparison is represented in Fig 2 for Coop-WSN with COPE and Space-Time WSN. The Coop-WSN shows the enhancement in stability period of the network. Till 1800 seconds the Coop-WSN have no dead nodes and this is because of the adaptive nature of the scheme which makes the nodes to select the path according to the residual energy of the nodes. COPE and

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Space-Time WSN have dead node at 200sec and 220 sec because of not taking the residual energy at priority. The proposed scheme outperform the COPE and Space-Time WSN.

Fig 3 shows the comparison on the basis of throughput. Coop-WSN have enhance the throughput of the network. The Space-Time WSN have less throughput due to excessive direct communication with the destination node which cause the packets to collide with each other the collusion of packets will reduce the bandwidth and bottelneck the receiver which will cause the receiver node to drop the packets.The COPE have better throughput but low than the proposed scheme because of the unnecessary retransmission of data over the fading channel. Analysis shows that presented scheme enhance the throuput by 47.5% than the COPE and 52.5 % than the Space-Time WSN.
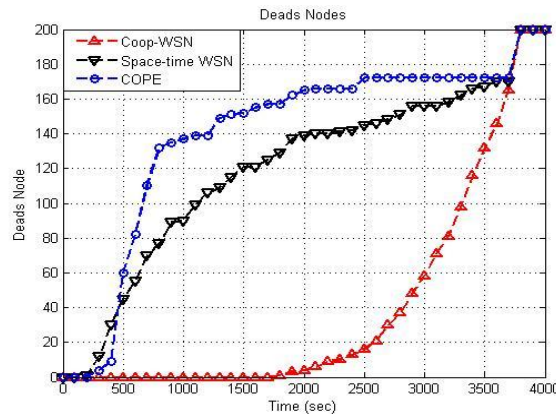
Fig 2. Dead nodes
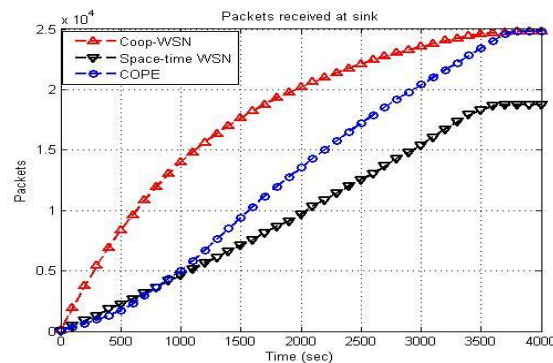
Fig 3. Packets received at destination

Fig 4 shows the comparison on the basis of End-to-End delay. The Coop-WSN also shows enhancement in the End-to-End delay due to the availability of reliable relaying path and less distance between the relaying nodes. Space-Time WSN faces delay due to the retransmission of the signal over the fading channel and this will reduce the bandwidth and increase the collusion of packets and hence increase the delay in the network. Analysis shows that presented scheme enhance the delay by14.9% than the COPE and 19% than the Space-Time WSN.

Fig 5 shows the comparison of the schemes on the basis of residual energy of the nodes. The Coop-WSN have shown the enhancement in the energy consumption. The COPE and Space-Time WSN have almost same result. It is because the COPE totally depend on the cooperative communication while the Space-Time WSN totally depend on the direct communication that is why the energy consumption of the nodes are higher during the constant data transmission. The Coop-WSN have adaptive communication so shows better. Analysis shows that presented scheme enhance the energy consumption by 31.6% than the COPE and 39.7% than the Space-Time WSN.

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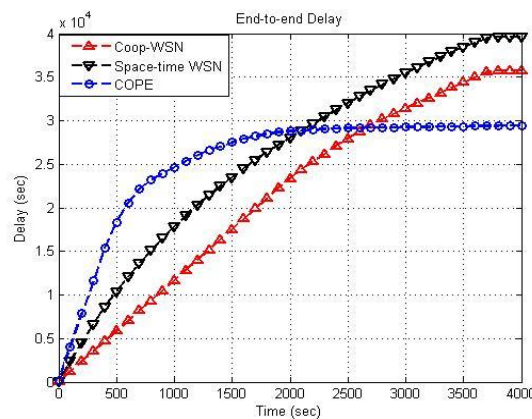
Fig 4. End-to-End Delay
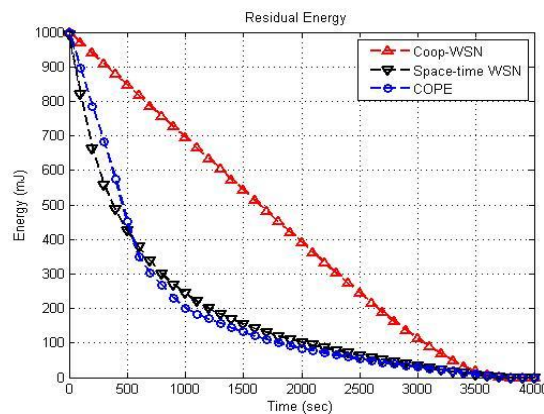
Fig 5. Residual Energy

Conclusion

In WSN, small sensor nodes are present with small battery backup so energy efficiency is of major concern. Cooperative communication in WSN made the nodes capable to communicate with each other and to share each other resources. Adaptive cooperation is another communication technique that allows the nodes to select the mode of communication either direct communication or through relaying path. The proposed scheme have the concept of adaptive cooperation. Coop-WSN is compared with COPE and Space-Time WSN and result shows that our proposed scheme outperform the COPE and Space-Time WSN with respect to stability period, throughput, energy consumption and end-to-end delay. It can be observe that the Coop-WSN have a tradeoff between the end-to-end delay and network lifetime.

In future work, removing tradeoff in between end-to-end delay and network lifetime.

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Towards an Energy-Efficient and Throughput aware scheme for BANs

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Abstract

Sensors within Wireless Body Area Networks (WBANs) are deployed in a dispersed manner and require a higher level of management for proper administration. For the network throughput to increase by a considerable margin, an energy efficient and path-loss aware routing scheme is required. This research is primarily concerned with the design of an Energy Efficient Network Model for BANs called EENMBAN to extend the network life-time through energy efficient routing. It is evident from simulation results that our proposed scheme EENMBAN increases the network lifetime, lowers path-loss and improves network throughput as compared to existing schemes. The scheme is giving better results in terms of throughput, in comparison to Link Aware and Energy Efficient routing protocol for BANs (LAEEBA) and Joint Power Control Scheme (PEH-QoS) by 70% and 90% respectively. Considering residual energy, our protocol outperformed its competitors by 33.3% and 49.5% respectively.

Introduction

Wireless Sensor Networks (WSNs) can be described as communication frameworks utilizing specialized sensor nodes that are spatially distributed [1]. The basic function of these sensor nodes is to analyze and record information regarding various physical or environmental factors (e.g. pressure,sound,humidity, noise, temperature etc.). The data so recorded is further transferred to the sink node. Further aggregation and filtration of data is done by the sink node which forwards that data to final destination by means of a central gateway typically termed as a Base Station (BS). The BS facilitates the WSNs connection to the world by employing numerous communication channels (the Internet, wired and wireless LANs, WiFietc.). The number of sensor nodes deployed in WSN is primarily dependent on the applications of the network. Number of nodes can range from a few nodes to hundreds. Each individual node may be annexed to several neighboring nodes. WBAN is a subset of WSNs; primarily developed for medical purposes.However with the passage of time, its applicability in other fields increased.During the initial stages of WBAN development, various sensor nodes were deployed to monitor a patient's body in order to provide the medical professionals with relevant and valuable information.WBANs are now used in numerous fields including athletics, military and intelligent biosensors etc. There are two main types of WBANs:

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➢ first one being in-vivo sensors implanted inside the body and

➢ second one are wearable sensors, i.e. attached to the body.

Both types of WBANs are designed to serve different purposes [1]. WBANfacilitates affordable and constant analysis by updating medical record in real-time via the internet. With the help of numerous highly sophisticated sensors, it is possible to diagnose different diseases at an early stage and with a high level of precision while also being used for computer-assisted rehabilitation [2]. It is imperativeto understand the characteristics of the bio-sensors and their impact on the human body prior to their placement inside the human body. Such an understanding is important in order to obtain an absolute degree of assurance that the normal bodily processes and functions are not interfered with in any manner.

In the field of sports, the performance of a player can be monitored through his/her fatigue or glucose levels which can be ascertained with the help of sensors placed on the players' bodies [3]. They can be of relevance in aerospace, where multiple sensors can be used to record information, equip the pilot with valuable information regarding perilous situations, and provide feedback during routine activities [4]. Significant enhancements have been observed in the medical profession with the advent of WBANs. In reference to monitoring patients, sensors can be administered on the patients' bodies while at home or in hospital, in order to monitor different body functions. A device, for example, Personal Digital Assistant (PDA) can be used to aggregate the signals received by the relay nodes from the sensors implanted in the patient's body. The sink node transmits the monitored data to the doctor with the help of a BS where the sink node serves to develop contact between the hospitals network and WBAN. WBAN serves as a source of reliable and continuous real time updates of data in relation to the patient's condition.These updates enable the doctor/physician to provide an accurate diagnosis. It also enables him/her to retain the acquired data for future use. In figure 1 the working of WBAN is shown. Irrespective of the numerous advantages, WBANs typically face certain inherent challenges during their deployment. One of them is the limited energy resources available to sensors. Communication typically utilizes more energy in relation to monitoring and aggregating processes. Different techniques have been proposed in order for sensors to improve energy consumption of nodes, enhancing their functional life. A leading technique employed for recharging the node batteries is induction in which the nodes are equipped with infrared light sensors (heat is generated for charging the batteries by exposing sensors to light which in turn excite the electrons).The electrons of infrared sensors can also be excited by heat produced due to exertion or movement of the patient body via mutual induction.
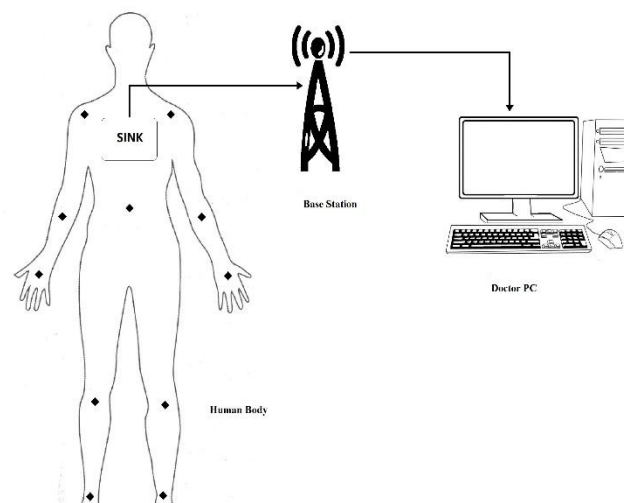
Figure 1: **A WBAN Environment**

Related Work

Applications of various routing protocols in WSNs have been suggested in literature. However, none of them are capable of achieving the preferred features of WBANs. Different aspects are considered while evaluating many of these protocols. Some of the WBAN protocols presented in recent years are discussed below.

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Authors in [5] introducedawearable motion node,capable of monitoring and recording various activities of the human body. A three-dimensionalaxes of accelerometer,gyro-meter and magneto-meter was employed in orderto obtain concrete and reliable information regarding inertia. One of the most significant limitations in delivering data routed through various paths in multi hop environment is communication delay. In [6],authors scrutinized the delay observed in transmission of packets channeled through multi paths heterogeneous wireless channels employing multi-hop communication. The main purpose of analyzing the delay is to assess the transfer of information from nodes to sink or to the hospital. In [7],incorporation of direct and multi-hop mechanisms is presented by the authors using the strengths of both variations. Furthermore, a new routing scheme is developed for heterogeneous WBANs. Typically multi-hop communication is used to dispatch the data from sensor to sink nodes. Single hop mechanism is utilized to deliver critical information directly to the sink.Authors in [8], sought to increase end to end network traffic by presenting an any-cast routing scheme.The proposed protocol employs a method in which the data is communicated to the closest reciever in order to reduce latency. This scheme can be employed to administerremote analysis and facilitate ECG realted services. If an accident is observed outside the hospital, by employing the suggested scheme, the precise location of the occurance can be ascertained.

In [9], an adaptive routing scheme for WBANs is presented, which ensures energy efficiency. Nodes utilize less amount of energy in forwarding crucial information in WBANs while, QoS is guaranted.In order to overcome the issues related to denser networks, authors in [10] introduced a protocol called "Any-Body". The sensors situated in close proximity with other are grouped together in clusters. Cluster Heads (CHs) are selected on the basis of their residual energy. The selected node remains the CH until its energy level decreases below that of any other node in the given cluster, after which new CH is selected based on defined criteria. As a result network stability period and throughput are improved.

In [11], a new routing technique termed as Enhanced Developed Distributed Energy-Efficient Clustering (EDDEEC)technique is proposed for WBANs. The primary principle of this routing technique is to dynamically alter the CH, based on certain pre-determined criteria.In [12], multi hop communication topology is employed by the researchers to get an energy efficient network with an enhanced functional life. Termed as the SIMPLE protocol, the suggested scheme functions on the principle ofcollecting data from each node and relaying it to the closest node, from where it is eventually delivered to the sink. Sink node calculates the Cost function (CF) for selection of relay node in the network.

In [13],Link Aware and Energy Efficient Scheme for Body Area Networks(LAEEBA) protocolis introduced which employs different attributes of both direct and multi-hop mechanisms to ensure the secure transfer of data to destination. Additionally, LAEEBA protocol is path-loss aware and offers superior reliability. Scrutiny of the simulation results reveals a better networkstability and enhanced functional duration of the nodes.

In [14], researchers proposed Co-LAEEBA which is a successor of LAEEBA. In similar fashion to LAEEBA it employs three different types of sensor nodes. The main aim of usingCost Function (CF) is to select relay node among intermediate nods. Sensed information by sensor node is sent to destination via the most efficient channel in Co-LAEEBA. Co-LAEEBA serves to enhance the routing and conserve energy by employing cooperation for forwarding information.

In [15],an adaptive power control (APC) algorithm is proposed by the authors, which proves to be more efficient in energy conservation. The transmission power level is continuously altered by the BS feedback, considering the requirement. The reliability of the link is affected by the energy saving level. A limitation of the suggested scheme is inferior path-loss ratio in comparison to the orthodox power control techniques.

In [16] a prototype is proposed for the purpose of monitoring and analyzing different parameters of patient's body. The patient's heart rate and numerous movement related functions are constantly analyzed by sensor nodes. The collected data is fed into the home health server from time to time. Integration and filtration of the data occurs at this stage. The data collected may be stored at a local

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data base for future scrutiny or shared with the medical server depending on the patient's condition.In [17], the researchers introduced PEH-QoSscheme, consisting of three modules that function to ensure the best QoS and to employ the energy resources in the most productive manner.

Motivation

For the purpose of achieving a higher quality of medical assistance, numerous WBAN protocols have been proposed. Sensor nodes in WBANs are used for analysis and recording of data relating to different morphological factors and functions. The collected information is then communicated with the medical server via a sink. The amount of energy consumed by the sensor nodes in sensing and transmission of data is of relevance, as the amount of energy available is limited. The speed at which data is transmitted is also an important factor. LAEEBA protocol [13], functions by either sending the collected information directly to the sink or through nearby nodes,based on the data criticalitysensed by node implanted in patient's body. Due to the incorporation of multi-hop communication each node processes the data before sending it to the node in succession. As a result, a significant amount of delay in the transmission of data occurs, which can be detrimental to the purpose of the protocol. The delay is further exacerbated by congestion. The LAEEBA protocol attempts to counter this issue by employing cost function in order to find the most viable route for datatransmission. However, one of the disadvantages in doing so is considerably higher energy consumption. It should also be noted that despite employing cost function and as a result exhibiting higher energy consumption, End-to-end delay is not addressed satisfactorily in LAEEBA protocol. Our proposed protocol is different from LAEEBA in terms of path-loss models used. Also as mentioned earlier LAEEBA used cost function for selection of forwarder nodes and route selection for data transmission but in EENMBAN no cost function is used for data transfer neither forwarder nodes are selected. Alternatively relay/advance nodes with higher initial energy are deployed to send data received from normal nodes to sink.

In PEH-QoS protocol[17], the authors have failed to address the path-loss during inter-nodes and node-sink data transmission.Other numerous short-comings attributable to these links include fading, noise effects and shadowing among others. We propose a new protocol referred to as EENMBAN to counter the disadvantages of LAEEBA and PEH-QoS.

The energy efficiency of the network is enhanced by addressing the issues related to energy consumption.

EENMBAN Proposed Protocol

In this section, we introduce our theorized energy efficient and path-loss aware protocol EENMBAN which ensures to improve the stability period, throughput of the network and reduce energy utilization by nodes.

A. Energy Consumption Model

In our presented protocol EENMBAN, LEACH system model is assumed as Energy consumption modelwhich is illustrated in figure 2 [1]
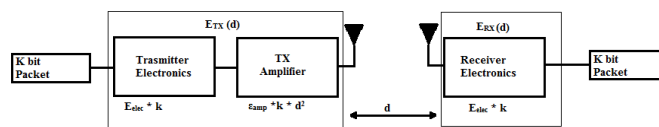
Figure 2: Energy Consumption Model

To achieve an acceptable $\frac{E_b}{N_0}$, in order to run the transmitter and receiver circuitry radio dissipates, $E_{elec} = 50 \, nJ/b$. Due to energy loss in channel transmission, r^2 is assumed. The transmission energy E_{trans} can be computed as [14]:

$$E_{trans} = b * (E_{elec} + E_{amp}) * d^2 \dots\dots\dots\dots (1)$$

where b denotes the packet size needed to transmit at distance d.Using multi-hop communication the energy consumption can be calculated as [14]:

$$E_{MH} = n * b * E_{trans} + (n-1) * b * (E_{rec} + E_{DA}) \quad (2)$$

where n represents the number of hops, E_{rec} is the required receiving energy and E_{DA} is the required energy for data aggregation.Also assume that $E_{rec} = E_{trans}$.

B. System Model

In our simulation scenario, sink node is deployed at the abdominal region of the human body as illustrated in figure 3. Eight nodes are placed for sensing, recording and forwarding of different parameters. Two varieties of nodes namely; advance and normal nodes are utilized. The formerhave higher initial energy as compared to normal nodes and act as relay nodes. Nodes represented by no.1, 4, 5 and 8 are normal nodes with initial energy equals to 0.1 J while nodes denoted by no.2, 3, 6 and 7 are advanced nodes with initial energy 0.3 J. Also the free space energy is taken to be 10 pJ, while the transmission and receiving energies are taken to be 50 nJ, with the data aggregation energy equal to 50 nJ and amplification energy is 0.0013 pJ.

C. Working Mode

Sensor nodes deployed in WBANs typically consist of three modes i.e. Active mode$(T.M_a)$, Sleep mode $(T.M_s)$ and Transient mode $(T.M_{s\to a})$ or $(T.M_{a\to s})$. The purpose served by the nodes in each of the mentioned modes is indicated by their names. The node is responsible for analyzing a particular parameter and obtaining relevant data in active mode, which is then dispatched to a specific location.The sensor switches to sleep mode in case of absence of any parameter to analyze. Transient mode is the state of the sensor while switching from active to sleep mode or the alternative.Transient duration (T_r) is the time consumed while performing the above mentioned transition and can be deduced using the following formula as:

$$T_r = T.M_{s\to a} + T.M_{a\to s}\dots\dots\dots\dots\dots\dots\dots\dots\ (3)$$

where$|T_r|$<active mode duration $(T.M_a)$.
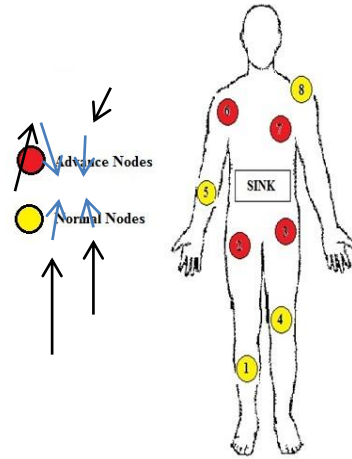
Figure 3: Schematic Diagram

D. Energy Computation Mode

The number of bits to be sent in the time allotted "T" are assumed as "N", so energy consumed by a single bit of data is deduced as under [18]:

$$E_b = \frac{P.M_aT.M_a+P.M_sT.M_s}{N}\dots\dots\dots\dots\dots\dots\ (4)$$

WhereE_b represents energy consumption per information bit, $P.M_a$= Power utilized during Active mode, $P.M_s$= Power utilized during Sleep Mode, $T.M_a$ = Time eclipsed during active mode, and $T.M_s$ = Time eclipsed during sleep mode. Hence the power utilized during active mode is peak toaverage ratio (Pa/r) times tansmission power (P_t) divided by PA drain efficiency (ζ).

$$P.M_a = P_t\gamma + P_c\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\ (5)$$

Considering the circuit required power, the power utilized by sensor during active mode is an amalgamation of transmission power multiplied by γ plus the circuit power (P_c).where $\gamma = \frac{Pa/r}{\zeta} - 1$.

E. Path-loss Computation Mode

Considering the fact that a human body is receptive to electrical signals and various materials are embodied on the body with differing dielectric constants and attributes of impedance, no

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communication system is completelyloss free. However systems with the lowest probability of losses are preferred. Path-loss is a term used to describe a decrease in the density of power of an electromagnetic wave. They are a common deterrent and degrade the performance of the system. In ON-Body WBAN, two factors determining the path-loss are frequency and distance. Two types of path-loss models are scrutinized below:

$$L_{path}[db] = a_{loss}lgd + b_{loss} + N_{loss} \ldots\ldots\ldots (6)$$

Provided a_{loss} and b_{loss} are linear fitting coefficients, N_{loss} is normally distributed variable having a standard deviation δ_N and d is distance between the transmitter and the receiver represented in mm.LMS algorithm is employed to determine the values of the above mentioned coefficients i.e. $a_{loss} = -27.6, b_{loss} = -46.5$ and $N_{loss} = 157$ [14].

The power received in relation to the Ground bidirectional reflectance model, which is a variety of RSSI path-loss models, is determined using the following formula[19]:

$$P_r = P_t G_t G_r \frac{h_t^2 h_r^2}{d^4} \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

The path-loss in relation to the above mentioned model can be determined by using the following equation:

$$L_{path} = 40logd - (10\log G_t + 10\log G_r + 20\log h_r)\ldots(8)$$

F. Bit Error rate Computation Mode

From [20], the probability of error is given by :

$$P_{error} = \frac{1}{c}e^{-\frac{2P_r}{N_{total}}\sin^2\frac{\pi}{2c}} \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

And

$$N_{total} = A_{bw}G_0 N_{Rf} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

where A_{bw} is the bandwidth, $\frac{G_0}{2}$is the power spectral density of noise.while $N_{Rf} = \frac{N_{total}}{A_{bw}G_0}$is receiver noise figure.

By putting values of N_{total} from (10) in (9) and taking log on both sides of that equation, we get:

$$P_r = -\frac{A_{bw}N_{Rf}\ln(c*P_{error})}{2\sin^2\frac{\pi}{2c}} \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Results and Discussions

The performance and effectiveness of our proposed energy efficient and path-loss aware protocol EENMBAN was evaluated by comparing it with LAEEBA and PEH-QoS protocols using MATLAB simulations. Network dimensions employed were 0.8m × 1.6m, with 8 nodes implanted on the body at fixed locations while coordinates of sink node are 0.4m × 0.9m. The total numbers of rounds taken are 500. The protocol was executed for a total of five times and the different calculations and average values along with the relevant conclusions are provided below.

Rounds instead of time are considered in order to analyze the performance of the protocol where the time taken by the proposed protocol performing its operation once was considered to be equivalent to one round. So from the establishment of the network till all the nodes die is the network lifetime.

A. Stability Period

The time calculated from the initiation of the process of the network to the time of failure of the first node to function is termed as stability period.

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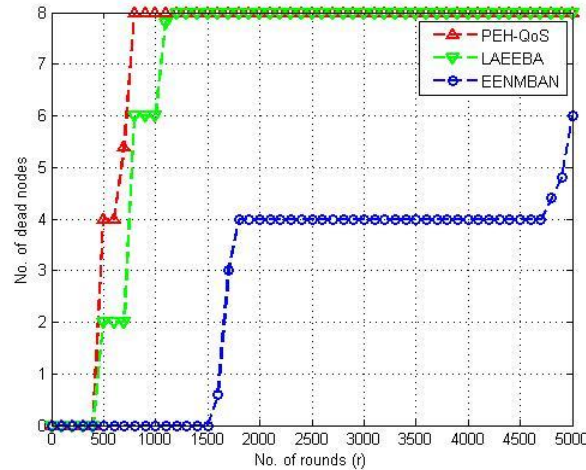
Figure 4: Dead nodes after specified intervals

Once the first node stops functioning the remaining period is referred as unstable period. From figure 4 it is evident that stability period offered by our proposed protocol EENMBAN is significantly superior to our benchmark protocols.EENMBAN and LAEEBA, both offer enhanced stability periods in comparison to PEH-QoS, primarily because they employ non-continuous data transmission. The only instance, in which data is dispatched to the sink node, is when there is a variation in the current value and previously recorded value. The reason why EENMBAN nodes 1, 2 and 3 perform in a superior manner to the other two protocols is that, it follows different path-loss models, after taking the signal quality into consideration.

As can be deduced from the figure produced above, node 1 of EENMBAN dies after completing 1500 rounds, in comparison toLAEEBA and PEH-QoS protocols in which node 1 dies after round 490 and 500 respectively, indicating significantly better performance.

B. Throughput

The number of packets received at BS after the completion of each round is known as throughput. Two types of links are used for communication in terms of bit rates. In EENMBAN, links with greater bit rates are preferred for deployment between relay nodes and sink. Links with low data rates are deployed between sensor nodes and relay nodes.

Figure 5 ascertainsthat EENMBAN outperformed LAEEBA as far as throughput is concerned. Despite considering cumulative noise effects of the links connecting the nodes with both being path-loss aware protocols, the performance ofLAEEBA is affected adversely by computation of Cost Function after regular intervals of time. In addition, data is processed by each node after it is received from neighboring nodes.PEH-QoS, on the other hand does not take the path-loss effects into account which greatly affects the net packet delivery ratio to the sink while improper load balancing is also observed. These limitations regarding the PEH-QoS result in its throughput value being lower than both LAEEBA and EENMBAN.

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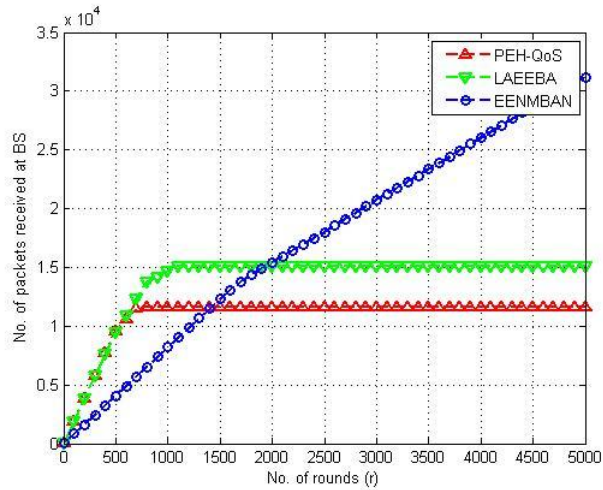
Figure 5: Number of Packets Received at BS

The total number of packets received at the base station observed in LAEEBA offered 20% more efficiency and reliability as compared to PEH-QoS whereas EENMBAN exhibited 70% superiority to LAEEBA and 90% superiority to PEH-QoS in the same respect.

C. Residual Energy

On the basis of initial energy, sensor nodes are classified into two groups.Normal nodes possessthe initial energy of 0.1j and advanced nodes having initial energy of 0.3j. Foran impartialcomparison of energy utilization of the discussed protocols, the starting energy level was set at 5.5j for each protocol. Review of the simulation resultindicates the superiority of our proposed EENMBAN protocol.It can be deduced from the figure given below that EENMBAN and LAEEBA display enhanced network lifetime in comparison to PEH-QoS protocol. The primary cause is the employment of non-continuous delivery of information by the better performing schemes.Among the three protocols EENMBAN displays a slower rateof decrease in the residual energy, resulting in maximized network lifetime.
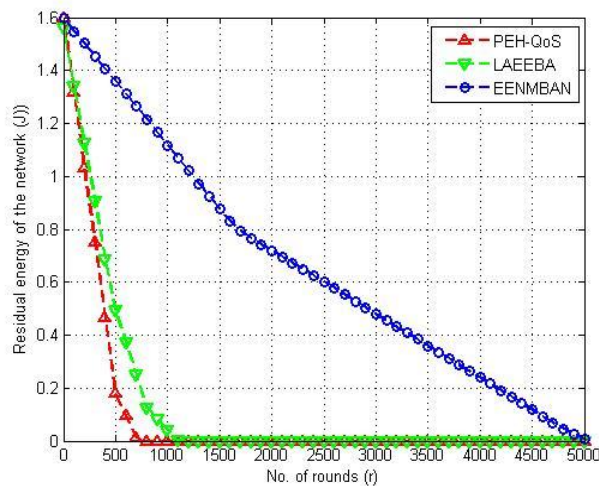
Figure 6: Residual Energy of the network

After the completion of 1500 rounds, EENMBAN displays a greater drop in residual energy.

The primary cause of this limitation is the employment of relay nodes. These relay nodes serve the dual purpose of data monitoring and relaying said data from sensors to sink. As a consequence of which a greater amount of energy is required by the relay nodes, causing a greater decrease in residual energy of EENMBAN,but still EENMBAN's performance is significantly superior to both LAEEBA and PEH-QoS while LAEEBA's performance is better than PEH-QoS.LAEEBA's

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performance is inferior to EENMBAN because of the employment ofimproper load balancing.Also normal nodes are used for data processing and relaying, resulting in greater energy utilization.As can be deduced from the illustration produced above, LAEEBA performed better than PEH-QoS regarding Residual Energy, surpassing the latter's performance by 16.2%. However, EENMBAN eclipsed the performance of both its competitors, proving more energy efficient than LAEEBA by 33.3% and PEH-QoS by 49.5%.

Conclusion & Future work

After the review of simulation results, it proves that EENMBAN exhibited markedly superior performance in relation to the two existing protocols i.e.LAEEBA and PEH-QoS in terms of network stability period, network lifetime and throughput.EENMBAN outperformed LAEEBA and PEH-QoS in successful packet delivery at 70% and 90% respectively. Additionally, EENMBAN enhanced the network lifetime at 33.3% and 49.5% larger margins than PEH-QoS and LAEEBA respectively.As the energy efficiency of a network depends on the above mentioned parameters so it's obvious that EENMBAN is more energy efficient. The most challenging task is to develop security measures, initially for ensuring the transfer of data within the sensors and to eventually implement the same measures throughout the entire network because in WBANs reliability of data is of primary importance. The different areas of the proposed protocol which possess room for further improvement include the energy harvesting capabilities of the sensors for the purpose of conserving a greater amount of energy and enhancing network lifetime to ensure positive progression towards the development of a more advanced protocol.Also the model used in the paper is static in terms of placement of sensors and the number of sensors deployed. In future dynamic scenarios will be considered.

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Smart Energy Meter

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Abstract

Electrical energy is one of the most important factors for the domestic, industrial and commercial development of any country. In transmitting electrical energy, conductors and transformers (rating) are selected on the basis of predicted Maximum Demand. Smart Energy Meter is an environmentally friendly energy meter that is used for measuring the electrical energy in terms of KWh .Many of the Electrical Power consumers uses the electrical power more than the Maximum Demand as per their desired, which is also the main reason of load shedding and also damaging of distribution transformers. The purpose of this paper is to monitor the Maximum Demand of the user and aware them, if it exceed the maximum limit. By using this energy meter we will monitor the power supply of every consumer. If the power consumption exceeds the Maximum Demand (as desired by the user) he/she will receive a messaged to lower the load otherwise the tariff will go high. User will able to receive a warning message by mobile phone to normalize the load, if the consumer does not respond then units will charged a faster rate than the normal, and if the respond is immediately then will receive another confirmation message of the normalized load.

Keywords: Transmitting Electrical Energy, Smart Energy Meter, Maximum Demand, Normalized Load

1. Introduction

Since 600 BC when electricity was just a concept mentioned by the Greek philosopher. Thales of Miletus, after performing some experiments with amber rods, this physical phenomenon has evolved in a huge way during thousands of years. The consequences of the great curiosity felt by many scientists around this field throughout history have meant in many inventions that have changed our lifestyles. No one can imagine a common day without access to basic resources like computers or Internet, elevators or mobiles phones; and all these services are now available thanks to the effort and research of many geniuses until our times.

When in 1752 Benjamin Franklin was taking his kite-flying experiments in Scotland, he accidentally discovered that lightning is electricity. It is supposed to be the first man that used the term electricity as something physically demonstrable and called the terms positive and negative charge. The Italian physicists Alessandro Volta also accidentally discovered an essential concept called voltage, and in his honor it is known the measure of battery power in volts. Thanks to his studies about contact potential he could build the first electric cell that produced a reliable, steady current of electricity. By connecting several of these cells together, a small battery was able to string a current. Due to this discover, the German high school teacher Georg Ohm started his

research in electrochemical cells and determined the direct proportionality between potential difference applied in a conductor and the electric current resultant, this relationship is called as Ohm's law and now it is the starting point for all students to introduce themselves in the basic circuits' area.

Some years later, one of the most relevant discoveries in the history of electricity was being developed by the Englishman Michael Faraday, the electromagnetic induction. He devised a mill in which a wire with current could turn around a magnet, so it was transforming electricity in movement, known as the first basic engine. Also a primary electrical device as the transformer was

managed by him by performing experiments on induction between coils of wire, creating the first toroidal closed-core transformer. Many of the questions of Faraday were solved hundreds of years later and because of him the dynamo was manufactured. In his honor the unit of capacitance is named the farad.

The Scottish mathematician James Maxwell is one of the most relevant investigators related with the electrical field. His systematic investigations about the relations founded by Faraday between light, magnetism and electricity took him to made four mathematical expressions describing all the behavior of electricity and magnetism. Many theoretical developments that we use at the current moment to try to explain and understand are solved thanks to these well-known equations. A max well is the electromagnetic unit of magnetic flux, named in his honor.

In this globalized world of continuous technology advances and unceasing communication, we think that something so rudimentary like lighting our houses   seems something from the middle ages, but what an irony, until 1879 when Thomas Edison built the first original carbon-filament bulb, this basic service was not as extended as we can imagine. The need of lighting dark places in an affordable way took the American inventor to try to find a way quitting off the burnt-fuel lamps for another based in electricity. A new era was coming; the industrialization was arriving to our lives. Many others remarkable scientists and researchers have been involved in this continuous evolution and development of this way of energy, achieving great benefits to the society and collaborating in the development of the industrialization. The next challenge was developing an electrical system that could provide electricity wherever they need it, and in the exact moment they demand it. It's no sense keeping investigating in how to create new and better electronic devices if they don't have access to power supply. The electricity system is in charge of this task, and it is currently based of five subsystems interconnected and coordinated in real time

In the early phase of household technology, delivery of electricity is completely depended on traditional energy meters. These meters play a key role in measuring the consumption of electrical energy in individual households. The usage of these meters has been slowly declining with the advancement in technology as rapid changes has been made to encounter the problems occurred by the traditional meters. The major problem arises when habitants are unaware of their daily behavior. Monthly feedback given to the consumers is not sufficient as the consumers will not have knowledge on how much energy does the individual appliances consume. To overcome the problems of traditional electricity meters, Smart Meters have been upgraded and developed. With the use of Smart Meter data, energy alerts will be provided to the consumers based on hourly utilization of energy. The primary objective of the Smart Meters is to reduce the energy consumption in the households. Our thesis utilizes real time Smart Meter data sets obtained from a Peshawar electric supply company. The energy consumption patterns can be facilitated in improving the behavior of users. The electricity market can be restructured with the installation of these meters, as it not only preserves the energy, but also eliminate the overloaded condition by informing the user. Trust and credibility of these meters is established only when the consumers have positive quality of experience. Timely consumption of consumers can be reduced as Smart Meters are connected to online billing.

Motivation Energy expenditures will be lowered by increasing the possibility of reduced consumption using analyzed Smart Meter data motivated to perform this research work. During the usage of traditional meters, there is involvement of wastage of much energy from users. As the electricity consumption of the household is known on monthly basis by conventional meters, there is an overall demand for the electricity utilities to explore a new development for benefit of the consumers as well as themselves. However, the study determines to make attempts to replace electric meter in respective households by minimizing the drawbacks occurred by consumer. The daily electrical usages change with respect to habits and it is mostly dependent on behavior of consumers. By using traditional meters, usages are not flattened as consumers are not aware of the knowledge about how much consumption has been made at any time or any particular interval of time in a day. The uncertain perception of the consumers can also be falsified as most of the consumers have very low knowledge regarding the Smart Meter and its installation. Lastly, to enable change and read concerns in the market also motivated to implement this project.

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Scope of the Thesis

This project deals with hourly energy consumption values and the manner how it is acquired from the energy provider. These standard values help energy utilities and consumers to know their energy consumption which is reported when they exceed their maximum demand. In fact, behavior of the consumers can be studied and results obtained can help the consumers in changing their behavior, in particular when correlated with a potentially varying price. This work explains a gap between the consumers and energy utilities so that they can communicate more efficiently through the two tariff implementation strategies of consumption. The consumers need to be educated with broader knowledge regarding the meter so that wrong perceptions can be altered. The variation in change of the usage has been well understood and determined. The research work can also help users to think intelligently when using their power. Moreover, consumption of energy at any time for the complete day is examined. Future savings which consists in determining when to use which appliance can be done by using prediction models and flattening techniques.

Study Prerequisites

The important prerequisites contributed in our research work are as follows: ● Analyze the maximum demand of the consumer ● comparison of maximum demand with the connected load of the user, ● Statistical modeling knowledge is essential to determine the relation between tariff, connected load maximum demand, ● The importance and evolution of Smart Meters has been studied in research papers and articles. This further contributed in improving the knowledge from traditional meters to advanced meters.

Structure of Thesis

The flow of the thesis is organized as follows. The first chapter includes a general description of introduction and its segments such as scope of the thesis, motivation and study prerequisites. The second chapter presents background work consisting of evolution of meters from past, traditional meters. It discusses the motions of Smart Grid, Smart Meter, power consumption, people's behavior, ARIMA models and ends with a literature survey. Chapter 3 explains aims and objectives, research questions and the methodology to find the answer to research questions. In chapter 4, a case study is performed on components used and this is followed with an explanation of results in chapter 5. Results are analyzed with a discussion provided to emphasize the consumption patterns. Finally, conclusions are drawn with explanation of future areas of research.

2. Literature review

Evolution of Electricity Meters from the Past In early years, electricity is available only to a specific section of affluent society. The advancement in technology over time encouraged meeting the demands of common people in all parts of the world. The history of electricity meter is well connected involving researchers from past. The general usage of electricity in the early 1870's is only confined to telegraphs and arc lamps. With the invention of the electric bulb by Thomas Elva Edison, the power energy market became widely opened to the public in the year 1879. Oliver B. Shallenberger introduced his AC ampere hour meter in the year 1888. Eventually, the progressive development in metering technology leads in enlightening the lives of many common people.

Traditional Electricity Meters and its types The electrical devices that can detect and display energy in the form of readings are termed as electricity meter. Traditional meters are used since the late 19th century. They exchange data between electronic devices in a computerized environment for both electricity production and distribution. In most of the traditional electricity meter aluminum discs are used to find the usage of power. Today's electricity meter is digitally operated but still has some limitations. A simple 1Phase 2 Wire electricity meter is shown in the below figure.

Some of the limitations faced by the traditional electricity meter are as follows:

➢ Meters are unreliable in nature as consumer has to anticipate for the monthly electricity bill.

➢ The process of measurement is supported by a specific mechanical structure and hence they are called as electromechanical meters.

➢ In order to perform meter readings, a great number of inspectors have to be employ-ed.
➢ Payment processing is expensive and time consuming.
➢ New type of tariffs on hourly basis cannot be introduced with the corresponding meters for encouraging the consumer.
➢ Development of meter software applications and supportive network infrastructure is complicated.

Besides the above mentioned limitations, there are also several other elements creating a huge gap between the consumer and distributor because of installation of traditional meters. Meters are of distinct types. Even though timely development of electricity meters helps the consumer to gain knowledge with respect to electricity consumption, statistics of the consumption couldn't be changed. Some of the basic types of electricity meters are explained as follows:

Table: Various electricity meters

Different Types	Outline
Electrolytic Meter	The whole current passes through the electrolyte. The major drawback is mechanical considerations and adoption by limited localities
Commutator Meter	Brush-shifting device is used to vary the current load and commutator's of small diameter facilitates in insulation attention. The major drawbacks are inadequate load characteristics, maintenance cost and lack of proper insulation.
Mercury Motor Meter	There is a satisfactory performance with the introduction of this meter. The adoption of rotor made a prominent role in supplying the calibration. The momentary short circuit is reduced or even prevented.
D.C Watt Hour Meter	This meter model is developed for heavy current circuits where the temperature coefficient is high. For indication of demand purposes a separate time switch is used. Also, it is a clock-type meter in which voltage variations is less with the reduced shunt loss.
Single Phase Induction Meter	Magnetic conditions are better improved to control the energy consumption and a considerable improvement in performance is also done. Meter inspection is easily assessed as the construction of this model has accessibility of simplifying assembly
Poly-Phase Watt Hour Meter	Lagging power factors in the meter reflects the characteristics of the current transformer. Attempts for improving high degree of accuracy have been built to avoid troublesome corrections. Interaction effects, calibration and increase in the effects of shunt loss are the greatest drawback of this model.

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Smart Grid Smart Grid is the modern development in electricity grid. Recent electrical grids are becoming weak with respect to the electrical load variation of appliances inside the home. The increase in population is also the indication of electrical grids becoming more fragile. The higher the population, the more load on the grid. Improving the efficiency of grid by remotely controlling and increasing reliability, measuring the consumptions in a communication that is supported by delivering data (real-time) to consumers, supplier and vice versa is termed as Smart Grid. Automated sensors are used in Smart Grids. These sensors are responsible in sending back the measured data to utilities and have the capability to relocate power failures and avoid heating of power lines. It employs the feature of self-healing operation. Literally, the concept of Smart Meter is commenced from the idea of Smart Grid. A carbon emission reduction of 5% is expected by 2030, annually by its installations and it can show a greater impact on environmental changes. For a sustainable development and establishment of new grid infrastructure, Smart Grids are recommended for many countries.

Smart Meter Smart Meter is an environmentally friendly energy meter that is used for measuring the electrical energy in terms of KWh (Kilowatt - hours). It is simply a device that affords a direct benefit to the consumers who want to save money on their electricity bill. They belong to a division of Advanced Meter Infrastructure and are responsible for sending meter readings automatically to the energy supplier.

Accurate meter reading will be provided with the inclusion of firm benefits from the Smart Meter. They record the consumption on the basis of hourly or less than hourly intervals. A Smart Meter has non-volatile data storage, remote connects or disconnects capability, tamper detection and two-way communication facilities. They perform remote reporting of the collected data to the central meter. This central meter monitors the functionality of the Smart Meter. From an operational perspective, use of Smart Metering allows an improved management and control over the electricity grid. Some of the benefits of Smart Meters are as follows:

o Low operational cost.
o Time saving to the consumers and utility companies for reporting the meter reading back to the energy providers.
o Online electricity bill payment is allowed.
o Power consumption can be greatly reduced during the high peaks with an intimation policy.
o Has a feature of automatically terminating the appliances off when they are not in use.

Smart Meter senses all the consumption generated inside the residents. Meter readings give a broader understanding to the energy utilities so that overall energy usage customs of the habitants can be altered. Finally, all the information that is generated by Smart Meter will increase help in noble generation.

Power Consumption The total amount of power consumed in an individual household is referred as power consumption. The consumption of power is an important aspect of electricity supply. People should be aware of preserving energy for future use. With daily usage of electricity, the energy patterns have been slowly varying. This variation of consumption patterns can be caused by weather conditions or unnecessary utilization of power by inhabitants such as increase of appliances in respective households and careless attitude in utilization for example not switching OFF the lights or television when not watching it. These factors may show greater impacts on end user. As the power supplied by energy companies is vast, most of the people are neglecting energy and its savings. The importance of consumption is declining in the mindset of utilities. The energy utilities should play a major role in advancing the Smart Meter technology and should make people participate in reducing energy consequences by creating awareness about the impact of their current level of consumption.

Study of People's Behavior People's behaviour is termed as behaviour of consumer on appliance consumption in a household. If the consumption of the customer is high then we can empathize that their usage of devices is also high, which means cost is directly proportional to the product of

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number of uses and the corresponding durations. It is important for energy companies in reaching the anticipation of the customer. In-fact most of the consumers rely on monthly bill they expect for. They usually do not know which appliances are consuming more energy and how they can

The above figure expresses the daily activities of household appliances measured by a Smart Meter in a home. Smart Meter is installed outside the house and its hourly consumption data is measured for lowering consumer electricity bills. This measurement facility converts simple home to a smart home.

Survey of Related Work The survey is split into four parts, namely socio-economical issues, technological issues, cases and prediction. As we started with literature survey in the initial stage of research, the division of cases is chosen to answer research questions in an organized manner.

Socio-economical issues The value of customer satisfaction in communication market is trusted with the services provided by service provider. In, the author explains people's behavior towards the Smart Metering system and states the services such as viewing electric consumption in real time, viewing the effect of turning electrical appliances on and off, making estimation of the next bill, or receiving messages directly from the grid operator. The consumption patterns during night and weekends are projected in the paper. A survey is conducted in different countries over different households and user's feedback is obtained so that people become motivated to be energy-conscious. A socio-technical review to promote sustainable energy consumption using Smart Meters is done. Answers are proposed for a set of research questions such as 1) is feedback useful for energy saving and behavioral change? 2) What presentation of feedback is good and effective? Scientific advice on energy saving instruments for household energy consumption is provided. A Smart Metering privacy model is implemented to measure the privacy that a Smart Meter will provide with and without involvement of third parties. The advantages of Smart Metering concept are low metering costs, energy efficiency and easier detection of fraud

A quantitative survey was conducted among various households and results of this survey were presented in paper . The mapping of consumer's perception with household appliances is done. A theoretical framework named TAM is proposed for household perception of Smart Appliances. Mean scores and standard deviations for perceived usefulness, perceived ease of use, attitude and intention to use, safety, control and comfort are tabulated.

Technological Issue The connection between meter and the household appliances is carried out in different ways. The connection can be dedicated line, wireless connection, web-based communication and power-line communication between the appliances in home and the meter . The secured scenario can be maintained by connecting the meter to the data centre. When Smart Meters are connected with mobile phones, the actual power consumption of a device when it is switched ON/OFF or plugged in/out is observed. An overview of Smart Metering installations, implementations, and functionality which is installed in the Netherlands is given in. In, Smart Metering involves installation of one or several Smart Meters by continuously monitoring and sending feedback of data to the customer. Consumers, by making use of Smart Meters, will get safe, secure and affordable energy, and a reduction of carbon emissions is possible. In, the architecture of Smart Energy Management System was developed to control the transmission capacity and rate generation for the aggregated load conditions of the Smart Appliances. Energy prices, consumption and cost of consumption under different demand conditions i.e. on-peak, mid-peak and off-peak values are tabulated. The energy cost of each appliance is shown in pictorial form. In, the importance of Smart Meter in the market with respect to the customer and business organization has been reviewed. Functionalities and benefits of Smart Meters compared to mechanical meters are explained. The authors are curious to find out the hypothesis to the proposed questions in this particular research paper. To make energy efficient society, the customer must be aware of the energy consumed. So, different feedbacks are proposed in this paper to save energy and improve energy efficiency. In the monitoring of Smart Meters in Hungary is discussed. The meter has two-way communication capability for tariff based operation and remote control. The communication tools of the meter such as Zigbee, WIMAX and Home Area Network supporting the energy meter is addressed. Energy Management System with high level application possibility has been proposed

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Cases In consumption patterns are analyzed in two households and an office in the UK, where real time reporting is done using web. The need for Smart Meters, benefits and how to monitor the power is detailed. Experimental setup is designed in three household premises. The experiment setup contains a section of equipment and software. Graphs are observed on a 24 hour cycle online for weekday, Sunday, before and after the change of appliance. The analysis is also done for heating water, turning on central heating and printing from a laser printer. Direct feedback is suggested to identify the appliances of high burn. The aim of influencing consumer habits has been achieved by indicating where the savings are possible. A thorough analysis of 15 minute residential meter data of 50 houses were used to derive several target applications such as identifying demand response potentials, abnormal load behaviors and fault diagnosis. In the processing of Smart Meter data with the aid of Supervisory Control and Data Acquisition System, billing and weather data is focused. The data collected by the researchers at Pacific Northwest National Laboratory was used. The load profile of two households with highest and lowest energy consumption over 15 minutes during the month of April is plotted. The impact of temperature on the power consumption of a household is demonstrated. A Smart Metering development system for a Korean residential environment is explained and system monitoring of other countries is reviewed in. A pilot demonstration with the developed system is conducted in 77 different sized households located in two different cities. The study is focused on verifying the effectiveness of In-Home Display which is an essential component of Korean Smart Metering system. Many ideas such as Advanced Meter Infrastructure, Smart Grid and Smart Metering system have been proposed. The results interpreted convey that people living in small houses are more sensitive to price-related information. The daily power consumption comparison graphs of two cities before and after using In-Home Display are demonstrated. The impact of temperature on daily power consumption is observed.

Prediction In price prediction is done on the basis of Home Energy Management System. The experiment evaluated results in saving 22.2% of electricity expenditure daily. Types of pricing models such as Real Time Pricing, Day Ahead Pricing, Time of Use Pricing and Critical Peak Pricing are specified. Client interface data model for the energy consumption is constructed using XML. The graph for actual price and predicted price, maximum power utilization i.e. peak hours are also compared and observed. Test bed is designed to evaluate the Home Energy Management System. In simulation model presents a generated load profiles for household to construct flat tariffs. The impact of Smart appliances and variable prices on electricity bills of a household is investigated. Field tests are carried out to estimate the bill saving and other cost estimations. The operations of household appliances are shifted so that users can reduce their cost. The load curves for working days, Saturday and Sunday are demonstrated. Comparison of load curves for flat tariff and time based tariff is shown. The results of the paper show how variable pricing will affect consumer behavior under realistic environment conditions.

In an ARIMA approach to forecast short term electricity prices to improve accuracy by forecasting errors is proposed in the paper. Based on the historical data obtained from California power market, ARIMA model is implemented on daily average prices. Forecasting curves after single and double error adjustments are shown in graphical form. Statistical results such as mean, variance, Mean Square Error, Maximum Absolute Error for forecasting price of California and after twice error adjustments are tabulated. In, spot electricity price forecasting has been done using European Energy Exchange data. ARIMA (3, 0, 3) (1, 1, 1) is founded to be the best fitting model for the experiment. From the results, Maximum Absolute Percentage Error and Mean Absolute Percentage Error of the model are rounded. In, results from Spain and California markets are presented in this paper. The differences of both the market has been observed by applying ARIMA model. Time series analysis is explained with steps from identification to forecasting of the model. The outcome of the Spanish market is 5 hours to predict future prices and 2 hours is needed for California market predictions.

Monthly energy data forecasting approach of Provincial Electricity Authority of Thailand is provided to decompose trend cycles and seasonal patterns. Decomposition technique is used for time series forecasting, while correlation coefficients and mean absolute percentage errors are computed to measure fitting accuracy. In, seasonal ARIMA model (2, 0, 1) (2, 1, 0) is used for

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forecasting the mobile traffic. Analysis is performed based on the real time data obtained from CMCC. NRMSE is calculated for determining and acceptance of forecast errors. The papers which impacted our research addressed people's behavior towards Smart Metering system ; benefits of Smart Meter compared to mechanical meters and feedback to save energy on improving energy efficiency consumption patterns on a 24 hour cycle are analyzed in two households in the U.K a Korean residential environment of a Smart Metering system , implementation of ARIMA model on time series analysis and the use of seasonal ARIMA (2, 0, 1) (2, 1, 0) model which is analyzed with real time data

3. Design and implementation

Aim and Objectives The important prerequisites contributed in our research work are as follows:

➢ Analyze the maximum demand of the consumer
➢ comparison of maximum demand with the connected load of the user
➢ Statistical modeling knowledge is essential to determine the relation between tariff, connected load maximum demand
➢ The importance and evolution of Smart Meters has been studied in research papers and articles. This further contributed in improving the knowledge from traditional meters to advanced meters.

Research Questions

RQ.1) What are the methods to measure and analyze the power consumption of household applications in a real-time environment?
RQ.2) How can we model the energy consumption of single household and their superposition?
RQ.3) How should power consumption be reduced in household appliances to flatten daily consumption patterns?
RQ.4) How should we save distributing transformer?

The first research question is formulated to retrieve information about methods to measure electricity. More importantly, assumptions and variations with real-time data are accounted and analyzed. The second research question is framed to filter different types of models and select a suitable model for fitting the data. In addition, smart way of superposition of the data is essential to observe behavior of households. The third research question is acquired to find the optimal way to flatten daily consumption patterns.

Research Methodology The research methodology involved in our research using case study and stages that are followed for answering the research questions are as below:

1. In the first stage of the research we have to perform a literature review related to Smart Meters. The data which is measured using Smart Meters is obtained from an energy provider. The results which are obtained from data are plotted in the form of graphs and observations are done regarding the consumption, price-cost, cumulative cost of the household and further statistical analysis. Particularly, in this stage the results are statistically summarized from the arrived data. The flow of research methodology is shown in below figure.
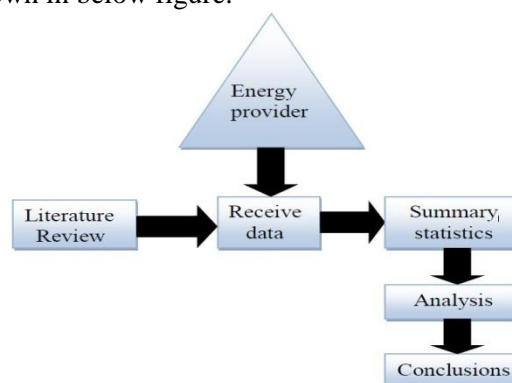
Figure: Flow of Research Methodology

2. In the second stage of the research, a prediction model is selected. Model matching should be done after model selection, which is followed by validation. Different household energy consumption and cost patterns can be modeled using ARIMA. Various data sets are processed to obtain price-consumption correlations for observing behavior of households using superposition.

3. In the third stage of research, a method of flattening consumption patterns is identified and developed, aiming at flattening daily patterns and attempting to change the attitude of consumers. Finally, conclusions are drawn from the analysis.

Theory Electrical energy is one of the most important factor for the domestic, industrial and commercial development of any country. It is generated centrally in bulk and transmitted economically over long distances.

During the process of Generation, Transmission, Distribution and utilization of electrical energy the total electrical energy is preserved at every stage. The industry of electrical utility is probably one of the largest and most complex industry in the world and the challenging problems is to be tackle by power engineering. The operation and control of power system play a very vital role in the field of Electrical Power Engineering. Electrical conductors and Transformers (Rating) are selected on the basis of predicted Maximum Demand (Connected Load) from the users. Greater the maximum demand greater will be the cost on the equipments and if the connected load exceeds the rating of transformer it may damage it.

Meter is a device used to measure the units consumed by users. The main component of distribution system are transformer, conductors. By using this energy meter we will monitor the power supply of every consumer. If the power consumption exceed the Maximum Demand (as desired by the user) he/she will receive a message to lower the load or the tariff will go high.

Following are the components of smart energy meter

o   Transformers (Current transformer, Potential transformer)
o   Rectifier
o   7805 IC
o   ATMEGA328
o   SIM 900D
o   LCD
o   LOAD

Working A 12 AC transformer is connected to the power supply which converts 220 to 12 V. Then with the help of rectifier AC is converted to DC ,and the ripples are minimized through filters Now this 12 V DC is 5V DC using 7805 IC because the micro processor ATMEGA328 , LCD and GSM SIM 900D works on 5V DC

C.T is used to count the units and also for current ratting. A crystal 16 MHz is used to generate frequency, thus this frequency is feed into the controller.LCD display will show units consumed, total voltage applied, current and connected load.GSM is connected with a network by using a SIM900D and programmed to sent message to user if he exceed his maximum demand. User will receive a warning message to normalize his load if he does not respond then units will charged a faster rate than the normal, and if he responds immediately then he will receive another confirmation message of normalized load.

The overall mechanism is shown in the block diagram

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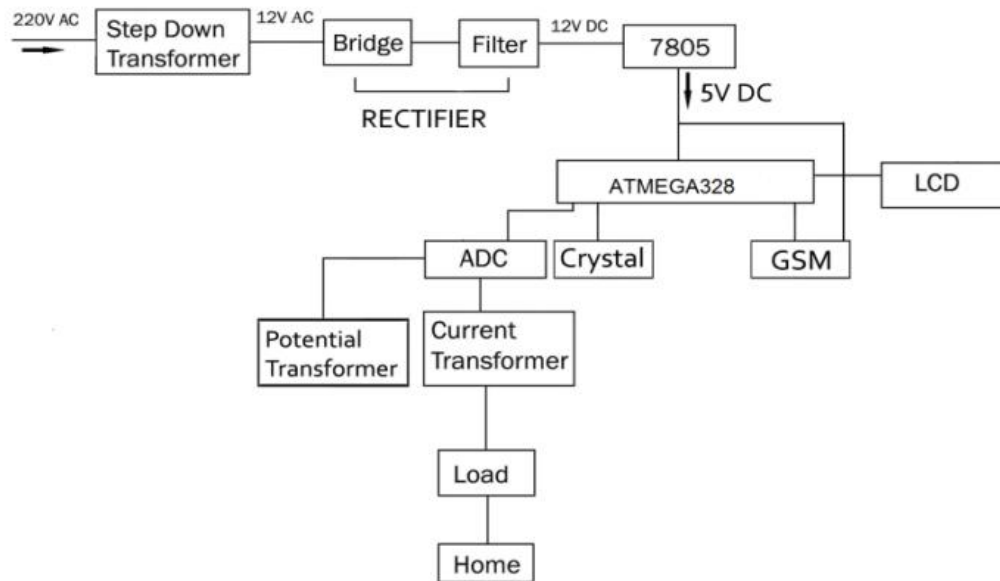
Block Diagram

4. Conclusion

By using this energy meter we will monitor the power supply of every consumer. If the power consumption exceed the Maximum Demand (as desired by the user) he/she will receive a message to lower the load otherwise the tariff will go high.

Greater the maximum demand greater will be the cost on the equipments and if the connected load exceeds the rating of transformer then it may damage it.

5. Future work recommendation

➢ In future RF module with alarm may be used instead of /or along GSM incase of no network availability.
➢ Multiple mobile numbers of users can be used in future.
➢ Dual sim technology can also be used in future, if one network is not available the other will operate
➢ It can also be used in three phase.

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A Supply Chain Network Design and Decision Approach to Product Distribution

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Abstract

Network design and optimization problems for product distribution appear widely in shipping applications with the main objective to minimize the shipping cost as the product distribution accounts for a significant portion of the logistical cost. The lead time from the first step to the last is long and it comprises of many levels. Product distribution accounts for a significant portion of the logistical costs of a product. Distribution activities are repetitive in nature and they influence the delivery lead time to consumers. A well designedsupply chain network can significantly minimize these costs and lead time. The current study presents a supply chain network design and decision approach for the distribution of products by identifying the supplier, plant and warehouse location and customer allocation. Grade of the product and capacity of the warehouse to satisfy the required customer demand, are solved for optimum solution. The selection of shortest route with minimum hurdles increases the responsiveness and minimizes the transportation cost. An example is solved to clarify the proposed heuristic.At the end, concluding remarks and recommendations for further research are presented.

Keywords: Network design, Traffic factor, Supply chain

1. Introduction

Supply chain managers frequently come across location and allocation problems at the design phase of a supply chain that involves determining the number of suppliers, plants, warehouses and assiging of customers. It appears imperative to treat the location and allocation decisions simultaneously. But due to the complexity of the problem, a breakdown into levels (level-1, level-2 and level-3) helps to manage the complexity of large sized problems. The location decision involves substantial investment. Since it can't be changed frequently, therefore, it has long term implications. The suppliers, plants and warehouses' locations acts as prelude to the overall process of supply chain network design with far reaching effects on the performance of the logistics and distribution system. On the other hand, the allocation decision is more dynamic in nature as these assignments need to be reviewed and changed from time to time as the supply chain grows. This is especially true for the steel, petroleum, cement, etc. products' distribution in Pakistan and other developing countries as well, where the retail outlets and customer buying stations for such productsare expanding at an increasing rate.

The work presented is mainly concerned with location of warehouses covering all customers and allocation of customers to the warehouses and minimizing the number of warehouses while satisfying customer demand. We have also incorporated the inter-warehouse distances, thereby further improving the product distribution. Another feature of our approach is to incorporate the traffic factor based on which the route for product delivery to the customers is decided. Some constraints must be imposed during the customer demand delivery associated to a warehouse. Minimizing the number of warehouses increases the load per unit warehouse and thus warehouses

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must be built with sufficient capacities. Customers are assigned to a warehouse based on the capacity of the warehouse. The procedure developed determines all the feasible routes for the delivery of products to customers from a warehousethrough a shortest feasible route. The required grade of the product is also incorporated in this study which further improves the solution.

A supply chain comprises of suppliers, manufacturers, distributors, traders and consumers. A supply chain delivers products with quickest distribution to the customers and at most reasonable price. A supply chain is no longer a single chain but a network tied with many chains, called supply chain network. It is realistically believed that the study of supply chain network has more real-world significance than the study of traditional supply chain [1]. Supply chain networks are worldwide networks with suppliers, manufacturers, distribution centers, traders and customers. The supply chain networks perform the functions of location of raw materials, conversion of those into intermediate and completed products, the distribution of completed products to consumers and its key objective is to fulfill the consumer requirements. In old-style supply chain networks, the objective is to balance the benefits among the firms involved, to enhance the operating efficiency throughout the services, to maximize the profitability of the procedures and to generate value for the consumers [2]. Supply chain network management is a progressively applied policy for companies. Supply chain network management is an integration of main business procedures from suppliers to end customers. Hence, a supply chain network management system can only be effective if it supports all the main business procedures [3]. Having an effective and efficient supply chain network offers a marketing zone for enterprises in the worldwide business atmosphere. Determining locations, quantity of product flow and reducing transportation costs are handled as a network design problem in supply chain management. Items that include the supply chain are highlighted to provide customer satisfaction and to get competitive advantage in process between raw material suppliers and end customers [4]. A global economy and a growth in consumer expectations concerning costs and services have forced manufacturers to increase their business practices particularly within their supply chains. A supply chain is a network of business entities mutually responsible for moving a product from supplier to consumer. It contains such interconnected activities as the supply of raw materials for manufacturing, customer order, management of inventory, production scheduling and transporting goods to consumers. Supply chain management covers the management of these activities in a smooth way [5]. The processes in product supply chain and logistics are part of today's greatest important economic activities. The ever growing size of transportation of products has its own concerns, particularly those relating to the environment. Transportation activities are significant causes of air pollution having harmful effects on human health and also responsible for global warming. These matters have raised concerns on reducing the volume of emissions worldwide. In this respect, many countries have set strict targets on minimizing their carbon emissions in the near future [6].

The problem studied in this paper is related to the determination of all the required warehouses in order to satisfy a set of customers demand. Various industrial constraints are involved and studied in the planning and operating processes. The procedure developed leads to considerable improvement in terms of minimizing the number of warehouses and selecting the feasible routes. The solution procedure is based on linear programming model which is solved by the Network Simplex algorithm. LP_Solve_5.5.2.0_IDE and MATLAB R2015a predefined functions and formulae are used to achieve the required final integer optimal solution.

2. Literature Review

A. Gill presented a supply chain network design method for the delivery of petroleum products by recognizing the locations of warehouses and allocations of gas stations. Supply chain supervisors often come across location of warehouse and allocation of gas station problems at the design stage of a supply chain that includes determining the number of warehouses and assigning of consumers to warehouses[7]. Supply chain networks offer the structure for the manufacturing, storage, and delivery of products like pharmaceuticals, steel, vehicles, cements, computers, furniture, and clothing, throughout the world. A. Nagurney developed a modeling and analytical framework for the design of sustainable supply chain networks. A network optimization modeling framework and a procedure are presented, which is then applied to calculate results of a variety of numerical

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sustainable supply chain design cases in order to exemplify the method [8]. In the competitive trade world today, industrialists face the continuing task to frequently calculate and design their production and delivery systems and policies to offer the desired consumer service at the lowest possible cost. Long-range existence for manufacturing companies will be very tough without highly optimized strategic systems. Savings in the range of 5–10% can be attained by using strategic and calculated logistics models and it can significantly affect the profitability of the firm [9].

J.F. Campbell presented the problems of location of discrete hubs. Hubs serve as transshipment and switching points for traffic between identified origins and destinations. A non-negative flow is linked with every origin-destination pair and an attribute such as distance or cost is associated with each movement. The word cost is used throughout the study which represents the element of interest [10]. Supply chain network design deals with a variety of decisions i.e. determining number of products, capacity and location of facilities and may include decisions such as product distribution and transportation to customers. It may also include operational decisions e.g. satisfying customers demand [11]. The management of supply chain has been considered as the most significant activity in several organizations. In supply chain management, the goal has been to send required products from one level to another, in order to fulfill customer demands such that sum of the costs is minimized [12]. In integrated supply chain design, the decision makers need to consider inventory and distribution costs when the number and localities of the facilities (warehouses) are determined. The goal is to minimize the overall cost that comprises location and inventory costs at the distribution centers, and supply costs in the supply chain [13].

Ting and Kaike presented a computational study for common network design in multi-commodity supply chains. Their aim was to minimize the cost including location, transportation, and inventory costs[14]. Seval E and Nursel O presented a mathematical model for multi stage and multi period reverse supply chain network, which maximized overall revenue of the network. The suggested model defines warehouse locations and material movements between phases in each period [15]. Tsao YC and Jye-Chye presented a supply chain network design considering transportation cost discounts and developed an algorithm to solve SCM problems using nonlinear optimization techniques [16]. In recent years, the study on supply chain networks has become a main focus. Components and product movement through suppliers, product manufacturers, product distributors, and consumers, is termed as supply chain network. These networks have many applications in manufacturing and distribution, e.g., automobile and electronic industries [17]. Striving for optimal conditions is essential because the current competitive conditions motivate manufacturers to produce faster and inexpensive products with a better quality. Unsuitable process parameter settings may result several manufacturing problems as product defects, longer lead times and higher prices [18]. In the periodic event scheduling problem (PESP), events have to be arranged repetitively over a certain period. It is a complex and well-known problem with many real-world applications [19]. Various methods have been applied for solving linear and nonlinear network flow problems with the aim of examining, improving and understanding the computational efficiency of suggested solutions for lowest cost problems. C.M.S. Machado et al. suggested a network flow linear program model to explain the problem of reducing costs of production and delivering of products to customers [20].C. A. Colberg *et al.* [21] presented that the emissions of single road vehicles depend on many factors such as type of engine (two- or four-stroke, gasoline or diesel) and its size, driving conditions (acceleration and speed), road gradient, type of exhaust technology, type of fuel and maintenance.Emission Factors of single vehicles can be measured by dynamometer tests.Imenez-Palacios *et al.*[22] presented thatVehicle emissions can of course vary with the engine load and with vehicle characteristics. The vehicle specific power (VSP) is a measure for engine load and useful for comparison between different measurement conditions.

3. The Inter-Warehouse Distances

The inter-warehouse distances are incorporated in this study. Table 1 shows the inter-warehouse distances. If warehouse $W_l$has sufficient capacity to fulfill the customer demand then there is no need of installing any other warehouse. If a single warehouse does not have sufficient capacity, then the customer will load some of the required demand from one warehouse and will then go to another nearest warehouse to complete the demand on a shortest possible route. While going to the

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nearest warehouse, the route will be decided based on the shortest distance, maximum traffic factor value, capacity of warehouse and availability of grade of the required product. Figure 1 shows a general fully flexible supply chain network.

Table 1. Inter-warehouse distances

	W_1					
W_1	0	W_2				
W_2	$D_{2,1}$	0	W_3			
W_3	$D_{3,1}$	$D_{3,2}$	0	W_4		
W_4	$D_{4,1}$	$D_{4,2}$	$D_{4,3}$	0	W_5	
W_5	$D_{5,1}$	$D_{5,2}$	$D_{5,3}$	$D_{5,4}$	0	W_6
W_6	$D_{6,1}$	$D_{6,2}$	$D_{6,3}$	$D_{6,4}$	$D_{6,5}$	0

Here,$D_{i,j}$is the distance betweeni^{th}andj^{th}warehouses for $i \neq j$.
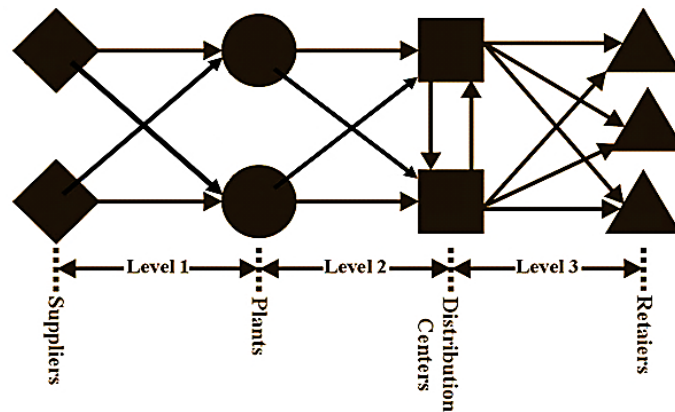
Figure 1:A fully flexible supply chain network

4. Heuristic Solution Approach
The approach is two folds. First, the warehouse locations are chosen from the available sets of warehouses which can cover the customers based on a pre-assigned maximum threshold distance. Then, the customers are allocated to the selected warehouses. The steps of the procedure are as follows:

4.1 Location of warehouses
The location of warehouses involves two steps. First, to construct a binary coefficient matrix so as to identify the potential locations, then selecting the actual locations using a mathematical programming model.

4.1.1 Construction of the binary coefficient matrix for maximum threshold distance
Based on the maximum permissible distance, d_{max}, a binary coefficient matrix $[\alpha_{ij}]$ is prepared, which is to be used as an input to the mathematical model. The relation used to construct the binary matrix is:

$$\alpha_{ij}= 1, \text{ if } d_{ij} \leq d_{max}, \text{otherwise 0.}$$

Note that:
$$d_{ij} = \frac{D_{ij}}{T_{ij}} \quad (1)$$

Whereas, d_{ij} is the revised distance, D_{ij} is the actual distance and T_{ij} is the traffic factor value.

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4.1.2 Construction of the binary coefficient matrix for the capacity of warehouses

Based on the capacity C_j of the set of warehouses X_j, a binary coefficient matrix $[\beta_{ij}]$ is prepared, which is to be used as an input to the mathematical model. The relation used to construct the binary matrix is:

$\beta_{ij}= 1$, if sum of capacities of all the warehouses is greater or equal to the sum of total customer demand, otherwise 0.

4.1.3 Construction of the binary coefficient matrix for grade of the required product

Based on the grade of the products, a binary coefficient matrix $[\gamma_{ij}]$ is prepared, which is to be used as an input to the mathematical model. The relation used to construct the binary matrix is:

$\gamma_{ij}= 1$, if a set of warehouses Xj has grade of the products demanded by customer i, otherwise 0.

4.1.4 Route existence

A route between the two nodes will exist if:
$$\alpha_{ij}\beta_{ij}\gamma_{ij} = 1 \quad (2)$$

and a route between the two nodes will not exist if:
$$\alpha_{ij}\beta_{ij}\gamma_{ij} = 0 \quad (3) \quad i = 1,2,...,m \text{ and}$$

$j = 1,2,...,n$

Whereas, m is the number of customers, n is the number of sets of warehouses.

4.1.5 Network simplex method mathematical model

Network simplex method is composed of nodes and arcs. The locations of warehouses and customers are represented by nodes and the distances between them are represented by arcs (routes).

Minimize: $\quad Z = \sum_{pq} d_{pq} Y_{pq}$ (4) *Subject to:* $\quad A_{p,qr} Y_{pq} \geq R_p$ (5)

$$A_{p,qr} = \begin{cases} -1 & \text{if } p = q, \\ +1 & \text{if } p = r, \\ 0 & \text{Otherwise.} \end{cases} \quad (6)$$

Whereas, A is a matrix indexed by the set of nodes and is incidence matrix of a network. And p is the number of nodes, d_{pq} is the distance from node p to node q, Y_{pq} is the required amount of products to ship from node p to node q through distance d_{pq}. Negative value of R_p means capacity of warehouse (source), and positive value of R_p means customer demand (destination).

A customer may be facilitated directly from a single warehouse. However, when a single warehouse has not sufficient products as demanded by the customer, then two or more than two warehouses jointly can satisfy a customer. Figure 2 shows all the feasible routes to approach a customer. A customer Cmay be directly facilitated from warehouse 1 or may be facilitated from two warehouses i.e. starting from warehouse 1 (origin) and passing through warehouse 2 and then reaching customer C. Similarly, a customer C may be facilitated from three warehouses i.e. starting from warehouse 1 (origin), passing through warehouses 2 and 3 and then reaching customer C and so on.
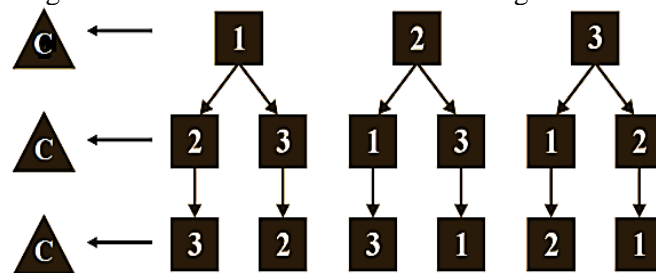
Figure 2:Warehouse-customer feasible routes

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5. Example

The production plants produce unlimited products and then store the products in the warehouses. Table 2 shows the capacity of each warehouse. A single warehouse may or may not have sufficient capacity to fulfill the total customer demand. If a single warehouse cannot satisfy customer demand, then two or more than two warehouses (set of warehouses) jointly satisfy the customer demand. It is preferred that a warehouse be constructed with sufficient capacity. The customer demands are shown in Table 3.

Table 2. Warehouse capacity

Warehouse	Capacity
1	500
2	700
3	400

Table 3. Customer demand

Customer	Demand
C_1	390
C_2	350
C_3	250
C_4	380

The example solved explains the proposed procedure. Table 4 shows the inter-warehouse distances. The distance between warehouse 1 and warehouse 2 is 60km. The distance between warehouse 1 and warehouse 3 is 70km and similarly the distance between warehouse 2 and warehouse 3 is 45km.

Table 4. Inter-warehouse distances

	W_1		
W_1	0	W_2	
W_2	60	0	W_3
W_3	70	45	0

The warehouse-customer distances are shown in Table 5. The distance between warehouse 1 and customer 1 is 110km and the distance between warehouse 2 and customer 1 is 60km and so on.

Table 5. Warehouse-customer distances

	W_1	W_2	W_3
C_1	110	60	45
C_2	70	95	80
C_3	25	90	95
C_4	95	40	75

$X_1, X_2,…, X_{15}$ are the maximum feasible number of sets of warehouses fulfilling the customer demand. Table 6 shows the maximum number of feasible sets of warehouses for satisfying the customer demand.

Table 6. Sets of warehouses

Set	Members	Set	Members	Set	Members
X_1	W_1	X_6	$W_2\ W_1$	X_{11}	$W_1\ W_3\ W_2$
X_2	W_2	X_7	$W_2\ W_3$	X_{12}	$W_2\ W_1\ W_3$
X_3	W_3	X_8	$W_3 W_1$	X_{13}	$W_2\ W_3\ W_1$
X_4	$W_1\ W_2$	X_9	$W_3 W_2$	X_{14}	$W_3\ W_1\ W_2$
X_5	$W_1\ W_3$	X_{10}	$W_1\ W_2 W_3$	X_{15}	$W_3\ W_2\ W_1$

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Table 7 shows the warehouse-customer distances. In the set X_1 of warehouses, the direct distance from warehouse W_1 to customer C_1 is 110km. In the set X_4 of warehouses, the total distance, starting from warehouse W_1 (origin), passing through W_2 and reaching customer C_1 (destination) is 120km. Similarly, in the set X_{10} of warehouses, the total distance starting from warehouse W_1 (origin), passing through W_2 and W_3 and reaching customer C_1 (destination) is 150km and so on.

Table 7. Warehouse-customer distances

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	110	60	45	120	115	170	90	180	105	150	175	175	225	190	215
C_2	70	95	80	155	150	130	125	140	140	185	210	210	185	225	175
C_3	25	90	95	150	165	85	140	95	135	200	205	225	140	220	130
C_4	95	40	75	100	145	155	120	165	85	180	155	205	210	170	200

The traffic factor values for the designed routes are given in Table 8. For the set of warehouses X_4, the distance between W_1 and W_3 is 70km and traffic factor value is 1. The distance between W_3 and C_3 is 95km and traffic factor value is 0.9. The total distance of the route starting from W_1 passing through W_3 and reaching C_3 is 165km. So, the overall traffic factor value for this route will be 0.94.

Table 8. Traffic factor values for the designed routes

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	0	1	1	1	1	0^+	1	0	1	1	1	1	0	1	0
C_2	1	1	0	1	0	1	0	1	1	0	1	0	1	1	1
C_3	1	1	0.9	1	0.94^*	1	0.93	1	1	0.95	1	0.96	1	1	1
C_4	1	1	0	1	0	1	0	1	1	0	1	0	1	1	1

Mathematically: $\dfrac{[70+95]}{\left[\dfrac{70}{1}\right]+\left[\dfrac{95}{0.9}\right]}=0.94 \quad (7)$

The route starting from W_2 passing through W_1 and reaching C_1, has a traffic factor value 1 between W_2 and W_1 and has a traffic factor value 0 between W_1 and C_1. This route will be discarded because there is no overall traffic flow possible from warehouse W_2 to customer C_1. Hence, the overall traffic factor value is 0^+ (zero) for this designed route.

The actual distances divided by the traffic factor value gives us revised distance d. When the traffic factor value is zero, then either there is no route from the warehouse to customer or the route is closed. Table 9 shows the revised distances from the sets warehouses to the customers.

Table 9. Revised warehouse-customer distances

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	∞	60	45	120	115	∞	90	∞	105	150	175	175	∞	190	∞
C_2	70	95	∞	155	∞	130	∞	140	140	∞	210	∞	185	225	175
C_3	25	90	105	150	175	85	150	95	135	210	205	235	140	220	130
C_4	95	40	∞	100	∞	155	∞	165	85	∞	155	∞	210	170	200

∞ means that either the distance is too large or there is no access possible from origin to destination. Based on the maximum permissible distance, d_{max}, a binary coefficient matrix $[\alpha_{ij}]$ is prepared. In Table 10, the binary coefficient matrix is shown. The following relation can be used to construct the binary matrix.

$\alpha_{ij}= 1$, if $d_{ij} \leq d_{max}$, otherwise 0.
$d_{max} = 100km$ (In this case)

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Table 10. Binary coefficient matrix [α_{ij}]

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
C_2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
C_3	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0
C_4	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0

Based on the capacities of the sets of warehouses, a binary coefficient matrix [β_{ij}] is prepared. The following relation is used to make the binary matrix for the capacities of the sets of warehouses. β_{ij}=1, if sum of capacities of all the warehouses is greater or equal to the sum of total customer demand, and 0 otherwise. Table 11 shows that each set of warehouses has sufficient capacity.

Table 11. Binary coefficient matrix [β_{ij}]

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Based on the grade of the products, a binary coefficient matrix [γ_{ij}] is prepared. The following relation is used to construct the binary matrix. γ_{ij}= 1, if a set of warehouses X_j has products of the required grade demanded by customer i, and 0 otherwise. Table 12 shows the binary coefficient matrix [γ_{ij}] for the grade of the required products.

Table 12. Binary coefficient matrix [γ_{ij}]

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C_3	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0
C_4	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0

Multiplying the corresponding binary coefficients α_{ij}, β_{ij} and γ_{ij} evaluated in Table 10, 11 and Table 12 respectively. Using Eqs. 2 and 3, the corresponding values are shown in Table 13.

Table 13. Existence of routes

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
C_1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
C_2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
C_3	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
C_4	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0

The network flow diagram for this example is shown in Fig. 3. There are three warehouses and four customers. The total nodes are 7. Negative value inside the node shows source (warehouse) and positive value inside the node shows destination (customer demand). Y_{15} is the units of product required to shift from warehouse 1 (node1) to customer 2 (node 5) and d_{15} is the corresponding actual distance (70 km). Using Eq. 6, binary coefficients of Y_{ij} are shown in Table 14.

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Table 14. Coefficients of Y_{ij}

Y_{qr}	Y_{15}	Y_{16}	Y_{23}	Y_{24}	Y_{25}	Y_{27}	Y_{31}	Y_{32}	Y_{34}
1	-1	-1	0	0	0	0	+1	0	0
2	0	0	-1	-1	-1	-1	0	1	0
3	0	0	+1	0	0	0	-1	-1	-1
4	0	0	0	1	0	0	0	0	+1
5	+1	0	0	0	+1	0	0	0	0
6	0	+1	0	0	0	0	0	0	0
7	0	0	0	0	0	+1	0	0	0

(Number of nodes (i) — leftmost vertical label)
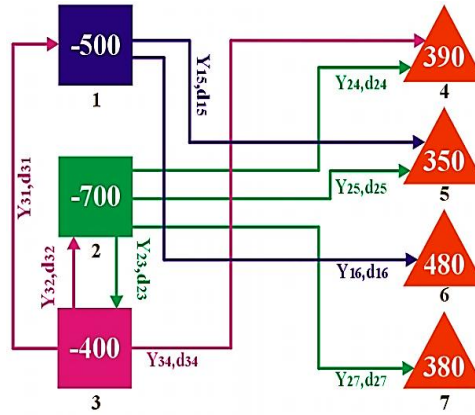
Figure 3:Network flow diagram

$$d_{ij}= [d_{15}\ d_{16}\ d_{23}\ d_{24}\ d_{25}\ d_{27}\ d_{31}\ d_{32}\ d_{34}]\ (8)$$

From Eq. 8, the distance matrix is:

$$d_{ij}= [70\ 25\ 45\ 60\ 95\ 40\ 70\ 45\ 45]\ (9)$$

$$Y_{pq} = \begin{bmatrix} Y_{15} \\ Y_{16} \\ Y_{23} \\ Y_{24} \\ Y_{25} \\ Y_{27} \\ Y_{31} \\ Y_{32} \\ Y_{34} \end{bmatrix} (10)$$

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$$B = \begin{bmatrix} -500 \\ -700 \\ -400 \\ +390 \\ +350 \\ +480 \\ +380 \end{bmatrix} \quad (11)$$

From Eq. 4, the objective is:

Minimize: $Z = 70Y_{15} + 25Y_{16} + 45Y_{23} + 60Y_{24} + 95Y_{25} + 40Y_{27} + 70Y_{31} + 45Y_{32} + 45Y_{34}$

And from Eq. 5, the constraints are:

$$-Y_{15} - Y_{16} + Y_{31} \geq -500$$
$$-Y_{23} - Y_{24} - Y_{25} - Y_{27} + Y_{23} \geq -700$$
$$Y_{23} - Y_{31} - Y_{32} - Y_{34} \geq -400$$
$$Y_{24} + Y_{34} \geq 390$$
$$Y_{15} + Y_{25} \geq 350$$
$$Y_{16} \geq 480$$
$$Y_{27} \geq 380$$

The problem is solved with the data provided in the tables. The model comprises of 7 constraints and 9 variables with an objective to minimize the total cost and minimizing the CO emission. All instances were solved using lp_solve version 5.5.2.0 for 32 bit OS, with 64 bit REAL variables, 2.00 GB of RAM and Intel® Core™ i3 CPU 2.53 GHz processor. Time to load data was 0.01 seconds; presolve used 0.06 seconds, 0.20 seconds in simplex solver, in total 0.27 seconds.

$Y_{15}=30$	$Y_{24}=0$	$Y_{31}=10$
$Y_{16}=480$	$Y_{25}=320$	$Y_{32}=0$
$Y_{23}=0$	$Y_{27}=380$	$Y_{34}=390$

Considering the transportation cost equal to $1 per mile per unit, the optimum solution is: Z = $77950.

The sub-network of Figure3 is given in Figure 4.
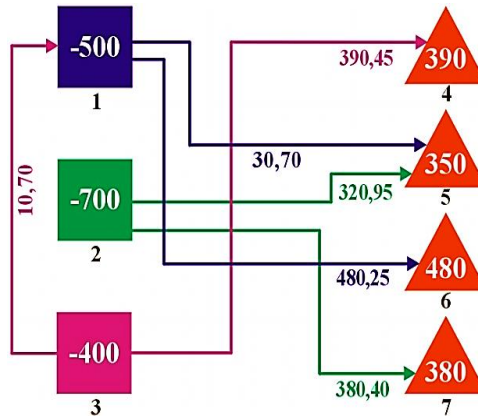
Figure 4:Product supply to demand locations

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In this case study, the total demand is equal to total capacity of the three warehouses. If we increase the capacities of the warehouses as shown in Fig. 5, then less number of warehouses will fulfill the required demand from customers. For example, if we increase the capacities if warehouse 1, 2 and 3 to 800, 900 and 700 respectively then only two warehouses (warehouse 1 and 2) will be enough to fulfill the total customer demand. There will be no need of warehouse 3.
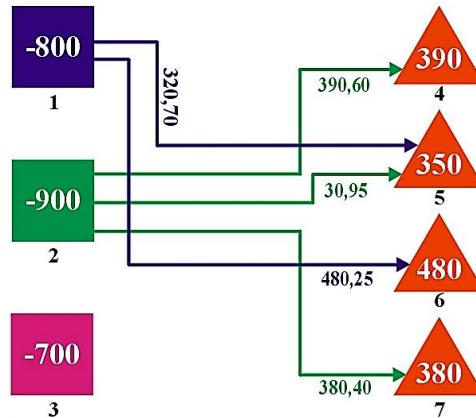
Figure 5:Final network flow diagram

6. Concluding Remarks

The present paper evaluates product distribution strategy with a view to improve the distribution network for better area coverage and to identify the major warehouse locations and allocation of customers to the selected warehouses. The capacity issue is important as a company has a practice of frequently reviewing its supply chain decisions. The required grade of product is included in the current analysis and the inter-warehouse distances further optimized the solution. Traffic factor is incorporated in the mathematical modeling and has an important impact in the route selection for the supply of products. The problem is solved for feasible routes to deliver products to the end customers, which minimizes the carbon-monoxide emission from vehicles to the environment.

It is envisioned that the scope of the analysis could further include issues such as criteria for sequencing and scheduling, precedence relations, preemption and Gantt charts. The sequencing and scheduling criteria issue was omitted from current analysis based on the assumption that customers have sufficient waiting time for loading of the required products. Secondly, for the existing four customers, sequencing and scheduling, precedence relation and preemption had never been a problem.

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Skin Color Detection Using GIE in Spatial Domain

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Abstract

The skin tone detection is an exceptionally intrigued theme for a person who has a place with software engineering, restorative and building fields. The scientists presented various types of calculations for skin tone detection. But in this paper, execution of skin tone detection depends on the scope of pixels of Hue part from HSV shading space using Global Image Enhancement (GIE) technique in spatial domain. Skin tone detection using GIE is the extraction of skin-hued pixels from images. Skin tone detection assumes a critical part in numerous fields of science. It gives us the establishment in numerous applications, for example, confront discovery, skin illnesses, figure prints matching management system, signal investigation, confront following, passionate registering, biometric reconnaissance management systems, confront quality grouping, facial picture coding pressure, human posture displaying, ordering and recovery of pictures and recordings, picture altering, client controlling and steganography and communication of human with PC and so forth. In this article we also check the ratio of skin and non-skin pixels of image. Further, it is noticed that the proposed method gives attractive results.

Keywords HSV, GIE, Skin detection, Color segmentation, skin ratio.

1. Introduction

Skin detection is a very important skill [1]. Skin detection is very helpful in different fields of life [2]. Through skin detection techniques we can divide the image into two categories i.e. skin and non-skin part of image [3], [4]. Skin detection provides help in face detection. Skin detection is used in medical field to diagnose the different types of skin diseases [5], [6]. It can be used in development of different kinds of applications such as, face detection, skin diseases, finger prints matching, gesture analysis, face tracking, emotional computing, biometric surveillance, face attribute classification, facial image coding compression, human pose modeling,indexing and retrieval of images and videos, image editing, vehicle drivers, drowsiness detection, user controlling, browsing behavior (e.g.,surfing indecent sites) and steganography and interaction of humans with the computer etc. [7].

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2. Algorithm
We can detect skin tone in just simple five steps.
- Acquire the image
- Perform equalization
- Find the Hue – Saturation – Value(HSV)
- Do Morphological operations
- Skin detection in RGB

2.1Acquire the image
First of allacquire a desired RGB image. Then, calculate the histogram, probability and probability density function (pdf) of gray levels as shown in figure 1 and 2.

Figure 1. AcquiredImage
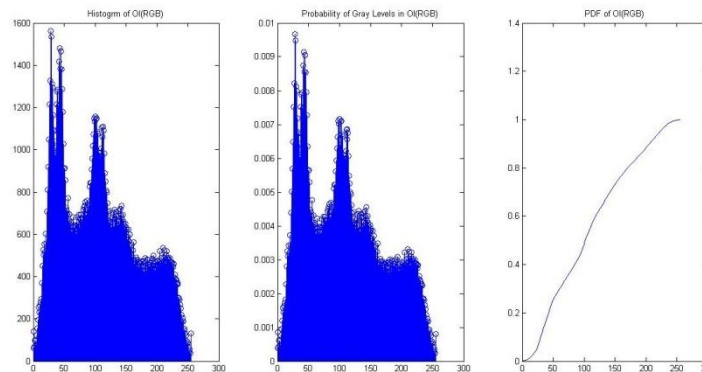
Figure 2. Histogram, Probability and PDF of Acquired Image

2.2 Perform Equalization
After acquiring the image equalized it and also calculate the histogram, probability and probability density function (pdf) of gray levels of this equalized image. As shown in figure 3 and 4.

Figure 3: Equalized Image

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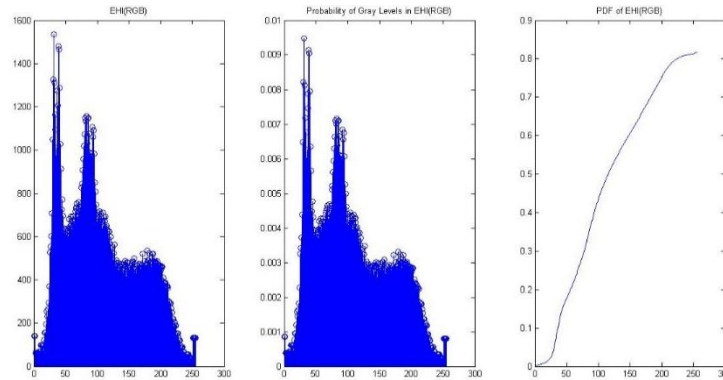
Figure 4: Histogram, probability and PDF of Gray Levels of equalized image

2.3 Find the HSV (Hue – Saturation – Value)

Now transform this Equalized RGB image into HSV. HSV color space provides the better result than other color spaces because of only in HSV color space, the value component is independent. The value component represents the brightness. HSV varies from image to image. The HSV value of this image lies between 0.29 to 1.58.

(HSV(:,:,1)>=1.58 | HSV(:,:,1)<=1.05)&(HSV(:,:,2)>=0.29 & HSV(:,:,2)<=0.50)&(HSV(:,:,3)>=.29 | HSV(:,:,3)<=0.48);
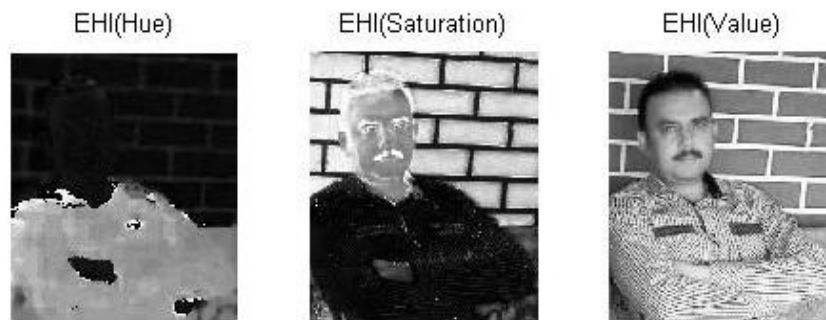
Figure 5: Hue Saturated and Value Components

2.4 Perform opening and closing Operations

Morphology is a method of image processing based on shape and size of the neighborhood pixels. The value of pixels in the output image after performing the operation is based on the neighborhood value of pixels in the input image. The morphological operations are:

➢ Morphological opening
➢ Morphological closing

Morphological operations are performed by using different types of shapes like diamond, disk etc [10], [11]. But in this article disk shape is used with radius 6. The results of morphological operations are shown in figure 6.

Figure 6: Morphological operations

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Operations	Non Skin Pixels	Skin Pixels	Total Pixels	Percentage of Skin Segments
EHI HSV	44214	9714	53982	18%
Morphological Opening	50017	3911	53982	7.2%
Morphological Closing	49815	4113	53982	7.6%

Table 1: Skin Tone Analysis of Morphological operations

Table 1 shows the total number of pixels which is equal to sum of number of skin and non-skin pixels during EHI HSV operation, Morphological opening and closing operations. It also shows the 18 % skin segmentsare occurredafter EHI HSV operation which also contains the wall area but after closing operation the resultant image only contains 7.6% skin segments as shown in figure 6.
.

2.5 Skin detection in RGB domain

The skin tone detection is performed after morphological operations. The results of skin tone detection of RGB image are shown in figure 7. The first picture shows the skin tone detection in red component, second shows the skin tone detection in green component and the third picture shows the skin tone detection in the blue component.
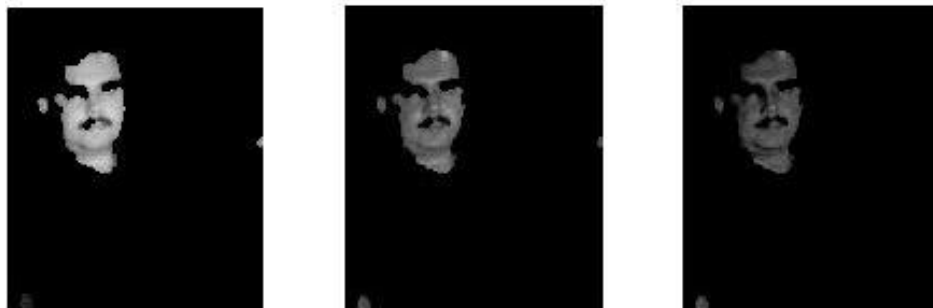
Figure 7: Skin detection in RGB Component

3. Comments and Conclusion

All results are simulation based using the MATLAB R2011a. The figure 8 show the result of porposed skin detection using GIE based method. This figure looks like a binary image in which white color represents the skin segment and black color represent the non-skin segment.
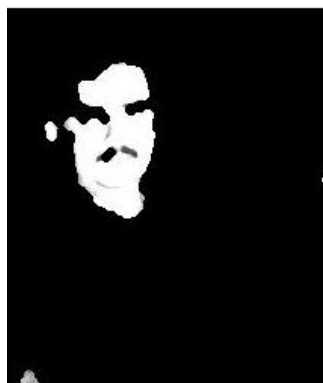
Figure 8: skin detection of image

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Table 1 shows the quantity of non-skin and skin pixels using with GIE based methods. It also shows that the resultant image that is shown in figure 8 contains 7.6% skin segment.

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Performance Evaluation of MANET Routing Protocols in Various Network Environments

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Abstract

Mobile nodes in MANET carry out dual functionality of being a router and host such that it can accept incoming traffic as well as direct outgoing traffic. A vital aspect for routing protocol is that they need to be energy efficient in terms of battery consumption of the nodes which participates and routes traffic into the network. In this research work, three routing protocols TORA, OLSR and GRP have been evaluated for their performance. The metrics used were throughput, network end-to-end delay, network load and routing overhead. Validation of performance has been conducted on an office network of size 100m x 100m using OPNET Modeler 14.5 network simulation tool. The simulations show that OLSR protocol has the highest network load but in term of packet end to end delay and throughput OLSR protocol performs better than both GRP and TORA protocols. It also illustrates that TORA protocol is better than GRP and OLSR protocols in terms of routing overhead while GRP protocol is better than TORA protocol in terms of packet end to end delay and throughput of a network.

Keywords Mobile Ad-hoc Networks (MANETs), TORA, OLSR, GRP, Routing Protocols and OPNET.

1. Introduction

The concept of MANETs (MANETs) is believed to have started around the early 1970s (Misra and Mandal 2005). MANETs is the combination of mobile nodes, in which a node acts as a router and a node itself. Routing protocols are used to find the efficient path to the destination network using the routing table. They are divided into three main types, reactive, proactive and hybrid routing protocols. In MANETs the mobiles nodes exchange information with each other through routing protocols (AODV, TORA and GRP etc) which discover routes among these mobiles nodes. These routing protocols have different characteristics and perform quite well in various conditions. So choosing the right protocol becomes a challenge considering the various factors involved in affecting the performance of the routing protocols. Generally the impact of applied topology updates and strategies has been considered in evaluating the performance of a network. Some other directions have also been explored in order to enhance the performance capabilities of MANETs. Samar et al. in (Samar and Haas 2002) presents various strategies for broadcasting updates by proactive routing protocols in mobile ad hoc networks in order to reduce the network routing overhead. A dynamic congestion detection and control routing (DCDR) method for ad hoc networks has been developed by Senthilkumaran et al in (Senthilkumaran and Sankaranarayanan 2013). The method is based on the estimations of the average queue length at the node level. The evaluation performance of TORA and OLSR has done in (Talooki and Ziarati 2006) using the NS2 network simulator. The results of these routing protocols show that TORA protocol performs better than OLSR protocol. Another performance comparison of routing protocols was done in (Bertocchi, Bergamo et al. 2003). The result of this study shows that both routing protocols i.e. OLSR and TORA perform good using the medium size network load. Another performance of routing protocols i.e. TORA and OLSR was done using the Glomosim simulator (Hassan, Youssef

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et al. 2006). The results show that when a source sends packets to different destinations nodes in a different network then OLSR performs better than TORA. But the results also shows that when a source sends data to a common destination node in the network then TORA protocol performs better than OLSR protocol. The performance comparison of three routing protocols OLSR, TORA and GRP are checked in using NS2 network simulator. The results show that TORA protocol performs better than OLSR and GRP protocols. All routing protocols have good performance when the nodes movement in the network is slow. QUALNET network simulator is also used to check the performance evaluation of the routing protocols i.e. OLSR, TORA and GRP protocols. The results show that at high mobility and medium node density TORA protocol performs better than OLSR and GRP protocols. To investigate some of these factors, this research work focuses on evaluating the performance of an office network of size 100m x 100m using OPNET Modeler 14.5 network simulation tool . The performance is evaluated for Ad hoc On-Demand Distance Vector (AODV), Temporally-Ordered Routing Algorithm (TORA) and Gateway Routing Protocol (GRP) routing protocols in MANETs for varying network environments. OPNET network simulator was used instead of Network Simulator 2 (NS2) for its enhanced features and ease of usage. Various techniques and various network simulation environments have been tested to gauge the performance of the routing protocols in different scenarios. Performance evaluation was conducted for both proactive and reactive routing protocols i.e. OLSR, TORA and GRP. The protocols were compared under varying parameters including network overhead, network delay, network load and network throughput. These different routing protocols' parameters were assessed using TCP traffic. These performance metrics which we have used in our simulation have two aspects in a network.

- Reliability of the network
- Efficiency in the network

The reliability of the routing protocols of a network can be determined by network load, packet end to end delay and throughput of a network, while efficiency of a network can be determined by routing overhead.

The rest of the paper is organised as follows. Section 2 presents the MANET routing protocols TORA, OLSR and GRP. The experimental setup is given in Section 3 including the various performance metrics and simulation setup used for this research work. The results and their analysis is provided in Section 4 followed by concluding remarks in Section 5.

2. MANET's Routing Protocols

This research work investigated TORA, OLSR and GRP routing protocols among the reactive, proactive and hybrid routing protocol classes respectively. The details of these routing protocols are as follows.

2.1. Reactive Routing Protocol TORA (Temporally Ordered Routing Algorithm)

Reactive routing protocols are also called on-demand routing protocols because these routing protocols find the best path to the destination network by using a connection oriented process whenever it needs the path to the destination network. Some examples of reactive routing protocols are, AODV (Ad hoc on demand distance vector), DSR (Dynamic source routing), TORA (Temporally ordered routing algorithm), SSR (Signal stability routing), CBRP (Cluster based routing protocol) (Kiwior and Lam 2007). In these protocols, the route maintenance process maintains the route until the route is no longer desired or the destination is unreachable .

TORA is one of the reactive routing protocols. It has the following features.

- It is highly adoptive and efficient protocol.
- It is scalable distributed routing protocol which uses the idea of reverse link.
- It is a dynamic protocol used in multipoint wireless networks.
- It is source initiated protocol.
- It maintains many paths from source to destination networks.
- It uses control messages which are related to a small set of nodes.
- It reacts to the topology change whenever all routes to the destination network fails.

It has two main functions, creation and maintenance of routes.

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2.2. Proactive Routing Protocol OLSR (Optimized Link State Routing Protocol)

Proactive routing protocols make and maintains route to every other node in a network whether the route is needed for sending of data or not.

One disadvantage is the inefficient bandwidth usage due to periodical update of the routing table through transmission of control messages (Demers and Kant 2006). Examples of proactive protocols are DSDV (Destination Sequenced Distance Vector), WRP (Wireless Routing Protocol), GSR (Global State Routing), CGSR (Cluster head Gateway Switch Routing), OLSR (Optimized Link State Routing Protocol).

2.3. Hybrid Routing Protocol GRP (Geographic Routing Protocol)

The third type of MANET protocol is the hybrid protocols. Hybrid protocol combines best features of proactive routing protocols and reactive routing protocols. Hybrid routing protocol is also called balanced hybrid routing because it exchanges their routing table to the neighbour routers in the network. While link state routing protocols exchange only the change in topology to the neighbour routers in the network (Jin Mook, In Sung et al. 2008).. Hybrid routing protocols uses less processing power and less memory. Examples of hybrid protocols are ZRP (Zone Routing Protocol), GRP (Geographic Routing Protocol) etc.

The following section presents the various metrics used for performance evaluation of the MANET system's routing protocols. It also focuses on the study of the design parameters for the system which play an important role in the performance evaluation of MANET protocols.

3. Experimental Setup

A comparison of the performance evaluation of routing protocols was conducted by using the following four metrics; Network Overhead, Packet sending ratio, Network end to end delay, Network throughput.

- Network overhead is the total number of data which are injected into the transmission line of a network is called network overhead. Network overhead is one of the important measures of scalability of MANET's protocols. Other threads which influence the network overhead are congestion of network and route error packets (Naserian, Tepe et al. 2005).
- Packet sending ratio is a ratio of total number of packets which is transmitted by the source node and the total number of packets received by the destination node. It measures that during packet transmission from source to destination node how many packets are lost. By packet sending ratio we can find the efficiency of routing protocols. For a good network design the packet sending ratio must be high, otherwise it will not be a good network (Uyen Trang and Xing 2005).
- Network end to end delay is the total time taken by the data which is transmitted from source node to the receiver of the destination node then this time taken by the packet from source to destination is called network end to end delay. It is represented in seconds. The end to end delay of a network shows us that how well the routing protocols adjust to the different constraints in the network .
- Network Throughput is the average rate of successful messages delivered over a communication channel is called network throughput. We represent throughput in bits/second or packet/second.

The network modelling in OPNET starts with selecting a blank scenario on which a small office network of size 100m x 100m is prepared. The simulations have been grouped into four categories as shown in Table 1. The four categories have 5, 15, 20 and 25 nodes respectively. Categories 1 and 2 have mobility speed of 10 Km/Hr while Category 3 and 4 have mobility speed of 20 Km/Hr.

Table 1. Categories of Simulation

Category	No. of Nodes	Mobility Speed
1	5	10 Km/Hr
2	15	10 Km/Hr
3	20	20 Km/Hr
4	25	20 Km/Hr

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4. Results and Analysis

The analysis of simulation results is presented in this section. The results of overall routing overhead were analysed for a network followed by the analysis of the network load for the routing protocols. This is followed by the analysis of the network load, packet end to end delay and network throughput for the different routing protocols. For the simulations presented in this research work, the global statistics of the office network have been utilised and average values for these statistics are recorded and displayed in all the graphs for the simulations results.

4.1. Analysis of Routing Overhead

Network load for OLSR, TORA and GRP is presented in Figures 1(a-c) respectively. The simulation results are considered for all scenarios such as 5, 15, 20 and 25 network nodes which are moving with 10 km per hour and 20 km per hour at a constant speed. It can be observed that in term of network load OLSR protocol has the worst performance. This is due to the fact that being a proactive routing protocol; OLSR keeps the routing table of a network up to date by continuously sending periodic updates to other nodes in the network which in turn induces more traffic load. From the results analysis it is also clear that TORA protocol is the second worst protocol in terms of sending high network traffic into the network. As TORA works in Ad hoc network therefore it depends on clock which synchronized between the nodes.

| (a) | (b) | (c) |
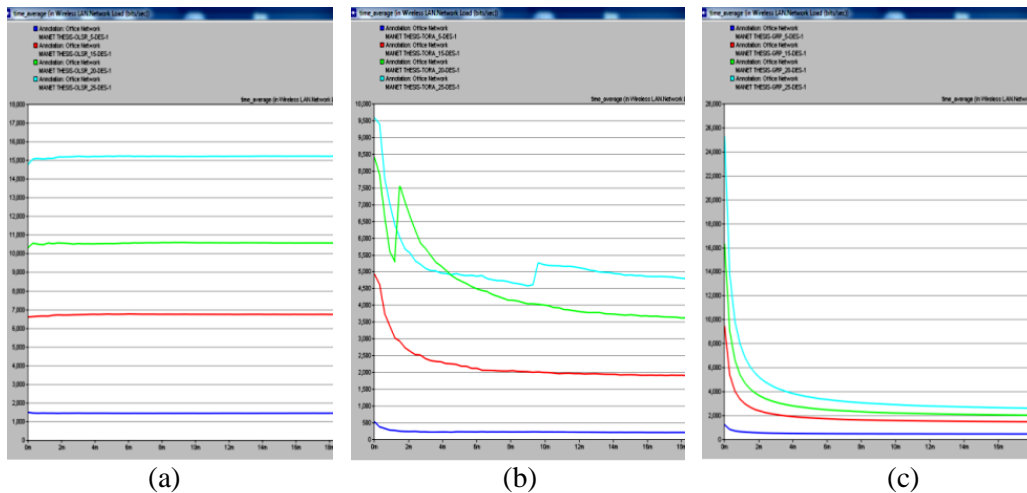
Figure 1. Routing Overhead in (a) OLSR (b) TORA (c) GRP with mobile nodes 5, 15, 20 & 25

GRP protocol due to hybrid routing protocol sends packets to the destination when it is aware of the entire path. It has multiple paths therefore if one route fails it uses the alternate path for the traffic due to which network traffic is controlled. GRP protocol performs better than OLSR and TORA protocols because GRP protocol have less routing overhead than TORA and OLSR protocols by sending less number of traffic into the network. Its network traffic comprises when a source node is sending data to a destination node, not periodically or in any other form. This eliminates the redundant transmission of updates and in turn reduces the network load. Thus GRP protocol performance is better than OLSR and TORA protocols in a small resource network. By the performance analysis of the routing protocols, it can be concluded that OLSR protocol has worst performance due to sending large amount traffic into the network while GRP protocol outperforms the other protocols as it sends the least amount of traffic on the network. The analysis of Network Load for the routing protocols is presented as follows.

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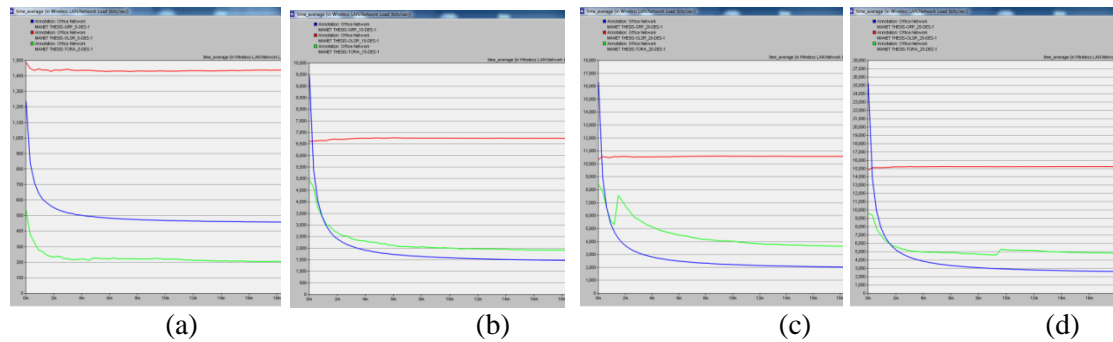
Figure 6. Network Load of (a) OLSR (b) TORA (c) GRP with 5, 15, 20 & 25 nodes at 10km/h, 10km/h, 20km/h and 20km/h respectively.

4.2. Analysis of Network Load

OPNET Modeler allows for three categories of network loads; light, medium and high load. The network simulation in this research work is designed for medium load.

Figure 2 shows the 5 nodes scenario which is moving with 10 km per hour speed has no effect on the network traffic. But with scenario of 15 nodes which is moving with speed of 10 km per hour has initially a small effect on the traffic load. In the beginning of simulation the network traffic is large but after some time it becomes constant. Same is the case in scenarios of 20 and 25 nodes which are moving with the speed of 20 km per hour. In the beginning of simulation network traffic is high but as the nodes move with 20 km per hour speed, it takes some time for the routing traffic to become constant.

(a)   (b)

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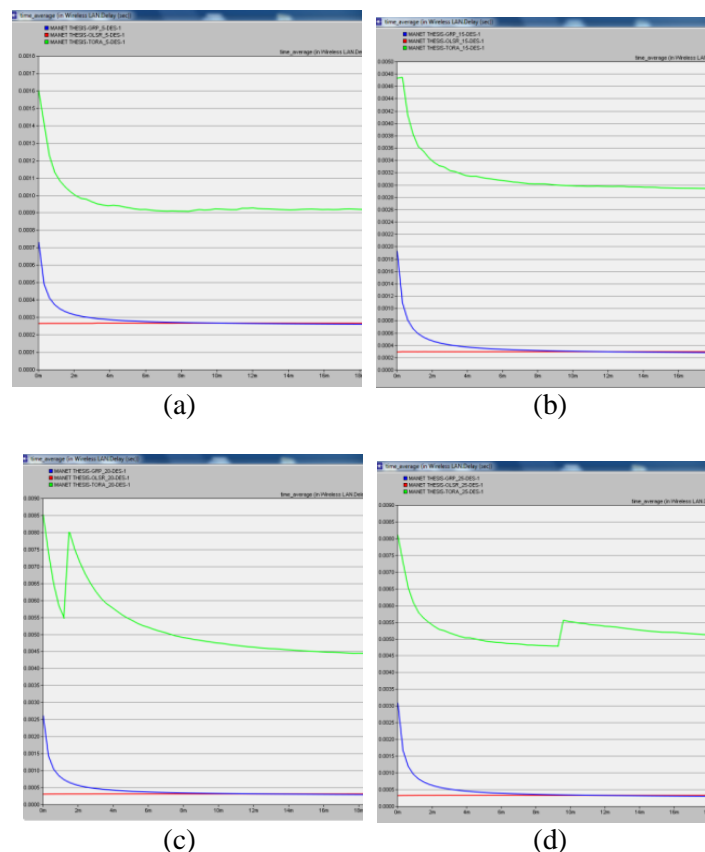
Figure 2 End to End Delay of OLSR, TORA & GRP with (a) 5 (b) 15 (c) 20 and (d) 25 nodes at speed of 10 km/h

In Figure 2(a), we have observed that with 5 nodes scenario which is moving with 10 km per hour speed has no effect on the network traffic. Hence it is constant throughout the simulation. But in scenario with 15 nodes which are moving with 10 km per hour has initially a small effect on the traffic load. It has high network traffic in the beginning of simulation. But as time passes its effect on traffic load gradually decreases and after some time i.e. after 8 minutes as shown in figure it becomes constant. But in scenario of 20 and 25 nodes which are moving with 20 km per hour has initially small effect on routing traffic. In the beginning of simulation it has large traffic load but after some time network traffic suddenly decreases and at once again it is abruptly increases. After some time i.e. 2 minutes network load gradually decreases and after 20 minutes it becomes constant. The fourth scenario given in Figure 6(d), with mobile nodes of 25 which are moving with 20 km per hour speed has initially large traffic load. But after some time of the simulation it gradually decreases and at time of 9 minutes it abruptly increases and then decreases and after some time it becomes constant. It is clear from the results that in all scenarios of 5, 15, 20 and 25 nodes which are moving with 10 and 20 km per hour have no change in the network traffic. The amount of routing traffic is constant by increasing the node mobility speed and number of nodes. It is due to proactive nature of OLSR which finds and maintains all routes to every node in the network in advance.

4.3. Analysis of Network End to End Delay

Simulation results for the network delay of the office network utilising the routing protocols is depicted in Figure 7 (a-d). Four scenarios with mobile nodes of 5, 15, 20 and 25 are imitated with mobility speed of 10 km per hour respectively. OLSR finds and maintains all the routes to other nodes in the network which are always ready whenever a source node is sending traffic to a destination node in the network. As OLSR continuously sends periodic update to other nodes in the network its routing table for every node is up to date. Therefore, it always keeps information regarding a fresh path which is available for use at any time. From the simulation analysis it is concluded that OLSR protocol has consistent network delay. In Figure 3(a-d), it can be observed that TORA protocol has the highest delay in all the other routing protocols. TORA finds the routes by sending the route request messages to all the network nodes when a source node needs to send data to a destination node. Therefore to receive the route request reply from other nodes in the network and create a route to the destination node, TORA protocol takes some time or in other words incurs a delay. It can also be viewed from the simulation results that at the beginning of the simulation TORA protocol has a greater delay but after some time it gradually decreases and at last it becomes constant. It can be concluded that TORA protocol performs worst in terms of end to end delay as compared to OLSR and GRP. GRP protocol has initially high delay but after some time it becomes constant; almost similar to OLSR protocol. It is because the OLSR protocol is of hybrid nature. Hence from the four scenarios of 5, 15, 20 and 25 mobile nodes moving with 10 and 20 km per hour, it is concluded that OLSR protocol has the best performance because its delay is minimum. After OLSR protocol, GRP protocol has the better performance than TORA protocol because it has less delay than TORA protocol. TORA protocol has the highest delay which performs worst in all the three routing protocols.

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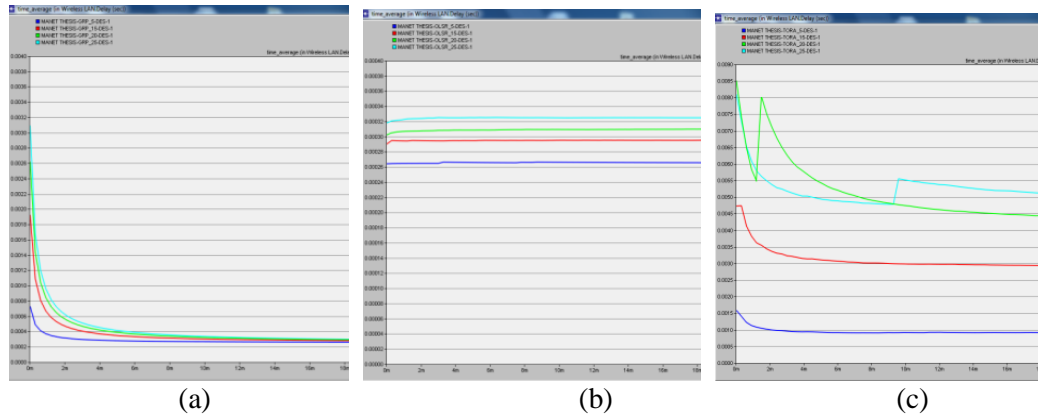
Figure 3 End to End Delay of (a) GRP (b) OLSR and (c) TORA on 5, 15, 20 & 25 nodes at speed of 20 km/h.

4.4. Analysis of Network Throughput

In Figure 4 and 5, the simulation of throughput of routing protocols is performed. It is comprehensible from the simulation results that in all scenarios of mobile nodes i.e. 5, 15 20 and 25 which are moving with the speed of 10 and 20 km per hour, OLSR protocol has the highest throughput than TORA and GRP protocols. OLSR protocol creates and maintains routes to every node in the network in advance. When a source node wants to communicate with destination node then the routes to that node is available in advance. Therefore, it reduces the delay and increase the throughput of a network. As we know that throughput is the average rate of successful messages delivered over a communication channel. Therefore, OLSR protocol have higher throughput. GRP protocol has initially high throughput, but after some time throughput of GRP protocol gradually decreases and at last it becomes constant. Due to hybrid in nature, it has the combination of good qualities of both proactive and reactive routing protocols; it has higher throughput than TORA protocol and lesser throughput than OLSR protocol. Hence GRP protocol has better performance than TORA protocol and worse performance than OLSR protocol in terms of throughput of a network.

From the simulation results we observe that in all scenarios of mobile nodes, TORA protocol has less amount of throughput than OLSR and GRP protocols. TORA protocol is a reactive protocol due to which it has no routes in advance to destination node in a network. When a source node want to communicate with a destination node in a network then TORA protocol creates routes by sending route request messages to the nodes in a network. When a source node receives a route request reply then it creates a route to that node. Hence TORA protocol requires some delay to create a route to a destination node in the network. Therefore TORA protocol has high delay and less amount of throughput than OLSR and GRP protocols.

Hence, from the simulation results of throughput, it is deduced that OLSR protocol has the highest throughput than TORA and GRP protocols. GRP protocol has better performance than TORA protocol in terms of throughput. At last, TORA protocol has low performance than OLSR and GRP protocols in terms of network throughput.

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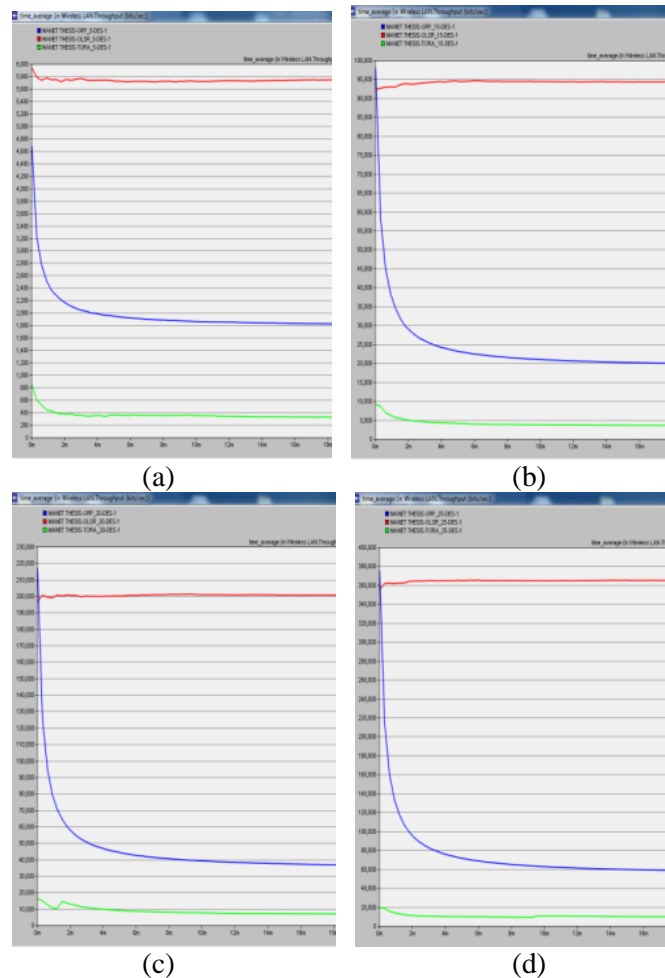
Figure 4 Throughput of GRP, OLSR & TORA on (a) 5, (b) 15, (c) 20 and (d) 25 mobile nodes with speed of 10 km/h.

From the detailed studies of simulation results, it is concluded that among the routing protocols there is no single routing protocol which is superior to others. One routing protocol may have better performance than others routing protocols in terms of routing overhead but at the same time that protocol may perform worst than other protocols in terms of some other performance metrics which we have studied in this research thesis. Such as packet end to end delay, throughput and network load. Therefore the selection of a best routing protocol depends on the network scenario which you have to design.

Factors which are considered in this research thesis are node mobility and network load which affect the performance results of routing protocols. Finally, we have come to know that proactive routing protocols have good performance in high capacity network while reactive routing protocols have better performance in low capacity network.

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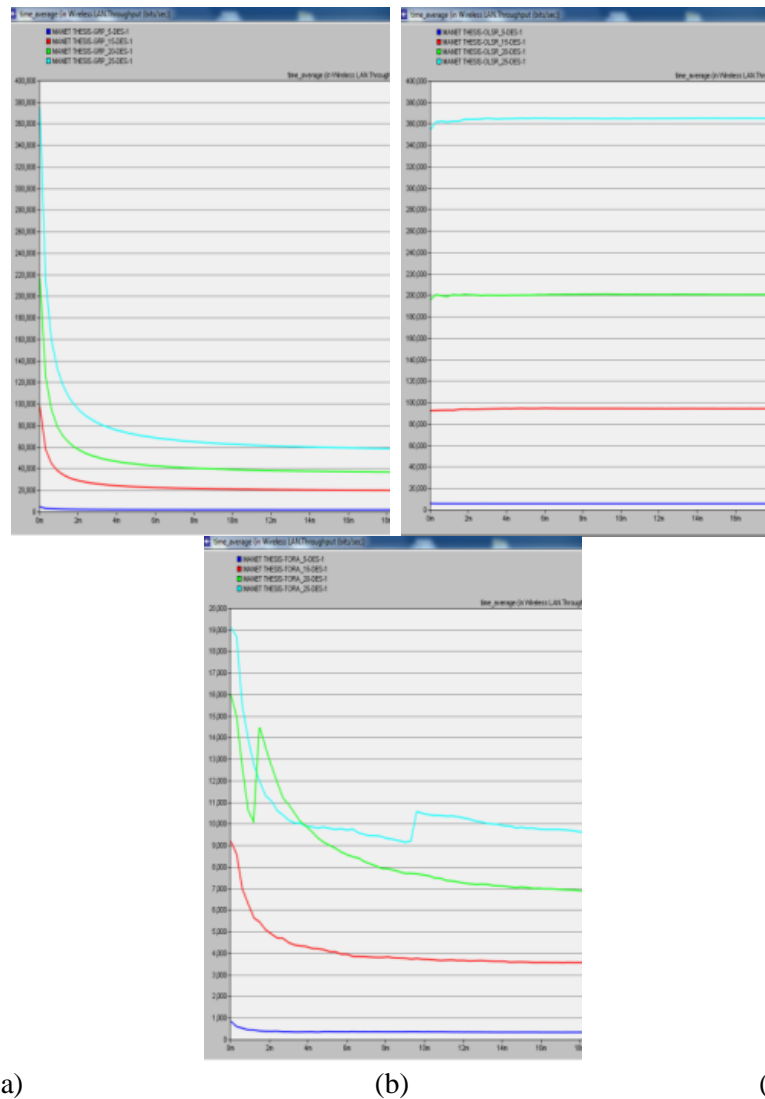
Figure 5 Throughput of (a) GRP, (b) OLSR and (c) TORA on nodes 5, 15, 20 &25 with speed of 20 km/h

4.5. Conclusions

In this thesis research, we have performed the simulations to evaluate the performance of three Ad hoc routing protocols i.e. OLSR, TORA and GRP which are proactive, reactive and hybrid routing protocols respectively. We have evaluated the performance of these routing protocols in terms of routing overhead, network load, network delay and throughput. From the simulation results we have drawn the following conclusions:

- OLSR protocol has the highest network load but in term of packet end to end delay and throughput OLSR protocol performs better than both GRP and TORA protocols.
- TORA protocol is much better than GRP and OLSR protocols in terms of network load and routing overhead.
- GRP protocol is better than TORA protocol in terms of packet end to end delay and throughput of a network.

Future works of this thesis research is to explore new algorithms which enhance the drawbacks of Ad hoc routing protocols which is compared in the thesis. Such as, OLSR protocol which performs better than other MANETs protocols performance metrics such as, packet end to end delay, but at

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the same time it has a disadvantage by continuously sending routing traffic into the network, which causes high routing overhead in the network. Due to proactive routing protocol it continuously updates the routing table by flooding the routing information. So, it has better performance in high bandwidth links. If new routing algorithm is explored then it will remove all these problems. Other performance metrics such as data drop (buffer overflow), media access delay and retransmission attempt can also be used in evaluating the performance of routing protocols in MANETs in various network environments.

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Skin Tone Detection and Segmentation in Spatial Domain

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Abstract

This article is about human skin tone detection and segmentation by using spatial filters. Human skin tone detection and segmentation plays an important role in many fields like computer sciences, medical and electricaletc. There are various techniques used for human skin detection and segmentation in spatial domain as well as in frequency domain. The human skin color varies from person to personand region to region, therefore, it is difficult to introduce a specific method for human skin detection and segmentation.As through skin detection we can make the two segments of digital image, "skin segment" and "non-skin segment". This article also present the value of skin segment part in percentage. Different researchers used different type of methods and color models but the proposed method here is "without Global image enhancement" (GIE) by using HSV color model for the skin detection and segmentation in spatial domain.

Keywords Human skin tone detection, GIE, skin segmentation, HSV, Morphology

1. Introduction

Skin detection is becoming an attractive topic for researchers from past few years just because it plays very important role in the field of image and signal processing [1]. Human skin detection and segmentation is the first step which we can take for the face detection. Skin detection is also helpful in the medical field [2] [3]. Human skin detection and segmentation plays an important role in face tracking, gesture reorganization, face tracking, emotional computing, biometric surveillance, face attribute classification and is also used to filter the adult data on internet [4] [5] [6]. The main challenge in skin detection is to make the recognition robust to the large variations in appearance of skin that may occur, like in color and shape, effects of occultation, intensity, color, location of light source, etc. Imaging noise can appear as speckles of skin like color, and also many other objects like wood, leather and some clothes are often confused as skin. In general, human skin is characterized by a combination of red and melanin (yellow, brown) and there is somewhat a range of hue for skin and saturation that represents the skin-like pixels. Most of the work done in the area of skin detection have been concentrated on detecting skins of European, Black or East Asian ethnicities, whereas, less focus have been concentrated to detect East Asian (i.e. Pakistani, Indian) skins[6].

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2. Algorithm

We detect the skin in this article by using Hue- Saturation – Value (HSV) algorithms . We apply this algorithm on original Red Green Blue (RGB) image without using any equalization. We can detect the skin in 4 steps:

1. Read an image
2. Convert into HSV
3. Perform morphological operations on it
4. Detect a skin and show the results.

2.1 Read an image

On the very first step, select a RGB image. For this purpose matlab provides us the built in functions of imread() and imshow(). For this purpose the First command which is used is imread() to acquire our desired image then, to show the image by using imshow() command. The result is shown in the figure 1.

Figure 1. Original Image

2.2 Convert into HSV

In this step, convert our RBG image into HSV color model. RGB color model is not suitable for human skin detection because of its non-uniform characteristics. HSV values vary from image to image so the HSV values of this image are:

$(HSV(:,:,1)>=1.58$ | $HSV(:,:,1)<=1.05)\&(HSV(:,:,2)>=0.29$ & $HSV(:,:,2)<=0.50)\&(HSV(:,:,3)>=.29 | HSV(:,:,3)<=0.48)$;

The results are shown in figure 2.

OI(RGB)   OI(HSV)

Figure 2: Original Image in RGB & HSV Domain

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2.3 Perform Morphological Operations

Morphology is a technique of image processing based on shape and size of the neighborhood [7]. The pixels value of the output image after morphological operation is based on the neighboring pixels of the input image [8]. The morphological operations are performed by using the spatial filters [9]. Matlab provide us different types of morphological operations but for this work we only need two types of morphological operations and these are:

- Morphological opening
- Morphological closing

These morphological operations are performed by using disk shape with radius 6. Morphological operations are performed with using different kind of spatial filters [10],[11] but in this article the proposed types of spatial filters are min and max average filter. The results of morphological operations are shown in figure 3.

Analysis of skin part on different steps of proposed method is shown in table 1. Table 1 shows that in start skin part is 16.1 % but when we perform morphological opening it is reduced to 9.6% and after closing it is enhanced to 10.2 %. This is the accurate result of skin part.

Types of operation	Non skin pixels	Skin pixels	Total pixels	Pixels in Percent
HSV	289808	55792	345600	16.1%
Morphological opening	312257	33343	345600	9.6%
Morphological closing	310069	35531	345600	10.2%

Table 1: Analysis of skin pixels
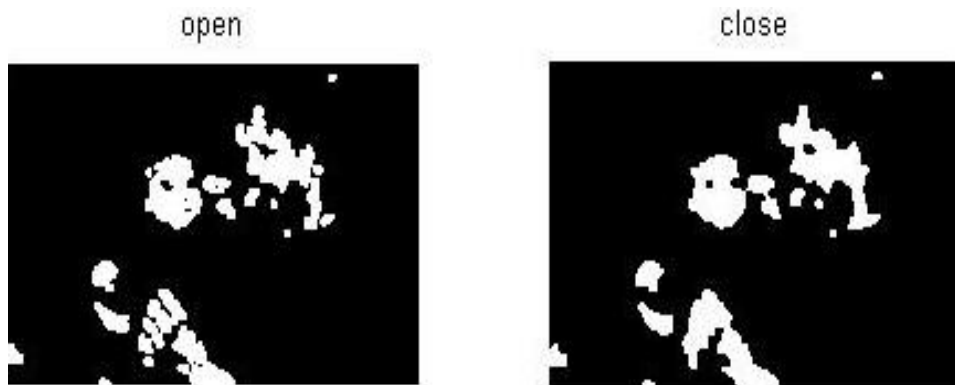
Figure 3: Morphological Operations

2.4 Detection of skin

As shown in figure 4 theskin tone is detected in three different component images red, green and blue. To get the final results we add these three images by using imadd and immultipy built in functions. The resultant and final image is shown in figure 5.

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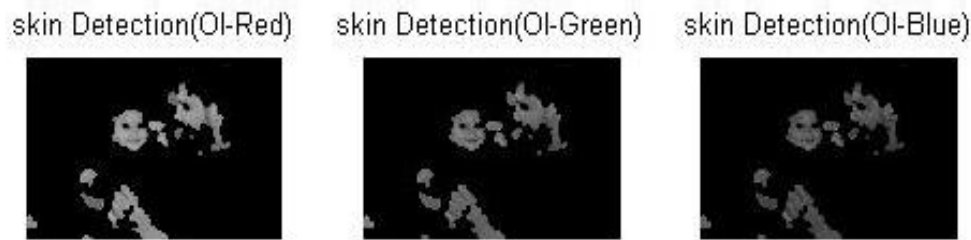
Figure 4. Skin Detection in RGB Components
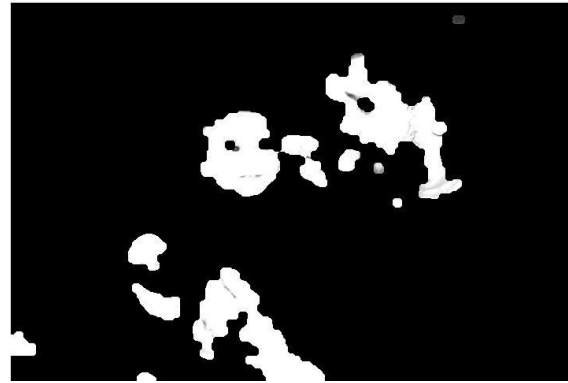
Figure 5.Skin Detection

3. Comments and Conclusion

Acquire a RGB image and apply HSV algorithm for skin detection on it. After skin detection in HSV perform morphological operation with using min and max spatial filters on image. Skin is detected in three different images as shown in figure 4. Simulate these red green blue component images by using "imadd" built in function provided by MatlabR2011a, and the resultant image is shown in figure 5.As shown in table 1 the resultant image has only 10.2% of skin part.

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Bandwidth Enhancement of Microstrip Antenna using Slots and Fractals with Stacked Patches

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Abstract

This paper presents a compact wide band microstrip patch antenna. A U shaped slot is introduced in the ground plane along with a stacked patch having same fractal geometry on both patches to enhance the bandwidth. The bandwidth of the basic patch antenna was just 3.1%.While the bandwidth of our proposed antenna is improved up to 25% in the range of 4.8 to 6.2 GHz with a good efficiency of 79%. Another advantage of our proposed technique is that our antenna works on multiple bands in the frequency range of 4.8 to 6.2 GHz and from 7.3 to 7.5GHz which is suitable for WiMax, WLAN and Satellite communication.

Keywords

WLAN, WIMAX, Bandwidth, Microstrip patch antenna, Fractal patch antenna

1. Introduction

From last few decades, the wireless communication has played a very important role in our daily life. This has created a significant research interest in the RF front end and antenna design. The Researchers are striving for wideband, low cost and compact antenna design. The microstrip patch antenna has the potential to fulfill these requirements. It is widely used in wireless communication because of its low profile, light weight and low cost. Besides its favorable attributes, it has a few limitations such as narrow bandwidth and low efficiency.
 Numerous techniques for bandwidth enhancement have been suggested that includes low permittivity substrate design (Kumar and K. Praveen, 2013). The problem associated with using low permittivity substrate is that the antenna size increases. In (Sanyal *et al., 2013*) a shorting pins technique has been investigated but the bandwidth is improved only 13%. The main conflicting issue is that if you increase the bandwidth so the antenna size will be affected. Different slotting techniques are used for bandwidth enhancement. In (Lee et al., 1997) a U shaped slot is used to enhance the bandwidth up to 20%. A V shaped slot has been investigated (Rafi et al., 2004) it has

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been stated that V shaped slot give better result compare to U shaped slot. Other slotting techniques such as E shaped, half U shaped and a defected ground structure is also been investigated (Rana and Deepak, 2014 .For a wide band as well as multiband application a fractal geometry is also been used (Choukiker et al., 2010). Other fractal geometry such as multiple fractal geometry technique and modified square fractal shape using gap coupling technique has been used for bandwidth enhancement (Yadav and khanna, 2014-2015). Band width enhancement is also achieved by using stacked patch antenna (Ansari et al., 2008).

This paper elaborates an innovative technique for bandwidth enhancement of patch antenna. A U shape slot is introduced in the ground plane along with a stacked patch having same fractal geometry on both the patches. Using such techniques our bandwidth is enhanced up to 25% in the range of 4.8 to 6.2 GHz. The proposed antenna is applicable for worldwide interoperability for microwave access, wireless local area network and satellite communication.

2. Antenna design

Our proposed antenna has been designed and simulated in CST (computer simulated technology) microwave studio. First a simple patch antenna has been designed having a length of 16mm and width of 24mm. Fig 1(a) shows that the same dimension used for the ground plane as well then a U shaped slot has been introduce in the ground plane which will enhance the band width. The dimensions of the U shaped slot are shown in table 1.

Fig 1(b) shows the front view of sacked patch antenna in which same fractal geometry on feed patch as well on parasitic patch. Four similar slots cut on all the four sides of the bottom and top patch having same length 8mm and width of 2.5mm which will enhance the band width as well as work on dual band. The FR4 substrate has been used between the feed patch and ground plane and also between the feed patch and parasitic patch as well with a dielectric constant value of 4.3. The bottom dielectric layer has thickness of 2.4mm and upper has 1.5mm as shown in fig 1(c). The coaxial probe method has been used for feeding.

(a)

(b)

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(c)

Fig.1. (a) U slot in Ground Plane (b) Front View of Stacked Patch Antenna (c) Bottom View of Stacked Patch Antenna

Table.1. Dimensions of U Shaped Slot

Parameter	Value
Height of vertical arms U shape slot	7mm
Horizontal length of U shape slot	7.5mm
Width of Vertical and horizontal arms	0.5mm

3. Results and discussions

This section shows the simulated results of different parameters like return loss, impedance bandwidth and radiation pattern etc.

Fig.2. Return Loss of Conventional and Proposed Patch Antenna

Fig 2 shows the return loss of conventional patch antenna is representing by the solid curve while the proposed broad band antenna return loss is represented by the doted curve. The return loss of conventional patch antenna is -12dB while the maximum return loss of our proposed design is -21dB.It is clear from the graph that the conventional patch antenna has a very narrow bandwidth of 144MHz. On the other hand the bandwidth of the proposed design antenna enhances from 4.8

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to 6.2 GHz. The gain of the proposed antenna is 4.77dB at 5GHz and its efficiency is 79% as shown in fig 3.

Fig.3. Simulated Radiation Pattern at 5 GHz

The above discussed results are shown in table 2.

Table.2. Simulation Results of Our Proposed Design Antenna

Antenna type	Resonance frequency (GHz)	BW (MHz) at reference level (- 10dB)	RL (dB)	Efficiency
Conventional patch antenna	4.6	144	12.3	52%
With U shape slot in ground plane	5.4	698	-23	85%
With fractal staked patch	5.4 7.4	1370 218	-15 -17	79% 53%

Fig 4 shows the current distribution path of the proposed design antenna which shows the current is distributed near the U shaped slot and along the fractal geometry.

Fig.4. Current Distribution Path of Proposed Antenna

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Fig 5, 6 shows the simulated results of radiation pattern for both elevation and azimuth plane at frequency 5GHz, and 5.5GHz. Our proposed antenna has a 3dB beam width of 125^0 and 112^0 for elevation plane at frequency 5GHz and 5.5GHz. While for azimuth plane the 3dB beam width of 169^0 and 258^0 at frequency 5GHz and 5.5GHz.

(a)

(b)

Fig.5. Elevation Pattern at Frequency (A) 5 GHz (B) 5.5 GHz

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(a)

(b)

Fig.6. Azimuth Pattern at Frequency (A) 5 GHz (B) 5.5 GHz.

4. Conclusion

The results for simulated patch antenna with U shaped slot in the ground plane and added stacked patch with fractal geometry show the bandwidth enhancement. The simulated results for the given antenna show wideband operation in 4.8 to 6.2 GHz and a gain of 4.77 dB. Our proposed designed stacked patch antenna is applicable for WLAN (802.11a), WiMaX and satellite communications covering a range of 4.8 to 6.2 GHz.

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Home Energy Management System to improve Demand Response Intelligently

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Abstract
In smart grid (SG) a home energy management (HEM) system play an important role which can permit demand response used for domestic consumers. In this paper a smart HEM system is described for handling great power feeding appliances for demand response (DR) study. Domestic load achieves with predetermined priority and assurance on suggested set of rule and total power feeding should below definite level. To show the application of suggest set of rules for DR at appliance level a simulating device is established. Determines in the present paper that device can be use to consider DR capabilities for domestic consumers

Keywords Demand side management, smart grid, Home energy management

1. Introduction

Over The Previous some years, electric power systems have met more frequent strain situations by cause of electricity demand increases [1]. During severe peak times system stress condition is due to outages on transmission lines. Series failure and large area power outages are possible due to such action. DR has intended to trade by means of such surprising supply bound Actions by system loads control, whereby recapture Equilibrium among electricity demand and supply [2].transfer load can rise consistency and effectiveness in DR. In USA, several DR procedures are broadly applied by commercial and industrial clients. DR procedure are mostly real-time pricing, direct load control, time-of-use programs [3]. On the other arrow, some of them use time-of-use, serious peak pricing and real-time Estimating procedures. In commercial market DR are established and being functioned by utility, but in present paper we concentrate on domestic customer. EV in domestics market DR can be perform at home to dodge minimization of transformer overloading. [4]. In domestic users background, there are three types of DR mechanization stages , first is hand

operated DR second is half-automated DR and third is completely automated DR [5]. The mainly accepted DR procedure are entirely automated DR that can be followed by HEM. HEM scheme is in charge for observing and dealing the process of inside home applications, and provided that load transferring and coming off corresponding to a quantified group of desires. Diverse set of rules and standards [6],[7],[8],[9],[10] Be able to used, dependent on types of load and requirements of DR procedure existing in several areas. Several Hardware applications of HEM are suggested in [11],[12]. In the literature allots of papers are concentrated on adjusting little power feeding applications, for example coffee maker freezers, illumination, and additional lump loads. Utilization these applications are not accurate for DR because they are not greatly effect on household power feeding. To reduce domestic power feeding best application scheduling are topic of earlier work [9, 10]. But, such arrangement will suffer a holdup time for procedure of each application. Current paper offerings the development of a HEM set of rules for management domestic power severe consumptions. These are: Planetary make cold elements, H2O radiators, garments dryers and EV. There are different varieties of sizes from 3 kW to 4–10 kW. The most excellent part of designed HEM set of rules is the skills to manage nominated applications and to retain the entire domestic power feeding under a certain Boundary, while seeing consumer choices and letting the Consumer further elasticity to work their applications. To show the application of suggest set of rules for DR at appliance level a simulating device is established. General, research results are probable to deliver a vision into the equal of load limitations likely for domestics clients, can be understood as DR abilities in residential Arcades among automatic DR.

2. Related Work

In current several DSM policies have been planned. The main objective of these methods is cost minimization and drop in peak load demand. Demand-Side Management (DSM) tools have recently grew consideration by the scientific community due to their rewards in terms of sensible use of energy and cost decrease[13].One method in housing load management is DLC [14-17] . DLC policy, based on an agreement between the service corporation and the clients, the service is accomplished by means of the service, which can distantly control processes and feeding energy of specific applications in a household. E.g., control illumination, warm air comfort apparatus fridges, and drives. On the other hand, with arising of housing load control and house robotics, consumers' confidentiality can be a main worry and also a wall in applying DLC program [18].For DLC program smart value, where consumers are cheered achieve freely their loads, i.e., by decreasing their feeding at max out hours [19-21].[8], has explained an inducement based energy consumption scheme in order to reduce the demand during peak hours and energy cost. In [10] , an optimal energy feeding setting up design is planned so that to reduce the PAR and also to reduce the waiting time of each domestic application action. The core goal of these keys is to reduce the electricity prices while assuring the users' relief; this can be attained through the implementation of methods based on optimization models [22] or [23] heuristics, such as Inherited Algorithms [24] and modified Evolutionary Algorithms [25], which are used to resolve more composite designs of the demand management problem.

The paper is organized as follows. Section 2 presents the related work and motivation. Problem formulation is discussed in Section 3, and algorithm along with discussion is described in Section IV. Paper is concluded in Section V.

3. Proposed HEM design

In SG HEM play an important role by connecting utility and company. Most of the user are busy in its own work and have not much time for manually control of load .In this paper given automatically control of load to improve consumer power consumption and utility load curve.

3.1 A Demand Response (DR) Occasion

A DR occurrence is defined as, a period for which the client demand are to be reduced so that to improve the stress of the system. Those consumers who contribute during DR can be up-to-date of the DR circumstance by a noticeable indication from a utility through their smart meters as shown in fig. 1 In our study, we accept the outdoor signal received by HEM system is a procedure of a

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demand reduction request (kW) and duration (hours).there will be a communication between generation and load through utility as shown in fig. 2.

Fig. 1 HEM design
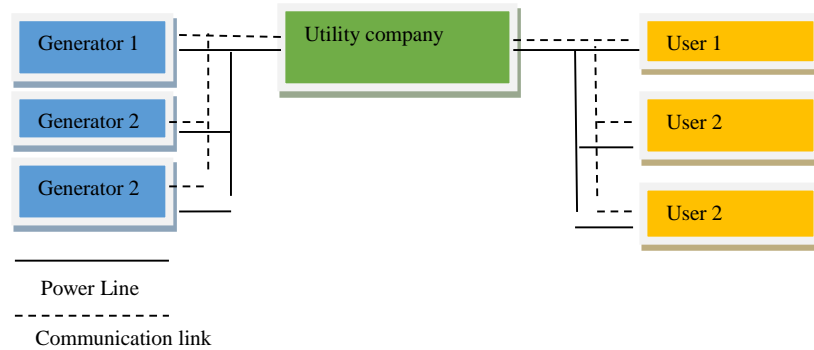
Fig. 2 Considered Demand-Side Management (DSM) scenario [26]

3.2 Load Priority and Client Relief Liking

The primary stage earlier the designed HEM algorithm be able to run is on behalf of an owner to established load importance and relief favorite. Some examples of load precedence and fondness setting is revealed in Table 1. For this household revealed, that the water radiator is of the maximum priority. These are tailed due to the planetary cooling component, the clothing dryer, and also EV. Relieve level situations could be stated for each application. For the water warmer, the warm water temperature first choice is fixed. For i.e., 115-130' .For the planetary cooling component room temperature fondness can be affirmed, e.g., 72 – 80 f. For dryer, a holder can need its entire instant, extreme heat coil OFF period and least heat coil ON spell.

Appliance	Load priority
Water boiler	1
Planetary cooling	2
Textile dryer	3

Table 1: Selection criteria

3.3 HEM Control Policy due to Application Category

The demand boundary has the significant feature in order to control the position of applications in algorithm. Destruction in demand limit will effect in turn off particular applications along with their importance. Client fondness situations be acceptable to be violated from least significant loads to a maximum significant ones so that to assurance the wished demand limits.

3.4 DR Permitted Load Models
DR allowed load types of a WH, a planetary cooling, an outfits Dryer, and an EV are executed according to [15]. This is to permit us to investigate the influence of the planned set of rules on overall home power feeding and application super visualization. Load model high spot are summarized below.

3.4.1 Electrical Water Heater Load Model
 The power feed Of the Water Heater is at its evaluate power when   it is ON, and Zero when OFF. See (5*).*

$$Pwh = Pwh * Swh$$

Pwh Water Heater power feeding in time interim
Swh HEM control signal for Water Heater.0=off 1=on

3.4.2 Planetary Cooling Load Model
Planetary cooling is at its rated power when ON and as soon as it is OFF power will be zero (6).

$$Pac = Pac * Sac$$

Pac power use in time interval by AC
Sac HEM control signal for AC .0=off 1=on

3.4.3 Garments Dryer Load Model
Power feeding of the distinctive clothes dryer contain motor portion and warming coils. Using equation (7), the power valued of the clothes dryer is intended for each time interim.

$$Pcd = Ph * Scd + Pm * Tcd$$

Pcd power used in time period
Ph rated power
Pm   motor rated power
Scd for AC *HEM* control signal.0=off 1=on

4. Methodology
A smart grid is not an only promotion to the electric transmission and distribution systems but a whole renovation with 21st century organization, metering and communications skills. Smart grid technologies takings gain of many progressions used nowadays, with geographic data systems and wireless communication. Individually part of the smart grid takes its own system and social welfares with the objective of refining how electricity is carried and used. The smart grid contains four main mechanisms: advanced metering infrastructure, advanced distribution actions, advanced transmission processes and advanced asset administration. With these technology developments, the electrical needs of Pakistan can be met with greater efficiency and consistency.

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Generated power

controller

computational engine

local controller

clients

intelligent load sheeding
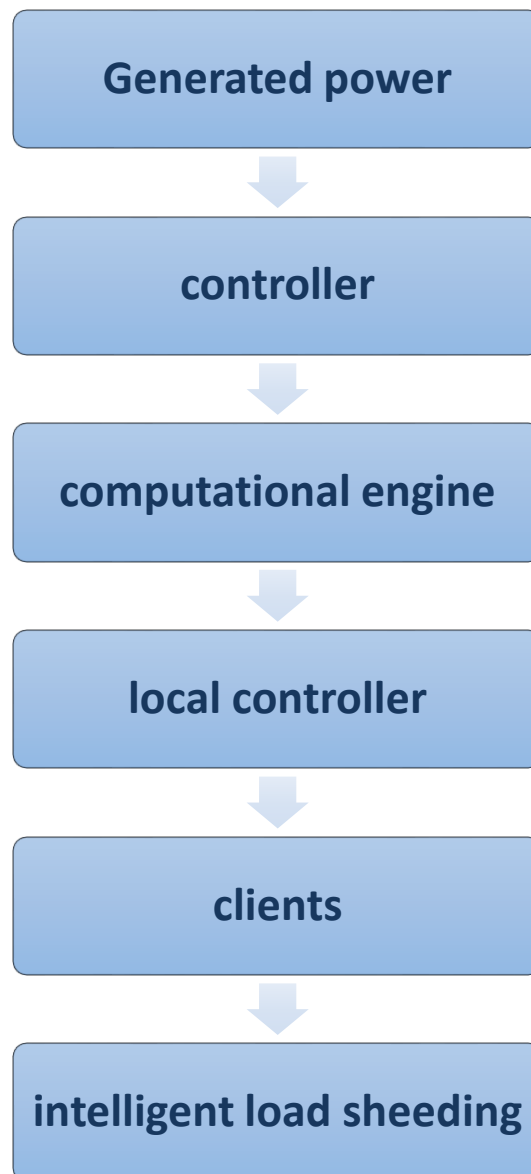
Fig. 3 flow chart

5. Implemented Network in Proteus

In this paper two controller is define one is for load control acting as a client and other is for generation control acting as a server. Controller and load are connected through double pole double through (DPDT) relay. Loads to be shed are decided by Arduino controller and this useful information is carried to clients which has its own local controllers. Priority of loads has been set according to priority of consumer. Circuit has been implemented in proteus as shown in Figure 3. To lead that very simple idea of ILS, the work basically comprises of four major systems. And these networks were made in Proteus. First of all the very basic system was a manual control network that has been developed in Proteus and two controllers with defined programming distributing generated power actually between three loads was discussed. Load was connect and disconnect according to the set priority as shown in table 2.

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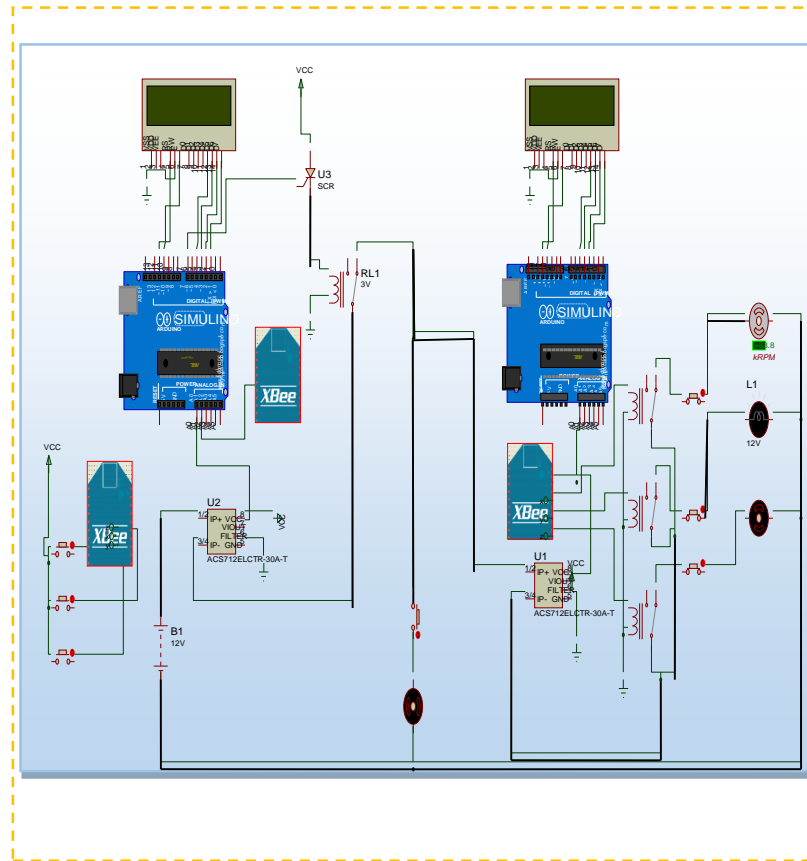
6. Simulation and Results

The following Figure 5 explain the power generated at start there will be some transient and then after sometime it's become steady b/c the system can only accept constant power. Power is varying then system will not be able to take decision. It also shows that it takes a very small time to for constant output being produced. Output will be varied if source voltage is varying.
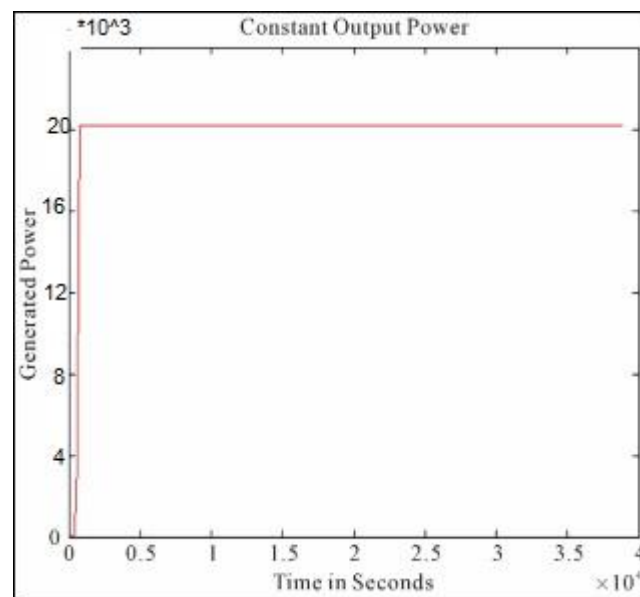
Fig.6 Generated power

Conclusions

This paper give us the modest idea about Smart Grid where the load can manage through intelligent computerize system. We did the intelligent load management, which moderate our old conventional system. . Domestic load achieves with predetermined priority and assurance on suggested set of rule and total power feeding should below definite level. The planned HEM set of rules consider both priority and customer satisfaction. DR has intended to trade by means of such surprising supply bound Actions by system loads control, whereby recapture Equilibrium among electricity demand and supply.

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A Simple and Efficient Two Dimensional Redundancy Check for Error Detection

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Abstract

Data communication is the transmission of digital data between devices or nodes. During transmission the data can be lost and unwanted error can be occurred, which can corrupt the information bits. In communication system there are two types of errors single (random) bit error and burst (multiple bits) error which can corrupt the binary data in digital system. Various error detection techniques such as vertical redundancy check (VRC), longitudinal redundancy check (LRC), checksums, cyclic redundancy checks (CRCs) and cryptographic hash functions are used to check either error is occurred or not. In this paper a robust method for error detection is presented, in this method binary data is arranged in square pattern which has equal numbers of rows and column. Then calculate the sum of columns and parity of rows. Then it perform NOR operation on column sum and parity of rows and transmit it with binary data. This method efficiently detects the single and multiple bit errorsby using less redundancy bits. Lastly, conclusion and future work is highlighted.In this research work the reliability of this method is also compared with other methods.

Keywords Error detection, multiple bit error, Single bit error, 2D parity check, checksum

1. Introduction

In data communication system when binary data istransmitted from transmitter to receiver side the errors can be occurred during transition. Error can convert binary 0 into 1 and vice versa [1]. Two types of error single bit and burst can occur in data bits. Single bit error alters only one bit and does not change the others or nearby bits, while in burst error more than 2 bits can corrupt [2-3]. For error detection different types of algorithms are used such as vertical redundancy check (VRC), longitudinal redundancy check (LRC), checksums, cyclic redundancy checks (CRCs) and Additive redundancy check (ARC). Error detection algorithms append parity bits at the transmission node and recalculate the parity of data at receiver side [4-6]. If the parity of transmitted bits is not equal to received bits so it mean an error is occurred. In this research paper a robust method for error detection is proposed, which showed better results than other existing error detection techniques [7-8].
In this method less redundancy bits can cover more information bits so it utilize less bandwidth and processing time. It simply based on addition and parity calculation. This method calculate the parity of each row and then perform NOR operation with sum of columns. Moreover in this research paper a comparison of different error detection techniques have been discussed and their shortcomings are also highlighted. The comparison is based on how many errors each technique can detect, number of parity bits and complexity.
The rest of this research paper is organized as follows. In section 2, related work is discussed briefly. Section 3 describes the methodology of some existing techniques. While section 4 describes

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the analysis and the discussion part is covered in section 5. Finally, in section 6 conclusion and future work is discussed.

2. Related work

The 2D parity check arrange the data bits in matrix form (m*n) then apply the parity check in each row and column wise. It apply the even parity in each row of packet (this method is known as VRC method) and then again apply parity check in column wise. Apply the even parity at each column is known as the LRC. It transmit the row parity and column parity along with information bits. At receiver side system again calculated the parities, if the transmitter side parity is equal to receiver side parity so it mean there is no error occurred during the transmission else there is an error occurred. In 2d parity check the single bit error effect the 2 parities one is row parity and second is column parity and if two bits are erroneous then again two column parities effected but if there are three errors in data or three bits are corrupted then four parities will effected and this method is failed to detect the four errors in similar positions of row and columns like if bit 2 and 3 is erroneous in 1st row and there are 2 more bits at similar positions which are erroneous in 2nd row then 2d parity is enable to detect the error [9-10] .

VRC arrange the data in row format and then apply the even parity on it and the result of this parity make a redundant (n1) bit and send this redundant (n1) bit with binary data. At receiver side system again apply even parity and check the redundant bit (n2). If n1=n2 than there is no error in data otherwise data is erroneous. This method is efficient for single bit or if the total number of bits changed are odd [11-12].

Similarly LRC organize the binary data in matrix form (m*n) and the n apply the parity check at columns wise. It get the redundant bits and transmit theseredundant bits with original binary data. At receiver side LRC again repeat the same process and calculate the redundant bits of received data. Then it compare the redundant bits of both transmitter side and receiver side if they match so it mean there is no error occurred otherwise data is erroneous. This method also fail to work when in a column 0 is changed to 1 and 1 is changed to 0 at same time [14].

Checksum is most widely used error detection technique, it add the binary data bits in column wise. Then take the complement of sum (checksum) and transmit it along information bits. At received side it add the redundant bits with the sum of data bits, if the result is zero then it accept the data otherwise reject the data and considered as a corrupted data [13].

In [15] a technique was used which is based on binary data .Suppose there are N number of bits at transmitter side, count the number of 1's and 0's in input binary data and insert a flag at total number of (0's+1) position. Data is transmitted and at receiver side count the number of bits before flag and name it n1 after that drop the flag and count the number of 0's and name it n2 .If n1 is equal to n2 than there is no error otherwise data is corrupted.

In (ARC) Binary data which will be sent at transmitter should be in square form and if the number of bits are not in squared form then append 0's after most significant bit to make it squared and name it (A). Add the number of bits in column and name it (sum A). After that take the transpose of data bits and name it (A'). Add the number of bits of column and name it (Sum A').Now calculate ARC by adding (Sum A + Sum A') and send this ARC bits along with binary data bits. At receiver side repeat the same procedure and calculate ARC bits and compare it with the transmitter side ARC if both are equal then there is no error otherwise bits are corrupted. . This method is more effective as compare to other methods. In this method small amount of redundancy bits can accommodate more binary data bits [16].

3. Methodology
3.1 Transmitter site:

Let us suppose the length of binary data is n square bits, if number of bits are not squared value then append 0's at most significant bit to make it squared after that make square (n ×n) pattern and m is the total number of bits and order of matrix is squared root of m and name it A

Now find the redundancy bits by following 3 steps

1) Add all the pattern of columns A and get the Sum and Check the carry flag

2) Store the sum in row matrix S.

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3) Calculate the event parity of all the rows and save it in a row matrix P.
4) Perform NOR operation on S and P and the result will be redundancy bits which will transmit with information bits.

Information bits=0101 0010 1011 0101
Step 1: Arrange the data bits in n x n square matrix.

$$
\begin{array}{ccccc}
0 & 1 & 0 & 1 & P1 \\
0 & 0 & 1 & 0 & P2 \\
1 & 0 & 1 & 1 & P3 \\
0 & 1 & 0 & 1 & P4 \\
\hline
\end{array}
$$

$$
\begin{array}{ccccc}
C & s4 & s3 & s2 & s1 & P5
\end{array}
$$

Step 2: Find the parity of all rows and find the sum of all columns and monitor carry flag.

$$
\begin{array}{ccccc}
0 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 \\
1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 \\
\hline
0 & 1 & 1 & 1 & 0
\end{array}
$$

Carry bit is 1.

Step 3: perform NOR operation on values of row parity with sum of columns data bits, also include carry bits which is S5. The result will be redundancy bits for proposed method

$$
\begin{array}{ccccc}
S5 & S4 & S3 & S2 & S1 \\
P5 & P4 & P3 & P2 & P1 \\
\hline
R5 & R4 & R3 & R2 & R1
\end{array}
$$

After applying NOR operation the redundancy bits are 01000.

$$
\begin{array}{ccccc}
1 & 0 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 \\
\hline
0 & 1 & 0 & 0 & 0
\end{array}
$$

Now transmit the binary data along with redundancy bits. The graphical representation of Transmitter side process is shown in Figure 1.

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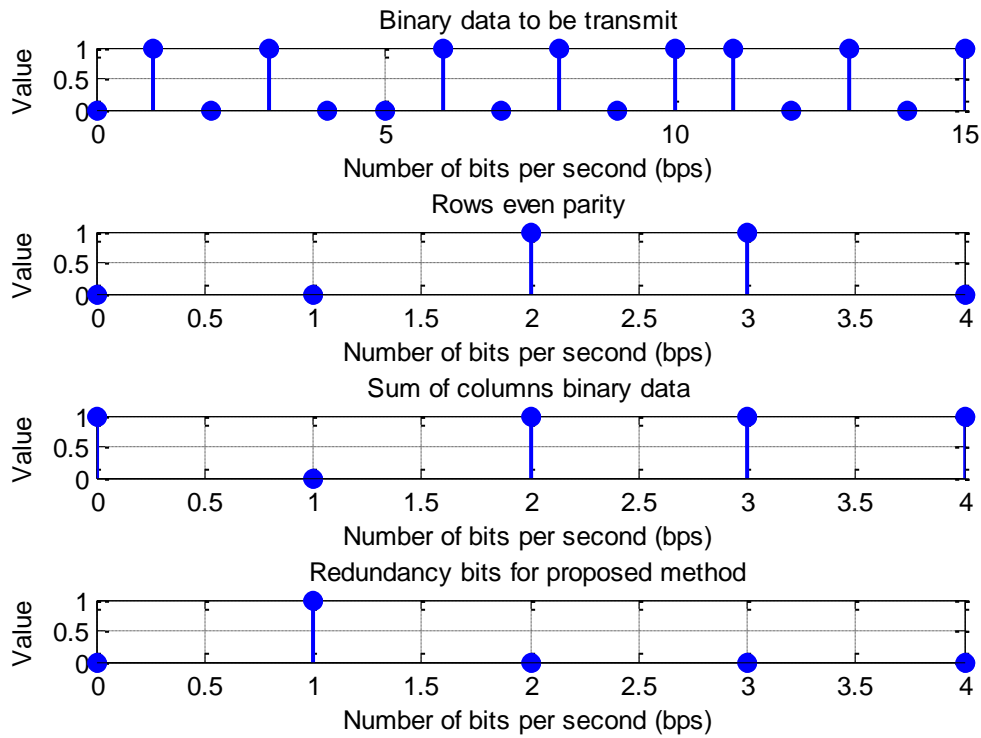
Figure 1. The graphical representation of transmitter side computations

Receiver site:

At receiver site binary data is received along redundancy bits.To check either received data is correct or not again calculate redundancy bits by following same steps as followed at transmitter site. And NOR the columns entries of matrix C with the corresponding entries of row matrix R accept the bit of carry flag

If the result of corresponding entries of NOR is **zero** then there is no error in the data otherwise data is erroneous. The graphical representation of receiver side process is demonstrated in Figure 3.

Let us consider an error has been occurred at bit location 5th, in below string red color is showing presence of error. Now we apply proposed method to check either it detect the error nor not.

Received information bits = 0101 1010 1011 0101 0 1 0 0 0

Received redundancy bits = 0 1 0 0 0

Step 1: Arrange the data bits in n x n square matrix.
Step 2: Find the parity of all rows and find the sum of all columns and monitor carry flag.

$$
\begin{array}{ccccc}
0 & 1 & 0 & 1 & 0 \\
1 & 0 & 1 & 0 & 0 \\
1 & 0 & 1 & 1 & 1 \\
0 & 1 & 0 & 1 & 0 \\
\hline
1 & 1 & 1 & 1 & 1 \\
\end{array}
$$

Carry bit is 1.

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Step 3: perform NOR operation on values of row parity with sum of columns data bits, also include carry bits which is S5. The result will be redundancy bits for receiver side.

After applying NOR operation the redundancy bits are 00000.

$$
\begin{array}{ccccc}
0 & 0 & 1 & 0 & 1 \\
1 & 1 & 1 & 1 & 1 \\
\hline
0 & 0 & 0 & 0 & 0
\end{array}
$$

Redundancy bits at receiver side = 0 0 0 0 0
Redundancy bits at transmitter side = 0 1 0 0 0

Compare the redundancy bits of both transmitter and receiver side, if they are equal so there is no error occur else an error has been occurred.

$$0\ 0\ 0\ 0\ 0 \neq 0\ 1\ 0\ 0\ 0$$

In this case the redundancy bits of transmitter and receiver side are not equal, it showed the presence of error. Figure 2. Illustrates the graphical representation of transmitter and receiver side redundancy bits, from the graph it can clearly observe that transmitter side redundancy bits are not equal to receiver side redundancy bits, so it shows occurrence of error.
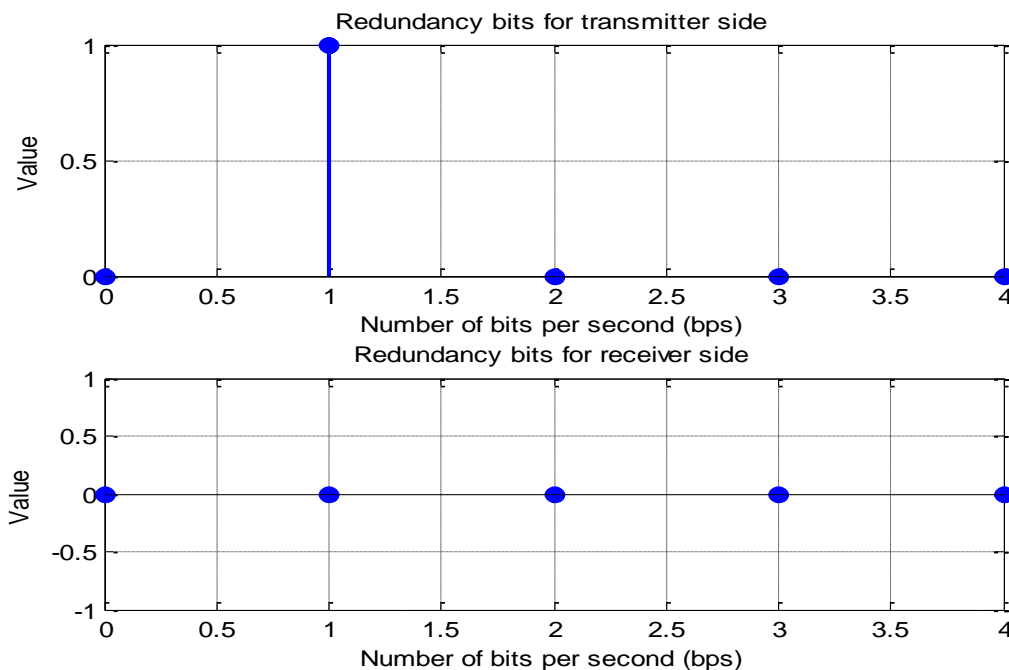
Figure 2. The graphical representation of transmitter and receiver side redundancy bits

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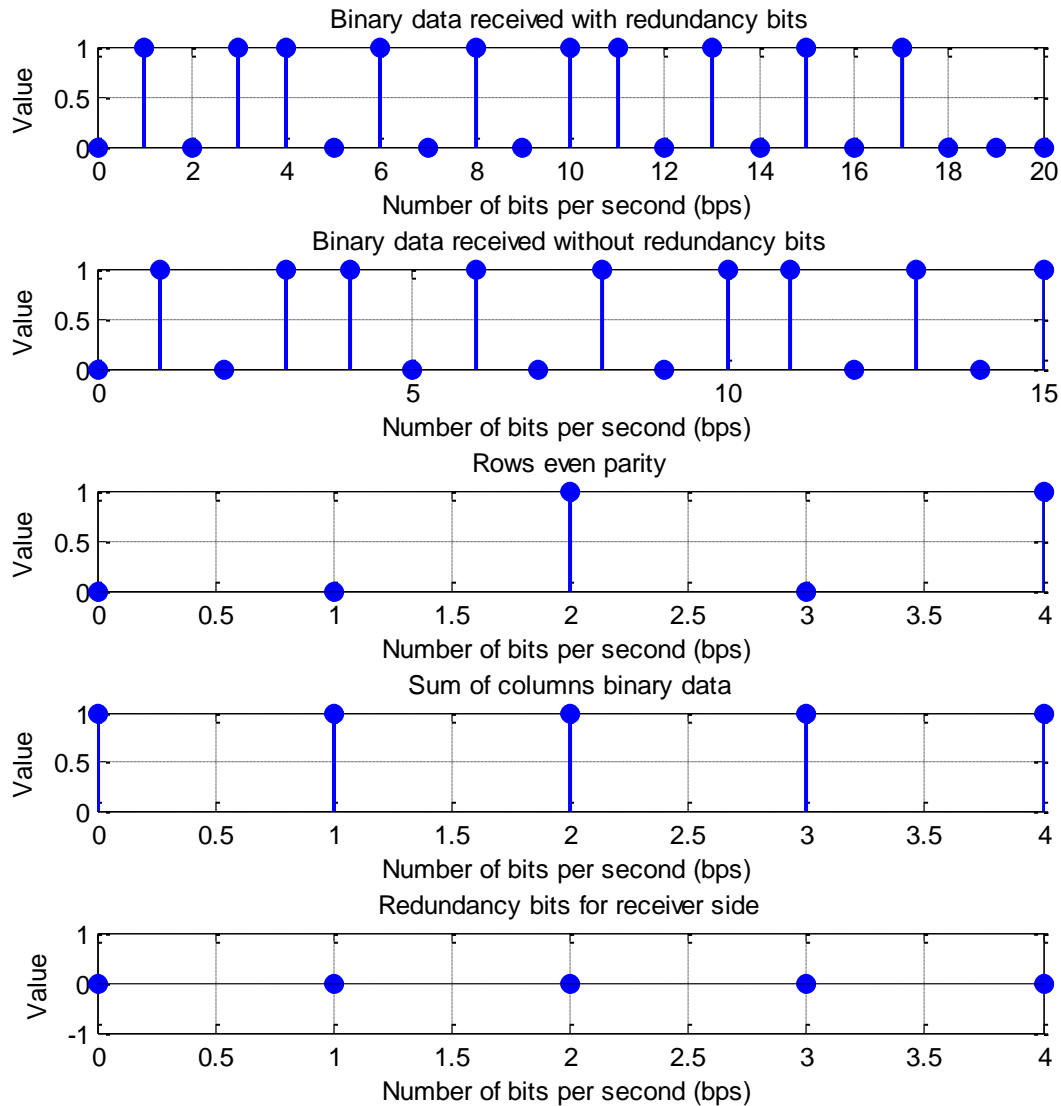
Figure 3. The graphical representation of receiver side computations

4. Analysis

If number of information bits are not in squared pattern then append zero's at most significant location to make it squared pattern.

Number of information bits= N^2
Number of redundancy bits= $M = N+1$
Total no. of (data bits + ARC bits) = $M + N^2$

Code rate = $\dfrac{No.\ of\ data\ bits}{No.of\ \text{(data bits + redundancy bits)}} = \dfrac{N^2}{M + N^2}$

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5. Discussion

Comparison of proposed method with other existing methods shows that it can easily detect all those errors which other methods cannot detect. VRC used to detect single bit error it can only detected burst error when total number of changed bits are ODD. When number of bits changed are even VRC cannot detect error. LRC can detect single bit and burst error. If in a same column 0 is changed to 1 and vice versa LRC can't detect it. Checksum is very effective error detection method, if bit inversion in one segment is balanced by bit inversion in another corresponding segment then Checksum fails to detect error. In 2D parity check, parity of individual column and row is calculated.

For a long binary data it takes more redundant bits. If even number of 0's swap with even number of 1's and vice versa, then 2D parity check fails to detect errors. While Additive Redundancy Check (ARC) is based on basic arithmetic including carry operation (Addition). It is more effective than other methods.

It can easily detect those errors which other methods fail to detect. Comparison of proposed method with other methods is given in Table 1.

Table 1. Comparison of proposed method with some existing techniques

Method Name	Original Binary data	Corrupted data	Error detection
VRC	01101001	01110001	NO
LRC	01101001	01101011	NO
	10110011	10110001	
Checksum	01101001	01101011	NO
	10110011	10110001	
Proposed method	01101001	01101011	YES
	10110011	10110001	

6. Conclusion

There are different methods are available for the error detection and correction. Every method has its own advantages and disadvantages. The efficiency of these methods are different from each other. We have also discussed about the performance of proposed by comparing it with the existing Methods. In this paper a simple error detection technique is proposed, its efficiency is calculated on different types of errors i.e. single bit error, two bit error and burst error and also we include carry bit in it.It takes less redundancy bits to cover more data bits which mean this method is more efficient than other methods, this is one of its advantage over all existing error detection methods. For future work it is recommended modify this method for error correction purpose.

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Load Frequency Control of Micro Hydropower Plant Using Fuzzy Controller

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Abstract

This paper presents the design of a fuzzy controller for the load frequency control of micro hydropower plant. Micro Hydropower Plant (MHPP) has been classified as one of the most efficient renewable energy source.Most of the northern rural areas of Pakistan are not connected to the main supply grid, hence the installation of MHPP in such areas are very important. MHPP do not need any sophisticated grid system, thus the total installation cost is very low. The only problem MHPP faces is the variations in consumer loads;which results in serious problem of frequency deviations. A self-tuning fuzzy PID controller is proposed to nullify the load variations, so that to produce a minimum impact on the power system frequency. The efficiency of proposed controller is confirmed by various results even at worst load transitions. For a load variation of about 70% in a system incorporated with the proposed fuzzy controller; results inan average settling time of 6 seconds and an overshoot of 23%, while for conventional PID controller; the corresponding values are 12 seconds and 29%.

Keywords: Renewable energy, micro hydropower plant, PID controllers, fuzzy logic

1. Introduction

The demand of cleanenergy is increasing with the passage of time, as the fossil fuel based energy sources causes numerous environmental problems (Pfenninger and Keirstead, 2015). In the early days, hydropower was just used in sawmills, textile mills, trip hammers etc. It is assumed that MHPP is being the most ancientrenewable energy source. In developing countries, micro hydropower plants are used to generate electricity in the rural areas (Vyas *et al*., 2015).

The intake water flow to the turbine gate can be adjusted according to the generator connected load using mechanical or electro hydraulic governors (Salhi *et al*., 2014). Mechanical or electro hydraulic governors are replaced by the most advancedservo motor. In the proposed research work, a PID controller is used to control the servo motor. A most common method known as Zeigler-Nicholas method is used for tuning of PID controller. Similarly other methods like fuzzy logic tuning, auto-tuning and neural network are also used for PID tuning (Sukede and Arora, 2015).

The proposed MHPP frequency controller considers the consumer load variations at each and every operating point. It has been stated in previous studies that conventional PID controller with fixed tuned parameters could not efficiently handle the effect of frequency variations at every operating point. Such frequency variations are due to abrupt changes in both the consumer load and incoming water flow. The controller self-tuning mechanism at every operating point should be employed to handle such problems.

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This Paper isdistributed in five sections. The first section has covered the introduction. Section II deals with the mathematical modeling of micro hydropower plant. Section III explains the design of fuzzy logic controller. Simulation results obtained using Matlab-Simulink and results discussions are explained in section IV. Conclusion of the research work is presented in section V.

2. Mathematical modeling

Design of MHPP control system requires the mathematical modeling of its various components. Initially all the linear differential equations of MHPP components are derived. The same equations are transformed into each MHPP component transfer functions (Naghizadeh*et al*., 2012).

2.1 Servo Motor Modeling

The function of a servo motor is to control the flow of incoming water through the penstock. The water passing the gate and reaching the turbine blades is in accordance with the generator connected load. Whenever the connected load increases, the servomotor allows more water, so that generator meets the requirement of increased load. In the opposite scenario of decreasing load, the servo motor decreases the flow of incoming water and hence the electricity generation decreases (Kundur, 1994).

$$G(s) = \frac{1}{(1 + sT_e)} * \frac{1}{(1 + sT_m)} \tag{1}$$

Servo motor in the proposed control system has electrical time constant (T_e) of 0.01sec and mechanical time constant (T_m) of 0.1sec. The servo motor final transfer function is as follow.

$$G(s) = \frac{1}{0.001s^2 + 0.11s + 1} \tag{2}$$

2.2 Turbine Modeling

The mathematical model of a turbine is represented by the division of turbine mechanical output power change (ΔP_m) and the change in gate position (ΔG). The mathematical form is represented as follow (Kundur, 1994).

$$\frac{\Delta P_m}{\Delta G} = \frac{1 - T_w s}{1 + 0.5\,T_w s} \tag{3}$$

Water starting time (T_w)values ranges from 0.5 to 4.0 secondsfor full load (Kundur, 1994).Using plant actual data,T_w is calculated to be 1.41seconds (Rukh, 2014). The transfer function of turbine model in final state is as follow;

$$\frac{\Delta P_m}{\Delta GA} = \frac{1 - 1.41s}{1 + 0.705}$$

2.3 Generator Modeling

The synchronous generator modeling can be derived from swing equation in terms of electrical power (P_e) and mechanical power (P_m). The following equation elaborates the rotor dynamics (Kundur, 1994).

$$2H\frac{d\Delta\overline{w_r}}{dt} = \Delta\overline{P_m} - \Delta\overline{P_e}$$

Where (H) represents generator inertia constant and (w_r) represents rotor angular velocity. With the Laplace transformation;

$$2Hs\Delta\overline{w_r} = \Delta\overline{P_m}(s) - \Delta\overline{P_e}(s) \qquad (4)$$

The composite consumer load is comprised of frequency dependent and non-frequency dependent load and is described as

$$\Delta\overline{P_e} = \Delta\overline{P_l} + D\Delta\overline{w_r} \qquad (5)$$

Substituting Equation (5) in Equation (4), thetransfer function representing generator and load is given as follow.

$$\frac{\Delta\overline{w_r}(s)}{\Delta\overline{p_m}(s) - \Delta\overline{p_l}(s)} = \frac{1}{2Hs + D}$$

The inertia constant of the generator having speed above 200rpm are in the range of 2 to 4. In the proposed control system, the value of inertia constant is assumed to be 2.5 and the load damping constant to be 1.5 (Kothari and Nagrath, 2011).Hence the final transfer function model of the generator along with the load is given as follow.

$$\frac{\Delta\overline{w_r}(s)}{\Delta\overline{p_m}(s) - \Delta\overline{p_l}(s)} = \frac{1}{5s + 1.5}$$

3. Fuzzy Logic Controller

In the proposed control system, the method used for initial tuning of PID flow controller parameters is known as Ziegler-Nichols method (Yousef, 2015). The initial PID parameters (k_p^*, $k_i^*$and k_d^*) are 2.4264, 0.8886 and 1.6563 respectively. Fuzzy logic controller readjusts these initial PID parameters for every operating point, which ultimately improves the system output response. The numbers of fuzzy controller inputs are chosen to be only two; the first one is error (e) and second one is change in error (Δe), while there are three system output, i.e. ΔK_d, ΔK_i and ΔK_p.

$$K_d = \Delta K_d + k_d^*$$

$$K_i = \Delta K_i + k_i^*$$

$$K_p = \Delta K_p + k_p^*$$

Where k_d^*, k_i^* and k_p^* represent the initial tuned PID flow controller parameters, which will be readjusted for each and every moment by fuzzy controller outputs ΔK_d, ΔK_i and ΔK_p. The final parameters K_d, K_i and K_p will run the whole power system.

The numerical input variables (e and Δe) are converted to linguistic variables by seven fuzzy sets. Which are High Positive (HP), High Negative (HN), Medium Positive (MP), Medium Negative (MN), Low Positive (LP), Low Negative (LN) and Zero (Z).This conversion is called the fuzzification process. The fuzzy membership functions of input and output parameters are displayed in figure 1 and figure 2 respectively. A rule table defines the effect of input variables upon output variables. This is purely based on the operator personal experience of MHPP operations.

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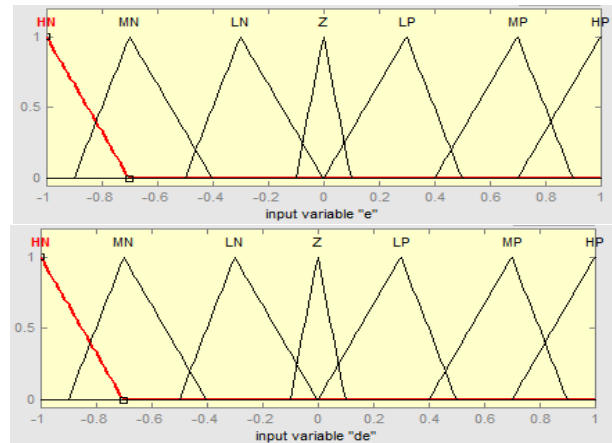
Figure 1: Fuzzy controller input error (e) and change of error (Δe) Membership functions
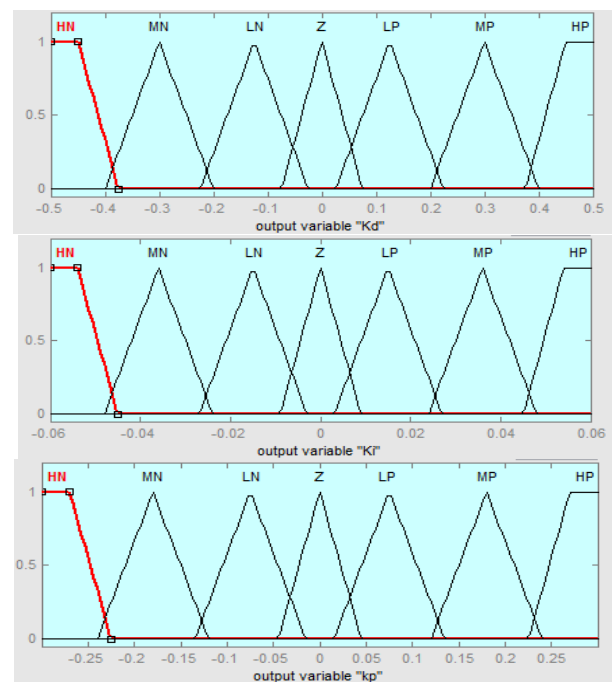
Figure 2: Fuzzy controller output (k$_d$, k$_i$, and k$_p$) Membership functions
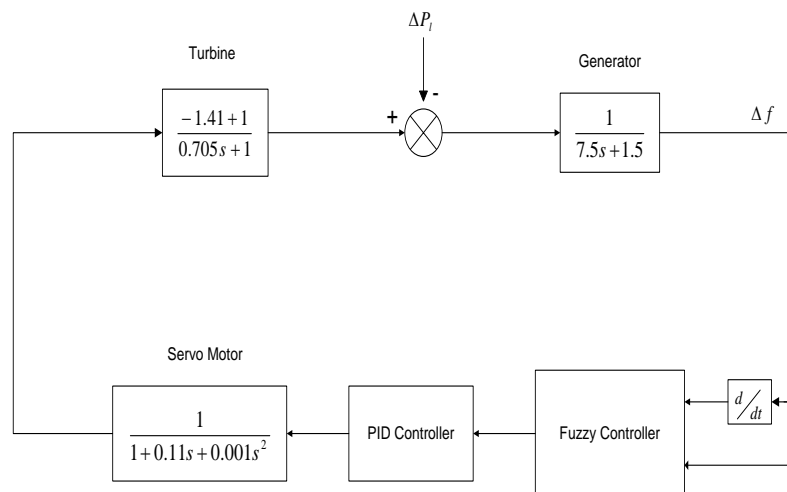
Figure 3: MHPP incorporated with fuzzy logic controller

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Figure 3 presents the proposed control system incorporated with PID-Fuzzy controller along with the transfer function model of servo motor, turbine and generator.

The output of each and every defined rule is obtained by a method known as fuzzy inference method. The most common inference method is the MAX-MIN method. Centroid de-fuzzification method is used for the transformation of fuzzy values into output crisp values. The actual system operates through these crisp values.

4. Simulation Results and Discussion

This research work is being performed to develop an advance controller that can easily handle the drastic load conditions of MHPP. The simulation results of the proposed control system is divided into two phases; first phase is about simulation results of conventional PID controlled MHPP model, while the second phase demonstrates simulation results of MHPP model incorporated with fuzzy logic controller.

The simulation results of MHPP model is best observed, when MHPP is in its steady state, and a sudden load variation is applied at time, t = 60seconds.The simulation results are summarized in table 1 and table 2 for a consecutive load rejection and acceptance of 70% respectively.

Figure 4 reveals that the worst load rejection of 70% is efficiently handled by the Fuzzy controller, and the frequency deviations reaches the settled zone in 7.12 seconds while the overshoot is limited to only 21.89%.In case of conventional PID controller, the corresponding settling time value is 12 seconds and overshoot is 28.86%.As the frequency deviations reduced to zero, hence during operation, the MHPP model remained stable for both the controllers. Furthermore the frequency deviation curve of Fuzzy controlled MHPP model is rather more stable in the terms of fewer and low amplitude oscillations.

Table 1: MHPP results with 70% load rejection

Controller	Overshoot	Settling time
Fuzzy logic controller	21.89%	7.12 sec
PID flow controller	28.86%	12 sec
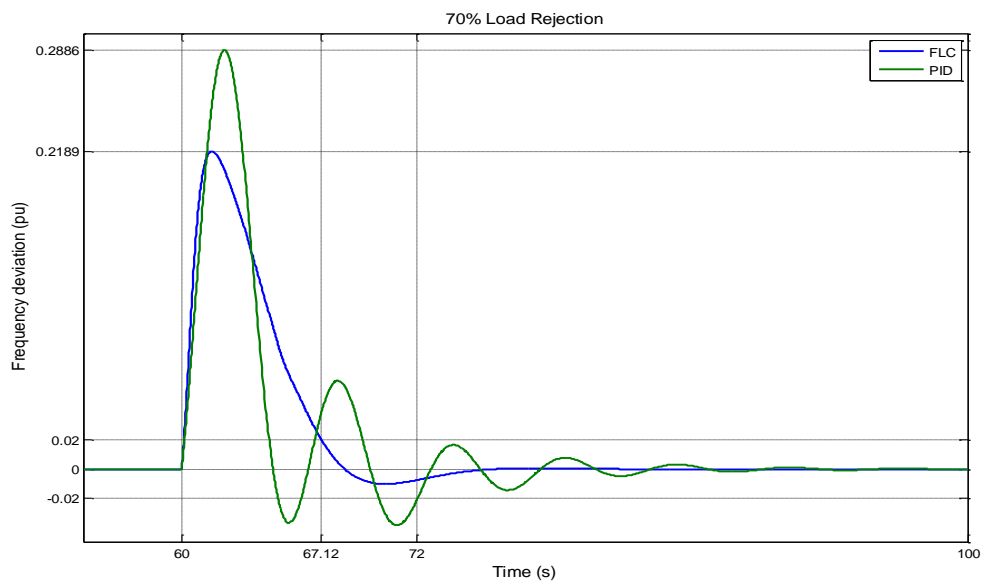
Figure 4: Frequency response for 0.7 p.u load rejection

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The simulation results of MHPP for 70% load acceptance is summarized in table 2, while the step responseis shown in figure 5. Here it can also be confirmed, that Fuzzy controlled MHPP model gives very efficient and reliable results as compared to Conventional PID controlled MHPP model.

Table 2: MHPP results 70% load acceptance

Controller	Undershoot	Settling time
Fuzzy logic controller	23.77%	5.55 sec
PID flow controller	28.86%	12 sec
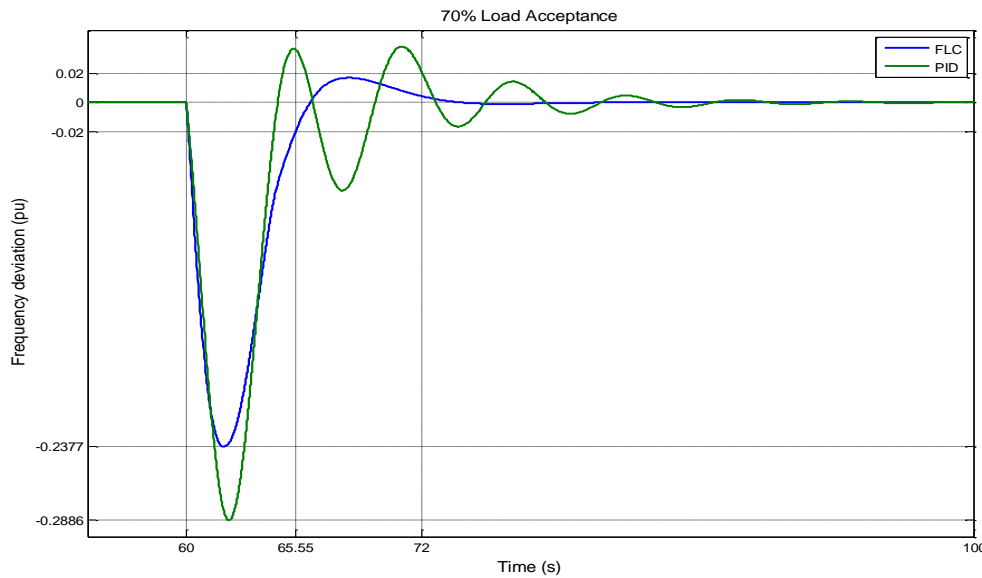
Figure 5: Frequency response for 0.7 p.u load acceptance

5. Conclusion

This paper presented the design of a Fuzzy controller, that can tunes the PID controller parameters online, so that the frequency deviation of MHPP model remains in a stable state for any kind of load variations.

First of all the MHPP components were individually modeled and their transfer functions were obtained. Later on, a fuzzy controller was designed and a lot of simulations were performed for achieving the most efficient membership functions regarding their quantity, shape and distribution range. Lastly the MHPP was simulated for some load variations and the results were obtained.

Unlike Conventional PID controller, all the simulated results verify that load frequency deviations of micro hydropower plant could be efficiently controlled by fuzzy controller.

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Bandwidth Enhancement of Microstrip Antenna using Slots and Fractals with Stacked Patches

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Abstract

This paper presents a compact wide band microstrip patch antenna. A U shaped slot is introduced in the ground plane along with a stacked patch having same fractal geometry on both patches to enhance the bandwidth. The bandwidth of the basic patch antenna was just 3.1%.While the bandwidth of our proposed antenna is improved up to 25% in the range of 4.8 to 6.2 GHz with a good efficiency of 79%. Another advantage of our proposed technique is that our antenna works on multiple bands in the frequency range of 4.8 to 6.2 GHz and from 7.3 to 7.5GHz which is suitable for WiMax, WLAN and Satellite communication.

Keywords: WLAN, WIMAX, Bandwidth, Microstrip patch antenna, Fractal patch antenna

1. Introduction

From last few decades, the wireless communication has played a very important role in our daily life. This has created a significant research interest in the RF front end and antenna design. The Researchers are striving for wideband, low cost and compact antenna design. The microstrip patch antenna has the potential to fulfill these requirements. It is widely used in wireless communication because of its low profile, light weight and low cost. Besides its favorable attributes, it has a few limitations such as narrow bandwidth and low efficiency.

 Numerous techniques for bandwidth enhancement have been suggested that includes low permittivity substrate design (Kumar and K. Praveen, 2013). The problem associated with using low permittivity substrate is that the antenna size increases. In (Sanyal *et al., 2013*) a shorting pins technique has been investigated but the bandwidth is improved only 13%. The main conflicting issue is that if you increase the bandwidth so the antenna size will be affected. Different slotting techniques are used for bandwidth enhancement. In (Lee et al., 1997) a U shaped slot is used to enhance the bandwidth up to 20%. A V shaped slot has been investigated (Rafi et al., 2004) it has been stated that V shaped slot give better result compare to U shaped slot. Other slotting techniques such as E shaped, half U shaped and a defected ground structure is also been investigated (Rana and Deepak, 2014 .For a wide band as well as multiband application a fractal geometry is also been used (Choukiker et al., 2010). Other fractal geometry such as multiple fractal geometry technique and modified square fractal shape using gap coupling technique has been used for bandwidth enhancement (Yadav and khanna, 2014-2015). Band width enhancement is also achieved by using stacked patch antenna (Ansari et al., 2008).

This paper elaborates an innovative technique for bandwidth enhancement of patch antenna. A U shape slot is introduced in the ground plane along with a stacked patch having same fractal

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geometry on both the patches. Using such techniques our bandwidth is enhanced up to 25% in the range of 4.8 to 6.2 GHz. The proposed antenna is applicable for worldwide interoperability for microwave access, wireless local area network and satellite communication.

2. Antenna design

Our proposed antenna has been designed and simulated in CST (computer simulated technology) microwave studio. First a simple patch antenna has been designed having a length of 16mm and width of 24mm. Fig 1(a) shows that the same dimension used for the ground plane as well then a U shaped slot has been introduce in the ground plane which will enhance the band width. The dimensions of the U shaped slot are shown in table 1.

Fig 1(b) shows the front view of sacked patch antenna in which same fractal geometry on feed patch as well on parasitic patch. Four similar slots cut on all the four sides of the bottom and top patch having same length 8mm and width of 2.5mm which will enhance the band width as well as work on dual band. The FR4 substrate has been used between the feed patch and ground plane and also between the feed patch and parasitic patch as well with a dielectric constant value of 4.3. The bottom dielectric layer has thickness of 2.4mm and upper has 1.5mm as shown in fig 1(c). The coaxial probe method has been used for feeding.

(a)

(b)

(c)

Fig.1. (a) U slot in Ground Plane (b) Front View of Stacked Patch Antenna (c) Bottom View of Stacked Patch Antenna

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Table.1. Dimensions of U Shaped Slot

Parameter	Value
Height of vertical arms U shape slot	7mm
Horizontal length of U shape slot	7.5mm
Width of Vertical and horizontal arms	0.5mm

3. Results and discussions

This section shows the simulated results of different parameters like return loss, impedance bandwidth and radiation pattern etc.

Fig.2. Return Loss of Conventional and Proposed Patch Antenna

Fig 2 shows the return loss of conventional patch antenna is representing by the solid curve while the proposed broad band antenna return loss is represented by the doted curve. The return loss of conventional patch antenna is -12dB while the maximum return loss of our proposed design is -21dB.It is clear from the graph that the conventional patch antenna has a very narrow bandwidth of 144MHz. On the other hand the bandwidth of the proposed design antenna enhances from 4.8 to 6.2 GHz. The gain of the proposed antenna is 4.77dB at 5GHz and its efficiency is 79% as shown in fig 3.

Fig.3. Simulated Radiation Pattern at 5 GHz

The above discussed results are shown in table 2.

Table.2. Simulation Results of Our Proposed Design Antenna

Antenna type	Resonance frequency (GHz)	BW (MHz) at reference level (- 10dB)	RL (dB)	Efficiency
Conventional patch antenna	4.6	144	12.3	52%
With U shape slot in ground plane	5.4	698	-23	85%
With fractal staked patch	5.4 7.4	1370 218	-15 -17	79% 53%

Fig 4 shows the current distribution path of the proposed design antenna which shows the current is distributed near the U shaped slot and along the fractal geometry.

Fig.4. Current Distribution Path of Proposed Antenna

Fig 5, 6 shows the simulated results of radiation pattern for both elevation and azimuth plane at frequency 5GHz, and 5.5GHz. Our proposed antenna has a 3dB beam width of 125^0 and 112^0 for elevation plane at frequency 5GHz and 5.5GHz. While for azimuth plane the 3dB beam width of 169^0 and 258^0 at frequency 5GHz and 5.5GHz.

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(a)

(b)
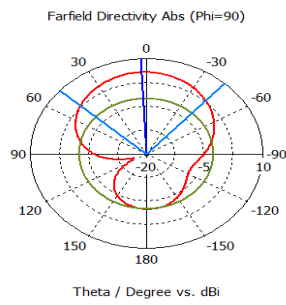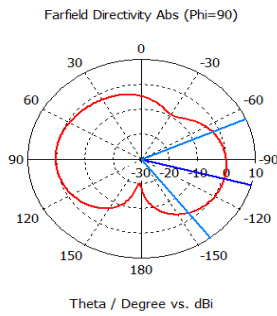
Fig.5. Elevation Pattern at Frequency (A) 5 GHz (B) 5.5 GHz

(a)

(b)

Fig.6. Azimuth Pattern at Frequency (A) 5 GHz (B) 5.5 GHz.

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4. Conclusion

The results for simulated patch antenna with U shaped slot in the ground plane and added stacked patch with fractal geometry show the bandwidth enhancement. The simulated results for the given antenna show wideband operation in 4.8 to 6.2 GHz and a gain of 4.77 dB. Our proposed designed stacked patch antenna is applicable for WLAN (802.11a), WiMaX and satellite communications covering a range of 4.8 to 6.2 GHz.

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School Leadership's Technology Readiness for ICT Integration in Schools in Developing Countries like Pakistan

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Abstract

The considerable investment have been making by Government of Pakistan in the integration of Information and Communications Technology (ICT) in education for several years. However, a little work has been done in investigating and examining the technology readiness of stakeholders such as school leaders (principals and vice principals) regarding the use of ICT in their schools. This paper measures the school leadership's Technology Readiness (TR) and the demographics which effects on it. The Technology Readiness Index (TRI) developed by Parasuraman (2000) was used to measure the technology readiness of school leadership in Pakistan. In this study, a sample of 90 principals and vice principals participated. The data for this research was collected through a survey questionnaire, interviews, and focus group discussions. This study revealed that the overall technology readiness level of school leaders was moderate (mean: 2.86). Also, there was a significant difference between technology readiness and gender found which demonstrated that male population had higher technology readiness than females. This study contributes to the existing literature and suggests that successful integration of ICT in schools depends more on school leadership's technology readiness level as well as their positive attitudes towards ICT.

Keywords ICT for education, Technology Readiness, Educational Technology

1. Introduction

Over the past several years, Information and Communications Technology (ICT) has played a vital role in improving the quality of education at all levels. Many educators define the Integration of ICT into education as, "using ICT effectively and efficiently in all dimensions of the educational process including the necessary infrastructure, curriculum and teaching-learning environments (Earle, 2002)". While, integrating technology into education is a complex proces and may encounter a number of challenges. Summak *et al.* (2010) have summarized no. of such barriers as─lack of computers, poor funding, technical difficulties, lack of time, poor administrative support, resistance to change, low level of digital literacy, poor training opportuinies, and lack of vision for integrating technology into learning processes. These difficulties have been confirmed by many other studies such as (Anderson *et al.*, 1998; Bariso, 2003; Pelgrum, 2001). Some of the researchers believe that the successful

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integration of ICT in education typically depends on principal's and teacher's willingness, beliefs and attitude towards technology (Cavas *et al.*, 2009; Christensen, 2002; Jacobsen *et al.*, 2002). Yalcin *et al.* (2011) determines that teachers' and principal's pedagogical beliefs are important because they effect their use of technology in the school. Badri *et al.* (2013) established that the perceived self-efficacy of principals and teachers keep a crucial role in many facets with respect to the school environment. The efficacy of principals and teachers regarding technology use and integration in the classroom will enrich their self-belief in terms of teaching capabilities (Albion, 2001; Eyyam *et al.*, 2010; Russell *et al.*, 2003). In addition, teachers and principals who do not have positive attitudes towards technology are not likely to benefit from it and or unable to utilize it efficiently into the learning environment (Gülbahar *et al.*, 2008). Hence, principal's and teacher's preparedness to adopt technology directly effect their success in integration of technology. Thus, predicting user readiness towards technology is imperative.

The main objective of this study was to provide an indepth understanding of technology readiness and to measure the technology readiness level of principals and vice prinsipals in all four provincess of Pakistan, then identify the co-relation between technology readiness and their demorahics which effects on it.

2. The Conception of Technology Readiness

The concept of Technology Readiness (TR) has appeared from studies focusing on how new technologies are embraced. Initially, this concept emerged from telecommunications technologies (Parasuraman, 2000) and became widely spread predominantly in the domain of marketing where research concentratres on finding segments of the market who are prone to embrace new technologies. For instance, mobile data services (Massey *et al.*, 2007), online insurance (Taylor *et al.*, 2002), distance education (Andaleeb *et al.*, 2010). Other areas of application include internet acceptance models (Lim *et al.*, 2004); human resources (Walczuch *et al.*, 2007); construction (Jaafar *et al.*, 2007); banks (Berndt *et al.*, 2010); the hotel industry (Victorino *et al.*, 2009); accounting-related consumers (Lai, 2008); and small businesses (Ramayah *et al.*, 2003). The authors of these studies found the TR model is an effective way for studying people's tendency to embrace new technologies (Caison *et al.*, 2008).

Parasuraman (2000) developed the Technology Readiness Index (TRI) in order to measure consumers' persistent inclinations to adopt new technologies. He identifies four dimensions related to technology belief which directly affects an individual's level of technology readiness (Elliott *et al.*, 2008). The four dimensions are: optimism, innovativeness, discomfort, and insecurity.

- Optimism: A positive view of technology and a belief of a principal that s/he offers students and teachers better control and flexibility in school
- Innovativeness: A propensity to be a technology discoverer
- Discomfort: A perceived lack of control over technology
- Insecurity: A disbelief of technology and uncertainty about its ability to work appropriately

Of these four dimensions─Both optimism and innovativeness determines as being drivers of technology readiness, whereas dismcomfort and insecurity are considered as inhibitors. These dimensions jointly determine an individual's propensity to embrace new technologies (Colby *et al.*, 2003). The Technology Readiness Index (TRI) can be used to measure the technology readiness (TR score) of employees (i.e. principals and vice principals in our case). Technology readiness of school leaders is very essential for making the right selections to design, implement, and manage the school leadership-technology link (Parasuraman, 2000).

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3. EdTech landscape of Pakistan

As compare to international interests in educational technology, ICT in education was emaphised in a National Information and Communications Technology (NICT) strategy for education in Pakistan. The strategy contains six elements─1) Use ICT to extend the reach of educational opportunity 2) Apply ICT to strengthen the quality of teaching and educational management 3) Employ ICT to enhance student learning 4) Develop complementary approaches to using ICT in education 5) Build on the current experiences of existing and successful ICT programmes and 6) Develop capacity at the federal and provincial department of education levels (MoE, 2007). Numerous ICT for education initiatives have been launched in Pakistan by the Punjab provincial and federal government to achieve the above objectives. More than 4200 public schools of Punjab were equipped with state-of- the-art IT laboratories and the laptop schemes (Chief Minister Punjab Laptop Scheme and Prime Minister Laptop Scheme) distributed 200,000+ laptops to students (Yasira, 2015).

Alongside government other entities such as platfoms-content developers, implementors, third party solution providers, teachers training institutions, social media agencies, virtual universities and othe potential players are making ICT for education available in Pakistan. These may include─ Sabaq.PK, Knowledge Platform, The Reading Room Project, Rehan School, 3Restart, Punjab E.Learn, NUST ITE, EDeQUAL, Communicators (BroadClass), AMAL, Academic Achievement Plus, Agnitus, AFAQ Department of Innovative Learning, GeniTeam, 3iLogic, ToffeeTV, Rabtt, TeleTaleem, PiLabs, JugnuTV, Jugnoo Media, FESF, Arbisoft. Matheletics, Socio Engineering Consultants, Beaconhouse ELE, The Citizens Foundation, Allied Schools, Roots Millennium Schools, Care Foundation, The Citi School, Developments in Literacy, AKU-IED, Teach for Pakistan, Department of Staff Development, VM Institute of Education, Allama Iqbal Open University, Ali Institute of Education, Team Ants, Meri Taleem, Robotics Lab, TinTash, Virtual University, iEarn, Mindstorm Studios, Sharp Image, Creative Chaos, Flickable, Comsats Virtual Campus. Other educational entrpreneurships- Invest2Innovate (i2i), Plan 9 and X, LUMS Centre for Entrepreneurship, IBA Invent, Pakistan Innovation Foundation (PIF), WECREATE–Pakistan, The Nest i/o, Acumen Fund, MIT Enterprise Forum-Pakistan (MIT EFP), P@SHA (Launchpad and social innovation fund).

Although these projects and initiatives demonstrate that Government of Pakistan and other organizations reinforce the importance to the integration of ICT into education of Pakistan but school leadership's technology readiness has not been taken into considerations and there have not been enough studies carried out about principals' technology readiness for ICT integration in schools, both in international and dometstic literatures (Cavas *et al.*, 2009). Therefore, this study is significant in creating an indepth awareness about technolgy readiness and this way, contributing to the existing literature about smooth integration of ICT in schools.

4. Methods

4.1 Participants and design

In this study, quantitative descriptve method was used to measure the technology readiness of schools principals and vice principals. The sample consisted of 90 participants. The schools principals and vice principals were invited on the principals convention organized by AFAQ (Association For Academic Quality) to participate in the survey questionaire. Out of 90 participants, 69 of them responded to the survey questionaire and remaining 21 participants did not respond to all questions; therefore, incomplete responses were not used in further data analysis.

Table 1 shows the demographics of the participants. Male population consisted 54% (n=49) of the sample, and females 46% (n=41). The average age of respondents was 35 years old. The particpants participated from different regions Lahore (36%), Peshawar (30%), Karachi (23%), and Quetta (11%).

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Table 1: Demographic statistics

	Frequency	Percent (%)
Gender		
Female	41	46
Male	49	54
Age in years		
≤25	14	15.5
26-30	19	21.1
31-35	27	30.0
36-40	17	18.8
41-44	7	7.7
≥45	6	6.6

4.2 Study instrument

A 36-item Technology Readiness Index (TRI) was adopted and used by making it in simplified English language. Cronbach alpha coefficients were calculated in order to measure the scale reliability among the items. The overall scale reliability was determined as high coefficient α score .71.

4.3 Analysis method

The participants were asked to respond and rate their degree of agreement based on 5-point Likert scale starting from strongle disagree (1), to strongle agree (5). The collected data was then analyzed using SPSS 20.0. Mean and standard deviation was calculated for each of the four dimensions of TRI scale (optimism, innovativeness, discomfort, and insecurity). Independent-Sample t-test was also conducted to measure the significant difference in demographic variable of participants such as gender across the TRI dimensions. A significance level of 5% was used to determine the statistical significance.

5. Results

In Table 2, mean and standard deviation of each TRI dimension are shown along with their correlation coefficients. The highest mean score of 4.07 was rated to optimism, whereas, Innovativeness was rated with the next highest mean score of 3.18. Both of these are the drivers of tecnology readiness index (TRI), that shows they positively affect TRI. Meanwhile, participants optimism level was higher than their innovativenss. On the other hand, discomfort and insecurity are the inhibitors of TRI, having mean scores of 2.03 and 2.16 respectively. The collective mean of all dimensions of TRI was 2.86 with a mean standard deviation of 0.48.

Table 2: Means, standards deviation and correlations

Dimensions	Mean	Standard deviation	Optimism	Innovativeness	Insecurity	Discomfort
Optimism	4.07	0.43	1			
Innovativeness	3.18	0.66	0.628**	1		
Discomfort	2.03	0.49	0.112**	0.209*	1	
Insecurity	2.16	0.37	0.009	0.010	0.585**	1
TRI (Overall)	2.86	0.48				

The correlation analysis of TRI dimensions depicted that the correlation between drivers of TRI (optimism and innovativeness) is high 0.628, as compare to the correlation between the inhibitors of TRI (discomfort and insecurity) 0.585.

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The mean values of Inhibitors of TRI (Insecurity (2.16) was higher than discomfort (2.03)), as shown in Table 2, and the mean value of all the TRI dimensions was 2.86 which clearly depicts that the participants was having moderate technology readiness.

Table 3: Independent Sample t-test (Dimensions of TRI and gender)

Dimensions	t-value	Sig. (2-tailed)	Mean Difference.	Std. Error Difference
Optimism	-2.274	0.015	-0.17604	0.06335
Innovativeness	-2.785	-0.004	-0.30179	0.09513
Discomfort	-1.864	0.055	-0.1616	0.07178
Insecurity	0.072	0.925	-0.00474	0.05441
TRI (Overall)	-2.968	-0.007	-0.16104	0.04106

p<.05

In table 3, an independent sample t-test was conducted to observe and compare the technology readines level of participants with respect to gender variable (male/female). There was a significant difference in scores for male and female participants found for the dimensions—optimism, innovativeness and overall TRI, whereas no any significant difference was found in discomfort and insecurity. Hence, male participants demonstrated a significantly higer mean value for optimism and innovativeness than female participants, as a result, male participants showed significantly higher technology readiness score than female participants. These results endorse with another study that demonstrates male participants show more technology readiness (Summak *et al.*, 2010).

6. Discussion

Integration of ICT into all educational process is essential for improving the quality of teaching and learing. While Integrating technology into education may encounter a number of challenges and some of them needs to be kept into consideration such as school leadership, as it is one of the critical factor in a seamless integration of technology in schools. School leadership's attitudes, perceptions, and behaviors towards technology are the key ingredients for successful integration of ICT into Schools.

This research study was conducted to measure school leaderships' technology readiness by using Technology Readiness Index (TRI). TRI is a scale consisting of four dimensions (i.e., optimism, innovativeness, discomfort, and insecurity). This study found that participants optimism level was higher than innovativeness and mean value of insecurity was higher than discomfort. Hence, overall technology readiness level of all the participants was moderate.

A no. of TRI researches have already been carried out to assess TRI score of the teachers such as in Turkey and Abu Dhabi. The Trukish school teachers had overall TRI (2.96) (Ref). This result is very much close to our study i.e., (2.86). In their study the optimism level (4.17) was higher than innovativenss (3.28) which is also endorsing with our results. In another research, attitude of teacher's towards technology use was found as favorable (ÖZGEN *et al.*, 2012). One of study conducted by Woodrow (1992) reported that there is no signifciant difference in attitude of teachers and their age but found that there is a significant differnece in tems of gender. Male teachers showed higher technology readiness than female which is also consistent to our study (Dupagne *et al.*, 1992; Ertmer *et al.*, 1999).

7. Conclusions

This study revealed that the school leadership's technology readiness level was not high, which can hinder the smooth integration of ICT in their schools. For the successful implementation and integration of ICT in schools we recommend that all stakeholders such as government, NGOs, policy and decision makers, researchers, educationists, and practitioners should design some activities to increase school leadership's technology readiness. This can invigorate the successful integration of ICT in schools and may add value to the quality of education.

Acknowledgements

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Service Oriented Architecture Vulnerabilities in Web Applications – An Overview

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Abstract

Service Oriented Architecture (SOA) is considered as most innovative technology of the past decade. The main reason for its success is, ability to interoperate and integrate heterogeneous systems. The objective of SOA is to minimize the dependency among interacting systems or subsystems. Besides its qualities, SOA is inherently insecure and vulnerable to security threats. The basic reasons behind its weakness is weak building blocks and poor service construction. This study focuses on the effectiveness of tools and techniques proposed in the literature to detect web-service vulnerabilities. Moreover, the paper proposes a method to evaluate the correctness of web vulnerability scanners. The main building blocks of web-services are: Web Service Description Language (WSDL), Simple Object Access Protocol (SOAP), Universal Description and Definition Interface (UDDI) and XML. This research addresses web-service vulnerabilities related to WSDL document, SOAP messages and XML.

Keywords WSDL, SOAP, XML, Vulnerabilities, web-services (WS), Service Oriented Architecture (SOA). Web vulnerability (WV)

1. Introduction

Service Oriented Architecture (SOA) is becoming popular as they provide simple mechanism for communication between consumer and the service provider, over the internet. Many new applications of SOA has emerged recently, ranging from online store to large corporations [1]. To cope with issues related to wide area of SOA applications, large number of standards and protocols are introduced [2]; paper focuses on security protocols, only.

The web applications like e-commerce and business intelligence (BI) using web-services platform, are subjected to most common attacks like parameter tempering attack, replay attack, coercive parsing attacks, oversized payload attack, SQL/XML injections, CDATA field attack [3]. Currently the basic building blocks of WS technology are weak, making them vulnerable and easy targets for attackers [4].

Furthermore, another weakness in SOA is use of XML to communicate with dissimilar technologies through SOAP messages. The problem in XML technology is, it contains data in between opening and closing tags that results in very large messages. To process these large

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messages greater memory, processing and resources are required. The main strength of XML is flexibility; to format according to the needs of web service. However, it is also a potential threat to web service security [5]. Because attackers can re-format XML content by injecting their own tags to access unauthorized data.

Apart from web-service vulnerabilities, first task to secure a web-service using standards and protocols (will discuss in next section). Secondly, use of tools and techniques to detect vulnerabilities with in a web-service. However, unfortunately there is not a single tool or technique available that promises accurately detect web-service vulnerability [6].

The paper organized as follows. Section II presents our research objectives. Section 3 presents literature review. Section 4 explain the survey methodology. In section 5, paper presents the classification of web vulnerabilities. The section 6 explains the proposed method to evaluate effectiveness of WV scanners. The section 7 provides the conclusion and future work.

2. Research Objectives

To detect different types of vulnerability scanners are used. Testing web application for all possible vulnerabilities is not possible for both manual and automatic approach. The reason is it is not feasible to manually search each type of vulnerability that it costs much time and effort. However, automated tools mostly used in web application testing. Most of these tools produce a high number of false positive that cause more confusion [6]. Moreover, some of these tools are unable to detect the vulnerabilities that really exist in web application. The objective of this research is to develop a mechanism that will evaluate the effectiveness of these tools [7].

A. Research Questions

Which web vulnerability scanners is suitable for detection of specific kind of vulnerability? Is there any mechanism that can overcome limitations (false positive and low coverage) of vulnerability scanners?
Is it feasible to use different scanners for testing single web-service based application?

3. Literature Review

In 2009, Vieira et al. [8] presented an experimental evaluation of 300 publically available web services. Its results shows security flaws in 177 web services. Additionally, number of false-positive as high as 35% and 40 %(in two cases) are observed. However, less than 20% false-negative are observed in two scanners. These results shows inaccuracy of web vulnerability scanners.

This paper presents a practical experience report focuses on the following three questions:

- What is the coverage of vulnerability scanners?
- What is the rate of false positive of each scanner?
- What are common web vulnerabilities?

Security vulnerabilities like SQL Injection and XPath Injection are common problems of web services that directly related to the structure of the web service code.
Two approaches for testing web service for vulnerabilities are:
- Black Box Testing
- White Box Testing.

Automated tools are available for both type of testing. But they have some limitations and considered less effective. A technique "software fault injection" is introduce to observe the effectiveness of different tools. In this technique software faults are injected to application code and scanned through different web-vulnerability scanning tools. This process evaluates the strength

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and weaknesses of these tools, concerning detection of vulnerabilities (false negative) and false positive.

A four step process is used to evaluate the effectiveness of each tool. These steps are as follows

Preparation: select the vulnerability scanners and a large set of publicly available web services.
Execution: use the vulnerability scanners to scan the services to identify potential vulnerabilities.
Verification: perform manual testing to confirm vulnerabilities (i.e., remove false positives).
Analysis: analyse the results obtained

As a result of experiment, six different types of vulnerabilities were pointed by scanners:

SQL Injection, XPath Injection, Code Execution, Possible Parameter Based Buffer Overflow, Possible Username or Password Disclosure and Possible Server Path Disclosure.
In [8] the experiment resulted in detection of SQL injection vulnerability by every scanner, included in the experiment. This concluded, scanners have different capability of penetration testing, so results of different scanners may not be comparable. The paper suggests to use more than one tool for good coverage.
The resulting false-positives excluded from the vulnerability scanners analysis. Because it was very difficult to avoid them. The paper [14] proposes a method to manually confirm the presence or absence of vulnerabilities without accessing the application code.

In [8] according to this method, set of rules and corresponding checks are defined to classify detected vulnerabilities, in three groups. These groups are false positives, confirmed vulnerabilities and doubtful.

Authors concluded [7] that it is very difficult to select a web vulnerability scanner. Because different scanners are implemented in a different way and they are designed to address dissimilar set of vulnerabilities. Another important aspect was high number if false-positive that are very difficult to avoid. Lastly, the only vulnerability that can be detected easily was SQL injection. This vulnerability can be properly tested by major vulnerability scanners of the market like Acunetics.

In 2011, Shahgholi [9] proposed a new security framework for protecting XML against security threats. His research focuses on WSDL document vulnerabilities like WSDL scanning and XML vulnerabilities like parameter tempering, and oversize payloads in SOA environment. The authors claim that WSDL vulnerabilities are always rank in top ten web service vulnerabilities. Some of the WSDL and XML vulnerabilities discussed in this paper are: Recursive Payload, oversized payloads, and WSDL attacks (WSDL scanning and parameter tempering).

The paper [9] discusses few security standards for web service security but have limitations. The XML encryption is a security standard that focuses on encryption of XML document or selected parts of XML document. The XML encryption uses two techniques for document or elements encryption, first one is Secret key encryption and the other is Public key encryption. The secret key techniques uses single key for encryption and decryption, it also requires a secure path for sharing public key between two communicating parties. While Public key encryption uses two keys; public key for encryption and secret or private key for decryption.

Hence, considered as more secure then Secret key encryption. Another standard for XML security is XML digital signature: this technique is similar to "public key encryption". However, in "public key encryption technique sender uses its own private key to sign specific parts of message, so in this way message is only visible to receivers with the public key". When dealing with different types of keys, XML Key Management specification *(XKMS)* is used. It is a trusted web service that provide interface between web application and Public Key Infrastructure (PKI). The main task of

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XKMS is to locate and validate public keys. Authors proposed [9] a better approach for web service security by a six step process using existing standards and techniques.

In the first step, provider requests for public and private key pair to "trusted web service". Then in the second step, key generated by "trusted web service". After this trusted web service, request XKMS for to store generated public key in the PKI for specific web service. In the fourth step, PKI respond XKMS again its request for public key storage. The fifth and last step in encryption process, XKMS forwards the response to trusted web service that allows the owner of the web service provider to encrypt its WSDL file. At this stage, one users with the private key can use the WSDL file to consume web service. Sixth and the final step is to publish WSDL file to Universal Description and Definition Interface (UDDI) registry. Now the use can search and consume this web service. To conclude, the authors claim [9] that this is the first practical model for preventing web services again XML and WSDL document vulnerabilities. Therefore, it is not possible to evaluate this solution.

In 2007 "Yee et al [10], describe that defending mechanism for existing WS framework from suspicious attacks are vulnerable, not adaptive and adequate. But they introduced the adaptive method against WS attacks related to SOAP/XML/SQL, to protect the WS based application. The ID/IP framework work like an agent which act as a sensors, a technique like clustering data, some rule with fuzzy logic, also capturing and classify irregularities, and keep away from false alarm.

In 2007, Phan et al [11], presented most common security challenges that exist in SOA environment. The paper identifies some special vulnerabilities that occur because of insecure nature of XML. Moreover, the paper proposes techniques for avoiding vulnerabilities like replay attacks, encryption problems and policy consideration.

The authors [11] claim that many industrial web services are not designed to be secure. Further, it discuss problems with service oriented architecture (SOA). The SOA based application uses XML to communicate with dissimilar technologies using SOAP messages. But the problem is, it contains data in between opening and closing tags that results in very large messages. To process these large messages greater memory, processing and resources are required. The main strength of XML is flexibility; to format according to the needs of web service. But it is also a potential threat to web service security. Because attackers can re-format XML content by injecting their own tags to access unauthorized data. In XML encryption, application must prevent information like public key to unintended recipients. This problem occurs when two parties share public key on insecure network using "secret key encryption". Another important aspect of security vulnerabilities is "access control". According to authors, security must be implement at different level to ensure "secure access control". The technique recommended for access control is role-based access control (RBAC).

4. Methodology
The research papers collected from Google Scholar, ACM digital library and IEEE Xplore. To search the relevant papers, both manual and automatic search process is used.

4.1 Inclusion / Exclusion criteria
The aim while selection of papers was to select high quality and most relevant papers. We selected those papers that specifically relates to Service oriented architecture vulnerabilities and that have target of industrial implementation of service-oriented architecture. Most of papers are reviewed that published recently. Importantly We select current research work since 2000 to be aware of current challenges, solution and future work flow, but some basic articles are also included that have most number of citations.

Those papers that were published in low quality journals and less number of citations were neglected; also Tutorials, lecture notes, magazines and workshops were excluded.

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5. Classification

In this section, table I enlists the most common WV. These vulnerabilities are classified on the basis of category, level and types. Details of these parameters are given below.

Categories: Web application can be effected from different aspects. These aspects are: Availability (A), Access Control (AC), Data Integrity (DI), Confidentiality (C)

Type: Static types of vulnerabilities that exist in the WSDL documents of web application. These type of vulnerabilities can be detected by scanners without executing the web service. However, dynamic vulnerabilities are those which are detected by analysing request and response of web service at runtime [12].

Level: This depict the web service layer on which following attacks can occur. The two layers are: Process layer (p) and Message layer (M) [13].

TABLE LXV:
CLASSIFICATION OF WEB VULNERABILITIES

ID	Vulnerabilities	Category	Level	Type (Static/ Dynamic)
OP	Oversize Payload	A	M	Dynamic
CP	Coercive Parsing	A	M	Dynamic
SAS	SOAPAction Spoofing	AC	M	Dynamic
XI	XML Injection	DI	M	Dynamic
WS	WSDL Scanning	AC, C	M	Static
MS	Metadata Spoofing	All	M	Static
AO	Attack Obfuscation	A	M	Dynamic
OC	Oversize Cryptography	A	M	Dynamic
IFL	Instantiation Flooding	A	P	Dynamic
IF	Indirect Flooding	A, AC	P	Dynamic
WAS	Web service Address Spoofing	A,C	M	Dynamic
MH	Middleware Hijacking	A, AC	P	Dynamic
CJ	ClickJacking	C	P	Dynamic
CI	Code Injection	C,AC	P	Dynamic
SQLi	SQL Injection	AC,C	P	Dynamic

The table 2 enlist WV scanners (Tools), vulnerabilities they detect, type, and ease of use. This table provide an overview of abilities of scanners that can detect different types of vulnerabilities. The table 2 is not complete because of limited time. However, it provides rough idea about the abilities of different scanners and common vulnerabilities that exist in web services.

TABLE LXVI:
WEB VULNERABILITY SCANNERS COMPARISON

Tools	Vulnerability	Type (Open source/commercial)	Usability (Easy, intermediate, difficult)
W3af	CJ,	Open source	Intermediate
SqlMap	SQLi	Open source	Difficult
ZAP proxy	XI, IFL, IF	Open source	Difficult
Acunetix, HP	XI, IFL, IF, OC, SAS, WS, MS,OP,CP	Commercial	Easy

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Rational AppScan	XI, OC, SAS, WS, MS	Commercial	Easy
WebInstect and IBM	XI, OC, SAS, WS	Commercial	Easy
Skip Fish	XI,	Open source	Intermediate
Grendel Scan	XI, MS,OP,CP	Open source	Intermediate
Arachni	XI,CI,WAS	Open source	Easy

6. Tools Evaluation Method

Most of the previous researches proposed many solution regarding identification of WVs in actual web application or web application under testing. In some cases they used code injection technique to check the effectiveness of tools [8].

In this paper we proposed a method that will evaluate the effectiveness of tool by following simple these steps.

Step 1: Select a vulnerability scanner.
Step 2: Take a sample web application.
Step 3: Insert one or more vulnerabilities in web application.
Step 4: Execute vulnerability scanner on this web application.
Step 5: If scanner detects the vulnerability successfully, it is acceptable and,
Step 1: If it detects vulnerabilities other than inserted vulnerabilities, it is not suitable for testing as it generate false results.

7. Conclusion and Future Work

There are many problems exist in service oriented architect (SOA). Some of these problems are related poor building blocks of SOA. While other are related to poor construction of web services. We can't change the building blocks of SOA but we can adopt security standards to overcome most of the problems. To confirm a web application is safe, we need to test it with automated tools. These tools cause high number of false positives and low coverage. In this paper we presented a WV detection method that can evaluate the effectiveness of WV scanner for specific vulnerabilities. It requires web application or web service with one or more pre-inserted vulnerabilities. Just like other lists of standards and attacks that are available in different repositories. We can also create a repositories in which web applications with pre-inserted vulnerabilities are stored publically. This will help to evaluate effectiveness of WV scanners against a variety of web application vulnerabilities.

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Critical Challenges for Requirement Implementation in context of Global Software Development: A Systematic Literature Review Protocol

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Abstract

Context: Successful requirement engineering (RE) leads to success delivery of software. There exist a lot of challenges during RE process especially when we talk about Global Software Development (GSD). This research is to find challenges and barriers in path of RE in context of GSD.

Objective: The objective is to find and analyze the challenges in RE process.

Method: Systematic Literature Review (SLR) is used as research method to achieve the goals.

Result: SLR protocol is developed. Expected output of this study is to list out all challenges which the stakeholders are facing in implementing RE in the context of GSD through SLR.

Keywords: Systematic Literature Review; Requirement engineering; Requirement Implementation; Global Software Development; Systematic Literature Review Protocol.

1. Introduction

RE is a way to collect requirements from user in a proper way by applying various techniques[1, 2]. RE is divided in four phases. Requirement elicitation is the first phase in which we collect requirements from users, requirement analysis phase is the phase in which we analyze the requirements, requirement specification and validation phase. The quality of final deliver software is totally depended on proper requirement implementation[3]. The more errors and bugs remain in this phase the more is the chances of failure of the software and the more it is expensive to fix it latterly on[3]. RE needs more attention and much effort is required. The RE is difficult when implemented it locally but in case of GSD the case is worst because there exists some challenges like culture difference, physical and geographical change, language and terminology difference, lack of face to face conversation and time zone difference[3-5]. Their exists communication and coordination problems during requirement elicitation[6]. Besides some other challenges also exists but the source of all difficulties and challenges will be the above mentioned factors. To overcome the challenges some practices and success factors are needed[7]. We need to address these challenges systematically and should analyze these challenges through company size, different continents, decade and experimental methodologies.

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2. Motivation and Related Work

According to Yvonne Hsieh[3] culture diversity causes coordination problems and is a big challenge because people belongs to different cultures and have different explanations and translation of requirements. Coordination and collaboration is a big success factor in GSD. According to Daniela Damian[4] the cause of improper conversation is due to time difference because most of the time if there is a night in one country the other country have office time so difficult to communicate. According to Paula Laurent[1] lack of an appropriate technical infrastructure prohibit inter-site collaboration. Face to face communication is the best way to resolve issues and misunderstandings but in GSD the big challenge is that teams are physically separated. According to Vibha Sinha[8] requirement change management is very difficult because it needs proper negotiations and discussion which is difficult without face to face meeting. Common understanding of requirements requires integration with communicating environment. According to Barkha Javed[9] knowledge sharing is big problem during RE process due to culture diversity and terminology difference and there is a lack of proper and effective communication due to which knowledge management also becomes difficult. Paolo Tell[10] also discuss the issues arises due to lack of communication which cause improper negotiations in time. According to Daniela E. Damian[11] building trust in GSD is very difficult because there are some factors which are necessary for trust building like face to face meeting and proper discussions but due to distance and culture diversity building trust becomes challenge. Coordination and collaboration is also a big source of trust building. The author says that language and terminology difference is a big challenge and it affects requirement elicitation process because this phase of RE process requires direct communication with clients to gather requirements and transfer knowledge and this factor causes difficulty. According to Nosheen Sabahat[12] proper global project management is necessary to tackle all the challenges and to bring coordination among the team members. Brian Berenbach[13] also discusses the importance of role of project management in GSD and according to him one of the observed issue was lack of effective leadership. According to S. Arun Kumar[14] requirement management is a big challenge in GSD and it needs change management frameworks and models which can solve these problems. The author discusses the challenges which arise due to low involvement of customers in GSD.

 S. Sakthivel[15] says that experience with new technologies and the complexities arises from technologies are considered as barrier in path of negotiations and discussing requirements. The author further says that costs of infrastructure are also an issue for client's side mostly to discuss the requirements. Besides understanding and selection of proper RE process is not easy task so it needs to focus.

3. Aims and Objectives

Our objective is to find critical challenges in path of RE process in GSD through SLR. For SLR we have developed SLR protocol and discuss here in detail. We will address some questions which are helpful in analyses of these challenges. After protocol development and SLR process we will prioritize the factors. Besides importance of this field no SLR have been conducted to address the given research questions. Hope this will decrease some of the research gap in current subject.

4. Research Method

Systematic Literature Review (SLR) will be our methodology. Figure 1 shows step by step execution of our research methodology.

4.1 Systematic Literature Review (SLR) Process

According to Kitchenham[16] SLR is divided into 3 main stages. These are planning the review, conducting the review and doing a review.

4.2 SLR Protocol Developments

Before conducting the systematic review, review protocol was developed. A pre-defined protocol increases the hardship and iteration of the review. Procedures and review plan is specified through SLR. The various stages of SLR process are aim and need, research questions, search string, involvement and removing criteria, form of data extraction and arrange data from papers. Fig1 shows SLR protocol developments stages.

4.3. Research Questions

We address the following 5 questions.

RQ1. What are the challenges, as discussed in the literature, elaborated from software vendor's view in implementing requirements engineering processes throughout organizations in context GSD?

Based on objective and the above Research Question some further questions arises like

RQ2. Is there any relationship between these challenges and size of organization in GSD?

RQ3.How these challenges vary from continent to continent in GSD?

RQ4.How these challenges are related to different research methods in GSD?

RQ5.What is the impact of changing period on these factors in GSD?

We will make search string for the RQ1 only, papers selected based on RQ1 will be analyzed for answering the rest of questions.

4.4. Making of Search Terms

People: Clients and Vendors included in GSD

Interference: challenges in requirement implementation.

Outcomes of relevance: Better implementation of RE in   GSD.

Our research question contains the following above information.

RQ1. [What are the challenges, as discussed in the literature] "**Interference**", elaborated from software vendor's view in [implementing requirements engineering] **"Outcome"** processes throughout organizations in context [GSD] "**People**". ?
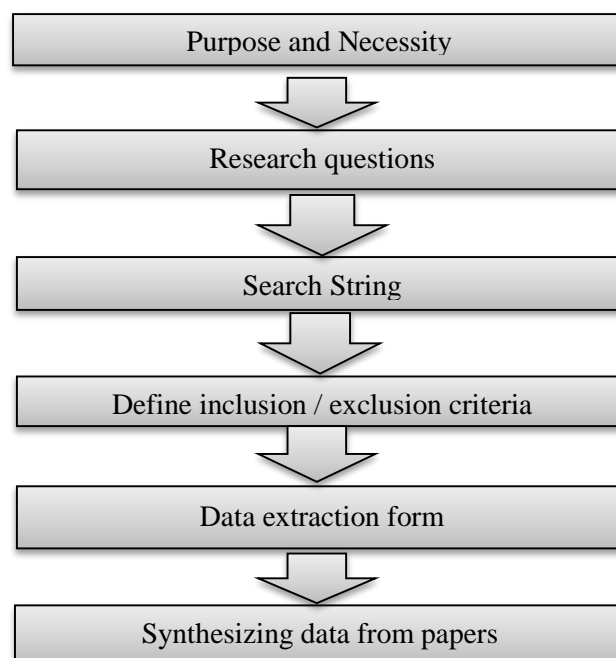
Fig 1.Development process for the SLR Protocol

5. Search Strategy:

It include the following sections

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- Method for searching
- Electronic data sources used
- Strings for the search
- Validation of search
- Documentation of the search
- Management of search result

5.1. **Range of search (time and space).** Refer to research questions we will search for all published literature with no bound and limit on any time (years).

5.2. Method for searching: There are two search method automatic searches or manual search. Search string is executed on search engines of electronic data sources in automatic searching while in manual searching search is done by browsing through specific journals or conference proceedings.

5.3. Electronic data sources used.
- Google scholar
- Science Direct
- Springer link
- Acm portal
- IEEE Xplore

5.4. Strings for the search
Search string is splitted into three types of sub search strings.
A. Preliminary search string: This will be initial string which will help in preliminary search.
B. **Big search string:** Using Boolean operators and by combination of major terms and its equivalents we can obtain this string.

C. Smaller sub search string: As some of libraries do not get long string so we will divide it into smaller strings and will do the independent search for each string

5.4.1 Search terms identification
The below steps (strategy for searching) are used for making of search terms.
Step1: Major terms derivation: For the derivation of major terms use the research questions, by identifying people, medium and outcome.
Step2: Find the substitute spellings and synonyms for these major terms
Step3: Find out the key words in any related paper;
Step4: Use Boolean Operators for combination if the library allows. Use "OR" in case of substitute spellings and synonyms and use "AND" in case of combination of major terms.

5.5. Documentation of the search:
Proper documentation of search results is necessary, and the following data will be listed:
- Database name
- Strategy for the search
- Phase of the search
- Search date
- No of publications found
- No of publication chosen
- Decision of introductory chosen
- Decision of final chosen

6. Selection of publications:

figure 2 show detail of selection process

- Involvement Criteria
- Removing Criteria
- Determination of Publication Quality

6.1 Inclusion Criteria: Entry criteria will be used to limit the number of papers which are retrieved by applying search strings and which are included for final data selection. The following are some inclusion criteria

- Papers written in English only are acceptable
- Papers which are related to RE in GSD only
- Papers which discuss the challenges only during requirement implementation in GSD.
- Studies that are related to RE only but they are fitted in GSD also.

6.2 Exclusion criteria: On the basis of removing criteria we decide which paper will be removed from the final list. The following are some exclusion criteria on base of which we will exclude papers from selected ones

- Studies which are not related to our Research questions
- Studies that do not discuss RE in GSD
- Studies that do not discuss challenges during RE in GSD.
- Papers belong to GSD but they don't discuss RE
- Papers that discuss RE but don't fit in GSD.
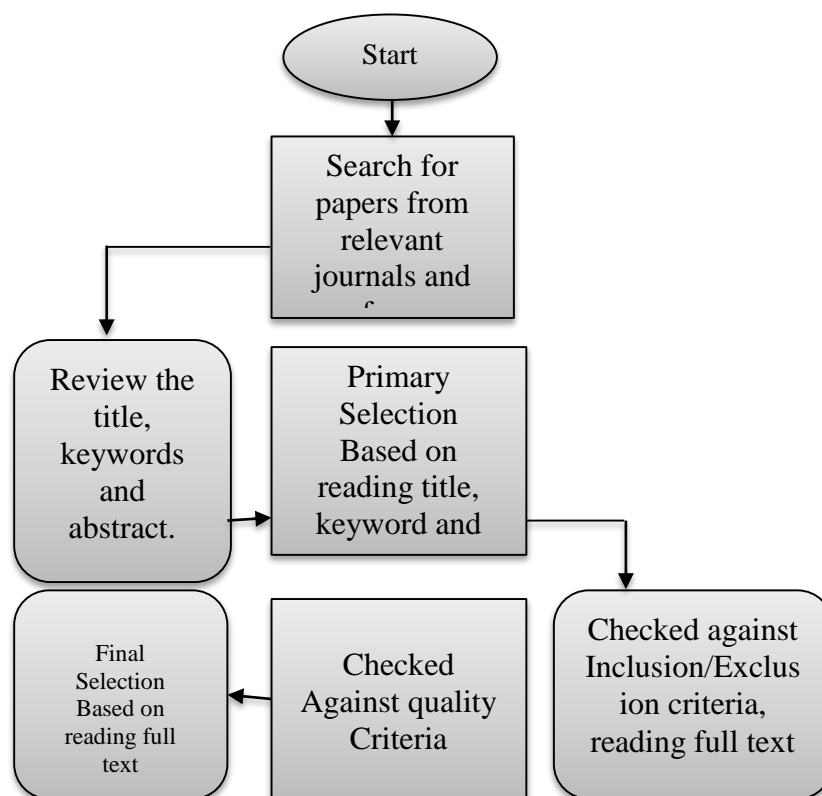
Figure 2. Publication Selection process

7. Strategy of Data Extraction:

Figure 3 shows the detail of data extraction process

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7.1 Primary Study Data:

The data Extracted from publications will contain the following.
- Publication detail (Title, Authors, Reference)
- Data related to research questions

7.2 Data Extraction Process:

One person will do the extraction for review. Secondary person can provide the guidance if he find problems in data extraction.

7.3 Data synthesis:

We will synthesize the extracted data in SLR which give answers of the research questions .The following data will be synthesizes.
- Date of review
- Publication details (Title, Authors, Reference)
- Sample Population
- Company size (small, medium, large)
- Location of the Analysis (continent)
- Publication year
- challenges in requirement implementation in GSD
- Publication Quality Description
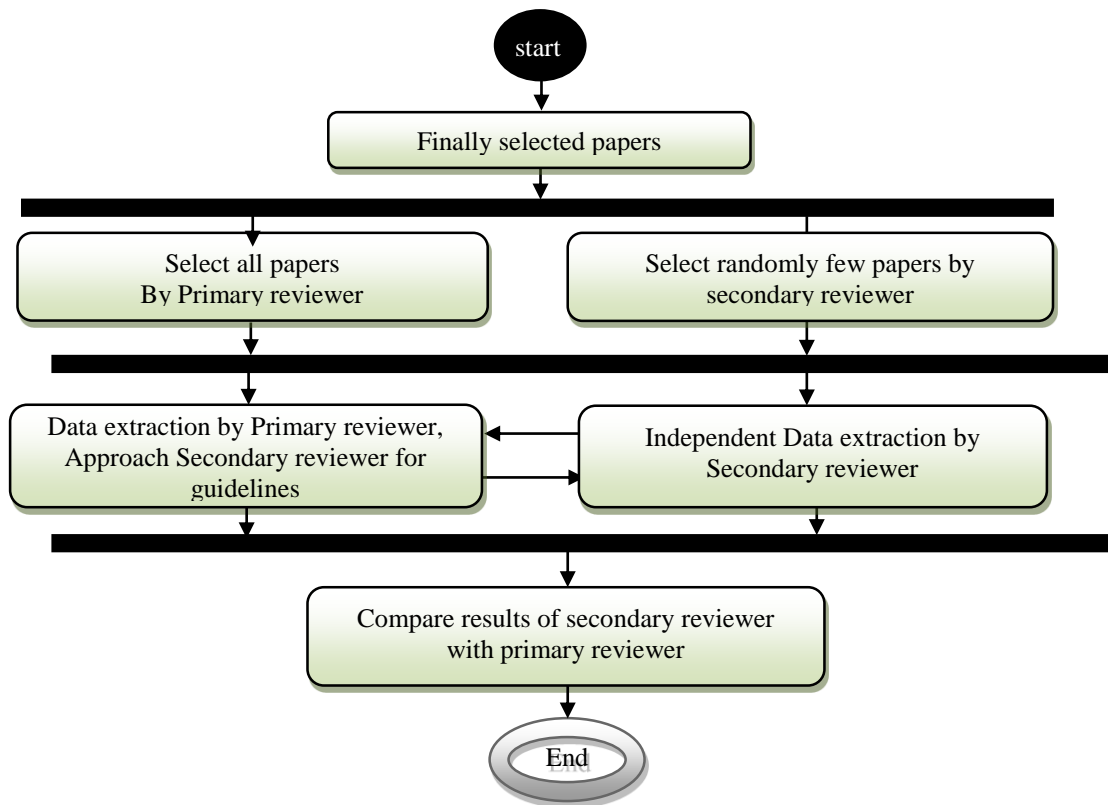
Figure 3: Data Extraction Process

8. Conclusion and future work

SLR protocol were developed and discussed in detail. The next step will be to apply this protocol and do SLR process. After SLR we will identify list of challenges and will mark some factors as more critical and will make analysis of the factors. In future we will find practices needed to implement RE in GSD successfully. The end goal is to make Requirement implementation model which will address the challenges and its solutions and practices in the context of GSD.

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Impact Assessment of Node Density over FSR and DSR

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Abstract

Mobile Ad hoc Network (MANET) is a set of mobile nodes that are capriciously placed thus the interconnections among nodes be dynamically varying. A routing protocol is used to locate routes involving mobile nodes to assist communication inside the network. The foremost purpose of such an ad hoc network routing protocol is to ascertain accurate and competent route with a couple of mobile nodes. Route ought to be uncovered and maintained with a least of overhead and bandwidth use. There are numeral routing protocols were projected for ad hoc networks. It is quiet complicated to evaluate all of the protocols. This paper presents performance estimation of two different routing protocols i.e. Dynamic Source Routing Protocol (DSR), and Fisheye State Routing (FSR) with admiration to uneven pause times and node density. Performance of DSR, and FSR is determined on the basis of Average end-to-end delay, Throughput and routing overhead. Based on the simulation outcome FSR execute well compared to DSR.

Keywords DSR, FSR, MANET, NS-2, Routing Protocol

1. Introduction:

Wireless networks are a promising tool that allows users to get services and information automatically irrespective of their geographic location. With such abilities, this technology could be fit in many mobile objects who need to get or share the information (Khan and Ali, 2013). Moreover wireless technology is most sutible for situations in which mobility is inevitable, e.g. battlefields, meeting, rescue operations, classrooms etc. In terms of configurations, there are two main types of network, one with the infrastructure and other is ad hoc (infrastructure less) (Loo, Mauri et al., 2016). In infrastructure wireless network configuration, nodes are connected with a base station permanently. Infrastructure less configuration is ad-hoc in nature, each node works as router to send and receive its own and other nodes data. They are also called as mobile ad-hoc networks or MANET (Loo, Mauri et al., 2016).

MANET are the self-organizing and self-configuring wireless networks which do not rely on infrastructure and has the potential of quick deployment in response to application needs. Nodes in MANET work as routers which determine and maintain routes to further nodes in the network (Hinds, Ngulube et al., 2013). Due to deficiency of centralized entity and mobile nature history of nodes, network topology varies repeatedly and impulsively. That's why the routing protocols for ad hoc wireless networks have to acclimatize promptly to the recurrent and erratic changes of

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topology. MANET being nature of vibrant topology, nonexistence of established infrastructure, bandwidth-constrained wireless links, and resource energy constrained nodes, always need an adoptive nature routing protocol.

Numerous routing protocols have been proposed for MANET. Kaur and Khurana categorize them into two major classes i.e. Proactive and Reactive (Kaur and Khurana, 2014). In proactive protocols each node makes its personal routing table to determine a path from source to destination and routing is stored in sequence. If there is any disparity in a connection topology, then whole network is modernized. Their example includes Optimized Link State Routing protocol (OLSR), Destination sequenced Distance vector routing (DSDV), Wireless routing protocol (WRP), Fish eye State Routing protocol (FSR), Cluster Gateway switch routing protocol (CGSR) (Kaur and Khurana, 2014). Whereas Reactive Protocols make a route when they are needed. When a node desires to send data to other nodes primary it discovers a destination node path by route discovery process. Examples of Reactive Protocols includes, Ad hoc On Demand Distance Vector (AODV) Dynamic Source routing protocol (DSR), Temporally Ordered Routing Algorithm (TORA) (Kaur and Khurana, 2014).

The dilemma related to the MANET routing protocol that there is no single protocol available which works better in all types of scenarios. As the user's need may vary from situation to sitution therefore we can suggest some protocols for specific circumstances. This paper studies the effect of density of nodes of the nodes in Warfield and rescue operations scenarios. Two well-known protocols FSR and DSR are selected from reactive and protective categories respectively. Both protocols are simulated in same environment with variable density of nodes.

2. Overview of FSR and DSR Protocols

Fisheye State Routing Protocol is a proactive routing protocol. FSR's technique commonly used for minimizing the size of information to present it in the form of graphs. It is based on eye of a fish which highly configure the pixels near focal point. As the distance from the focal point increases, the detail decreases. The functionality of FSR is to maintain the topology at each node. It only exchanges information with neighbors, which periodically precede them to further neighbor. Link state packets are not over flooded in FSR. The table entries with large sequence number were replaced by small sequence number in this exchange process (Pei, Gerla et al., 2000). The protocol divides the network into different scope, relative to each node. As the distance increases, it gives progressively less detail. The exchange frequency is directly related to distance. The accuracy increases as the packet get closer to destination. FSR minimizes the control message overhead by using periodic exchange of topology map. In FSR when the network size expand more, considerable amount of bandwidth were consumed by update messages. FSR makes the routing protocol scalable by the collection of data on the topology. FSR has highest resolution power in time which helps it to focus its view on nearby changes by observing them and creating changes at destination, but in FSR the performance of protocol is dependent on the number of hops linked to each scope level so that would be chosen carefully. Accuracy is less because of avoidance of fastest nodes information. Routing table size grows linearly with the size of network, and very poor performance in small ad hoc networks (Sathish, Thangavel et al., 2011).

Dynamic Source Routing Protocol is a reactive or on demand routing protocol (Mbarushimana and Shahrabi, 2007). The dynamic source protocol is comprised of two main mechanisms like route discovery and route maintenance which make them self-organizing and self-configuring. Route discovery is the mechanism in which a packet is sent by source node to a destination node by obtaining source route to destination (Sathish, Thangavel et al., 2011). In route maintenance a packet is sent to destination by source node, which is able to detect while using a source route to the destination if the network topology is changed. In DSR source node send packets of information to different distant nodes. Any node that has a path to the destination can reply to the RREQ packet by sending a route reply (RREP) packets. The reply is being sent using the route record in the RREQ packet. Status of the route is assessed by cache node present in route, which also insures the packet successfully cross the link to the next node. If it does not receive any acknowledgement, it reports error back to the source and leaves it to on the source to arrange a new route for its self

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(Nyirenda, 2009). This protocol is based on reactive approach which neglects the need to periodically flood with network along with table update messages which are in table driven approach. Route cache information would be achieved by intermediate nodes to efficiently reduce control overhead. DSR reduces overhead of route maintenance by utilizing the routes when they are required. Discovery of single route may lead to many routes to destination, due to the intermediate nodes may reply route request from the local cache. A broken link could not be locally repaired by route maintenance mechanism. During the route reconciliation phase, route cache information could also result the incontinency. DSR is inefficient because its packet header size develops along with longer of route due to the source routing. One of is drawback is RREQ flooding due to the presence of the request packet which potentially leads to all nodes in the network. In DSR each node is active on for the route request so no energy is saved by this (Nyirenda, 2009).

3. Related Work

Many researches had compared the performance of FSR and DSR with other protocols. Prateek. *et al* had evaluated the performance of DSDV, AODV and DSR. They reported that both reactive protocols performed well in high mobility state than proactive protocols (Prateek, Arvind et al., 2013). Sharma and Roberts evaluated the performance of DYMO, DSR and AODV protocols. They reported that DSR performed well in terms of throughput while give average performance in jitter (Sharma and Roberts, 2012). Thaseen and Shanti studied the performance of FSR, LAR and ZRP routing protocols. They concluded that FSR is a good protocol for dynamically changing network topologies because its throughput is high with mobility of nodes (Thaseen and Santhi, 2012). Pei et al compered the performance of AODV, DSR and FSR in random way point mobility model with UDP traffic and 2.5 sec pause time in 1000x1000 meter square area. They determined FSR is good for large mobile network when mobility is high and bandwidth is low (Pei, Gerla et al., 2000). Satish et al studied the performance of DSR, FSR and ZRP protocols. They reported that DSR performed well as compered to FSR and ZRP in terms of packet delivery ratio and throughput (Sathish, Thangavel et al., 2011). Nand and Sharma appraised the performance of ZRP, FSR and AODV. They established from the results that FSR and AODV were appropriate for falling routing traffic overhead and for throughput in highly mobility nodes. ZRP is superior for low mobility scenarios (Nand and Sharma, 2011). Mittal et al assess the performance of DSR under static nodes and dynamic nodes with and without trajectory. They reported that in Static nodes network the entire thing is finished with the consent by network management authority except in Dynamic each node is liberated to be in movement or disappear/join (Mittal, Singh et al., 2013).

4. Simulation Environment and Parameters

The simulation is conducted in NS-2 for the network of 7, 14, 21, 28 and 35 nodes deployed randomly, move according to Random way point mobility model for Warfield scenario. The node's speed varry from 0 to 2m/s. The pause time are kept 3sec for the complete 300 sec of simulation time. The terrain area is 300m x 300m with constant bit rate (CBR) traffic pattern. The values for the diverse parameters are summarized in the table given below:

The performance metrics used for comparison are throughput, end- to-end delay, and routing overhead. Throughput is the time consumed by delivered data packets from source to destination. This gives effectiveness of a routing protocol with in time constraint and its unit is kbits/sec or Mbits/sec (Taneja and Kush, 2010). End to End Delay- Total time span taken by a packet to deliver from source to destination. This includes queuing, processing, transmission and propagation delay (Taneja and Kush, 2010) (Makkar, Bhushan et al., 2011). Routing overhead is the whole numbers of routing packets move across the network often represented bit per second or packet per second.

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Table 1: Simulation values and parameter

Parameters	Values
Simulator	NS2
Terrain Size	300m x 300m
Scenario	Warfield
Number of nodes	Variable (7,14, 21,28 and 35)
Node Speed	0-2m/s
Simulation time	300 Sec
Mobility model	Random way point model
Traffic model	CBR (Constant bit rate)
Routing protocols	DSR , FSR
Node placement	Random
Pause time	3sec
Number of Nodes	7, 14, 21, 28 and 35
Radio propagation Model	Propagation /two ray ground
MAC protocol	IEEE 802.11
Antenna Model	Omni –directional
Channel type	Channel/Wireless channel

5. Results and Discussion

The aim of this research was to shed light on the performance of two well-known protocols from both reactive and proactive classes in a warfield scenario for variable node density in 300x300 meters square area. The performance measured in terms of end to end delay, routing overhead and throughput.

Figure 1 below shows the average end to end delay which is composed on four basic delays i.e. transmission delay, processing delay, propagation delay and queuing delay. Its observed from the simulation that in warfield and rescue scenario that DSR has more end to end delay as compared to FSR. The delay upsurges as the number of nodes increases. The possible explanations for DSR delay are. First the network is not converged with DSR initially, so the DSR has to converge the network by flooding to find the route from source to destination. Second, in DSR when a source node forwards a packet to the destination node, each node in way through which the packet passes adds a new header until it reaches to the final destination. While FSR has fresh updated path information of each nodes due to proactive routing strategy. Therfore when ever a node has to transmit data, the paths are already available without finding best path which incures delay. The transmission delay is directly proportional to the length of the packet, therefore with increase in size packet transmissions delay rises. The size of the packet also increases the processing and queuing delay.

Figure 2 expresses the results for routing overhead. FSR has higher routing overhead than DSR. FSR routing overhead keeps on increasing with number of nodes. The reason behind that is FSR is a proactive routing protocol. Proactive routing protocol continuously transmit the control message such as "Hello message, Topology information message, routing level to keep the network converged. Those control messages are transmitted by all nodes at regular interval, while DSR does not transmit these control messages as DSR is a reactive protocol and does not converge the network until required.

Figure 3 shows the throughput for both protocols, FSR shows better throughput than DSR. The reason is as DSR is reactive and do not know the path from source to destination. It first establishes the path between source to destination by flooding, things which degrades the throughput of DSR is at each intermediate node the packet header is attached to the packet, making a packet longer, suppose if the packet has to pass through five hops to the destination five extra header will be add with the attach data packet. Where as in FSR it consult the routing tables for destination and forward the packet according, adding no extra headers. So in DSR the overall data is overburdened with per hop header.

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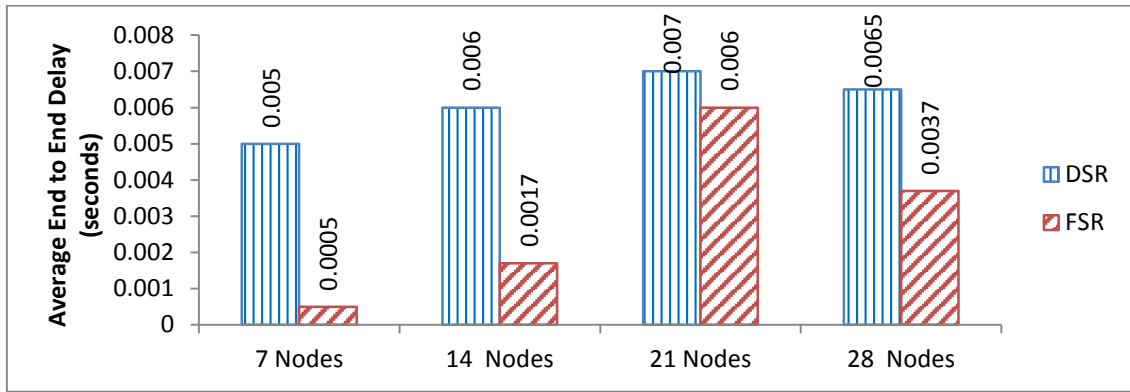
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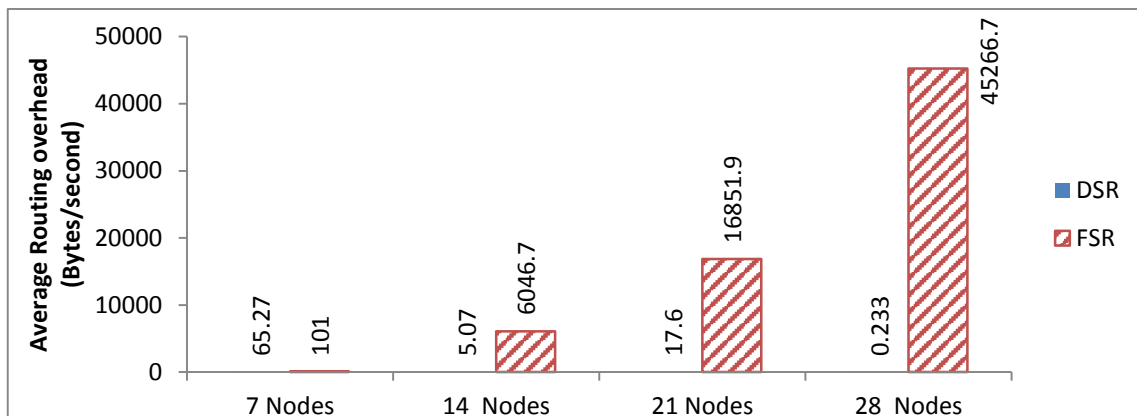
Figure 2: Average Routing Overhead
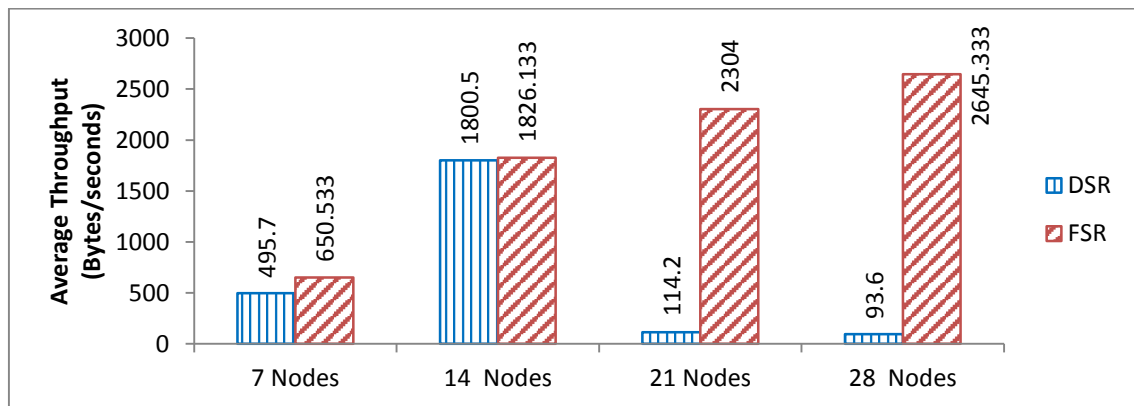
Figure 3: Average Throughput

6. Conclusion

This effort assessed the performance of DSR and FSR routing protocol for MANET through irregular greatest velocity of nodes. We considered the average end-to-end delay, routing overhead and throughput as performance metrics. Our simulation results demonstrated that FSR is the best for warfield scenario as throughput is better than DSR and routing overhead. While the end to end delay of DSR is much higher than FSR. In future study, special node deployement strategy, mobility model, additional metrics such as outstanding energy, average packet size of routing packets and normalized routing overhead might be taken into consideration.

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Applying SPL Approach To Produce High Quality Smartwatch Applications

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Abstract
Nowadays, the demand of smartwatch is very high and it becomes a necessity of life in the era of the digital world. However, prevailing smartwatches do not fulfill the demands of various stakeholders that enforce them to develop their own smartwatches. After all, developing a new product from scratch is tedious and costly. The demand of smartwatch is increasing day-by-day. Hence, it is very important to apply an effective technique that would permit the development of quality products in a speedy way and would cope with current problems. In technical and social views; the price of smartwatches is increasing while regarding application area, interconnection with other mobile devices also likely to introduce security and privacy issues. To address these problems, we have introduced the SPL approach for the development of smartwatch and also we have identified the architectural drivers such as privacy, flexibility, evolvability, variability, availability, and performance in our SPL approach in order to develop quality products. Feature Modeling approach is used to model the variabilities and commonalities while for architecture designing orthogonal variability model is utilized.The SPL for smartwatch development can provide high satisfaction of stakeholders needs as well as high extensibility of smartwatch functionalities.

Keywords Architecture design; smartwatch; software product line; Smartwatch applications; Orthogonal Variability Model

1. Introduction

The world of digital data is progressively moving from hand carries to wearables. The wearable technology is growing rapidly and is expected to blow up in near future (Vincenzo Morabito,2016). It provides a strong foundation for any type of technological innovations that are wearable. Wearable computing, wearable gadgets, or wearable clothing has penetrated in every walk of life and it becomes everyday consumer technology even in strategic organizations like military as well (Adami, 2015 and lamkin, 2016). Global market invests a huge amount of money on wearable technology which was $2 billion in 2015 and is anticipated to reach $5.8 billion in 2018(statista,2016). According to Bernard Marr, growth in wearables market is expected to go up to 35% by 2019(Bernard Marr, 2016). According to [CSSinsight,2016] half of wearables sold in 2018 will be smartwatches and it is rapidly increasing. As in Figure. 1, tech analyst firm CSS Insight shows the market share of smartwatches among wearables.
Smartwatch has become part of life for millions of people worldwide. The concept of the smart wristwatch is not new. The plus Four Wristlet Route Indicator from 1927 can be considered as the

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first wrist-worn navigation gadget and Seiko and Casio developed data entry watch in the 1980s (Joan Bempong, 2016). The smartwatches have been evolved rapidly and now almost considered as the necessity of life.

In order to meet the customer requirements, products should be developed quickly with high quality. Single-system engineering approach only addresses the single application development and it considers the design as *use* perspective, while the SPL approach focuses on *reuse* of core assets. Therefore, only software product line (SPL) approach can cope with this challenge by developing core assets to reuse them to produce several applications to meet the diverse needs of customers with lower cost.
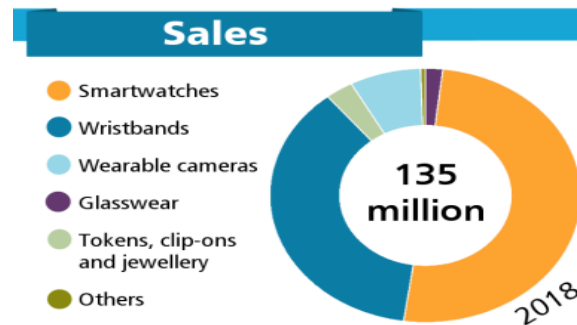
Figure 50:Market Share of Smartwatch

Hence, it is very important to produce smartwatch products using SPL approach that reduces the time to market, cost and produces quality products. In SPL approach core assets are considered as the foundation of SPL. The core assets comprise product line architecture (PLA). The PLA is a layout for creating products of the related domain. The PLAs allow to build a number of applications from same architecture and companies do not need to build products individually (D. Batory,1998). In order to satisfy emerging needs of customers, it is necessary to have an efficient PLA so that products could be driven by using reference architecture.

In this paper, we propose a PLA for a smartwatch that covers variabilities and commonalities of smartwatch domain. As smartwatches often share similar behaviors, shifting the focus from single product to that of the product line is an effective way towards software reuse.

The contribution of this paper is dual. First, SPL fundamental concept is applied for designing architecture of smartwatch. By applying SPL approach, we performed domain analysis and architecture design to illustrate commonalities and variabilities of smartwatch domain. To show righteousness, the state-of-the-art practice, i.e., SPL practice at SEI is applied. For every single sub-process, best development practice is chosen. For modeling of variability and commonality, Feature Modeling is used and for architecture designing, OVM is utilized. Secondly, to start designing architecture of smartwatch domain, architects require the key requirements that are likely to have an impact on the basic structure of the implementation. These requirements decide the structure of smartwatch architecture – they are known as architectural drivers. Architectural drivers are high-level functional requirements, technical constraints, business constraints, and quality attribute requirements. we identified the quality attribute requirements of the smartwatch, such as variability, availability, evolvability, flexibility, privacy, and performance. These drivers are the design forces that presides over the early design decision.

2. Related Work
2.1 Software Product Line Practice
SPL can be expressed as "A set of software-intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way" (Clements et al., 2002). Core assets are the foundation of SPL that encompass, reference architecture, reusable components, and requirement artifacts. According to reference (Pohl, K et al ,2005), SPL process has two paradigms:

domain engineering and application engineering. In domain engineering SPL engineers' setup, a reusable platform and make a reference architecture by defining commonalities and variabilities. The purpose of SPL is to reduce time to market and cost of production and to increase the quality of products by reusing core assets which already have been tested and verified. To accommodate diversity between products while reusing core assets is the aim of this approach. This diversity could be brought by accommodating variability in a systematic and defined way. Therefore, variability management is the primary factor in the success of any SPL.

We propose an approach to the development of smartwatch which is based on SPL approach and it considers all necessary architecture drivers during the development of products. SPL includes two processes: domain engineering process and application engineering process. Domain engineering (development for reuse) process is composed of domain analysis, domain design, and domain realization while in application engineering process (development with reuse) products are derived from domain engineering by reusing core assets as shown in Figure 2. Core assets are reusable artifacts that are utilized in building more than one products in an SPL. Core assets can be domain models, software components, requirement specifications, test plan, and process description etc. (Clements, P., Northrop, L, 2002). The application architecture determines the general structure of targeted application. The architecture quality drivers like variability and flexibility support the entire range of application architectures. The application architecture is obtained by binding the variability of reference architecture which is documented by using orthogonal variability model (OVM).
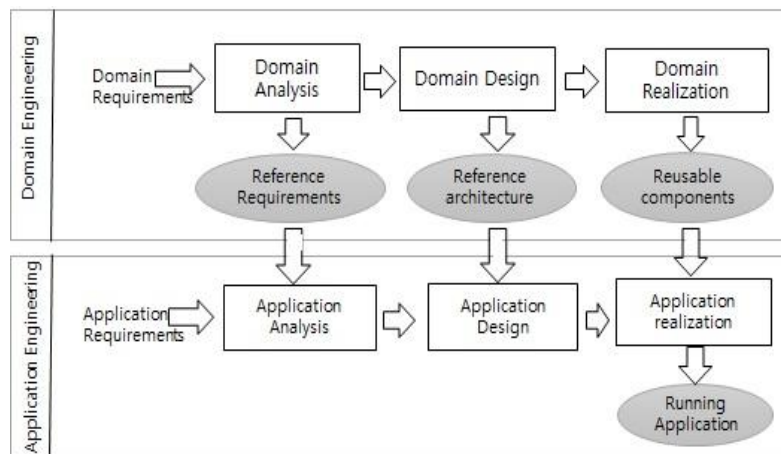
Figure 51: Software Product line approach

In CMU/SEI (SEI framework 5.0, 2016) various practices of SPL framework are expressed in detail to aid industrial practitioners to apply SPL. Industrial practitioners usually consider suitable areas for research that include: product line scoping, understanding the relevant domain, requirement engineering, architecture design, and architecture evaluation. In product line scope practice area, the domain knowledge can be gathered to identify features of SPL (K. Schmid, 2002). In practice of requirement engineering, engineers know how the system should act, the features it should own, the qualities it should show, what the system must. The system must satisfy constraints of the system and its development to satisfy the demands of customers of the specific market segment. During SPL architecture design, the structure and texture of system are defined. Architecture is a very important aspect in SPL because reusability depends on the structure of architecture. In SPL many methods are used to design the architecture (M. Matinlassi, 2004). OVM (Pohl, K et al ,2005) methodology can be used for building the architecture of SPL to make sure the reusability of a reference architecture to produce quality products. In architecture evaluation practice area, quality of architecture is measured by Architecture Tradeoff Analysis Method (ATAM) (SEI, August 23, 2016). ATAM method exposes architectural risks and provides insight to show how quality attributes tradeoff against each other.

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2.2 Smartwatch

With the popularity of smartwatches, a number of studies on smartwatches have been carried out. The patent (Richard et al. 2013) disclosed a block diagram of smartwatch and user interface features. The smartwatch has become part of daily life and research is in progress to use it in every perspective of life. It is also used as a tool for medical adherence (Shrivastava et al., 2015). As the demand of smartwatch is very high because smartwatch is very popular now a day and it is used almost in every walk of life. In order to derive different smartwatch applications as early as possible to meet the demand of various customers. SPL approach can be useful to reduce time to market and to produce quality products at very low cost. However, to the best of authors knowledge, there is no literature that addresses the SPL approach for smartwatch domain.

3.   Smartwatch Product Line Engineering

This section elaborates the development of Smartwatch by applying product line approach and the focus of this section is domain engineering process of SPL.

3.1 Domain Engineering

The scoping is the preliminary activity of domain engineering and it must be defined before domain analysis. In this case, the aim of SPL is to deal with smartwatch applications that fulfill the needs of individuals in a different walk of life such as for students, professionals, patients, sports persons and for parents to monitor their kids. Domain engineering consist of three sub-processes: domain analysis, domain design, and domain realization sub-process (Figure 3).

3.1.1   Domain Analysis

The aim of domain analysis is to elicit and document the commonalities and variabilities between the SPL family members. Commonality and variability can be modeled in many different ways depending on goals and viewpoints but we have employed Feature Model. Feature Model is a tree where features of the system are represented by nodes. Children of a node show different features which are part of parent feature. Feature modeling was initially introduced by [Kyo C. Kang, et al] and researchers in (Kyo C. Kang, et al 1998, Krzysztof Czarnecki,2000) further elaborated the Feature Model and it has been welcomed extensively by SPL professionals. Based on the selection of these features new product of SPL is derived. This is due to the fact that features are abstract concepts that support communication among stakeholders of SPL, therefore, it is easy for product line engineers to express commonality and variability of SPL as features (R. Capilla et al. 2013). Researchers have defined methods (Y. Lin, et al. 2010) to transform feature models into architecture models and software architecture designing is one of the crucial and important phases of software development cycle, hence it needs a lot of attention (L. Tan et al. ,2012). Figure.3 shows feature the feature model of the smartwatch. As shown, features are modeled either mandatory, optional or alternatives. Mandatory features show commonalities while optional and alternatives show variable features of SPL. Display and applications are two main features of the smartwatch. However, a smartwatch may include other functionalities as shown in Figure. 3.
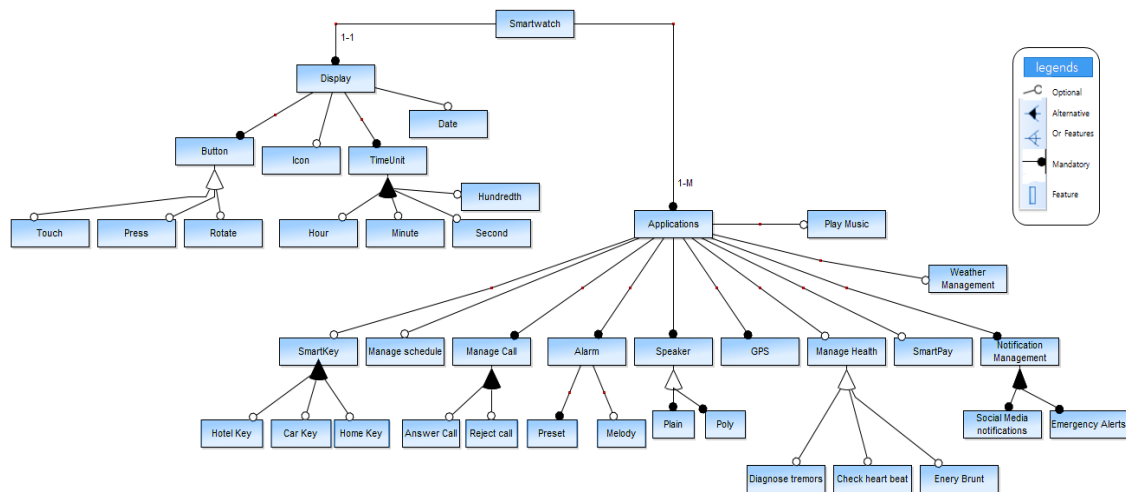
Figure 52: Feature Model of smartwatch

3.1.2   Domain Design

The intent of domain design is to build a generic PLA for the product line. The determined variability during domain analysis sub-process is expressed explicitly in PLA. To design reference architecture for a smartwatch, OVM (Kyo C. Kang, et al, 2000) is utilized for modeling the variability in the design phase. OVM provides a cross-sectional view of variability across all product line development artifacts. The meta model of OVM is shown in Figure 4 (Pohl, K et al ,2005).
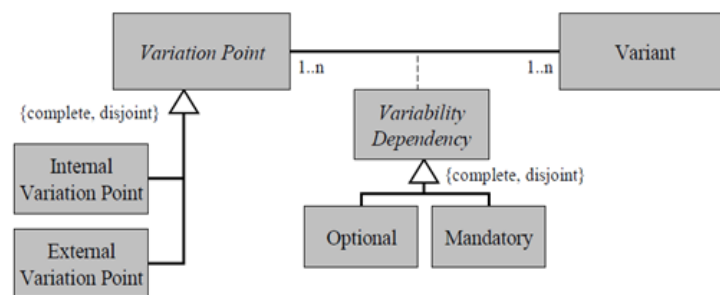
Figure 53:OVM variability meta-model

The OVM is comprised of two elements: variability subject or variation point (VP) and variant or variability object (Kyo C. Kang, et al, 2000). In OVM, variability is shown separately from the component diagram and traceability links show the implementation of specific variability. To construct Feature Model we used used MetaEdit+ (MetaCase,August 12,2016) to model the features of the smartwatch.

In Figure 5, the component "Health Management" is implemented in one or more versions such as energy brunt, heartbeat, and diagnose tremors. "Energy brunt" component is implemented further such as the energy in calories or in kilocalories.

Some quality requirements arise when we apply SPL approach for a smartwatch. Most important quality requirements are those which supports flexibility, evolvability, variability, availability, privacy and performance.

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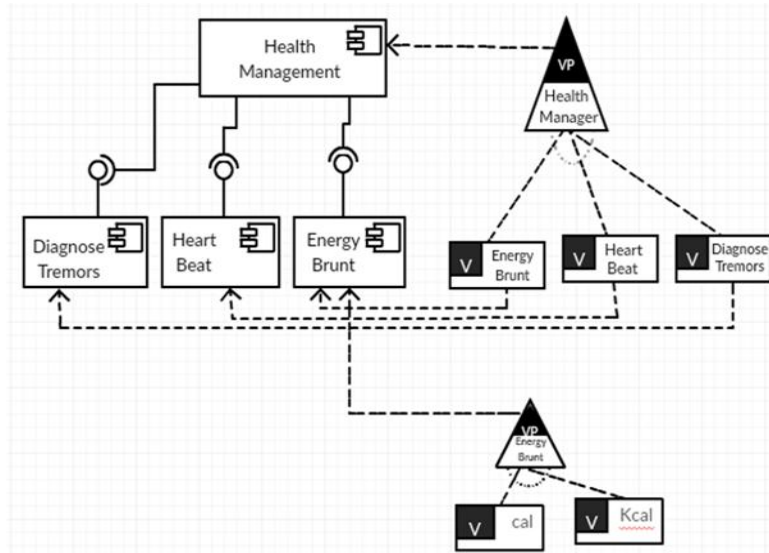
Figure 54: Architecture of health management component

Architectural quality drivers are not all requirements for a smartwatch, but they are an early attempt to capture and identify those requirements, that are most effective to the architect to make early design decisions. Hence our proposed architecture focuses on the architectural quality drivers to deliver a quality architecture. The architecture of the system is designed flexible to provide easy changes. It is impossible to envision all future requirements of the SPL products; therefore, architecture must have the capability to cope with it. While designing architecture of SPL, architects consider the evolvability of architecture.

This quality of SPL goes further than flexibility and it deals with changes to architecture itself. Variability is very important for architecture designing. The architects determine which configuration mechanisms to use and where they should apply. The variability is the property of a system that addresses various needs of customers and provides them customized applications. Availability is also a most important quality requirement because smartwatch is consisting of many devices and applications. They could fail individually or simultaneously.The failure can endanger the system operation. Smartwatches offer many benefits to end-users in terms of real-time access to the information but they also lead to complex privacy and security issues (Harrison et al.,2014). Regarding privacy, access to data should be restricted to only authenticated users. The smartwatch should forbid malfunctions and flaws with appropriate error handling and input validation. For performance, all operations must evade excessive memory consumption. In the case of running many applications, the smartwatch should support scalability to avoid slow service.

3.1.3 Domain Realization

The intent of this sub-process is to provide the detailed design and implementation of core assets, based on SPL architecture. The reusable core assets are components and interfaces. The components which are identified in domain design are implemented in detail to reuse in application engineering. Since the output of this sub-process is not a working application, but rather, loosely coupled reusable components.

3.2 Application Engineering

The aim of application engineering process is to engineer reusability of core assets as high as possible. In application engineering variabilities and commonalities are exploited and variants are bound to build new

applications. During Application engineering, different smartwatches are derived in accordance with the customer's specific needs. The feature model of smartwatch provides a variety of applications

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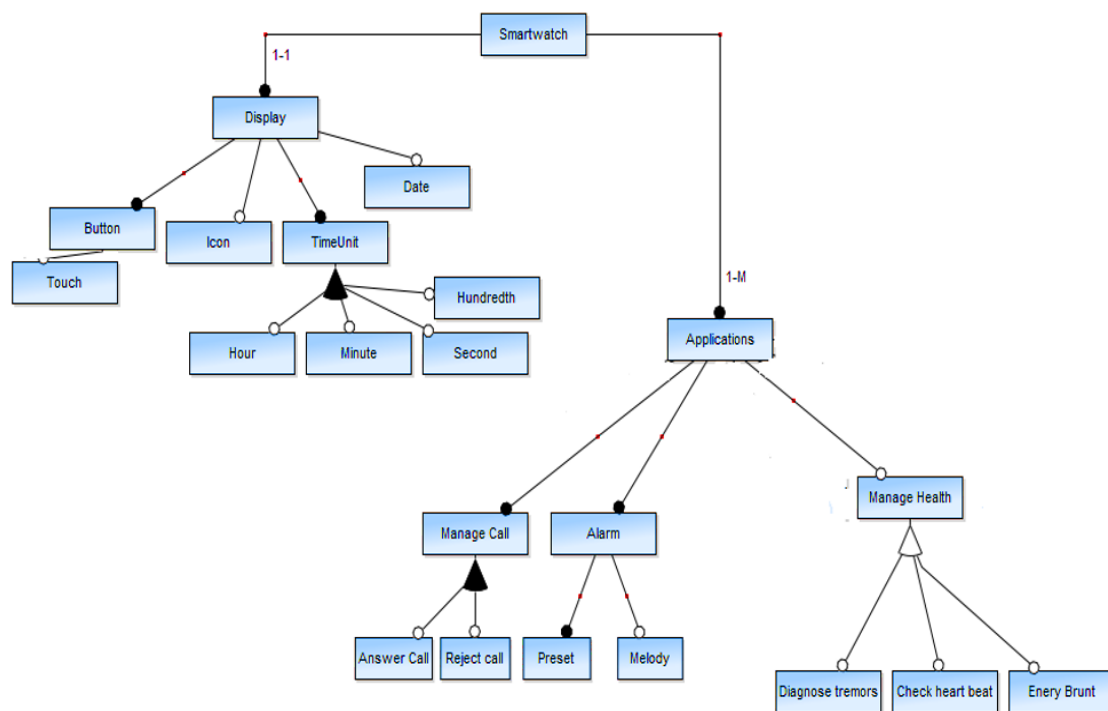
Figure 55:A specific configuration model

for different stakeholders. To derive different smartwatches, we chose respective features from the feature diagram to meet the specified needs of customers. For example, Figure 6 shows a configuration of feature model depicted in Figure 3. This specific smartwatch addresses the needs of customers in health domain and also support call management, alarm, and other functionalities. The feature model of a specific smartwatch is then used to specify which variabilities must exist in that particular architecture. During application configuration, we determine the binding time of variation points. For example, categorizing users by need, we bind the variants at this level.

4. Conclusion

The world of digital data is progressively moving from hand carries to wearables. The smartwatch has been used in all walks of life. According to the Tech analyst firm CSS Insight, the smartwatch has a share of $135 million, which will be half of the amount of all other wearables sold in 2018. Nevertheless, prevailing smartwatches have some complications that include technical and social issues. Technically, smartwatches became much costly. Regarding social issues, smartwatches also likely to introduce new and complex security and privacy issues.

In this research, we propose an SPL approach for smartwatch development to cope with aforementioned problems. Through the application of SPL, we performed domain analysis, architecture design, and domain realization to show commonality, variability, and their management regarding smartwatch development. We identified the quality drivers for the development of smartwatch, which leads to the development of the quality system. To show its appropriateness, the framework for SPL practice at SEI is applied. For variability modeling, feature modeling technique is utilized. For architecture designing, OVM is used. In the health management component diagram, "provide" and "require" relationship between interfaces for components are described.

In this paper, domain analysis and architecture design sub-processes of domain engineering is considered while domain realization or detailed design is left for future work.

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Segmentation and Classification of RBC and WBC in Blood Using KNN

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Abstract

The objective of the paper is to present the blood cells classification method to develop an automatic differential blood smear count system. To perform proper identification of the disease, the blood samples must be known for identification. The counting and analysis of blood cells provides a useful information to the pathologist, for finding the infection and its action. The proposed system consists of two automatic steps: segmentation of blood cells and Classification of blood cells. Different features of cells are then extracted from the image. From these features, database is created and with the help of this database, set of test images and kNN algorithm is used for learning, and classification. Experimental results have shown the effectiveness of system.

Keywords, Blood cells, segmentation and classification, using kNN algorithm.

Introduction.

1. Introduction:

The process of life is maintained by blood, and it is a body flowing that consisting of plasma and blood cells .The blood cells can be classify as erythrocytes, leukocytes and thrombocytes. To perform proper identification of the disease, the blood samples must be known for identification. For the image acquisition used, the blood smear slides are taken by high resolution digital camera to microscope; the images are captured by adjust microscope magnification to get good declaration. For identify different types of blood cells and for count their quantity in blood smear, image processing is used on various blood smear images. The image is preprocessed, so as to remove noise, and then change to gray level is done. For separating out various cells, morphological operations followed by watershed segmentation and labeling of segmented cells. Different features of cells are then extracted from the image. From these features, database is created and with the help of this database, set of test images and kNN algorithm is used for learning, and classification of image is done.

Blood:

The familiar red fluid in the body that contains leukocytes (WBC) and red blood cell (RBC), platelets, proteins, and other elements. The blood is transported throughout the body by the circulatory system.

Erythrocytes - (RBC's):

The erythrocytes are the cells which are highest in numbers. It does not have nucleus. Their cytoplasm consists of hemoglobin that gives a typical red color of the cells. Its primary Function is to transport oxygen from the lungs to the cells of the body & assist with CO_2 removal.

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Leukocytes-(WBC's)

One of the cells the body makes to help fight infections. There are several types of white blood cells (leukocytes).The two most common types the lymphocytes and neutrophils.

Neutrophil:

A type of white blood cell that is filled with microscopic granules, little sacs containing enzymes that digest microorganisms. Or a type of white blood cell with a nucleus that is so deeply divided that the cell looks to have multiple nuclei. In formally called a poly.

Eosinophils:

The nucleus of eosinophil is frequently bi-lobed and its cytoplasm consists of orange to red stained granules.

Basophiles:

They are very less in blood. The nucleus of basophile is frequently bi-lobed to multi-lobed. After staining, the cytoplasm is full of large, deep-bluish to purple granules.

Monocytes:

Monocytes are large, circulating, white blood cells having the kidney shaped nucleus. The cytoplasm is of light blue color.

Lymphocytes:

A small white blood cell (leukocyte) that plays a large role in defending the body against disease. Lymphocytes are of 2 main types B cell sand T cells. It has a large, dark-staining nucleus with a Small cytoplasm to nucleus ratio.

Platelet:

An irregular, disc-shaped element in the blood that assists in blood clotting. During normal blood clotting, the platelets clump together (aggregate). Although platelets are often classed as blood cells, they are actually fragments of large bone marrow.

2. Proposed Method Architectures.

Blood segmentation and process consist of the following step.
Chart 1 shows the stages of classification.
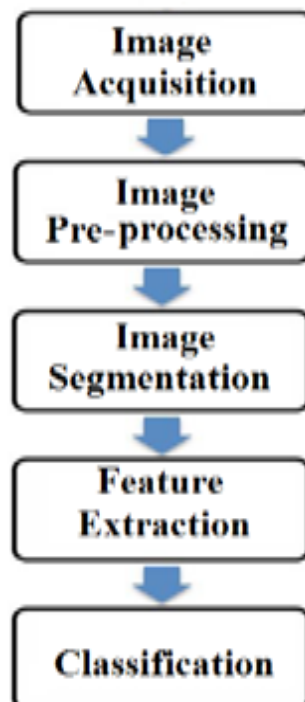
2.1 Image acquisition:

The images from blood smear slides are captured by connecting high resolution digital camera to a microscope by adjusting microscope magnification to get good resolution.

2.2 Image preprocessing:

The pre-processing stage includes noise reduction and contrast enhancement of acquired image and is performed to prepare the image for the further stages. For processing the image it is converted into gray scale image, to avoid being influenced by dye color. A typical peripheral blood smear image consists of four components, namely background, erythrocytes, leukocytes, and thrombocytes. To segment the desired object from the background, the green channel is used, as it is found that the green component of the RGB input image gives the best contrast between the background and the foreground which consists of blood cells.

2.3 Image segmentation:

In image processing, segmentation is the process of partitioning a digital image into multiple segments. For blood cells classification, segmentation of cells is required. So, for segmentation of blood cells, the segmentation process based on thresholding, morphology, and watershed segmentation is used. It is performed to cover every element in the blood slide in a distinct area.

i.   Binarization:

In order to segment the desired object from the background, i.e. to produce a binary image, that separates foreground and background image pixels, Otsu's adaptive threshold algorithm is applied on the green channel.

ii.   Mathematical Morphology:

Mathematical morphology operations are used to fill the holes in the blood cells and to remove the unwanted points in the red blood cells and background.

iii. Watershed Segmentation:

For separation of overlapping cells, watershed transform is used.

2.4 Feature Extraction:

In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction. To analyze the individual objects of interest from the background in the segmentation process, border touching cells obtained in binary images are removed and then labeling of the objects within the segmented image is performed .The features of the blood cells such as area, histogram, circularity, cytoplasm ratio, color of cytoplasm are extracted from a set of images to prepare a database, required for classification of cells. A hierarchical strategy is used here so as to get fast and more accurate classification of cells. Chart 2 shows the hierarchical strategy of classification.

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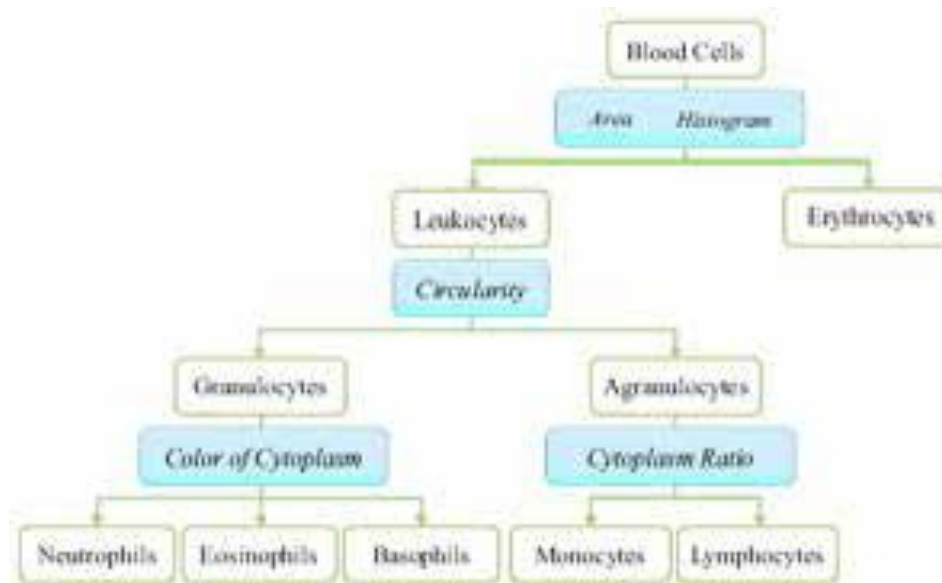
i.   Area & Histogram:

Out of various blood cells WBC's are the largest whereas platelets are the smallest blood cells. So, area can be used as a feature to separate WBC's from RBC's. Also based on histogram, RBC's and WBC's can be separated out; as RBC's are without nucleus and WBC's have nucleus. After the labeling of the segmented cells in a binary image, WBC's and RBC's can be separated out based on these features. For further features the segmentation of nucleus of WBC from its cytoplasm is required.

ii.   Circularity:

The circularity of the nucleus of WBC is calculated using below listed formula, and if the circularity is one, it indicates a perfect circle and if it is 0, it indicates increasingly elongated polygon. So, based on circularity, WBC's can be divided into a granulocytes and granulocytes, as a granulocytes have almost circular nucleus, whereas granulocytes has irregular shape nucleus.

$Circularity = 4*\pi *(AiP/i\,2)$

Where, Ai = Size of the nucleus in the labeled blood cell i,

Pi = Perimeter of the nucleus in the labeled blood cell i.

iii. Color of cytoplasm:

The granulocytes are named according to their staining properties. So for each granulocyte, hue component is found and then average and standard deviation is calculated.

iv. Cytoplasm ratio:

Lymphocytes have larger nucleus then monocytes, so the ratio of the cytoplasm to the cell can be used to distinguish between monocytes and lymphocytes which are types of granulocytes.

$Circularity = 4 *\pi * (AiP/i\,2)$

Where, Ai = Cytoplasm area of the labeled cell i.

2.5 Image classification:

There are various techniques to classify images. The algorithm used here is kNN. In pattern recognition, the k-nearest neighbor algorithm is a method for classifying objects based on closest training examples in the feature space. KNN is a type of instance based learning, where the function

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is only approximated locally and all computation is deferred until classification. Here an object is classified by a majority vote of its neighbors, with the object being assigned to the class most common amongst its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of its nearest neighbor. The drawback of this simple approach is the lack of robustness that characterizes the resulting classifiers. The high degree of local sensitivity makes it highly susceptible to noise in the training data.

3. Results and Conclusions:

In this proposal the main interest is that it becomes suitable for further processing, like segmentation and counting of Red blood cells, Segmentation, classification and identification of White blood cells, platelets removal, checking the morphology of the cells. This works presents the values corresponding to features computed for different types of segmented cells. From experimental results it is observed that neutrophils, a type of WBC's, are having highest area whereas RBC's are of smallest area, if compared between RBC's and WBC's size It is also observed that , among various types of WBC's, monocytes and lymphocytes are the one which are having nearly circular nucleus. In addition, it is seen that monocytes has larger value of cytoplasm ratio compared to lymphocytes. From results obtained it can also be stated that, mean and standard deviation of hue component of various. Granulocytes are different, indicating the different color of cytoplasm of each granulocyte.
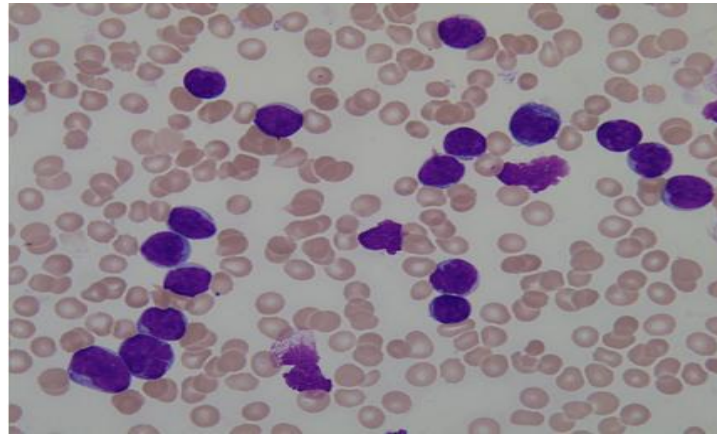
Figure 56

Figure 1: show the blood smear slides are captured by connecting high resolution digital camera. Or microscopic image

Figure 57

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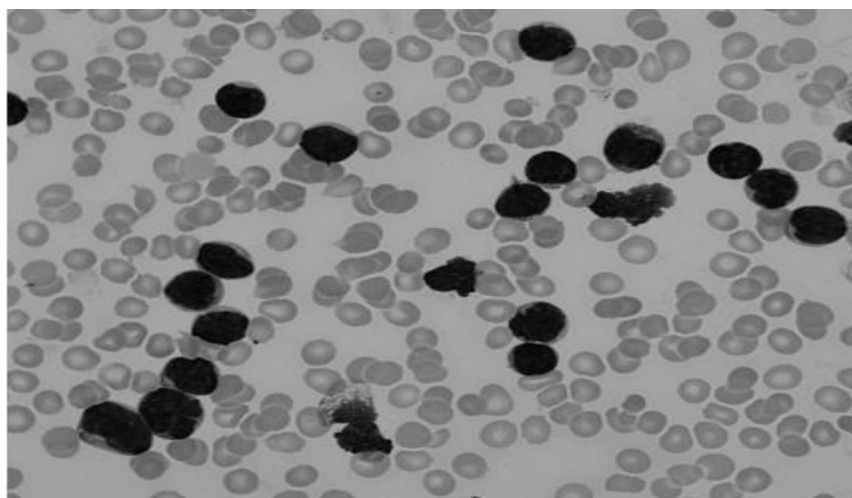
Figure 2: show the gray scale image

The pre-processing stage includes noise reduction and prepares the image for the further stages. For processing the image it is converted into gray scale image,

Figure 58

Figure 3: show the threshold image.

In image processing, segmentation is the process of partitioning a digital image into multiple segments. For blood cells classification,
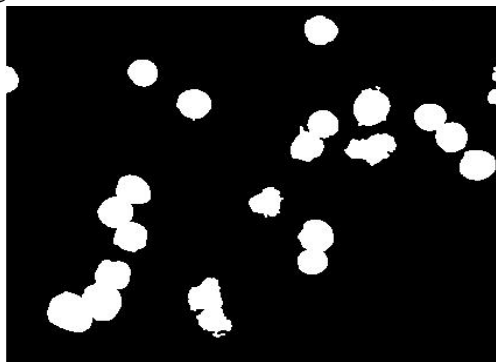
This figure shows the background Removal blood
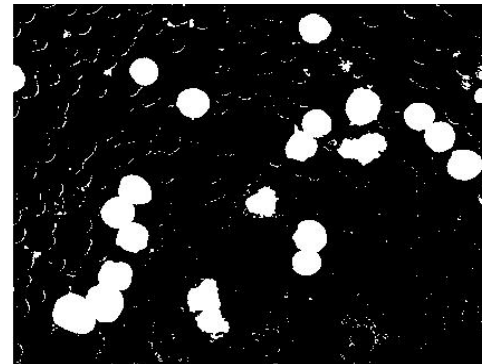
this figure show the area opening result.

Table shows the different feature values of different cells.

| Cell type | Features | | | | |
	Area	circularity	Cytoplasm ratio	Cytoplasm Color Mean	Std Dev.
1	1.989	NA	NA	NA	NA
2	5.717	0.317	NA	3.366	0.93
3	5.190	0.386	NA	3.930	0.77
4	4.975	0.271	NA	4.619	0.50
5	3.452	0.704	0.3722	NA	NA
6	2.981	0.833	0.2439	NA	NA

Table 1: Experimental results *1: Erythrocytes, 2: Neutrophils, 3: Eosinophil's, 4-Basophils, 5-Monocytes, 6-Lymphocytes, NA – Not applicable

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A Corpus Based Study of the Frequency in the Use of Common Discourse Markers by the Native and Pakistani Non-Native Speakers of English

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Abstract

The attention of the researchers to the discourse markers in the field of linguistics started in 1980's but its main focus was only the native speakers of English. With the passage of time the scope of research took its turn towards the non-native speakers of English. Many researchers have discussed the use of the discourse markers as well as the frequency of the occurrences of DM by non-native speakers. The main purpose of this research paper was to find out whether Pakistani non-native speaker uses more discourse markers (DM) or is that the native speaker who takes the help of pragmatic markers in their day to day conversation. The research was conducted by using the AntConc software which is a corpus tool for analyzing data. All the data was collected in the form of interviews and conversations between native and non native speakers. The results have shown that the use of pragmatic markers by Pakistani non native speakers is more than that of the native speakers of English which were mostly used as the connectors between the utterances.

Keywords Discourse Markers, Non-Native Speakers, English Language, English Native Speakers

1. Introduction

The word discourse is widely used in linguistics like discourse analysis, discourse community, discourse markers, expressive discourse, hortatory discourse, Meta discourse, modes of discourse etc. In this discourse literature discourse markers or pragmatic markers are used both in written as well as in spoken. According to Buyssee (2012) discourse markers (DM) fulfill indexical function that is an optional linguistic item which connects utterances in the context. Discourse markers are also called discourse connections, discourse operators, sentence connectors etc. "Every researcher has a different view on their functions and definition" (Jabeenetal. 2011). Discourse markers do not affect the truth condition of statements but it adds to the decoding of what is said (Moreno, 2001).

The researches in this field begin in 1980's where researchers paid attention to the delimitation of domain of DM including pragmatic issues. Yet all the researches were based on the native speakers' use of DM. It was in the recent years that the scope of DM has extended to the non-native speakers as well. The scope of investigation regarding DM not only extended to NNS but also to the wide range of language varieties and corpora especially in the learners language (Aijmer Simon-Vandenbergen, 2009)

Many topics related to DM are explored by researchers in comparison with DM in non-native English speakers' languages including Chinese, French, Spanish etc (Ying, 2007; Moreno, 2001). However, there is very little known about the frequency of the use of pragmatic markers by Pakistani non-native speakers. The present paper calculates the frequency of the use of the DM by

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Pakistani non-native speakers in comparison with the native speakers. The occurrence of discourse markers is explored quantitatively to answer the question if non-native speakers use pragmatic markers more than that of the native speakers of English.

2. Mehtodology

Data for this research was selected from television interviews where the non-native speakers were interviewed by the native speakers. Data in this research is based on 8 conversations that are between the native and the non native speakers. The non native speakers are all Pakistani where as the native speakers of English are from different backgrounds mostly Canadian native speakers. Some conversations were taken from the news channels and the data was retrieved from different news channel websites. Other data was collected by recording live conversations between the native and non-native speakers of English. To increase the validity of the results the speakers were not informed about the recording but were asked later if their conversation can be utilized for the research purpose. The subject who showed a positive response only their data was utilized in the research.

After the collection of all data the conservations were typed word by word. The non native data was typed separately from the native data. It was then passed through the corpus tool named as AntConc to calculate the frequency of the occurrences in both the native and non native. The device helped in locating the discourse markers in both conversations. The results shown by the tool were saved and analyzed. The words that were not functioning as the discourse markers were excluded and the rest of the data was analyzed for the results.

3. Results

The discourse markers that were studied in this research included you know, see, like, and, you see, so, kind of, I mean, look, well and hmm. Firstly, the non native Pakistani English data was analyzed for all the discourse markers mentioned above. In that data the use of "see" was checked. The concordance hits for "see" were 8 in which only 5 were used as discourse markers by the non-native speaker, where as in the conversation of the native speaker the use of "see" as a discourse marker was just 4 times (see table 1). This shows that "see" is used more by the Pakistani English speakers than that of the native speakers of English in their speech.

Table 67: Use of Discourse Marker "See"

Discourse marker	Native speaker	Non-native Speaker
See	4	5

In the recent years the non-words like "Um and Hmm" are studied for their interactive purpose in conversation and therefore are added to the discourse markers category (Vasilescu et al., 2010). Both hmm and um are used for keeping the conversation flawless (see table 2). It is also used to keep the conversation clean from the pauses and earns the speaker some time for thinking while he is speaking. The results for the use of hmm and um were checked in both native and non-native conversations. The concordance hit for "hmm" as a discourse connector was eight (8) in the non native speech, where as in the data of native speakers' conversation it was used four (4) times. This shows that the use of Um or Hmm is more in the Pakistani non-native speakers' conversations than that of the native speakers of English.

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Table 68: Use of Discourse Marker "Um or Hmm"

Discourse marker	Native Speaker	Non-native Speaker
Um or hmm	4	8

"So" is a discourse marker that has occupied many researchers because it acts in various ways in a sentence. The concordance hits for the pragmatic marker "so" was 36 in which only 19 were used as discourse markers by the native speakers of English where as the concordance hits were 32 in the Pakistani non native speakers' data in which 31 were used as a discourse marker. This shows that Pakistani non native speakers of English uses 'so' more than the native speakers of English. Pakistani non native speakers have used 'so' mostly as a discourse marker unlike the native speakers.

Table 69: Use of Discourse Marker "So"

Discourse marker	Native Speaker	non-native speaker
So	19	32

When the data was put through the corpus software for the check of frequency of the discourse marker "you know", the results showed the occurrence of "you know" was more in the non native data then in the native one (see table 4). The concordance hits for non native was nine (9) in which only six (6) were used as discourse connectors where as in Pakistani non native data the concordance hits were ten(10) in which all were used as pragmatic markers.

Table 70: Use of Discourse Marker "You Know"

Discourse Markers	Native Speaker	Non-native Speaker
you know	6	10

The data was searched for the frequency of occurrences of discourse marker "well" in native and Pakistani non native conversation in English (see table 5). The results in the non native data showed six (6) occurrences where as in native data it showed five (5) occurrences. The difference in the use of "well" in both conversations is not very different, yet the frequency is more in non native speakers' data.

Table 71: Use of Discourse Marker "Well"

Discourse Markers	Native Speaker	Non-native Speaker
well	5	6

"Look" is also used as a pragmatic marker to connect the utterances. AntConc searched the frequency of occurrence of "look" in both native and Pakistani non native data and the results showed no concordance hits (table 6). This means that look is rarely used by the native and Pakistani non native speakers of English.

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Table 72: Use of Discourse Marker "Look"

Discourse Markers	Native Speaker	Non-native Speaker
Look	0	0

When the data was put through the software to check for the concordance hits for the discourse marker "and" the result for the non native speakers was seventy two (72) in which only twelve (12) times it was used as discourse marker (see table 7), where as in the results of the native speakers showed the concordance hits with seventy seven (77) in which only nine (9) were used as pragmatic markers.

Table 73: Use of Discourse Marker "And"

Discourse Markers	Native Speaker	Non-native Speaker
And	9	12

The concordance hits for the pragmatic marker "i mean" showed one(1) and two(2) in native and Pakistani non native conversation respectively (see table 8). Similarly the concordance hits for "you see" was also one (1) and two (2) in native and non native conversation respectively but the use of 'you see' in native speakers' conversation was not as a pragmatic marker.

Table 74: Use of Discourse Marker "I mean & you see"

Discourse Markers	Native speaker	Non-native Speaker
I mean & you see	1	2

All these results show that Pakistani non native speakers use more discourse markers than the native speakers of English. Table 1.1 shows the total result concluded from the research which shows that the use of discourse markers in native speech is less than that of non-native speech. This signifies that non-native speakers like use of pragmatic devices such as general extenders e-g and, so, like, you know etc. The use of pragmatic devices by native speakers in the corpus data was forty-eight (48). The non-native Pakistani data analysis has shown that the use of discourse markers is more in the corpus of NNS than the native speakers of English that is seventy-five (75) as shown in table 9.

Table 75: Comparison of Discourse Markers among NS and NNS

Discourse markers	Native speakers	Pakistani non-native speakers
see	4	5
um or hmm	4	8
so	19	32
you know	6	10
well	5	6
look	0	0
and	9	12
I mean & you see	1	2
Total use of dm	**48**	**75**

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4. Discussion

Discourse markers have received a great deal of attention in the study of pragmatics for over twenty years. Schiffren's 1987 work played a major role in development in this field. Initially it was just focusing on the use of discourse markers by native speakers but after 2000 it gradually included the use of DM by non native speakers as well. Researchers have started looking at the corpora establishing a comparison between native and non native speakers of English. Different aspects were discussed in by different researchers by comparing and contrasting the data specially inquiring the frequency of the use of DM by the native and non native speakers of English (trillo, 2002; jabeen et al., 2011; ying, 2007; moreno, 2001) but results were quite incompatible with one another. The research was conducted to find out if non native speakers use more DM in their conversations or is that the native speakers who frequently use discourse markers to connect their utterances. However the results show that the native speakers unconsciously use less pragmatic markers than the native speakers. At the same time if the larger corpus is collected and studied it is possible that the result may fluctuate from the present research as the data used in this research was less than 4000 words.

This research will help the students in the second language learning as well as help the teachers to opt for pedagogical approaches that will help the students in learning the target language.

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School Autonomy and Retention in Rural Public Primary Schools: Evidence from Pakistan

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Abstract

The purpose of this study is to explore the impact of devolution of financial autonomy to public primary schools through Parent Teacher Councils (PTCs) on retention of primary school children in the Khyber Pakhtunkhwa (KP) province, Pakistan. Two sources of data were used for the purpose: a) Education Management Information System (EMIS) for the years 2006-11 and 2007-12, and iii) a specially designed survey questionnaire used to compile information about PTCs and school quality from 222 public primary schools in the KP Province.

Preliminary results find that *transfer of PTC funds on time* and*schools with separate classrooms for each grade level* are found to be significant in improving retention to the last grade of primary. The researcher recommendations based upon this study include the following: first, schools shall receive PTC funds in a timely manner, that is, start of a financial year, so they can spend it as per school needs.Second, the government shall focus on improving the quality of existing schools by constructing one classroom for each grade level, thus a school shall consist of six classrooms at a minimum for six grade levels.

Keywords: school autonomy, retention, rural primary schools, Parent-Teacher Councils, budget.

Introduction

In line with the spirit of devolution of power to the lower tiers of service delivery, the Government of Khyber Pakhtunkhwagave a certain degree of autonomy to all the public schools in the province in2007. The autonomy granted had three pronged effects, namely a) financial autonomy, which empowered the Parent-Teacher Councils (PTC) of the schools to plan budgetary spending on need basis and execute it accordingly, b) administrative autonomy, which empowered the PTCs to hire a teacher, procure goods and campaign for the betterment of the school, and c) political autonomy, diluting to a certain extent the political interference and influence in school affairs that has clogged the education system. One of the main features of the PTC reform was that the Government increased non-salary budget of PTCs[1] from Rs. 2,000 lump-sum per classroom to Rs. 7,000 per classroom per annum for the operation and maintenance of schools (Elementary and Secondary Education Department [E&SE], 2013). Second, a mechanism was devised for upfront transfer of the budgets to the bank accounts of the PTCs right at the start of a financial year so that the schools can spend it on need-basis (ibid). The previous mechanism of centralized purchases was done away with which was prone to corruption, delays in purchases, and poor quality of items purchased. Another important feature of the fiscal autonomy was local decision-making: the PTCs were authorized to spend the budget on need-basis hence giving them the authority to make the spending decisions on their own. Discussions with the PTCs/head teachers and analyses of various national and international assessment reports at that time revealed that due to the item specific rigid

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allocation of budget and fear of bureaucratic audit, schools were reluctant to spend the funds and hence every year the budget would get lapsed. In order to resolve this issue, a system of independent, third-party audit, once in three years, was introduced (ibid). Also the budget was mandated to be non-lapsable in case schools do not utilize their budgets during a financial year. Other features of the reforms included restructuring of the council's composition, formulation of PTC functions and community participation especially involvement of parents. These features have been published as a guide, for general as well as stakeholders' information, known as PTC Guide in 2007, which is still being used.Also, the PTCs have been further empowered to utilize upto Rs. 1.00 million in case of development work like construction of additional rooms, group latrine, Boundary walls etc. PTC is neither a donor-driven reform, which dries up after the departure of donors nor are new PTC-like reforms introduced every year. Such like reforms require a considerable cost – in terms of time, change in forms and formats, capacity building and money – on the part of stakeholders who not only implement such initiatives but also bring improvement in them from time to time. This background necessitated to explore the impact of PTC reforms in KP province on students' educational outcomes namely retention to the last grade of primary. Theoretical Framework

This section develops a theoretical framework for understanding how PTC reforms are likely to impact students' retention to the last grade of primary. Education Production Function model has been used by various studies that assessed the impact of school resources or budget on students' educational outcomes e.g. school attainment, enrolment, and learning (Chudgar and Shafiq 2010; Hanushek, Link and Woessmann 2011; Jimenez and Sawada 2003; di Gropello and Marshall 2005). Hence, this paper uses education production function model as the theoretical basis for econometric specification because of the nature of PTC reform (devolution of financial autonomy), availability of data and nature of research question, which is, to assess the impact of PTC reforms on retention to the last grade of primary.

Based on the review of literature, the peculiarities of the KP context and the confines of existingdata, the following analytical framework is proposed.

Factors Affecting Retention to the Last Grade of Primary Education
(Pre-Primary - Grade 5)
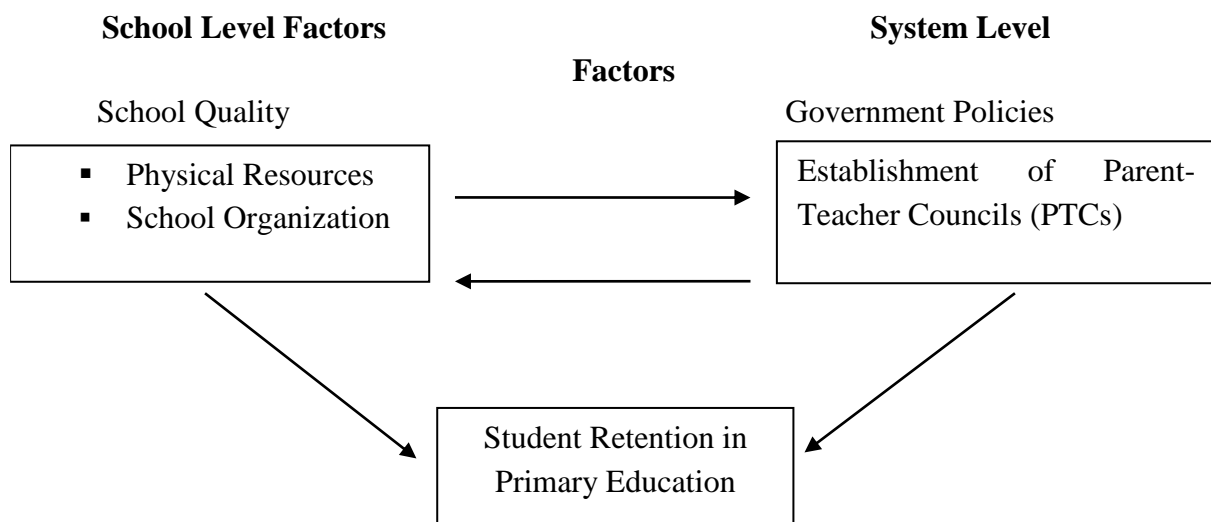
Analytical Model of Retention and Learning Outcomes

Literature Review

Review of literature reveals that several system-level factors influence retention such as availability of primary and post-primary schools, school fees, local teachers' recruitment in rural areas,

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community participation, accountability mechanisms andfiscal and administrative management mechanisms (popularly known as school based management (SBM)), to name a few. However, this section examines the impact of one of the most commonly cited factors that affect retention – school based management (SBM) – due to availability of data, type of research question and nature of reform implemented in the province.

School Based Management (SBM):

Review of the literature shows that various forms of SBMs have been adopted by the schools all over the world. They are known as Village Education Committee in India, School Based Management in the UK and U.S., Site Based Management in Israel, School Management Committees in Uganda and Parent Teacher Association/ Parent Teacher Council/School Management Committees in Pakistan. The main feature of these programs is the transfer of decision-making power in terms of human, material and financial resources to a school from a centralized government authority (De Grauwe 2005). However, these programs differ in three major ways: the management strategy involved, the actors involved, and levels of authority devolved. In terms of management strategy, some countries have developed SBM as a national policy while others have developed SBM through a local initiative by parents and teachers, due to the lack of government support. For example, in some Latin American countries, communities organize their own schools, which are administered and financially supported by an association of households. These initiatives are known as PROHECO, EDUCO and PRONADE in Honduras, El Salvador and Guatemala. In other developing countries such as India, Pakistan, Indonesia, and Uganda, a statutory body is constituted on behalf of the government to govern the schools (Suryadarma et al 2006). In terms of the involvement of actors, in some countries it is a local initiative involving parents, teachers, principals and local community members (as is the case in Pakistan and India). In other countries such as Uganda, the Parent Teacher Association (PTA) consists of teachers and parents as well as participants from central/district government (Prinsen and Titeca 2008). In terms of areas of control, in some countries few decisions of importance are transferred to school professionals while in others the parents and the community exercise significant power over decisions concerning the school's management.

Most of the studies have examined the impact of SBM on student learning outcomes or teachers' performance. There are very few studies that have looked into the impact of SBM on retention. One such study by Di Gropello and Marshall (2005) investigated the impact of Programa Hondureño de Educación Comunitaria (PROHECO) community schools on student outcomes (repetition, dropout and test scores) in rural Honduras. Using data collected by Unidad Externa de Medición de la Calidad de la Educación (UMCE) project in 2003, the authors identified the mechanisms through which PROHECO schools lead to better student outcomes. They found that PROHECO schools through increased parental involvement and teachers' effort lead to better student performance in terms of test scores than traditional/non-PROHECO schools. However, the study found no evidence of the effect of PROHECO schools on student completion rates and dropout. The authors argue that PROHECO schools are disadvantaged by lower level of teachers experience (2 years in PROHECO schools versus 12 years in traditional schools), teacher training (50% versus 100%), parental education (2.4: 3), as well as a reliance on smaller class sizes (29:37 however, they are multi grade classes with one or two teachers teaching six grades at one time). However, the authors did not explain why dropout in PROHECO schools is not statistically significant when the learning outcomes are better as this finding is in contrast with the literature that argue that better learning outcomes, either through grades or test scores, result in better retention rates (Hanushek and Luque 2003; Hanushek 2008; Lloyd, Mensch, and Clark 2000).

Conversely, a study of EDUCO program in El Salvador (Jimenez and Swada 2003) has shown that community managed schools have more positive educational outcomes of grade three students, such as lower rates repetition and higher rates of retention to the last grade of primary school. This positive finding is related to community participation, better classroom environment and careful teacher management. Community participation has been attributed to enhanced teacher monitoring

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and frequent parent-teacher meetings whereas better classroom environment has been attributed to the teachers' flexibility to teach multi-grade classes. Teacher's experience and higher wages in EDUCO schools (based on their performance, as determined by parent teacher association) resulted in increased retention and reduced dropout.

An important element of SBM is the decentralization of budget to the schools; however, there is no study so far that has looked into the relationship between budget allocation, expenditure and its impact on student retention to the last grade of primary. This study fills that gap by analyzing the impact of budget allocation and expenditure on retention in Khyber Pakhtunkhwa, Pakistan.

Research Question, Data and Variables

The literature review provides essential background to formulate this study's main research question:*What aspects of PTC reforms (such as students' attendance, students' sitting arrangement, parental involvement and timely availability of funds) along with school quality and school characteristics are associated with desired schooling outcomes - retention rate to the last grade of primary – in two time periods (2006-11 and 2007-12)*? In order to address this research question, two data sources were used: a) EMIS (Education Management Information System) and,b) primary data collected by conducting interviews from the headmasters of select public primary schools.

The EMIS data source is a comprehensive database of all government schools in KP province, compiled by the Elementary and Secondary Education Department (E&SE). The E&SE department collects a middle-of-school-year filled questionnaire from all public schools in the province since 2001. The data from the EMIS database provides a comprehensive picture of selected aspects of public schools at provincial level. For the current study, the EMIS database for the years 2006-11 and 2007- 2012 have been used.

The second data source is the primary data collected through a specially created survey questionnaire implemented in 222 public primary schools in KP. The questionnaire was filled by the head masters of public primary schools. The overall purpose of survey questionnaire was to collect information about the allocation and expenditure of PTC data in order to understand its impact on students' retention. The information generated from the survey enabled a more detailed assessment of the effectiveness of PTC reforms. This information highlights areas most directly influenced by the implementation of PTC reforms such as: number of classrooms per grade, availability of PTC funds, the amount of funds spent, expenditure by type of commodities (classroom consumables, repair and maintenance and office consumables), total expenditure incurred, balance amount, and parental involvement. In addition, data about school quality (number of teachers, grade by grade enrollment, students' attendance) and school characteristics (type of school e.g. girls' only, boys' only and mixed school) was collected to assess the impact of expenditure of PTC funds and to verify certain aspects of EMIS data and available data in schools' registers. Survey data, together with data collected from EMIS 2006-2011 and EMIS 2007-12 will help address the following research question: What aspects of PTC reforms (such as *students' attendance, students' sitting arrangement, parental involvement and, timely availability of funds*) along with school quality and school characteristics are associated with students' retention rate to the last grade of primary?

The dependent variable is retention to the last grade of primary school, which is a six years cycle in the context of KP; from kachi/ pre-primary/pre-grade1 to grade 5. Retention has been calculated from the enrollment data retrieved from the EMIS database for the periods 2006-11 and 2007-2012. The dependent variable, retention rate to the last grade of primary, is measured at the school level. The dependent variable refers to the percentage of children in each school who are retained or who survive to the last grade of primary education (i.e., Grade 5). The school retention rate is computed by dividing the total number of Grade 5 enrollments in year (y+6) by the total number of enrollments in the pre-primary grade (pre-Grade 1) in year (y). The percentage is obtained by multiplying the proportion by 100 (Mehta 2007). The first set of independent variables used in this study refer to PTC reforms and school autonomy. This set includes variables such as: children's

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sitting arrangement, parental involvement, funds received, availability of funds on time, funds spent and balance amount. The first variable, *sitting arrangements*, determines whether schools have enough classrooms. Three dummy variables have been created that indicate whether children have separate classrooms (1=yes, 0=no), Shared Classrooms (1=yes, 0=no) and/or are Without Classrooms (1=yes, 0=no). The second variable, *parents' involvement* is created by adding head masters' responses to two variables: whether the parents attend PTC meetings (1=always, 2=seldom, 3=never), and whether parents participate in school related activity (1=always, 2=seldom, 3=never). The third variable *funds received* is coded 1 if the school received funds in any of the three years for which the PTC data was collected and 0 if the school did not receive funds. Fourth variable, *timely funds* determines whether the school received funds on time in any of the three years for which the PTC data was collected. The dummy variable timely funds=1 indicates PTC funds were received on time in one of the three years while 0 indicates that funds were not received on time. The fifth variable *funds spent* determines whether the school spent the money (1) or not (0). The last variable, *balance amount* indicates whether the school has a balance (0) or not (1). The second set of independent variables refer to school quality, which comprise of *school size, PTR (katchi-grades 2), PTR (grades 3-5)*, *children's attendance and mono/multigrade school*. The variable *school size*(SCHSIZE) is an interval level variable that has been constructed from EMIS data of 2007 and 2012. School enrollment variable is created by summing enrollments from kachi to grade 5 in years 2007 and 2012. Using quartile approach, the sample of 222 schools has been grouped into small, small-to-medium, medium and large sized schools. SCHSIZE had a moderate positive skew hence it was transformed into Log (SCHSIZE). The second variable *Pupil Teacher Ratio (PTR)* estimates class size. Two interval level variables have been constructed; one for early grades (kachi-grade 2) and another for higher grades (grades 3-5). These variables are created in two steps. First, school enrollment (kachi- grade 2) variable is created by summing enrollments from kachi to grade 2. Second, PTR (kachi-2) is computed as: PTR = (School enrollment (kachi- grade 2) / number of teachers)*100. Similar method has been adopted for the interval level variable PTR (grades 3-5). The third variable, *children's attendance*, is a dummy variable indicating percentage of students' (90% or more) present during the day of school visit by the surveyors of PTC team. This variable has been constructed in two phases. First, the number of students present on the day of visit to schools in 2013 has been divided by total number of students in a school and the output is multiplied by 100. Then this variable has been dummy coded as one if students' attendance is greater than 90 and 0 if the attendance is less than 90.The last variable*multigrade* (MULTIGRADE) determines whether a teacher teaches two or more grades at the same time in the same classroom or space. This is a dummy variable where 1 represents multigrade school if a school has less than six teachers and 0 represents monograde schools if a school has more than six teachers.

The third and final set of independent variables refer to school characteristics, which consist of school location (urban/rural) and school type (girls' only, boys' only and mixed schools). The first variable *urban/rural*indicates the location of the schools. This variable has been coded into a dummy variable (0, 1) where 1 indicates urban schools and 0 indicates rural schools. The second variable *school type*=1-3 indicates boys' school, girls' school and mixed school (boys' school with girls enrolled in them) respectively.

Methodology

To address the research question - *what aspects of PTC reform are associated with higher retention rates to the last grade of primary?* - the two datasets, EMIS (2006-2011 & 2007-2012) and PTC Survey data 2012-13 were integrated based on unique school code, which resulted in 222 schools. Multiple regressions were conducted to examine whether PTC reforms (timely funds, funds spent, parental involvement and children's sitting arrangement), school quality (school size, pupil-teacher ratio (PTR), children's attendance, mono/multigrade schools) and school characteristics (school location and school gender e.g. girls' only, boys' only and mixed schools) are related to retention rates*?* This analysis necessitates the availability of PTC reforms data for six years because, as mentioned earlier, retention is calculated for six years, from pre-grade 1 to grade five. However, the PTC survey questionnaire captured information about PTC reform (funds allocation, expenses

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and type of items purchased) for three years 2010-2012 because of unavailability of earlier record with schools. The data was collected from 222 schools which were common in PTC2012-13 and EMIS (2006-11 and 2007-12) databases. A multiple linear regression analysis was conducted to examine the relative influence of each set of independent variables on retention rate.

As mentioned earlier, this paper uses an education production-function approach to examine the effect of "inputs" (PTC reform) on "outputs" (retention). Production Functions for PTC and retention is presented in the following equation:

Retention Rate $_{\text{(to the last grade of primary education)}}$= F (PTC, SCHQUAL, SCHORG, η)   (1)

PTC is a vector of variables representing school autonomy reform, implemented by strengthening Parent Teacher Councils (PTCs). Variables included in PTC are: parental involvement (PRTINV), timely funds (TIMELYFUNDS), funds spent (FUNDSPENT) and children's sitting arrangement (SITTINGARRANGEMENTS). SCHQUAL and SCHORG represent school quality and school organization.School size (SCHSIZE), PTR (kachi- grade 2), PTR (grades 3-5), students' attendance (PRCNTCHILDRNATTENDANCE) and mono/multigrade (MULTIGRADE) are school quality variables (SCHQUAL) included in the production functions. Variables included in the school organization (SCHORG) are: urban/rural (URBRUR), and school gender (SCHGENDER).

Multiple linear regression analysis has been used for comparison of three groups of schools (all girls', all boys' school and mixed schools). The equation is as follows:

Retention Rate $_{\text{(to the last grade of primary education)}}$ $= a_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 +$ e

where a_0 representsintercept or constant. The coefficient b is referred to as the slope while e represents presence of error (Lewis-Beck 1980). The variables from X_1 to X_7 representsvarious school quality variables.

A multiple linear regression analysis has been conducted to examine the relative influence of each set of independent variables on retention. The multiple linear regressions require dependent variable to be continuous (Randolph and Myers 2013; Heck 2004) and in this equation the dependent variable –retention to the last grade of primary–is a continuous variable. Multiple linear regressions help in assessing the independent influence of each independent variable (PTC, school quality and school organization) on the dependent variable (retention) (Alexopoulos 2010; Lewis-Beck 1980).

Results

This study assessed the relationship between PTC reform and rates of retention to the last grade of primary schooling in two cycles (2006-11 and 2007-12) together with measures of school quality and school characteristics. The two time periods were selected to observe the consistency of results, that is, whether the reforms produced similar results.

Table 1 contains the coefficient for the regression model for all the independent variables on retention rates for a sample of 222 schools. Of all the independent variables, two variables – *children with separate classrooms and children with shared classrooms* versus the reference category children without classrooms show a statistically significant relationship with the retention to the last grade of primary schooling for the time period 2006-11. On the other hand, two variables - *funds received on time and separate classrooms* – are statistically significant with the rates of retention to the last grade of primary schooling for the time period 2007-12. These two models explained around 4 percent of variance in retention rates for both the time periods, which was statistically significant (F=1.9, p < .05).

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Table 1 – Multivariate Analysis of PTC Reform on Retention to the Last Grade of PrimarySchool,2006-11 and 2007-12

Dependent Variables: a) Retention Rate to the last grade of Primary (2006-11) [#]
b) Retention Rate to the last grade of Primary (2007-12) [##]

	Retention 2006-11		Retention 2007-12	
	Unstandardized Coefficients	Standardized Coefficients	Unstandardized Coefficients	Standardized Coefficients
Independent Variables	**B**	**Beta**	**B**	**Beta**
PTC Reforms				
Timely Funds	4.017	.060	8.273	.126*
Funds Spent	7.555	.059	11.497	.094
Separate Classroom	31.084	.467***	14.907	.230*
Shared Classroom	25.330	.387**	7.900	.124
Parent's Participation	-4.422	-.049	8.005	.091
School Quality				
Children's Attendance	6.459	.099	.873	.014
Medium of Instruction (Urdu)	-2.481	-.036	-3.288	-.049
School Characteristics				
Rural School	10.213	.051	-14.242	-.073
Girls School	-3.421	-.035	-9.729	-.100
Mixed School	.721	.011	3.091	.047
(Constant)	20.386		43.124	
n	222			
Adjusted R^2	.040		.040	
F	1.90**		1.91**	

*** $p \leq .001$; ** $p \leq .05$; *$p \leq .10$.
\# The retention rate refers to the number of students enrolled in Grade 5 in 2011 as a percentage of the number of students who were enrolled in the kachi (pre-primary grade) in 2006.
\#\# The retention rate refers to the number of students enrolled in Grade 5 in 2012 as a percentage of the number of students who were enrolled in the kachi (pre-primary grade) in 2007.

After examining the separate impact of school facilities and PTC reforms on retention rates, combined analyses of the influence of school facilities & PTC reform on rates of retention to the last grade of primary school for the 2007-12 was conducted. The analysis revealed that five variables—namely, *school size, PTR in kachi-grades 2, PTR in grades 3-5*, *timely funds and children's attendance*—had statistically significant associations with retention rates (Table 2). This comprehensive model explained 36 percent ofvariance in schools' rates of retaining students to the last grade of primary school (F=9.5, p < .001).

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Table 5.18 - Multivariate Analysis of School Facilities, PTC Reform on Retention To The last Grade of Primary 2007-12

Dependent Variable: Retention Rate to the last grade of Primary School (2007-12)

Independent Variables	Retention 2007-12	
	Unstandardized Coefficients	Standardized Coefficients
	B	Beta
School Quality		
No. of Amenities	.458	.024
Medium of Instruction-Urdu	2.278	.034
School Size (Log)	34.735	.366***
Pupil-Teacher Ratio (grades Kachi-2)	-.975	-.394***
Pupil-Teacher Ratio (grades 3-5)	1.709	.448***
Children's Attendance	-9.493	-.149**
PTC Reform		
Timely Funds	8.189	.125**
Funds Spent	-1.597	-.013
Separate Classrooms	5.677	.087
Shared Classrooms	10.634	.167
Parent's Participation	4.637	.053
School Characteristics		
Rural School	-7.826	-.040
Multi-Grade School	1.555	.022
Girls School	-5.448	-.056
Mixed School	4.790	.074
(Constant)	-33.021	
n	*222*	
Adjusted R^2	.36	
F	9.52***	

*** p ≤ .001; ** p ≤ .05; *p ≤ .10.

Discussion:

Multiple regressions were conducted to examine whether PTC reforms (timely funds, funds spent, parental involvement and children's sitting arrangement), school quality (school size, PTR (kachi-grades 2, grades 3-5), children's attendance and multigrade school) and school characteristics (rural schools, school gender) are related to retention rates in primary education.

In terms of PTC reform variables, *timely funds* was significantly positively associated with retention rates for the time period 2007-12. The analysis indicates that when primary schools received PTC funds on time, retention levels increased, on average, by 8.2 percentage points. However, the variable 'timely funds' was not found significant for the retention cycle 2006-11 though the coefficients are positive in sign in both time periods. This finding may be because the variable, timely transfer of funds, represents funds transferred to PTCs during recent three years (2010-2012) hence the impact was visible and significant for 2007-12 and not for 2006-2011. However, the finding of little impact of timely transfer of funds on retention cycle 2006-2011 does not discard the importance of transfer of funds on time.

The second PTC reforms variable, PTC funds spent, was not significantly associated with retention for both time periods. This lack of statistically significant differences may be explained by the fact

that more than 95 percent schools in the data set spent the money during the years for which the data was collected (2010-2012). Hence, a very small percentage of schools that did not spend the funds were not representative to yield any effect on retention. Rates of parents' participation in parent-teacher meetings and children's school related activities did not show any statistically significant relationship with retention rates although research by Willms and Somers (2000) found that parental involvement have a statistically significant impact on time to complete primary education. This counter intuitive result may have occurred due to false reporting by the head teachers who reported that more than 80 percent parents were always involved in school-related and children related activities.Further research is required from parents' and teachers' perspective regarding their participation in parent-teacher meetings and children's school related activities to verify the reporting of head teachers. The last PTC reforms variable, children's sitting arrangement, was significantly positively associated with retention to the last grade of primary school for both time periods after controlling for other variables. The analysis indicate that schools in which children at different grade levels sit in separate classrooms had higher rates of children completing the primary education cycle in both time periods as compared to schools where children who did not have classrooms.As described earlier, data on children's sitting arrangement were collected by the researcher to explore the impact of children who have separate classrooms versus children who sit in open air and children who share classrooms versus those who are without classrooms. The regression results indicate that schools that have grade levels in separate classrooms tend to have retention rates 31 percentage points higher than schools without any classrooms. Similarly, schools in which children who share classrooms with children in other grades tend to have retention rates about 25 percentage points higher than schools without classrooms in the 2006-11 period. The coefficient for this variable was also statistically significant for the time period 2007-12. These findings indicate the importance of separate classrooms for better educational outcomes. With regards to the school quality and school characteristics variables, the analyses showed no impact of these variables on retention rates for both time periods. These findings may be due to the small data size (222 schools). Future research can address this limitation by using more comprehensive and large datasets.

To summarize, very few researchers have studied the issue of retention to the last grade of primary schooling. Similarly, the impact of school operational budget allocation on retentionhas rarely been studied, although the issue of inadequate school infrastructure in many developing countries has been documented by many researchers. This study, thus, contributes to the literature, by indicating that the timely provision of PTC funds (for maintenance of school infrastructure and, purchase of classroom consumables) and the provision of separate classrooms for children influence their retention.

Conclusion

This study assessed the impact of PTC reform on retention rates for two time periods (2006-11 and 2007-12). The study reveals two major findings. First, the analysis indicates that timely provision of PTC funds play a significant role in increasing retention. This is one of the major policy finding that needs to be adopted by the Government of KP. After the strengthening of PTCs in 2007, complaints were received from headmasters that they don't receive fund at the start of a financial year, which makes it difficult for them to plan school's budget and spend it on need basis. The Government ensured that the schools receive PTC funds at the start of a financial year. Hence, the finding, that the school must receive PTC funds on time, has a major policy standing.

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The second major finding is that schools with separate classrooms for each grade level have significantly higher retention rates in both time periods (2006-11 and 2007-12) as compared to schools where children have to sit in open air or share classroom. Nearly 50 percent of public primary schools in the KP province comprise of only two classrooms instead of the requisite six classrooms – one for each grade level. This empirical analysis demonstrates that investing more in school infrastructure (in terms of building more classrooms) needed to be one of the priorities in a country like Pakistan to improve its human capital and thereby improve its long term development potential.

This study points to three main areas for future research. First, this study collected data from head teachers about various aspects of PTC reforms such as funds' management and improvement in school quality, however, future research can seek opinion of parents and community members as well to get a balanced view of resource allocation and distribution and improvement in school quality. Second, parents' perception about their involvement, or lack thereof, in their children's school related activities and overseeing PTC activities may be taken into account to identify issues that restrict them in contributing fully to the development of school. Third, a comparison of rural and urban schools (though very few, 4%) is necessitated to assess the difference between impact of PTC reform on retention rate to the last grade of primary.

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SUSTAINABLE ARCHTECTURE

Street Culture of the Walled City Lahore - A walk Down the Memory Lane

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Abstract

Streets help to connect places, people thus allowing them to communicate from area to area from neighborhood to neighborhood, from cities to other cities and much more thus acting as modes for social gathering like a small universe or small hubs for cultural activities. Streets are treated as places that create the sense of community. This research paper focuses on studying the nature and characteristics of the street culture focusing on one of the rich street culture of the walled city how it evolved over years and the cultural connection it set. This research was supported by literature studyand conjecture. The study reveals that the old walled city street culture still shares unlimited stories of its glorious past and gives a hint to the historic reference as the original street culture has always continued yet some sectors have been furbished following its original context thus connecting to the old chapter of the traditional Lahori culture with the new Lahore now. The study reveals that the walled city street evolved slowly preserving most of its historic urban picture, ancient structure and the lost culture for the generation next.

Keywords: CulturalHeritage, Lahore, walled city, cultural revival, street life.

1. Introduction

Since the origin of the city Lahore it has seen the seasons of instability and serenity including all the stories of being a princely state and also got looted during insurrections still Lahore managed to remain in the limelight during various time periods. Its acclaimed as a city that routes many stories for writers and painters, was much popular during 1500 A.D onwards when the Mughal Empire established its main capitals here and king Akbar constructed a thirty feet high fortified

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wall around the city with twelve different gates initially with the addition of a 13th "Mori" gate that was made during the British era. The Walled city itself is a small world within this enormous Lahore city not just because of its glorious architecture but its people as well as one would find old customs and values here and people living in their ancestral homes called the havelis or mansions. The Walled Citylies on an ancient mount in the north-west of Lahore that traces its history that's more than1000 years old. Latif in his book claims that to know the exact date of its foundation is impossible, but concludes that Lahore was an important town in the mid-seventh century.It is one of the largest living cultural hubs of the known world as its one of the fortified cities with natural settlements with the world's narrowest streets that connects all the mohallas, katras and kochas. Question is as to what makes the Walled City unique and different from the rest. From the vivid memories from my childhood till date might be perhaps the whole concept of walled city, its streets, mohalas and kochas as its all quite inspiring. These streets have experienced the historical contributions by the Afghans, Tughluqs, Lodhis, Hindus, Mughals, Sikhs and the Britishers. Fragments of these eras are still found in every street, nook and corner of the walled city that's what makes it a city of wonders and magnificence.
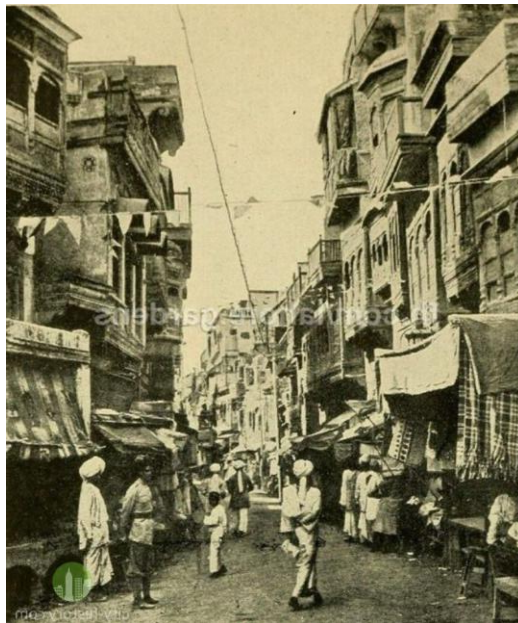
Figure-1: An old picture of walled city street

Now these pathways or streets serve as connecting spaces, allowing movement of goods and people. They also act as places of social gathering, of the informal assembly of people, where children play and emulate other people and learn from them; also where the culture of communities takes root and where integrated services are performed. The streets also signify as a segment of life shaped up by history.The streets also signify as a segment of life shaped up by history. They serve as a link to our past. Walled city streets have a very stronger character and attribute that it has managed to carry out for so many years and still exists. Not just this it has been strengthened by add more global proposals like food street culture or any other arts schools. As per the urban planning principals streets hierarchy and layouts are the first priority. Streets let us travel from place to place, to shop, to eat and involve ourselves in socially interacting with others. These streets join both the public and private realm with other parts of the city. According to Moughtin, '*The Street has not been a mere means of access but essentially an arena for social expression.*'

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Figure-2: An Ariel view of the vibrant food Street, Lahore Fort

The 17th century French revolution resulted in the development of a new and yet more techno physical patterns of the city replacing the old security systems with the new as they were no more effective. Defensive systems are one of the top priorities while planning for any city planning. The 20th century further brought changes in the usage and design patterns of the streets layouts. The communicating ambience and rich culture of the streets was replaced by the efficiency of roads that made them more efficient. Some roads merely served the combined purpose of streets and road whereas the others were just meant just for vehicular purpose. A negative impression continued with the supremacy of the pedestrian privileges as its one of the traits of the street it got lost in the process. Also it ended up in the introduction of more vocabulary apart from the street like way, path, highway, mall, avenue, boulevard, route and promenade all used interchangeably. The major task was to investigate the difference between a "street" and "place" that was categorized by the quality of street life and the amenities it offers to its users especially to the pedestrians. The increasing trend of street usage as roads nowadays with the control of the vehicles in cities that has resulted in social and physical degeneration.

Figure-3: An Ariel view of the street

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The Walled City Lahore developed at a slow pace retaining its ancient built structures, rich traditions and glorious cultures saving them for the successive generations created neither by a one man nor in one period. Urban expansion was as an organic course that accommodated the concerns of the common human intellects. While studying the character of streets they are usually straight for a short distances but also mostly winding and twisting providing safety and discretion along with the element of surprise of what might come next. The layout of the city formulates a composite mesh of both social and cultural activities with private and public places blending into one another as one moves through intricate paths that are often efficient for the pedestrians only. Building with more floors are effectual enough to maintain the temperature by providing shades at most hours shielding the contracted streets from the extreme sunrays with least open spaces for movement along the narrow streets and the neighboring structures are usually used for shops on the ground floor with family residences on upper floors with a flat roof or mumtis. These rooftops were utilized for the sleeping purpose in summers but also social exchange the year round nowadays like at various occasions like basant etc.

2. Materials and Methods

The neighborhood pockets around all the 13 gates of walled are more or less the same but with differences at some levels so the material for this study on the walled city was collected from the primary and secondary sources of historic literature which was further verified by examination of the streets in the walled city. Numerous visits were carried out for close examination though detailed observation. Thus the collected material was analyzed with reference to its urban composition of horizontal arrangements.

3. Results and Discussion

Through a thorough study the academic research the results reveals that the streets here were mostly used as informal social places for the locals as a space should act as a place when it addresses the human desires in their natural, cultural and historical milieus. For the public places the social values of users equally important as any other inclusion or linking values. Similarly the Walled City street acts as a place where it provides the scenery to the users according to their cultural and natural context. The ladies of the families are often standing in doorways or the jharokas of the balconies or sitting on the steps of entrances to chat as mentioned above that the layout of the streets provides privacy and shade from the scorching sun.

The streets have a hierarchy descending from Guzars to the Mohallas to the Gallis and then the Band Galli that is the blind end. Before the industrial revolution people used bullock, carsts, horses, camels and oxen for mobility purpose. According to a Spanish preacher Fra Sebastianwho visited Lahore in 1641 states:

> *"It is a handsome and well – ordered city, with large gateways and pavilions. I entered the city, a very difficult undertaking on account of the number of people who filled the streets, some on foot, some on camels, some on elephants, other in small carts, jolting one against the other as they went along. Those who could best, passed on first, this being the receiving hour at Court; many of the gentry were proceeding there, accompanied by as many as five hundred followers on horseback."*

There some spaces in the Walled City's horizontal arrangement that adopts amiability among the residents known as Katrah an outdoor room or a podium that has privacy due to the blind end of the street like the band galli used for social interactions also known as the cul-de-sac that gives an attenuated privacy from the strangers to enter here.Apart from these there are other characteristics found in the walled city Lahore those factors are discussed in detail below that identifies the forces

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of walled city street and make it still immortal and stand out in the crowd then rest of the contemporary streets of other founded areas of Lahore:

3.1: Strength

Any city street should be flexible enough to make room for effective use for everyone both the drivers and the pedestrian. Places with multidisciplinary functions offer more possibilities to their users than the onesthat are designed to restrict them for minimum function. This environment quality is known as its strength or robustness. This quality of City Street is usually achieved by the diversified usage of that place. There is no isolation of activities in the streets of the Walled City either of residential or commercial bazaars. Any street functionsperfectly for residential activities also dojustice for the commercial activities. This type of mixed use includes life and vitality to the streets of the Walled City. Robustness grounds the mixture of people of all types, ages with activities and thus improves the odds of sociability among the people of that particular area as this trade is found less in the people of the contemporary areas as they are usually unaware of their neighbors or their occupations where the people from the walled city still know one another with all their family back grounds.

Figure-4: A busy Multidisciplinary street of Walled city Lahore

3.2: Natural Defence System

For a new comer these narrow streets look like a labyrinthfull of cul-de-sacs- the band gallis where in fact these streets offer a slight clue for buffer spaces thatoperates as riddles or strains to keep these strangers out. The above mentioned thresholds or buffers are usually in the form of the arches, doorsteps, low stone posts or just the unexpectedthinning and curving of the street. Usually the ladiesspend their time standing at the doorsteps to keep an eye on their children and other activities happening on the streetreferring to the 'eye on street' concept by Jane Jacob that she mentioned in her article *"Death of the cities"*. The jhorakas or windows open onto the streetswhere a neighbor is usually more familiar than a new comeremphasizing on safety as these private spaces openinto semi-publicplaces that offers more cordiality and the 'eye on street' by the household themselves thus ends into a natural dog eye watch of the street itself. These streets are beautifully ornamented with balconies, windows, Jharokas with woodwork detail and other architectural features and activities. They also aid in generating a pleasant pedestrian environment. Not just the ladies men or elderly of the household is also found to spend more time sitting at the doorstep or in their house with doors open thus creating a physical link of the house with the public space (the street) that enhances the sense of possession and natural surveillance as mentioned by Oscar Newman that:*"Windows and doorways, when facing streets, extend the zone of residence' territorial commitments."*This is also understandable as "visual permeability" in the sense that these windows, doorways and balconies all add in the visual permeability between the private and public spaces of

any particular street. This featuremakes a feeling of protection among the users of the street that they are not alone in the public space thus offersmore comfort and ease by eliminating the feeling of being disconnected. All these activities promote walk ability and themakes the pedestrian more secure about the surroundings.
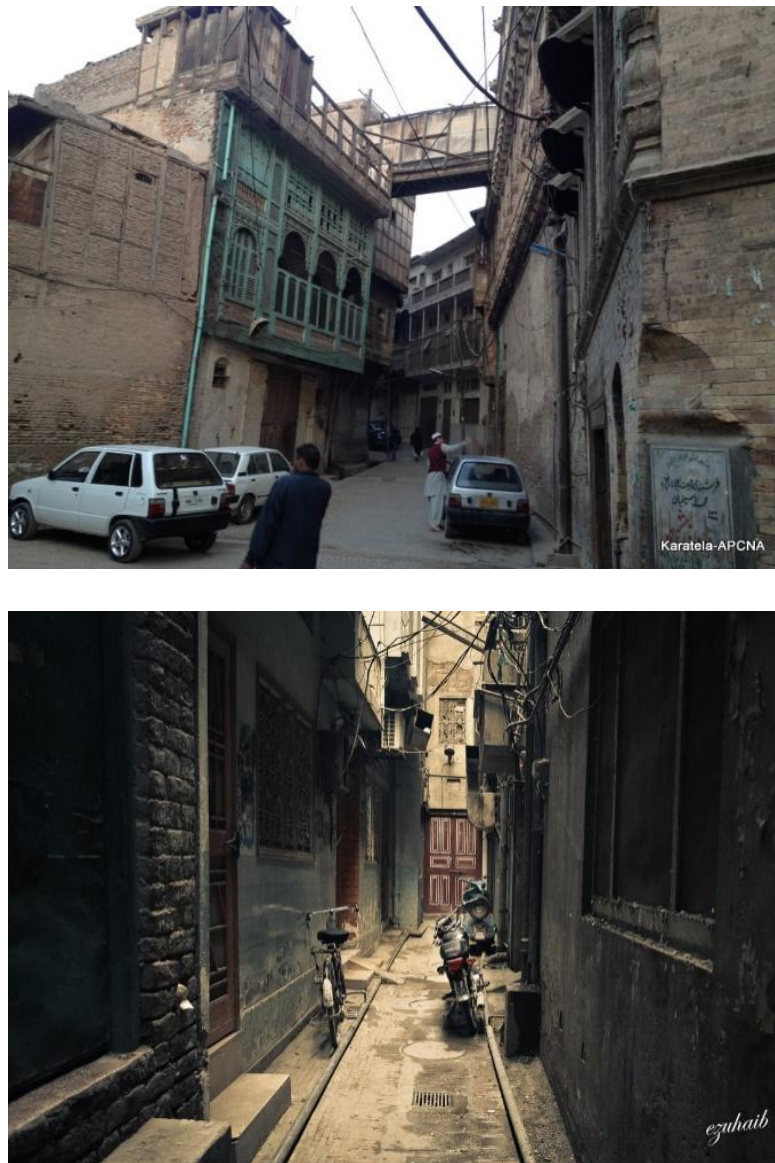
Figure-5: Views of winding streets adding to a natural Dog watch for the residents.

3.3: Social Center

In Lahore shoppingis a cultural trait as a ritual with all the steps like examination, selection and then bargain that leads to an impulsive meet up with the neighbors or people from around. Eateries like shops of halwapuri, lassi or siripayi are utilized as the informal gatherings spaces provided by these street café's. Alexander narrated that "*people choose to linger in public spaces where they can enjoy the view towards some feature of interest*". Looking at other people has also happened to be a trait in our culture that is usually yet still found in the walled city streets.

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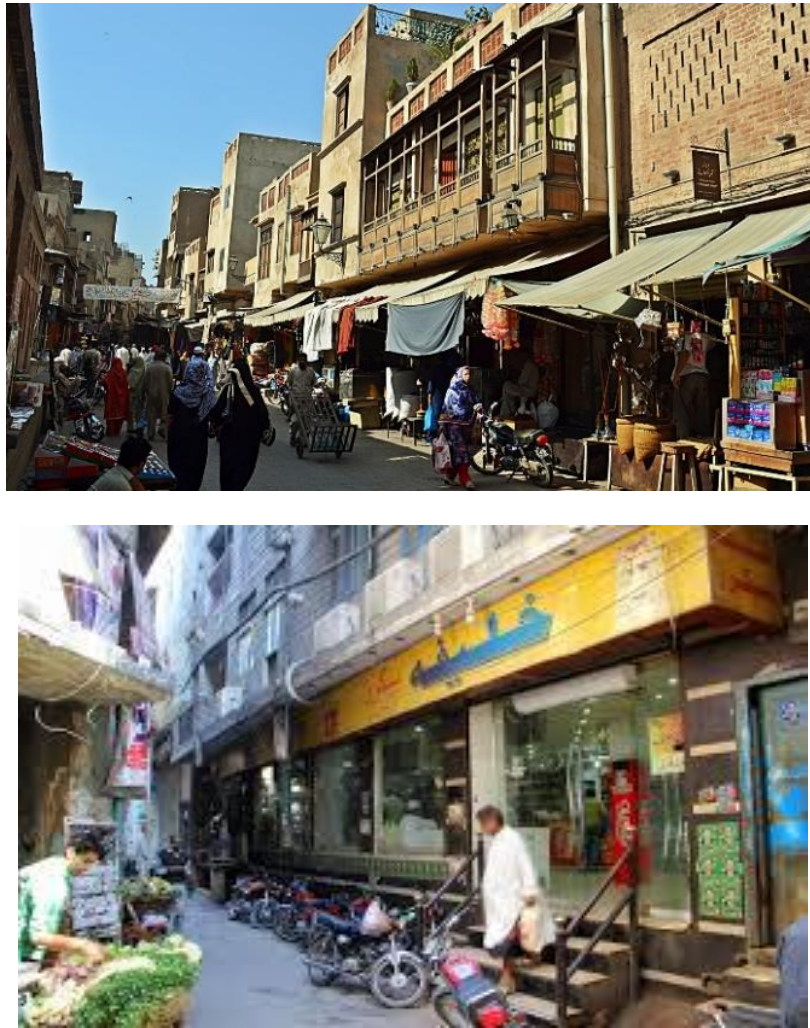
Figure-6 Views of the walled city multidisciplinary streets

3.4: Harmony and Enclosure

The term "Enclosure" is related to the scope to which these buildings, naturals cape including trees, boundary walls and other elements that definesthe urban settlement visually. The feeling for enclosure is improved by the building heights on both sides of streets that in turn directs to cordiality among the users. The streets can be more effective if the planners reduce the width of the roads so the dwellings come practically close enough then it can provoke an urban quality which lifts the spirit of the residents.The skyline and the structures should complement each other rather different in external façade yetintegrated with the whole composition. These unites the walled city's urban structure followed by the curvilinear street layout also provides visual closure. These curvilinear streets generate element of surprise as the street proceedsit starts converging into a visually spacious pedestrian places. The streets should be for staying in and not for moving through the way they are today that can be achieved by making a bulge in the center of the public bath and make the ends more narrow so that the path forms an enclosure which is a place to stay and not just to pass through.'

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Figure-7 Urban harmony of the walled city

4. Conclusion and Recommendations

A thorough inspection comprised of detailed investigations of the street layout of the walled city Lahore reveals that for planning the street design there has always been a great apprehension for mobility along with its social and psychological impacts. Also the width of the streets caters for the ways of this mobility whatever means for movement were used earlier. For example in the medieval time the width of the streets werecalculated according to the width and area compulsoryfor the laden camels or the bullock carts to pass through also to make these streets straight to facilitate the carts. They were also concerned about the social and defensive systems for example the concept of the Fina and cul-de-sac are most commonly noticed in walled city. There have been various attempts to relate street as a placethen just a pathway which also includes a noticeable drift both in the utilization and character of the street pattern.

Confusing streetswith road is not the same as designing it as any place. The quality of life can be improved if such places with these activities take place are vigorous and well designed. The design of the public spaces particularly the street effect the idea that can happen for such social activities like spending time on the streets, chatting, shopping and keeping a dog eye watch on one another etc. The discontinuation of pedestrian use on the roads is mainly because of increase in traffic, pollution and noise as a result of it and hasresulted indecreaseof social interaction of adults and children on streets.The idea is to make ourselves aware about the present conditions that will be helpful to improve the street conditions of Lahore today and the future. In many areas the street is at risk for the pedestrians use due to fast traffic and so it is unsocial and not safe either. Usually the residents stay within their houses and only move about only in their personal motorcar that lessens the street use with comfort. Another trait of the street is its use as a place of casual meetings that also includes conversation and entertainment. It also strengthens people's social desires to meet and greet within daily basis without formally going anywhere.

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"Sustainability" Organic Green Building Features: Day Lighting and Natural Views

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Abstract

Organic Interior is environmentally conscious design that derives from nature and imagination. Natural style of a space promotes the natural beauty and comfort that is created by natural organic shapes and forms found in nature. In a organic design ideology there is a repetition of material and motifs and basic principles as a whole in terms of a unified organism. In which every part relates to other performing different function but at the same time reflecting symbiotic ordering system. We learn connection and sharing from nature.The contact with nature of human leaves its impact that is very creative and long lasting from early childhood.

Keywords: organic, green, day lighting, natural views and sustainable

Introduction

Research studies show that contact with nature is the most beneficial source in reducing our stress and by improving our mood. Distraction theories show that pain absorbs our attention while expose to nature appears to reduce stress as it shares the soft and diverse spaces found in nature that needs concentration of human. Nature has a healing power that affects our responses by curing them in a positive way.

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BIOPHILIC DESIGN PATTERNS & BIOLOGICAL RESPONSES

The table illustrates the functions of each of the 14 Patterns in supporting stress reduction, cognitive performance, emotion and mood enhancement and the human body. Patterns that are supported by more rigorous emphirical data are marked with up to three asterisks (∗∗∗), indicating that the quantity and quality of available peer-reviewed evidence is robust and the potential for impact is great, and no asterisk indicates that there is minimal research to support the biological relationship between health and design, but the anecdotal information is compelling and adequate for hypothesizing its potential impact and importance as a unique pattern.

14 PATTERNS		∗	STRESS REDUCTION	COGNITIVE PERFORMANCE	EMOTION, MOOD & PREFERENCE
	Visual Connection with Nature	∗ ∗ ∗	Lowered blood pressure and heart rate (Brown, Barton & Gladwell, 2013; van den Berg, Hartig, & Staats, 2007; Tsunetsugu & Miyazaki, 2005)	Improved mental engagement/ attentiveness (Biederman & Vessel, 2006)	Positively impacted attitude and overall happiness (Barton & Pretty, 2010)
	Non-Visual Connection with Nature	∗ ∗	Reduced systolic blood pressure and stress hormones (Park, Tsunetsugu, Kasetani et al., 2009; Hartig, Evans, Jamner et al., 2003; Orsega-Smith, Mowen, Payne et al., 2004; Ulrich, Simons, Losito et al., 1991)	Positively impacted on cognitive performance (Mehta, Zhu & Cheema, 2012; Ljungberg, Neely, & Lundström, 2004)	Perceived improvements in mental health and tranquility (Li, Kobayashi, Inagaki et al., 2012; Jahncke, et al., 2011; Tsunetsugu, Park, & Miyazaki, 2010; Kim, Ren, & Fielding, 2007; Stigsdotter & Grahn, 2003)
	Connection with Natural Systems				Enhanced positive health responses; Shifted perception of environment (Kellert et al., 2008)
NATURAL ANALOGUES	Biomorphic Forms & Patterns	∗			Observed view preference (Vessel, 2012; Joye, 2007)
NATURAL ANALOGUES	Material Connection with Nature			Decreased diastolic blood pressure (Tsunetsugu, Miyazaki & Sato, 2007) Improved creative performance (Lichtenfeld et al., 2012)	Improved comfort (Tsunetsugu, Miyazaki & Sato 2007)
NATURAL ANALOGUES	Complexity & Order	∗ ∗	Positively impacted perceptual and physiological stress responses (Salingaros, 2012; Joye, 2007; Taylor, 2006; S. Kaplan, 1988)		Observed view preference (Salingaros, 2012; Hägerhäll, Laike, Taylor et al., 2008; Hägerhäll, Purcella, & Taylor, 2004; Taylor, 2006)
NATURE OF THE SPACE	Prospect	∗ ∗	Reduced stress (Grahn & Stigsdotter, 2010)	Reduced boredom, irritation, fatigue (Clearwater & Coss, 1991)	Improved comfort and perceived safety (Herzog & Bryce, 2007; Wang & Taylor, 2006; Petherick, 2000)
NATURE OF THE SPACE	Refuge	∗ ∗ ∗		Improved concentration, attention and perception of safety (Grahn & Stigsdotter, 2010; Wang & Taylor, 2006; Wang & Taylor, 2006; Petherick, 2000; Ulrich et al., 1993)	
NATURE OF THE SPACE	Mystery	∗ ∗			Induced strong pleasure response (Biederman, 2011; Salimpoor, Benovoy, Larcher et al., 2011; Ikemi, 2005; Blood & Zatorre, 2001)
NATURE OF THE SPACE	Risk/Peril	∗			Resulted in strong dopamine or pleasure responses (Kohno et al., 2013; Wang & Tsien, 2011; Zald et al., 2008)

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Human Response to the Interior Environment

Sociological factors:

It addresses social needs and problems of occupants Factors that relate to such responses, include mainly are group dynamics and communication that should be considered during planning a interior space.
Human Behavior and the Interior Environment

Group dynamics

It includes personality and cultural background of individual involved and the function of work they perform in that space. Studies of communication reveal that, in conversation, people prefer to sit across from one another rather than side by side. Factor of group dynamics and communication affect personal interactions within an environment.

Psychological Factor

It determines an individual's sense of wellbeing in the working space. Visual privacy, acoustic privacy, and aesthetic factors are key determinants to be considered.

Aesthetic

Environment is the most important factor that continuously varies and affects everything and aesthetic is one of the important factor that effects on human behavior in a space. Aesthetic is

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expressed in a space by creating connection of exterior with the interior space. When we look at an object, its physical appearance causes a sensory experience in us. The designer's appreciation of this experience helps him to communicate his determined and understanding to the user.

Factors

Functional efficiency

Studies show that a worker's productivity increases with an improved environment. Emphasis upon the following specific environmental conditions contribute to improved worker efficiency. Lack of connection with nature enhances the human span problem of attention and hyper activeness in human being. The HeschongMahone Group, Inc., in its most recent study of day lighting in schools found that views through windows in school classrooms improves students performance by 5-10% . Also researchers from the Rocky Mountain Institute and Carnegie Mellon University have reported significant improvements in productivity as a result of green building features including day lighting and nature means.

• Proper Day lighting for each task.

• A suitable acoustic environment that allows a comfortable communicative environment, limited disturbance of noise to be more concentrated at work.

• Human/facility interface features designed to be used within human mobility and strength limits. (Special attention should be given to the removal of accessibility barriers for the handicapped worker.)

• An environment that allows workers to function within their most productive range of motion.

Health concerns

A research by Ulrich and Colleagues at Texas A&M University reveled that stressors recover faster and more positively if they are connected with natural environment rather than in urban scenes lacking nature.

Health concerns also factor into the selection of materials. The designer cannot control all such toxins, but must be conscious of the range of possible impacts of material selections, and avoid such occurrences when possible.

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Richard Forman, PhD., a professor of landscape ecology at Harvard University states that Structures can be designed to provide habitat for targeted species, to enhance surrounding natural systems, to attract and educate people leading to nature protection elsewhere. Efforts to put people in closer contact with nature can be achieved by the building design, landscape designs and interior design.

The LEED Rating system currently reward certain features that relate to green building designs including Day lighting, Green roofs, Water efficiency, Energy savings , Stewardship of resources and Improved indoor environmental quality.
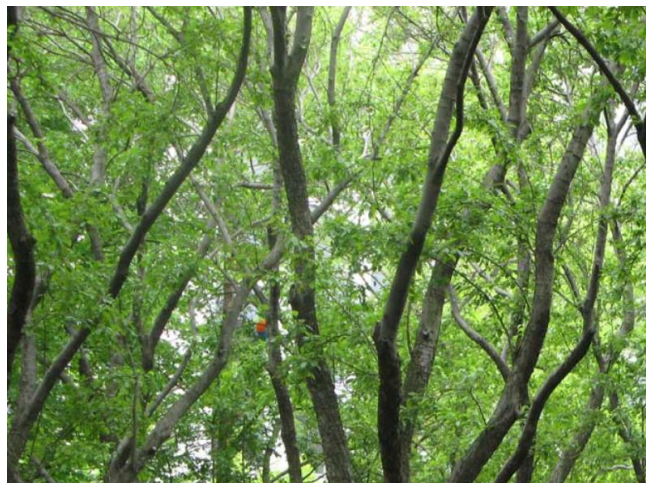
Conclusions:

- Research analysis shows the main characteristics of green design are outdoor views for inspiration, wood, stone, rugs of natural fiber, improved indoor air quality and natural sunlight innovation and roof top garden.
- Biophilia seem to point to a combination of genetic and cultural systems that help us realize our own needs to connect and work with nature.
- Research shows that early connections with nature have very positive effects on development of human.
- Worker's productivity increases with an improved INDOOR environment.

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- Research reported significant improvements in productivity as a result of green building features including day lighting and nature means.

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MATHIMATICS AND COMPUTATION

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MHD Free Convection Flow past a Vertical Plate that Applies Arbitrary Shear Stress to the Fluid with Ramped Wall Temperature

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Abstract
This article concentrates on the exact analysis of free convection flow of viscous fluid past a vertical plate with arbitrary shear stress and ramped wall temperature. The fluid is considered to be electrically conducting and passing through a porous medium. The equations governing the problem are first written in dimensionless form and then solved for the exact solutions using Laplace transform method. The graphs of velocity, temperature are plotted for various parameters of interest. It is found that velocity decrease with increasing wall shear stress in both cases of ramped and constant wall temperature.

Keywords Free convection, Ramped wall temperature, MHD, Shear stress

1. Introduction

The concept of free convection flow of a viscous incompressible electrically conducting fluid in the presence of a transverse magnetic field in porous media is of much importance due to the important role of magnetic field on the boundary layer flow control and on the performance of many systems using electrically conducting fluids. Furthermore, such type of flows has many applications in plasma studies, cooling of nuclear reactors, thermal insulation and heat transfer from pipes and transmission lines. Free convection flow of a viscous incompressible fluid through a porous medium bounded by an infinite vertical plate under the action of a magnetic field has been studied by (Raptis and Kafousias , 1982). Periodic temperature step changes are also important in building heat transfer applications such as in air conditioning, where the conventional assumption of periodic outdoor conditions may lead to considerable errors in the case of a significant temporary

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deviation of the temperature from periodicity. Keeping this in view, several authors have studied free convection flow past a vertical plate with step discontinuities in the surface temperature. Several authors have studied free convection flow past a vertical plate with step discontinuities in the surface temperature. However, here we are only highlighting some recent and important contributions (Dos *et al*., 2012, Patra *et al*., 2012, Rajesh, 2011, Samiulhaq *et al*., 2012, Seth *et al*., 2013). (Fetecau *et al*., 2013) for the first time investigated free convection flow near a vertical plate that applies arbitrary shear stress to the fluid when the thermal radiation and porosity effects are taken into consideration. However, so far no study has been reported in the literature which focuses the entropy effects in a free convection flow with ramped wall temperature past a vertical plate that applies arbitrary shear stress to the fluid. Even such studies are not available for viscous fluids.

Therefore, the aim of the present investigation is to provide exact solutions for MHD flow of a Newtonian fluid past an infinite plate that applies arbitrary shear stress to the fluid.

2. MATHEMATICAL FORMULATION

$$\frac{\partial u}{\partial t} = v \frac{\partial^2 u}{\partial y^2} + g\beta_T \left(T - T_\infty \right) - \frac{v}{K} u - \frac{\sigma B_0^2}{\rho} u, \tag{1}$$

$$\rho C_p \frac{\partial T}{\partial t} = k \frac{\partial^2 T}{\partial y^2} \quad y, \ t > 0, \tag{2}$$

We assume that no slip appears between the plate and fluid, thus the corresponding initial and boundary conditions are

$$u(y,0) = 0, \ T(y,0) = T_\infty; \qquad \forall \ y > 0,$$

$$\frac{\partial u(0,t)}{\partial y} = \frac{f(t)}{\mu}; \quad t > 0,$$

$$T(0,t) = T_\infty + \left(T_w - T_\infty \right) \frac{t}{t_0}; \quad 0 < t < t_0, \ T(0,t) = T_w, \quad t \geq t_0, \tag{3}$$

$$u(\infty,t) = 0, \ T(\infty,t) = T_\infty; \quad t > 0,$$

By introducing the following dimensionless variables

$$u^* = u\sqrt{\frac{t_0}{v}}, \quad T^* = \frac{T - T_\infty}{T_w - T_\infty}, \quad y^* = \frac{y}{\sqrt{vt_0}}, \tag{4}$$

$$t^* = \frac{t}{t_0}, \quad f^*\left(t^*\right) = \frac{t_\circ}{\mu} f\left(t_0 t^*\right),$$

into Eqs. (1) and (2) and dropping out the star notations it yields

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial y^2} + GrT - K_p u - Mu, \tag{5}$$

$$\Pr \frac{\partial T}{\partial t} = \frac{\partial^2 T}{\partial y^2}, \tag{6}$$

The corresponding dimensionless initial and boundary conditions are

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$$u(y,0)=0,\ T(y,0)=0\ ;\ \ y\geq 0,$$

$$\frac{\partial u}{\partial y}\Big|_{y=0}=f(t),\ T(0,t)=t\ \ ;\ 0<t\leq 1,\ T(0,t)=1\ ;\ t>1,\qquad(7)$$

$$T(\infty,t)=0,\ u(\infty,t)=0.$$

3. EXACT SOLUTION

Applying Laplace and inverse Laplace transforms we get

$$u(y,t)=u_c(y,t)+u_m(y,t),\qquad\qquad(8)$$

Where

$$u_c(y,t)=a_1\int_0^t\left(\frac{e^{a_2(t-s)}\operatorname{erf}\left(\sqrt{a_2(t-s)}\right)}{\sqrt[3]{a_2}}-\frac{2\sqrt{t-s}}{\sqrt{\pi}a_2}\right)\frac{e^{-H_1s-\frac{y^2}{4s}}}{\sqrt{\pi s}}\,ds$$

$$+\left[\frac{a_1}{a_2\pi}\int_0^{t-1}\frac{\left(2\sqrt{t-1-s}\right)e^{-H_1s-\frac{y^2}{4s}}}{\sqrt{s}}\,ds\right]H(t-1)$$

$$-\left[\frac{a_1}{\sqrt[3]{\pi a_2}}\int_0^{t-1}\frac{e^{a_2(t-1-s)-H_1s-\frac{y^2}{4s}}\operatorname{erf}\left(\sqrt{a_2(t-1-s)}\right)}{\sqrt{s}}\,ds\right]H(t-1)$$

$$+\frac{a_3}{a_2}\left(t+\frac{\Pr y^2}{2}\right)\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t}}\right)$$

$$-\frac{a_3}{a_2}\frac{y\sqrt{\Pr}\sqrt{t}}{\sqrt{\pi}}e^{\frac{-y^2\Pr_{eff}}{4t}}+\frac{a_3}{a_2^2}\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t}}\right)$$

$$-\frac{a_3e^{a_2t+y\sqrt{\Pr a_2}}}{2a_2^2}\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t}}+\sqrt{a_2t}\right)$$

$$-\frac{a_3e^{a_2t-y\sqrt{\Pr a_2}}}{2a_2^2}\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t}}-\sqrt{a_2t}\right)$$

$$-\frac{a_3}{a_2}\left((t-1)+\frac{\Pr y^2}{2}\right)\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t-1}}\right)H(t-1)$$

$$+\frac{a_3}{a_2}\frac{y\sqrt{\Pr}\sqrt{t-1}}{\sqrt{\pi}}e^{\frac{-y^2\Pr}{4(t-1)}}H(t-1)$$

$$-\frac{a_3}{a_2^2}\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t-1}}\right)H(t-1)$$

$$+\frac{a_3e^{a_2(t-1)+y\sqrt{\Pr a_2}}}{2a_2^2}\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t-1}}+\sqrt{a_2(t-1)}\right)H(t-1)$$

$$+\frac{a_3e^{a_2(t-1)-y\sqrt{\Pr a_2}}}{2a_2^2}\operatorname{erf}c\left(\frac{y\sqrt{\Pr}}{2\sqrt{t-1}}-\sqrt{a_2(t-1)}\right)H(t-1)\qquad(9)$$

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And

$$u_m(y,t) = -\frac{1}{\sqrt{\pi}} \int_0^t \frac{f(t-s)e^{-H_1 s - \frac{y^2}{4s}}}{\sqrt{s}},$$

(10)

correspond to the covective and mechanical parts of velocity.

4. PLATE WITH CONSTANT TEMPERATURE

$$u(y,t) = \frac{a_1}{\sqrt{\pi a_2}} \int_0^t \frac{e^{a_2(t-s) - H_1 s - \frac{y^2}{4s}} \, \mathrm{erf}\left(\sqrt{a_2(t-s)}\right)}{\sqrt{s}} ds$$

$$-\frac{a_3}{2a_2} e^{a_2 t + y\sqrt{a_2 \mathrm{Pr}}} \, \mathrm{erf}\, c\left(\frac{y\sqrt{\mathrm{Pr}}}{2\sqrt{t}} + \sqrt{a_2 t}\right)$$

$$-\frac{a_3}{2a_2} e^{a_2 t - y\sqrt{a_2 \mathrm{Pr}}} \, \mathrm{erf}\, c\left(\frac{y\sqrt{\mathrm{Pr}}}{2\sqrt{t}} - \sqrt{a_2 t}\right)$$

(11)

$$+\frac{a_3}{a_2} \, \mathrm{erf}\, c\left(\frac{y\sqrt{\mathrm{Pr}}}{2\sqrt{t}}\right)$$

$$-\frac{1}{\sqrt{\pi}} \int_0^t \frac{f(t-s)e^{-H_1 s - \frac{y^2}{4s}}}{\sqrt{s}} ds.$$

5. LIMITING CASE

In this section we intend to discuss one of the limiting case of our general solutions.

5.1 SOLUTION IN THE ABSENCE OF POROUS EFFECT

$$u(y,t) = \frac{a_1}{\sqrt{\pi a_5}} \int_0^t \frac{e^{a_5(t-s) - Ms - \frac{y^2}{4s}} \, \mathrm{erf}\left(\sqrt{a_5(t-s)}\right)}{\sqrt{s}} ds$$

$$-\frac{a_3}{2a_5} e^{a_5 t + y\sqrt{a_5 \mathrm{Pr}}} \, \mathrm{erf}\, c\left(\frac{y\sqrt{\mathrm{Pr}}}{2\sqrt{t}} + \sqrt{a_5 t}\right)$$

(12)

$$-\frac{a_3}{2a_5} e^{a_5 t - y\sqrt{a_5 \mathrm{Pr}}} \, \mathrm{erf}\, c\left(\frac{y\sqrt{\mathrm{Pr}}}{2\sqrt{t}} - \sqrt{a_5 t}\right)$$

$$+\frac{a_3}{a_5} \, \mathrm{erf}\, c\left(\frac{y\sqrt{\mathrm{Pr}}}{2\sqrt{t}}\right) - \frac{1}{\sqrt{\pi}} \int_0^t \frac{f(t-s)e^{-Ms - \frac{y^2}{4s}}}{\sqrt{s}} ds.$$

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$$u(y,t) = a_1 \int_0^t \left(\frac{e^{a_5(t-s)} \operatorname{erf}\left(\sqrt{a_5(t-s)}\right)}{(a_5)^{\frac{3}{2}}} - \frac{2\sqrt{t-s}}{\sqrt{\pi}a_5} \right) \frac{e^{-Ms-\frac{y^2}{4s}}}{\sqrt{\pi s}} ds$$

$$+ \left[\frac{a_1}{a_5\pi} \int_0^{t-1} \frac{\left(2\sqrt{t-1-s}\right)e^{-Ms-\frac{y^2}{4s}}}{\sqrt{s}} ds \right] H(t-1)$$

$$- \left[\frac{a_1}{(a_5)^{\frac{3}{2}}\sqrt{\pi}} \int_0^{t-1} \frac{e^{a_5(t-1-s)-Ms-\frac{y^2}{4s}} \operatorname{erf}\left(\sqrt{a_5(t-1-s)}\right)}{\sqrt{s}} ds \right] H(t-1)$$

$$+ \frac{a_3}{a_5} \left(t + \frac{\operatorname{Pr} y^2}{2} \right) \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t}} \right) - \frac{1}{\sqrt{\pi}} \int_0^t \frac{f(t-s)e^{-Ms-\frac{y^2}{4s}}}{\sqrt{s}} ds$$

$$- \frac{a_3}{a_5} \frac{y\sqrt{\operatorname{Pr}}\sqrt{t}}{\sqrt{\pi}} e^{\frac{-y^2 \operatorname{Pr}_{eff}}{4t}} + \frac{a_3}{a_5^2} \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t}} \right)$$

$$- \frac{a_3 e^{a_5 t + y\sqrt{\operatorname{Pr} a_5}}}{2a_5^2} \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t}} + \sqrt{a_5 t} \right)$$

$$- \frac{a_3 e^{a_5 t - y\sqrt{\operatorname{Pr} a_5}}}{2a_5^2} \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t}} - \sqrt{a_5 t} \right)$$

$$- \frac{a_3}{a_5} \left((t-1) + \frac{\operatorname{Pr} y^2}{2} \right) \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t-1}} \right) H(t-1)$$

$$+ \frac{a_3}{a_5} \frac{y\sqrt{\operatorname{Pr}}\sqrt{t-1}}{\sqrt{\pi}} e^{\frac{-y^2 \operatorname{Pr}}{4(t-1)}} H(t-1)$$

$$- \frac{a_3}{a_5^2} \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t-1}} \right) H(t-1)$$

$$+ \frac{a_3 e^{a_{12}(t-1) + y\sqrt{\operatorname{Pr} a_5}}}{2a_5^2} \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t-1}} + \sqrt{a_5(t-1)} \right) H(t-1)$$

$$+ \frac{a_3 e^{a_5(t-1) - y\sqrt{\operatorname{Pr} a_5}}}{2a_5^2} \operatorname{erf} c\left(\frac{y\sqrt{\operatorname{Pr}}}{2\sqrt{t-1}} - \sqrt{a_5(t-1)} \right) H(t-1), \tag{13}$$

where

$$a_1 = \frac{Gr\sqrt{\operatorname{Pr}}}{\operatorname{Pr} - 1}, a_2 = \frac{H_1}{\operatorname{Pr} - 1}, a_3 = \frac{Gr}{\operatorname{Pr} - 1},$$

$$a_4 = \frac{K_p}{\operatorname{Pr} - 1}, a_5 = \frac{M}{\operatorname{Pr} - 1},$$

$$a_6 = \frac{Gr}{H_1}, H_1 = K_p = M.$$

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6. Graphical Results AND Discussion

In this section, the influence of among various physical parameters involved in the considered problem on velocity, temperature some are represented through graphs. In order to understand the physical aspects of the problem, the numerical results for velocity are computed and plotted for various parameters of interest such as magnetic parameter M, porosity parameter K_p, effective Prandtl number Pr, dimensionless time t and shear stress f. Here in this paper two of them is discussed. The velocity profiles for different values of magnetic parameter M are shown in Fig. 1. It is found that the velocity is decreasing with increasing values of M in both cases of ramped and isothermal plates. Physically, it is true due to the fact that increasing values of M causes the frictional force to increase which tends to resist the fluid flow and thus reducing its velocity. The effects of the shear stress f induced by the bounding plate on the non-dimensional velocity profiles are shown in Fig. 2. The velocity of fluid is found to decrease with increasing f in both cases of ramped velocity and isothermal plate.
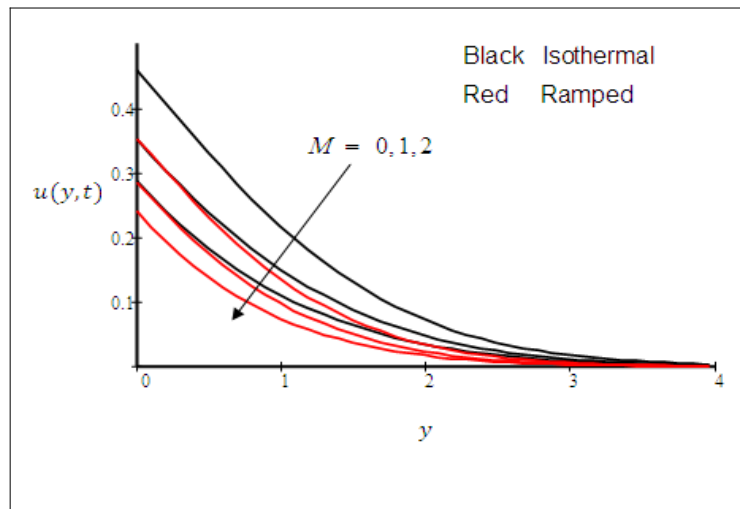
Figure 1: Velocity Profiles for Different Values of M
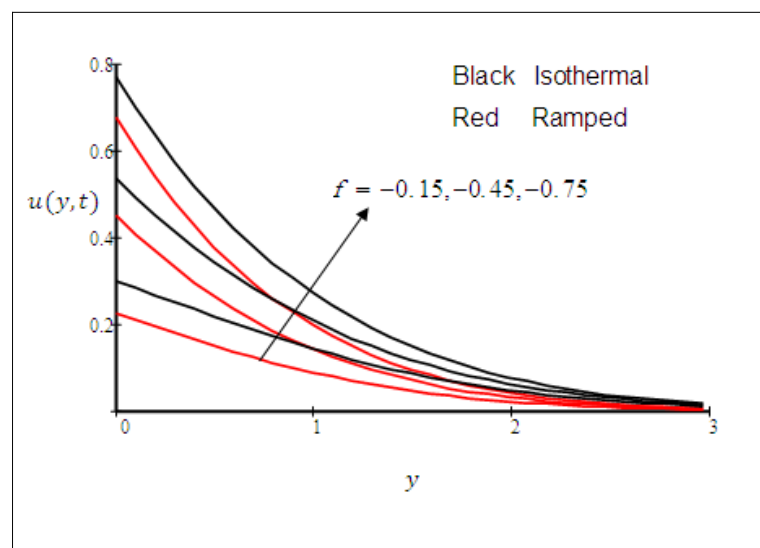
Figure 2: Velocity Profiles for Different Values of f

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URBAN PLANNING

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An Effective Drainage System for Underpasses

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Abstract

It is a well-known drainage system of an underpass is effective up to a certain limit; it fails after that limit (heavy rainfall or storm). Main problem faced is that water is trapped in the underpass. In order to avoid this situation water should be drain out before entering the underpass and continuous drain of water from underpass by natural means. In this paper, it is discussed that if at the start and end of underpass a smooth speed bumps with low gradient. Three perpendicular grates to drain water one at the start (starting slope) of the bump one at the middle (apex) one at the end (ending slope) of the bump. In this way water is drain before it is trapped. Also if camber is provided to the road of the underpass to a certain slope and grates to drain water is provided parallel to the road at one end of the road, it can also form continuous drainage for water if the limit exceeds.By this type of arrangement drivers are also forced to drive bit slower so safety is increased.

Keywords Drain, speed bumps, crowned, continuous drainage

Introduction

Poor design, placing and maintenance coupled with grossly inadequate drainage mechanisms have left most underpasses extremely vulnerable to flooding during heavy downpours (Rasheed Kappan, 2014). Major issue is due to faulty or old methods of draiage system design. No matter how much effective the drainage system of an underpass is, it can be flooded during storms. An underpass is an artificial depression dug out from the ground. Drainage for an underpass is always a problem because it's almost always impossible to align the slope of the underpass drainage with that of the main drain outside the underpass (whose level will be higher than the underpass). The problem becomes worse when the underpass is located at a site which is topographically also a naturally depressed zone. In such areas the tendency of water from all the surrounding catchment area is to flow towards that depression with no escape route in sight (Civic Planning, Water Management, 2009). This problem needs special attention and requires most effective solution possible. The idea discussed in this paper is, that if 2 smooth (smooth in sense of grade change) speed bumps are provided. One speed bump at the start of underpass (consider moving in one direction) and one at the end of the underpass. And alsothree perpendicular grates to drain water, one at the start (starting slope) of the bump, one at the middle (apex), one at the end (ending slope) of the bump. In this way water will be entrapped in the firstdrain before entering the depression zone of the underpass. Also by this flooding of underpasses can be reduced. Further, in this proposed idea of the drainage design, camber is provide with 1:100 slopeto the road, inside the underpass can be negative or positive. In this additional security of drainage is made.

What is an underpass?
An underpass is an artificial depression dug out from the ground. An underpass for vehicular traffic is a depression built with an aim to cope with the sever traffic congestion.

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Why underpasses are built?

Figure 1: Night View of Traffic at Underpass Seoul, South Korea.

It is usually built to overcome prolonged traffic gridlock around any intersection and to provide rapid movement of traffic in one direction. They can run under roads in the exact direction they are required.(Horsham cycling forum).

Underpasses drainage system failure.

An underpass is a depression, so no matter how much effective the drainage system is, it fails when it floods. This happens because all the water is gets entrapped inside the underpass. Despite having proper drainage system underpasses around the world fails epically in third world countries where advance designs are rare or rather expensive.

Why failure occurs?

1) Faulty drainage planning – An underpass is an artificial depression dug out from the ground. Drainage in an underpass is always a problem because it's almost always impossible to align the slope of the underpass drainage with that of the main drain outside the underpass (whose level will be higher than the underpass). The problem becomes worse when the underpass is located at a site which is topographically also a naturally depressed zone. In such an area the tendency of water from all the surrounding catchment area is to flow towards that depression with no escape route in sight.

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Figure 2: Tunnel in King Abdullah Street (Jeddah-Saudi Arabia)

It is important therefore to ensure that the drainage for surrounding catchments is planned in such a way that all water gets diverted away from the underpass BEFORE it enters the depressed zone.
2) Poorly designed / constructed rainwater harvesting systems. As per court orders all flyovers are supposed to do rainwater harvesting.
a) The system is obviously insufficient because its recharge capacities have not been designed after taking into consideration the runoff generated by the entire catchment of the underpass area.
b) Poor intake of the system because of faulty design / construction.
c) The system is poorly maintained. Rainwater Harvesting (RWH) system needs regular cleaning to maximize its intake capacity. If this is not done, the system gets choked and becomes defunct. Its cleaning is especially necessary where the RWH system takes (water from road / open surfaces etc. where the silt load is high.(Civic Planning, Water Management, 2009).

Why proper drainage is required?

Proper drainage is essential to:
1. Maintain the street's level of service.
2. Minimize danger and inconvenience to pedestrians during storm events (FHWA 1984).
3. Reduce potential for vehicular skidding and hydroplaning.
4. Maintain good visibility for drivers (by reducing splash and spray).(Urban storm drainage criteria manual, vol 1).

Possible solution to the drainage problem

Many solutions have followed in order to solve this issue. In many developed countries they placed electric motor over an underpass to pump water immediately from gutter inlets or drainage grates to drainage facility. It is a very easy and effective method especially during storms. But it requires alot energy to operate. And Pakistan is already suffering from energy crisis. Some underpasses uses just grate and gutter inlet. Means without motor or its alternatives. It is cheap and simple but it

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becomes ineffective during storms and heavy rainfall. So there must be solution in between these two solutions.

Proposed Idea

Idea discussed includes usage of very smooth speed bumps one at start of the underpass and one at the end of the underpass. 3 inlets grates are provided on each speed bump as shown in figure 3. One at the
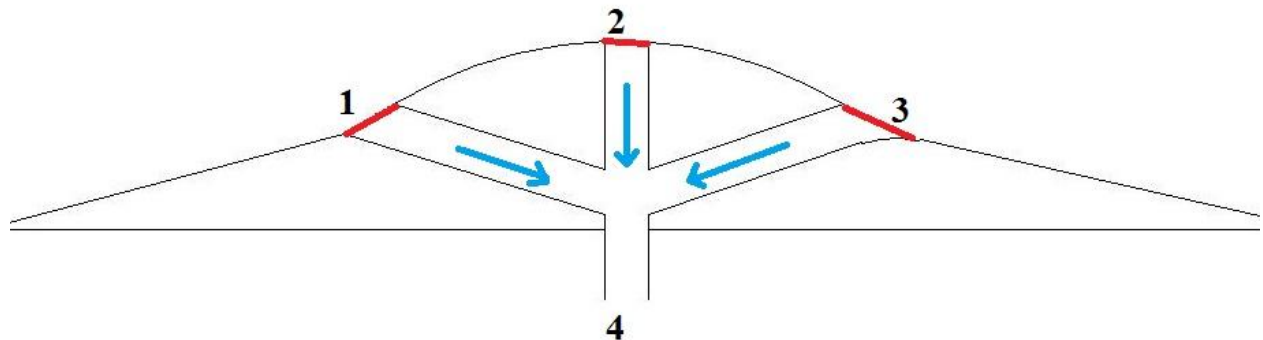
Figure 3: shows the proposed speed bump cross-section, 1, 2, 3 indicates grates inlet from which the drainage water enters. 4 indicatetowards main drainage facility.

Beginning of the bump (indicated as 1 in figure 3), one on the apex or middle of the bump (indicated as 2 in figure 3), and one at the end of the bump (indicated as 3 in figure 3). Each of the inlet collect water and meet at one junction (economical design) (indicated as 4 in figure 3) and water then moved towards the main drainage facility. Inlets 1, 2 and 3 can have separate drainage pipeline connection with the main drainage facility or outlet. Usually it will depend on the average flooding in the area. It is not necessary that grates must be placed in these points. Grate 1 can be anywhere on the increasing slope, 2 should be at middle or apex point and 3 can be anywhere on the decreasing slope.

Design of the Speed Bumps

Speed bumps are one tool available in the traffic calming toolbox, and have gained acceptance by international jurisdictions since their development in the early 1970s by the Transport and Road Research Laboratory (TRRL) in Great Britain. However, design and application varies widely between jurisdictions, and speed humps often meet resistance from residents and road users. (Margaret Parkhill*et al, 2007*)

For this case special speed bumps must be provided. It must be very smooth. Slope will depend upon the topography and amount of average rainfall. Height of the bump will also depend upon the topography and the amount of average rainfall. Increasing and decreasing slope must be equal. Slope must be not very high in order to make it smooth. Slope should be between 0.25 to 0.5 % (suggested value and non-practical value). Or it must not be like usual speed bumps it would be like small hill with smooth and low gradient.

Also, there must be sign boards in order to warn the drivers about the bumps.

Cambered Road

Proposed idea includes cambered roadin order to deviate water towards the drains that enter the underpass. Basic idea is to provide camber on the road inside the underpass. Grates inlet are provide at one end of the road after some interval or continuous.Grates are provided in the direction of the road. The spacing of the inlets depends on the design discharge, geometric configuration of the curb and gutter section, and the extent to which water is permitted to spread on the traveled way. (Paul H. Wright *et al*)Road inside the underpass can be crowned at the middle or at end of road

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(like super elevation). In this way if the water enters the underpass is more deviate towards the side drains rather than trapped in the depressed zone of the underpass creating blockade.

Advantages

Following are the advantages of using this type of design.

1. No additional cost is requiringcreating separate drainage facility for storm or floods.
2. No running costs as it does not require motor to pump the water from the drains.
3. Water can be entrapped and drained out before even entering the depression zone from the grates inlet provided at the speed bumps at the beginning and end of the underpass.
4. Even if the water entered the underpass it can be deviated towards the gutters because of the camber.
5. Due to speed bumps drivers are warned to slow down a bit so safety for the driver is increased.

Disadvantages

Following are the disadvantages of using this type of design.

1. Speed bumps must be smooth, this can cost.
2. Speed bumps provide little inconvenient to the drivers.
3. Gutters must be connected directly to the drainage facility.

Conclusion

This type of design has both advantages and disadvantages. Although it is cost saving in sense no running cost. But it can have high maintenance cost. Also cambered road can increase initial costs. But it can decrease flooding of underpasses up to great extent. Flood waters is first entrapped near the bumps and then diverted towards the grates inside the underpass due to camber in the road. All this process is natural and no external source of energy will be used in this type of drainage system. Although more research should be carried out in order to make it more effective and efficient practical.

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Aitchison College, Colonial Built Heritage in Lahore City, Pakistan - A Case Study

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Abstract

The colonization of Lahore city by the British during 19th century to the mid of 20th century had left remarkable effects of urban design and native architecture that are venerable along with classic visual facts of the significant historical era. The British hired local skills and vernacular architectural styles combined with their native achievements to build a number of buildings that stand now as pleased heritage in Lahore city. The old building of Aitchison College is a landmark and has great values in colonial buildings of Lahore. A case study of the old building of Aitchison College selected Colonial built heritage was brought out in this conversation. This Colonial building was distinguished to fall into three broad architectural categories, namely, British Colonial style of 18th century, Local Indo Islamic style and Neo- classical styles favored in Victorian Britain. This research paper will surely open up new avenue for the further researcher in the conservation of colonial heritage in this area.

Keywords Colonial, Lahore, Built heritage.

Introduction

Lahore City

The Lahore city is an old urban area of the Punjab. The Lahore was one of the leading cities in the 17th century of the Mughals era in subcontinent. Its vicinityas central crossways in the North Punjab took riches as well as victorious militaries. As an end outcome the urban cultured a rich pattern of architectural heritage that replicates the administrative affluences of the victors of the Lahore city. The contemporary Lahore city, however, is prearranged along an outline set especially by the Britain during their approximately hundred years of British colonial rulers over the subcontinent.[1][4]

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Local Architecture of Lahore

Local architecture of Lahore city is renowned as garden places and sub-urban garden places erected around Lahore with the passage of time. Presently, mostly along the main axis of the Lahore city, this low-density suburbanization is quiet obvious. The green areas and beautiful gardens of the city,prominent the built-up zones from the main lanes. While, in the places left between the streets, temporary neighborhood and small commercial activities developed. These public squatter settlements, known as "*katchiAbadi*", changedlong lastingfeatures of the urban area of the city. Consequently, it is very classical to see low-income pocketsseem like combined to the peak valued real estate and property.[4][5]

Colonization in Lahore

The British post-colonial period apparent two major styles of colonial architectural heritage. The first main architectural style was international, generallyintroduced by the architectural work of Le-Corbusier and subsequently the Brutalist architectural style. The next one continued the colonial touch and custom of contemporarydevelopmentapprehensions with Orientalized building elevations.This style of architecture was introduced in the city from the time of British raj (1849–1947), colonial architecture style combined Mughal, Gothic and Victorian styles. Designmethods used in the construction of greatspiritual gathering spaces and schools in their home land were assumed in the city. This architectural style was tracked in the earlyphases of growth in buildings. A mixtureof Indo Islamic designs and Indian local materials definitelyburnt clay brick carried out by the Britain engineers in India during late 19th and early 20th centuries is named as Indo-Saracenic style of architecture. This amalgam style united diverse features of the Hindu with that of the Mughal architecture style in an excited manner providing rise to pointy arches constructed with common clay bricks, domes, spires, tracery, minarets, open pavilions, ornamental work on stone, steel trusses and use of tainted glass. This likely style is leading in this public buildings and Queen Victoria Pavilion.[4][6]

Adaptation of vernacular architecture with native skills and designs into British style had led to the evolution of a new school of architecture during 1849-1947. Introduction of bungalow type residential forms with verandahs, hexagonal or octagonal bays and minarets, stain glass fanlights, Venetian shutters doors/ windows, carved bargeboards, monkey-tops (pointed hoods over windows), partially glazed and wooden paneled doors, sash ventilators, ashlar masonry with exposed bricks for elevations, porches, etc. marked this period. Construction of clock towers, light houses, turrets, conical/ cross gable/ Jack arch/ pitched/ pyramidal roofs, bell shaped domes, circular arches, curvilinear parapet, buttresses, finales, reinforced cement concrete and prefabricated members are the highlights of this period.[5]

Aitchison College

The Aitchison College is located in district Lahore, Punjab, Pakistan. The Aitchison College was recognized in 1886, it is a public and unhindered school contract of providing an education that uses academics structures, sports performances and co-curricular activities as tools for characterdevelopment of their scholars. The Aitchison College has richhistoriccontextual and valuable architectural style of British colonial age. The old building of Aitchison College is the best example of colonial buildings. Seven colonial buildings which were constructed with common clay bricks with exposed bricks on building elevations are erected in the Aitchison College site with a tactful planning. The Aitchison College initially designed on January 2, 1886 as the Punjab Chiefs' College was renamed Aitchison College on November 13, 1886.

Architectural Heritage of Aitchison College

There are seven colonial buildings in the Aitchison College which are all constructed in British colonial period minimum 100 years ago in British Raj.

1. Old building of Aitchison College.
2. Mosque
3. Boarding Hostel Building block-1

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4. Boarding Hostel Building block-2
5. Boarding Hostel Building block-3
6. Manadir
7. Gurdwara.

Characteristics of Colonial Built Heritageof Old Building of Aitchison College

The old building of Aitchison College is the main building which constructed with common clay bricks and has rich architectural values. The main old building of the College is a blend of dual designs as reflected in the building facade and plan, a ground floor plan designed by Colonel Jacob and an elevation of the old building designed by Bhai Ram Singh. Such as an outcome, both men shared the prize in a competition for the design of Aitchison college building. Common Clay Brick is the main building material used in the construction and pink red stone is also used in building as an aesthetical element in facade and in interior of the building.

Figure 1.1: North Side Elevation of Old building of Aitchison College Semicircular and pointed arches have been used in verandah opening

Figure 1.2: Main dome is decorated with mini domes

The facade of the building at the north side and east side as shown in the Figure 1.1 and Figure 1.2 respectively reflects a great artistic values of colonial architecture and a beautiful arrangement of arches of different forms constructed on the verandah which produce an attractive sight for viewers.

The building structure of the Aitchison college old building is made of common clay bricks, with some components in pink marble / red sandstone. The edges of each four-sided block are striking at the roof side by side with arched structure and domed kiosks "*chatries*" of various sizes and shape.

Semicircular (Figure 1.1) and pointed arches constructed on doors and windows opening which made them prominent. The octagonal towers surrounded by beautiful small domes (Figure 1.2) marked the corners of the central block which had the main building hall, whereas "*chatries*", domes and finials were used to highlight the corners of the old building, creating a highly articulated skyline and excellent architectural style.A clock having 5'-0" diameter (Figure 1.2) fixed in the tower with very artistically in the center of two small towers which can visualized from a far distance easily.

Building Architecture and Building Structure

Atchison College is a lavish sharp-eyed, significant, self-governing, and semi-private boy's school for boarding and day students of the Lahore city. It facilitates their scholars in every respect of education quality. It preserves example of all architectural styles and techniques of the British colonial period at their best. It constitutes a standing reference collection of colonial architectural planning, attractive bricks shapes, sustainable materials, methods and decoration

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traditions. The building structure is made of red clay bricks with gorgeous forms and with some elements in pink marble / red sandstone. The turns of for each rectangular block are marked at the roof level with arched structure for decoration and different sizes of domes are used very tactfully.

Architectural styles

The building of Aitchison College is constructed with different forms of clay bricks.These different forms of bricks freely used with lime mortar in the building structure and facade as well.

Figure 1.3: Column

Figure1.4: Balcony

The column of verandah (Figure 1.3) constructed in steps with depressed offsets, in the center of the column a framed offset developed very artistically with bricks and a base 12" projected with an eye-catching design out ward the verandah. In the corner of pillars half round inner side chamfered bricks used in a frame line which created a border strips in rectangular form. A red stone decorated with cut stone ornamental balcony (Figure 1.4), overhanging out ward in the building facade looking very attractive supported with stone braces which add more attraction in the building facade.

Figure 1.5: Pointed Arch

Figure 1.6: Segmental Arch

The doors and windows opening (Figure 1.5) constructed with common clay bricks in the form of pointed arches, these are connected with centrally abutment and created a balance / symmetrical view in elevation. The southern side of the old building decorated verandah opening with segmental arches (Figure 1.6) constructed with bricks, a key stone used in the center of segmental arch which visualized and prominent the arch opening in a stunning and stylistically.

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Figure 1.7: Column

Figure 1.8: Pointed Arch

Figure 1.9: Arch (circular)

Figure 1.10: Column Nosing tip

Figure 1.11 Redstone Jali of Parapet wall

Figure 1.12: Circular Arch

The column of verandah of boarding hostel is decorated with steps offsets (Figure 1.7) and bricks used in such a way to develop a harmony in the sequence of steps in descending orders very tactfully. The mixture of different arches such as pointed arch, circular archon the top of the center, ogee arch and semicircular arches also constructed in the window opening (Figure 1.9) in the building facade of the old building. An ornamental design of nosing prepared in clay brick (Figure 1.10) constructed in columns of verandah with lime mortar and circular arches used with round shape *jalli* (Figure 1.11) in the facade. A variety of different forms of bricks used in the Aitchison College buildings. The pointed arches constructed with clay bricks (Figure 1.8, 1.9). On parapet walls red stone *jalli* are used with depressed offset and replicated it in the parapet wall continuously (Figure 1.11). The special size and forms of stone jali used in the parapet wall with a typical style and the replication of the same pattern in all-around the building. The segmental arches constructed with common clay brick with a key stone prominent with decorating printing design (Figure 1.6). In the building facade the different sizes of bricks used in different forms and style with a sequence of offsets very artistically which produce an aesthetical view in the building elevation. The circular arches also used in elevation of the old building with red stone *jalli* fixed in the center (Figure 1.12).

Deterioration of Aitchison College Building

Some parts of Aitchison College old building have impaired with dampness which cause the deterioration of brick masonry.

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Figure 1.13: Seepages appeared on the brickwork on the entrance of the Old building of Aitchison College

Figure 1.14: Deterioration of bricks has started due to dampness under the Balcony of Old Building and the hairline groves which cause the deterioration and efflorescence

Figure1.15: The efflorescence and deterioration appeared on the face of brickwork in the outer plinth of the Old building Aitchison College due to dampness

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Figure 1.16: The efflorescence appeared on the ceiling of Aitchison College Old Building

Figure 1.17: The deterioration of bricks in the column and on building facade ofAitchison College

On the some parts of the Aitchison college old building the efflorescence /salts appeared on the face of the brickwork (Figure 1.13, Figure 1.15 and Figure 1.16) due to dampness, no doubt the main brickwork of different parts of the building are preserve from the efflorescence / salts . The water penetration into the brickwork through the out let of water drain which continuously flowed and cross hairlines cracks (Figure 1.14) on the corner of the top surface of the floor which absorb raining water which cause the efflorescence and deterioration in the bricks of old building of Aitchison College (Figure 1.17).

The main cause of efflorescence is generally dampness which penetrates in the brick section in different ways and impaired the bricks. Generally it is not harmful brutally but the effect of moisture in the internal section of brick again and again with variation of temperature which causes the deterioration of clay bricks (Figure 1.17). The ceiling of verandah (Figure1.16) has impaired by efflorescence and an ugly view of ceiling has developed and some parts of brickwork become damaged.

The brick masonry of colonial old building of Aitchison College impaired with efflorescence (Figure 1.15) and the deterioration of brickwork started (Figure 1.17) due to the repetition of efflorescence impact which generally produced by the penetration of moisture in brick masonry.

The effect of salts and efflorescence produces an ugly impression to the viewer and has a bad impact on the brickwork as observed in the Aitchison College old building (Figure 1.13 to 1.17). The brickwork of the building facade bearded a lot of climatic changes and variation of hot humid temperatures, in spite of this when observed recently the crystallization of white powdered salts seen on the brickwork faces and after passing a 100 years the faces of bricks became destroyed slowly and an unpleasant look also developed (Figure 1.17) which needs to be rectification as per standard to conserve this great heritage from further decay, it require to take an emergent action without further delay.

Conclusions

The colonization of Lahore city by the British during 19ᵗʰ century to the mid of 20ᵗʰ century had left remarkable effects of urban design and native architecture that are venerable along with classic visual facts of the significant historical era. The British hired local skills and vernacular architectural styles combined with their native achievements to build a number of buildings that stand now as pleased heritage in Lahore city. The building of Aitchison College is a landmark and has great values in colonial buildings of Lahore.This Colonial building was distinguished to fall

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into three broad architectural categories, namely, British Colonial style of 19th century, Local Indo Islamic style and Neo- classical styles favored in Victorian Britain. This research paper will surely open up new avenue for the further researcher in the conservation of colonial heritage in this area. The British combined vernacular architecture with local skills and construction techniques with their native architecture to develop a beautiful mixture of European and Indo Islamic features. The British employed local techniques coupled with their native practices to build several structures that stand now as proud and prestigious heritage possessions of Lahore city. These buildings contribute to the best of all planning methods, materials, construction techniques and maintenance intending them immortality. Further concluded that the dampness which destructing the brickwork of some parts of the Aitchison College building should be required emergent rectification. The only need of the hour is to sincerely take up their immediate protection and conservation for the benefit of the present and future generations.

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Sethi House A Cultural Heritage

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Abstract

SethiMohallah that is I Heart of the walled city of Peshawar contains seven houses including Sethi House a cultural heritage.Such Historic buildings have their own traditional and special techniques used in construction. Working with wood and stone is very technical and time taking as well as perfection is required to fulfill the requirements of that house. This paper documents and describes the site and its plans including entrance and rooms.

It would be a singular honor for our generation, if we could preserve some of these houses for our future generations so that they may feel proud of their forefathers. For the tourists visiting Peshawar and Pakistan, it would be a source of enjoyment. These houses which were built with great zeal and dedication are now a part of our national heritage. The design of the house resembles old houses in Baghdad whereas the decorative elements trace their origins to Samarkand and Bukhara, and even bits of Persia and India.

Site Plan

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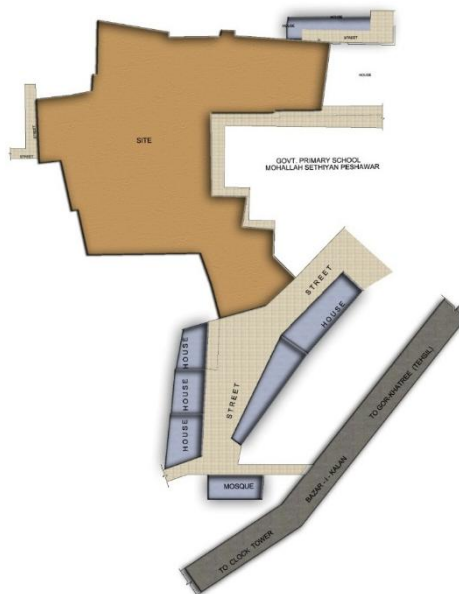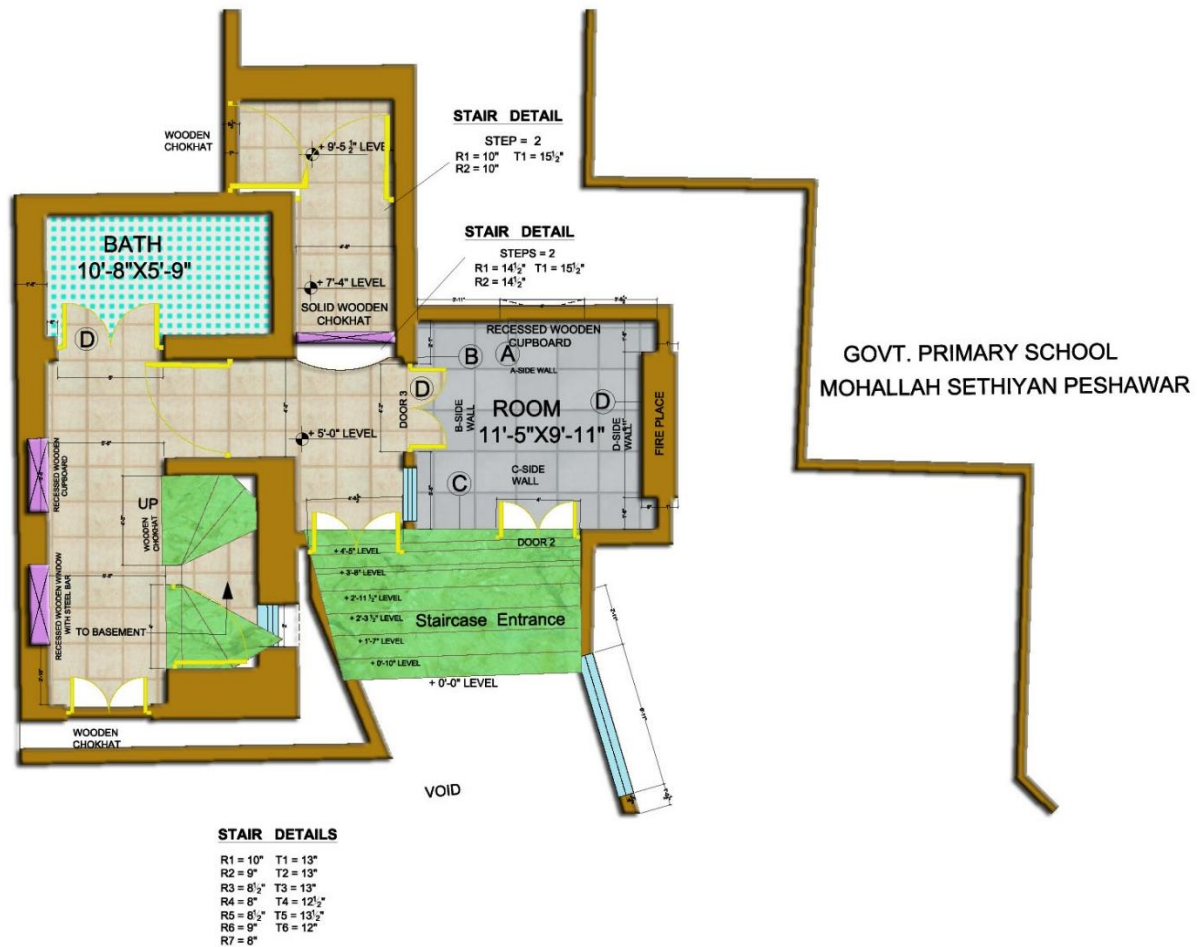
Introduction

The word Sethi is a Sanskrit word 'Sreshthin' which means the head of a business community. In the words of architect Naeem Safi, the house embodies techniques and aesthetic influences from a diverse range of sources. The houses in MohallahSethiyan near Gor-Khuttree were primarily built by the wealthy traders of this family in the 19th Century.

They have highly decorative carved Wooden Doors, Balconies, Mirrored, carved and Painted Rooms, very well ventilated basement, multi-storied houses with open upper storey for catching fresh air. The main house usually surrounds an open courtyard, where business was transacted. The surrounding rooms were provided with highly decorated carved wooden arches supported by wooden pillars.

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Entrance to A room

The entrance to this room is from two sides: one from central courtyard and the other from the new construction. On this side, is a highly decorated sliding door embellished with coloured glass laid in wood work /wooden frame & beads to enhance its beauty. The other entrance is from a corridor which leads to the central courtyard. This room has a very beautiful CheeniKhana or China Cupboard for placing exquisite decoration pieces or works of art. On the wall opposite central courtyard, this CheeniKhana is made by lime mortar and inlaid mirrors. On the back side of these transparent glass panels, flower baskets are painted in a very aesthetic manner.

The clarity, sharpness and brilliance of colours is depicted in the photographs. The ceiling is embellished with glass and mirrors encased in wooden frames / filigree work in different, well proportioned, perfect geometric patterns. One very fine coloured broken glass globe is hanging from the ceiling.

Window

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Celling

Basement

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In restortion works of any old building for conservation maintainance and treatment of that old building is very important to make that building in an alive form.

Conclusions

Proper measures should be taken to restore the building in an alive form as trained crafts man should be highly encouraged to do work. Serious efforts be taken to restore the building preservatives in original form.

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MANAGEMENT SCIENCE

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Role of HR Practices in Employee Retention

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Abstract

The main aim of the paper is to investigate and determine the current human resource practices for the retention of core, competent and high performing employees in an organization. It will assess the relationship between Human Resource practices and retention. Market trends are shifting very quickly and with this remarkable change, now organizations have realized the truth that keeping the quality and correct number of work force could give them competitive advantage over their competitors. There are five important HR practices i.e. career development, supervisor support, work environment, rewards and organizational policies that influences employee retention directly.

Keywords Employee Retention, HR Practices, Techniques of employee retention in corporations

1. Introduction

Market trends are shifting very quickly and with this remarkable change, now organizations have realized the truth that keeping the quality and correct number of work force could give them competitive advantage over their competitors. H.R. practices and employee retention are closely related to each other and the efficient and effective formulation and execution of H.R. policies can lead to low turnover rate in the organization and higher level of employee commitment. Effective policies and increased role of H.R. in the organizations is making the organizations and management realize to retain their high performing and competent employee by employing effective policies regarding employees so as to retain them in the organization (M. Azhar, et al, 2009).

The major contribution of this study is the assessment of determinants of Employee Retention in Telecom Sector of Pakistan. Research results show the relationship and also the intensity level of the determinants through which they impact on the employee retention

1.1 Aims of Research

The main aim of the study is to investigate and determine the role of human resource practices for the retention of core, competent and high performing employees in an organization i.e. PTCL. (A Telecom Company, Karachi). It will assess the relationship between H.R practices and retention. Employee retention is a highly important strategic tool for organizations. Through employing effective policies of H.R. employers can retain high performing, competent and committed employees of the organization's workforce that beneficially can lead to organization's progress and ensure its success

1.2 Research Objectives

The sole objective on which the research is focused on:

i.   Role of HR practices in employee retention: The study is aimed to enhance the understanding and knowledge of retention. The study will focus on the Telecommunication sector and will take in to consideration the organization PTCL (A telecom company) of Karachi, Pakistan and aim to determinate how to retain employees there.
ii.   Check the relation of employee retention with the working environment.
iii. Check the relation of employee retention with the organizational policies.
iv.   Check the relation of employee retention with the rewards.

1.4 Scope of the Study

The study is conducted to find out the role of H.R. practices on employee retention. The scope of the study is limited. The thematic scope of this study is to find out the role and effectiveness of efficiently conducted H.R. practices to retain core and competent employees. Whereas, the geographical scope of study is the south of Karachi i.e. PTCL (Call Centre, D.H.A. phase VI).

1.5 Benefits of the Research

If incompetent employees and workforce are employed by the manager in this case organization can face following problems such as, experiencing the high turnover rate, waste of time and resources in recruitment and training of that new employee, no interest in job, no organizational development. Various organizations are realizing that retention is a strategic issue and represents it as a competitive advantage (Walker, 2001). Since the study is completely from employer's and employee perspective, it will give the clear picture as how the effective H.R. practices is beneficial for the individual as well as for the organization and how it can lead to enhance the efficiency and success of the organization.

2. Literature Review

Market trends are shifting very quickly and with this remarkable change, now organizations have realized the truth that keeping the quality and correct number of work force could give them competitive advantage over their competitors. H.R. practices and employee retention are closely related to each other and the efficient and effective formulation and execution of H.R. policies can lead to low turnover rate in the organization and higher level of employee commitment. Effective policies and increased role of H.R. in the organizations is making the organizations and management realize to retain their high performing and competent employee by employing effective policies regarding employees so as to retain them in the organization (M. Azhar, et al, 2009). Past few years has been the most critical and tensed period for the telecommunication sector in Pakistan as far as retention of employees is concerned (Sylvia & Wilfred 2010).

2.1 Telecommunication Sector of Pakistan

According to a study conducted for the telecommunication sector of Pakistan it was found out that even though good amount of salary is offered to the employees working in telecom firms and call centers but still the turnover rate in this sector is relatively high than other sectors, reason for this is workload and long working hours which is unethical from employee perspective (Silvya & Wilferd 2010). Mostly in call centers, in which employees work constantly for many hours, this is against the law and wrong. Due to this turnover rate of employees in the telecommunication sector is high as compared to other sectors in Pakistan.

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2.2 Theoretical Framework

Employee retention model is a philosophical and newly touted theory. It states that, to keep employees, we must understand what they like and what they do not like. The theory emphasize that it is needed to set up an effective an efficient process so that there would be more chances to help employees to meet their individual needs.
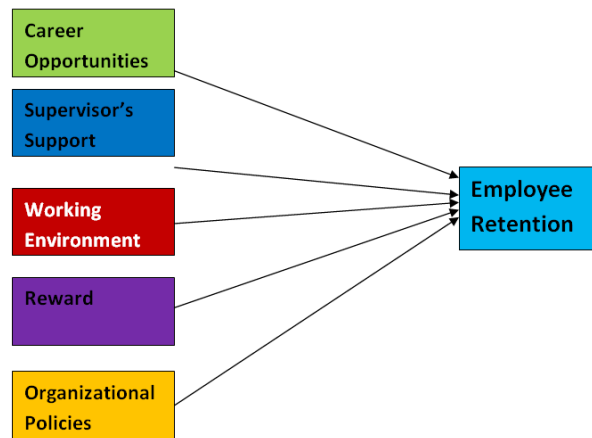
Figure 1: Theoritical Framework

3. Variables of the Study

As far as the research is concerned, the researcher has a strong motive behind it. The Research will be focused on few major variables that show the relationship of H.R. practices and employee retention. These variables will also be identifiable in the questionnaire as well as they are as follows:

3.1 Working Environment: The work environment is comprised of the physical location, equipment, materials processed or used, and the activities of an employee while engaged in the performance of his work, whether on or off the railroads property. There are no stated exclusions of place or circumstance.

3.2 Reward: Something given or received in return or recompense for service, merit, hardship, etc.

3.3 Organizational Policies: A way or method of action chosen, frequently by an organization, institution, university, etc. from among alternatives to guide and decide present and future decisions and positions on public matters.

3.4 Career Opportunities: A career opportunity is a positive or beneficial situation or combination of situations in the career of any employee.

3.5 Supervisor's Support: Supervisor support is defined as the degree to which leaders give importance their employees' contributions and support them.

3.6 Retention: The action of keeping valuing and retaining core and competent employees.

3.7 Turnover: The action of turning over; an upset or overthrow.A sudden change; a setback.

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4. Research Methodology

The research methodology for this research is based on case study method supported with self-administered questionnaire based survey. Since, Dr. Ahmed (2010) reported that case study is more dependable and significant technique due to its many sources of information. PTCL (Call Centre was taken as a case) to identify the role of HR practices in employee retention.

Population: The population for the study is the employees of PTCL (Call centre), inclusive of the employees, at top level management, middle level management, and low level of management.

Sampling Methodology: Next important work to be done is to decide on the sample size. A good sample size is nearly 50% of the total population and for this research that is on local scale. It is decided that the employees of PTCL (Call centre, D.H.A. Phase VI) are surveyed regarding the research.

Data Collection Method: The issue discussed in the research is tried to resolve by collecting data from both primary and secondary sources. For developing the theoretical framework the secondary data is gathered from the previous research articles and journals while the primary data is collected through the questionnaires. After the literature survey, the variables are considered which are described in the theoretical framework. Employee retention is the dependent variable, which is going to be checked for relationship with career development, supervisor support, working environment, rewards and organizational policies that are considered as independent variables. Self administered questionnaires are used as main sources of collecting the primary data. Primary data is collected through filling the questionnaires from the employees of PTCL (Call Center) Karachi.

Data Analysis Techniques: The research work is exploratory in nature in which the Percentile method is used to present the result of Research.

5. Data Analysis

This study examined the relationship of career development, supervisor support, work environment, rewards and organizational policies with employee retention among the employees of telecommunication in Pakistan.

It was decided to take 50% population as the sample for conducting the survey. The total no. of employees in PTCL call centre (D.H.A. phase VI) are 122. Since it was decided to survey 50% of the entire population therefore, 60 questionnaires were distributed out of which 50 returned back. Probability sampling method is selected and it is used Stratified Sampling Technique for the case study based research. Since, in stratified sampling technique population is segregated into uniform clusters and groups of employees were made based on their ranks/positions in the hierarchy. It was decided to take three layers i.e. top level management, middle level management and low level management employees and 10% employees from every defined section is surveyed. The response rate for the study was 84% approximately.

5.1 Company Profile

Call Centers by PTCL is set up to offer service to offshore companies. The distinctive services are airline booking/confirmation, data entries, hotels, help line, banking, insurance claims, reservations, medical prescription entries, etc. The customers' who are overseas, their calls are in

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retreat to call centers in Pakistan through VoIP technology where trained operators act in reaction to the inquiries of the customers. This service requires quick reaction, excellent communication links and well-organized handling without any time delay. Pakistan Telecommunication Company Limited continues its effort to bring innovative products and solutions to its valued customers. Establishment of Domestic Call Centre is yet another method for corporate businesses to send a message of special care to their customers.

5.2 Demographic Profile

Table 1: Age

Age in years	Respondent	Percentage
18-28	19	54%
29-38	27	38%
39-48	4	8%
49 or above	0	0%
Total	**50**	**100%**

Table 1 Interpretation: There were 60 survey questionnaires distrubuted out of which 50 returned back. Table 1 shows that out of 50 respondents, 54% of total respondent are between the age group of 18-28, 38% of the respondents are between the age group of 29-38. Only 8% of the age of 39-48 and there is no respondent in this research are in age that is above the age above 49.

Table 2: Employees by Gender

Gender	Respondent	Percentage
Male	32	64%
Female	18	36%
Total	**50**	**100%**

Table 2 Interpretation: Table 2 shows that out the 50 respondents surveyed, 64% of the respondents were Male and 36% of the respondents were female. These male and female are the employees of PTCL call centre (D.H.A Phase VI, Karachi).

Table 3: Employees by Academic Profile

Academic Profile	Respondent	Percentage
Matriculation	4	8%
Intermediate	14	28%
Bachelor	23	46%
Master	6	12%
Technical Certificate	3	6%
Other	0	0%
Total	**50**	**100%**

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Table 3 Interpretation: Table 3 shows that out of 50 respondents, 8% of the respondents having academic education till Matriculation, 28% of the respondents are Intermediate, 46% respondents are bachelor's degree holders, 12% respondents are Master's degree holders, 6% of the respondents have technical education. The difference in academic qualification clearly specifies that tree levels of management i.e. top, middle and low levels of employees were surveyed for the research and stratified sampling method was used for the research.
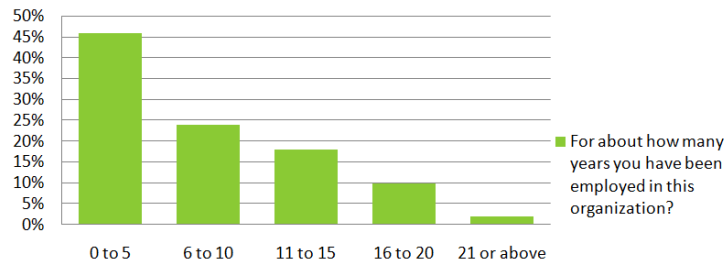
Figure 2: Years of Employment

Figure 2 Interpretation: When the respondent were asked about their years of employment, 46% of the respondent answered that they were employed approximately form 0 to 5 years, 24% respondents were employed from 6 to 10 years approximately, 18% of the respondents were employed in this organization from 11 to 15 years, 10% of the respondents were employed from 16 to 20 years, and 2% of the respondents were employed form 21 years or more than 21 years. As representatives of majority population, it gives researcher the idea that in call centers particularly in this organization (PTCL, for which the study is conducted) employees leave or intend to leave the organization with in few years.
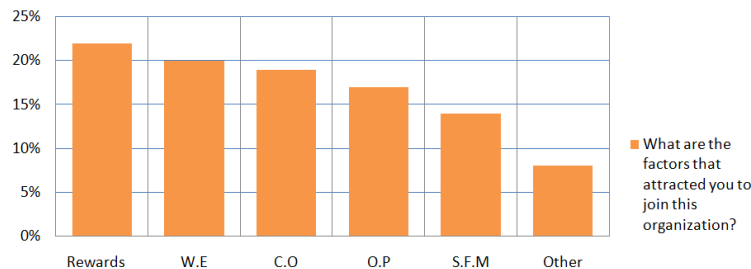
Figure 3: Factors Attracted To Join This Organization

Figure 3 Interpretation: When the respondents were asked whether about the factors that attracted them to join this organization, 22% respondents opt for reward to be the factor of attraction for them, 20% respondents said that they joined this organization because of its working environment, 19% responded for career opportunities, 17% said organizational policies, 14% said responded that the support from managers attracted them to join this organization. Whereas, 8% respondents opt for other factors such as training and development or challenging job tasks etc.

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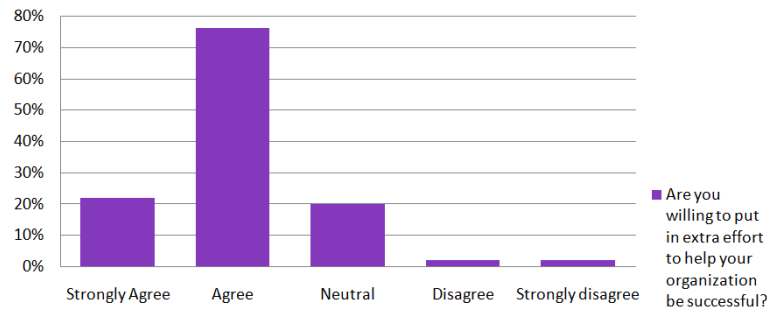
Figure 4: Willing to Put Extra Efforts

Figure 4 Interpretation: When respondent were asked that would they agree, that they are willing to put extra effort for the success of the organization, 100% respondent answered for this question, out of which 22% of respondent are strongly agreed that they are willing to put extra effort for the success of the organization. 76% of respondent are only agreed with this view, 20% results shows they neither agree nor disagree, and they are neutral. 2% of respondent are disagreed with this statement and 2% of respondent are strongly disagreed means they were sure that they did not show any willingness to put extra effort for the organization in which they are working.

Figure 5: Motivating Factor for Extra Effort

Figure 5 Interpretation: When respondent were asked that what motivates them to put extra effort for performing their job tasks, 100% respondent answered for this question, out of which 26% of respondents have chosen reward as the motivational factor for them. 8% respondents opt for the working environment as the motivational factor, 24% results shows that the respondents consider career opportunities as motivating factor for them. 18% respondents choose organization policies as a source of motivation for them. 12% employees said they get motivated when they get support from their managers.

5.3 Findings

On the basis of obtained data from the survey, the most important findings are summarized as after conducting the survey it came to know that majority of the employees that is 26% were not willing to retain in the organization. Out of 50 employees 13 were agreed to leave the organization and 8 employees strongly agree with this view. Therefore it can be concluded that expected employee turnover can be high for the organization. Many studies show that reward and retention are greatly linked with each other (Mercer, 2003; Watson, 2009).Similarly, in this study when employees were asked about what influence or motivate them to join this organization 22% employee chose reward as the influencing factor constituting the majority percentage.

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6. Conclusions

It is concluded from the research and study that retaining talented employees is really the toughest job. Retention is an important concept that is emerging to be an important matter that organizations have started to put extra efforts and are trying to formulate effective policies regarding it to retain it high performing and competent employees. Employees who are motivated to greater extent are proved to be more productive and innovative for the organization. Thus, leads to organization's success.

7. Areas of Further Study

- Role of HR Practices in Employee Retention and to Study new Technique of Retention.
- Employee retention and job sculpting.
- Effective ways and techniques of employee retention in telecommunication sector

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Role of Human Resource Practices in Employee Retention and to Study a New Technique of Retention

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Abstract

Market trends are changing very rapidly and with this change, organizations have realized the fact that keeping the quality and right number of workforce could give them competitive advantage over their competitors. The relation between HRM and retention of employees is the old one. Past few years has been the most critical and tensed period for the telecommunication sector in Pakistan regarding the retention of employees. The study of role of human resource practices in employee retention was based on a survey of employees of a telecommunication sector i.e. PTCL and the employees of PTCL call centre and others were surveyed as well. This research has also been conducted to study the technique of the employee retention i.e. job sculpting. The result depicts the positive relation between the HR variables and employee retention and reveals that if employer designs jobs for their employees especially for the experienced ones by keeping employee's interest, expertise, skills in mind then employee works with more interest and try to gives his/her 100% in their job.

Keywords

Human Resource Practices, Employee Retention, Techniques of Employee Retention in Corporate Sector

1. Introduction

Market trends are shifting very dramatically and with this change entities have realized the fact that finding the right number and form of work force is very difficult and important but retaining best ones is the toughest job. Therefore, Retaining top talent is always been a precedence for companies. However, this main concern has not always been plain. Organizations are sometimes amazed that experienced personnel who are salaried attractively and given good promotions opt to depart from the company. The reasons they quote are monotony and logic of stagnation.

1.1 Purpose of the Study

The main purpose of the study is to investigate and determine the current human resource practices for the retention of core, competent and high performing employees in an organization i.e. PTCL. (A Telecom Company, Karachi) as well as in call centers. As well as study is designed to study the technique of employee retention i.e. Job Sculpting.

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1.2 Research Objectives

The present study is aimed to enhance our understanding and knowledge of retention. The study will focus on the Telecommunication sector and will take in to consideration the organization PTCL (A telecom company) of Karachi, Pakistan and call centers of different entities and aim to determinate how to retain employees there. New technique is also considered in my work i.e. job sculpting, my aim to collect literature on it as well as to explore it among the employees at telecommunication companies.

1.3 Research Methodology

The research methodology for this research is based on case study method supported with self administered questionnaire based survey.

Employee retention is the dependent variable, which is going to be checked for relationship with career development, supervisor support, working environment, rewards and work-life policies that were considered as independent variables in PTCL (Call centre was taken as a case) to identify the role of HR practices in employee retention. As well as study aims to study to new technique of employee retention, i.e. job sculpting. Qualitative study approach has been focused. From findings we have derived our conclusions and recommendations, regarding the Employee retention in telecommunication sector

2. Background Study

Market trends are changing very rapidly and with this dramatic change, now organizations have realized the fact that keeping the quality and right number of work force could give them competitive advantage over their competitors. Some HR experts are of the opinion that the quality of HR contributes about 25% to the performance of an organization. Therefore, demand for the talented employees has been increased.

2.1 HRM

Human Resource Management is the vast and very deep concept. Many scholars and specialists define the term HRM in different styles but all of them agree on the same concept of Human Resource Management. The best way we found to define HRM is that, it is the progression in which policies and practices are involved in carrying out the "people" aspects of a management position.

Human Resource Management process is comprised of following steps:
Conducting the job analysis

- Planning labor needs and recruitment
- Selecting job candidate
- Orienting and training new employees
- Training and development
- Wages and salaries management
- Providing incentives and benefits
- Performance appraisal
- Communication
- Building employee commitment

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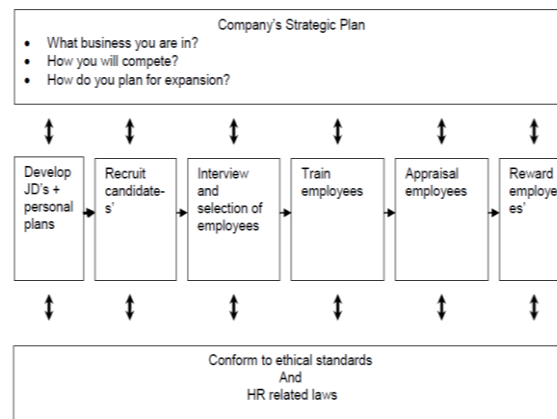
Figure 1: Strategy and the Basic Human Resource Management Process
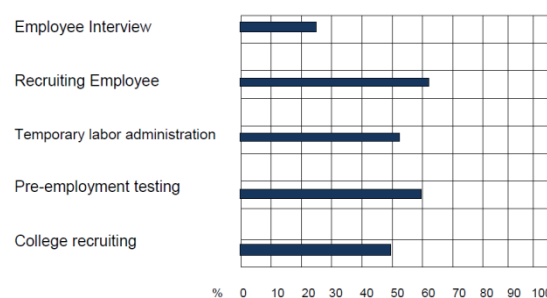
Figure 2: HR Controbution in an Organizational Work

3. Management Processes

The five functions of Management Process are:

- **Planning**, initial stage where managers establish goals, develop rules and procedures and make plans.
- **Organizing**, division of work among subordinates takes place, communication channels and authorities are established too.
- **Staffing**, the most important task done by the managers is to hire right people at the right time for the right place.
- **Leading**, getting the others to get the job done and maintaining the moral of the subordinates.
- **Controlling**, check and balance system where managers compares the forecasted work with the work done to check weather the job is done well or need corrective actions to take place.

4. Employee Retention

As discussed earlier it is the most important responsibility of HR person to hire very carefully otherwise they will face variety of unfortunate acts and events. HR persons knows that what is the JD and for that specific job what kind of employee they are looking for, the skills, abilities, knowledge, thus they consider every inch of employee for any particular job. But HR responsibility doesn't end on hiring and training, but most importantly they also need to keep their best people with them.

Here we are disclosing some of the steps to shun talent drain, they are:

1. There should be challenging tasks and work should not become boring. Time to time new learning can boost employee's skills and knowledge.

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2. As mentioned earlier some of the employees leave organization due the interference of colleagues and managers, that's why privacy at the work force is also important. Discussion with each other is important but one should not annoy anyone beyond the limits.

3. Seniors must be accessible, so their subordinates can contact them easily when they need to do discussion. Chain of command should not be too complicated and communication should be according to the C's of communication, i.e. clearance, completeness, correctness, etc

4. Behavior and attitude towards the employees should be according to the designation of an employee. Should formulate employee friendly policies for the company.

5. Decentralized decision making is important. Ask good employees for their views in the important decisions of the company. This can give the sense of belonging to talented employees. It can also help in retaining them.

6. Discipline at workforce is necessary.

4.1 Importance of Employee Retention

1. Recruitment and selection is very lengthy, complex and costly process. Finding very suitable and healthy person for the job is tough job that demands efforts from HR experts. New hired person is just like a raw material that needs polishing of skills, coaching from his supervisors. It is an absolute wastage of time money and efforts when skilled employee leaves organization frequently. Due to which HR has to start the whole employment process, simply the repetition of the work.

2. When employee leaves organization, they not only take their skills and expertise but they also take knowledge about the company, confidential data and strategies of the organization with them to the new entity. So, it is considered as the big loss for the company as they are not only losing their talented employee but also leaking their data in market.

3. Employees who stay in organization for a longer time can perform better than those who leave organization frequently. Those who stay knows the organization in and out better then others. Due to which HR don't needs to train them again.

5. Role of HR

In retaining employees Human Resource personnel plays very vital role, some of their roles are:

1. Whenever employee leaves organization, it is the main responsibility of the Human resource personnel to investigate why that employee left, what were the factors of leaving and change. Doing discussion with the employees is the responsibility of HR. HR personnel should not focus on exit interviews but they need to sit and discuss diverse issues face to face with employees.

2. Hiring is the tough job and very boring process. It's really difficult for the recruiters to find out the right candidate for the job. Therefore at the time of hiring they should check track record of the candidate. If candidate changes job frequently then avoid hiring them, but if that candidate have potential then after hiring taking steps for its retention is also essential.

3. HR person must make sure that whoever they are hiring is capable of doing job and does he fits in the JD, because doing wrong job is unhealthy for the employee as well as for the employer. Providing realistic job review is the responsibility of the HR to share with candidate at the time of hiring.

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4. People work for earning; HR should quote reasonable salary that is acceptable by both the parties. More over conducting motivational activities on the and off the job is the responsibility of the HR department because they are the people who hired them that are why they know the mind sets of the employees hired by them.
5. Motivation and encouragement of the employees is vital.

6. Retention Strategies

Strategies that can be used to retain an individual are:

1. An employee will always look for a change if he wants to grow and have a potential but in his existing job he is not getting it.
2. Employer first needs to know who are serious in work and who just time passers are. Those who want to grow team leaders should offer them some challenging work according to his interest to keep him involved in his work. Because when potential employees get bored they quit for change.
3. If there are disputes between employee and employer, employee and employee, employer and employer than employee will look for pleasant environment where he can work in peace. So, working environment should be pleasant and work supporting.
4. Too much rigidness at work, no freedom of friendship with colleagues and work interference can force them to leave. Policies regarding these things should be their but in acceptable manner.
5. It is the responsibility of the HR to hire the right person for the right job. Before hiring checking of previous record is also essential.
6. Worker gratitude is also important factors which go a long way in retaining employees. Nonentity works better than appreciating the employees. Their hard work must be recognized. Monetary benefits such as incentives, cash prize also motivate the employees and they prefer staining in the organization. The performers must have an upper edge and should get attention from the management.
7. Performance appraisal as well as performance management should be there to check previous records, make improvements for the future and take corrective actions.
8. It is the responsibility of HR to reward good performers and encourage slow learners.
9. There should be proper reward system, salaries should be discussed with the employees at the time of hiring, and policies should be friendly.
10. It is important for the management to understand the employees to gain their faith and confidence. The reliable performers must also have a say in the company's decisions for them to sense important.

7. Research Findings

Study examined the relationship of the HR practices i.e. rewards, work life policies, superiors support, career opportunities and working environment on retention of employees as well as studying the concept of job sculpting.

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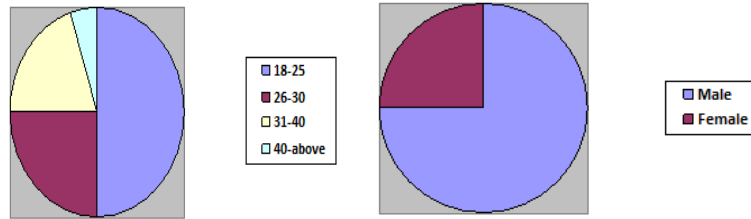
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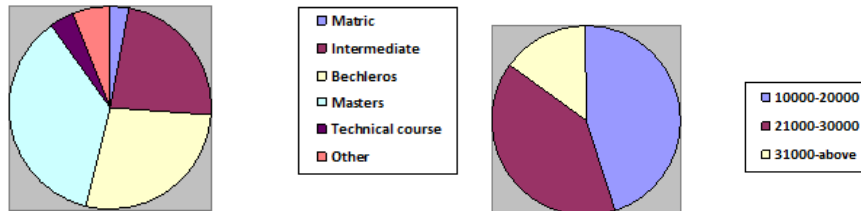
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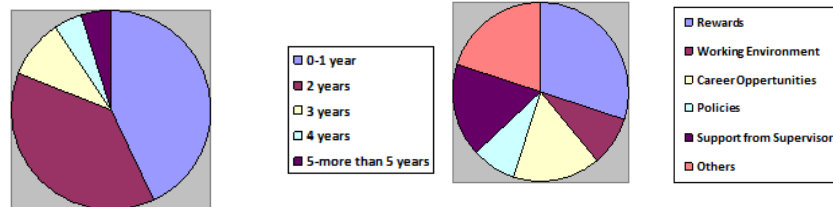
Figure 7: Years of Employement in Current Organization/Figure 8: What Attracts you to join this Company
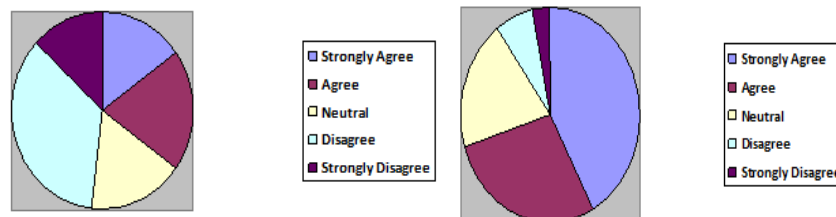
Figure 9: Do you Supervisors know what activities you enjoy? / Figure 10: Do you blieve that a person's job task should be negotiated with their supervisor?
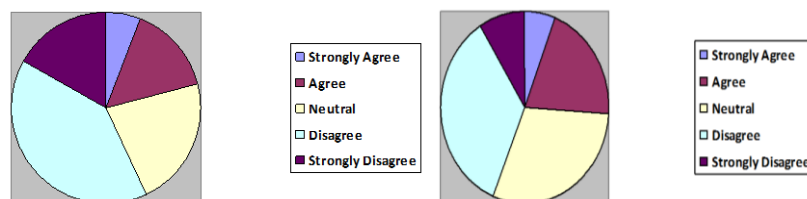
Figure 11: Does you company inspire the very best in your work performance? / Figure 12: This company shows an interest in you as an individual?
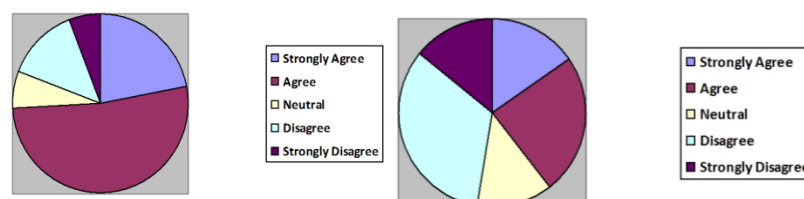
Figure 13: Do you feel that the job description should be flexible depending upon who holds the job? / Figure 14: Do you think a supervisor should spend time discovering his/her employee's non-work interest?

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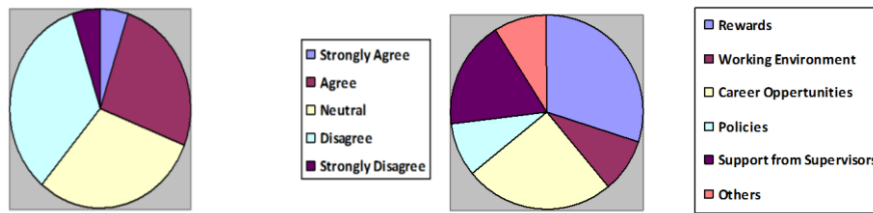
Figure 15: Are you willing to put in extra effort to help your organization be successful? / Figure 16: What motivates you to put extra efforts in your job?
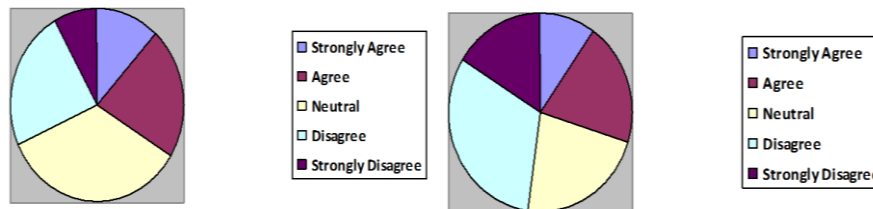
Figure 17: Do the organizational policies and preceders are helpful, well understood and upto date? / Figure 18: Does the employees are offered with good amound of verity in their job and challenging work?
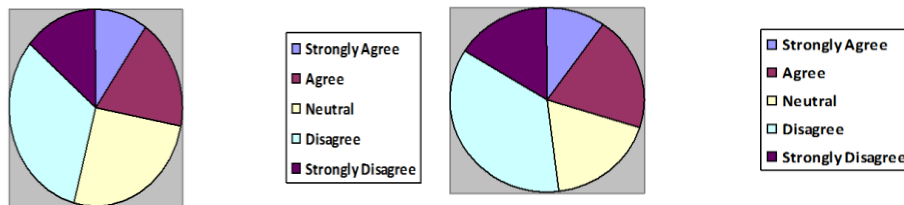
Figure 19: Does the organization provide regular opportunities for personal and career development? / Figure 20: Does the workers and management get along in this organization?
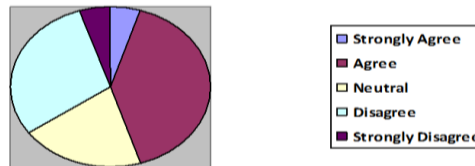
Figure 21: Are you considering leaving this company?

8. Conclusions

We have concluded from my research and study that retaining talented employees is really the toughest job for the employers and HR personnel. When company hires new employee he is just a raw material then company gives him/her the training, polish their skills and make him/her capable to compete with others. They become the asset of that company but when they leave company or decide to leave then it becomes threat for that company because one of his good and talented employees wants to leave him.

The one thing becomes very obvious after research that money alone is not sufficient; employees are influenced by other factors as well greatly such as work load. Suffering and exhaustion from too much time on job can lead to unsatisfactory work performances thus employee might not be dedicated to the firm.

Here we have some recommendations for the telecommunication sector of Pakistan:
- Should identify the issues of employees and try to resolve them instead of ignoring them.

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- Have informal communication with employees, keep the communication channels open.
- Provide direction to employees and communicate the value of their work as well as their own with them.
- Bring new strategies and implement them, strategies should be related to work life policies, work environment, growth opportunities.
- Job rotation can help in creating interest and enhancing the knowledge.
- Provide growth opportunities to those who are experienced and educated.
- Continuous development, offering new courses related to their work
- Retention strategy implementation.

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Impact of Service Quality Dimensions on Customer Satisfaction: A Study of Telecom Industry of Peshawar (Pakistan)

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Abstract

Service quality is crucial factor in customer satisfaction. Customer satisfaction is effected by service quality dimensions. In order to make the customers satisfy every company strives to enhance its quality of services. This research finds out the impact of service quality dimensions on customer satisfaction in the telecommunication industry of Peshawar (Pakistan). A sample of 140 respondents was observed. Research objectives and questions were developed, along with the hypotheses that were further tested and analyzed. For analysis SPSS was used, with the help of SPSS 20 package was used, with the help of which descriptive statistics Correlation and regression analysis results were obtained.. The study figures out that service quality has effect on customer satisfaction and that there exists a positive relationship between service quality dimensions (except physical equipment's). This research is concluded by gaining the attraction of service providers towards improving their service quality to increase customer satisfaction.

KeyWords: Quality Services, Satisfaction, Telecom Industry.

Introduction to the cellular companies of Pakistan:

In the today competitive world people are more and more dependable on the information technology .Mobile phones are a necessity for everyone these days. Telecommunication industry in Pakistan is considered to be the most competitive industry .from the past few years, competition in the market increased to high level, particularly in the area of mobile and other five major's brands i.e.Mobilink, Warid, Telenore, Zong, andUfone are competing with one another to capture the market and their customers. These days, mobile phones are not only the source for voice chatting but also provides many facilities like SMS(short message service),Web browsing, and also MMS(Multi Media Messaging)etc. to their valuable customers. Due to the large number of mobile phone users and it's services in the country , create an opportunity for competition among the mobile phone companies , all of them are focusing on different types of strategies ,that how to operate and manage their brand position in the market in order to get the maximum shears and more loyal customers.

Due to the rapid growth and increasing rate of competition in the service industry .i.e. telecommunication sector in both developed and developing countries made the service quality an important factor for measuring and evaluating (browns &bitner, 2007).in the today's competitive environment service quality is not only the effective part of the business and also take this

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conversation a prominent position. In the absence of the customer's satisfaction and loyalty, companies cannot exist in the today competitive environment, as well as without meeting the customers' requirements an organization cannot achieve its overall objectives. Service quality builds a strong and everlasting relationship among the company and its customers and its two way flow of values.

Reason for selection of Area:

The reason that why we select this is due to the day by day increasing rate of the Mobile phones usage, telecommunication industries of Pakistan are focusing on various types of marketing strategies in order to gain new customers as well as to retain their previous/old customers.

Research Objective

The general objectives of the study include the finding out the relationship among the service quality dimensions and customer's satisfaction in the Mobile telecommunication industry of Peshawar (Pakistan).this study specially seeks to:

Research Question

This will answers the following research questions:
Is there any relationship exists between the customer satisfaction and service quality dimensions in the Mobile telecommunication industry of Peshawar (Pakistan)?

Literature Review

Starting with the Customer satisfaction:

The benefits that come from the satisfaction of customers are often leads to high customer's loyalty, repeat purchase, and positive verbal communication about the service providers (jones and sasser 1995, cronine and Taylor 1992, Molinari et al.2008). The loyal customer are often purchase from their suppliers without turning to the competitors, and also creates a circle of customers that can leads to steady cash flow. Customer satisfaction also creates a long term customer relationships that can give a competitive advantage to the company (storbackaet al.1994).

With reference to "In business you get what you want by giving other people what they want" the comparison between the former anticipation and the performance that is done in reality of the product or service can be define as customer satisfaction. From marketingperspective this conceptof customer satisfaction is the indication of customer devotion towards any service or product of the company. The companies can grab maximum profit through the satisfaction of customers. So customer satisfaction is imperative in today's high competitive domain to run the business in the desired manner. Said that "customer satisfaction is worthless. Customer faithfulness is priceless". Customer satisfaction is the basic factor the success of business".

For the development of loyalty and satisfaction between the customers the telecom sectors needs to be very careful about their customer services which they are providing. The evaluation of services which is provided by a brand is the determination of satisfied customer. So the study of ahn,han and lee shows that when the customer do not getting their complaints properly and do not giving a proper response to the customer then result is that the customer is searching for other brands and switching off you. It happens when the service sectors customer service centers are not work properly and do not handle the complaints of the customer and not giving a proper response to the customer. But inso many occasions the telecom sector takes a huge amount of time to solve the customer's problem. For network coverage or call quality and many other huge amount of problems. One thing is very common in customers that they haven't wait for a long time to solve their problem. The result is that the customer loses their satisfaction with that particular brand and then they looking for other brands. More things the friendly environment and friendly attitude from the service sector workers at customer services points can create a very good impression on the customer which can also half the firms to make the customer loyal and satisfied. But in to another

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side if the telecom sector fails to provide such services like call drops etc. to its customer then it is experienced that according to churn,kim,park and jeongsaid that such type of telecom sectors called customer oriented and also provide such services which can increase the customer satisfaction. And if the customer get that all needed services in that very brand so they can get more satisfied .So customer loyalty and satisfaction is very key and important factor for the company.

Service

Service sectors are playing a critical and important role in the economies of developed and developing countries of the world. The 21ˢᵗ century is considered to be as the service industry. All the economic activities which are intangible in nature are services, not physically like products, that can give some value to its customers. Services occupy a significant position in all business industries due to the developments in IT and the globalization of economics of the world. Services is not only limited to service base business , like telecommunications , banks , hotels, restaurants and beauty salons, no a day's services become a strategic tools for gaining a competitive advantage as compared to the competitors. In today's competitive markets the products heavily depend on the service to acquire competitive advantage, and to satisfy customer's needs.
Edvardsson, (1998) says that the concept service must be viewed from the customer's perspective because service is based on the customer's total perception of the outcome which is the service. "He points out the participation of the customer in the service process since he/she is a co-producer of the service and the customer's outcome evaluated in term of value added and quality meaning the customer will prefer service offered to be of high value and quality"

Service Quality

Quality in service business has become an important thing through which the service provided fulfill the consumers need and wants. If the company's want to increase their profit and market share they need more and more attention to service quality. Service qualityshould be considered as an important and key strategic factor for the firms to set apart their products and services from competitors by streamlining service as process the consumers appraise. Several researchers appreciate the impression ofassessing service quality by comparing what they have confidence in and a seller should offer and compare it against the seller actual service performance. (Gronroos 1982). The importance of service quality to benefits contributing to profit and market share. (Parasuraman, et.al 1985).
The benefits that came from the creating and maintaining quality of service are greater as compared to cost that leads to the result of the poor quality. Superior and good service quality no day's companies using for achieving a competitive advantage. Superior service quality can leads to customer satisfaction which in return gives the firm various advantages such as :(1) the relation between the firm and its customers become more secure, (2) the customers start re- purchasing the firm products/services, (3) perusing others customers through the word of mouth,(4) creating good brand image in the mind of the customers ,(5) and also the greatest advantage that the firm profits will be increased. Continuous improvement in quality is not considered to be a cost for a firm, it's an investment of a firm that will leads for generating a source of revenue (Hutt and Speh in TijiptonpnoFandy 2001; 78, 79). Analysis confirm that there is positive and significant relationship between service quality and customer satisfaction this notion has also been confirmed through a study that was conducted by Omotayo and Joachim (2011) on 148 subscribers of major telecom communication companies in Nigeria.

Dimensions of service quality

Tangibles

The tangible side of service quality mean to the quality of physical environment, the equipment offered to make the service a charming experience, the external show of people providing the service (MuhammadAsif Khan, 2010). The furthermost important features of service quality are "Assurance" and "Tangibles" because they got the peak score. (Ishfaq Ahmed, 2010). Tangibility

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refers to the "Modern equipment's" "visual appealing facilities" "employees who have net, professional's appearance" "visual appealing materials associated with the service"

Reliability

"Reliability is subject to how well customer's services problems are handled; execution of error free services the first time; provide services at the promised time without any delay and hassle maintaining spotless services history. Furthermore, as stated reliability should be consider as the utmostsignificant factor in conventional service (Parasuraman et al., 1988). Reliability also involves precise order fulfillment; precise record; correct quote; truthful in billing; exact calculation of commissions; keep services promise". There is no room for doubt, consumer confidence in telecommunication industry is one of the crucial factor for the attainment in business rivalry and it is not irrational that many of these important sectors have centered trust their propaganda activities, The trust of the customers and encourage them to take benefit from telecom sectors can be influential on the quality of services.

Responsiveness

Responsiveness can be explained as the degree of servicesprovided proficient to help customer on time (Yong,2000).The responsiveness aspect of service quality diligently involves the inclination to make availability timely or favorable services by the service provider staff to the customers. If the customer perceived that services delivered could not be efficient and in a comprehensive way, the services are deemed to have a negative impact.

Assurance

Assurance emphases on the skill of the employees about the multidimensional understanding of the service provision, courtesy, and their capacity to impartassurance and trust in the service providers 'know-how. Theapprehension that employees should have the capacity to encourage trust and confidence among the customers about the ability of cell phone service providers in anticipating and meeting customers' needs (MuhammadAsif Khan, 2010). Offering well warranty terms deliver greater assurance to buyers and can result in more sales (MohdRizaimyShaharudin, 2009). It is the ability to build trust in customer's and showing courteousness every time. Assurance comprises polite behavior of the staff, respect and gratefulness for the customers and building sureness in them about the service (Parasuraman 1988).

Empathy

According to the Parasuraman et al. (1985) empathy is the individual attention and caring of the customers that the firm provided to its valuable customers. Empathy involves paying individual attention and employeeswho know the wants of their customers and convenience business hours. According to the Ananth et al. (2011) empathy is the individual attention, giving personal attention, convenient operating hours, by giving best interest in heart in understanding customer's needs.

Hypothesis to be tested

H_1: "Tangibility" has a significant role in creation of customer satisfaction.

H_2: "Reliability" has a significant role in creation of customer satisfaction.

H_3:"Responsiveness" has a significant role in creation of customer satisfaction.

H_4: "Assurance" has a significant role in creation of customer satisfaction.

H_5: "Empathy" customer satisfaction.

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Theoretical Frame Work
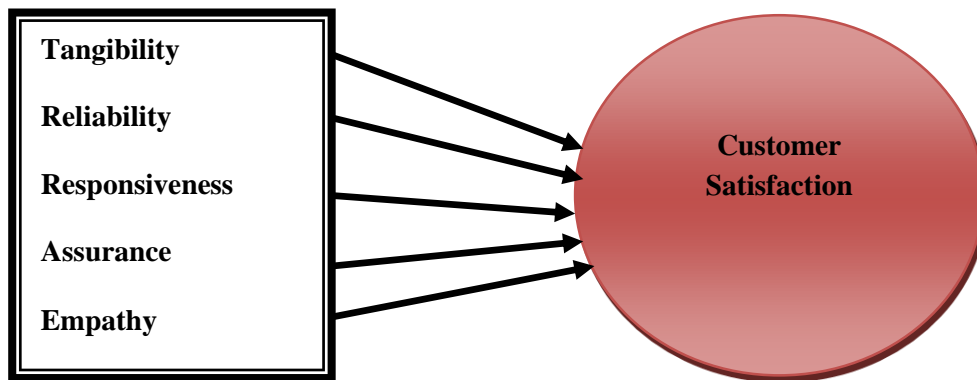
Figure 1

In the above research frame work, "tangibility", "assurance", "empathy", "responsiveness", "reliability", are the independent variables which affect service quality. Service quality is the intervening variable which has direct influence on customer's satisfaction. Whereas customer's satisfaction is dependent variable. Hence, independent variables lead to increase the service quality and this ultimately increases customer's satisfaction (dependent variable).Based on above model following hypothesis are developed.

Methodology

The study was is intended toexplore the objectives of this study and evaluate the hypothesis, for this purpose the descriptive research method was employed. The study used structured questionnaire (5 point Likert scale) for analysis purpose adopted from the study of (Alba 2012). The Population of the study was education sector (Universities of Peshawar). The elements were the people using one of the telecom services like Mobilink, Ufone, Telenor, Warid and Zong. Study use non probability sampling and on convenient basis distribute 150 questionnaire among students and teachers of Private sector. 140 responses are considered for final analysis and 10 were discarded due to incompleteness. Study use Statistical Package for Social Sciences (SPSS) 20 for analysis purpose.

Response rate of the respondent

Questionnaire was distributed among 150 students of City University of Science and information technology,AbasynUniversity, Peshawar model Degree College for boys and also from Muslim educational complex of Peshawar (Pakistan) on convenient basis. The respondents were asked to answer the close ended questions regarding their GSM service provider. From the target sample fully 140 questionnaires were received. In last for the Study used 140 questionnaires for final analysis and conducted descriptive statistics and correlation and regression analysis. After the final analysis we find out the response rate of the respondent through the following formula.

Response= response/total no. of response*100

Response= 140/150*100= 93.3%

So the response rate our respondents was 93.3%.

Analysis & Discussion

Reliability of Scale

Following table 1 is the illustrationsof the reliability of the data gathered from respondents. The table exhibits the data collected from mentioned sample is reliable and respondents answered in correctly. As the variables values are exceeding from 70% which is the conventional limit of acceptance for reliability. The variable Reliability and Responsiveness having the Cronbach's Alpha less than .7 cannot be measuredas standard of Reliability but our results shows that both

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variable are valid. The below table calculations suggest that the responses given by respondents of the study are reliable.

Table no 1: Reliability of Scale:
Reliability Statistics

S.no	Variables	Cronbach's Alpha
1	Physical Equipment's	.711
2	Reliability	.608
3	Responsiveness	.673
4	Assurance	.701
5	Empathy	.734
6	Customer satisfaction	.713

Demographic Result

In the above table the output shows that there are 108 male respondents with the total percentage of 77.1 % and there are 32Female respondents there percentage are 22.9% .the collection of total respondents were 140.In the given table there are 72 respondents their age were from 15-25 and 31 respondents the age were from 26-35 and 37 respondents there age were from 36-45.

In the above table there are 97 student respondents with the total percentage of 69.3%, and 43 lecturer's respondents with 30.7%. The collection of total respondents was 140.The output of the above table shows that there are 41 respondents from the Mobilink with the percentage of 29.3%, while 29 respondents from the Zong having the percentage of 20.7%. The respondents of the Warid, Telenor, and Ufone are 19, 26, and 25 with the percentage of 13.6%, 18.6% and 17.9

Table no 2: Demographic Result

Measure	Items	Frequency	Percentage
Gender	Male	108	77.1
	Female	32	22.9
	Total	140	100
Age	15-25	72	51.4
	26-35	31	22.1
	36-45	37	26.4
	Total	140	100
Occupation	Student	97	69.3
	Lecturer	43	30.7
	Total	140	100
Network type	Mobilink	41	29.3
	Zong	29	20.7
	Warid	19	13.6
	Telenor	26	18.6
	Ufone	25	17.9
	Total	140	100

Table no 3: Regression model:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.016ᵃ	.000	-.007	3.66590	.000	.034	1	138	.853
2	.405ᵇ	.164	.151	3.36510	.163	26.774	1	137	.000
3	.470ᶜ	.221	.203	3.26049	.057	9.932	1	136	.002
4	.592ᵈ	.351	.331	2.98725	.130	27.017	1	135	.000
5	.671ᵉ	.450	.430	2.75877	.100	24.288	1	134	.000

Model Summary

In the above table of multiple regression the value of R= .016 which shows that there is 1.6% association between Physical equipment's and Customer satisfaction. R square= .000 which shows that there is.000% change in Customer satisfaction is because of Physical equipment's. F change shows that the statistical significance of the model. The value of F-change =.034with significance level=.853 representing that the model is statistically insignificance.

In model two the value of R=.405 which shows that there is 40.5% association between physical equipment's, Reliability with customer satisfaction. R square= .164 which shows that .164 % change in customer satisfaction is because of physical equipment's, and reliability. F change shows that the statistical significance of the model. The value of F-change =26.774 with significance level=.000 representing that the model is statistically significance.

In model three the value of R=.470 which shows that there is 47.0% association between physical equipment's, Reliability and responsiveness with customer satisfaction. R square= .221 which shows that .221 % change in customer satisfaction is because of physical equipment's, reliability and responsiveness. F change shows that the statistical significance of the model. The value of F-change =9.932 with significance level=.002 representing that the model is statistically insignificance.In model 4 the value of R=.592 which shows that there is 59.2% association between physical equipment's, Reliability and responsiveness and assurance with customer satisfaction. R square= .351 which shows that .351 % change in customer satisfaction is because of physical equipment's, reliability, responsiveness and assurance. F change shows that the statistical significance of the model. The value of F-change =27.017 with significance level=.000 representing that the model is statistically significance.

In model 5 the value of R=.671 which shows that there is 67.1% association between physical equipment's, Reliability and responsiveness, assurance and empathy with customer satisfaction. R square=. 450 which shows that .450 % change in customer satisfaction is because of physical equipment's, reliability, responsiveness, assurance and empathy.F change shows that the statistical significance of the model. The value of F-change =24.288 with significance level=.000 representing that the model is statistically significance.

Table no 4: ANOVA

ANOVAᵃ

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.461	1	.461	.034	.853ᵇ
	Residual	1854.558	138	13.439		
	Total	1855.019	139			
2	Regression	303.649	2	151.825	13.407	.000ᶜ
	Residual	1551.370	137	11.324		
	Total	1855.019	139			
3	Regression	409.234	3	136.411	12.832	.000ᵈ
	Residual	1445.786	136	10.631		
	Total	1855.019	139			

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4	Regression	650.321	4	162.580	18.219	.000[e]
	Residual	1204.698	135	8.924		
	Total	1855.019	139			
5	Regression	835.173	5	167.035	21.947	.000[f]
	Residual	1019.846	134	7.611		
	Total	1855.019	139			

From analysis of variance the significance of the model was confirmed. Since the sig value was less than 0.05, except on only one relationship in which the value of p is greater than 0.05 so the model one was insignificant, and there was no relationship at all between the dependent and independent variables, the rest of model is significant. It is observed that all the independent variables, that is, reliability, responsiveness, assurance, empathy except physical equipment's are connected to the dependent variable, that is, customer satisfaction

Table no 5: Coefficients:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	20.548	1.528		13.450	.000
	Physical equipment's	-.024	.128	-.016	-.185	.853
2	(Constant)	12.663	2.071		6.114	.000
	physical equipment's	-.070	.118	-.046	-.592	.555
	Reliability	.677	.131	.405	5.174	.000
3	(Constant)	8.696	2.369		3.671	.000
	physical equipment's	-.038	.115	-.025	-.335	.738
	Reliability	.559	.132	.334	4.222	.000
	Responsiveness	.421	.134	.249	3.151	.002
4	(Constant)	1.883	2.535		.743	.459
	physical equipment's	.072	.107	.048	.673	.502
	Reliability	.485	.122	.290	3.970	.000
	Responsiveness	.207	.129	.123	1.605	.111
	Assurance	.701	.135	.396	5.198	.000
5	(Constant)	1.493	2.343		.637	.525
	physical equipment's	.075	.099	.050	.761	.448
	Reliability	.316	.118	.189	2.687	.008
	Responsiveness	.162	.120	.096	1.354	.178
	Assurance	.355	.143	.201	2.486	.014
	Empathy	.591	.120	.402	4.928	.000

a. Dependent Variable: customer satisfaction

Thus, Regression equation for this study is customer satisfaction=20.548+-.016(physical equipment's) +.405 (reliability) +.249(responsiveness) +.396(assurance) +.402(empathy) .since significance value is 0.00<0.05, we accept our hypothesis that there is a significant relationship between dependent and independent variables, except the significance level for physical equipment's is greater than 0.05, so for physical equipment's we reject our hypotheses. From above table it is clear that each and every independent variable is significantly connected to customer satisfaction except physical equipment's which is negatively mean no connectivity with the

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customer satisfaction. Among all variables, reliability and empathy is the major variable with standardized coefficient b=.405 & .402 that can satisfy the customer toward their particular service provider. While assurance is the third momentous variable with a standardize coefficient of b=.396 Furthermore the fourth variable responsiveness with a standardize coefficient2.49, while the variable physical equipment's has negative mean no influence on customer satisfaction.

Table no 6: Correlation:

Correlations

		physical equipment's	Reliability	Responsiveness	Assurance	Empathy	Customer satisfaction
physical equipment's	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	140					
Reliability	Pearson Correlation	1.000**	1				
	Sig. (2-tailed)	.000					
	N	140	140				
Responsiveness	Pearson Correlation	.255**	.255**	1			
	Sig. (2-tailed)	.002	.002				
	N	140	140	140			
Assurance	Pearson Correlation	.257**	.257**	.363**	1		
	Sig. (2-tailed)	.002	.002	.000			
	N	140	140	140	140		
Empathy	Pearson Correlation	.318**	.318**	.357**	.499**	1	
	Sig. (2-tailed)	.000	.000	.000	.000		
	N	140	140	140	140	140	
Customer satisfaction	Pearson Correlation	.318**	.318**	.345**	.396**	.571**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	140	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

The above table show the strength of association between the physical equipment's and the Reliability with value of 1.000 (p=0.000) which means that there is 100% association between these two variables which shows that there is strong positive correlation between these two variables. The level of significant is at 0.01 which means confident interval is 99%. The correlation value of physical equipment's and Reliability with Responsiveness are .255 (p=0.002) and .255 (p=0.002). Both show that there is weak positive correlation among these three variables. The level of significant for both are at 0.01 which means confident interval is 99%. The correlation values of physical equipment's, Reliability, Responsiveness and with Assurance are .257 (p=0.002), .257 (p=0.002) and .363 (p= 0.000). It shows that the strength of association between these variables is week positive.
 The above table shows the correlation values of physical equipment's, Reliability, Responsiveness and Assurance with Empathy are .318 (p=0.000), .318 (p=0.000), .357 (p= 0.000) and .499 (p=0.000). It shows that there is week correlation between physical equipment's, Reliability, Responsiveness; there is moderate correlation between the Empathy & Assurance. The level of significant for all are at 0.01 which means confident interval is 99%.

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The above table shows the correlation values of physical equipment's, Reliability, Responsiveness, Assurance and Empathy with Customer satisfaction are .318 (p=0.000), .318 (p=0.000), .345 (p= 0.000) .396 (p=0.000) and .571(p=0.000) It shows that there is week correlation between physical equipment's, Reliability, Responsiveness, Assurance and Empathy. There is moderate correlation between the Empathy & Customer satisfaction. The level of significant for all are at 0.01 which means confident interval is 99%.

Summary of the results

The reliability table show the data collected from respondents. The data collected from mentioned above sample is reliable and respondents answered to best of their knowledge. As variables are exceeding from 70% which is the standard of acceptance for reliability.The demographic shows that there are 108 male respondents with the total percentage of 77.1 % and there are 32Female respondents there percentage are 22.9% .the collection of total respondents were 140 There are 41 respondents from the Mobilink with the percentage of 29.3%, while 29 respondents from the Zong having the percentage of 20.7%. The respondents of the Warid, Telenor, and Ufone are 19, 26, and 25 with the percentage of 13.6%, 18.6% and 17.9 In regression model the value of R=.671 which shows that there is 67.1% association between physical equipment's, Reliability and responsiveness, assurance and empathy with customer satisfaction. R square=. 450 which shows that .450 % change in customer satisfaction is because of physical equipment's, reliability, responsiveness, assurance and empathy.F change shows that the statistical significance of the model. The value of F-change =24.288 with significance level=.000 representing that the model is statistically significance.

Analysis through ANOVA elucidated that overall model analysis were significant. With reference to analysis significance value was less than 0.05 so it specifies the model to be statistically significant except the model 1 in which the value of p is greater than 0.05. analysis confirm the assumption that all the independent variables, that is, reliability, responsiveness, assurance, empathy except physical equipment's are connected to the dependent variable, that is, customer satisfaction.From Coefficients results it was inferred that all independent variables are significantly connected to customer satisfaction except the physical equipment's which has shown no relationship with the customer satisfaction.The correlation computation for the all the independent variables shows that there is positive significant relationship between service quality dimensions and customer satisfaction, except physical equipment's.

Discussion

The study was intended tomeasure any possible impact of service quality practice on customer satisfaction in telecommunication industry Peshawar (Pakistan). The study supported the hypothesis of possible positive significant association between quality service provided and customer satisfaction. The observation lead us believe that the customer satisfaction to great extent rests on ensuring that the firm determinedly provides high service quality standards. With the provision of quality procedures has noteworthy effect on the level of customer satisfaction. Amongst Measured Service quality variables that suggestively customer satisfaction include, physical equipment's, reliability, responsiveness, assurance &empathy except physical equipment's which has no effect on customer satisfaction. For managers, these outcomes haveimperative implications inconnection to brand establishingstrategies. The study inferred that service quality is the foremostsource to customer satisfaction. It was also concluded that recommendations of a successful brand establishment strategies are found when companies provide their customers with quality services in comparison to the other companies while being in the same industry.

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Conclusion & Recommendations

Conclusion

This research analyzes the possible relationship between degree of customer satisfaction & service quality provided by considering its major dimensions e.g. "physical equipment's", "assurance", "reliability" "responsiveness", "empathy". Current research finding has suggested thatthere is positive and significant relationship ofservice quality and Customer Satisfaction in the telecommunicationindustry in Peshawar (Pakistan) services has been dramaticallyinfluenced by Empathy Reliability, Responsiveness, and Assurance, on other hand the effect physical equipment's were almost nothing to do with positive significant impact on customer satisfaction. From the relationship it can be also concluded that customers" perception is maximum in the reliability and on empathy and lowest in the Responsiveness & Assurance.

From research results a significant positive relationship between the empathy and satisfaction was observed, which recommends that the customers prefer a face-to-face service in telecommunication industry of Peshawar (Pakistan).Reliability was observed to have positive significant relationship with Customer Satisfaction, Reliability is taken as the accuracy and timeliness in the services that has been provided. Assurance was observe to have positive and significant relationship with Customer Satisfaction; Assurance is considered as an approach of being secured, respondents opinionsspecified that the customers assurance is importantmeasure of the service quality that should be included, quick responsiveness with intention of providing ease and satisfaction also have a positivelyinfluenced customer satisfaction in telecommunication industry of Peshawar (Pakistan). This study showed that the customers of telecommunication industry choose to deal with the human being rather to interact with automated machines. It can be concluded thatautomated machinery has no role in encouragement of customer satisfaction in telecommunication industry of Peshawar (Pakistan)

Recommendations

The present study intended to evaluate customer satisfaction, which is considered to be pivotal variable in industry. Current study assessed the role of customer satisfaction in telecommunication industry Peshawar Khyber Pakhtunkhwa Pakistan.

1. Our study assumed that, customer can be satisfied by founding good relationship with customers over efficient and provision of good service quality according to the perception of customers would lead toward brand loyalty.

2. Research findings has practical implication for service firms and apart from that, it is also beneficial for businesses that emphasis on relational marketing. It is recommended managers of such industries should have a firm belief in "providing best customer services and delivering superior service quality" for success and business development or in achieving customer satisfaction.

3. It is suggested for the telecommunication sectors to emphasize more on the service quality and its key dimensions that are physical equipment's, reliability, responsiveness, assurance, empathy, the more emphasize that the telecom sectors must give toward is reliability, and empathy because the reliability and empathy having big influence on the customer satisfaction.

4.The quality of delivery services needs to be enhanced by the application of the up-to-date technology, the behavior, attitude and other dealings of the customer care service providers should be improved and welcoming, providing customers to easily communicate about their difficulties, so that their issue can be addressed effectively, strategies should be consider to reduce the time period of the waiting call by the respondents as it may lead the respondents to boredom, irritated and disappointed, this would not be translated in good for any company, and it will certainlyeffect in not making the customers loyal toward the companies.

Future scope of research:

As this study is conducted in only Peshawar area, its scope can be broaden to include other cities of the country in the studies. This study is first effort in Pakistan.Future research should incorporate other variables such asservice quality etc. That influence satisfaction of customers in telecom industry.The future research scope should also be broadening to other Asian countries.Present study was limited by budget and time constrains, consequently was only Peshawar based with limited

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sample size 140 respondents. For future studies, it is recommended that researchers should expand the scope of the survey and use larger sample size. (samuel)

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Dynamics of Profitability of Banks in Developing Economy (A Case of Panel Data Analysis)

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Abstract

This study analyzes empirically the focal indicators in the wake of the high return of banks for the period 2008-2013 as compared to last decades using balanced panel data set for 34 banks with 272 observations.

For analysis of panel data the best estimator that was developed by Arellano and Bover (1995) and Blundell and Bond (1998) also named as GMM technique so or better estimation GMM technique was used on the panel data through STATA software. Assets structure, leverage of banks, revenue diversification following exogenous variables does not confirm as explanatory factors. Capitalization in banks holds positive association with returns against assets while other bank specific variables liquidity, financial structure and size are to be found significant. Macro-economic variables inflation and rate of interest are to be found negative and significant determinant while GDP has no effect on profitability of banks.

Key words: Bank profitability; Assets Structure, Financial structure, Capitalization and Liquidity
JEL Classification: G21, L11.

1. Introduction.

Over the past twenty years the Pakistani banking industry has undergone incredible changes. The new developments including technological advances, deregulation and concentrated competition, formulated the makeup and presentation of banking organization in Pakistan. The main purpose of this study is to recognize the decisive factors that affected the performance of the banks in Pakistan over the period 2006-2013. Numerous researchers identify the interrnal and external factors which determine the profitability of banks, include Bourke (1989); Molyneux and Thornton (1992); Abreu and Mendes (2002); Mamatzakis and Remoundos (2003); Girardone et al. (2004); Goddard et al. (2004b); Kosmidou et al. (2005); Athanasoglou et al.(2006); Athanasoglou et al. (2008);Dietrich and Wanzenried (2009). The present situation of economic crisis has increased the importance of

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the functioning of the banking system for economic growth of the country. Pakistan represents fascinating opportunity to study bank profitability for more than a few reasons. First, Pakistan banking system is one the important system of Asian market banking system. It is also moving toward the high growth achievements. It is also having a major share of the country business growth especially from the last decade of its business. Secondly, Pakistani banking sector provides good banking system in country and having largest network of branches. Finally, and most amazingly, Pakistani banks have been considerably more profitable than other businesses return in the country. Most of the factors used by previous researchers that affect the profitability of banks are asset structure, asset quality, capitalization, leverage, financial structure, liquidity, and revenue diversification. The major economic factors which are used by the previous researchers are GDP, inflation and interest rate. The literature which is discussed with respect to the determinants of bank profitability in advanced countries like Europe and United States depicted that it is appropriate to re-investigate the determinants of profitability in developing countries. In this context, we apply the generalized method of moments (GMM) estimator, this is also known system-GMM estimator, and this technique is developed for dynamic panel models by Arellano and Bover (1995) and Blundell and Bond (1998). The structure of this paper is as follows. Section second reviews the literature. Section third explains the data and methodology and defines the variables used in study. Section four describes the results of study. Section five finally summarizes and concludes the findings.

2. Literature Review

2.1 Asset Structure

When banks liberalized interest rate on loans and banks applies markup pricing Garcia-Herrero et al., (2009).Higher proportion of loans in asset portfolios of banks is directly concerned with high liquidity risk that may result inability of banks in paying liabilities or to increase funds on asset side of balance sheet. Recent studies showed that there is direct relationship between bank profitability and proportion of loans in portfolio of assets but liquidity and profitability are inversely related. They renounced studies that explain the said results are Barros et al. (2007), Chio-razzo et al. (2008),DeYoung & Rice (2004), Goddard et al. (2004), Iannotta et al. (2007). These results compel us to test the hypothesis:

Hypothesis 1: There is direct and significant association between asset structure and profitability of banks

2.2 Capitalization

Commonly equity is highly risky so it requires high return. It is most expensive comparative to all other liabilities of business. Garcı´a-Herrero et al., (2009), Hakenes and Schnabel,(2011). So in banks it is presumed that when equity increased in liabilities of banks its cost will also be increased so banks pay more attention to arrange funds. The capital ratio when increases than profits of banks will also be increases as interest on loans decreases Berger (1995b), capital ratio is also a cushion for banks to finance its assets at more favorable rate of interest that increased the profitability of bank Athanasoglou et al. (2008). Increase in capital ratio have signaling effect as when the banks wants to increase its capital than it is signal that future prospect of banks is positive and profitability of banks also boost up due to their signaling effect Berger (1995b).The studies helping the relationship of capitalization and profitability of banks are Alexiou and Sofoklis (2009), Athanasoglou et al. (2008), Berger (1995b), Bourke (1989), Garcı´a-Herrero et al. (2009), Iannotta et al. (2007) and Molyneux and Thornton (1992). So to explain the relationship of capitalization and profitability the following hypothesis is developed.

Hypothesis 2: There is a direct and significant relationship between profitability of banks and capitalization.

2.3 Financial structure.

Due to favorable financial conditions the customer deposits are treated as good in financial structure. Moreover, cost of deposits is relatively low comparative to other liabilities of banks

Claeys and Vander Vennet,(2008), Garcı´a-Herrero et al., (2009). To show the relationship of Financial structure and profitability following hypothesis is made.

Hypothesis 3a: There is direct and significant association between financial structure and profitability of banks

The other school of thought explained that in competitive market deposit attraction becomes a difficult procedure. So banks have to pay more interest on deposits to attract depositors. This war of deposits between banks consequences in form of crises in 2007. So there is a second hypothesis to show the relationship of deposits proportion in total liabilities and banks profitability.

Hypothesis 3b: There is negative relationship between financial structure and profitability of banks.

2.4 Liquidity.

Liquidity risk is the risk that bank will not be able to pay its obligations on time Jenknson (2008). The liquidity in case of banks is also problematic because depositors may call their funds at any time when they want so banks have to fire out its assets at less prices for arrangement of funds to fulfill depositor's requirements Diamond and Rajan (2001). The relationship of liquidity and profitability of banks are negatively associated Chaplin et al. (2000). Liquidity risk has much importance for banking sector to pay depositor obligations Comptroller of the Currency (2001).The hypothesis made to show the relationship of liquidity and profitability is as follows:

Hypothesis 4: There is inverse and significant relationship between liquidity and profitability of banks.

2.5 Leverage

Leverage is used by a number of researchers to show the effect on profitability. The leverage shows negative relationship with profitability in US and Japan markets W. C. Kester (1986). The relationship of leverage and profitability is significant and positive M. Long and I. Maltiz (1985). A number of other researchers explained the relationship of leverage and profitability as when the funds other than equity increases that bearing comparatively low cost due to benefit of tax shield that increases profitability. The debt to asset ratio is significantly and positively associated with profitability of banks W. K. John(1999). From the above researches the following hypothesis is made to show the relationship of leverage and profitability:

Hypothesis 5a: There is direct and significant relationship between the leverage and profitability of banks.

On the other hand some researchers also found negative relationship of leverage. The relationship of leverage and profitability is significant and negative favoring the concept of pecking order theory that firms firstly prefer to use capital than firms arrange the external financing A. Shah and S. Khan (2007). The profitable organizations less depends upon the external financing C. M. Stewart and N. S. Majluf (1984). The relationship of debt to equity ratio and profitability of business is significant and positive A. Shah and S. T. Hijazi (2004). The hypothesis made to show this relationship is as under.

Hypothesis 5b: There is negative and significant association of leverage and profitability of banks.

2.6 Revenue diversification

Initially banks try to increase diversification by adopting the other sources like fee based business and then they expand business by trading, insurance contracts etc. Elsas et al (2010). The revenue diversification affects positively on profitability of banks through relying on interest based business Chiorazzo, V., C. Milani, and F. Salvini, (2008). The relationship of revenue diversification with profitability is explained as:

Hypothesis 6a: There is direct and significant association between profitability of the banks and revenue diversification. On the other hand some researchers explained that revenue diversification is negatively associated with profitability. It is not compulsory for Revenue diversification to improve profits of banks it may become case for decrease in profits of banks Stiroh, K. J., and A. Rumble (2006). The relationship explained as:

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Hypothesis 6b: There is inverse and significant relationship between revenue diversification and profitability of banks.

2.7 Size.

The relationship is like U-shaped curve. First the profitability increases with increase in size than it tends to decrease due to management problems in the business Athanasoglou et al. (2008). The larger size of banks results in larger profits to banks due to economies of scale effect. The performance of large size banks are poor, means size is negatively affected the profitability Barros et al. (2007). Another research explains the concept of too-big-to-fail also explains the negative relationship of size with bank profitability Iannotta et al. (2007). So there are two schools of thoughts to explain the relationship of size and bank profitability. Hypotheses are as under:
Hypothesis 7a: There is positive and significant relationship between size and profitability of the banks.
Hypothesis 7b: There is negative but significant association between size and its profitability of the banks.

2.8 GDP

GDP is treated as external factor that may affects profitability of the bank. The gross domestic product (GDP) shows increase in economic activity as well as increase in profitability of business Bikker and Hu (2002). GDP and inflation has no significant effect on the profitability of the banks especially in Islamic banking but GDP growth rate is positively and significantly affects the profitability of business Hassan and Bashir (2002).A number of other researchers use GDP as external factor in determination of profitability of the banks Rhoades (1985), Bourke (1989) and Demirguc-Kunt and Huizinga (2000). The following relationship is explained in the hypothesis:
Hypothesis 8: There is positive but significant association of GDP and profitability of the banks.

2.9 Inflation

The effect of inflation on profitability of banks depends upon how much the inflation affected salaries and others operational costs Revell (1979). The effect of inflation on profitability depends on the factor that how much the management of banks anticipates the inflation and counter it. The management should anticipate the rate of inflation to increase the revenue faster than the cost will enhance profit positively. Perry (1992).The effect of inflation on the profitability is significant and positive Alexiou and Sofoklis, (2009). This hypothesis based on said researches is developed as under:
Hypothesis 9: There is direct and significant association between inflation in the economy and the profitability of banks.

2.10 Interest rate

Some researchers explained that in the time of low interest rate the banks compel to reset loan and deposit rates. This affects the gap between deposit and loan rate that negatively affected the profitability of the banks. The studies that support the hypothesis of positive relationship are. Bourke (1989), Claeys and Vander Vennet (2008), Demirgu and Huizinga (1999), Garcı´a-Herrero et al. (2009) and (Molyneux and Thornton 1992). The first hypothesis is made as under:
Hypothesis 10a: There is a positive and significant association between interest rate and profitability of the banks.
When the interest rate declines the banks are more conscious to avoid interest rate risk that results more profits. Avkiran (2009). The hypothesis made on this school of thought is as under:
Hypothesis10b: There is inverse but significant relationship between rate of interest and profitability of banks.

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3. Methodological Aspects

3.1. Sample

Panel data is used to find out the impact of different determinants on profitability of banks. For this purpose 8 years data were collected from 2006 to 2013. A sample of 34 banks was observed to find relationship of different determinants and profitability on banks in Pakistan. For analysis of panel data the best estimator that was developed by Arellano and Bover (1995) and Blundell and Bond (1998) also named as GMM technique, so for better estimation GMM technique used on the panel data through STATA software. Data was collected from balance sheet analysis and annual reports of banks.

3.2. Model Equation:

$ROA=α$ $+β1Assetstructure+β2Capitalization+β3Financial$ $structure+β4Liquidity+$ $β5Leverage + β6Revenue diversification+β7Size+β8GDP+β9Inflation+β10Interest$ $rate+ €$

4. Results and Discussion

TABLE # 1: Descriptive Statistics

Variables	Observations	Mean	Std. dev.	Min	Max
Profitability	272	.1820	1.5177	-.5422	24.732
Asset structure	272	.5163	.2208	.0134	1.6470
Capitalization	272	-2.5288	44.8711	-516.25	200.48
Financial structure	272	.7433	.2427	0	.9727
Liquidity	272	.4725	.2649	.0102	3.9622
Leverage	272	.9031	.9463	0	8.13
Revenue diversification	272	.2277	.4010	-6.1182	.4999
Size	272	18.1643	1.5739	14.7109	21.2628
GDP	272	3.4767	1.4859	1.6066	6.1775
Inflation	272	13.0135	5.6813	5.9685	20.6665
Interest rate	272	.2450	4.8150	-6.7740	7.1253

TABLE # 2 : Correlation Matrix

	Profit	Asset structure	Liq	F.Strc	Capt	Lvrg	Revenue diversification	GDP	Inflation	Interest rate
Profitability	1									
Asset structure	-0.02543	1								
Liquidity	0.1694	0.506	1							

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Financial structure	-0.2009	-0.2	-0.072	1					
Capitalization	0.0922	-0.1673	-0.032	-0.0894	1				
Leverage	-0.3252	0.3309	-0.046	0.2298	-0.6288	1			
Revenue diversification	0.4437	-0.0066	0.1678	-0.2013	0.0006	-0.138	1		
GDP	0.1327	-0.0531	-0.056	-0.0405	0.0226	-0.062	0.0.1870	1	
Inflation	-0.0257	0.1004	0.1399	-0.0671	0.0296	-0.054	-0.1112	-0.238	1
Interest rate	0.0011	-0.1555	-0.223	0.1086	-0.0565	0.109	0.0365	0	-0.905	1

TABLE # 3 : Method: Arellano-Bond dynamic panel-data estimation

Variables	Coefficient	Std. Error	t-Statistic	Prob.
Profitability-Lag-1	6.3318	.8766	7.22	0.000
Asset structure	1.3267	1.6425	0.81	0.419
Capitalization	.0100	.0019	5.16	0.000
Financial structure	-7.1861	1.4004	-5.13	0.000
Liquidity	-6.8296	1.2889	-5.30	0.000
Leverage	-.4409	.5523	-0.80	0.425
Rev. diversification	.1267	.2067	0.61	0.540
Size	-.5846	.2179	-2.68	0.007
GDP	-.0663	.0803	-0.83	0.409
Inflation	-.2649	.1033	-2.56	0.010
Interest rate	-.3387	.1305	-2.59	0.009
Constant	22.3742	4.2108	5.31	0.000

4.1. Diagnostic Tests

Wald test   201.68   Hausman test   56.20

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5. Conclusion:

This study analyzes empirically the focal indicators in the wake of the high return of banks for the period 2008-2013 as compared to last decades using balanced panel data set for 34 banks with 272 observations.

Pakistani banks characteristically fit into place in different retail-oriented activity and all-embracing set of connections and caring relationship with customers. As a result, deposits and loans from the customer compose a large part of Pakistani banks financial and economic structure and funding has little weight with respect to United States and European countries. This paper concludes that this attribute enhances return of banks in terms of assets. The findings depicted that asset structure, GDP, leverage of banks and revenue diversification are insignificant determinants of profitability. This paper does not hold results that loans against assets are related to profitability same as leverage and revenue diversification do not appear to be explanatory variables in profitability of Pakistani banking industry for said period. The management must consider asset structure and leverage because both are bank specific factors and required proper management for better results. Financial structure, Liquidity, size, inflation and rate of interest are negatively affecting profitability. The macro specific variables considered in study inflation and rate of interest have inverse and significant influence on returns against assets while GDP is to be found insignificant factor in present study. Capitalizations of banks are to be found positive indicator. Due to time constraints limited bank-specific and macroeconomic-specific variables were investigated for eight years period. The researchers can include more variables both bank specific and macroeconomic specific factors in addition of data period can confirm and contribute for better decision making.

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Determining the Impact of Personality Traits and Organizational Culture on Organizational Conflict: A Case Study of Telecom Companies in Peshawar City

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Abstract

The study has been conducted to find out the impact of personality traits and organizational culture on organizational conflict. The employees working in the telecommunication sector were treated as the population of the study. The employees were selected randomly. 220 questionnaires were distributed among employees. 207 filled questionnaires were returned back from these employees. The response rate was 94 percent. Simple Random sampling technique was used for the study. Regression and correlation tests were used to testify the hypotheses of the study. As per the results of regression analysis, organizational culture was found to have significant effect on organizational conflict while personality traits were found to have insignificant effect on organizational conflict.

Keywords: Personality traits, organizational culture, organizational conflict

1. Introduction

In today's era of global competition and so much advancement in technology, the survival of organization has become a vital factor. Since employees are the real asset for any organization and the major source for sustainable competitive advantage. The employees need to be focusing on the job fully. If due to any reason the employee feels disturbed, then the bad consequences could be faced by the organization. These bad consequences could be because of conflicts. In the firms, March and Simon (1958), stated conflict as a collapse in the process of decision making, so that a person or team observe complexity in the selection of alternate. The 21st century gives a wide experience by different source like internet and other approachable sources; now a large number of persons are now having the source to interrelate with others across the multi cultures (Templer et al., 2006). Due to these frequent communications, this culture dissimilarity is one of the main causes for the creation of conflict (Kaushal & Kwantes, 2006).

1.1. Research Problem

Chen and Sheng (2010) found the relationship among different factor of conflicts but studying them together has not been focused up to the best of my knowledge (Holt & DeVore, 2005). Researchers

in the past have specifically focused on the developed countries (Ghorbani & Razavi, 2011), but there is limited or very scarce research on developing countries

1.2. Research Questions
- What is the impact of personality traits on organizational conflict in telecom sector?
- Do differences in organizational cultural promote conflicts in organizations?

1.3. Objectives of the Study
- To investigate the factors leading to conflict in an organization.
- To explore the strength of association between personality traits and organizational conflict.
- To determine the conflicts created by organizational culture in organization.

2. Literature Review
2.1. Organizational Conflict
According to Chen, Mei-Liang and Juin-Ming (2010) Conflict is Latin word which means different forces have a collision, which is disagreement and abrasion between group members (Forsyth, 1990). Webster Dictionary explains conflict as disagreement, war, unfriendliness, or opposition among irreconcilable forces (Chin-Lien Wu, 2003). According to Encyclopedia of Management, conflict is defined as a process that one individual or group realize that concentration or interest is opposite by the other group or individual (Chau-Chiuan Yu, 2005).There are certain definition of conflict which is given by the scholars.

1996	Robbins	Conflict is a state in which a person having all incentives of job stops others or set hurdles on the way of those who desires to get what he is having already.
2003	Translated by Yin-San Huang	The difference between two or more organization, groups or individual.
2008	Huei-Ru Jan	Conflict, in adding up a circumstance, is an action, a situation of perception, and a course of communication. In simple, when both sides are in discrepancies, disagreement and different, conflict occurs
2013	Muhammad Ramzan, Maria Khan	Conflict is also said to be a social problem in which two or more individuals, parties, families, communities, or districts state arguments with each other

Conflict theory is the most important theory for any manager. Primarily it is rooted in the field of psychology, business and sociology, but not in education and communication. It is difficult to define conflict as it is complicated to an agreement about the definition of this term (Borisoff & Victor, 1998). The simple way to identify the term "conflict" is to divide theories of conflict in situational functional and interactive. The followers of situational approach believe that a conflict as an expression or term under certain situation and those who view as functional think that a conflict serves a social function. The third theory views conflict as interactive.

2.2. Personality Traits:
Many independent groups of researchers found and defined the five broad areas based on experimental, data-driven research. ***Agreeableness:*** Persons high in agreeableness are described as

selfless, innocent, helpful, obedient, and ''motivated by others 'needs'' (Costa & McCrae, 1992).
Conscientiousness: There is no known research investigate the relationship between conflict and conscientiousness. This is not completely incredible that conscientiousness is order, accomplishment orientation and dutifulness, characteristics that are unlikely to be linked conflict. Fuller and Hall (1996) studied that difference in living behavior were a source of inter personal experience such as conflict. Since both incompetence and laziness (low conscientiousness) and extreme neatness (high conscientiousness) may be the cause of conflict with a partner.
Extraversion: Extraverts are usually encouraging, societal, energetic, fantastic, and concerned with other people (Costa & McCrae, 1992; Watson & Clark, 1997). In addition to these trait, several conceptualizations of extraversion also include adjectives such as prevailing, self-confident, dominant, and forceful (Costa & McCrae, 1992; Trapnell & Wiggins, 1990).
Neuroticism: Neuroticism is described as the tendency to understanding emotions such as unhappiness, anger, guiltiness and fear. The most often study of the five-factor traits; neuroticism has also been study in association to conflict. It is related to both frequency of conflict and affects intensity related with that conflict (Bolger & Zuckerman, 1995; McFatter, 1998; Suls et al., 1998).
Openness to experience: Those people high on openness to experience are described as imaginative, interested, introspective, and conscientious to internal feelings (Costa & McCrae, 1992; Hofstee, deRaad & Goldberg, 1992). Openness is the least studied of the five-factor traits.
According to Antonioni, (1998) several personalities traits with conflict in comfortable manner and others avoid it. People with a passive hostile personality tend to actively avoid conflict and feel uncomfortable confronting others in a conflictual situation. Individual feel angry or irritated but are not relaxed express that emotion. Emotions which are concealed for too long may erupt when control weakens and typically there is an explosion in a moment of heat, stress and pressure. John, Barbuto, Phipps and Xu (2010) point out that an integrate conflict management style completely mediates the relationship between neuroticism and leadership effectiveness and to some extent mediates the relationship between conscientiousness and leadership effectiveness.
Personality and conflicts are related to each other in many ways. As per the results of McAdams (1995) the employee differences in personality are at three stages: What a person has (level 1), what he does (contextually effected plans, objectives and anxiety (level II), how the individual measure his experience (life meanings-level III). As per the relationship between conflict and personality, we may be having different traits (level I) which will be related to conflicts, certain objectives and behavior of conflicts (level II). They stated that attributes of agreeableness is linked with the objectives which maintain social association, which ultimately affect the behavior of conflict, and the meanings of issues and partners.

2.3. Organizational Culture:

Hofstede's (1980; 2001), influential work on cultural values and directions, individuality and grouping is now the most important direction along with culture categories (Bond & Smith, 1996; Kagitcibasi& Berry, 1989; Triandis, 1990). Individuality is described by self-dependence, freedom, away from group, and dominance of personal objectives over team objectives.Some researchers believe culture as the basic component detained by employees of organization (Sathe, 1983; Schein, 1984; Lewis, 1992), some researchers give preference to the concept as culture is the combination of supposition, approaches, viewpoints, values and attitude. According to Lewis (1996) consider that this preference may be due the culture's model's basing on Organization Development Model, which state this view of culture, or the effective results of the books of Peters and Waterman (1982); Deal and Kennedy (1982), who put forward the combination theory. According to Ghorbani and Razavi (2011), there was a significant relationship between organizational culture and conflict.

2.4 Hypotheses:

In the light of literature review the following hypotheses have been developed.
H$_1$: There is a significant effect of personality traits on organizational conflict.
H$_2$: There is a significant effect of organizational cultural on organizational conflict.

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2.5 Theoretical Framework

On the left side of the framework given are the independent variables i.e. personality traits and organizational culture. Personality traits were measured with the help of 4 facets while organizational culture was measured with the help of 5 facets. On the right side there is dependent variable which was measured with the help of 2 facets.


```
┌──────────────────────────────┐
│ Personality Traits           │
│   - Conscientiousness        │
│   - Extraversion             │
│   - Agreeableness            │────────┐
│   - Neuroticism              │        │
│   - Openness to Experience   │        ▼
└──────────────────────────────┘   ┌──────────────────────────────┐
                                    │ Organizational Conflict      │
                                    │   -  Task conflict           │
                                    │   -  Relationship            │
┌──────────────────────────────┐   │      conflict                │
│ Organizational Culture       │   └──────────────────────────────┘
│   - Sharing information      │        ▲
│   - Support attitude         │        │
│   - Encouraging office       │────────┘
│     environment              │
│   - Respect for employee     │
│   - Outcome oriented         │
└──────────────────────────────┘
```
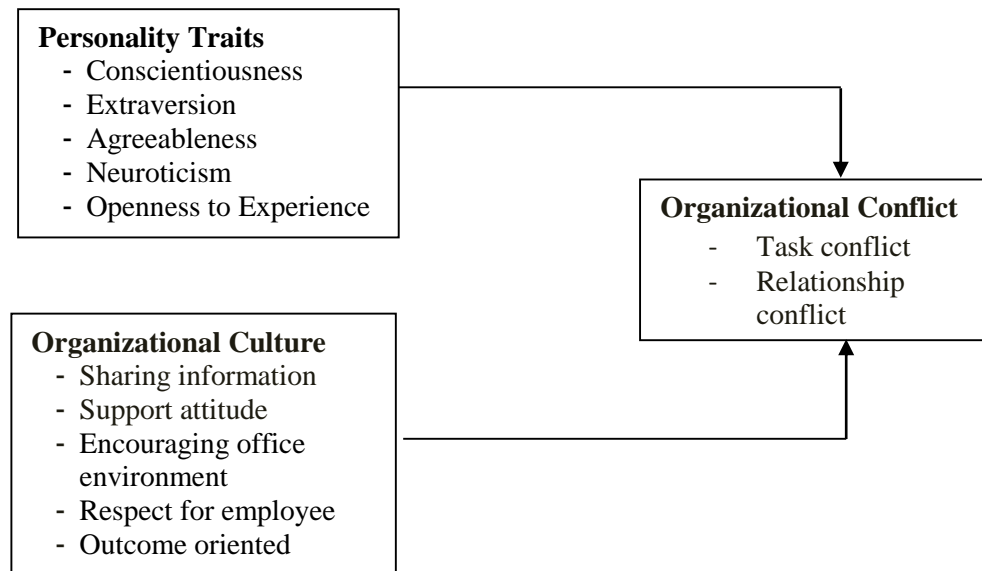
Figure 1: Theoretical Framework

3. Methodology

The data collection was carried out through both primary and secondary resources. Primary data was collected with the help of a self-administered questionnaire and secondary data collection was gathered with the help of previous researcher's articles and journals. All employees of telecom companies were the population of the study employed in Peshawar. Since the researcher belongs to Peshawar so the employees of Peshawar was the specific focus. As it was very difficult to cover the whole population for the data collection and also for the data analysis. So the population of current research work was divided in the sample which has been selected by random sampling technique (Ghorbani & Razavi, 2011). 220 questionnaires were distributed among the respondent using simple random sampling technique. 207 filled questionnaires were returned. The data was collected with the help of questionnaire that consist of two sections sec 1 was independent variable which contains two variables i-e personality traits and organizational culture. Personality traits questionnaire was adopted from Smith (2003) and measured with the help of 4 facets i-e agreeableness which was measured with 3 questions, extraversion which was measured with 3 questions, conscientiousness which was measured with 4 questions and neuroticisms which was measured with 5 questions. While organizational culture questionnaire was adopted from Sashkin and Rosenbach (2013) and measured with the help of 5 facets i-e sharing information which was measured by 6 questions, supportive attitude which was measured by 6 questions, encourging office environment which was measured by 5 questions, respect for employee which was measured by 5 questions and outcome oriented which was measured by 5 questions. Sec 2 was dependent variables i-e organizational conflict. Organizational conflict questionnaire was adopted from Henning (2003) which were measured by 2 sub variables i-e task conflict and relationship conflict. Task conflict is measured with 5 questions while relationship conflict is measured with 7 questions.

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4. Results and Discussion

Table 1: Reliability Analysis

S.No.	Variable	Cronbach's Alpha	Items
1	Agreeableness	0.770	3
2	Extraversion	0.778	3
3	Conscientiousness	0.812	4
4	Neuroticism	0.736	5
5	Sharing information	0.837	6
6	Supportive attitude	0.710	6
7	Encouraging office environment	0.749	5
8	Respect for employee	0.757	5
9	Outcome oriented	0.751	5
10	Task conflict	0.733	5
11	Relationship conflict	0.744	7

The above table 1 shows the reliability. Agreeableness was measured with 3 items the cronbach's alpha value is .770 reflecting that the variable is highly reliable and the questions asked were relevant to the variable. Extraversion was measured with 3 items the cronbach's alpha value is .778 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Conscientiousness was measured with 4 items the cronbach's alpha value is .812 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Neuroticism was measured with 5 items the cronbach's alpha value is .736 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Sharing information was measured with 6 items the cronbach's alpha value is .837 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Supportive attitude was measured with 6 items the cronbach's alpha value is .710 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Encourging office environment was measured with 5 items the cronbach's alpha value is .749 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Respect for employee was measured with 5 items the cronbach's alpha value is .757 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Outcome oriented was measured with 5 items the cronbach's alpha value is .751 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Task conflict was measured with 5 items the cronbach's alpha value is .733 reflecting that the variable is highly reliable and the questions asked are relevant to the variable. Relationship conflict was measured with 7 items the cronbach's alpha value is .744 reflecting that the variable is highly reliable and the questions asked are relevant to the variable.

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Table 2: Correlation:

	Personality Traits	Organizational Culture	Organizational Conflict
Personality Traits	1		
Organizational Culture	.719** .000	1	
Organizational Conflict	.554** .000	.834** .000	1

**. Correlation is significant at the 0.01 level (2-tailed).

The above table of correlation represents the strength of association between two variables. The correlation value of organizational culture with personality traits is .719 (p=.000) means that strength of association between organizational culture and Personality traits is 71.9% the association is highly significant at .01%. The correlation value of organizational conflict with personality traits is .554 (p=.000) means that strength of association between organizational conflict and Personality traits is 55.4%.the association is highly significant at .01%. The correlation value of organizational conflict with organizational culture is .834 (p=.000) means that strength of association between Organizational conflict and organizational culture is 83.4% the association is highly significant at .01%.

Table 3: Model Summary^a

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.837	.700	.697	.20171

a. Predictors: (Constant), organizational culture, personality traits

In this table 3 the organizational culture and personality traits were taken as independent variable and organizational conflict as dependent variable. R shows the strength of association. The value of R is .837, which means that the organizational culture and personality characteristics and organizational conflict are 83.7% percent correlated to each other. R^2 shows variance explained in the dependent variable due to variation in the independent variable. The value of R^2 is .700, which means that organizational culture and personality characteristics cause's 70 percent variation in organizational conflict. The adjusted R-Square value shows that organizational conflict is affected 69.7% by organizational culture and personality characteristics.

Table 4: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19.367	2	9.683	237.987	.000
	Residual	8.301	204	.041		
	Total	27.667	206			

a. Predictors: (Constant), organizational culture, personality traits
b. Dependent Variable: organizational conflict

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The above table shows the results of ANOVA test. The test was used to know the model fitness. For the estimation of the results, the researcher should be sure about the model fitness. If the model is suitable then the results are trustable and if not then the model should be changed. The important value in this regard in the table is F-statistics. The standard in this regard is 4. If the value of F-statistics is higher than 4 then the model is statistically significant and suitable for the estimation of results and if the value of F-statistics is lower than 4 then the model should be changed and it is not suitable for the verification of hypothesis. The F-statistics value in the above table is 237.897. The p-value is .000, which means that the model is suitable and statistically significant.

Table 5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.663	.128		13.017	.000
	Personality traits	-.072	.042	-.094	-1.711	.089
	Organizational culture	.663	.041	.902	16.354	.000

a. Dependent Variable: organizational conflict

The above table shows the results of coefficients that have been used in the regression test as the independent variables. The value of β for personality characteristics is -.072. The negative sign shows the negative movement of independent variable in response to change in the dependent variable. It further shows that 1 unit change in the personality characteristics causes -.072 in the organizational conflict. The t-value of personality characteristics is -1.711, which is slightly lower than the standard value. The t-value should be more than 2 whether in negative or positive direction. This statement can be seen in the p-value which is .089, which is just higher than 0.05, means that it is insignificant. It is concluded that the personality characteristics has insignificant effect on organizational conflict. The result is contradicting with the result of McAdams (1995), so we have no sufficient evidence to accept our alternate hypothesis (H1). The value of β for organizational culture is .663. The positive sign shows the positive movement of independent variable in response to change in the dependent variable. It further shows that 1 unit change in the organizational culture causes .663 in organizational conflict. The t-value of organizational culture is 16.354, which is higher than the standard value. The t-value should be more than 2 whether in negative or positive direction. This statement can be seen in the p-value which is .000, which is lower than 0.05, means that it is significant. It is concluded that the organizational culture has significant effect on organizational conflict. The result is in connection with the study of Ghorbani and Razavi (2011), so we have sufficient evidence to accept our alternate hypothesis (H2).

5. Conclusion

The study was conducted to analyze the effect of personality traits and organizational culture. The study was basically conducted on the telecom sector of Pakistan. The employees working in the telecom companies at Peshawar were the population of the study.

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207 employees from telecom companies comprised of sample size of the study. Simple random technique was used. The data was collected by closed ended, structured questionnaire. 5 likert scale method was used in the questionnaire (strongly disagree, disagree, neutral, agree, and strongly agree). Reliability statistics was used to know the reliability of the variables, to check that whether the variables are reliable for the data collection. Correlation test was used to know the relationship among the dependent and independent variables. Regression test was used to know the cause and effect of the variables. As per the results of reliability test all the variables are reliable. The value of Cronbach's alpha is above 70% for all variables. As per the results of correlation test, organizational conflict has 83 percent positive relationship with organizational culture and this relationship is significant under 5 percent. Organizational conflict has 55 percent positive correlation with personality characteristics and also significant. According to the regression results of personality characteristics and organizational culture on organizational conflict, personality characteristics have insignificant effects on organizational conflict (p-value: .089). While organizational culture has significant effects on organizational conflict (p-value: .000).

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Conflict Management System in Public Education Sector of Peshawar Region

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Abstract

Purpose: This study explores the existence and mechanism of a formal conflict management system (CMS) in an education sector. In particular, it explores the role of higher or top-level management practices of CMS to resolve the conflicts within the organization.

Methodology/approach: The study is based on qualitative research conducted in public sector primary and secondary education of Peshawar region. Semi-structure interviews were conducted with E&S officials across the organization.

Findings: The case study demonstrates the central role of top-level management and existence of any formal system of conflict management system in the education department Peshawar. It highlights the hierarchical procedure to solve the conflict. Study also explored about formal system for groups or unions to solve conflicts, but this authority holds director of education at top-level management. Mechanism is involved on both levels (individuals and groups) for solution of conflicts. CMS, Informal, role of arbitrator and mediator was found.

Keywords: Conflict Management System, Integrated Conflict Management System, Mediation, Arbitration

Introduction

In today's world as business is expanding and new technologies are coming in market. Organizations need a proper management system to cope with the situation within and outside the organization. As the dynamic and diverse nature of business and external factors are forcing organizations to change their existing coursing of action. In doing so, there is a possibility that organization may dwell into conflicts or resistance. To deal with disputes and conflicts within an organization, a proper conflict management system (CMS) is needed and it is understood that conflict is inevitable, (Tjosvold 2008). CMS is the best management approach to avoid disputes between individuals and groups conflicts. Study contains that what are types of conflicts, which affect individual and groups in the organization. Integrated conflict management system (ICMS) is the new and comprehensive approach to deal with the conflicts. it can be helpful to convert organizational culture easily. ((Lipsky, Seeber, and Fincher, 2003; Lynch, 2001, 2003). Conflict is detrimental to the performance of the organization and its employees (Karen, 1997). Mediation and arbitration are both extremely useful techniques to deal with disputes.

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Research Objectives

1. To investigate whether any formal conflict management system exist in Education sector.
2. To find out about the mechanism and process of dealing with conflicts in Education sector.

Research Question

1. Does formal CMS system exist in Education sector?
2. What is the mechanism or process for dealing with conflicts in Education sector?

Literature review

Conflict management system (CMS) is an imperative part of an organization, which plays significant role towards the resolving of any conflict in an organization. It is called an alternative dispute resolution (ADR) process (Schoeny and Warfield, 2000; Singer, 1990; SPIDR, 2000; Ury, 2000). ADR was the philosophy started from America, since civil rights movements. CMS plays an important role in an organization to overcome the disputes among individuals or groups, or interpersonal conflict or intra personal conflict occurs in the organization. CMS also helps in other components like management differences between individuals (employees), collaboration between personnel, find out solution of problems, respond to disputes and helps in change process or in cultural change in organization (Fisher and Ury's , 1981).. In 1988 (Ury, Brett, and Goldberg) proposed a three step conflict resolving model, which comprises of power based process, rights based process and interest based process.

Besides that, in 1996 six principles were written down on CMS (Ury, Brett, and Goldberg, 1988, p. 41). From investigation, it was find out that peers and managers should take part in the motivation of disputants to share their frustration freely with them.

Furthermore, (Costantino and Merchant) concentrated on the cost effectiveness issue, which was the major issue in the conflict management system. They proposed six principles to resolve the conflict and give proper knowledge and skills to the disputants adopt ADR and can express their point of view. From study and literature review, it has been proposed that there are six effective approaches to develop a better and comprehensive conflict management system or design of conflict management. Which worth of the system, easy approach, free will to express point of view, so many choices and development. The best CMS values client some factors like respect, integrity, professionalism and cooperation. (Lynch, 1998).

The great ombudsman Rowe also assessed and gives her views on CMS system and put forward another philosophical approach, which was called integrated conflict management system (ICMS). It was the best approach to change culture of the organization and prevention of disputes between individuals and group. ICMS emphasized on pre-conflict resolving techniques as well as post conflict resolution techniques. (Lynch, 1998).

Organizations usually have four phases to resolve a conflict, first phase generally has no defined process, second phase comprises of right based process and review of arbitration to resolve a conflict, third phase process is concerned interests based process which comes

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in the shape of mediation, fourth phase is developing an integrated conflict management system to resolve a conflict (Retrieve). For severe conflicts and grievance procedures, mediation and simple process of conflict resolution is not that much enough to solve disputes among individuals and groups (Retrieve). Mediation and grievance procedures do not address sources of conflict but only symptoms of conflict. While integrated conflict management system not even addresses the sources, but also it reduces the cost of resolving a conflict (Retrieve).

Integrated conflict management system might be made of five different antecedents, (Lipsky and Avgar), first the broadness of a system that gives easy access to every employee working in the organization, secondly to develop such a culture in which employees and other personnel should feel comfortable and can discuss and raise their issues without any hesitation, third one to create a comprehensive system in which working personnel having so many choices to raise their issue at any stage whether it is right-based or it is interest based. Fourth step comprises of structural based components, which are very strong. From investigation and study it has been found that one third of the organization has adopted ICMS approach to resolve the conflicts and disputes among employees in United States (Lipsky et al.'s (2012). Society of professionals in dispute resolution (SPIDR) argued and assessed that ICMS is better and comprehensive phenomena of Conflict Management System (Gosling et al. 2001)

Mediation and arbitration concepts are very essential in the of process conflict management system. Mediation is concerned with negotiation while arbitration is concerned with the formal third party; it might be a lawyer, a judge (retrieve). Mediation concept is major part of ADR approach (Fisher and Ury's 1981). Another important point was that in organization ombudsperson or mediator can help in the development of an effective system, which might overcome disputes. (Lynch, 1998).

Methodology

The research was conducted on the bases of (Paul L. Latreille and Richard Saundry, 2016) concepts that a comprehensive conflict management system can bring positive cultural change in the workplace. For that purpose, to be more specific Education sector of Peshawar has been taken for sampling and interview method of qualitative research study is used due to nature of the study of research. Therefore, open ended, semi-structured interview questions were prepared in light of research objectives and questions to collect data and check whether there is any formal CMS system exists in the education sector in Peshawar.

Sample Selection

For the collection of data education sector has been selected for interviews in Peshawar. It comprises of eight male and eight female circles in Peshawar and A.D.O represents each circle. For the purpose of data collection, top management cadre has been selected to explore the scope of the study in the education sector of Peshawar. It also consist role of top-level management including District Education officer, Assistant deputy Education officer and Assistant deputy officer. Semi structured questionnaires are prepared to collect data which are concerned with formal conflict management system, cultural change,

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workplace environment, role of mediator & arbitrator and effects on performance. For further exploration, data is analyzed to conclude results and find out about variables.

Data Collection

Semi structured interviews were scheduled with the head of the department District education officer (D.E.O) Peshawar and Assistant deputy education officer (A.D.E.O) Peshawar and Assistant deputy Education officer sports (A.D.E.O). Interviews were conducted to get knowledge and full depth of procedure implemented in the education department Peshawar of CMS. Before going for an interview with head of the department, concerned person, Personal sectary of D.E.O make an appointment and scheduled interview time. Initial meeting was up to 10-15 minutes in the office of D.E.O. After that (A.D.E.O) interviewed, relevant data were collected according to open-ended questionnaire. All the interviewed persons were belonged to top-level management. Two persons were gone to collect data through interview, one was voluntarily to note the data for an author, and interview recorded in the form of audio (voice). The total time of interviewed personnel were 30-35 minutes, all the questions were prepared based on multiple research papers. (Ariel C. Avgar, 2016), (Paul L. Latreille and Richard Saundry, 2016), (Jie yang, 2012)

Data Analysis

Information gathered first collected in the form of audio and written notes, and then it converted into MS-word document for more purpose that is meaningful and converted information into understandable and simple shape. First, the information and knowledge categorized, structured, and coded into topics and sub-topics. Then meaningful shape were given to generated data that the whole CMS system based on Research questions, which helped to collect data. Besides that, furthermore this qualitative technique helps to give readers understanding and comprehend meaning of research and collected information. On basis of themes and sub themes, the collected knowledge has been presented in the shape of conclusion and discussion part of this research or study.

The case study

District education department of Peshawar is the main head of primary and secondary school level in the Peshawar district and it has eight male school circles and 8 female school circles at primary level. It is the governing body, which regulates and holds controls on the primary and secondary level of education and all types of regulations and rules. It has a great role in the promotion of educational activities in the whole district and sustenance of quality education to get departmental goal. It has District education officer who is head of the department and responsible personnel and Assistant district officers in all the circles at primary level, after examination and assessment of education department Peshawar it has appeared that there is no formal "conflict management system" in the education department of Peshawar. But there is an informal process which helps to overcome and reduce over disputes between the employees and groups in order to improve performance and culture of the organization. Process is a bit complicated but a comprehensive procedure to solve

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an issue occurred between individuals. Model might help to understand the whole process of conflict management system.

Hierarchical procedure to solve conflict

"On school (whether primary or secondary) level whenever conflict arises between teachers then first principle should play role of arbitrator to solve an issue, after that ADO circles performed his role to if principle may not solve the issue. If conflict or disputes are severe then Assistant deputy education officer (A.D.E.O), play his role, after that district education officer (D.E.O). If the issue is more severe then director of education and then sectary of education comes forward to play his role. Most of the employees are not satisfied according to A.D.E.O with this procedure but majority of them are satisfied with it. There is also a procedure of complaint against higher authority if they do not listen to individuals or groups, for that purpose government of KPK has established complaint cells for more facilitation. Despite this employees can easily and without fear discuss conflicts with higher authority".

Individual level conflict resolution

Accordingly if there is a complicated issue then individual can contact and meet directly with the head of the department and higher authority.. Mostly interpersonal and intra-personal conflicts arise and solved in the education department, but group conflicts are less as compare to individual or interpersonal conflicts. Individuals can easily and without fear raise their conflicts with top-management. (A.D.E.O)

Role of Arbitrator and mediator

Arbitrator might be from outside the department can come forward and solve the issue. Department has involved role of mediator who works as a third person. In inquiry process arbitrator has great role because in this process third person listen both parties and make decision based on evidences. There is no mediation process involved in education department. Hierarchical procedure is used to solve an issue, which comprises of headmaster or principle, and then ADO circle at primary level, then Assistant Deputy Education officer, then District Education officer, then Director of Education, then in the last sectary Education performs his role to resolve a conflict. All the higher authority might perform role of arbitrator.

When to solve and treat conflict as a conflict

It is certain if there is complex problem occurred among individuals then departmental inquiry is conducted to know about and assess the whole situation until headmaster or headmistress should report to higher authority if not then there will be no further process of solution." There was a case between two teachers, disputes leads one person to police station, when A.D.E.O asked about it, he responded that he didn't know about such type of severe situation because principle of school didn't inform the top-level management."

Integrated conflict management system

There is no process of integrated conflict management system involved in education department Peshawar.

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Group-level conflict resolution

Group conflicts are concerned with the unions only while interpersonal conflicts are related with teachers, non-teaching staff and ADO's circles. Unions issue comprises of up gradation, increase of salary and allowances, and other benefits. For such a purpose education department of Peshawar does not responsible, because according to laws department has no authority. Director of education is responsible and D.E might announce committee or select certain experts to generate data and solution a formal process to solve an issue of groups of such an issue, but through proper channel, cases are sent.

Outcomes from informal and formal procedure.

According to A.D.E.O and D.E.O there is a positive effect on performance and cultural change on education sector. Most of the employees may contact and meet with higher authority without any fear and raise his/her issue.

Satisfaction level of individuals with the system

Individual are not satisfied with the so-called lengthy process of the department to solve an issue, it takes months and years to solve an issue, the procedure is very cheap and dull (A.D.E.O). Change process always brings anti-status co forces to gather and becomes a barrier.

individual level confict resoltuion	Group level conflict resolution	organizational level conflict resolution
• role of mediator is not confirmed but there is role of arbitrator • Mostly conflicts arises • heirarchical procedure involved	• role of mediator is confirmed and there is role of arbitrator • less conflict arises • committe perform role	• role of mediator and arbitrator is confirmed • less conflict arises • informal process invovled to solve conflicts. • Minister of education, sectary education and political involvment to solve an issue.

Conclusion

There is no formal system of conflict management system in the education department Peshawar. All the working force should follow process of conflict management system. Every individual should have to follow the process or he might get directly to the head of the department in case conflict is severe. There is a formal system for groups or unions to solve conflicts, but this authority holds director of education at top-level management, he

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can make a committee for specific problem. Mechanism is involved on both levels (individuals and groups) for solution of conflicts.

Future Recommendations

Study can be extended for further research to explore the data by interviewing teachers and A.D.O circles. Response rate should decide whether there is any acceptance of whole process of conflict management system in the education sector.

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Exchange Rate as a Determinant of Fluctuation in Foreign Exchange Reserves: Evidence from Economy of India

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Abstract

This study explore the relationship and causality link between Foreign exchange reserves and Exchange rate (nominal and real exchange rate) for economy of India using annual data, cointegration analysis. The cointegration result point out that there is a long run relationship exists between Foreign exchange reserves and Exchange rate, The result also point out that the causality direction goes from Nominal effective exchange rate towards foreign exchange reserves while in relationship between foreign exchange reserves and real effective exchange rate the causality link goes from foreign exchange reserves towards real exchange rate. it means that Nominal effective exchange rate effect the Foreign exchange reserves and foreign exchange reserves effect Real exchange rate.

Keywords: Foreign Exchange reserves, Nominal Exchange rate, Real exchange rate, Cointegration.

1. Introduction:

Foreign Reserves is deposit in the form of foreign currencies or foreign financial instrument held by central bank, which allows Government to make their Exchange Rate stable, and reduce the unexpected emergencies and Economic shocks, The demand for huge accumulation of foreign exchange reserves increased after the break down of Bretton wood agreement in (1973) and accelerated in recent years, because most of countries adopt the floating exchange rate system, there are several theories which suggest that a country which have fixed or managed floating exchange rate system should have more reserves accumulation as compare to a country which have freely flexible exchange rate system, because in fixed or manage floating exchange rate system central bank intervene in foreign exchange market for necessary arrangement to make stable the exchange rate (Choi, Gwan et al. 2004)According to (Mendoza 2004) a large amount of foreign exchange reserves is a self insurance motive for unexpected economic shocks, a large amount of foreign

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exchange reserves can help the monitory authority to control the demand and supply of home currency in international market to make exchange rate stable. But some economist argues that holding large amount of foreign exchange reserve is most costly and risky, they explain cost in form of opportunity cost and the Risk in the form of interest rate differential and exchange rate differential risk which arises from imbalances of maturity and fluctuation of exchange rate[2].But those economist who is in the fever of holding a large amount of foreign exchange reserve, they argue that these cost is very small as compare to the cost when the value of a currency of a country decrease and the government pay return on it financial instrument which they issue in foreign currency or when pay for their import (khan & Ahmed (2005)).

There are several recent studies available which has been done on the relationship between foreign exchange reserves and exchange rate, for instance (Prasad and Raju 2010)explore the relationship between foreign exchange reserves and exchange rate and suggest that the relationship between Foreign Exchange reserves and Exchange Rate are inversely proportional to each other when the exchange rate increase or currency depreciate, the Quantum level of Existing foreign exchange reserves decrease because of government intervention in foreign exchange market to restore their home currency value. Similarly (Kasman and Ayhan 2008) explore these relationship in Turkey and found that there is a long-run relationship between foreign exchange reserves and exchange rates, they also study the causality link between Foreign Exchange Reserves and Exchange Rate, they suggest that in case of Real Effective Exchange Rate the causality kink goes from Foreign Exchange Reserves to Real Effective Exchange Rate in both Long and Short run, and in case of Nominal exchange rate they suggest that in the long-run nominal exchange rate effect foreign exchange reserves. (Ahmed and Pentecost 2006)also examined this relationship and suggest that there is long run dynamic relationship between exchange rate and international reserves. (Aizenman and Marion 2003) and (Flood and Marion 2002)studied the demand for foreign exchange reserves, the result showed that instability of nominal effective exchange rate significantly reduce the level of international reserves, they also suggest that greater exchange rate flexibility lower reserves holding.(Prabheesh 2007)) explore the demand for foreign exchange reserves using cointegration analysis, the result showed that foreign reserves demand is a function of exchange rate flexibility in long run, the result also suggest that accumulation of international reserves is highly responsive to capital account as compare to opportunity cost.(Naraya and smyth 2006) explore the short and long run correlation among real, international reserves and interest rate differential and exchange rate, the result suggest that these three variables have single correlation, real exchange rate effect positively on international reserves, interest rate differential also optimistic effect but statistically insignificant, and in short run the relationship between these three variable are non monotonic.The existing studies have mostly on the Exchange Rate Volatility and the Demand for Foreign Exchange Reserves, The relationship between Exchange Rate and Foreign Exchange Reserves, however, has not been investigated for Economies of Pakistan and India up to my knowledge, therefore, the main objectives of this study is to fill the gap by undertaking a study the Relationship and causality link between Foreign Exchange Reserves and Exchange Rate (Real and Nominal exchange rate) evidence from economies of Pakistan and India.

Paper is organized as follows: Chapter 2 discusses Methodology and Variable justification. Chapter 3 discusses the results of data analysis and last Chapter 4 discusses the conclusion.

1.1 Objectives of the Study:

The main objectives of this study are:

- To investigate long run movement/direction of Foreign Exchange Reserves and Exchange Rate (Real and Nominal exchange rate) in India and Pakistan.
- To investigate short run movement/direction of Foreign Exchange Reserves and Exchange Rate (Real and Nominal exchange rate) in India and Pakistan.

- To investigate the causality link between Foreign Exchange Reserves and Exchange Rate (Real and Nominal exchange rate) in India and Pakistan.

1.2 Models:

In this study we use models which are derived by (Kasman and Ayhan 2008)to examine the relationship between Foreign exchange reserves and Exchange rate for economy India.

Model A: FERS   = $\alpha + \beta$ NEER + ε…………………………………………………(1)

Model B: NEER   = $\alpha + \beta$ FERS + ε…………………………………………………(2)

Model C: REER = $\alpha + \beta$ FERS + ε………………………………………………...(3)

Model D: FERS   = $\alpha + \beta$ REER + ε…………………………………………………(4)

  REER =   Real effective exchange rate

 NEER   =   Nominal effective exchange rate

  FERS   =   Foreign exchange reserve

ε = Error term

1.3 Hypothesis:

Based on previous studies which are conduct by different author for different countries economy, I hypothesize that:

> H1: There is no relationship between Foreign exchange reserves and Nominal Effective Exchange Rate.
>
> H2: There is no relationship between Nominal Effective Exchange Rate and Foreign exchange reserves.
>
> H3: There is no relationship between Real Effective Exchange Rate and Foreign exchange reserves.
>
> H4: There is no relationship between Foreign exchange reserves and Real Effective Exchange Rate.

2. Methodology:

This study examine the relationship and causality link among foreign exchange reserves and exchange rate, using cointegration technique, vector auto-regression model (VAR), (VECM) and Granger causality test, the goal of this study is achieved in three steps: In first step we use Unit root test to determine the order of integration of data series, whether the data series are in first order, secondly we use the cointegration test to find whether there is a long run relationship between variables, and in last step we test the causation using Granger causality test.

2.1 Unit Root Test:

In order to examine the integration level and data stationarity, we use the classical unit root test called Augmented Dickey and Fuller (ADF) unit root test, this is because ADF is more reliable for testing the nonstationarity of data series, a stationary variable can be define as, A variable which have constant mean and variance with respect to time called stationary variable,when a variable is nonstationary it requiring first-order differencing to achieve stationery which is called I(1),there are three types of different regression form of ADF unit root test for every time series data.

Without Intercept (c) and Trend (t): $\Delta Y = \delta Y_{t-1} + u_t$……………………………..(5)

With Intercept (c) : $\Delta Y = \alpha + \delta Y_{t-1} + u_t$……………………(6)

With Intercept (c) and Trend (t): $\Delta Y = \alpha + \beta T + \delta Y_{t-1} + u_t$…………………..(7)

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In the above regression equations each equation has its own critical value which depends on sample size, and in each case the null hypothesis:

$$Ho: \delta = 0 \quad \text{(Unit root exist)}$$
$$H1: \delta \neq 0$$

Decision rule for accepting or rejecting the null hypothesis are:

If ADF test statistic > critical value in this case we can not reject the null hypothesis, it means that a unit root exists.

If ADF test statistic < critical value in this case we can reject the null hypothesis, it means that the Unit root does not exists.

After converting the nonstationary data series in to stationary data series the next step is applying cointegration test.

2.2 Cointegration Analysis:

Cointegration analysis a statistical technique use for time series data, it is used for determination of long run relationship between two or more variables, to perform cointegration test among variables it is necessary to identify the integration order for each variable in the model. For identification integration order we use Dickey Fuller (DF) test, Augmented Dickey Fuller (ADF) test and Phillips perron (1988) test to determine the integration order. Once we identify the integration order then our next important step is to perform cointegration test among variables to determine any long run relationship between variables. There are two basic cointegration technique are more used, one is (Engle and Granger 1987) two step cointegration procedure which is used to the cointegration relation among two series, this technique has a problem of receptive selection of independent variables, and the other one is Johansen cointegration technique, which is produced byJohansen and Juselius, this test is used for determination of cointegration based on trace statistics and Max-eigenvalue statistics, in this analysis trace statistics is used to test the null hypothesis which addressed that there are at most "r" cointegration equations against alternative which address that there are "m" equations, similarly Max-eigenvalue statistics is used to test the null hypothesis that "r" cointegration equations beside the alternative that there are "r + 1" equations.

2.3 Granger Causality Test:

Granger causality test is a statistical technique use for causal affect based on forecasting, for example if X does Granger cause Y, it means that the past value of Xshould hold information that can help in forecasting Y, which shows that both variables have relationship. In this study we use Granger causality test to determine the causality relationship between Foreign exchange reserves and Exchange rate. This model we can present in the form of ECM (error correction model):

$$\Delta Y = \alpha_1 + lagged(y, x) + \beta_1 EC_{t-1} + \varepsilon_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(8)$$

$$\Delta X = \alpha_2 + lagged(x, y) + \beta_2 EC_{t-1} + \varepsilon_2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(9)$$

Where x and y indicate Exchange rate (real exchange rate and Nominal exchange rate) and foreign exchange respectively. $\beta_1 EC_{t-1}$includecointegrate terms, reflecting the long-run equilibrium relationship between variables. And the above Models the short-run dynamics is provided by the lagged values of the difference terms.

2.4 Explanation of the Data:

The data is obtained for the period of 27 years started from 1983 to 2009 from source of International Financial Statistics (IFS) and Asian Development Bank (ADB), the variable which

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we used in this study are nominal effective exchange rate, real effective exchange rate, and foreign exchange reserves.

3. Analysis and Discussion of Results

In this chapter we perform unit root analysis for the stationary for Six variables, a stationary variable can be define as, A variable which have constant mean and variance with respect to time called stationary variable, when a variable is nonstationary it requiring first-order differencing to achieve stationery which is called I(1), We have used the Augmented Dickey-Fuller (ADF) unit root analysiss, because the result of ADF unit root analysis is more consistent. ADF unit root analysis can be expressed in three different regression form the first one is, without constant(c) and trend (t), With constant (c), and With constant (c) and Trend (t). The observed approach proposeddiagram assessment for given data, if the diagram present such unique changes (increase and decrease) in variables and not clear step movement, then the time series is best represented by the second situation, therefore we have design time series diagram of all the variables in our model.
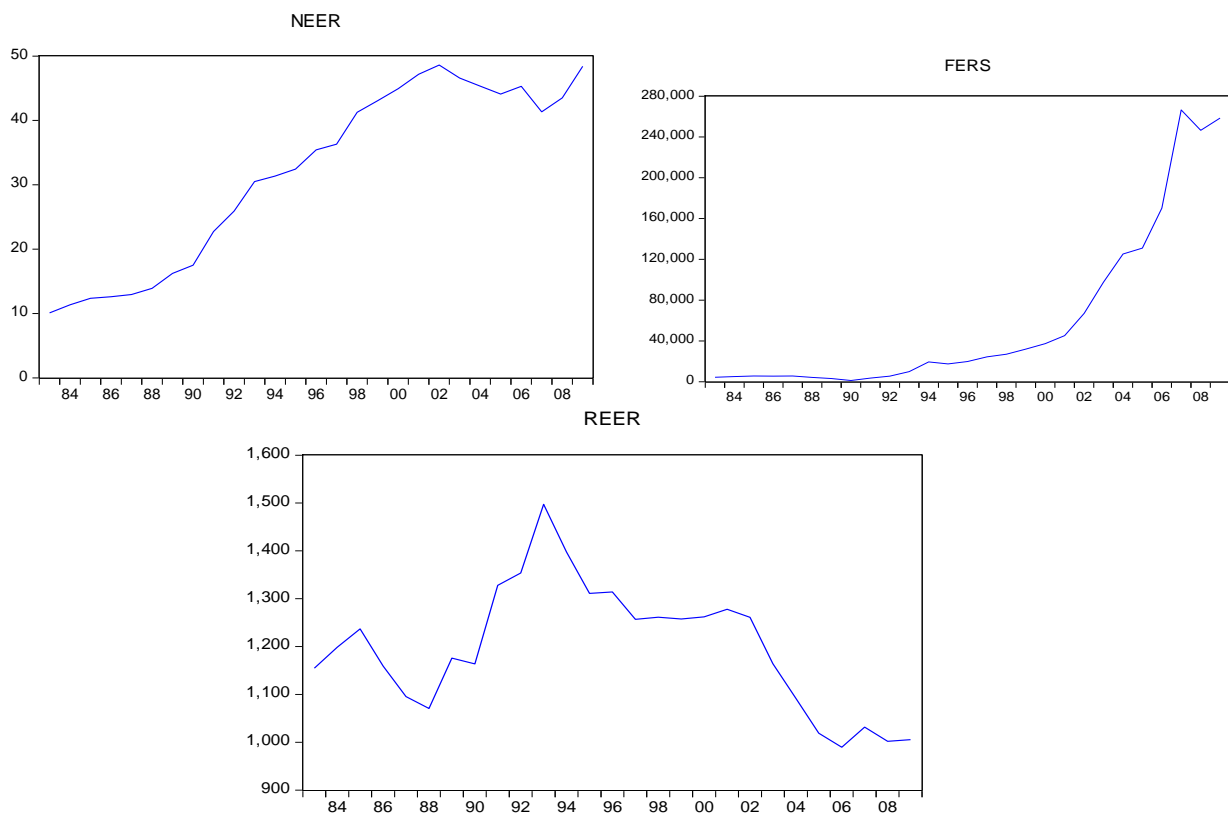
After investigating the diagrams of all the variables in the model we get that FERS, NEER and REER, have Trend in data on level, Therefore, in our study, we use a constant (c) and trend (t) and other with constant (c) and without trend (0) model. As we have taken annually data sets, we will use the lag (n = 1). Therefore, we chose (c, t, n) = (c, 0, 1) for without trend and (c, t, n) = (c, t, 1) for with trend in the Augmented Dickey fuller analysis.

Table no. I Analysis of Augmented Dickey fuller Hypothesis

Variables	Types of analysis (c, t , n)	ADF analysis Statistics	D-W Statistics	Probability
FERS	C 0 0	1.679394	2.148136	0.1060
Δ FERS	C 0 0	-4.265726*	2.012689	0.0003
NEER	C 0 0	-1.103260	1.537109	0.2809
Δ NEER	C t 0	-3.409364*	1.927933	0.0025
REER	C 0 0	-0.921612	1.645711	0.3659
Δ REER	C 0 0	-4.334841*	2.067821	0.0002

1- *represent rejection of null hypothesis at 1% level significance
2- ** represent rejection of null hypothesis at 5% level significance
3- c, t, and n stand for constant, trend, and lag correspondingly.
4- P values represent Probability.
5- Δ represent1 difference

All three variables FERS, NEER, and REER, are stationary on the levels and the first difference at 1% level of significance, the analysis rejected the null hypothesis that there is a unit root in first difference in variables (FERS, NEER, REER) at 1% significance level. The D-W statistics also support the value of all FERS, NEER and REER.

Model –A Johansen Cointegration Analysis:
Statistic for Selection of Lag Order:

Table no. II

Lag	LoglL	R	FPE	AIC	SC	HQ
0	-325.0749	NA	4.95e+09	25.15961	25.25639	25.18748
1	-293.2600	56.28795*	4.63e+08*	22.78923*	22.93440*	22.83103*

The above table shows that two variables (FERS and NEER) are integrated in first order. After that we are applying Cointegration test to explore whether both variables are cointegrating with each other. Before examining the relationship among variables, we first identify the appropriate lag order of VAR model. To achieve this task we apply information creation: Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQ).Table no. 2 present the result of most favorable lag Selection. According to the results of this analysis, 1is the most favorable lag order.

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VAR Cointegration test Statistic
Table no. III

Hypothesis	Eigenvalue	Maximum Eigenvalue	5% significant Value	1% significant Value
r = 0**	0.728796	31.31720	14.07	18.63
r ≤ 1	0.097170	2.453302	3.76	6.65

Hypothesis	Eigenvalue	Trace Statistic	5 Percent significant Value	1 Percent significant Value
r = 0**	0.728796	33.77050	15.41	20.04
r ≤ 1	0.097170	2.453302	3.76	6.65

The above table shows the values of Trace statistic and Max-eigenvalue, according to the above table Trace statistic value is greater than both 5% and 1% critical values which show one cointegration equation at both 5 percent and 1 percent significance level. Maximum-eigenvalue analysis also point out one cointegrating equation at both 5 percent and 1 percent significance level because Maxium-eigenvalue is also greater than at both 5 percent and 1 percent significant values. The result of these data point out that our null hypothesis is rejected. Which is denoted that there is One Cointegration equation r = 1 between the two variables at a 5 percent and 1 percent level of significance. Therefore, we can suggest that our annually data from 1983 to 2009 show that there is a long run relationship between Foreign Exchange Reserves and Nominal Effective Exchange Rate in India.

Table no. IV: Granger Causality Analysis

Null Hypothesis:	Obs	F-Statistic	Prob.
NEER have no impact on FERS	26	3.30033	0.0823
FERS have no impact on NEER		0.01961	0.8898

On the basis of F-statistic an P-value we analyze the Granger causality result which is shown in above table, the hypothesis which addressed that NEER have no impact on FERS can be rejected and the hypothesis that FERS have no impact on NEER cannot be rejected, therefore we conclude that two variables have unicausality which goes from Nominal Effective exchange rate to Foreign exchange reserves, the presence of long run relationship between variables Granger causality analysis require vector error correction model (VECM), the VECM result indicate an inverse

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relationship between Foreign exchange reserves and Nominal effective exchange rate the same result that nominal effective exchange rate affect the foreign exchange reserves is conduct by (Kasman and Ayhan 2008)for Turkey, (Prasad and Raju 2010) for India and (Ahmed and Pentecost 2006) for Africa.

Model –B

Johansen Cointegration Analysis:

Statistic for Selection of Lag Order:

Table no. V

Lag	LoglLRFPEAICSC		HQ			
0	-97.76953	NA	126.0914	7.674579	7.771356	7.702448
1	-55.17934	75.35188*	5.147386*	4.475334*	4.620499*	4.517136*

The above table shows that two variables (NEER and FERS) are integrated in first order I(1). After that we are applying Cointegration test to explore whether both variables are cointegrating with each other. Before examining the relationship among variables, we first identify the appropriate lag order of VAR model. To achieve this task we apply information creation approaches (see Model A for explanation). Table no. 5 present the result of most favorable lag Selection. According to the results of this analysis, 1is the most favorable lag order.

VAR Cointegration Analysis StatisticTable no. VI

Hypothesis	Eigenvalue	Trace Statistic	5 Percent significant Value	1 Percent significant Value
r = 0**	0.728796	33.77050	15.41	20.04
r ≤ 1	0.097170	2.453302	3.76	6.65

Hypothesis	Eigenvalue	Maximum Eigenvalue	5% significant Value	1% significant Value
r = 0**	0.728796	31.31720	14.07	18.63
r ≤ 1	0.097170	2.453302	3.76	6.65

The above table shows the values of Trace statistic and Max-eigenvalue, according to the above table Trace statistic valueis greater then from 5 percent and 1 percent significant value which shows that there is one cointegrating equation at both 5 percent and 1 percent level of significance. Maximum-eigenvalue analysis also point out one cointegrating equation at both 5 percent and 1 percent significance level because Maxium-eigenvalue is also greater than from both 5 percent and 1 percent significant values. The result of these data point out that our null hypothesis is rejected. Which is denoted that there is One Cointegration equation r = 1 between the two variables at a 5

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percent and 1 percent level of significance. Therefore, we can suggest that our annually data from 1983 to 2009 show that there is a long run relationship between Foreign Exchange Reserves and Nominal Effective Exchange Rate in India.

Table no. VII: Granger Causality analysis:

Null Hypothesis:	Obs	F-Statistic	Prob.
FERS have no impact on NEER	26	0.01961	0.8898
NEER have no impact on FERS		3.30033	0.0823

On the basis of F-statistic and P-value we analyze the Granger causality result which is shown in above table, the hypothesis which addressed that FERS have no impact on NEER cannot be rejected and the hypothesis that NEER have no impact on FERS can be rejected, therefore we conclude that two variables have unicausality which goes from Nominal Effective exchange rate to Foreign exchange reserves, and this result also support the VECM result that both variable have negative relationship, but independent variable i.e FERS does effect in very small amount which is near to zero, the same result that nominal effective exchange rate affect the foreign exchange reserves is conduct by (Kasman and Ayhan 2008; Prasad and Raju 2010)and (Ahmed and Pentecost 2006).

Model –C

Johansen Cointegration Analysis:
Statistic for Selection of Lag Order:

Table no. VIII

Lag	Logl	LR	FPE	AIC	SC	HQ
0	-155.3255	NA	10555.34	12.10196	12.19874	12.12983
1	-144.1125	19.83831*	4815.054*	11.31635*	11.46151*	11.35815*

The above table shows that two variables (REER and FERS) are integrated in first order I(1). After that we are applying Cointegration test to explore whether both variables are cointegrating with each other. Before examining the relationship among variables, we first identify the appropriate lag order of VAR model. To achieve this task we apply information creation approaches (see Model A for explanation). Table no. 5 present the result of most favorable lag Selection. According to the results of this analysis, 1is the most favorable lag order.

VAR Cointegration Analysis Statistic

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Table no.IX

Hypothesis	Eigenvalue	Trace Statistic	5 Percent significant Value	1 Percent significant Value
r = 0**	0.722969	37.32877	15.41	20.04
r ≤ 1*	0.237947	6.521755	3.76	6.65

Hypothesis	Eigenvalue	Maximum Eigenvalue	5% significant Value	1% significant Value
r = 0**	0.722969	30.80701	14.07	18.63
r ≤ 1*	0.237947	6.521755	3.76	6.65

In the above table we present the Trace statistic value and Max-eigenvalue, based on these values we can determine the relationship of variables, according to the above tableTrace statistic point out two cointegration equations at 5 percent level of significance and one cointegration equation at 1% percent level of significance. Maximum-eigenvalue analysis also point out two cointegrating equations at 5 percent level of significance and one cointegration equation at 1 percent significance level. The result of these data point out that our null hypothesis is rejected. Which is denoted that there are two Cointegration equation r = 2 between the two variables. Therefore, we can suggest that our annually data from 1983 to 2009 show that there is a long run relationship between Real Effective Exchange Rate and Foreign Exchange Reserves in India.

Granger Causality analysis:

Table no. X

Null Hypothesis:	Obs	F-Statistic	Prob.
FERS have no impact on REER	26	3.64338	0.0688
REER have no impact on FERS		0.35886	0.5550

On the basis of F-statistic an P-value we analyze the Granger causality result which is shown in above table, the hypothesis which addressed that FERS have no impact on REER can be rejected and the hypothesis that REER have no impact on FERS cannot be rejected, therefore we conclude that two variables have unicausality which goes from Foreign exchange reserves to Real Effective exchange rate, this result also support the VECM result that both variable have negative relationship, this result is different from the result of Pakistan because in Pakistan Foreign exchange

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reserves does not affect Real effective exchange rate, but in India Foreign exchange reserves affect the Real exchange rate and the same result is conduct the (Kasman and Ayhan 2008)in Turkey.

Model –D

Johansen Cointegration Analysis:

Statistic for Selection of Lag Order:

Table no. XI

Lag	LoglLRFPEAICSCHQ					
0	-323.0842	NA	4.24e+0925.0064825.1032525.03434			
1	-293.959451.52847*	4.88e+08*	22.84303*		22.98820*	22.88483*

The above table shows that two variables (FERS and REER) are integrated in first order I (1). After that we are applying Cointegration test to explore whether both variables are cointegrating with each other. Before examining the relationship among variables, we first identify the appropriate lag order of VAR model. To achieve this task we apply information creation approaches (see Model A for explanation). Table no. 11 present the result of most favorable lag Selection. According to the results of this analysis, 1is the most favorable lag order.

VAR Cointegration Analysis Statistic

Hypothesis	Eigenvalue	Maximum Eigenvalue	5% significant Value	1% significant Value
r = 0**	0.722969	30.80701	14.07	18.63
r ≤ 1*	0.237947	6.521755	3.76	6.65

Table no. XII

Hypothesis	Eigenvalue	Trace Statistic	5 Percent significant Value	1 Percent significant Value
r = 0**	0.722969	37.32877	15.41	20.04
r ≤ 1*	0.237947	6.521755	3.76	6.65

In the above table we present the Trace statistic value and Max-eigenvalue, based on these values we can determine the relationship of variables, according to the above tableTrace statistic point out two cointegration equations at 5 percent level of significance and one cointegration equation at 1 percent level of significance. Maximum-eigenvalue analysis also point out two cointegrating equations at 5 percent level of significance and one cointegration equation at 1 percent level of significance. The result of these data point out that our null hypothesis is rejected. Which is denoted that there are two Cointegration equation r = 2 between the two variables. Therefore, we can suggest that our annually data from 1983 to 2009 show that there is a long run relationship betweenForeign Exchange Reserves and Real Effective Exchange Rate andin India.

Granger Causality analysis:

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Table no. XIII

Null Hypothesis:	Obs	F-Statistic	Prob.
REER have no impact on FERS	26	0.35886	0.5550
FERS have no impact on REER		3.64338	0.0688

On the basis of F-statistic and P-value we analyze the Granger causality result which is shown in above table, the hypothesis which addressed that REER have no impact on FERS cannot be rejected and the hypothesis that FERShave no impact on REER can be rejected, therefore we conclude that two variables have unicausality which goes from Foreign exchange reserves to Real Effective exchange rate, this result also support the VECM result that both variable have negative relationship.

Conclusion:

This study examines the relationship and causality link between Foreign exchange reserves and exchange rate (nominal and real exchange rate) for economy of India, using cointegration analysis. The goal of this study is achieved in three steps: In first step a Unit root analysis is used to determine the order of integration of data series, whether the data series are in first order, secondly cointegration analysis is used to find whether there is a long run relationship between variables, and in last step Granger causality analysis is used to analyze the causation. The Unit root analysis indicates that all variables are stationary in first order *I(1)*, after achieving the stationaraty of data seriese the next step is Cointegration analysis, The cointegration result point out that there is a long run relationship exists between Foreign exchange reserves and Nominal effective exchange rate and foreign exchange reserves and Real effective exchange rate. After determination of long run relationship between foreign exchange reserves and exchange rate (nominal and real exchange rate) the next step is finding the causal relationship between these variables using Granger causality analysis, the Granger causality analysis point out that the causality link goes from Nominal effective exchange towards foreign exchange reserveswhile in relationship between foreign exchange reserves and real effective exchange rate the causality link goes from foreign exchange reserves towards real exchange rate, it means that Nominal effective exchange rate effect the Foreign exchange reserves and foreign exchange reserves effect Real exchange rate.

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Motivation in Theory and in Practice; A Comparison

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Abstract

The study aims to identify what motivation is and what are the factors that motivate different levels of employees at different level. The study used qualitative method to collect the data 6 interviews were conducted from different level of employees in service sector companies to identify the factors that they think motivate employees and then matched to the different theories proposed by various authors like Maslow hierarchy of need, Herzberg theory, hennery Fayol theory, Elton Mayo's, goal setting theory, expectancy theory etc. Research identify that interviewer said motivation is a driving force which enables an employee to perform certain act or to achieve specific goal some factors which were common in the interview's from 6 people that companies are using Theory Y and Goal Setting theory with the combination of Maslow hierarchy of needs theory to motivate their employees and feels this combination a suitable way to motivate employees to achieve their goals.

Introduction:

Today in time of development and competition where the companies have achieved the heights of production efficiency which is known as efficient curve there is no space for more break through innovations e.g. the Japanese companies who all have the best and almost same like machineries and efficient production styles, by this full stop to production efficiency the companies are now looking forward to strategic competencies to which is the only possible way for them to get competitive advantage over competitors . According to Author the core value to build and to get a best strategy is an Employee of the company therefore it is known as an asset of the company not an expanse. The employee of the company is an asset who has a major input in developing the company.

Various authors presented different models in which they presented different factors that motivate employees for e.g Frederick Herzberg proposed theory of motivation-hygiene according to him satisfiers are the motivators andthe dissatisfiersare hygiene factors. Fayol presented 14 elements then and now theory,equity theory was proposed by John Stacey Adams in which he said that employees will be motivated if the input in the work they have is equilant to the output they receive or experience. Victor vroom proposed expectancy theory, the idea of why employees are motivated to do any task or achieve any goal, for this Vroom proposed three variables Expectancy, Instrumentality, Valence. Two theories to view employee motivation were proposed by Douglas

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McGregor. The theories were called as Theory X and theory Y. Maslow gave a five element model in which he defines an employee at different stages and the variables he needs at different steps. Mary parker stated that managers are the one who can make their staff motivate to achieve the desired goals for organization. Elton Mayo conducted Hawthorne studies and worked on human relation school stated that team work and social needs motivate employees.

Research objective:

This Research focuses on;

- Understanding the employee's motivation in real setups with respect to different previous motivational theories, and
- To identify the factors/ causes of motivation in the perspective of managers at different level.

Research question:

This research aimed to answer the basic question that what managers think motivation is? And how employees are motivated?

Methodology:

Qualitative interviews by the managers of the different organizations with the question what they think motivation is and how employees are to be motivated and the results will be analyzed in the light of previous literature which will be contribution to the literature, e.g. among different authors various variables what are those and common variables which are suggested by managers in interviews.

Sample Selection:

The sample of data collection for this paper was managers of service sector in which the front line and high level employees of Banks, United Nations and Telecommunication industry was selected as a sample. The sample was 6.

Data Collection:

The data collection for the completion of this paper was qualitative in nature and compromise of 6 interviews of Mangers of Service Sector reputed companies.

Data Analysis:

Information collected through interview's was first recorded and then tabulated in MS word.

Literature Review:

Motivation is to provide motive means to provide some reason of performing any task and the motivation is the process to provide an employee with some reasons which are motives to perform certain actions with which the employee be task oriented. The rewards may be intrinsic or extrinsic, the motives differ from the person to person and level of the individual e.g. a front line worker will prefer an increase in salary while the high level employees such as department managers will prefer a tour to any other country with family. The company should determine the best suitable motives for the employees.(Shanks 2012).

Frederick Herzberg analyzed some factors which results in satisfaction and dissatisfaction of employees. His analysis involved interviews from different employees to know the variable, elements which make them motivate and results were clearly different between the elements causing satisfaction and dissatisfaction. According to Herzberg satisfaction of employees is directly related to the motivation of an employee.To know the behavior of employees that how satisfied and happy are they with their work several questions interviews were conducted, the findings drawn from the interviews were factors that results satisfaction of those discriminated work results in dissatisfaction at their jobs, the motivation hygiene theory was developed by him in which he describes these results the satisfiers were called as motivators while dissatisfies were factors of hygiene, the term hygiene he used in the sense to be considered factors of maintenance, without

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which it is not possible to avoid dissatisfaction, but do not give satisfaction by themselves(Stello 2012).

According to Fredrick Taylor employees can be more productive and perform more efficiently if the work given to them is divided into more smaller parts and if the employees are provided with challenges according to their specialized background (Taylor).Every employee should have specific task not generalized but within some limitations, Fayol proposed 14 elements for making an employee production as given below. According to this model workers are to be given in what they are specialized; it takes empowerment into an account and also discussed the importance of training and development programs. Fayol also talks about not to terminate employees when downsizing but to shift them in their specialized departments. These 14 variables in this research paper will play a vital role taking interviews from the managers to know if now these elements have significant value in motivating employees(HISSOM 2009).

An equity theory was proposed by John Stacey Adams in 1963, in which theorist emphasized that employees will be motivated if the input in the work they have is equilant to the output they receive or experience. They should have the equlancy of input and output with an equal ratio. Adams stresses the importance of fairness at work place for the employees to be motivated, and reward system which could not be only the financials but also the respect in working place. The variable Respect seems to be a different from other researches and will be of keen observation in the time of interviews by the managers, so it is very important for the organizations to ensure employees are getting equal output of their input and to know how employees perceive the balance that is equity.

Victor vroom in 1964 proposed expectancy theory, the idea of why employees are motivated to do any task or achieve any goal, for this Vroom proposed three variables Expectancy, Instrumentality, Valence. Expectancy refers to the degree of achieving the outcome associated with the behavior, Instrumentality refers to the awards associated with the individual's action and the Valence is the value of the anticipated reward to the individual. According to Vroom these are the three variables used by individuals to identify the motivational force.

"Motivational force (MF) = Expectancy X Instrumentality X Valence"

Expectation is the conviction that the effort increases, leading to a higher power that is if I work harder than it will be better. This is affected by such things as:

1. Sufficient resources are available (eg raw materials, time)
2. Sufficient knowledge to do the job
3. Theneededcare to do the job (for the support of the supervisor or the correct information at work).

Instrumentality is the belief that if you accomplishthe tasks well than a valued outcome will be received. The extent to which a major result will lead to the second level of the result, that is, if I do a good job, there is something for me. This is affected by such things as:

 1. A clear understanding of the link between performance and results - for example, the rules of "the game" award
 2. Confidence in the people who decide who gets what results Lead
 3. Transparency in the process that determines who gets what

According to vroom **"Valence** is the importance that the individual places upon the expected outcome. For the valence to be positive, the person must prefer attaining the outcome to not attaining it. For example, if someone is mainly motivated by money, he or she might not value offers of additional time off."

In his 1960 book, *The Human Side of Enterprise*, Douglas McGregor suggested twotheories a way presented to view employee motivation. The theories were named as Theory X and theory Y. In both these theories stress the importance of management's role in motivating an employee and includes people for the value of the company in economic view.

Theory X assumes that the average person:
- Displeasures work and try to avoid it.
- Has no willpower, desires no responsibility, and would slightly follow than lead.
- Is self-centered and therefore does not care about organizational goals.
- Repels change.

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- Is gullible and not particularly intelligent.

Theory Y makes the following general assumptions:

- Work can be as natural as play and rest.
- People will be self-directed to meet their work goals if they are loyal to them.
- People will be devoted to their goals if rewards are in place that addresses higher needs such as self-fulfillment.
- Under these circumstances, people will seek responsibility.
- Most people can handle responsibility because creativity and ingenuity are common in the population.

In general theory Y seems to be more reliable to make employees productive but according to McGregor some it is upon the level and kind of employees to which theory among both fits on, some employees are not matured and cannot be use theory Y for them.

Goal setting theory was proposed Edwin Locke in 1968, this theory states that behavior of a human is driven by the desire achieve goals, it stress the importance of challenging goals but the goals should be realistic; easy or vague will not give enough output(Lunenburg 2011).

Maslow proposed a five elements model in which he defines an employee different stages and the variables he needs at different steps, Maslow started from the basic needs of an employee that is food shelter and slowly and gradually moved towards self-actualization, According to this theory motives for an employee are not always static but changes time to time e.g. an employee at a stage could be motivated for a house but after some time his level changes and motives become different (Boeree 2006).

Mary Parker Follet was the one who defines management as getting work done through others she felt administrators are responsible for motivating their staff to achieve the goals of the organization better not just making orders. However, she declines the phenomenon of making only orders to their staff and believed that they should be trained to make their employees to achieve the desired goals for the organization(Indabawa and Uba 2014).

Elton mayo was also the one who worked on human relation school, in study of Hawthorne studies he wanted to derive what effect the productivity of employees on their work and wanted to make control on the factors that affect productivity of employees by some variables such as Work hours, Rest breaks, Humidity Temperatures. He in his development of research originate a principle of motivation, he selected sixwomen from an assembly route and separate them from the other members of the factoryunder the eye of a controller and made some changes to their working setting.Changed work timings in various hours, days, weeks.

Increased and decreased the number of work breaks and the time of the lunch hourSometimes he returns the women to their usual and harder working environment. Normally with a 48 hour week, including Saturdays and no rest pauses: Team produced 2400 relays per week each, In this time duration individual's became a team and worked wholeheartedly with co-operation and felled low pressure and happy with the knowledge that they are able to achieve what they wanted to and derived about their responsibilities. Elton found in his result of the experiment thatSingle workers cannot be treated in loneliness but must be considered as members of a group, financial incentives and good working conditions are not as much of important for individuals as they want to belong to a group, unofficial orInformal groups formed at work have a solideffect on behavior, Managers should be aware of the societal needs and to ensure that staff working with the organization, rather than against them(Mayo).

Interviews:

The manager of Dubai Islamic Banks was asked about motivation and its factors, His answer was motivation is all about how I take work from them in a way they are willing to do more, and highlighted the factors of theory Y.

Manager at United Nations was in favor of theory Y but under the umbrella of Maslow theory and Frederick Herzberg elements of motivation for satisfaction of employees. The manager of Telecommunication sector was in the favor of Goal setting theory according to him Goal setting

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is base for telecommunication sector.

Other manager at Telecommunication sector was in the favor of both theory X and Y.

Front line manager at Silk Bank was in the favor of expectancy theory with the combination of Theory Y while higher level manager was in favor of Maslow theories with the combination of Theory Y.

Regional Manager of Dubai Islamic Bank was in the favor of theory Y with the combination of Maslow theory.

Theory	Factors
Frederic Herzberg	satisfiers motivators and the dissatisfies hygiene
Taylor	Productive employees and performing efficiently if divided into smaller parts
Henry Fayol	14 elements
John Stacey Adam Equilancy theory	Fairness at work
Victor vroom Expectancy theory	Expectancy, Instrumentality, Valence
McGregor Theory X and Y	Theory X… Avoidance Theory Y…commitment of employees
Goal setting theory Edwin Locke	Human behaviour is driven by the achievement of realistic goals
Mary parker Theory of management	Management is responsible for getting work done by employees
Elton Mayo Hawthorne studies	Make control on the factors that affect productivity of employees by some variables such as Rest breaks, Work hours, Temperatures, Humidity.

Table 1

Interviewers	factors
Managerof Dubai Islamic Banks	Theory Y
Manager at United Nations	Theory Y, Frederick elements and Maslow theory of need
Manager of Telecommunication sector	Goal setting theory
Other manager at Telecommunication sector	Theory X and Y
Front line manager at Silk Bank	Expectancy theory and theory Y
Regional Manager of Dubai Islamic Bank	Theory Y and Maslow theory of need

Analysis:

For the completion of this paper a qualitative method was used in which the questions were asked by different managerial level employees as an interview that what they think is motivation and how an employee can be motivated? These Managers were employees of large service companies in Pakistan and the employees duty stations was Peshawar, 6 interviews conducted in which the focus was on the theories discussed in the literature.The main purpose in interviews were to pick up the

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points that are very relevant to the points proposed in different previous theories of motivation and which theory is more effectively used now a days or any combination of those elements.

According to respondents, motivation is a driving force which enables an employee to perform certain act or to achieve specific goal.Almost all interviewer's answers were matching to the theory Y proposed by Mcgregor,but they were linking theory Y with Goal setting the importance of realistic and challenging goals, these two theories seems to be highlighted in interviews with a touch of Maslow hierarchy of needs, The interviewers talk about theory Y, Goal setting theory and different level of goals should be proposed in different levels which stress the importance of Maslow hierarchy of needs while some interviewers also talk about theory X importance for low level employees but the weightage overall of theory X was low.

Therefore according to above interviews analysis this research paper reached to the findings that at this time large companies are using Theory Y and Goal Setting theory with the combination of Maslow hierarchy of needs theory to motivate their employees and feels this combination a suitable way to motivate employees to achieve their goals.

The findings are also a direction for future researches if they wish to work on currently active motivational elements which are used and recommended by companies, and are more effective and the companies to motivated employees should pick the above combination of different authors.

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The Relationship Between Capital Structure, Ownership Structure and Firm Efficiency, Empirical Study of Pakistan

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Abstract

The aim of the study is to examine the importance of efficiency in order to measure the performance of an organization. The efficiency of the firm is very important for development and existence of organization. This study further examines the relationship of capital structure, ownership structure and firm efficiency. In order to measure efficiency of firm a very important model of Data Envelopment Analysis (DEA), constant return to scale (CRS) is used to get the accurate figure of technical efficiency. The inputs variables are total assets and total equity and outputs variables are total sales and net profit before tax are used to measure technical efficiency. This study further studied the relationship of technical efficiency with capital structure and ownership structure and found significant relationship between them. To obtain the accurate results this study used different techniques such as correlation analysis, ordinary least square regression analysis on a panel data of 100 non-financial companies listed on Karachi Stock Exchange (KSE-100) coving a time period of six years (2005-2010). The research study examine a significant positive relationship between leverage, ownership concentrations, family owned ownership and firm efficiency (technical). On the other the study found a negative relationship between managerial ownership, institutional ownership and firm technical efficiency. On the bases of results and finding of this study it can be argue that a significant relationship exist between capital structure, ownership structure and firm technical efficiency in the context of Pakistan.

Key words: firm efficiency, leverage, ownership structure and Pakistan Stock Exchange.

1. Introduction

Now a day's managers facing number of challenges and problems, the capital structure decision made by the management is very important in selecting the optimal structure, it is obligatory for management of the firm to select capital structure in such a way to increase firm value which is an important decision.The basic definition of capital structure is that how a firm or organization is financed, capital structure is the combination of debt and equity sustain by the firm, the selection of capital structure is issue of great interest in the literature of corporate finance, the main reason is due to the leverage ratio that is mix of funds which affects availability and cost of capital and also the investment source of firms, currently most of practical research is applied on listed companies of different stock exchanges. Modigliani and Miller (1958) examine that strategies do not affect firm value in perfect capital market, but later on argue that change in capital structure can increase the firm value due to tax advantage of debts.

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MM (1958) suggested that under perfect capital market assumptions, tax free economy, homogenous expectations, and no transaction costs, capital structure show irrelevant behavior in determining value of the firm.

Efficiency is one of the most important factor in a business success due to proper utilization of resources of firm.Many firm use new techniques and tools in there organization in order to bring efficiency, in simple words, efficiency means relationship between inputs of the organization and its outputs (Low, 2000). But more specifically efficiency is the limit of an organization to which it uses all of its resources (inputs) to meet its organizational goals (outputs) (llona and Evelina, 2013). Moreover managers are facing hug financial issues to find the accurate measure of firm performance (Hashem and Mehdi, 2010).

The very widely used measure to find out efficiency of firm is (DEA) Data Envelopment Analysis. DEA approach is used and applied in most of the previous literature to find out the efficiency of different firm and organizations such as, banks, universities, and industrial firms (Yue, 1992).

The (DEA) Data Envelopment Analysis uses multiple inputs and outputs and gives a result showing a sole measure of efficiency (Morita and Aykiran, 2009).

Ownership structure is also a very important element that highly affects performance of the firm and efficiency. Ownership structure refers to the control of a company, it might be in few people's hands, government, management, and family owned business etc. It is also define as the distribution of equity with regards to vote and capital, the relationship of equity ownership and performance has got very importance in the corporate finance literature. Some previous research contradictory results exist on firm efficiency of different companies through different ownership structures such as managerial ownership and concentration ownership which help to examine the relationship of firm technical efficiency and scale efficiency with ownership structure. (Ongore, 2011) conducted study on companies operated in Kenya reported a significant relationship between ownership structure and companies performance by using agency theory uses Return on Assets, dividend Yield and Return on Equity for company performance. (Ongore. 2011) also studied that managerial ownership has uncertain effect on a performance of a company.

This study used four ownership structure variables in order to explore the effect of all on firm efficiency. Enough research works have been done on firm efficiency and ownership structure, but the relationship of capital structure, equity ownership structure and firm efficiency has not been studied in combine by using Data Envelopment Analysis as measuring tool for accurate result of efficiency empirically tested in Pakistani context. As for as this study is concerned it can be ever first study which investigate the impact of capital structure and ownership structure with a firm technical and scale efficiency in the context of Pakistan. Various studies investigated contradictory results of ownership structure with efficiency of firm. However this study explore relationship among these all variable using (DEA) Data Envelopment analysis tool as measuring technical efficiencies.

This research study adds value to the literature by exploring the impact of capital structure and equity ownership structure on firm technical efficiency measured by Data Envelopment Analysis (DEA).

2. Literature Review

There is a well-documented research available on the association ofcapital structure, ownership structure and firm efficiency in previous research studies, this study attempt to discuss the existing literature on capital structure, ownership structure and firm efficiency, and number of tools to establish relation among these variables in the context of Pakistan. Firm value maximization is the primary goal of every organization, so the management develops different strategies to accurately and efficiently utilize resources to achieve their goals. Efficiency in short is the inputs and output ratio. And that's why every organization tries to adopt new techniques and methodologies to use minimum inputs and maximize their outputs for the sack of achieving their organizational goals and to get the maximum efficiency level. There are number of factors that influence firm goals. Here we are discussing the effect of capital structure and ownership structure on firm efficiency.

The conflict of interest among the owners manager and outside shareholders and also those between minority and controlling shareholders lie at the heart of corporate governance literature, in the

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previous literature a lot of research is available on the effect of ownership structure on firm performance (Morck et al. 1988; McConnell and Servaes 1990; Hermalin and Weisbach 1991; Himmelberg et al. 1999).

2.1 Capital structure

The basic definition of capital structure is that how a firm or organization is financed, capital structure is the combination of debt and equity sustain by the firm, the selection of capital structure is issue of great interest in the literature of corporate finance, the main reason is due to the leverage ratio that is mix of funds which affects availability and cost of capital and also the investment source of firms, currently most of practical research is applied on listed companies of different stock exchanges.

2.1.1 Capital structure and firm Efficiency

Performance of firm is affected significantly by different variables and factors; one of the significant factor among them is capital structure, many empirical research has been carried out to explore the positive, negative or no relation among the capital structure and firm performance.

Pathak (2011) examine in his research study that the level of debts has negative significant relationship with firm performance which is consistent with some studies of Asian countries but not relevant to the findings of western economy studies, the reason behind this conflicting result can be relatively high cost of borrowing by the developing countries like India as compare to the western countries. Khan (2012) studies finding were same as agency cost model of Jensen and Meckling (1975) and did not explore any significant impact of efficiency on leverage.

RodenLewellen (1995) examines 48 US firms capital structure for the period of 1981-1990 and founded a positive association between capital structure and profitability. Hadlock and James (2002) argue that high level of profitable corporations use capital structure with high debts level.Abor (2005) examine a significant positive relationship between capital structure, and performance for the period of 1998-2002 in the Ghanian listed firms,

Kester (1986) conducted a research study and investigate a negative association of capital structure and profitability (performance) in Japan and US firms. Friend and Lang (1988) reported similar results. And many more such as Rajan and Zingales (1995) conducted study and found the same results in G-7 countries, Wald (1999) studied this relationship in develop countries and examine the same results, Haung and song (2006) also investigated a negative relationship between performance and leverage in China firms. Ebaid (2009) studies the capital structure choices impact on firm performance of 64 firms for the period of 1997-2005 in capital market of Egypt. And uses three measures of performance gross profit margin, ROA and ROE, and suggested that choices of capital structure has weak or near to zero impact on performance of firms.

2.2 Ownership Structure

Ownership structure refers to the control of a company, it is also define as the distribution of equity with regards to vote and capital, it may be hands of financial institutions, government, people and managers, the relationship of equity ownership and performance has got very importance in the corporate finance literature, does the ownership concentration, managerial ownership and family control ownership affects the market and financial performance of the firms? Discussion and literature tried to answer these questions.

2.2.1 Ownership Concentration and Firm Efficiency

Ownership concentration can be defining as that the control of organization in the hand of few people or parties and they are considered to take the important decisions of the organization. In concentrated ownership, the owners evaluate and monitor the developmental activities and enable the firm to use all of resources in an efficient and effective way and achieve the firm efficiency for relatively better performance of the firm. On the other hand firm with dispersed ownership most of

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the individuals are not much interested to actively participate in the control and management of the firm which leads to poor firm performance.

Djankovand Claessens (1999) studied the Czech firms and suggested that increase in concentrated ownership has a direct relation with firm profitability and labor productivity. Kuznetsov and Muravyev (2001) investigated the direct association between technical efficiency of firm and ownership concentration by analyzing the Russian non-financial privatized firms. Some studies also examine that ownership concentration has a direct relationship with corporate performance of firms in the context of Pakistan. Nguyen (2011) also reported that a firm performance is enhanced with ownership concentration.

While some of the research studies investigated negative relation between concentrated ownership and performance of the firm. Lehnand Demsetz (1985) discussed that a negative relationship survives between concentrated ownership and market value of the firm. Chen and Dickinson explore negative association between concentrated ownership and performance of the firm by using top five share holder proxies for concentrated ownership. They suggested that negative association may be due to the state ownershipexistence in ownership concentration. Ongore (2011) investigated that ownership concentration has a significant negative relationship with performance of firm by usingKenya's forty two listed companies.

On the basis of above literature it can be hypothesized that there is a significantrelationship between ownership concentration and efficiency of firm.

2.2.2 Managerial Ownership and Firm Efficiency

Managerial ownership also plays vital role in firm performance and efficiency. The previous research studies indicate contrary results of managerial ownerships and firm performance. Hirshleifer and Thakor (1992) argue that due to risk adverse behavior of few managers they do not go for risky decisions (projects) to secure the growth career of the firm and many times their decisions avoided decreasing firm value. Shah et al (2011) and Wahla, Shah and Hussain (2012) examine a negative association of managerial ownership and firm's performance in the context of Pakistan.

But some of previous studies explore, those companies which have high managerial ownership, managers have the right and authority to invest in those projects which is highly risky as well as more profitable which lead to increase the performance of firm. Morck, (2000), and Chen,Mande and Guo(2003) also found a directassociation between managerial ownership and firm's value. Javid and Iqbal (2008) investigated 60 Pakistani firms and examine a directrelationship between managerial ownership and firm's performance. Most of firms pay enough packages and incentives to their managers in order to havegood firm performance and to bring the maximum efficiency in firms. This study is also identifiessignificant association between managerial ownership and firm efficiency.

2.2.3 Family owned ownership and Firm Efficiency

Family owned ownership means when a company majority of shareholders are family members and operate and control the firm. Reeb and Anderson (2003) examine US family owned firms and suggested that family owned is US have greater profitability and value than those having non-family owned firms. Maury (2006) explore non-financial companies among thirteen European states and founded that the profitability of family control and owned firm have 16 percent higher profitability as well as 7 percent higher valuation than that of non- family owned companies. From above discussion we can say those firms having family owned ownership perform well than that of non-family owned ownership. Every member of the family tries to use the resources of the firm efficiently to achieve organizational goals of maximizing firm value. And in this respect each and every member of family goes for risky projects which are beneficial and profitable for organization so as to increase firm value. As we know that higher the risk higher will be the return. So firm can get maximum outputs if firms efficiently utilize its resources (inputs) by investing in risky projects.

2.2.4 Institutional Ownership and Firm Efficiency

Institutional ownership represents the control of company in the hand of the financial institutions like banks, insurance companies and other financial companies. Financial institutions follow highly risk adverse behavior andbecause of this risk averse behavior they do not make investment in uncertain projects that increase the firm value. And might be due to this risk adverse behavior they may not be able to utilize effectively the firm resource. Morck,Shivdasani and Nakamura (2000) have examine a negative relationship between institutional ownership andfirm's value of Japanese firms. Bhattacharya and Graham (2007) explore the significant negativerelation of institutional ownership with performance of firm by investigating 116 listed companies in Finland. Lanouar and Elmarzougu (2010) suggested negative but significant relationship between institutional ownership and firm's performance in France. While some previous studies examine directassociation between institutional ownership and firm's performance, Bjuggren, Eklund and Wiberg (2007) suggested from his research study a directassociation exists between institutional ownership and firm performance after studying 300 Swedish listed companies.

On the basis of above previously studied research discussion it is expected that a negative relationship exists between institutional ownership and firm efficiency.

2.3 Firm Efficienc

Efficiency is a very important factor which is considered in the success of business. Management brings all its efforts to properly use and utilize its resources in order to achieve organizational goals effectively and efficiently. In simple words Efficiency refers to the ratio between output and input. Firm efficiency describes that how much the firm produces output by using inputs. There are various types of efficiencies which are used for measuring and evaluation of organizational performance. In the past, researchers and business practitioners used Pure technical efficiency, Scale efficiency,Technical efficiency, Profit efficiency, X-efficiency, Productive efficiency, cost efficiency and other types of efficienciesfor evaluation of the organization performance. For firm efficiency various method were used to calculate the accurate figure of efficiency. Each technique has its merits and demerits. Some previous research studies used a parametric approach called Stochastic Frontier Analysis (SFA) that calculates efficiency, while some of researchers used financial ratios as measure of efficiency andData Envelopment Analysis (DEA) to calculate efficiency. A non-parametric approach Data Envelopment Analysis (DEA) is first time presented by Charnes, Cooper and Rhodes (1978) and calculated firm efficiency by using inputs and outputs of the firm with the help of linear programing. Farrell (1957) was first find out the basis for computing efficiency and production output at low level and furthermore he studied two that there are two parts of efficiency, one is allocative efficiency and second one is Technical efficiency,As for as allocative efficiency is concern it shows the capability to take better combination of inputs to produce the target level of outputs. Technical efficiency refers toa firm's capacity to producehigher level of inputs at a given level of inputs. Charnes, Cooper and Rhodes (1978) added multiple inputs and outputs in model and extend the works of Farrell (1957). They suggested Constant Return to Scale Model or CCR model represented by their name is suitable when firm is going to maximize the technical efficiency from a given level of inputs. But it may be possible to decrease inputs to accomplish high efficiency. Therefore in order to achieve high efficiency Banker, Charnes and Cooper (1984) developed another Variable Return to Scale Model or BCC Model that is used to achieve a given level of production by a minimum level of inputs. The extended model additional rots Technical Efficiency to the pure technical efficiency, and scale efficiency. In the past research studies, the researchers and business practitioners used the above models to calculate and evaluate firm efficiency.

According to Zheka (2005) there are two basic reasons to use technical efficiency in transition context, Firstly; many companies' shares do not freely trade because there is a high inflexibility in the stock market. Secondly, technical efficiency helps to foresee the effect of corporate governance on firm value and enables to investigate the base of the corporate governance problem, particularly in a case where resources are an insufficiently used. They argued that firm efficiency and firm value moves in same direction and link of corporate governance with firm efficiency are further likely to foresee the association between firm value and corporate governance particularly in a context when

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organization worth is not observable. He also stated that there was a direct association of foreign ownership with firm efficiency but there was no evidence found in Ukraine that increases in Government ownership would decrease the firm efficiency. Sufian (2006) reported the efficiency of financial companies and Malaysian merchant banks by applying Data envelopment analysis. Thomsen, Pedersen and Kvist (2006) studied in their article that Anglo-American countries have no significant influence of individual ownership on the firm value. Margarities and Psillaki (2007) studied the relationship between leverage and firm efficiency by using non-parametric DEA approach and found direct relationship between leverage and production frontier,Margarities and Psillaki (2009) also found parallel results that firm efficiency can be improved by taking high leverage. Morita and Avkiran (2009) reported that DEA is a most typical technique for the measurement of efficiency assessment with multiple inputs and outputs. According to Skokan and Stanickova (2012) DEA is an applied technique to model operational processes for the evaluation and assessment of organizational performance across different fields, industries or countries.

The above literature showed that DEA is the most wide and commonly used method for measurement of efficiency. Morita and Avkiran (2009) reported that firm efficiency was straight affected by the selection of inputs and outputsvariable. So after the above discussion this study also used two input variables, total assets and total stockholder's equity and two output variables, total revenue and net profit before tax for the measurement of technical efficiency and scale efficiency of non-financial firms in the context of Pakistan.

2.4 Hypotheses of the Study

On the basis of above discussion of literature this study covers the following major hypotheses so as to examine the relationship between capital structure, ownership structure and firm efficiency. Null hypothesis are given below.

Hypothesis 01 (H_0) there is no significant relationship between capital structure and firm efficiency.
Hypothesis 02 (H_0) there is no significant relationship between ownership structure and firm efficiency.

Alternative hypothesis are given below.

Hypothesis 01 (H_1) There is significant relationship between capital structure and firm efficiency.
Hypothesis 02 (H_1) There is significant relationship between ownership structure and firm efficiency.

3. Data Collection, Sample and Variables

This research study cover a sample of 100 companies from non-financial sector listed on Karachi Stock Exchange (KSE). The data cover a period of six years (2005 to 2010). This study exclude financial sector from sample selected because their capital structure and profit are different (Shah 2009). The firms having ownership structure data but incomplete are also excluded from selected sample. The data sample is a panel data set. Companies are selected from various sectors of the economy. More ever the sample is selected due to the availability of the data of all variables used in this research study. The capital structure variable, ownership structure variable and efficiency data is obtained from annual reports of each and every firm.

To explore this relationship, correlation and regression analysis were used. The regression model is given below.

$$Efficiency, = \alpha + \beta 1(Capital\ Struture) + \beta 2(Ownership\ structure) + \mu,$$

To test the given hypothesis the above model is used. The ownership structure variable is further sub divided into three variables which include ownership concentration, institutional ownership, and managerial ownership. Capital structure variable used Debts to Equity ratio of every firm.

3.1 Measurement of Efficiency

To calculate the efficiency of the firm researchers used different techniques in order to find out the correct figure of efficiency. These techniques include Analytical hierarchal process, financial ratios, and Data Envelopment analysis. The two preliminary reasons to use technical efficiency in

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transition context according to Zheka (2005) are. First due to rigidity in stock market most of companies' shares do not trade freely. Second, technical efficiency helps to show effect of ownership structure and corporate governance on value of firm, and help to explore the problem particularly when there is insufficient use of resources.

3.2 Data Envelopment Analysis (DEA)

Data envelopment analysis is efficiency evaluation method which is presented by Chames, Cooper and Rhodes (1978) for the measurement of firm efficiency and used constant return to scale assumption and this model is later on extended by Banker, Cooper and Chames in (1984) by using variable return to scale assumption to measure the efficiency. The only difference between these two models is free variable denoted by Uo. Data Envelopment Analysis combine to use multiple inputs and output variables of a firm which is known as decision making unit (DMU) and gave a single result which shows the efficiency between input and output variables of DMU.

In previous studies, DEA has used for efficiency measurement of different firms which may be financial and non-financial firms. This study use Data Envelopment analysis technical efficiency model to find out the annual technical efficiency of all firms used in the study from 2005 to 2010, Technical efficiency is defining as at a given level of inputs a firm capacity of production to produce a high level of output.

Constant return to scale (CCR) model is suitable when firms at a given level of inputs maximize its technical efficiency. Technical efficiency (TE) is further decomposed to pure technical efficiency (PTE) and scale efficiency (SE) by the extended model. This study used two inputs variables and two output variables for the measurement of technical efficiency of all non-financial firms used in this study, inputs variables were total assets and total stockholder's equity and total outputs variables were total revenue and net profit before tax.

3.3 Measurement of Ownership Structure Variables

In this research study the following ownership structure variables were used to measure the ownership structure followed by Alam (2013) which include ownership concentration, managerial ownership and institutional ownership. The measurements of these variables are given below;

Ownership Variable	Description
Ownership Concentration	Total number of shares owned by top 5 shareholders / total number of shares * 100.
Managerial Ownership	Total number of shares held by board of directors / total number of shares outstanding * 100.
Institutional Ownership	A dummy having 1 value if a firm majority shareholder (more than 20%) are banks and 0 otherwise.
Family owned ownership	Value of 1 if board of directors is represented by a family or it is a family-run business, otherwise 0

Panel Regression Model

$$TEff\text{it} = \alpha + \beta1(MO)\text{it} + \beta2(OC)\text{it} + \beta3(IO)\text{it} + \beta4(FO) + \beta5(LEV)\text{it} + \mu\text{it}$$

Where
TEff =   Technical Efficiency of ith firm in time t
α =   Intercept of the equation
β =   Coefficient of Independent variables
OC =   Ownership Concentration of ith firm in time t
IO =   Institutional Ownership of ith firm in time t
MO =   Managerial Ownership of ith firm in time t
FO =   Family owned ownership of ith firm in time t
LEV=   Debt to Equity ratio of ith firm in time t
μ =   Error term of ith firm in time t in the equation

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4. Results and Discussion of the Study

The panel data set is used in the study which is a combination of time series and cross section data. Data set covers a time period of 2005-2010. First for the efficiency measurement Data Envelopment Analysis is used (technical efficiency), to explore the effect of capital structure and ownership structure on firm efficiency (technical efficiency), the study use different panel data techniques such as Descriptive statistics, correlations analysis, Heteroskedasticity test, and OLS analysis.

4.1 Correlations analysis tables of variables used.

Variables	Teff	Lev	OC	MO	IO	FO
Teff	1					
Lev	0.13**	1				
OC	0.20**	0.08*	1			
MO	-0.08*	-0.02	-0.16**	1		
IO	-0.10**	-0.005	-0.07	-0.02	1	
FO	0.036	-0.047	-0.03**	0.04**	0.023	1

**,* represent significance at 1% and 5% levels respectively.

4.2 Regression analysis of variables used

The panel data regression is used to explore the effect of capital structure and ownership structure on firm efficiency (technical). To test the hypothesis the following techniques are used to find out the accurate results.

4.3 Panel data technique of variables used

To explore the effect of capital structure and ownership structure on firm efficiency (technical) panel data regression analysis is used. The following table shows common effect model results, as Gujrati (2004) suggested that F-statistic value will be used to choose the accurate model among the common effect model and fixed effect model, and to suggest the best model among fixed effect model and random effect model Hausman test is used. If P-value is less than 0.05 this means that fixed effect model will be used, and if P-value is greater than 0.05 this means that random effect model will be used for analysis. First to select model among common effect model and fixed effect model F-value is calculated by the following formula.

$$F= \{(R^2_{FE} -- R^2_{CE})/N-1\}/ \{(1--R^2_{FE})/NT-N-K-1\}$$

Where

R^2_{FE}= fixed effect model R^2

R^2_{CE}= common effect model R^2

N= Number of cross sections

T= Number of time period   K= Number of independent variables

By calculating the F-value with the help of above formula, the value is 0.663989, which is less than 2. Thus the null hypothesis is accepted and alternative hypothesis is rejected that is fixed effect model should be used. And this means that common effect model should be used among common effect model and fixed effect model.

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4.4 Common effect model results

Dependent Variable = Technical Efficiency

Independent Variables	Coefficients	t-value	p-value
Leverage	0.02045	3.10	0.0020
Ownership Concentration	0.02346	4.85	0.0000
managerial Ownership	-0.0820	-2.14	0.0322
Institutional Ownership	-0.078318	-2.44	0.0148
Family owned ownership	0.037766	1.89	0.0584
R Square		0.06	
F value		9.69	
Prob (F-statistic)		0.000000	

The above table represent the explanatory power of model used which are, F-value 9.69, P-value 0.0000 and R square 6 percent. The coefficient of leverage is positive and its value is 0.002045, t-value is 3.10 and Probability value is 0.0020, this shows that leverage has significant positive relationship with firm technical efficiency at 5% significance level, it may also interpreted as unit increase in leverage brings 0.002045 units increase in technical efficiency of firm, remaining other things constant. And this result proves our first hypothesis.

The ownership concentration coefficient is 0.002346 which is positive and t-value is 4.85 having probability value is 0.0000, these results shows that ownership concentration has positive significant relationship with efficiency (technical efficiency) at 0% significance level, it might also be interpreted that one unit increase in ownership concentration brings 0.002346 units increase in technical efficiency of the firm remaining other things constant. And thus it proves our second hypothesis.

If we look at the coefficient of managerial ownership which is -0.000820 which is negative and t-value is -2.14 having probability value 0.0322, if we look at these values this shows that managerial ownership has negative but significant relationship with technical efficiency of a firm with significance level of 5%, we can also interpret these results that one unit increase in managerial ownership will bring 0.000820 units decrease in firm technical efficiency keeping other things constant, and as a result it prove our third hypothesis.

Similarly the coefficient value of institutional ownership is -0.078318 which is negative and it t-value is -2.44 and probability value is 0.0148, these results shows that institutional ownership has negative but significant relationship with technical efficiency at 5% significance level, which means one unit increase in institutional ownership brings 0.078318 decrease in firm technical efficiency keeping other things constant, and it help to prove our forth hypothesis.

The last explanatory variable is family owned ownership having coefficient value of 0.037766 which is positive its t-value is 1.89 and probability value is 0.0584, these results shows that family owned ownership has significant positive relationship with firm technical efficiency at 10% significance level, this means that a unit increase in family owned ownership brings 0.0377 unit increase in firm technical efficiency at a significance level of 10% remaining other things constant, and thus it proves our last and fifth hypothesis.

4. Conclusion of the Study

This study is conducted to explore the effect of capital structure and ownership structure on firm technical efficiency.

First to measure the efficiency of firms very important data Data envelopment analysis (DEA) model is used, a scale of data envelopment analysis (DEA) which is called constant return to scale model is used in order to get the actual figure of technical efficiency. Constant return to scale model

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use multiple inputs and multiple output variables to get the overall technical efficiency score of a firm, the study uses total assets and total equity as inputs variables total sales and net profit before tax as output variables. Furthermore this study also finds out the association of technical efficiency, capital structure and ownership structure. Capital structure variable uses debts to equity ratio of all 100 non-financial firms listed on KSE-100 index.

To get the accurate empirical results, this study used the correlations analysis technique and ordinary least square (OLS) regression analysis model on total of 100 non-financial firms listed on Karachi stock exchange covering a six years period from 2005 to 2010. The results of study rejected the major hypothesis of the study and find out that capital structure and ownership structure has a significant effect on firm technical efficiency in the context of Pakistan. Ordinary least square (OLS) regression model produces these results. On the basis of empirical results the conducted study has found significant positive relationship between leverage and firm technical efficiency, ownership concentration and firm technical efficiency, family owned ownership and firm technical efficiency in the context of Pakistan, and founded significant negative relationship between managerial ownership and firm technical efficiency, institutional ownership and firm efficiency in the context of Pakistan. The results of panel data technique are similar to the results of Zheka (2005), studied the association of firm efficiency and ownership structure in the context of Ukraine. And on the basis of above empirical results it is argued that between capital structure ownership structure and firm technical efficiency a significant relationship exists.

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Arising Students Entrepreneurial Tendency through Entrepreneurial Attitude Orientation: Evidence from Universities of Peshawar KP, Pakistan

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Abstract

This research paper empirically investigates the findings on the entrepreneurship attitude perspective of the final year business management undergraduate entrepreneurs and non-entrepreneur's students of Peshawar universities. Total 272 questionnaires were distributed among the students of four public and private universities of Peshawar in KP, Pakistan. SPSS statistical software version 17.0 was used for the data analysis. Study used "T" test for measuring the mean difference of entrepreneurial attitude orientation towards entrepreneurs and non-entrepreneur's students of Peshawar KP, Pakistan. Result of the study reveals that the mean of entrepreneurial attitude including (self-esteem, personal control, innovation and need for achievement) of entrepreneurs and non- is not significantly different.

Keywords: Entrepreneurial Attitude Orientation (EAO), Self-esteem, Personal control.

1. Introduction

Entrepreneurship is important for development of countries and playing a vital role in inspiring the economies of developing countries at present time (Manzoor and Jalil, 2014). In recent era, entrepreneurship has developed one of the best critical happenings for the development of any economy (Azhar et al., 2010). The successful levels of entrepreneurship are not one approaching from Cambridge Research Park but furthermore from Asian countries definitely from Pakistan (Ullah et al., 2012). The quantity of societies in Pakistan who obligate a positive approach towards entrepreneurship is fewer than the normal of its issue determined duke countries. (Mian and Qureshi, 2011). Though Stimpson et al., (1991) identified that, the difficulties with the behaviours / personality attitude when determining entrepreneur attitudes were favours to (a) research procedures that be there not established definitely to be there used in determining entrepreneurship (b) altered mechanisms that relevance to Scaling the similar perception really associate unwell (c) personality ideas are proposed for use crossways a comprehensive range of condition, determining

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overall inclinations; and (d) the necessity for theoretic model that together effect and are inclined by happenings in atmosphere that are too much cooperative.

The attitude of demographic had too its individual difficulties in determining entrepreneurial attitudes for the tactic was disposed to simplifying the groups of individual inside the populace. The result of this research used by way of a director to take additional realistic decisions in respect of entrepreneurship development. This study provide indication to the board and strategy producers of SME's development of Pakistan to take corrective arrangements for attractive the entrepreneurs' presentation through attitude development. Lastly, this study provides opportunity to all stakeholders in the area the chance to gain deep knowledge about the relationship of entrepreneurial attitude and entrepreneurs' development.

InAsian countries, very limited amount of research work have been done on the context Entrepreneurial Attitude Orientation (EAO) in higher education sector of Pakistan (Shariff& Saud, 2009). Research study future indications depicts the in-depth analysis of measurement of entrepreneurial attitude including (self-esteem, personal control, innovation and need for achievement) of entrepreneurs and non-entrepreneurs groups (Shariff& Saud, 2009). So, this particular research study enhances the literature on EAO particularly in four public and private universities of Peshawar KP, Pakistan.

2. Literature Review

Entrepreneurship is important for development of countries and playing a vital role in inspiring the economies of developing countries at present time (Manzoor and Jalil, 2014). The successful sections of entrepreneurship are not only approaching from Cambridge Research Park but moreover from Asian countries specifically from Pakistan (Ullah, et al., 2013). In Pakistan, women entrepreneurship has received greater attention in light of new business creation and economic growth (Ullah, et al., 2013).Entrepreneurial accomplishments and entrepreneurship can give to economic and communal development, as maintained by research and communal development information throughout the world. There is a widely recognized that entrepreneurial orientation is vitally important to the performance of small business (Sriprasert, 2013).

The theory of attitude has been used in many research and promoted in relationships of theoretic and applied tactic on entrepreneurial attitudes (Robinson *et al*., 1991). The attitude method to the extrapolation of entrepreneurship has been the subject of wide study happening in the industrialized world.Entrepreneurial attitudes container be related with 5 central features like a personal fundamentals/personalities factor (internal control , taking risk and need for achievement), personal environmentally friendly feature (gender , having business-owning family and family status), personal impartial factor (existence the owner of business, vision and financial assurance), business background factor (societal approaches /attitudes hand new businesses, competition and the availability of loan) and corporate /business impression factor (Naffziger,et al., 1994).

2.1 Hypothesis of the Study are as under

Hypotheses of the study are as under. First we discuss about achievement. High Level achievement motivation, risk taking tendency, and inclination for innovation are attached with an importance on profit and development. The minor business holder seems to be a theoretical linkage among the entrepreneur and the director showing features there are associated additional to the director then to the entrepreneur (Stewart et al., 1998).The learning of motivation in perspective of entrepreneurship in relations of basic ideas such as, risk taking, achievement need have produced diversified outcomes (Boris, 2004).The need for achievement is linked to Maslow's need for self-actualization and "goal accomplishment", which is seen as an essential heavy attribute in the character of fruitful entrepreneurs (Darroch and Clover, 2005). The first hypothesis of the study is as follows

H_1: The mean of entrepreneurial achievement of entrepreneur's students and non-entrepreneur's students is significantly different.

Secondly discuss Self-esteem that entrepreneurs that display self-confidence, base their feelings on the fact that they can overcome all necessary challenges on their path to success and still attain their desired goal (Good, 2003).Self-esteem is an essential entrepreneurial feature that is associated to other psychological features (Koh and Ho, 1992). Self-confidence is a necessary requirement for

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successful entrepreneurship, since entrepreneurs have a developed gradation of self-confidence comparative to non-entrepreneurs (Robinson et al., 1991). The second hypothesis of the study is as follows

H_2: The mean of entrepreneurial self-esteem of entrepreneur's students and non-entrepreneur'sstudents is significantly different.

Thirdly we discuss the personal control that entrepreneurs who have a developed personal control take responsibilities related with their venture additional eagerly than characters with a minor control (Littunen, 2000; Olson, 2000) The study examined the features of entrepreneurial character and establish by determining magnitudes with pursuit of excellence, work ethic, mastery, dominance, as well as further measurements to define achievement motivation and locus of control. This dimensional inspection of personalities in each personal characteristic was then re-measured finished time, to get if the entrepreneur preserved the similar characteristics. In the situation of locus of control, the entrepreneur improved in the proportions of work ethic, mastery, pursuit of excellence and dominance, although the further magnitudes declined a little (Littunen A, 2000).Risk taking is also significantly related to entrepreneurial intentions of the business graduates in Pakistan. Both internal and external locale of control has no significant impact on entrepreneurial intentions between business graduates in Pakistan (Saeed et al., 2013). The third hypothesis of the study is as follows

H_3: The mean of entrepreneurial personal control of entrepreneur's students and non-entrepreneur'sstudents is significantly different.

Lastly we discuss the innovation. Richardson (1994) reflects an innovator a substitute for an entrepreneur (Richardson, 1994). Successful entrepreneurial venture is innovation by the founding individual or team. Innovation is the specific instrument of entrepreneurship because innovation is the act that endows resources to create wealth (Drucker, 2006). Entrepreneurship changed from the innovation, strategic management and strategic change literature has absorbed on entrepreneurial accomplishments inside an organization in instruction to exploit performance (Kuratko, et al., 2001).Entrepreneurs who perform innovative behaviours at a level superior to those of their competitors will have a greater chance of success in a new venture. However, the identification of superior innovative behaviour becomes problematic because of the ambiguity and uncertainty embedded in new ventures (Borman and Motowidlo, 1993). The fourth hypothesis of the study is as follows.

H_4**:** The mean of entrepreneurial innovation of entrepreneur's students and non-entrepreneur'sstudents is significantly different.

3. Research Methodology

In this chapter we discuss the research methodology used in the research. Total number of business management undergraduate/graduate students in private (IM Sciences Peshawar, Abasyn University Peshawar) and public (Agriculture University Peshawar, Peshawar University)sector universities was 843. Respondents were selected from the four aforementioned universities of Peshawar KPK, Pakistan. Number of business management undergraduate/graduate students in public sector universities of Peshawar was 520 that depicts the percentage of 61% (510*100/843). The number of business management undergraduate/graduate students in private sector universities of Peshawar was 323 and demonstrates the percentage of 39% (333*100/843).The sample size was determined with the help of following formula of (Yamane, 1967). The final sample consisted of 272 entrepreneurs and non-entrepreneur's students.

$$n = \frac{N}{1 + N(e)^2}$$ **n= 843/1+843*(.05)^2 n=272**

Stratified simple random sampling technique was used for data collection with the help of proportionate allocation method. From private university total represents 107 students that depict 39% (107*100/272) of the total sample. The questionnaires items were taken from Entrepreneur Attitude Orientation (EAO) Survey (Outcome1.2) instrument (Shariff and Saud, 2009; Yusof,et al., 2008) which are the self-esteem, needs for achievement, innovation and personal control.

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4. Data, Presentation, Analysis & Interpretation

In this research study used SPSS version 16.0 software to examine the composed data. First demographic variables were examined and their descriptive statistics were calculated. Afterward descriptive statistics correlation and independent sample T-test is designed among independent and dependent variables.

The student's entrepreneurial workshop attending status. Students who attend the workshop were 64 and represents 23.5% and those students who didn't attend the workshop represents 208 and depicts 76.5% of the whole sample. To remove a point from questionnaire, (Cronbach's alphas) ranged less than 0.70 (Sekaran A, 2003). So the overhead captioned reliability statistics value of four variables demonstrates that there is no any problematic of deletion of questionnaire items.

Pearson Correlation was performed in the table given below to mention the relationship between IV's. As shown in the table entrepreneurial self-esteem, need for achievement, innovation and personal control has significant relationship at .01 level which is less than P<.05. This further shows that there exists positive association among I.V's.

4.1 Levene Statistics and Independent Sample T-test

According to (Howard, 1960) if the P value of Levene statistics is greater than .05 this depicts population variance is equal or homoscedasticity and if the value of P is less than .05 this depicts population variance is unequal (heterogeneity). In below captioned table the significance values of achievement, self-esteem, personal control and innovation shows P>.245, .601, .225 and .885 respectively which further demonstrates there exists equal variance in the EAO.

The independent-samples t-test compares the means between two unrelated groups on the same continuous. The following table depicts the result of means difference of entrepreneur and non-entrepreneurs graduates on entrepreneurial attitude orientation (EAO i.e. (self-esteem achievement, innovation and personal control). T-test assumes that the two groups must have approximately equal variance on the dependent variable. The equality of variance was checked by Levene statistics.

The independent sample t test result measures the mean difference (Blair, R. Clifford; Higgins & James J, 1980) of entrepreneurs and non-entrepreneur's students towards entrepreneurial attitude orientation i.e. (achievement, innovation, self-esteem and personal control). The t value of achievement shows -.328 which is insignificant at .743 which because significance value is P<.05(Blair, et al., 1980). This depicts that the alternate hypothesis is rejected and null hypothesis is accepted i.e.The mean of need of achievement of entrepreneurs and non-entrepreneurs is not significantly different. The t value of self-esteem shows .720 which is insignificant at .472 which because significance value is P<.05(Blair, et al., 1980). This depicts that the alternate hypothesis is rejected and null hypothesis is accepted. The mean of entrepreneurial self-esteem of entrepreneurs and non-entrepreneurs is not significantly different. The t value of personal control shows .838 which is insignificant at .403 which because significance value is P<.05(Blair,et al., 1980). This depicts that the alternate hypothesis is rejected and null hypothesis is accepted i.e. the mean of entrepreneurial personal control of entrepreneurs and non-entrepreneurs is not significantly different. The t value of innovation shows .170 which is insignificant at .865 which because significance value is P<.05(Blair,et al., 1980). This depicts that the alternate hypothesis is rejected and null hypothesis is accepted i.e. the mean of entrepreneurial innovation of entrepreneurs and non-entrepreneurs is not significantly different.

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Table76: Levene Statistics and Independent Sample T- Test

Levene Statistics			Independent Sample T- Test		
Variables	F	Sig	T	Df	Sig. (2-tailed)
Achievement	1.358	.245	-.328	270	.743
			-.300	50.0	.765
Self-esteem	.275	.601	.720	270	.472
			.700	52.2	.487
Personal Control	1.482	.225	.838	270	.403
			.774	50.3	.443
Innovation	.021	.885	.170	270	.865
			.168	52.9	.867

5. Discussion, Conclusion, Recommendations & Future Research

This study examines the business management entrepreneurs and non-entrepreneur's students' inclination towards (EAO) entrepreneurial attitude orientation i.e. (innovation, self-esteem, personal control and achievement).Entrepreneur Attitude Orientation (EAO) Survey (Outcome1.2) instrument based are the self-esteem, needs for achievement, personal control and innovation. The questionnaire was based on two sections the first part was descriptive and the second part was based on 5 point Likert scale. The reliability of need for achievement, self-esteem, personal control, and innovation was found (.934, .913, .870and .894) respectively for five items each.The sample size was determined with the help of following formula of (Yamane, 1967). The final sample consisted of 272 entrepreneurs and non-entrepreneur's students. Random sampling technique was used for data collection. The masculine represents 211 and feminine represents 61 of the overall sample 272. There were more male than female in the survey. The descriptive statistics indicate that the large of participants were male with age of early (20's to 40) years and above. Study used independent-samples t-test compares the means between two unrelated groups on the same continuous. The equality of variance was checked by Levene statistics and was found P>.245, .601, .225and .885 respectively for the achievement, personal control, self-esteem and innovation.

The hypotheses of the research study were examined concluded SPSS version 16.0. Hypothesis two of the study states that the mean of entrepreneurial Self-esteem of entrepreneurs and non-entrepreneurs is significantly different and was found insignificant in this study. Therefore null hypothesis should be accepted that is the mean of entrepreneurial self-esteem of entrepreneurs and non-entrepreneurs is not significantly different. The result of hypothesis two is consistent with previous study of (Shariff and Saud, 2009). This study also supports the concept. Hypothesis three states that the mean of entrepreneurial personal control of entrepreneurs and non-entrepreneurs is significantly different and was also found insignificant in the study. The null hypothesis should be accepted that is the mean of entrepreneurial personal control of entrepreneurs and non-entrepreneurs is not significantly different. The result of hypothesis three is consistent with previous study of (Shariff and Saud, 2009). This study also supports the concept. Hypothesis one states that the mean of entrepreneurial achievement of entrepreneurs and non-entrepreneurs is significantly different and was found insignificant in this study. Therefore null hypothesis should be accepted that is the mean of entrepreneurial achievement of entrepreneurs and non- is not significantly different. Hypothesis four states that the mean of entrepreneurial innovation of entrepreneurs and non-entrepreneurs is significantly different and was also found insignificant in the study. The null hypothesis should be accepted that stated the mean of entrepreneurial innovation of entrepreneurs and non-entrepreneurs is not significantly different. The result of hypothesis one (entrepreneurial achievement) and four (entrepreneurial innovation) is not support by previous studies. The reasons are that i) Due to unawareness about research and its significance towards

society the respondent's attitude was non-series in filling questionnaires. Both entrepreneurs and non- entrepreneurs group of students were taken part in a survey voluntarily but some of them were not serious in giving right answer to the particular statement based on 5 point Likert scale.ii) Due to non-serious attitude of respondents some of result if this research study was biased specifically achievement and innovation result was insignificant which was not consistent with the previous studies of the same context of EAO and iii)Furthermore the respondents were students and they are not well aware about the practical implication of entrepreneurship and its impact towards society. That's the reason that way some of the results were biased.

The research study found the two groups of business management students i.e. entrepreneurs and non-entrepreneur's proclivity towards entrepreneurial attitude orientation(EAO) i.e. (self-esteem ,achievement, personal control and innovation).The result of correlation matrix shows there exist strong and positive relationship of achievement, personal control ,self-esteem and innovation). The independent sample T-test was utilized in the study in-order to measure the mean difference amid of entrepreneurs and non-entrepreneur's student on entrepreneurial attitude orientation. Result of the T-test found that the mean of entrepreneurial attitude orientation i.e. (achievement, self-esteem, innovation and personal control) of non-entrepreneurs and entrepreneurs is not significantly different. This further indicates that there is no difference of opinion amid of both groups of entrepreneurs and non-entrepreneurs on positive inclination of (EAO) entrepreneurial attitude orientation i.e. (achievement, self-esteem, personal control and innovation). Moreover, entrepreneurial programs take benefits in relations of advanced productivity, improved organizational performance, inexpensive advantage and improved product quality and quantity. Entrepreneurial activity is very much useful and its influence straight on the development of economy.

In Pakistan, such kind of guidelines should be improved which maintenance and Entrepreneurial practice sat could each level. Pakistan is facing the worst security conditions due to which economy is not stable. Organizations are taking decisions very frequently due to the unexpected economical conditions. Due to worst economical conditions organizations are moving towards downsizing and employees are unable to put their full potential towards their goals as a result of insecurity of job. It is important to develop such an environment where government should encourage entrepreneurial culture that enhances the economy of the country.

The sample of the research study was only in use from the public and private sector universities of Peshawar KP, Pakistan due to that this research study was incompletely generalized. Due to shortage of time in finishing point of thesis study data was collected on cross sectional basis.The area for further research is, an in-depth analysis of more public and private universities and organizations to understand some other features contributing in the direction the entrepreneurial orientation. In future the contemporary hypotheses should be tested in multiple samples from numerous other organizations and universities of Pakistan on longitudinal basis.

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Impact of Talent Management Strategies on Employee Performance Behaviour with the Mediating Role of Talent Management Outputs

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Abstract

The purpose of the study was to examine empirically the effect of talent management strategies on employees' performance behavior, through mediation of talent management outputs, in telecommunication industry in Pakistan. Positivist paradigm had been used for the study. A structured questionnaire was used to collect data from a convenience sample of 200 employees of telecommunication industry located in Rawalpindi-Islamabad area. Descriptive statistics, correlation, and regression tests were used to analyze the data. The results indicated that talent management strategies significantly and positively affect employees' performance behavior; whereas the talent management outputs partially mediate the relationship between talent management strategies and employees' performance behaviour. The results provided new insights into the phenomenon of the study. It also offered opportunities to management to plan and initiate appropriate interventions to foster employees' performance behavior for organizations' competitiveness.

Keywords Talent management, employee performance, Telecommunication, Pakistan.

Introduction

Talent management has become vital for organizational competitiveness and sustainability in dynamic business environment. This aspect is receiving importance and attention of researchers that necessitates further exploring this phenomenon (Collings and Mellahi,2009;Viswesvaran and Ones, 2000).Within the context of Pakistan, the telecommunication industry is experiencing performance gap and organizations are pursuing talent management strategies to improve performance (Mushtaq et al., 2015). In a study (Mensah, 2015) conceptualized the role of talent management strategies in promoting employee performance behaviour through the mediating role of talent management outputs. The study necessitated further examination through empirical testing of the theorized relationship. This paper is extension of the Mensah's study.
The purpose of the study is to empirically examine the relationship of talent management strategies and employee performance behaviour, and the mediating role of talent management outputs in this relationship.

Talent Management

Talent management is the proactive identification of the important strategies and positions and the deployment of the qualified, skilled and differentiated human resource system to attract, recruit, develop and retain the talented and sharp employees on the basis of their performance behavior

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(Collings and Mellahi, 2009).Talent management entails differentiation and the strategic positioning of the talented employees in order to lead towards performance development and as well as the organizational differentiation and development (Cascio, 2008;Mensah, 2015)

Talent managementstrategy of pivotal position entails (Bourdreau, 2005); potential for roles and responsibilities in order to contribute to the organizational strategic issues. The focus is primarily on ensuring compatibility of person with the right job as well as role and responsibilities contributing to firms' strategic goals (DiRomualdo, 2009; Collings and Mellahi, 2009). The scope of talent recruitment is based on a find blend of internal and external markets and the staffing from a mixed talent pool (Cappelli, 2008; Glen, 2007; Iles, 2010).

Management of the employees is to develop the employees of the organizations enabling them to work better for the organization and make them more competent in their skills and abilities, development of a differentiated human resource team and structure of an organization in order to facilitate and support the management of the talented employees of the organization (CIPD, 2007). Researchers found that training and development, performance management, and integrated reward management contribute towards firms' strategic objectives (Caims, 2009; Kumari, 2012). Retention of talent is key to organizational competitiveness (Berger, 2004). An innovative approach to talent retention based on multidimensional aspects of work life balance, an effective work diversity policy, open communication providing employees with opportunity for a strong and powerful voice in the organization for their own rights and for the rights of other talented employees; flexible working hours, conducive work climate, and management orientation towards competence, fairness, and mutual respect (Mahapatro, 2010; Schuler, 2011; Viarman, 2012).

Talent Management Outputs

The aim of the talent management strategies is to achieve maximum output from talented employees of the organization and to utilize the talented employees more appropriately. The investment of talent management strategies helps in achieving some great outcomes such as employee satisfaction, employee engagement, employee motivation, employee commitment and perceived organizational support (De-Meuse, 2009; Barkhuizen, 2014).

Employees' motivation is the drive that energizes the employees to excel in physical, cognitive, and behavioural dimensions to achieve and sustain organizational objectives with a sense of purpose and devotion (Balouch, 2006) . The talent management strategies provide requisite stimulus to employees to demonstrate their best in tangible and intangible dimensions with a focus on organizational objective (Bakka, 2006); Maslow, 1943; Herzberg, 1968).

Employees' commitment is an individual's emotional attachment to the identification with and the involvement in the organization (Meyer and Allen, 1991). This phenomenon fosters productivity, enhanced relationship, devotion to achievement of organizational goals, customer satisfaction, organization citizenship behaviour, quality of products and services, and loyalty to the organization (Becker, 1960).

Employee Satisfaction

The organization determinants of employee satisfaction plays very important role. In an organization, proper organizing and managing the organizational variables can increase employee satisfaction. Talent focusedvariables oforganizational development, policies of compensation and benefit, promotion and career development, job satisfaction, job security, working environment and conditions, relationship with supervisors, work groups, leadership styles, and performance management determine employee satisfaction (Meyer and Allen, 1991; Sagheer et al., 2012).

Employee Engagement

According to (Rich et al., 2010), the employee engagement is the active and full performance of an employee or individual's cognitive, emotional and physical energies and efforts. The level of engagements is observed by the energy and efforts that an employee applies and that level of engagement highlight his or her motivational dimension of the engagement. These aspects reflect a positive and productive behaviour that is congruent with organizational strategic objectives (Kahn, 2010; Rich et al., 2010;Rhoades, 2001).

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Perceived Organizational Support

Perceived organizational support refers to the extent to which an organization gives importance to their employees or how much an organization values their employee's contribution and how much the organization cares about the well being of their employees, however high perceived organizational support will lead towards the improvement in work behaviour and attitudes and it will affect the work in positive and effective way. Employees will feel owned and cared and they will be obliged to pay and contribute in the production of the organization and to achieve the targets and goals of both individual and organization(Eisenberger, 1986).

Employee Performance

(Viswesvaran and Ones, 2000), states that job performance refers to how good and effectively or resourcefully an individual takes action and contribute with his or her behaviors (Viswesvaran and Ones, 2000). Performance is a positive or effective contribution of an employee or individual for the performance of the organization (Mensah, 2015). Task performance refers to the behaviors that contribute to the core duties and responsibilities (Van Scotter at el., 2000) (Borman & Motowidlo, 1993) (Motowidlo & Schmit, 1999). Task performance indicates the actions that are part of the formal duties and reward system that has been made by the organization and it refers to the requirements that are specified and mentioned in the job description of an employee (Van Scotter et al., 2000; Maxham, 2008).

Contextual performance refers to the factors and issues that are not directly concerned or not directly part of the job of an employee. It is the psychological and social mind setting that an employee has and acts with his or her behaviors. Contextual performance involves the behavioral patterns and factors involving extra role behaviour both towards coworkers and organization (Sonnentag and Frese, 2002; Koopmans, 2011). Adaptive performance focus on organizational and employees' agility and responsiveness to the changing external environment and aligning with the changes in proactive manner (Griffin et al., 2007; Dorsey, 2010).

Talent Management Strategies, out puts and Performance

Researchers have consensus that talent management strategies create an environment in which employees give their best in physical and psychological dimensions. The shaping of responsive and positive attitudes of employees results in desirable organizational behaviour in the form of desirable performance behaviour that affects organizational performance. Strong empirical evidence is available in literature that indicate that efficient talent management strategies affect attitudinal aspects of employees in the form of outputs that in turn affect performance (Huselid, 1995; Bish 2014; Festing, 2014; Mensah, 2015).
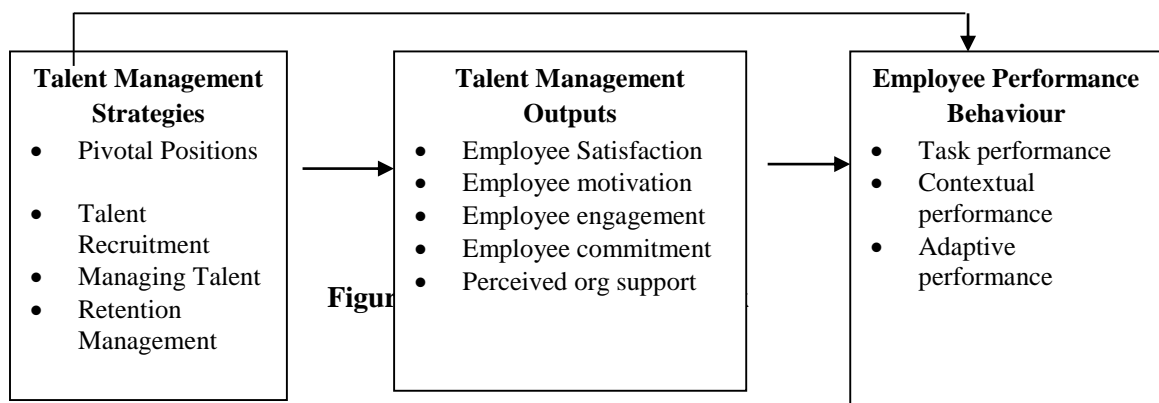
Statement of Hypotheses

H1: There is a positive effect of talent management strategies on employee performance behaviour.
H2: There is a positive effect of talent management strategies on talent management outputs.

H3: Talent management outputs positively affect employee performance behaviour.
H4. Talent management outputs mediate the relationship between Talent Management Strategies andemployee performance behavior.

Methodology

The study is quantitative, causal, and cross-sectional in nature. A structured questionnaire had been used to collect data from a sample of 200 employees working in Mobile Operators located in Rawalpindi-Islamabad area. Convenience sampling technique was used for selection of sample. The scale for different variables had been adapted from studies in which these scales had already been validated. The scale of talent management strategies (Cappelli, 2008; Collings and Mellahi, 2009); talent management outputs (Kahn, 2010; Sageer et al., 2014); and employee performance behaviour(Dorsey, 2010; Kirischer, 2010) were adapted. Face and content validity was undertaken through expert advice of academicians and practitioners. The pilot study was also conducted to test the reliability and validate the instrument of forty eight items. To empirically determine the impact of talent management strategies on employee performance behaviors, in this study various statistical techniques, including descriptive stats, OLS regression, correlation analysis techniques and Andrew F, Hayes model used for examining mediation effect with model 4 were used.

Data Analysis and Results

Table 1: Descriptive Statistics

Variable	N	Min	Max	Mean	Std.Dev	Skewness	kurtosis
TMS	200	1.75	4.31	3.3031	0.66042	-.573	-.650
TMO	200	1.65	4.30	3.1742	0.55076	-.360	-.388
EPB	200	1.44	4.44	3.1894	0.66301	-.386	-.137

This table indicates the normality of the data. The respondents were generally in agreement with regard to the variables of the study.

Table 2: Reliability Test

Variables	Cronbach's alpha	Items
TMS	0.759	16
TMO	0.795	20
EPB	0.801	12
Complete Instrument	0.785	48

The reliability statistics shown in Table 2 are within acceptable range.

Table 3: Correlation

	TMS	TMO	EPB
TMS	1		
TMO	0.685**	1	
EPB	0.438**	0.444**	1

Correlation is significant at 0.01 levels
The results in Table 3 indicate a positive and statistically significant correlation among the variables.

Table 4: Hypothesis Testing

Hypothesis	Variables	R	R2	B	S.E	F Statics	T Value	P
Hypothesis 1	**TMS-EPB**	0.685	0.470	0.433	.069	39.303	6.269	.000
Hypothesis 2	**TMS-TMO**	.685	.470	.572	.043	175.418	13.245	.000
Hypothesis 3	**TMO-EPB**	.439	.193	.560	.081	47.383	6.884	.000

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N =200, **p< 0.001**, *p<0.05.

Direct and Indirect Effects (Mediation)
Direct Effect of X on Y (TMS on EPB)

Table 5: Mediation Results

Effects	SE	T	Sig	LLCI	ULCI
0.2122	0.0922	2.3003	0.0225	0.0303	0.3941

Indirect Effect of X on Y (TMS on EPB)

	Effects	Boot SE	Boot LLCI	Boot ULCI
TMO	0.2206	0.0671	0.0951	0.3535

Hayes (2008) methodology was used for mediation and interpretation of the results as indicated in Table 5. Firstly, the direct effect of independent variable (talent management strategies) on dependent variable (employee performance behaviour) is checked and analyzed. Thereafter, the indirect effect of talent management strategies on employee performance behaviour has been tested statistically. Here the value of t-value is greater than 2, which shows that there is need of this mediating variable in order to have the results and relationship between the independent variable and the dependent variable. The results indicate a partial mediation.

Strategies Selection

In this study, there are four different dimensions of the talent management strategies, which are having impact on the employee performance behaviour through the talent management outputs. In order to find out the best suitable strategy in the four different dimensions, all dimensions of the talent management strategies were examined separately using Hayes model. All of the dimensions named as, pivotal positions (PP), talent recruitment (TR), managing talent (MT) and retention management (RM) were examined and their impact on the dependent variable, employee performance behaviour (EPB) was analyzed through the role of the mediating variable, talent management outputs (TMO). The results are given below:

Table 6: Outcome EPB

Variable	Coefficients	t	P	Indirect Effect
PP	0.0697	1.1722	0.2425	0.1723
TR	-.0162	-.3432	0.7318	0.1482
MT	0.1459	2.6759	0.0081	0.1070
RM	0.1319	3.1386	0.0020	0.0942

In Table 6, the entire coefficient values, t values, p values and values for the indirect effect are given for each variable. In the coefficient values, the highest value is for managing talent, which is 0.1459. It means the contribution and the changes due to the managing talent in the employee performance behaviour are almost 15 %. The t-value, which shows the individual testability of retention management (RT) is 3.1386, which is highest than any other variable. The P value, which shows the significance, is more significant for the managing talent (MT). In the indirect effect, the highest value in all variables is for managing talent, which shows that there is almost 11 % effect of managing talent on the employee performance behaviour. According to the above results, in the four talent management strategies the best suitable strategy is managing talent (MT), because it has large contribution in the effect on employee performance behaviour and its indirect effect on the employee performance behaviour is also up to 11% with the 2.6759 t-value.

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Discussion

The aim of this study is to examine the impact of talent management strategies on employee performance behaviour and how these talent management strategies plays its role through the talent management outputs which leads towards the employee performance behaviour. The results indicate the confirmation of the hypothesized relationship. The results of the study are in conformity with earlier studies (Collings and Mellahi, 2009;Bhatnagar, 2007; Langenegger et al., 2011). The newness of this study lies in its empirical testing to examine the relationship between the talent management strategies and employee performance behaviour. Hence the study positively contributes towards existing body of knowledge. The study also provides opportunities to managers and practitioners to initiate appropriate interventions strategies to attract and retain the talents for positive performance behaviour resulting into organizational competitiveness.

The study has limitations of small sample size, based on limited number of organizations, and cross section nature of the research. The choice of sample is likely to limit the generalizability of the findings. Future research should be based on random sampling and the longitudinal approach is recommended.

Conclusions

In changing environment of uncertainty, performance and sustainability of the organization is vital. Proactive identification of organizations' talent and its subsequent nourishment and development provide requisite stimulus for positive attitude towards work, co-workers, customers, and organizations. This positive attitude transform in tangible performance behaviour of employees that is vital for organizational survival in competitive environment. Organizations need to plan innovative talent management strategies enabling employees to demonstrate positive attitudes and behaviour that would enable organization to achieve sustainable success.

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Effect of Professional Self-Efficacy on Burnout with Mediating Role of Challenge & Hindrance Demands among Faculty Members

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Abstract

The aim of this study is examine the effect of professional self-efficacy on burnout using challenge & hindrance demands. Although HEC, Pakistan, has implemented some tough policies in the last few years aimed at improving the faculty members' qualification, however, policies targeted at the emotional and mental health of teachers as a result is still required. Multiple regression was carried out on a sample of university faculty members (n=153) with diverse demographics, teaching in different universities situated in Rawalpindi/Islamabad region. The results offer empirical evidence for the forecasting role of professional self-efficacy on the faculty members' opinion of challenge stressor (pressure) and consequently the level of burnout. However no significant results were observed for hindrance demands due to the faculty members' high level of professional self-efficacy. Hence it may be a favorable approach to endorse improved self-efficacy for the betterment of employees' health, especially where the organization is acquainted with the probable favorable part of self-efficacy reducing burnout among employees. Similarly, the human resource policies and practices in terms of job design, reward system, regular feedback and effective leadership can help employees in managing work characteristics. The level of occupational stress among employees can be reduced through various initiatives such as stress management trainings and workshops, managerial support and feedback. It is imperative to confront the degree of burnout among employees so as to determine the type, level and frequency of such programs to be implemented for the well-being of employees.

Keywords *Professional* Self-Efficacy, Burnout, Challenge Demands, Hindrance Demands.

1. Introduction

Various initiatives at industry and governmental level have been taken to bring the education services at par with the international level. These initiatives which, at one hand will produce qualified graduates imply heightened expectations from faculty members to improve performance in all aspects. Empirical studies reveal that these intensified expectations lead to burnout among faculty members. Similarly, different aspects in the job environment pose challenges and hindrances to teachers, who are facing difficulty to balance job demands and personal development; both of which are deemed necessary to ensure provision of quality education.

Previous studies reveal the presence of a higher level of burnout in careers that offer communal and human services such as the teaching profession (Skaalvik & Skaalvik, 2010). Similarly, the emphasis placed on faculty development in the 21st century is due to the changing course of teachers' responsibilities from transfer of education to knowledge conception. Educational reforms by government and HE institutions are focused on transforming universities into educational nurseries harvesting valuable human capital for the future. In these reforms faculty members are recognized as the core agents of change, stressing upon strategies of faculty development to enhance their skills and commitment level. However it is important to point out that teachers will

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perform well only when their efforts are realized and appreciate by the top tier of the organization(Aslam & Kingdon, 2011). Job factors such as unappealing incentives, lack of support from top management, high expectations but absence of training result in reduced motivation level among teachers. Similarly, Higher Education Commission of Pakistan, in hopes of fostering research practices, implemented a policy to recruit and promote specifically those faculty members with high number of research publications(HEC, 2012). This has placed added pressure on teachers to produce quality research work in order to progress in their careers. However one major challenge is the unavailability of training and professional development of employees particularly in the public sector, in this regard raising concerns among teachers.

Balancing the workload of teaching regular classes, conducting exams, evaluating students, managing classroom activities and all other responsibilities along with achieving goals of quality research work, is becoming increasingly demanding situation for faculty members. University administration emphasizes, both, upon effectively teaching students and on research work, which leaves the faculty members with challenges of lack of clarity of job tasks and time management as well. Faculty members are overburdened with their professional duties, making efforts for their career growth but face unavailability of support and rewards leading to dissatisfaction (Aslam & Kingdon, 2011).

1.1. Significance of the Study

Among the academicians in Pakistan, a high level of stress, burnout (Khan et al, 2014) and intention to leave (Khan et al, 2013 and Yousoff & Khan, 2013) has been observed through recent studies. These studies reveal stressors related to administrative and performance pressures (Khan et al., 2013; Yousoff, & Khan, 2013; Bhatti et al., 2011), poorly defined job duties (Khan et al., 2013; Fatima &Rehman, 2012), amendments in policies of higher education resulting in further changes in recruitment and promotion policies in universities (Khan et al., 2014). Hence it is necessary to study the factors contributing to burnout among faculty members in Pakistan so as to avoid turnover of valuable teachers.

1.2. Literature Gap

A recent empirical study was conducted on the influence of professional self-efficacy in job burnout and engagement(Ventura, Salanova, & Llorens, 2015). This study revealed that workers with high work-based self-worth perceived more challenge demands and resultantly were engaged to a larger extent. However no relationship was found with exhaustion, a dimension of burnoutsuggesting that this relationship needs to be further tested as there is evidence of positive(Crawford, LePine, & Rich, 2010; LePine, LePine, & Jackson, 2004), negative (LePine, LePine, & Jackson, 2004)and no relationship(Broeck et al., 2010) between these two variables in literature. Similarly, it was suggested that additional challenge demands (such as workload, time pressure) and hindrance demands (such as routine and role ambiguity) should be considered. Additionally, occupational sample of university lecturers was also proposed to be studied. Similarly existence of growth opportunities will also be considered as a hindrance demand to study the impact of raised criteria by HEC, on faculty members' promotion opportunities.

1.3. Research Objectives

The objectives of this study are:
1. To measure the effect of professional self-efficacy on burnout
2. To examine the mediating effect of challenge demand between professional self-efficacy and burnout
3. To investigate the mediating effect of hindrance demands between professional self-efficacy and burnout

1.4. Delimitations of the Study

The population of faculty members in universities located in Rawalpindi/Islamabad cities are considered only. Similarly only two dimensions of burnout (disengagement and exhaustion), one type of challenge demand (pressure) and two types of hindrance demands (routinization and role

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ambiguity) have been considered. In addition, data collection was carried out through the use of questionnaire only.

2. Theoretical framework

The effect of professional self-efficacy is studied as the independent variable on burnout as the dependent variable with challenge and hindrance demands as mediators as shown below
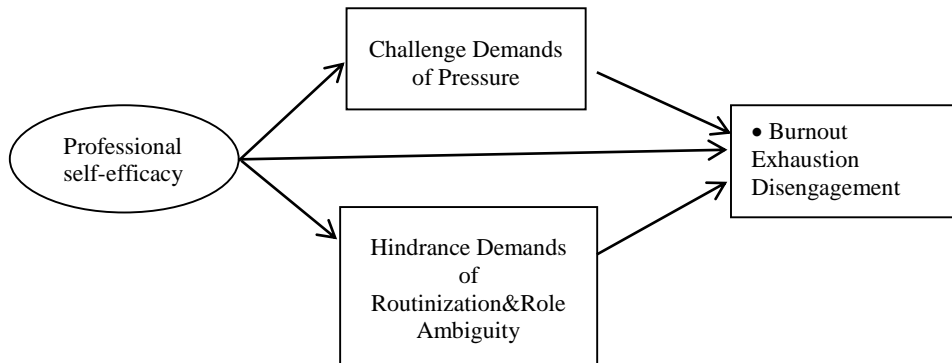
3. Research Methodology

Various public and private sector universities from Islamabad and Rawalpindi cities were approached for conducting the study. A non-probability sampling technique was employed with a total of 150 questionnaires disseminated among faculty members. The tests carried out for data analysis include demographic statistics, descriptive statistics, reliability statistics, correlation and regression on the independent, dependent and mediating variables using IBM SPSS 21.0. Additionally, six different sources have been used for all the variables. For measuring professional self-efficacy, the 'job self-efficacy scale' (Tang & Chang, 2010) has been used, whereas the 'Oldenburg Burnout Inventory (OLBI)' has been used to measure disengagement & exhaustion dimensions of burnout (Demerouti, Bakker, Vardakou&Kantas, 2003). For challenge demands of pressure, a seven-item questionnaire (Cousins et al., 2004) is used. On the other hand to measure hindrance demands of role ambiguity, a six-item scale is used (Tang & Chang, 2010), for routinization, a three-item scale (Choi et al., 2009) was used.

4.1. Demographic Analysis

Based on descriptive analysis, it was found that the sample consisted of 71% males and 29% female respondents. In addition, 61% of the respondents were reported to fall in the age category 26-35 years; whereas 21% were found to fall in the age group 36-45 years. The education level of a vast majority, 51% was Graduate level and 43% were at Post graduate level. Similarly, the job position of 31% of the respondents was of middle management level and 30% had supervisory responsibilities, with 27% experienced in non-managerial positions. The job function of the majority of the sample, 73% was of technical nature with 52% having more than five years' professional experience.

4.2. Descriptive Statistics

Table 1: Descriptive Stats and Analysis

	N	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
Professional SE	153	3.00	5.00	4.45	.527 .749	.196	-.194	.390	

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Challenge demand	151	1.00	4.50	2.54	.964	.413	.197	-.818	.392
Hindrance demands	151	1.00	4.67	2.60	.853	.837	.197	.355	.392
Burnout	151	1.00	5.00	2.98	.759	.234	.197	-.065	.392
Valid N (listwise)	151								

The results from descriptive statistics reveal the total number of non-missing values as 151 with 1 being the minimum value of the variables and 5 being maximum value. Similarly, the mean score for all 153 responses to professional self-efficacy was 4.45 (*SD=0.53)*; for 151 responses to challenge demand of pressure the mean score was 2.54 (*SD=0.97)*, for responses to hindrance demands of role ambiguity and routinization, the score was 2.60 (*SD=0.85)*and for responses to burnout the mean score was 2.98 (*SD=0.76)*.As evident from the table 1, there is little variability of results around the respective means as values of standard deviation of each variable are close to zero. Similarly, test for normality using skewness and kurtosis is based on the rule that the value of kurtosis must fall in the range of +3 and -3; whereas value of skewness must fall in the range +1 and -1. Also negative values show the distribution is skewed to the left (as in the case of professional self-efficacy only) and positive values show data is skewed to the right.

5. Hypotheses Testing

H1: Professional self-efficacy is negatively related to burnout
H2: Professional self-efficacy is negatively related to burnout based on challenge demand of pressure
H3: Professional self-efficacy is negatively related to burnout based on hindrance demand of routinization& role ambiguity

Table 1: Correlation

		PSE	ChalngD	Burnout	Hindrance.D
PSE	Pearson Correlation	1			
ChalngD	Pearson Correlation	.180[*]	1		
Burnout	Pearson Correlation	-.195[*]	.252[**]	1	
Hindrance.D	Pearson Correlation	-.100	.222[**]	.785[**]	1

As displayed in Table above, based on the correlation coefficient, r, and p-value, professional self-efficacy and pressure being strongly and positively correlated, professional self-efficacy and burnout being strongly and negatively correlated, pressure and burnout were strongly and positively correlated. On the contrary, hindrance demands and professional self-efficacy were not correlated; hindrance demands and pressure were found to be correlated positively whereas hindrance demands and burnout are negatively correlated. This means that as perception of challenge demands increases, burnout decreases; whereas as perceived hindrance demands increases, burnout also increases among employees.

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Table 2: Hypotheses Testing

Model	R	R Square	Adj. R Square	Std. Error of the Estimate
1	.195[a]	.380	.31	.94940

a. Predictors: (Constant), PSE

Table 3: ANOVA

Model 1	DF	Mean Square	F	Sig.
Regression	1	5.293	5.873	.017[b]
Residual	149	.901		
Total	150			

a. Dependent Variable: Burnout
b. Predictors: (Constant), PSE

The above results of multiple linear regression of PSE on burnout, based on F-statistic, R^2 and p-value revealed a significant regression.

Table 3: Coeffcients[a]

Model 1	Unstandardized coefficients		Standardized coefficients		
	B	Std Error	Beta	t	Sig
Constant	4.136	.663		6.237	.000
PSE	-.358	.148	-.195	-2.423	.017

Based on the unstandardized coefficient and standardized coefficients that are seen to be statistically significantly different from 0; this means that professional self-efficacy is a statistically significant predictor of level of burnout among employees.

Table 4: Hypothesis 2

Steps	IV	DV	R2	F Stat	B	Beta	T Value	Sig
1	Professional SE (PSE)	Burnout	.38	5.873	-.358	-.195	-2.423	.17
2	Professional SE	Pressure	.32	5.000	.261	.180	2.236	.027
3	Pressure	Burnout	.34	10.137	.321	.101	3.184	.002
4	PSE + Pressure	Burnout	.38	5.873	.456	-.48	-3.173	.002
			0.35	10.411	.377	.297	3.797	.000

Table above shows mediation results of professional self-efficacy (independent variable), pressure (challenge demand) and burnout (dependent variable) based on Barron and Kenny's mediation method (1986). Based on values of t-statistic and significance level; the regression results of above mentioned variables are significant.

Table 7: Hypothesis 3

Steps	IV	DV	R2	F Stat	B	Beta	T Value	Sig
1	Professional SE	Burnout	.38	5.873	-.358	-.195	-2.423	.17
2	PSE	Hindrance D	.10	1.513	-.163	-.100	-1.230	.221
3	Hindrance D	Burnout	-					

Table above shows mediation results of professional self-efficacy (independent variable), routinization and role ambiguity (hindrance demands) and burnout (dependent variable) based on Barron and Kenny's mediation method (1986). Based on values of t-statistic and significance level; the regression results of above mentioned variables are significant only in the first step. However in the second step, the regression of professional self-efficacy on hindrance demands of routinization and role ambiguity ignoring the dependent variable, burnout, showed statistically insignificant effect based on values of t-statistic and significance level.

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Table 8: Hypothesis Testing

	Statement	Result
H1	Professional self-efficacy is negatively related to burnout	Accepted
H2	Professional self-efficacy is negatively related to burnout based on challenge demand of pressure	Accepted
H3	Professional self-efficacy is negatively related to burnout based on hindrance demands of routinization and role ambiguity	Rejected

6. Discussion

Based on the findings above, it is important to realize that as self-efficacy with regards to one's profession increases, it will not only have positive impact on the employees' psychosocial well-being, but a negative effect on burnout as well.Since the study revealed an overall high degree of self-efficacy reported by the respondents, therefore the impact of perceived challenge demands on burnout was more visible as compared to that of hindrance demand. Similarly, when measuring the health of workers, the aspect of self-efficacy must also be considered as both these are related to each other (Schreurs et al., 2010). Similarly, the human resource policies and practices in terms of job design, reward system, regular feedback and effective leadership can help employees in managing work characteristics. For instance, although work pressure can be considered as a challenge by employees however insurmountable pressure can also lead to dissatisfied and unhealthy workers. The positive aspects of pressure include motivated collaboration and unity among team members as mutual challenges can be overcome together (Borzillo, 2007). However work pressure may also produce undesirable outcomes. Therefore an induction program aimed at clarifying the duties and responsibilities and also required standard of performance to reduce the amount of persistent pressure on employees. Similarly, flexibility in terms of the arrangement of how tasks are carried out based on urgency and importance can aid in managing tough time limits, workload and also performing challenging tasks. The job design should be suitable relative to the employees' skills and resources, extent of work control and managerial support (Leka, Griffiths, & Cox, 2003).

 In addition, systemic modifications must be introduced such as restructuring systems/ techniques so as to achieve role clarity, re-distribution of resources, analysis of training requirements, and the explanation of daily functions and support functions to avoid role uncertainty which may have occurred because of crossing one's dominions in the organization. Future research must take into account other service professions where different levels of self-efficacy may be probable. Also, certain conditions may be set as an experiment to evaluate the level of work self-efficacy such as difficulty in use of certain technology in everyday tasks.

7. Conclusion

As teachers constantly strive to become more professionally qualified, perform their daily tasks and make effort to produce quality graduates; they are likely to become exhausted at some point. Also, the job of teachers is not only restricted to imparting education, but also to act as mentors, leaders and counselors for students. In Pakistan unfortunately, few teachers have been celebrated as inspiring so as to bring the education sector at par with the international standards. Although HEC, Pakistan, has implemented some tough policies in the last few years aimed at improving the faculty members' qualification, however, policies targeted at the emotional and mental health of teachers as a result is still required. The reason is that such policies add to the already challenging job of the academicians and their job responsibilities; hence it is imperative to gauge their health as well.

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Impact of Psychological Contract on Employee Retention mediated by Organizational Trust

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Abstract

In recent years, organizations recognize the significance of their human capital as it is a source of various advantages. For this purpose companies hunt for reducing turnovers and bolstering employee retention that has become an important challenge. Loyal and trustful employer/employee alliance will help organizations to retain their potentially skilled employees. The Psychological contract fortifies this employment relationship. The basic aim of current study is to explore certain employer inducements under psychological contract and analyze their impact on employee retention with the mediating impact of organizational trust. Multiple regression, correlation analysis and sobel test was used to test the postulates through a survey using questionnaires in banking sector of Pakistan.Findings show that psychological contract dimensions have a significant connection with retention; in addition, organizational trust significantly mediates between professional growth, monetary rewards and stability, work-family and retention. This study attempts to help organizations to keep productive employees through various strategies like building trustful relationship and providing incentives like career opportunities, flexible job content, financial incentives, corporative social environment, work-life balance etc. to satisfy their expectations and in return getting quality work performance to bring organizational success.

Keywords: Psychological contract, employee retention, organizational trust

1. Introduction:

Banking sector of Pakistan is progressing rapidly via technological mediations, client's legacy and intense rivalry. Their prime concern is to promote client satisfaction thereby enhancing their revenues (Amin &Mustaghis, 2013). Diminish motivation of banking employees influence the customer and bank relationship, in turn lowering their profits (Abdul et al., 2014). Thus, retaining their human capital is on the top of the list, more importantly the ones who are contributing towards accomplishing the company objectives and guarantee their long term market sustainability (Coulan& Thomas, 2012; Gay &Simz, 2009; Lawler 2015).Pertaining to this, HR personnel's are probing ways to better understand the attitudes of employees and investing time and money to concoct several occasions like retention,predominantly in retail banking (Goyal& Joshi, 2012; Perrine 2005).

Along with other HR practices, psychological contract is an essential element to supports the livelihood of working relationship (Rousseau, 2004; Robert & Johnson, 2012).Fundamentally, the Psychological contract constitutes an unwritten agreement or individual's convictions, molded by the company regarding the trade or reciprocity between the association and employees in light of commonly acknowledged commitments (Beardwell et al., 2004; Guest and Conway, 2002).

Therefore, this study will analyze certain psychological contract dimensions in terms of employer contributions to inspect workers end results. Such crucial components under examination are career advancement chances, job content, social atmosphere, financial rewards and work-life balance and to study their impact on retaining productive workforce. This study endeavored to grow the body of knowledge on psychological contract and retention by setting up the possible mediating link of organizational trust to the serenity of international researchers. Thus, results of this research study assist banks in recognizing the effective factors of psychological contract for employee retention.

2. Literature Review:

2.1. Psychological contract dimensions and employee retention

Psychological contract is the main focus of some specialists for a long compass. PC has been characterized by Schein (1978) and Rousseau (1989) as an arrangement of unwritten complementary desires and a shared relation between a representative and the association.On the other hand, employee retention is holding representatives, especially proficient specialists (Mustapha et al., 2011; Shaw et al., 2005).ER portrayed as a procedure in which the workers are urged to stay with the company for the most extreme timeframe (Bidisha, 2013; Mita, 2014; Zineldin, 2000). This study examines the necessary employer provocations to analyze their impact on employee retention. Studies had investigated the positive effect of workers advancement programs on holding worker and employment fulfillment(Shelton, 2001; Sobia et al., 2013).Similarly, Shani and Divyapriya (2013) led a study on the relationship between knowledge administration and vocation improvement among IT experts, to keep skilled representatives. Likewise, research investigated that there was huge positive relationship between trainings and compelling responsibility (Agolla, 2009; Anis et al., 2010) and critical negative linkage between viable duties with representative turnover (Ashar et al.,2013).

Moreover, flexible job content is fundamental for holding workers of any age (Boomer Authority, 2009). Enhancements in work assignments for workers and nature of supervision may diminish turnover and retain employees (Choi &Sneed, 2006; Mobley et al., 1979).Similarly, the accurate fit among the job description, the position and abilities of the person helped companies to lower turnovers and gained retentions (Capko, 2001). Social combination implies the presence social connections at work. Social bolsters (passionate, enlightening, self-evaluation, instrumental, pragmatic) help to create employee commitment thus reducing the chances of turnovers (Walton, 1974).Another study predicted a significant connection between quality of social environment at work and job satisfaction, decreasing the intention of nurses to leave (Estryn-Behar et al., 2007; Hayhurst et al., 2005).Studiesreferred WLB as the day by day administration and depicted it as when an individual life clearly isolates and into two detectable circles that is work and life (Darcy et al., 2012; Mordi&Ojo, 2011; Nwagbara&Akanji, 2012; Karthik, 2013). *Kenexa Research Institute* in 2007 demonstrates that associations bolstering work-life adjust additionally leads to a much lower expectation of workers to leave (Lazar et al., 2010). Furthermore, creative work-life adjust rehearses permits associations to improve their reputation, therebypulling in and retaining staff hence, WLB significantly eradicated turnovers leading to retention (Jnaneswar, 2016; Rashid et al., 2013).

The major theory is that cash impacts representative conduct through molding their states of mind (Parker and Wright, 2001).Money related prizesincluded execution rewards, sensible pay rates, and compensation for rare abilities that help to draw and retain workforce (Parker and Wright, 2001). Research confirms that motivational variables that are critical in retaining workers are money related prizes, work attributes, and acknowledgment, administration and work-life adjust (Benjamin & Ahmad, 2012; Lockwood & Walton, 2008). As per Teseema and Soeters (2006) there is a positive connection between remuneration practices and keeping workers.A case of this, in a

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study by Horwitz et al (2008) found that the most effective technique for retaining employees reported by HR supervisors of information firms was still identified with remuneration. In another investigation of medical attendants led by Pillay (2009), it was distinguished that money related and non-fiscal prizes are critical so as to raise retention of representative. Similarly, the study of Farris (2000) and Ruvimbo and Ngirande (2014) revealed the positive association of financial rewards and retention.

2.2. Organizational Trust as mediator

Cummings and Bromiley (1996) characterize hierarchical trust as a person's conviction that other person will try to keep responsibilities, be straightforward, and not exploit of another. Hierarchical trust is reflected by how much representatives confide in their association and its pioneers (Kim &Mauborgne 1998). Similarly, Cohen and Dienhart (2013) declared trust as a key conduct that includes hazard and powerlessness. OT incorporates practices of consistency, generosity, and respectability (Greenwood & Van Buren, 2010). Trust has long been thought to be a basic segment of any effective relationship. Organizations can undertake various practices to attain and manage trust like being clear with individuals about what is anticipated from them, and afterward obviously recognizing when desires have been met. A decent administrator can be steady while leaving space for essential hierarchical adaptability to gain trust (Zemke, 2000).

Authors recommends that trust in bosses is identified with employment execution, unselfishness, work fulfillment, interactional equity, procedural equity, and participative choice making whereas trust in hierarchical authority is specifically identified with authoritative responsibility.In an authoritative setting, trust is an imperative worry in numerous sorts of connections including connections between collaborators, between a worker and his or her boss, and in the middle of representatives and top administration. In addition, research examine that OT significantly mediates between organizational justice and employee retention; (Marium& Omer, 2014) and talent management and employee retention; (Ali &HamidReza, 2014) and ethical leadership and perceptions of employee justice (Angela et al., 2014).

2.3. Organizational trust and employee retention

Mishra and Morrissey (1990) discovered four key parts in the advancement of trust: open correspondence, giving workers more choice making capacities, dispersal of basic data, and genuine sharing of discernments and emotions. Past examination has demonstrated a significant relationship of trust and representative turnover (Batchelor, 2013; Davis et al., 2000). In addition, workers' discernments about their association's corporate social obligation were absolutely identified with hierarchical trust (Hansen et al., 2011). Hence, trust appeared to be absolutely identified with occupation fulfillment, work engagement, and individual execution, commitment and diminished turnover expectations (Davis et al., 2000; Fruend, 2014; Fabian et al., 2014; Velez & Strom, 2012). There is a formal connection between administration trust, holding employees and business execution (*www.firstconcepts.com).*In addition, Altrnaz et al (2013) considered impact of ability administration on hierarchical trust in Ankara inns and uncovered positive retention in the association.Another study explored that workplaces that cultivated trust will build the level of mental proprietorship that workers accomplished and further diminish workers' expectation to leave their work environment (Olcker&Enslin, 2016).

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2.4. Conceptual Framework:
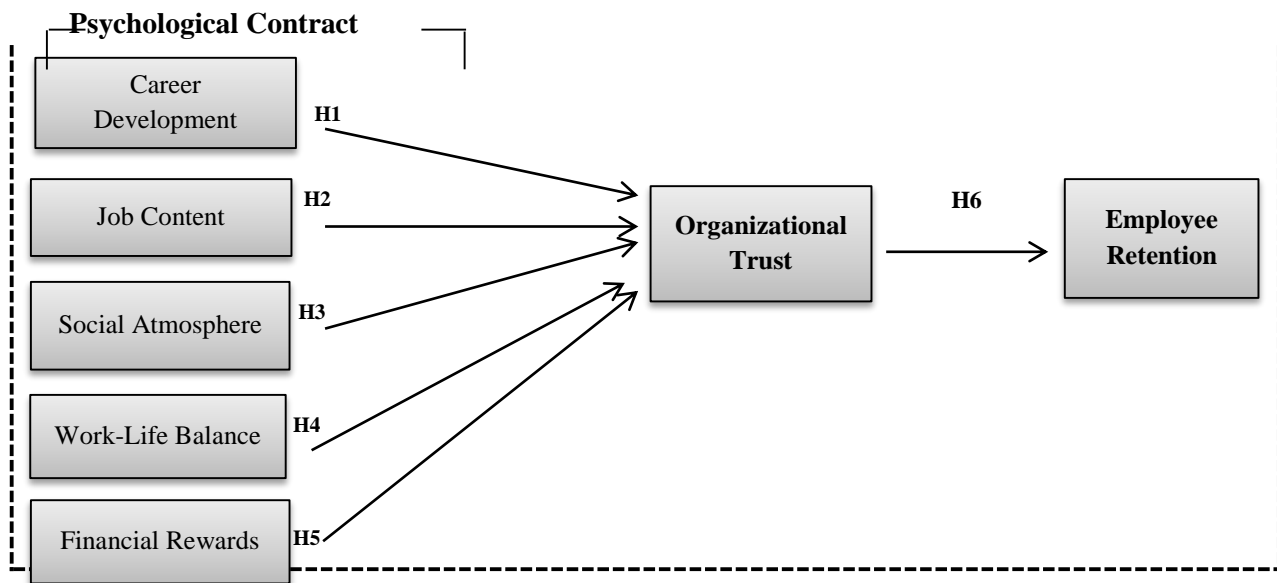
Figure 1: conceptual framework for research

2.3.1 Research Hypothesis:

On the bases of this proposed model, following hypothesis are made:

H1:*There is a significant and positive relationship between career development andorganizational trust.*

H2:*job content and organizational trust is positively and significantly linked to each other.*

H3: *There is a positive and significant relationship between social atmosphere and organizational trust.*

H4:*Asignificant and positive association is present between financial rewards and organizational trust.*

H5: *The relationship between work-life balance and organizational trust is positive and significant.*

H6:*There is a significant positive relationship between organizational trust and employee retention.*

H7: *Organizational trust significantly mediates between career development and employee retention.*

H8: *Organizational trust significantly mediates between job content and Employee retention.*

H9: *Organizational trust significantly mediates between social atmosphere and Employee retention.*

H10: *Organizational trust significantly mediates between financial rewards and Employee retention.*

H11: *Organizational trust significantly mediates between work-life balance and Employee retention.*

3. Research Methodology:

This is a quantitative study using cross sectional data and convenience sampling technique was used to define the sample frame which includes banks in WahCantt, Islamabad and Rawalpindi for

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primary data collection. Total 200 questionnaires returned for analysis. Research instrument used was a questionnaire approach to collect relevant data from selected sample. There were total 28 questions,elements of psychological contract practices(career development, job content, social atmosphere, financial rewards and work-life balance) scale were adapted from the study of Vos et al., (2003),employee retention (Mbugua et al., 2015) and organizational trustscale was developed from Tammy A. Boe (2002).

4. Data Analysis and Findings:

According to the frequency distribution, this study included 123 respondents from private banks which constitute 71% and 49 participants were from public banking sector which comprises 28% whereas none of the respondent was from semi-government sector. Moreover, 53% respondents were middle level employees, 26.7% were junior level employees and 20% participants were at senior management level. Mostly respondents were male which constituted 79.7%, others 20% were female participants whereas 66 respondents were from age 30-40, 56 were from 20-30 ages, 39 participants were between 40-50 aged groups and 11 respondents age were from 50-60. Moreover, Cronbach's alpha of career development, social atmosphere, financial rewards, work-life balance, organizational trust and employee retention are 0.713, 0.853, 0.820, 0.889, 0.824 and 0.815 respectively which are relatively high internal consistency except job content which is 0.574.

4.1. Correlation Analysis:

Correlation between PC elements career development, job content, social atmosphere, financial rewards, work-life balance and employee retention are 0.611, 0.582, 0.547, 0.573 and 0.595 respectively which shows the moderate positive relationship prevails between independent variablesand dependent variables but either this relationship is significant or not, we can see this from regression analysis.

Table 3: *Correlation among variables (N=172)*

	CD	JC		SA	FR	WLB	OT	ER
CD	1							
JC	0.544**	1						
SA	0.482**	0.610**		1				
FR	0.561**	0.681**		0.581**	1			
WLB	0.420**	0.601**		0.654**	0.489**	1		
OT	0.532**	0.583**		0.583**	0.581**	0.669**	1	
ER	0.611**	0.582**		0.547**	0.573**	0.595**	0.743**	1
	**Correlation is significant at the 0.01 level (2 tailed)							

4.2. Multiple Regression analysis for mediation:

In the first place, ER (dependent variable) regressed by IVs (CD, JC, SA, FR & WLB) predicate variable. The R_2implies 54% variation displayed in ER with F-value 39.570. Moreover, β values of CD, FR and WLB 0.379, 0.146 and 0.217 respectivelywith p-values less than the chosen level of significance hence these models were significant. Further, β value for JC and SA was 0.099 and 0.049 along with p-values more than chosen significance level as shown in table 4 therefore these models were not significant. After this, mediated variable i.e. OT was relapses by IVs (CD, JC, SA, FR& WLB). Result showed that 56% variation in DV (OT) caused by IVs and f-value was 42.966 which presented a good wellness of this model. Firstly, forCD, FR and WLBβ values were 0.208, 0.181 and 0.301 along with p-value 0.006, 0.11 and 0.000 respectively which are less than 0.05 hence these models were significant so these models were overall significant thus H1, H4 and H5

were accepted. Similarly, β values of JC and SA were 0.061, 0.071 with p values 0.479 and 0.304 respectively but these p values were greater than0.05 thus these model were not significant hence H2 and H3 were rejected.Then, ER, dependent variable was subsided by OT (mediator variable). Result exhibited that β and p-value were 0.754and 0.000 which was less than chosen level of significance therefore this model was significant. Further, 55% variation happened in ER due to OT with F-value 209.184 that portrayed good fitness of the model which was also proved by the t value more than 1.96 so H6 is accepted. Finally, ER (dependent variable) was regressed hierarchlyby predicate variables (i.e. CD, JC, SA, FR, WLB and OT) showing 63.5% of variation explained in ER caused by predicate variables.In addition F-value showed overall goodness of this model by 47.866. Result explained that βvalues were reduced for CD, FR & WLB and becomeinsignificant which means there was mediation by OT. Hence H7, H10 and H11 were accepted. Moreover, For JC and SA, values of β weredecreased but as the relationship of FC with OT and SA with OT was insignificant thus mediation of OT did not exist so H8 and H9 were rejected. Similar is the case with SA, β was decreases to 0.016 with t-value 0.255 and p-value 0.799 but

Table no 4: *Multiple Regression Analysis Summary for Mediation*

Steps	Descriptions		β	t-value	p-value
1	CD	ER →	0.379	4.900	0.000
	JC	ER →	0.099	1.111	0.268
	SA	ER →	0.049	0.691	0.491
	FR	ER →	0.146	1.983	0.049
	WLB	ER →	0.217	3.981	0.000
2	CD	OT →	0.208	2.786	0.006
	JC	OT →	0.061	0.709	0.479
	SA	OT →	0.071	1.030	0.304
	FR	OT →	0.181	2.558	0.11
	WLB	OT →	0.301	5.739	0.000
3	OT	ER →	0.754	14.463	0.000
4	CD,OT	ER →	0.283	3.981	0.350
	JC, OT	ER →	0.70	0.884	0.378
	SA, OTER	→	0.016	0.255	0.799
	FR, OTER	→	0.062	0.917	0.360
	WLB, OT	ER →	0.077	1.439	0.152

Note: t>1.96; p<0.05

4.3. Sobel Test:

Sobel test was conducted at *http://quantpsy.org/sobel/sobel*to prove the mediation of organizational trust. The sobel test value for organizational trust mediating between CD and ER was 2.759along with p-value 0.0058 which was less than 0.05 thus mediation was proved here. Similarly, Organizational trust mediating between FR & ER and SA & ER showed sobel test values as 0.717with p-value 0.474 and 1.026 along with p-value 0.305 respectively thus mediation is not present here as p-value is more than 0.05. Moreover, sobel test value for OT mediating among FR and ER was 2.5107 and p-value 0.012 which is smaller than 0.05 hence mediation was proved here as well. Furthermore, Sobel test value for OT mediating between WLB and ER was 5.376 along with p-value less than 0.05 so mediation was confirmed again.

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5. Conclusion and managerial implications

Pertaining to the results of present study it is important for the management to build trust factor via some strong contributions with correctly satisfy the expectations of their employees in context of the contract which give rise to loyalty and commitment thus diminishing employee retention. Realizing the importance of this study, managers can utilize this for practical implications. Managers should properly align the human capital to organizational success via basic psychological contract practices that is career advancements, flexible job design, rewards to evoke trust, commitment. Management can outline vocation programs in a manner that build the professional fulfillment and advance workplace among representatives in Pakistan.Dominant part of workers were in support with respect to tutoring, guiding and drilling career projects as they lead to favorable employer-employee relationship. Further, reward systems based on realistic appraisals must be utilized to reinforce motivation among employee which results in employee retention. Managers can provide control to employees over working schedules, connections with boss and authoritative responsibilities which can decrease work-life strife, diminish truancy, reduced turnover, eliminate work anxieties, enhance performance and expandprofitability. Most importantly, managers at banks should promote fair treatment their employee to build trust between employee and employer. For this purpose the management can give potential training to supervisors regarding honest endorsements of subordinates as trust is a precursor to positive employee attitudes towards the organization.

5.1. Future areas of research

The results of this research can only be generalized to banking sector so in future the same study can be conducted over other sectors of Pakistan. The study focus on only certain factors of employer contributions under psychological contract so other practices i.e. employee participation,supervisory support, communication channels, safety& security and recognitions etc. can be investigated. In addition, researchers can undertake this issue via longitudinal study approach to conclude inferences. Furthermore, the same study can be conducted separately in public and private banks to draw comparisons.

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Determinants of Employee Retention: A Comparative Analysis of Higher Education Institutes Peshawar

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Abstract

The objective of this study was to investigate the impact of retention factors in public and private sector institutes. It identifies the factors which are effective in retention in private/public universities in Peshawar. The universities which are selected for study are CUSIT and IMS, UOP.The study targeted the faculty members of the higher education institutions (universities) by convenient sampling technique. Questionnaires were used to collect responses; 200 questionnaires were floated to the faculty members of one public and one private university. Out of 200 questionnaires, 100 responses were received. Results are varied in both sectors but some major identified employee retention factors are – Compensation, Training and development, Supervisor support which are positively correlated. Effective retention measures can bring positive results to enhance commitment of employees and ultimate towards their organizations.

Key Words: Employee Retention, Compensation, Training and development, Supervisor support, Job Characteristics, Work-life policies

1. Introduction

Not that long ago, companies were competing to find and keep great employees. The fierceness of competition in the job market was reflected in numerous reports of hefty signing bonuses and generous stock option packages for non-management hires. With the slowing economy, however, recruiting and hiring top talent moved down in the list of most organization's priorities, and there was a growing feeling of satisfaction about keeping or retaining current employees of the organization. Brannik(2001) The professional environment has taken a paradigm shift from labor intensive environment to automated information society. The professionals are a lot more educated and skilled than it used to be a few decades back that has caused significant decrease in the organizational loyalty. This has created problems for companies to retain skilled technological employees. Studies show that high technology domains employee tend to work on projects that can augment their knowledge and skills which can help them further in their career success. Employee retention is an important issue that poses a significant challenge for organizations. Since human capital is central to an organization's performance, workforce attrition can have a profound impact on an organization's performance, growth and general business outcomes. Some of the major trends of the past decade include: new individual difference predictions of turnover (e.g., personality, motivating forces), increased emphasis on contextual variables with an emphasis on interpersonal relationships (e.g., leader–member exchange, interpersonal citizenship behaviors), enhanced focus on factors looking specifically at staying (e.g., organizational commitment) and dynamic turnover processes with the consideration of time (e.g., changes in job satisfaction).

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So, now for remaining in this competitive market employers have much more concern now to retain their skilled employees to gain a competitive edge in the market and thus improve the organizational productivity and goal attainments. Employee retention is one of the keys to maximize the profits and gains of an organization. This can be done by providing employee with job satisfaction, Compensation/Reward, flexi organizational culture, Career growth opportunities, Supervisor support, Work-Life Balance, human resource training and development strategy to improve their skills and performance levels.

2. Literature Review

2.1 Dockel et al Model:

DÖCKEL, BASSON, COETZEE (2006) The most relevant explanatory factors of employee retention were Compensation, Job Characteristics, Training and Development, Supervisor Support, Career Opportunities, and Work Life Balance.

Gardner et al., (2000) were of the view that salary is considered as a motivator as well as employee retention technique. Milkovich& Newman (1996) have clearly stated that among all types of reward,monetary pay is considered one of the most important and significant factor in employees' retention. In a research by Moncraz, Zhao & Kay (2009) it was concluded that although compensation was not one of the top factors influencing non-management turnover but compensation can act as a critical factor in reducing managerial turnover and increasing commitment to the organization.

2.2 Reward and Recognition and Employee Retention

Walker (2001), recognition from bosses, team members, co-workers and customer enhance loyalty of the employees. "Watson Wyatt" a global consulting firm, conducted a survey in USA, in the year 2002 among 12,750 employees at all levels of job and in all major industry sectors to know about their attitudes toward their workplace and their employers. It was found in the survey that the recognition is important for workers and they want to listen that their work is recognized and appreciated. Silbert (2005) forwarded the view that reward is important because it has an enduring impression on employees which, in-turn gives the employees an impression of importance that they are valued in the organization. Based on the above literature, the first hypothesis of the study is as follows:

H₁: Rewards/Compensation significantly affects Employee Retention.

2.3 Job characteristics and Employee Retention

Shoiab, Noor, Tirmizi& Bashir (2009) recommended technologically skilled employees tend to do work they find interesting and that challenges them to use their unique skills and talents. Repetitive work experiences strongly repel high technology workers and make them quit their jobs earlier than usual.Based on the above, the second hypothesis of the study is as follows:

H₂: Job Characteristics significantly affects Employee Retention.

2.4 Work-Life policies and Employee Retention

Work-life balance is increasingly important for engagement and affects retaining employees. Hyman et al., (2003) in their empirical research in the UK found that interventions of work demands into the personal life (e.g. working during the weekend) resulted into higher stress and emotional

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exhaustion among employees. In a study conducted by the Australian Telework Advisory Committee (2006) it was found that 70% of businesses that incorporated telework options reported a number of positive benefits, such as increased business productivity and reduced costs, improved employee flexibility and work life balance and increase number of employees participation. The third hypothesis of the study is as follows:

H₃: Work-Life Balance has significant impact on Employee Retention

2.5 Opportunity for Growth

Pergamit&Veum (1989) in their study found a close and positive correlation between promotions and job satisfaction and which in turn helps in retention of employees. Research by Meyer et al, (2001) has shown internal career development of employees is often the best predictor of an employee's effective commitment towards organization. Prince (2005) argued that talented employees are required for maintaining a competitive advantage and employees want career growth opportunities to develop and get success in their professional lives. Such plans include advancement plans, internal promotions and accurate career previews at the time of hiring of employees. Eysteretal (2008) state that job flexibility along with worthwhile career and life opportunities is a critical incentive for the employees. The forth hypothesis of the study is as follows:

H₄: Career Opportunities have significant impact on Employee Retention

2.6 Training & Development and Employee Retention

Messmer (2000) found that one of the key factors in employee retention is investment on employee training and career development. Organization always invests in the form of training and development on those workers from whom they expect to return and give beneficial outputs on its investment. Tomlinson (2002) forwarded the view that organizations can keep the leading edge in this competitive world by having their employees well trained in the newly upgraded technologies. Garg & Rastogi (2006) explained that in today's competitive environment feedback is very essential for organizations from their employees and the more knowledge the employee learn, the more he/she will perform and meet the globalization challenges of the market place. Thus, knowledge is the most expensive asset of a firm. The fifth hypothesis of the study is as follows:

H₅: Training and Development have significant impact on Employee Retention.

2.7 Supervisor Support and Employee Retention

PerSilbert (2005), well skilled and talented employees may easily find good job, position and workplace elsewhere however the effective way for retention this talented workforce is to enhance friendly and close working environment and to promote leader support. Freyermuth (2007) recommended that organization must groom leader to support the employees and to well build the work environment where they want to stay. Providing opportunities test their abilities and providing level of performance can enhance employees' capabilities and want to stay in the organization. The sixth hypothesis of the study is as follows:

H₆: Supervisor Support has significant impact on Employee Retention

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3. Theoretical Framework

The following is the theoretical structure of the study
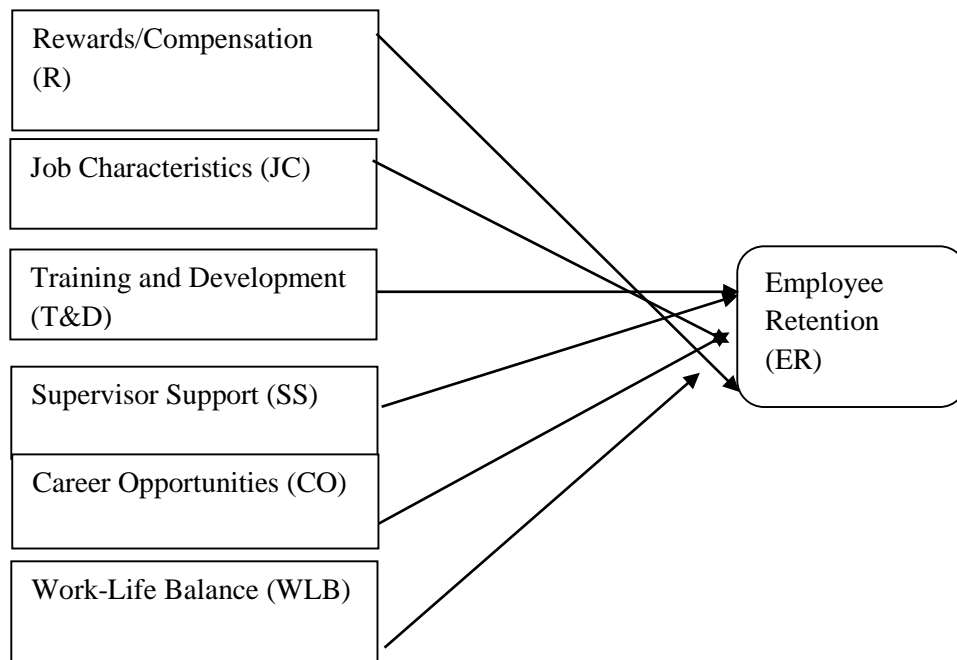
4. Methodology

This research study was based on qualitative research technique. Primary data was used in this study. The population of this study includes the employees of CUSIT and IMS, UOP operating in Peshawar city. Random convenient sampling technique was used in the conduct of present research. The sample size was 200 but 50 responses are collected from each university.

A research questionnaire has been used to examine the determinants of employee retention factors in IMS, UOP and CUSIT. For this measurement, five point Likert scale ranging from strongly disagree (1) to strongly agree (5) has been used. The survey questionnaire contains 45 close ended items in all. Retention factor measurement scale containing 45 items, adopted from Dockel (2003) is used for six independent variables; Compensation (6 items), Job Characteristics (5 items), Training and Development (6 items), Supervisor Support (6 items), Career Opportunities (5 items), Work-Life Balance (6 items) and employee retention (11 items).

The statistical tools used to analyze the collected data are descriptive statistics, reliability test, correlation and multiple regressions. The data was entered in SPSS 17.0 software to ensure proper entry.

5. Data Analysis and Result

5.1 Reliability test of the data

Inter items reliability or Cronbach's alpha coefficients of six independent, three moderating and one dependent variable are estimated, and provided in table 4.1

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Table: 1

VARIABLES	SUB-VARIABLES	NO OF ITEMS	RELIABILITY COEFFICIENT (α)	SOURCE
Employees' Retention Factors	Compensation	6	0.761	**Dockel (2003)**
	Job Characteristics	5	0.848	
	Training and Development	6	0.898	
	Supervisor Support	6	0.775	
	Career Opportunity	5	0.747	
	Work-Life Balance	6	0.832	
	Employee Retention	11	0.784	

Per table 1 our Cronbach's alpha (α) estimation variable Compensation is measured through 6 items with α = 0.761, Job Characteristics through 5 items, with α = 0.848, Training and Development through 6 items, with α = 0.898, Supervisor Support through 4 items, with α = 0.775, Career Opportunity through 5 items, with α = 0.747, Work-Life Balance through 6 items, with α = 0.832, Employee Retention through 11 items, with α = 0.784

5.2 Correlations

CUSIT

Table 2

Correlations		Compensation	Job_Characteristics	TND	Supervisor_Support	Career_Opportunities	WL_Balance	Employee_Retention
Compensation	Pearson Correlation	1	.408**	.485**	.135	.360*	.217	.709**
	Sig. (2-tailed)		.003	.000	.351	.010	.130	.000
	N		50	50	50	50	50	50
Job_Characteristics	Pearson Correlation		1	.221	-.127	.166	-.320*	.550**
	Sig. (2-tailed)			.123	.378	.250	.024	.000
	N			50	50	50	50	50
TND	Pearson Correlation			1	-.323*	.858**	.220	.526**
	Sig. (2-tailed)				.022	.000	.125	.000
	N				50	50	50	50
Supervisor_Support	Pearson Correlation				1	-.184	.006	-.154
	Sig. (2-tailed)					.201	.968	.286
	N					50	50	50
Career_Opportunities	Pearson Correlation					1	.045	.336*
	Sig. (2-tailed)						.758	.017
	N						50	50
WL_Balance	Pearson Correlation						1	.125
	Sig. (2-tailed)							.387
	N							50
Employee_Retention	Pearson Correlation							1
	Sig. (2-tailed)							
	N							

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Table 2 represents the correlations of variables in CUSIT.As far as retention factors are concerned, all variables are weakly correlated with each other. It means inter correlation is weak among all independent variables(Compensation, Job Characteristics, Training and Development, Supervisor Support, Career Opportunities, and Work Life Balance) but correlation between the Dependent Variable/ Employee Retention and Independent Variables/Compensation is strong.

Table: 3
IMS, UOP

Correlations		campensation	job_characteristics	Traning_and_Development	supervisor_support	carrer_opportunity	work_life_balance	employee_retention
campensation	Pearson Correlation	1	.697**	.806**	-.254	.670**	-.154	-.341*
	Sig. (2-tailed)		.000	.000	.075	.000	.284	.015
	N		50	50	50	50	50	50
job_characteristics	Pearson Correlation		1	.658**	.094	.506**	.233	.021
	Sig. (2-tailed)			.000	.517	.000	.103	.887
	N			50	50	50	50	50
Traning_and_Development	Pearson Correlation			1	-.251	.764**	-.047	-.220
	Sig. (2-tailed)				.079	.000	.745	.124
	N				50	50	50	50
supervisor_support	Pearson Correlation				1	.136	.331*	.667**
	Sig. (2-tailed)					.347	.019	.000
	N					50	50	50
carrer_opportunity	Pearson Correlation					1	.160	.125
	Sig. (2-tailed)						.266	.387
	N						50	50
work_life_balance	Pearson Correlation						1	.735**
	Sig. (2-tailed)							.000
	N							50
employee_retention	Pearson Correlation							1
	Sig. (2-tailed)							
	N							

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 represents the correlations of variables in IMS. As far as Retention factors (Compensation, Job Characteristics, Training and Development, Supervisor Support, Career Opportunities, and Work Life Balance) are concerned, all variables are weakly correlated with each other but Employee Retention and Independent Variables is strong in case of IMS, UOP.

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Table: 4
IMS, UOP
ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3.849	6	.641	24.829	.000[b]
	Residual	1.111	43	.026		
	Total	4.959	49			

a. Dependent Variable: employee_retention

b. Predictors: (Constant), work_life_balance, Traning_and_Development, supervisor_support, job_characteristics, carrer_opportunity, campensation

This table 4 indicates that the regression model predicts the outcome variable significantly well. Here, Sig value is 0.000 (p> 0.05) and indicates that; overall, the model applied is significantly good enough in predicting the outcome variables and model is significant at 1% level of significance

Table: 5 CUSIT ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	7.584	6	1.264	13.813	.000[b]
	Residual	3.935	43	.092		
	Total	11.518	49			

a. Dependent Variable: Employee_Retention

b. Predictors: (Constant), WL_Balance, Supervisor_Support, Career_Opportunities, Job_Characteristics, Compensation, TND

This table 5 indicates that the regression model predicts the outcome variable significantly well.Here, Sig value is 0.000 (p> 0.05) and indicates that; overall, the model applied is significantly good at 1% level of significance.

Table: 6 IMS, UOP Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	1.506	.257		5.856	.000
	Compensation	-.091	.096	-.157	-.946	.349
	Job_Characteristics	-.086	.089	-.139	-.971	.337
	Traning_and_Development	.029	.083	.062	.352	.727
	Supervisor_Support	.306	.073	.450	4.206	.000
	Carrer_Opportunity	.071	.115	.099	.620	.539
	Work_Life_Balance	.350	.056	.581	6.270	.000

a. Dependent Variable: Employee_Retention

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The table:6 shows "Unstandardized Coefficients column" shows two statistics which are the regression coefficient B and the standard error. The table shows Constant=1.506 and t-value=5.856, if we assume that all the independent variables are zero then the Employee Retention will be constant and that is 1.506. The table shows t-statistics and the significance or p-value for all variables. The results show statistically significant influence of T&D, CO,SS and WLB on Employee Retention where else all other variables show insignificant effect.

Table: 7 CUSIT
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.448	.695		2.085	.043
	Compensation	.355	.092	.486	3.867	.000
	Job_Characteristics	.372	.137	.308	2.705	.010
	TND	.188	.106	.393	1.778	.082
	Supervisor_Support	-.047	.051	-.099	-.927	.359
	Career_Opportunities	-.168	.130	-.247	-1.299	.201
	WL_Balance	.043	.108	.043	.393	.696

a. Dependent Variable: Employee_Retention

The table 7 shows "Unstandardized Coefficients column" shows two statistics which are the regression coefficient B and the standard error. The table shows Constant=1.448 when if we assume that all independent variables are zero then the Employee Retention will be constant and that is 1.448

The table shows the significant influence of C, JC, T&D on Employee Retention while all other variables have insignificant effect.

6. Discussion

This study was aimed to investigate the retention factors in private and public sector universities in Peshawar, Pakistan. By going along with the trend in the literature reviewed, this study opted for the most commonly used retention factors by researchers and professionals; these are: compensation, job characteristics, training and development, supervisor support, career opportunities and work-life balance.

The study has shown important findings in public sector institute i.e.: IMS, UOP. Per the results, Supervisor Support and Work-Life Balance have turned out to be exerting positive and significant impacts on Employees Retention, while Compensation and Job Characteristics have shown negative impact and Training and Development & Career Opportunities shows insignificant impact. So, we accept H_3 and H_6 while reject others.

The study has shown important findings in private sector institute i.e.: CUSIT. Per the results, Compensation, Job Characteristics and Training & Development have turned out to be exerting positive and significant impacts on Employees Retention, while and Supervisor Support and Career Opportunity have shown negative but significant effects and Work-Life Balance insignificant impact. So we accept H_1 ,H_2 and H_5 and reject others.

7. Conclusion

This study discovered three important retention factors; Compensation, Job Characteristics and Training & development are contributing to retain the faculty member's in private sector university while Supervisor Support and Work-Life Balance has significant impact on employee retention in public sector university hence proved that if all these factors can be taken under considerations and applied in institutes then retention of employees can be done. In conclusion, this research presents solutions to some of the issues regarding retention of faculty members of Higher Education Institutions of Peshawar, Pakistan. Others are encouraged to examine these and other retention factors and commitment constructs both theoretically and empirically.

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Impact of Human Resource Management Practices on Employees Job Satisfaction

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Abstract

Since last five decades a number of studies have been done on the area of Human Resource Management frequently. The impact of human resource management practices on employee's job satisfaction has also been judged for several times in many countries and organizations of the world. The existing literature depicts that there is significant relationship between human resource management practices and employees job satisfaction. This study is designed to investigate the effect of three major Human Resource Management practices (Employee Recruitment & Selection, Employee Training & Development and Employee compensation & benefits system) impact on Employee's job satisfaction in Pakistani context. Study analysis has been made over the thoughts of 73 respondents of two various manufacturing companies employees. The study affirms the previous literature and is beneficial and applicable to multiple other organizations too.

Keywords: Recruitment & Selection, T&D, Compensation & Benefits system and Employee Job Satisfaction.

Introduction

Organizations must adjust to variety of human resource management practices (HRMPs) to attain their key objectives. A company's HRMPs must create employee's knowledge, skills, and inspiration and should carry on previously, routes that ought to make executed (Dessler, 2007). The Harvard model (Beer et al. 1984) meets expectations concerning Concept and these are a key guide on aide all supervisors on their relations for workers and condensed on the human or delicate perspective about HRM. It strives toward worker promise which is not control. It meets expectations that employees required will make congruent, skillful and cosset compelling.
 "The process of impelling, hiring, modernizing and retaining human resources to achieve ultimate organizational goals is said to be Human Resource Management" (Ahmad et al. 2016a). HRMPs are vital aspect in influencing employee loyalty and their commitment to be retained with a firm" (Ahmad et al, 2016b). It holds that HRM methodologies similar to differentiation, innovation, the concentrate on personal satisfaction and cosset decrease will prompt practices in preferred training, appraisal, selection, rewards, employment designs, involvement, and security prompting that's only the tip of the iceberg caliber outcomes; promise and adaptability. It will then influence performance in that gainfulness will increase; development will a chance to be attained and in addition set absences, work turnover, and clash alternately client objections.

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Academicians, researchers, policymakers, practitioners, students, nearby and outside business and other creating nations might profit starting with this contemplate and exploring those affiliations between HR practices and job satisfaction. The investigation might expand those contemporary explorations and act of human resource management. And, it might additionally make advantageous for the created nations likewise they figure out creating nations likewise alluring spots for investment because of their extensive markets, and Shabby and gifted workforces (Budhwar and Debrah 2001). This study focuseson seeing in regards the effect of HRM practices looking into employee's job satisfaction and commitment "around Pakistani workers.

Job satisfaction is a subject about totally enthusiasm both individuals who partake energizes organizations and individuals who contemplate them (Omer, 2010). Organization and their chief tries their level best to make surroundings for those employees clinched alongside whom they feel satisfaction. This satisfaction of employee's previously, organization will be significant to performance and national training framework that extreme Frisbee impact with respect to national development. (Hackman & Lawler, 1971). So it is paramount with comprehend their conduct technique and disposition will aggravate them fulfill and build duty level.

There are a number of factors that impact satisfaction of the employees both in formed and creating nations. Analyst need analyzed this relationship of satisfaction between with pay, promotion, border benefits, working condition, help for research, disappointments and outrage

HRM Previously, some organizations concentrate once mankind's money improvement and supporters the HR planning, performance management and recruitment And Selection of workers (Cooke, 1992). Work-unit chiefs need aid this imperviousness assuming that workers need to transform employments and worth of effort.

Anyway HR in actuality profits the organization and other offices from claiming organization. There will be sorted out authoritative structure for fitting pays, correct grading, profits plans, development arrangements and employee compensation and so forth throughout this way, observing and stock arrangement of all instrumentation may be enhance. The mindfulness around employees, departments, Main management, owners and supervisors may be required in regards to HR. Those HR division need will manage those HR operational assignments for example, such that recruitment, selection, training, evaluations, increments, detachment and so forth. Those organizations are additionally in an organization to Pakistan.

Exercises of HRM incorporate HRM planning, staffing, training and development, performance management, compensation management, wellbeing and employee relations. Clinched alongside an initial stage, the management from the selected organization need disregarded the work for HRM practices and a principle driver about authoritative prosperity. Main lately, this possibility part of HRM over upgrading organization performance need been figured it out. HRM practices might enhance those performances about organizations toward helping to employee and client satisfaction, innovation, productivity, and improvement for useful notoriety "around firm"s Group (Noe., 2010). Human resource need aid viewed as those the vast majority significant advantage about an organization, yet altogether few organizations have the ability will completely outfit its possibility.

This study primarily focuses on the impact of above mentioned HRM practices in employee's satisfaction and their commitment with organization in Pakistani context. Data has been collected from a number of organizations in order to make analysis which is included in this study.

Problem Statement

Human resource management practices are one of the most crucial in every organization (Ahmad et. al., 2016b). These practices have a vital impact on employee's satisfaction and commitment as per existing literature. But in Pakistan this area still needed to be studied therefore, this endeavor is undertaken to cover something new and valuable to the organizations in Pakistan.

The Concept of HRM

HRM have been formed and a management idea which lays stress on the singular specialist and require on treat individuals likewise stakes as opposed expense (Beaumont 1992). If it might have

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been generally acknowledged as this new administration practice, the idea remains unclear similarly as it will be connected in distinctive routes.

Firstly, Human Resource Management is another label to work force management, pointing that organizations rename their work force division without fundamentally evolving practices, Secondly, Human Resource Management Concerning concept an approach for re- conceptualizing and reorganizing staff parts and describing the worth of effort about faculty department, Thirdly HRM Similarly as An completely new methodology to management for a uniqueness which lies in the joining from human resource under key management and the accentuation with respect to full and certain use for these resource. It might have been further highlighted that the unitary part for HRM as viable management that reaffirm employees" promise of the acknowledgment for shares of the organization objectives.

Armstrong (2001) provides for an all comprehensive aspects of the different see of HRM as: "A vital and sound methodology of the management about an organization's the vast majority esteemed resource: the individuals attempting there who separately and all things considered help those accomplishments of its objective.

Human resource management (HRM) practices, done whatever firm, are a mediator around those techniques and arrangements of HRM and HRM result. HRM practices incorporate work analysis, orientation, performance appraisal, human resource planning, work relations, selection, recruitment, payment and training and development (baily 1993). HR practices and employment satisfaction need aid mulled over generally in distinctive parts of the planet. It will be accepted that HR practices need aid nearly connected with employment satisfaction (Bartel 1994).

Job Satisfaction

An employee job satisfaction implies that the level from which employee feel happy and pleasure as stated by occupation. The satisfaction level about employees likewise connected with increment yield of the company, low truancy of the employees and low turnover (Bartel, 1994). Particular job satisfaction may be an element that might actuate the employee will partake) energizes those long term position.. As stated by Armstrong (2011) commitment, inspiration and occupation satisfaction, possibly together or separately, will make higher the point when individuals positively experience the provision from claiming HR arrangements concerned for making an equipped workforce, inspiring esteemed practices and giving work to chances on partake.

Byars (1997) proposed that earth of the job, payment policies, societal relationships, employee's needs and structure of the work need aid essential elements which influence the job satisfaction of the workers through which those turnover, absenteeism, and dedication of the workers would likewise have influenced. Compensation will be a standout amongst those center practices for HRM for which workers help over organization development. Payment makes laborers loyalty, work satisfaction, and increment previously, social living guidelines.

HR practices particularly job satisfaction is examined generally in distinctive parts of the globe. It may be accepted that HR practices need aid nearly connected with job satisfaction (Ting, 1997). On a large number of researcher and professionals trust that callous HR practices bring about finer level about job satisfaction which extremely enhances authoritative performance (Byars, 1997). In spite of the fact that the causal courses the middle of job satisfaction and occupation performance may be even now not resolved.

Recruitment & Selection

This includes two interrelated courses, recruitment may be those procedures for generating a pool from claiming fit individuals to apply to work with an organization whiles Selection is the transformation by which particular instruments would utilized to look over a pool of applicant's or people's suitableness for the work bringing under attention management objectives and lawful necessities (Bratton & Gold 2003).

Armstrong (2001) categorizes recruitment And Selection under three stages: characterizing requirement, attracting hopefuls and selecting hopefuls. Those recruitment and Selection procedure may be a standout amongst the mossy cup oak vital HRM capacities concerning concept it will be those side of the point for entrance under the vast majority organizations and the place practically

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organizations initiate talents that drive their objectives and enthusiasm. It and reflects the necessities and rationality of the organization as reflected in the bore from claiming people picked for those occupation. Different systems need aid utilized in the recruitment and selection transform and these incorporate different types of interviews, evaluation centers, educational program vitae, references amongst others.

Those HR worth of effort framework incorporates tight division of work and narrowly intended and particular occupations. Previously, such a system, constrained worker cooperation exists and staff arrangement tags point by point standards concerning job progression and compensation (Harel, 1999).

Recruitment is utilizing examination of the job so as will select and distinguish those necessities and necessities of the organization, and its identified with those embraced method (Harel, 1999). There are huge numbers variables that influence on the recruitment procedure and might make partitioned should inside and outside factors. Those confinements that forced toward the management and the work market limit those change transform from claiming recruitment approaches and it viewed as similarly as the primary outer variables. Organization's strategy and the dream of the organization could make acknowledged as a pointer of the endeavors of the recruitment and it's a sample of the inward variables (Noe, 2011).

Concerning concept, a professional HR manager, it is indispensable will bring those competency and capability with select fitting workers and put them for suitableness worth of effort positions (Marques, 2007). Determination is a paramount component Previously, HR functions, in light of the employee's Selection need end organization and organization with organization's improvement. Determination may be gathering the majority of the data over those applicants choose who may be fit and ought to further to bolster a chance to be to utilize every fill in position. Complex publicizing recruitment and selection framework might guarantee a preferred fit the middle of the individual's abilities and the organization's prerequisite (Fernandez, 1992).

Training and development

Training will be the formal and precise adjustment of conduct through taking in which concerning concept an after effect of education, instruction, improvement and arranged experience is shared (Armstrong, 2001). Training could be at work alternately off the work contingent upon the compelling reason being referred to proper training may be needed to different necessities for example, with fathom appropriate problems, on support performance, and likewise to nonstop improvement about mankind's asset. The act may be a standout amongst the practically essential viewpoints for HRM necessary on stay with organizations ahead from claiming their rivals Hilb (1992).

A thorough examine led towards Koch and McGrath (1996) showed that organizations that captivate clinched alongside deliberate training for their workforce need aid less averse should delight in those remunerates of a that's only the tip of the iceberg profitable workforce. As stated by Harel and Tzafrir (1999), training impact performance by enhancing aptitudes and abilities important should employees' assignments and development. Those discoveries uncover that training impacts authoritative commitment, member information and organization-based respect toward oneself (Guest 2002).

Different investigations demonstrate that training positively impacts level from claiming performance about directors (Bartel, 1994). Venture to training supports employee resolve and builds performance. In general, training permits workers will get more excellent competencies that would necessary on perform their occupations proficiently and successfully (Harel and Tzafrir 1999).

Compensation and Benefits

Compensation and benefit may be a precise procedure on assess the performance of a worker following a sure time. Compensation and benefit additionally impacts other HR practices for example, such that recruitment and selection, training and development, compensation, and employee relations. As performance appraisal prompts pay raise, promotion, and training, it is accepted that exceptional performance appraisal could need an effect with respect to Worker

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employment satisfaction. Compensation is those bonuses submitted of the worker because of their benefits. Compensation procedure could a chance to be isolated with immediate money related compensation and backhanded payment if it monetary alternately nonfinancial (Mondy, 2011).

Compensation may be a vital strategy in the organization, the place it could influence on the employer's plausibility on Lure new applicants, get employee's devotion and guarantee the most extreme level from claiming performance with help those organization objective and target starting with Worker (Mondy, 2011).

Compensation frameworks in the organization the table of the employees likewise should expansion Worker inspiration (Milgrom and Roberts, 1992), performance and profit. Hence, mossy cup oak of the organizations worried on Building and administering the ideal payment frameworks. As stated by anticipation hypothesis (Vroom, 1964), When pay will be interfaced with performance about assembly alternately individual, workers need aid less averse should build their exertions clinched alongside working tricky to increment the performance from claiming unique and the organization which identified with build and enhance the general organization's performance.

In light of anticipation principle (Vroom, 1964), it could make normal that, on the organization gives compensations and remunerates fancied and those employees clinched alongside question, the worker may be less averse to perform thus that those worker might a chance to be rewarded. Choosing a proper compensation component may be likely those center issue about mankind's resource managers, and speaks to those heart about staff economics (Dubrin 2006).

However, the point when organizations set objectives about moving forward their effectiveness, and efficiency, it obliges that its parts consume additional part exercises and perform them of the best of their abilities. Additional part performance by those employees may be a pointer for sure unique commitment should Generally speaking authoritative viability (Deckop et. al, 1999).

Compensation alludes with every last bit from the pay or remunerates setting the employees and emerging starting with their employment (Dessler, 2007). Payment will be a whole lot critical to workers on it may be a standout amongst the principle purposes behind which individuals fill in. Employees" existing status in the society, satisfaction, loyalty, and benefit are likewise impacted by those payment. Better mechanical relations might make those suitable attempting earth to all workers that eventually impacts job satisfaction (Khan and Taher, 2008).

Conceptual Framework

We have taken three multiple HRM practices i.e. Recruitment & Selection, Training & Development and Compensation & Benefits as independent variables. While employee job satisfaction has been undertaken as dependent variable. The model in this study was previously used by Wright (2010).

Figure1: Conceptual Framework
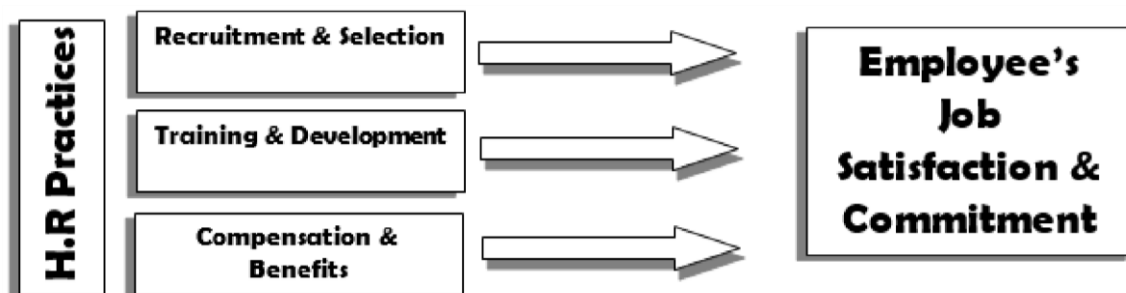
The above mentioned HRM practices impact has been measured over employee satisfaction in this study.

Study Questions

This study is based on following questions;
   a.   Does recruitment and selection has an impact on employee's job satisfaction?
   b.   Does training and development have an impact on employee's job satisfaction?

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c. Does compensation and benefits system have an impact on employee's job satisfaction?

Study Hypothesis

Our study carries following hypothesis;
H1. Recruitment and selection has a significant positive relation with employee's job satisfaction.
H2. Training and development has a significant positive relation with employee's job satisfaction.
H3. Compensation and benefit system has a significant positive relation with employee's job satisfaction.

Data Collection Method

Questionnaire is prepared for acquiring reply directly (by one-o-one meeting), all the data of respondents will be taken with their consent. Questionnaire contained closed ended questions with ratings on five point liked scale. Liked scale assists in checking the levels of agreement the target market has over the questions and researcher get quantitative data. Convenient sampling method was used in order to collect the required data for the study.

Population of the Study

For this purpose, data was collected from the employees of two Pakistani manufacturing organizations named;Hazara Phosphate Private Limited and Mujahid Oil and Ghee Industries Private Limited located in Hattar industrial estate KPK Pakistan. 100 numbers of questionnaires were distributed amongst various levels of employees in prescribed organizations.73 respondents answered positively. So our study analysis has been made over these respondent's thoughts.

Data Analysis

Model Summaries

Model summary gives specific consideration to the value of R-square. This statistic expresses about how far of the variation in the value of the dependent variable is explained by regression model. Following are the model summaries for each independent variable with its relation to dependent variable of the study,

4.5.1.1Model Summary of Training & Development

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.486[a]	.236	.228	.59265

a. Predictors: (Constant), Training and Development

R Square

R Square is coefficient of determination, this research results the value of R^2 is 0.236 which is normal fit 23% variation in Employee Job Satisfaction is explained by the independent variable Training and Development closer to 1, the better the regression line fit the data.

Adjusted R Square

This shows the value of R^2 which is squared. Squaring the value of R^2 gives more accurate value of R^2 which is adjusted. Its value goes up when we increase degree of freedom for this model we have the value of adjusted r square 0.228 when the degree of freedom is one.

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4.5.1.2Model Summary of Compensation and Benefits
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.240a	.119	.109	.67147

a. Predictors: (Constant), Compensation and Benefits

R Square

R Square is coefficient of determination, this research results the value of R^2 is 0.119 which is normal fit 19% variation in Employee Job Satisfaction is explained by the independent variable Compensation and Benefits, closer to 1, the better the regression line fit the data.

Adjusted R Square

This shows the value of R2 which is squared. Squaring the value of R^2 gives more accurate value of R2 which is adjusted. Its value goes up when we increase degree of freedom for this model we have the value of adjusted r square 0.109 when the degree of freedom is one.

4.5.1.3Model Summary of Recruitment and Selection

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.297a	.139	.129	.66487

a. Predictors: (Constant), Recruitment and Selection

R Square

R Square is coefficient of determination, this research results the value of R2 is 0.139 which is normal fit 13% variation in Employee Job Satisfaction is explained by the independent variables Recruitment and Selection closer to 1, the better the regression line fit the data.

Adjusted R Square

This shows the value of R2 which is squared. Squaring the value of R^2 gives more accurate value of R2 which is adjusted. Its value goes up when we increase degree of freedom for this model we have the value of adjusted r square 0.129 when the degree of freedom is one.

Coefficients

To determine the statistically significant unique contribution of each variable to the equation, will check the value in the column marked Sig. if the Sig value is less than .05 (.01, .0001 etc.) then the variable is making a significant unique contribution to the prediction of the dependent variable. If greater than .05 then can conclude that variable is not making a significant unique contribution to the prediction of dependent variable. This may be due to overlap with other independent variables in the model. In this case, all the variable making a unique contribution having significant value. .000 And .001

4.6.1.1Coefficient of Training & Development
Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.266	.295		7.675	.000
	Training and Development	.422	.086	.465	4.894	.000

a. Dependent Variable: Employee Job Satisfaction

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The Beta value for Training and Development is .465, it means that if there is One Unit increase in Training and Development, this causes 0.465 percent positive change in Employee Job Satisfaction Commitment while remaining all other variables constant.

4.6.1.2Coefficient of Compensation and Benefits

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.394	.339		10.005	.000
	Compensation and Benefits	.006	.078	.007	2.396	.001

a. Dependent Variable: Employee Job Satisfaction

The Beta value for compensation and benefit is quite lower (.007), as compare to other variables. If there is One Unity increase in Compensation and Benefits this cause 0.007 percent positive change in Employee Job Satisfaction Commitment while remaining all other variables constant.

4.6.1.3Coefficient of Recruitment and Selection

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.048	.413		7.373	.000
	Recruitment and Selection	.074	.097	.071	4.986	.000

a. Dependent Variable: Employee Job Satisfaction

The value of beta for recruitment and selection is .071 it means that if there is one Unity increase in Recruitment and Selection this lead to 0.71 percent positive change in Employee Job Satisfaction Commitment while remaining all other variables constant.

Significance level values of all the Variables are given separately as below;

Recruitment & Selection: 0.000, Training & Development: 0.000 and Compensation and Benefits: 0.001.it depicts that our hypothesis are accepted and previous literature has been affirmed

Conclusion

This study is designed to investigate the impact of human resource management practices on the job satisfaction and commitment of the employees. To find out the satisfaction determinants research model of HRM practices was used.There number of HR practices like recruitment and selection, training and development, appraisal process, career development and planning, compensation management, succession planning and job definition. For our study we choose three variable that was considered more suitable namely, recruitment and selection, training and development, compensation and benefits, it was assumed that considering Pakistani collectivistic culture they are will have more influence on determining job satisfaction and commitment in employees of any manufacturing industry of relevant area. All variables (recruitment and selection, training and development, compensation management) confirmed the previous studies by exhibiting positive significant relationship with job satisfaction and commitment. It is also concluded that recruitment and selection and training and development, compensation and benefits plays a vital role for the performance of the employees as training of the employees is an important but other variable are important to work on. These small variation in the results are may be the outcome of the absence of the other HRM practices which are not used in this study. All HRM practices should be used to understand their impact on the performance of the employees.

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Developing a Multi-Criteria Decision Support System for Determining Optimal Retention Inventory Stock in Public Sector's Technical Services Organizations of Pakistan

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Abstract

This paper reports on the development and successful implementation of a decision support system (DSS) for analyzing inventory retention stocks in Public Sector's Technical Services Organizations (TSOs) of Pakistan. The DSS is based on a multicriteria framework that includes statistical analysis of historical data, followed by a comprehensive fault trend analysis leading towrads formulation of "comparative analysis matrix" based upon price based and quantity based analysis of inventory, respectively. Finally a decision criteria (Forecasting Model) is formulated through three major forecasting techniques with minimum error calculations.The DSS is practically implemented on a Public Sector's TSO as a case study which has shown significant results.

The paper contributes to the inventory management literature in three ways. First, the paper introduces a new concept of comparative analysis matrix for identification of most critical items. Second, the paper develops a Multi-Criteria Forecasting Model which captures a richer operating environment. Third, the paper suggests how these criteria may be integrated in a single, interactive DSS. Although the forecasting model, and DSS are describe in the context of a specific organization, yet the DSS and the model are applicable to managing service parts in a wide variety of environments.

Keywords: Decision Support System, Inventory Management, Forecasting model

1. Introduction

Given the significance of inventories as valuable strategic resources for organizations (Cachon and Fisher, 2000), inventory management has always been one of the dominant areas of investigation in the operations management (OM) literature (e.g., Eroglu and Hofer, 2011). The methodology to

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inventory management that has gathered the most consideration in recent decades is the lean inventory philosophy, which sights excess inventories as waste and emphaseises on fostering inventory efficiency in firms (Eroglu and Hofer, 2011). To achieve higher inventory efficiency, organizations can benefit greatly from the use of effective Decision Support Systems (DSS) which can assure sizeable reduction in dead and inactive inventories. An effective Decision Support Systems shadows a magnanimous effect on efficiency of any organization as it encapsulates four major factors related to an effective inventory control system i.e material flow, information flow, procurement and delivery (Bevan, 2008). The "**most expensive**" material is the one that is "**not available**" when it is needed and the "**second most expensive**" material is the one that is available but "**not needed" (**Das and Tyagi, 1999). It is therefore the prime objective of inventory management is to devise an effective system that has the capability to optimize the stocks in such a way that material is kept at a minimum possible capital input without disturbing the output and ensuring increased profitability and productivity.The best supply organizations equipped themselves with the most sophisticated and practical analytical tools to bring down the inventory levels by 20 percent to 50 percent, that yields in savings for years". (Mattsson, 2007).

On the other hand, there is a huge amount of dead/inactive inventory piling up every year in most of the Public Sector's Technical Services Organizations of Pakistan, either due to inefficient procurement process or absence of effective forcasting techniques.While probing the facts, it is revealed that mainly three kinds of approaches are used for procurement of inventory in these organizations : one is as per the operational experience of the staff, second is based on the historical demands and the third is by relying on information provided by the Original Equipment Manufacturer(OEM).

Keeping above in view, this paper develops a multistage and multicriteria DSS through a case study, that focuses on analyzing inventory retention stocks in Public Sector's Technical Services Organizations (TSOs) of Pakistan and device a methodology for wise procurement of inventory. A case study of one of the leading TSO is carried out using its primary data between a period of 2011 to 2015. The studied organization is responsible to carry out the repair, maintenance and modifications of Surveillance Equipment.

2. Theoretical Background

The literature indicates numerous studies focusing different facets of spare parts demand forecasting and inventory control, including: items classification (Eaves & Kingsman, 2004), time bucket selection (Bartezzaghi & Kalchsmidt, 2011), demand forecasting models (Teunter & Duncan, 2009), lead-time demand distribution (Bacchetti et al., 2012) and parameter revision frequencies (Syntetos et al., 2010). Most of the less recent research on inventory management focus on traditional inventory control models. Reserachers of that era have either assessed conventional inventory control models under specific conditions or combined additional deliberations into established models (e.g. Das and Tyagi, 1999; Tyworth and Ganeshan,2000). The basic (Q, r) inventory control model was introduced by Harris (1913) which allowed an organization to place orders of size Q, whenever its inventory position reaches a re-order point (r). Carrying that basic concept a further ahead, the logistics literature has extended the (Q, r) approach in several other aspects. For example, researchers have brought into consideration certain additional factors, like transportation, buyer/seller relationships, quality considerations, short lead times and emergency conditions etc. (Landeros and Lyth, 1989; Beamon and Kotleba, 2006; Mattsson, 2007) and have further evaluated the approach under particular demand and lead-time distributions (Tyworth and Ganeshan, 2000; Tyworth et al., 1996).

Portfolio Effect is another well known subject in the stream of warehousing and inventory considerations. This term refers to the decrease of cumulative safety stock, attained through centralization of stocking locations. Then there are also numerous collaborative inventory management models tend to focus on the inventory decisions made by organizations participating in different collaborative program, such as CRP, ECR, QR and VMI. However, collaboration is a decision-making process that includes inter-dependent firms (House and Stank, 2001; Stefansson, 2006).

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In recent research, parallel to the forecasting models and DSS, various advanced and state of the art software and programs have been developed to optimize "Critical Spare Parts" provisioning like, *SAP - SCM, Fishbowl Inventory, S2K Warehouse Management Software, Conga Novatus Contract Management, Slingshot Enterprise Business Suite, Infor Supply Chain Management, Oracle SCM Cloud, Pronto Xi, Oasis, JDA software* etc. However these softwares are either specific to the requirement or complicated in nature. There is hardly any DSS in IM literature pertaining to the technical services organizations in Pakistan's environment and conditions.

3. Development of Multi-criteria Decision Support System

The sequence of action adopted in the development of DSS is depicted in **Figure-1** where the Stage-1 begins with the collection of historical data and ends at stage-4 with a consolidated list of forecasted spares. The sequence is as follow:
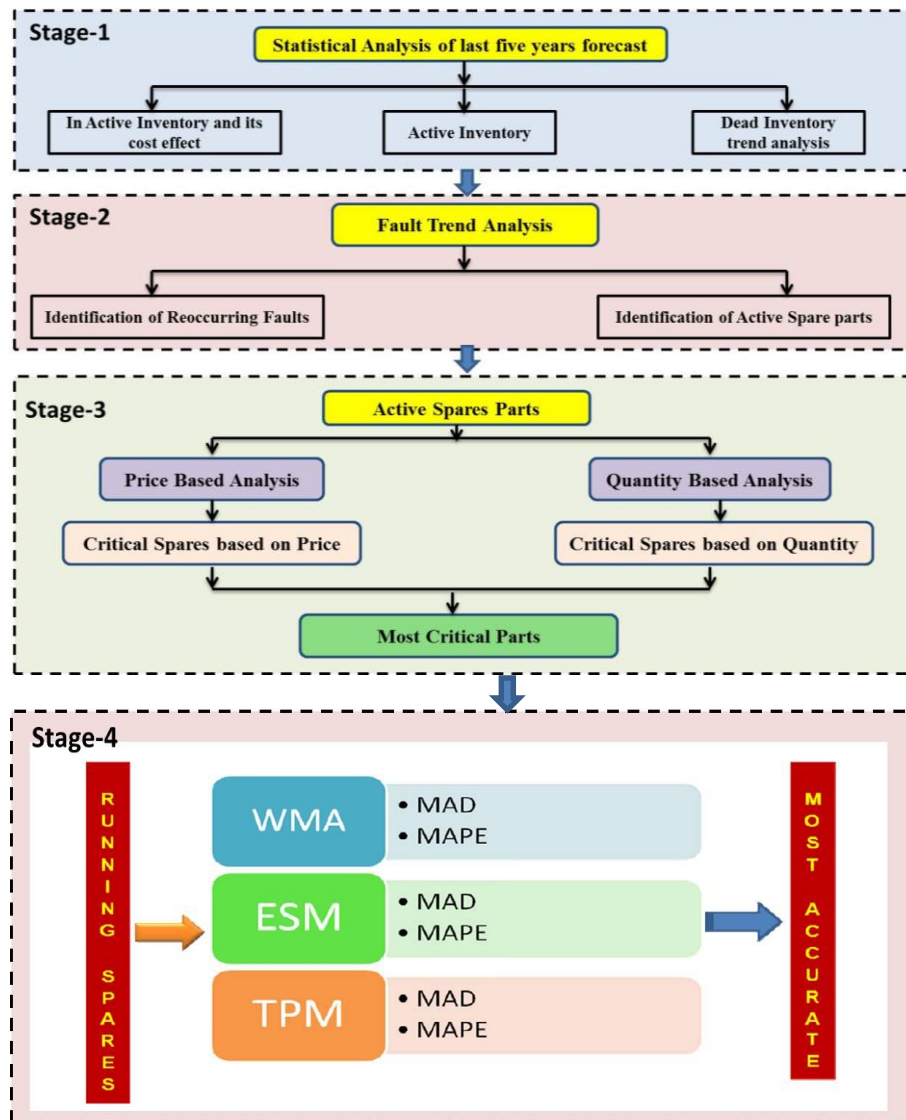
Fig-1 Theoretical Framework of proposed DSS

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3.1. Analysis of Forecasted Versus Actual Demands (Stage-1)

To start with, primary data of forecasted (purchased) and actually utilized spares parts between 2011 to 2015 of one of the leading TSO has been collected for quantitative analysis in order to have a fair idea of demand and supply curve of various items alongwith forecast errors for each year as shown in **Table-1** below.

Table-1 Forecast Errors in Forecasted/Utilized Spares Parts 2011-2015

Year (A)	Purchased Items (B)	Purchased cost(PKR) (C)	Utilized Items (D)	Utilized Items cost (E)	Forecast Error (C-E) (F)	% Utilization (D/B*100) (G)
2011	6889	106 M	4594	64.9 M	**41.1 Mn**	67 %
2012	4016	83.55 M	6102	52.3 M	**31.25 Mn**	152%
2013	5761	69.8 M	4983	57.8 M	**12 Mn**	86%
2014	7122	82.5 M	4086	42.6 M	**39.9 Mn**	57%
2015	3588	82.1 M	5008	63.4 M	**18.7 Mn**	140%
Total	**27376**	**423.95 M**	**24773**	**281 M**	**142.95**	

The historical data of last five years reveals that there is a significant gap between the projected and actually demanded quantities of parts. Another very important aspect of the data is the erratic behavior and intermittency of the forecasted values for most of the parts. In 2011 there is only 67% of spares utilization (in terms of quantity) which rises to 152% in 2012 with a gradual drop in 2013 and 2014 and then a sudden rise in 2015. A comparison of forecast (Purchased cost) and actual demand cost for last five years can be made from the graph in **Figure-2** below.
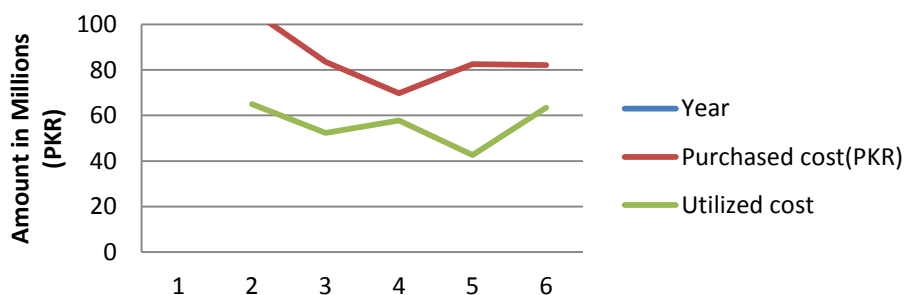
Fig-2 Forecast Cost versus Utilized Cost

Forecast cost and actual demand cost curves are completely misaligned with each other and a huge difference of amount exist at all instantaneous points. This difference has created a significant value of stuck amount and an upward trend in inactive inventory and dead spares. There can be seen a huge difference between forecast cost and actually utilized demand cost which strengthen the fact that forecast is not based upon a systematic procedure or modern techniques. Based on this analysis the complete retaining stock of the studied organization is segregated in three categories as shown in **Table-2**

Table-2 Retaining Stock segregation based on analysis of historical demands

Active Inventory	Items demanded ≥1 times in a year	121
In active Inventory	1 ≤Items demanded≤ 2 times in 5 years	1208
Dead Inventory	Items never demanded in last 5 years	< 2145

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3.2. Fault Trend Analysis (Stage-2)

In Stage -2 Fault Trend Analysis of different subsystems of Surveillance Equipment being repaired at the studied organization is carried out for a period of 2011-2015. Different subsystem varies in their fault rates which are properly recorded by Planning and Control Department of studied organization during their repair/maintenance process as shown in **Figure-3**.
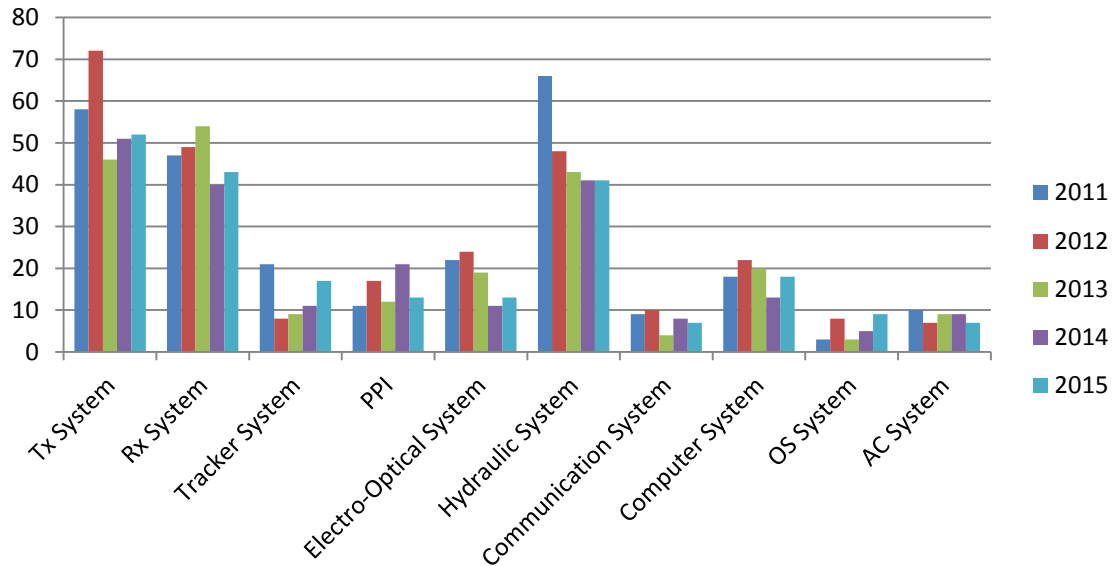
Fig-3 Fault rates in subsystems of Surveillance Equipment 2011-2015

It can be seen from the above mentioned graph that there are three subsystems i.e. Tx System, Rx System and Hydraulic System with maximum number of faults each year whereas Communication System, OS System and AC System have minimum number of faults and rest of the subsystems lies between these two extremes. Based on the fault rates of last five years, these subsystems can further be segregated in three categories as shown in **Table-3** below.

Table-3 Categorisation of subsystems based upon Annual Fault Rates

Category-1	Fault rate $\geq$ 40 per year	Tx System, Rx System, Hydraulic System
Category-2	$10 \leq$ Fault rate ≤ 20 per year	Tracker System, PPI, EO System, Computer System
Category-3	Fault rate ≤ 10 per year	Communication System, OS system,AC system

A major chunk of spares parts of active inventory belong to Category-1 subsystems. About 64% of faults are related to the category-1 subsystems whereas only 36% belong to rest of the 7 subsystems which clearly indicates that most of the active inventory items belong to category-1. These "Active non repairable items" are required to be forecasted in a systematic way to avoid inaccurate purchasing and compilation of dead inventory Spare parts which can be repaired at organizational level and need not to be replaced with a new one are not considered in this study as these spares are not part of the forecasting process and can easily be repaired through replacement of minor components.

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3.3. Formulation of Comparitive Analysis Matrix (Stage-3)

Some spares are cheaper than others where as other spares are either expensive or highly expensive. Similarly some parts are kept in low quantities and some are kept in larger quantities based upon their usage rate and historical data trend. The most significant and important impact is created by highly expensive spares as they utilized the main chunk of the annual budget. Forecasting of these spares is of extreme importance as it has a direct impact on the overall budget and can have serious repercussions if not purchased judiciously, on the other hand spare parts which are normally required in large volume are also important for forecasting as they also have a significant accumulated impact on the annual budget of the spares. In order to resolve this issue in a systematic way (3 x 3 Price / quantity) comparative analysis matrices have been formulated. The basic purpose of these matrices is to isolate those spares and items which are *critical* in terms of price and quantity. All those spare which are segregated as the most critical items in terms of price and quantity represents the major portion of the annual budget. Two types of categories are formed while formulating the comparative analysis matrix. On is "Price based category" and the other is "Quantity based category". The basic idea of this categorization is to select and analysis 121 active inventory parts which are further distributed in 9 boxes of the matrix for further detailed analysis.

3.3.1 Price Based Analysis

In Price Based Analysis, all active inventory items are divided in three sub categories based on their price i.e. low (**Lo**$\leq$ 0.1 Mn), Medium (0.1 Mn $\leq$ **M** $\leq$ 0.5 Mn) and Higher (**H** $\geq$ 0.5 Mn) and similarly the quantity based category is also divided into three sub-categories i.e. small (**S**$\leq$ 100 units), medium (100 units$\leq$ **M**$\leq$150 units) and large (**L**$\geq$150 units) as shown in **Table-4** below.

Table-4 Price Based Analysis

Category	Sub-category	No.of parts	Total No. of parts	No. of units	Total Nos of units	Price (Mn)	Total Price	Quantity (%)	Price (%)
LOW PRICE	LoS	74	**92**	3526	**6407**	**0.795**	**1.485**	**81%**	**8%**
	LoM	9		1161		**0.41**			
	LoL	9		1720		**0.280**			
MEDIUM PRICE	MS	10	**13**	430	**817**	**1.03**	**4.65**	**10%**	**27%**
	MM	1		129		**1.09**			
	ML	2		258		**2.53**			
HIGH PRICE	HS	16	**16**	688	**688**	**10.98**	**10.98**	**9%**	**65%**
	HM	0		0		**0**			
	HL	0		0		**0**			

It is quite evident from the above analysis, that although low price items comprise a major portion of active inventory (81 % in terms of quantity), yet they have the lowest cumulative effect on the overall inventory annual budget (i.e. 8% of the total expenditure), whereas only 16 parts (9% in terms of quantity) fall in the high price parts category but they have the most significant impact (i.e. 65% of the total expenditure). It can therefore be deduced that particular importance should be given on forecasting *high price & small quantity* (HS category) spares.

3.3.1 Quantity Based Analysis

In Quantity Based Analysis the active spares are again distributed on the basis of pre- determined criteria amongst nine boxes (subcategories) of 3x3 matrices as shown in **Table-5** below.

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Table-5 Quantity Based Analysis

Category	Sub-category	No. of part	Total No. of parts	No. of units	Total Nos of units	Price (Mn)	Total Price (Mn)	Quantity (%)	Price (%)
SMALL QUANTITY	SLo	74	**100**	3526	**4644**	0.795	**12.805**	**60%**	**75%**
	SM	10		430		1.03			
	SH	16		688		10.98			
MEDIUM QUANTITY	MLo	9	**10**	1161	**1290**	0.41	**1.5**	**16%**	**9%**
	MM	1		129		1.09			
	MH	0		0		0			
LARGE QUANTITY	LLo	9	**11**	1720	**1978**	0.280	**2.81**	**24%**	**16%**
	LM	2		258		2.53			
	LH	0		0		0			

As per Quantity Based Analysis, small quantity Items are around 60% of total quantity and consumes 75% of the overall inventory budget and within the small quantities items, high price items carries the major chunk. Quantity based analysis re-emphasized the deduction made through Price based analysis which was to closely track and continuously monitor *high price and small quantity* parts (**HS category**) since they constitute the major portion of annual spare budget.

3.4. Determination of "Optimum Retention Inventory Stock" (Stage-4)

Active spares have already been identified in first three stages of DSS. Stage-4 uses three different forecasting methods i.e. Weighted Moving Average, Exponential Smoothing and Trend Projection to predict the *required quantity* of these spares. Moreover there are some important forecasting factors which need to be considered carefully in order to make a factual prediction e.g. there are definite trends in certain demands which are denoted by an upward or downward slope. *Seasonality* is another important factor which is considered to be a data pattern that repeats itself over a period of 1 to 2 years of time. In some cases due to some extraordinary events certain irregular fluctuations can also be observed in spares demand pattern. Sometimes these variations are extremely random and needs to be smoothened in an effective way and sometimes a smooth trend line makes it easy to forecast demand in the right quantity. On the other side, the performance of a forecasting approach is measured through "Accuracy" i.e. the closeness of forecasted values to the actual values. In this research work "Forecasting Errors" are calculated using "Mean Absolute Deviation (MAD)" and "Mean Absolute Percentage Error (MAPE)" methods. Both of these Methods are globally accepted and reliable. Forecasting method with minimum MAD and MAPE value is selected out of three. It proved to be a very simple and easy going approach without compromising on accuracy as shown in **Figure-4**.


	WMA	ESM	TPM
Series1	49	26	25
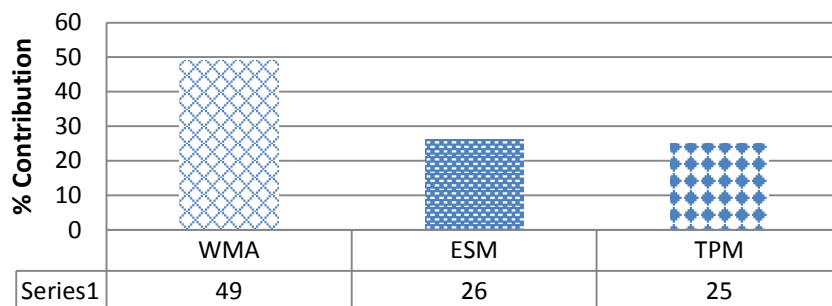
Fig-4 % Contribution of three Forecasting Methods

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Results show that 49% of the contribution is made by Weighted Moving Averages method, 26% of the contribution is made by Exponential Smoothing method whereas 25% of the contribution is made by Trend Projection method. A total number of 4640 units of 121 active spares have been forecasted and plotted in **Figure-5** below for a comparison with historical forecasts.

Year	2011	2012	2013	2014	2015
Purchased Units	6889	4016	5761	7122	3588	
Utilized Units	4594	6102	4983	4086	5008	4640
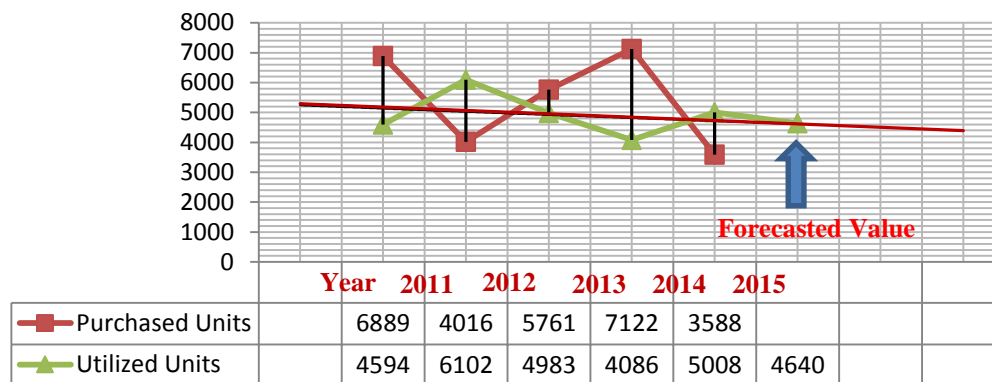
Fig-5 Comparison of Forecasted Value with Purchased/Actual Utilized Items

4. Conclusion

The proposed DSS finds the answer of two critical questions successfully i.e. *which items to be procured*? and *in how much quantity?* to maintain the "**Optimal Retention Inventory Stock**". The DSS identifies the active inventory items out of the whole retaining stock first and then figures out the "*most critical items*" in terms of price and quantity. Items identified as "HS" needs to be procured using JIT technique. It further estimates the number of items to be procured to avoid excess purchasing and compilation of dead inventory items. Although the DSS is specifically applied on a Public Sector's Technical Services Organization as a case study yet it has the flexibility to be applied for managing service parts in a wide variety of environments. There is a need to apply the results and findings of this research work on other sister organizations as well to further strengthen the findings. The proposed DSS would be a milestone for determination of Optimal Retention Inventory Stock by systematic forecasting of spares using multiple criteria.

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CONSTRUCTION PROJECT MANAGEMENT

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Building Information Modelling (BIM): The Future of Construction Industry in Pakistan

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Abstract

Building Information Modeling (BIM) has emerged in the recent decades and provided a new perspective on architecture, engineering, and construction (AEC) Industry. It shifted the trend from simple 2D drawings to intelligent 3D modeling. BIM brought rapid changes in the construction industry to visualize the final product. While the BIM has globally been used in construction and manufacturing industry, it has only been recently introduced in Pakistan's construction industry. Recent studies indicated that adoption of BIM is very slow because the majority of stakeholders in the construction industry of Pakistan have limited knowledge regarding this technology. The industry hugely relies on 2D drawings, regardless of the complexity of the projects. This research highlights the future potential of BIM in the construction industry of Pakistan, such as an increase in productivity, safety control, effective communication between stakeholders, cost and schedule management, and integration of project lifecycle process. The objective of this work is to bring awareness regarding BIM developments in accordance with construction industry of Pakistan.

Keywords

BIM, 3D Modeling, Construction Industry, Project Management.

Introduction:

BIM is an integral part of the construction industry in this modern period of time. It is a process to develop a digital model which helps to visualize the final outcome, the whole life cycle of a project can be illustrated through BIM. It generates more accurate results along with better control of project throughout its different phases. BIM is a new way to digitally design the project and can be effectively used in construction sequencing procedure (Azhar, S. 2011). It is an advanced technology which has rapidly revolutionized the process through which buildings are designed and constructed (Hardin, 2009).

BIM has been more rapidly recognized by Pakistan construction industry in the current decade. The simple two-dimensional drawings are widely used in the Pakistan construction industry which

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are also usually not integrated with the vision of different stakeholders in a project, such drawings lack the information regarding schedule, cost, and visualization detail. The 2D drawings often lead to ambiguities in understanding, however, BIM solves such issues by clear visualization. It also plays very important role in project delivery method in the construction industry.

In Pakistan, BIM application is very limited and is only used for architecture or presentation purpose and generally the model also does not contain any information regarding time schedule, the sequence of activities or cost estimation. Use of BIM in the project is relatively higher by architects as compared to the other stakeholders of the project. The working environment in Pakistan has a great impact on operations and procedures, to implement the ingenious technology is difficult due to the low rate of acceptance of change (Masood, R. *et al.*, 2013).

According to (Ali *et al.*, 2016) around 40% universities in Pakistan instruct BIM in their curriculum and it may take about the five years for universities to fully integrate the BIM into their curriculum as many universities have not yet recognized the importance of BIM. This paper includes a review of different research work carried out regarding BIM in Pakistan. It also explores previous work done in this field, which is followed by the discussion on the future potential and perspective of BIM in the construction industry of Pakistan. The last section of the paper provides the conclusion & recommendation.

Literature review:

Building Information Modeling is a 3D visual representation of a facility to be built. It is an intelligent model equipped with the project information. Several types of research have been conducted in Pakistan regarding BIM and its implementation, specifically in the construction industry. (Ali *et al.*, 2016) conducted a survey on different aspects of BIM integration in the education sector in which participants from different universities of Pakistan opted lack of professionally trained BIM staff in universities as the top barrier for BIM integration in construction management syllabus preceding traditional curriculum structures of construction engineering management, which need to be revised for better implementation of BIM.

Questioner survey was conducted by (Hussain and Choudhry, 2013) on application and benefits of BIM in the construction industry of Pakistan which revealed the rising awareness trend about BIM technology and 88% survey participant have little knowledge about BIM. In frequency analysis, it was observed that a large number of organizations were planning to use BIM in their projects. The main reason for interest in BIM according to AEC professionals in Pakistan came out as "tool for better visualization".

(A, Fatima *et al.*, 2015) concluded that adoption of BIM in Pakistan construction industry is very slow and its problems can be minimized employing BIM. It should be made an integral part of professional education for better future results. Status of Building Information Modeling adoption is below a satisfactory level, 73% do not use BIM at any stage of the project. There is a lack of command on BIM in the sectors primarily responsible for providing its education. The professionals in the construction industry of Pakistan placed "faster and more effective method" at the top, however, "reduce construction cost" was ranked as lowest in the BIM advantages list during questionnaire survey (Masood, R. *et al.*, 2013).

Future Prospective:

An extensive study was carried out about Building Information Modeling and its application in the scenario of Pakistan construction industry. Several critical issues in the industry were considered during the study. Safety, productivity, cost and schedule management are the key subjects which contain enormous scope for BIM application in Pakistan. Earlier research showed the lack of BIM adoption and implementation in every sector especially construction industry of Pakistan.

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Statistics depicts that Pakistan is ranked 9th in respect of labor force. According to Pakistan Bureau of Statistics, annual reports about 7.4% of total labor force in the country is associated with the construction industry. However, construction safety is not dealt on a priority basis by most of the construction industry stakeholders. Work related injuries and deaths are higher but most of the time are not properly recorded. Lack of regulations implementation is one of the core cause of such incidents. Work related injuries and deaths sometimes lead to suspension of work which resultantly effects the schedule and cost of the project. Developed countries have widely adopted the BIM technology in construction projects. BIM adoption has played a vital role for the safety of workers as BIM design reduce such risk at a construction site. Most of the construction injuries are related to falling from a height or falling of objects from height (Sijie *et al.*, 2015).

3D visualization helps to locate the more frequent falling and dangerous spots at the site during design. Such locations can be made less dangerous to the worker by improving the design and increasing safety parameters at those positions. This study suggests the implementation of BIM during the design phase for considering safety issues in the current scenario of Pakistan construction industry. To compete globally it is necessary to have a dynamic attitude in BIM adoption, also in terms of safety. BIM can also be helpful in better site layout for construction and safety planning. Visualization of BIM helps workers to avoid injuries at a site having construction equipment's like cranes, excavators etc. This visualization technique assists in dividing the site in different zones such as safer zone, red zone (Kristina *et al.*, 2009).

Automation has changed the manufacturing industry of Pakistan but the construction industry is still far behind its benefits, so resultantly the productivity improvement is also negligible. Labor Productivity is a serious concern in the construction industry all over the world. BIM give a promising solution in term of improvement in productivity of labor (Erik *et al.*, 2015). Construction equipment has a greater impact in term of construction productivity. BIM with the integration of machine guidance can also be used for the improvement in productivity of equipment (Seo, J. *et al.*, 2015). AEC industry of Pakistan is currently struggling to improve the productivity of both labor and equipment. BIM inclusion in projects will initiate a new era of smart construction in Pakistan industry.

Schedule and cost of the project are primary parameters need to be considered in construction project management. BIM contribute from start to end of the project which in detail can be elaborated as from Pre-construction phase to Post-construction phase (Azhar *et al.*, 2012; Aibinu and Sudha 2013; David *et al.*, 2013). Management of time schedule is a critical issue for a project manager for timely completion of the project. 4D BIM provides a solution for such issues along with visualization of the project. (Hexu *et al.*, 2015; Zhang and Hu, 2011). In Pakistan, most of the projects could not be completed within stipulated time limit which also result in much increase in project cost. Through the use of Building Information Modeling in scheduling and cost control process, Pakistan industry will be benefitted in true essence.

5D BIM (Lu *et al.*, 2016) provides more accurate and elaborative results regarding schedule and cost during different phases of projects. Many developed countries have adopted the technique in the implementation of various projects which resulted in the positive outcome. (Scheer *et al.*, 2014; Smith 2014; Forgues et al., 2012). The integration of BIM in project life cycle is essential in a current period of time to gain maximum advantages both in terms of time and cost saving in Pakistan industry.

BIM platform can be used to bring all the stakeholders of the project in Pakistan to consensus and its integration in project life cycle. BIM can be utilized as an effective communication tool between stakeholders and also for the purpose of facility management (Philips and Azhar, 2011). Every team member can visualize the project in a better way and can input or change any parameter at a certain time which then can be effectively communicated to all stakeholders of the project, such technology will definitely bring more advancement and prosperity to the construction industry of Pakistan.

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Conclusion and Recommendations:

This paper provided an overview of BIM characteristics which can be effectively incorporated in the construction Industry of Pakistan in coming years. Various perspective have been discussed for future of BIM in the construction industry. Safety in construction is one of the main issue and can be addressed by applying BIM which will result in a decrease of injuries and causalities at the site. Enhancement of productivity both in terms of labor and machinery will be one of the key factor for BIM adoption in Pakistan. BIM will also help construction industry of Pakistan in the integration of project life cycle, facility management, and effective communication between stakeholders, as these fields contain huge potential. BIM adoption rate is very slow in Pakistan and only architects use it to some extent, however, in the following years, it is expected to become a priority of AEC professionals to use BIM in their projects.

BIM can be more effectively used in Pakistan if the government make its implementation compulsory for the public projects amounting to a certain extent and then further can be transferred to lower levels. However, integration of BIM education in universities curriculum along with training of AEC professionals is pre-requisite for such employment. Proper guidelines need to be developed like developed countries in which BIM design is required as an integral part of the project. Only after actively implementing BIM in its full spirit can lead to reaping the benefits in coming years. Further research studies will be carried out regarding future implications of BIM technology application in Pakistan and its integration with other innovative technologies.

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Comparison of causes of Disputes in the Published Literature and the Construction industry of Pakistan

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Abstract

Disputes have detrimental effects on project leading to cost overruns, delays, poor quality of work and intangible losses to working relationship among the project participants. This study identifies the root causes of disputes in construction industry by an extensive literature review and a survey in the Pakistani construction industry. A three step content analysis approach has been adopted to collect and analyze the research papers published during the period 1993-2015. A total of 33 papers were found to be relevant. From these papers, 52 factors were found, out of which 31 have been shortlisted for this study. They were subjected to a screening process to determine the top five causes of disputes which are delays in payments, change orders, quality of works, delays in work and contractual anomalies. Based on the factors identified through literature review, a survey was conducted in Pakistani construction industry. The top five causes of disputes identified show an 80% convergence between published literature and professional practices in Pakistan with additional significance to poor contractor selection.

Keywords: conflicts; claims; disputes; systematic review; root causes; construction projects; literature review; content analysis

1. Introduction

Construction industry is getting complex day by day. It is riddled with dynamism and uncertainties owing to multidisciplinary nature of projects and stakeholders. Owing to the diversity, differences of opinion are bound to occur which may escalate to conflict The interaction of several parties like architects, engineers, constructors, skilled and semi-skilled labor, financiers, owners, developers, etc. may lead to inevitable conflicts which can quickly turn into disputes (Cakmak and Cakmak, 2014). These disputes can take place at any phase of the construction project i.e. during the design or execution (Hall, 2002). They become the primary source of problems in the construction. Every construction project is unique and has no standardized format, the interface problems are bound to occur. These turn into disagreements due to which the team members loose the spirit to perform resulting into compromised quality of work (Cheung and Suen, 2002). Another aspect of damage

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materializes into the time and cost overruns putting a strain on the business relationships among the parties which creates a state of dissatisfaction (Ilter, 2012). The conflicts and disputes are found to be increasing in construction industry (Yates and Hardcastle, 2003) escalating the direct and indirect project cost. The direct cost is the amount spent in dealing with lawyers, claim consultants and the costs associated with the delays of project. The indirect costs are the mistrust and poor work quality which deteriorate project success. Conflicts in construction industry have been ranked to be the highest factor behind the increase in project cost (Brockman, 2013). Therefore, in this research the probable causes of disputes in the construction industry are identified both through a literature review and a survey in the Pakistani construction industry. The possible value-add of this study into the body of knowledge comprises of a better understanding of causes due to prime stakeholders which may practically imply an insight into occurrence of major issues during the project lifecycle.

2. Methodology

The primary objective of this study, i.e. identifying the factors leading to disputes in construction industry was achieved by reviewing the literature. The methodology was divided into three stages; in the first stage, a three-step content analysis as suggested by Yi and Wang (2013), Hong et al. (2011) and Osei-Kyei and Chan (2015) for collecting and analyzing the factors was performed. In the second stage, the identified factors were subjected to a two-step screening process based on their frequency of appearance in the published literature. Through this procedure the dispute causing factors were ranked. In Stage 3 a survey was conducted in the construction industry of Pakistan to compare the results of literature review and factors currently affecting the market.

2.1 Stage 1
2.1.1 Step 1: Identifying the relevant Research Journals

In the first step, the pertinent journals publishing high quality research in the field of construction and project management are identified. The journals targeted included "Journal of Construction Engineering and Management (JCEM)", "International Journal of Project Management (IJPM)", "Journal of Civil Engineering and Management (J Civ Eng Manag)", "Construction Management and Economics (CME)" and "Engineering, Construction and Architectural Management (ECAM)".The journals JCEM, IJPM, CME and ECAM fall into the category of top six construction management journals (Osei-Kyei and Chan, 2015).

2.1.2 Step 2: Identifying the relevant Papers

In JCEM 6 research papers were found most relevant and used for further analysis. In IJPM only 2 papers were found to contain the required data. In J Civ Eng Managn and CME, no article made it into the relevant ones. In ECAM only 3 were found relevant to the topic. Afterwards search was conducted using Google Scholar to find out more papers on the subject topic. In total, 33 articles were selected from the literature search process and used for further analysis

2.1.3 Step 3: Examining the Papers

Factors having at least two citations were considered which then pass through the Stage 2 screening process.

2.2 Stage 2

2.2.1 Step 1: The factors appearing in at least 25% of the total papers were considered for further study.

2.2.2 Step 2: The factors were subjected to another screening process where their quantitative and qualitative significance was evaluated. For the quantitative evaluation, Equation 2 was used.

$$\text{Quantitative marks} = (\text{No of citations/Total Citations}) \times 50 \qquad (1)$$

The factors are also marked qualitatively and stated as High (H), Medium (M) and Low (L). They are given 1, 0.75 and 0.25 score respectively as given in Equation 2.

$$\text{Qualitative marks = Rating (H, M, L) x 50} \qquad (2)$$

On the basis of sum of quantitative and qualitative marks, 5 most significant factors that could lead to disputes were identified.

2.3 Stage 3: Identification of Causes of Disputes through Survey

The causes of disputes identified through the literature review were subjected to a survey in Pakistani construction industry to determine their ranking in the local industry. A pilot survey was conducted in the form of face to face discussions with professionals of construction industry to shortlist the factors for the detailed survey. Hill (1998) has suggested 10-30 participants to be adequate for such survey. The factors for which at least 60% respondents reported a candidacy to be a cause of dispute in the industry were carried forward to the next step. Based upon these suggestions, a detailed questionnaire was developed which was physically distributed to the professionals of construction industry. The respondents were asked to individually rate the probability and impact of these factors from 0 to 5 where 0 means no impact/no chance of occurrence and 5 depicts very high impact/very high chance of occurrence. These dispute causing factors can also be treated as risks as by definition "risk is the deviation of a variable from it expected value that may be positive or negative". Generally risks are considered to be negative occurrences (Schieg, 2006). Risks are calculated by multiplying the probability and impact of the events. Hence, these dispute causing factors are ranked by means of the methodology used to calculate the risks. The survey was sent to clients, consultants, contractors and subcontractors with the aim that the respondents should have an adequate experience to respond to the survey. According to Dillman (2000) for a population size greater than 30,000, at 95% confidence interval and 10% allowable margin error, the sample size comes out to be 96. This was the targeted size of sample in the survey. The reliability of data was checked in SPSS by calculating the value of Cronbach's alpha. If the value of alpha is above 0.8, the data is considered to be very reliable (Gliem and Gliem, 2003).   Afterwards relative importance index (RII) of the factors was determined using Equation (3).

$$\text{RII} = \sum W / AxN \qquad (3)$$

where W is the weight given to each factor by the respondents and ranges from 0 to 5, A is the highest weight (i.e. 5 in this case) and N is the total number of respondents.

3. Analysis and results

The factors which are the root cause of disputes in construction industry are identified. A total of 52 factors appeared in literature that could become the cause of dispute. Based on the first level screening, 31 factors that had at least 2 citations are enlisted along with selected references as shown in Table 1.

Table 77: Dispute causing factors from literature

S.No	Factor	No of Citations	References
1	Delays in payment	20	Acharya et al., 2006
2	Change orders	19	Al-Hammad,2000
3	Contractual anomalies	18	Musonda and Muya, 2010
4	Quality of work	14	Choudhry et al., 2012
5	Errors in drawings and specifications	14	Mitropoulos and Howell 2001
6	Lack of communication	13	Kumaraswamy,1997
7	Delays in work	12	Brooker, 2002
8	Changed conditions	12	Acharya et al., 2006
9	Delay in reply to queries	12	Acharya et al., 2006
10	Changes in prices of materials and labors	09	Iyer et al., 2008
11	Acceleration/Suspension of work	09	Semple et al., 1994
12	Estimation errors	08	Cheung and Yiu, 2006
13	Acts of God	07	Al-Hammad, 1993
14	Restricted access to site	07	Al-Hammad, 1993
15	Improper contractor selection	07	Kumaraswamy, 1997
16	Technical competence of team	07	Al-Hammad, 2000
17	Low bidding price	06	Zaneldin, 2006

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18	Negative attitude of parties	06	Zaneldin, 2006
19	Lack of proper supervision	05	Farooqui et al., 2014
20	Health and safety issues	04	Brockman, 2013
21	Insufficient drawing details	04	Huang et al., 2008
22	Risk allocation	04	Chan and Suen, 2005
23	Lack of familiarity with local laws	04	Huang et al., 2008
24	Unrealistic expectations	04	Cheung and Yiu, 2006
25	Extension of time	03	Chan and Suen, 2005
26	Exaggerated claims	02	Farooqui et al., 2014
27	Adversarial relationship	02	Chan and Suen, 2005
28	Team lacking spirit	02	Chan and Suen, 2005
29	Owner provided material	02	Bassioni et al., 2007
30	Extra works	02	Cheung and Pang, 2012
31	Productivity of labors	02	Huang et al., 2008

Delays in payment is the most cited cause of dispute by researchers with 20 out of 33 citations. *Change orders* and *contractual disputes* are next on the list. The top 3 factors have close competition. Therefore, from the literature point of view these three factors contribute almost equally towards occurrence of a dispute. Based upon the minimum 25% citation criteria set for first level screening, a total of 12 factors (Serial number 1 to 12 in Table 2) with at least 8 citations each are carried forward for further analysis. Based upon quantitative and qualitative scores the top five causes of disputes are highlighted in Table 2.

Table 78: Top ten causes of disputes as per literature

S.No	Description	Quantitative Points	Qualitative Rating	Total Points
1	Delays in payment	30.30	H	80.3
2	Change orders	28.78	H	78.78
3	Quality of work	21.21	H	71.21
4	Delays in work	18.18	H	68.18
5	Contractual anomalies	27.27	M	64.77
6	Errors in drawings and specifications	21.31	M	58.81
7	Lack of communication	19.69	M	57.19
8	Changed conditions	18.18	M	55.68
09	Changes in prices of materials and labors	13.63	M	51.13
10	Acceleration/ Suspension of work	13.63	M	51.13
11	Delay in reply to queries	18.18	L	30.68
12	Estimation errors	12.12	L	24.62

Afterwards face to face discussions were carried out with 10 experts of the Pakistani construction industry in which the 31 factors identified through literature review were discussed. A total of 18 factors passed the 60% screening process. The rest were dropped out from further analysis. The responses were obtained from 18 clients, 19 consultants, 45 contractors, 13 subcontractors and 2 suppliers/fabricators. In total, 50 respondents have more than 20 years of experience, 11 have 10-20 years of experience, 15 with 5-10 years of experience and 21 have 0-5 years of experience. This shows that the respondents have an adequate experience to respond to survey. The value of Cronbach's alpha came out to be 0.879 which shows that the data is very reliable. Afterwards, results were ranked on the basis of RII (Table 3)

Table 79: Causes of disputes in Pakistani construction industry

Factor	RII	Ranks
Delays in payments	0.517	1
Delays in work	0.494	2
Poor quality of works	0.471	3
Poor contractor selection	0.443	4
Change orders	0.413	5
Errors in drawings and specifications	0.409	6
Lack of proper supervision	0.4	7

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Negative attitude of parties	0.388	8
Estimation errors	0.369	9
Changes in prices off materials and labors	0.358	10
Delay in reply to queries	0.353	11
Acts of God	0.345	12
Lack of communication	0.336	13
Acceleration/Suspension of work	0.335	14
Changed conditions	0.329	15
Health and safety issues	0.312	16
Restricted access to site	0.312	16
Contractual anomalies	0.306	18

The most significant cause of dispute in local construction industry is delays in payment. In case payment does not take place associated stakeholders face serious cash flow issues. This often gives rise to disputes of higher degree. This is in agreement with the findings of Khahro and Ali (2014) that delays in payments is the most significant cause of dispute in Pakistan industry. Change orders has been ranked 2nd according to literature but 5th in Pakistani industry. This is also in perfect agreement with the findings of Farooqui et al. (2014) who have placed variations as the 5th most important cause of dispute. There is a complete agreement of the literature and the Pakistani industry on the ranking of poor quality of works (3rd position). Cost, quality and time are the key factors governing the project performance. Keeping this in view, there is an increasing importance given to quality of works in construction these days. The poorly executed works lead to reworks and increased maintenance cost, and a dispute among the project participants. This justifies its 3rd position in top ten lists. Delays in work has been ranked 2nd by the Pakistani industry and on 4th position according to the literature. It causes lawsuits, litigation, abandonment, over costs in local industry . Therefore, it has been categorized as a significant dispute by the construction industry. Poor contractor selection has been ranked 4th by the Pakistani industry but it did not make it to the top 10 list in the literature review. Around 83% of contractors are selected on the basis of lowest bid in Pakistan (Khan and Abdul Qadir Khan, 2015). This may lead to selection of an incompetent contractor those results in a dispute at a later stage due to poor quality of works, time and cost overruns. Owing to the low bid practice, incompetent contractor selection is a significant dispute in Pakistani industry. There is a significant difference in the position of disputes due to contractual anomalies in the literature and that in Pakistan. In local context, importance given to contract documentation is not significant as it has been indicated by Farooqui et al. (2014) that breaches of contract by the project participants is the least treacherous cause of dispute among the contract related disputes. This justifies its lowest position in Pakistani construction industry. Errors in drawings and specifications have been ranked alike at 6th position by literature and construction industry. This is also in agreement with the findings of (Khahro and Ali, 2014) who have ranked the errors in project documents to be the 7th most significant cause of dispute in the Pakistani industry. Lack of proper supervision did not make it to the top ten list in the analysis of literature review but has been placed on 7th position by the Pakistani industry. It appeared in 5 out of 33 research papers thus showing that as per the literature it is not a significant factor but Pakistani industry requires a proper supervision of the construction project. On similar grounds, negative attitude of parties appeared in 6 out of 33 papers but it made to the top ten lists as per local preferences. Also there is a difference of opinion on the ranking for lack of communication and changed conditions between the literature and the views of Pakistani industry. But on the whole it can be seen that 4 out of top 5 causes of disputes are common in the literature and the Pakistani construction industry. This depicts that there is an 80% agreement on the critical causes of disputes between the literature and the construction industry of Pakistan.

4. Conclusion

This analysis culminates into identification of most important root causes of disputes in construction projects through literature: *delays in payment*, *change orders*, *quality of work, delays in work and contractual anomalies*. Afterwards the factors identified through the literature review were subjected to a pilot survey and then a detailed survey in the Pakistani construction industry. *Delays in payments, delays in work, poor quality of works, poor contractor selection and change*

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orders have been ranked as the top five causes of disputes in the Pakistani industry. This indicates a near agreement on the critical causes of disputes as indicated by the literature and the Pakistani industry.

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Lack of Plant/Equipment Problems in Construction Industry of KP Pakistan

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Abstract

In every country economic development construction industry plays a vital role. The construction industry is globally faces various problems. One of the major problem faces by the construction industry is the lack of modern and innovative plant/equipment. The Purpose of the study was to investigate the main factors which contributing to lack of plant/equipment in construction industry in KP Pakistan. The data for the study has been collected from the selected clients, consultants and contractors by using five-likert scale questioner. Reliability test was used to analyze the data and also mean of each of the factor was concluded. The study revealed that unavailability of modern equipment and most of the modern equipment are manufacturing in abroad, which is the key cause of lack of plant/equipment in the construction industry. Furthermore the study revealed that low level of technology, cost effective technology, and unavailability of the spare parts and lack of skilled labor to properly control and maintain the equipment are also the main factors which contribute to lack of equipment. Recommendations for governments, adequate research in the relevant field and suggestion to Contractors, consultants and clients have been discussed in the study.

Keywords: Lack of equipment, SPSS, critical factors, construction industry, KP.

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1. Introduction

Construction Industry plays an important role in the economic development of any country. It constructs roads, buildings and others to establish the infrastructure the existence of which can provide a blood to economy. There are some other industries beside the construction industry which also play a pivotal role in the progress of any economy like brick manufacturing industry and steel industry. Construction Industry provides infrastructures like hospitals, schools, houses, highways, roads, railways, airport as well as sewerage and water supply system which are the prominent needs of the society and economy.

Construction industry is a key sector in which other sectors are also merged. This industry transforms most of the resources into physical shape through construction and social infrastructures the presence of which is essential for the socio-economic development of the country. The development of Construction Industry is important for the country in order to get the sustainable development of the society and economy as a whole (Oyedele, 2016). The said industry provides employment opportunities in the country which reduces the level of poverty by enhancing the disposable incomes of the people. People consume the part of incomes and then save the left amount which leads to investment in the region hence on one hand the social reforms will take place while on the other hand the country will become able to get good production, high employment ratios, low level of poverty, market boost, investment enhancement and structural changes that will lead to a prosperous society in the long run.

Plants and equipments keep a vital place in the construction of bridges, roads and other infrastructural developments. As the time passed, these tools have enlarged its position along the modern technology. The constructors use plants and equipments as tools for the better work in less time and with low cost. History is witnessed that these tools in or before (5000BC-9000BC) were made from natural materials including bones, stones, woods and animals fiber. Equipments are important as if we trace the history further, we will find that the first bridge was made by people by wood that was placed with the timber track and streams. The concept of construction industry over the past 200 years has been rapidly changing in a large extent. Technological advancement as started with the industrial revolution and the explosive growth of the global population has played a good role in this regard. The history of the construction industry took modernism with the establishment of factories and improvements in the metal work in the late 18th and early 19th centuries and so on.

Later on, in the 19th century the construction industries become vast and started journey towards success. Invention of machinery and boost of research on new technology performed distinctive role in the development of construction industry. Development in the construction was once a dream but beyond that, efforts of skillful and qualified human resources and technological advancement had played a vital role in it. Qualified and skillful human resources are considered as exclusive wealth for every company regarding constant change of competitive environment. (Busina & Korshunova, 2015).

After the independence of Pakistan, there were some of the private constructors in the country. Small works like construction of houses were made by provincial Governments or by central works department through private contractors. While others constructed public houses with the help of unskilled persons who did not know the technical knowhow. In 1971, Government of Pakistan established Housing Building Finance Corporation (HBFC), where everyone was allowed to enter like entrepreneurs, businessmen, industrialists and importers. And then many other associations were made just to bring development in the construction industry time by time.

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Most of the difficult projects were awarded to foreign contractors but in 1975, changes in government policy to award the difficult projects to domestic contractors in order to improve their confidence level and capacity.

Another helpful decision was made for the development of construction industry is Pakistan steel mills corporation. With the help of all these developmental improvements local contractors were able to face the tricky projects. Port Qasim, gigantic performance in the Indus basin works like Tarbela and Mangla dams, barrages and link canals are the examples of the efforts to improve the construction industry of Pakistan. Unfortunately the most neglected sector in Pakistan is construction sector which has 2.3 percent share in gross domestic products GDP. (History of Pakistan construction industry).

Construction industry is the key sector of each and every country both in developed as well as in developing countries. Construction industry faces various problems in developing countries as compared to developed ones. Lack of skilled labors, low level of government support, lack of cooperation, lack of investment, lack of public awareness, lack of building codes and regulations, lack of funds and finances, improper management, shortage of innovative equipments etc are the main problems in the construction industry which are the main obstacles in the way of economic development of the developing nations especially like Pakistan.

Another issue which is facing by construction industry is delay in payments. Availability of funds are essential for the construction industry without funds an industry can't buy resources like machinery, equipments and skillful employees etc.(Ramachandra & Rotimi, 2015)Payments are the backbone of every business especially of construction industry.

A successful and developed construction industry has a positive impact on country economy, but construction industries in developed countries as well as in developing countries is facing many problems. No priority has been given so far to this topic. The main issues and challenges which are related to construction industry in developing countries are globalization, construction industry development and the environment(Ofori & George, 2000) .

Equipments are the backbone of every construction and manufacturing processes. Lack of these equipment and plant causes delay of a project and also increases budget of a project. Besides these, companies which have well equipped also provide safety to his workers because there is always risk present while contact with heavy equipments. (Waris, Khamidi, & Idrus, 2013)Heavy equipments for heavy and complex construction are very essential. Availability of heavy equipments on construction site can increase labors working capability but can also help to complete the project within schedule and time.(Danso, 2014)The use of equipment and innovative methods has made changes in the construction technologies industry in the recent years. Required amount of time and job-site productivity of a project are often affected by using appropriate type and size of the equipments.

Lack of plant/equipments is the main problem which is facing now a day by construction industry. Purpose of the study is to explore the causes which contribute to lack of plant/equipments.

2. Research significance

Construction industry faces a lot of problems in developing countries as compared to developed countries. Lack of plant/equipments is one of the major problems which are facing by construction industries. Pakistan is a developing country and its construction industry is also facing problems like lack of plant/equipments. Equipments and machinery play an important role in every construction industry and thus construction industry play a vital role in country economy; it provides employment opportunity to skillful and semi-skilled persons. Beside this construction industry also provides share in country's gross domestic's products GDP. Significance of the study is to explore the reasons and problems behind the lack of plant/equipments in the construction

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industries of KPK. Khyber Pukhtunkhwa is the case study area where the primary data was collected through a questionnaire in Peshawar region.

3. Methodology

The initiative step was to study research papers of related topics from different journals. Purpose of research papers was to find out the factors which contribute to lack of plant/equipments problems in construction industry. After finding the critical factors the next step was to de a questioner to collect primary data. Questioner was designed and five likert scale was suggested which contains (strongly agree, agree, undecided, disagree, strongly disagree). After designing structured interview and pilot survey was conducted so as to find whether these factors are related or not. Some factors were excluded and some were included. When the questioner was final then the distribution process was started. Questioner was distributed among clients, consultants and contractors of Peshawar region. The returned questioners were then analyzed through SPSS software (statistical package for social sciences). Three tests were run like chi-square, probability and normality to conclude the required results.

Pakistan is included in the list of developing countries and just like other countries its construction industry is also in trouble. Just like other provinces of Pakistan Khyber pukhtunkhwa construction industry also faces problems. So Khyber pakhtunkhwa was selected as a case study.

Population for the study was registered contractors, clients and consultants of 2016 with Pakistan engineering council (PEC). Among the all registered contractors, client and consultant 120 were selected. Primary data was collected through questioner. Returned questioners were 94. Study was limited to Peshawar region due to less resources, lack of time and also due to lack of funds.

Collection of data is the main step in a research study. Mainly two types of data are used in research study like (a) primary data (b) secondary data.

Primary data is collected through questioner, survey, interview etc and secondary data is taken from websites, research papers etc. it was suggested to collect primary data through questioner.

Research papers were studied and related factors were found. Further the factors were investigated and the most suitable 34 factors were picked. A five likert scale was used like (strongly agree, agree undecided, disagree, strongly disagree). After the designing of questioner pilot survey and structured interview was conducted from some of contractors, clients and consultants, for the purpose to investigate whether the factors are related or not. Some of them excluded some factors from questioner and some included other factors. After that process the full and final questioner's distribution was started among 3cs.

When questioner was design a likert scale of five was selected for the measurement of data. Through the likert scale the respondents give their feedback.

3.1. Process of data analysis

Questioners were distributed and the returned questioner's data were then put in excel sheet and then in SPSS software. Every factor was coded like for the first factor F1 code was given and so on. The data was analyzed through SPSS and some tests were run for the purpose to achieve the required results.

3.2. Reliability Test

Reliability test is used to estimate the consistency of a measurement. That test will be considered reliable which give same result after interval of time. Estimation of data reliability is done by several ways, but mostly used are Split-half, Test-retest and Internal Consistency reliability. Every method has some advantages and disadvantages simultaneously. So it is important to pick the right test in right situation in your SPSS research.

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4. Results

At first the reliability test was applied on the data. The results show that the sample was reliable. Category of the reliability test was high.

Table 1: Reliability of samples

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.712	.707	34

During the analysis of data mean test was applied. Mean values represent that how much a factor affects the availability of equipments. Higher value higher will be affect. The following table shows the mean of every factor.

4.1. Top ten critical Factors

After finding mean for each of the factors then the top ten factors were chosen according to the mean value. High value was ranked first in descending order.

Table 2: Top ten factor

Code	Factors	Mean
F1	Unavailability of modern equipments	4.53
F6	Low level technology	4.31
F5	Cost effective technology	4.20
F27	High cost	4.15
F2	Unavailability of skilled labors	4.11
F4	Energy saving technology	4.03
F13	Worker possibility	3.96
F7	Spare parts availability	3.91
F28	Manufacturing is abroad	3.89
F3	Control and maintenance of modern equipments	3.68

Table 3: Mean values

	Mean	Std. Deviation	N
F1	4.5319	.71395	94
F2	4.1170	.84059	94
F3	3.6809	1.06975	94
F4	4.0319	.97773	94
F5	4.2021	.83704	94
F6	4.3191	.84513	94
F7	3.9149	1.04377	94
F8	3.6809	1.09949	94
F9	3.5106	1.25076	94
F10	3.5638	1.08319	94
F11	3.6277	1.11668	94
F12	3.1702	1.16986	94
F13	3.9681	1.23960	94
F14	3.4787	1.06487	94
F15	3.4255	1.04201	94
F16	3.5532	1.08377	94
F17	3.4894	1.07508	94
F18	3.5957	1.06073	94
F19	3.6489	1.16127	94
F20	3.5532	1.06374	94
F21	3.6596	.98977	94
F22	3.3191	1.07975	94
F23	3.4681	1.09448	94
F24	3.5638	1.15989	94
F25	3.6170	1.01713	94
F26	3.6064	1.03921	94
F27	4.1596	.90759	94
F28	3.8936	1.11170	94
F29	3.5532	1.22358	94
F30	3.4043	1.11990	94
F31	3.0106	1.19582	94
F32	3.2447	1.05429	94
F33	3.3298	1.14899	94
F34	2.9894	1.18680	94

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5. Conclusions

The development of Construction Industry is vital for any country in order to get the sustainable development of the society and economy as a whole, and modern plants /equipments has a great contribution in this regard. The study focused to find out the main causes of lack of plants / equipments problems in construction industry. The main causes which revealed from the study are following.

According to the contractors, consultants and clients the unavailability of modern equipments in the local market is one of the main cause which can lead the lack of plants / equipments in the construction industry, besides this, low level of innovative technology and cost effective technology have also the main cause to this issue. Furthermore most of the modern equipments are manufactured in abroad which are also the main cause that lead to lack of plant /equipments in the construction industry.

As the repairing and maintenance of the modern plants/ equipments is most important for reliable use. The study shows that highly innovative equipments are difficult to control and maintain, therefore lack of repairing and maintenance is also one of the major factor which cause to lack of innovative equipments.

Other factor that influences the lack of modern plants / equipments in the construction industry is the unavailability of sufficient spare parts for these innovative equipments.

According to the respondents modern plants / equipments needs skill full labor for sufficient and effective operations, and unavailability of skilled labors are also one of the main causes of lack of plants/ equipments in construction industry in KP Pakistan

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Poor Workmanship Problems in Construction Industry of Khyber Pakhtunkhwa Pakistan.

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Abstract

Poor workmanship in construction projects has been recognized as a very important supervision process in order to achieve the project objectives concerning time, cost, quality and safety. This research seeks to identify the poor workmanship problem that affect the performance of construction projects as a whole and analyze by using appropriate tools and technique and to improve workmanship environment. This project identifies forty-one major workmanship problems. The general methodology is to study depend on the survey questionnaire which will be collect from the various building projects, construction stakeholders (contractor, consultant, owner) different sizes by mail or personal meeting. The 99 number of worker gives better response which is related to construction projects. These data were analyzed by using SPSS frequency test and Relative important index tests, The Frequency test indicates how many stakeholders filled into the given Likert scale. RII test shows the ranking of these factors which were filled by stakeholders. Top ten critical factors are obtained from ranked factors, which are pointed in conclusion. This study investigates the poor workmanship problem and develops workmanship policies and strategies to the company contractor which can be implemented at the construction projects site for enhanced stake holder construction work.

Keywords

Poor workmanship, Construction Industry, Khyber Pakhtunkhwa, Test, SPSS

1. Introduction

One most important area of developing economies which is getting increasing attention as a possible region for the growth of well institutional arrangement is construction, an industry existent

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in every progressive activity. Nevertheless, the construction industry is threatened with numerous problems. Poor workmanship and shortage of equipment are some of the general problems that are related with the construction industry particularly in the emerging countries. Deficiencies in building can thus arise from either or a combination of the existence of the following situation; inaccuracy in design by the Designer, flaws from the builder, weaknesses in materials, and incorrect use of equipment, Common practices of faults in construction contains either or a mix of the following; defects in structure giving increase to cracks or breakdown; defects or errors in plumbing & electrical connections; insufficiency of sanitations for proper removal; inadequate facility for ventilation; poor freshening air and/or heating system; unsatisfactory fire prevention or shield mechanism and bad encyclopedic insulation system. Furthermore, defects in structure may also be as an effect of the following; termite beside vermin infection, wood rot, fungus, and dry rot. Damages as an outcome of earth settlement or earth movement can also consequence to defect to building.

There is the need to investigate the major factors that mostly contribute to poor workmanship in the construction industry in Khyber Pakhtunkhwa (KP), Pakistan. This study therefore, examines the major factors contributing to poor workmanship in the construction industry in KP from the view point of professionals such as contractors, consultants and engineers. The most important feature of a quality project is the workmanship; unluckily, poor class workmanship can abolish projects already put in place. Poor workmanship is one of the severe issues facing native contractors in most developing countries.

The KP construction industry is trouble with some severe problems, including absence of skilled labors and a lack of funding in exploration and development. Moreover, numerous of the industry's clients are disappointed with the standard of facility provided plus with the superiority of the finish product (i.e. the built building).

Numerous researches have been printed aiming to vividly improve the proficiency and quality of the industry, to strengthen the energy for change and to make the industry further responsive to customer needs the goal of this paper is double. First of all, to identify the most central problems presently facing the industry, and then second to evaluate the brutality of these problems by survey of construction companies

1.1 Research Objectives

- To investigate the factors effecting the poor workmanship in construction industry.
- To analyze these effected factors.
- To develop a check list for betterment of stake holders.

1.2 Research Significance

Most public building in KP, Pakistan are faced with problems of defects such as "cracking, staining/discolorations, efflorescence, rising humidity or water penetration, deflection, tile or plaster divided into layers, which have resulted due to building material and workmanship. In construction project, mostly collapse or damages are occurred due to substandard material and non-skilled team members. It becomes essential to accomplish a research that would scan problem of poor quality workmanship to help in providing solutions to the problem faced by workmanship in buildings.

2. Literature Review

According to Mydin to et al (2014), preceding research and analysis of the results, the intents of this study were attained. The types of flaws which usually happen on low-cost housing due to poor workmanship were identified, with cracks on walls ranking as the most common defect.

According to Shittu et al. (2013) The quantity of construction project completion is weak because of the speedy increasing rate of foremost flaws in building as an effect of poor quality constituents and workmanship which has been identified as the foremost cause of defects in Nigerian construction projects. This required the examination of problem of poor workmanship as a major cause of building defects. This was completed by examining the factors important to poor workmanship quality in public building projects.

According to Kaming et al (2010) numerous variables have an influence upon construction time and cost attacks in Indonesia. A questionnaire study was started of project managers working on high-rise construction projects in two Indonesian cities: Jakarta and Yogyakarta. Classified variables were identified according to their perceived significance and frequencies of occurrence. Inflation rises in material cost, erroneous material estimating and project complication are the key causes of budget overruns. The major causes of postponement are design changes, poor labor productivity and insufficient preparation. Delay and cost overrun variables were grouped into factors, and their relationships analyzed.

According to N.A. Othman and M.A. Othuman Mydin (2014) Poor workmanship is one of the famous factor that lead to building flaws and failures problems. Generally residential buildings are the one which practiced maximum of the failures problems due to poor workmanship. Poor workmanship problems are closely related to the designer and also the contractor that construct the buildings.

3. Methodology

Research papers were studied from different sources for factors which effect poor workmanship. First the research team members meet with stakeholder for structured interview to identify the problems on the particular topic. Most effecting factors were chosen after discussion with professional. Structured interview was both opened and closed ended. From the guidance of professional engineers, questionnaire was designed.

Furthermore, Pilot survey was conducted for finalizing the questionnaire. In next phase, designed questionnaire was distributed among contractors, consultants, and clients. Technique which was used for filling Questionnaires One-one Chat, Via Email, and Mobile calls.

Collected questionnaire data was saved in MS Excel for next process in Statistical Package for the Social Science (SPSS) Software. SPSS is used for data analysis of the research. SPSS gives some result from test runs.

3.1 Structured Interviews

The questions were questioned in a standardized manner and interviewer did not change from the interview schedule.

Structured interviews were quickly conducted, which means that a lot of interviews held in a short time.

3.2 Pilot Survey

A pilot Survey is well-defined as a minor study to test research procedures, data collection mechanisms and other research techniques in planning for a larger study. A pilot study is one of the important stages in a research project and is shown to pinpoint possible problem

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areas and deficits in the research mechanisms and procedure prior to execution throughout the full study.

3.3 Questionnaire distribution

Second survey was to distributed questionnaire during March, April, and May 2016. The questionnaire survey was distributed either personally or via e-mail to 120 members of top and middle management in the construction companies in KP. A sample of 120 practitioners received the questionnaire and 107 valid questionnaires were returned for analysis with a response rate of 90%. But 14 were incompletely completed. Then 99 questionnaires are finally used for data analysis.

4 Results and Discussion

Initially, collected data was inserted in MS Excel for further process.

SPSS software was used to analyze the collected data. Tests which were chosen for research are: Cronbach's alpha (reliability test), and Relative Importance Index. Results were showed in tabular form.

Table 1: Cronbach's alpha (Reliability Statistics)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
0.904	0.901	82

Cronbach's alpha reliability coefficient usually sorts between 0 and 1. Nevertheless, there is actually no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale.

"0.9 or greater value shows highly reliable data, 0.8 to 0.9 shows the good reliable data, 0.7 to 0.8 shows acceptable data, 0.6 to 0.7 Questionable data, 0.5 to 0.6 shows poor reliability, and 0.5 or lesser shows unacceptable data".

This test result was 0.904 and it shows the highly reliable data.

Table 2: Reliability Importance Index

Ranks	Factors	R.I.I
1	Financial difficulties faced by the contractor	0.89090
2	Complicated role of subcontractor	0.87474
3	Design deficiency affecting building resolution	0.78989
4	Project manager's competence	0.78989
5	Delays in contractor's payments to subcontractors	0.78383
6	Lack of coordination between designers and contractors	0.73737
7	Delay in contractor's claims settlements	0.73131
8	Delay in the approval of contractor submissions by the engineer	0.72727
9	Lack of communication between maintenance contractors	0.71717
10	Poor human resource management and labor strike	0.69292

Relative Importance Index is a type of analyses. It was used for the analysis because it fits the purpose of this study. It helped in finding the involvement a specific variable in designed

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questionnaire.

Where, **W** shows weighting specified to each statement and ranges from 1 to 5,

A shows Greater response number (5), and **N** shows total number of respondents.

5. Conclusion

This research was conducted to investigate the Factors effecting poor workmanship in Khyber Pakhtunkhwa Pakistan building construction projects from stakeholder's perspective through a questionnaire survey. The analysis of the participants' responses revealed that the poor workmanship in construction projects is a severe problem. The research investigated three critical risks in identified 41 factors.

Financial difficulties faced by the contractor must be resolved by higher authorities before wasting a time.

Complicated role of subcontractor should be well supervised during a project.

Design deficiency affecting building should be pre checked before construction.

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Causes of Disputes Between the General Contractor and Subcontractor in the Constrcution Industry of Pakistan

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Abstract

Disputes have detrimental effects on project leading to cost overruns, delays, poor quality of work and intangible losses to working relationship among the project participants. Subcontracting constituting a major portion of construction works needs attention as the dispute taking place between the general contractor and subcontractor may jeopardize the success of the whole project. This study identifies the causes of disputes between the contractor and subcontractor through a survey conducted in the Pakistani construction industry and determines that delays in payment, unfair risk allocation, delays in work, incompetent subcontractor and negative attitude of parties are the top five causes of disputes. This paper will be helpful to both contractor and subcontractor in assessing that where their relationship could take a sharp turn and take remedial measures beforehand.

Keywords: conflicts; claims; disputes; subcontractor; general contractor; construction projects

1. Introduction

Disputes and conflicts are used synonymously by some authors in their research like Mitkus and Mitkus (2014). Likewise, many other authors state that conflicts, claims and disputes are used interchangeably but their meanings are different (Love et al., 2008). Conflicts take place between two parties that compete over scarce resources, unharmonious goals and interfere with one another (Love et al., 2008). They also occur when the parties involved in the project reach a point where they become incompatible on the priorities and objectives. This creates an environment of frustration due to lack of cooperation among the parties (Acharya et al., 2006). The unrealistic expectations, interpersonal relations, administrative procedure, tradeoffs between technical and performance issues are also a cause of conflicts (Li et al., 2012) and more specifically in the construction industry (Dada, 2013). Conflicts can be external or internal. Internal conflicts emerge due to issues among the project participants. External conflicts are due to political and weather risks, and other

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external agents. Similarly, the conflicts can either be functional or dysfunctional. Functional conflicts aide in progress of the project while dysfunctional ones hamper it (Gould, 1999). In construction industry it is impossible to achieve a conflict-free environment. Though completely eliminating them is not possible, efforts should be made to keep them under control (Younis et al., 2008). Conflicts can be and should be managed so that they do not lead to disputes.

Disputes are *"matters or controversies outside the scope of jobsite management that must be settled" (Diek*mann and Girard, 1995*).*They are regarded as disagreement by some authors while others argue that a dispute cannot take place until a claim has been put up by one party and the other party rejects it. The party initiating the claim tends to refuse the rejection of their claim, giving rise to a dispute (Chynoweth et al., 2007). Difference of anticipated response against a particular claim between the two parties is at the core of disputes. It is a conflict that needs a resolution (Mustill, 1995).The parties in the construction projects watch out for their own interests. During the dispute resolution, if one party tends to compromise or show flexibility on the matter in hand, then the dispute has more chances of getting settled. The organizations should find the ways of resolving them as early as possible before they cause serious damage. The conflicts should be managed at their earliest so that they do not turn into disputes. The disputes are often resolved by the involvement of third parties in the process of litigation and arbitration (Frey, 2002).

In construction industry occurrence of disputes among the project participants is widely reported and it has been observed that they may take during any phase of the project (Hall, 2002). It has been reported that the amount spent in resolving disputes through litigation is US $5 billion annually in the Unites States(Ng et al., 2007). In addition it has been reported to be the major cause of increase in project costs (Brockman, 2013). The philosphy behind occurrence of disputes in the construction industry has been studied by various authors. Some owe it to interaction of multiple parties i.e. client, consultant, contractor, subcontractor, material suppliers etc., each having their own set of interests (Cakmak and Cakmak, 2014). Others consider that the uniqueness of each and every construction project and lack of presence of any standardized format leads to disputes (Cheung and Suen, 2002). Adversity among the parties of a project lead to disputes between them and this is true in the case of general contractor and subcontractor as well (Greenwood, 2001). There is an increase in the percentage of works subcontracted in the construction industry. The subcontracting may even account to 85% of the total construction works as per Mbachu (2008). This in turn indicates that the performance of a project is directly dependent upon the success of general contractor's and subcontractor's relationship.

What will be the status of project in case disputes take place between the general contractor and subcontractor? This question is alarming for the construction industry. When the propotion of works assigned to the subcontractor are significantly large, any dispute between them will have a triggering impact on overall success of the project. While studying the general contractor and subcontractor relationship authors reported that subcontractor complain about the unfair risk allocation. Construction contracts that serve as a tool to distribute risks in the project are based upon the wishes of the general contractor in Pakistan and the standardized conditions are missing (Choudhry et al., 2012). So an animosity is created between the parties when the project is at its infancy stage i.e. when the contracts are being executed. The contractor tend to focus on their own profit and select the subcontractor on the basis of lowest bid. After selection they squeeze the subcontractors further paving the way for disputes (Kale and Arditi, 2001). Contractors also have certain complaints like the subcontractors bring inadequate workers on site and lack the basic scheduling required for a seamless execution of project particularly the critical activities (Johansen and Porter, 2003, Akintan and Morledge, 2013). Blame culture is pretty common between the parties and misconceptions lead to erosion of trust. All these factors lead to laying foundations of sour relationship between the contractor and subcontractor that can overall lead to drastic impacts on the project. Therefore this study focusses on identifying the causes of disputes between the contractor and the subcontractor in the construction industry of Pakistan so that parties may have a fair idea that which areas need improvement.

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This will eventually lead to better performance of project and acheivement of project objectives.

2. Literature review

In the past a myriad of researches exist on topic of "Disputes in construtcion industry". However a very few have focussed particularly on the causes of disputes between the contractor and subcontractor. Out of the many research papers found on the subject topic, only 2 are based on the construction industry of Pakistan.
According to Farooqui et al. (2014) , lack of supervision skills, high expectations of the client, poor subcontractor selection, reluctance to seek clarification, lack of resourcefulness, unprofessional attitude of the project parties, lack of competency of the project team members, tender pricing, unfair risk allocation, escalation of material prices, changes in exchange rate of dollar, project participants default, financial instability, delays in payment, construction schedule very optimistic, unforeseen circumstances not catered for in the schedule, poor risk management, lack of communication and coordination, lack of contractual administration, poor procurement practices, payment plans not appropriate, lack of proper construction management, improper contract selection, unrealistic tender price, exaggerated claims, unjust and untimely presentation of claims, failure to follow the contract by either party, conditions of contract unclear, indemnification clauses and interpretation of contract clauses to be among the causes of disputes. Also Khahro and Ali (2014) studied the same topic and identified direct and indirect causes of conflicts. The direct causes of conflicts included delays in payment, contractual claims, public interruption, poor communication, differing site conditions, and variations, errors in contract documents, design errors, difference in evaluations, multiple meaning of specifications and cultural differences. The indirect causes arise due to above mentioned factors.
Among the few researches focused primarily on the subject of "Disputes between contractor and subcontractor", 3 research papers were found that include those written by Al-Hammad (1993), Enshassi et al. (2012) and a recent by Okunlola (2015). In Pakistan no research has been carried on the subject topic. A total of 31 causes of disputes have been identified through the literature that has been used in this study.

3. Methodology

Since very few researches have concluded the causes of disputes between the contractor and subcontractor, all dispute causing factors identified through literature i.e. the overall factors behind disputes in the construction industry were discussed with the experts during the pilot survey to narrow down those which impact the general contractor's and subcontractor's relationship in Pakistan. Hill (1998) has suggested 10-30 participants to be adequate for such survey. After the scrutiny of these factors and based upon the suggestions of the experts a detailed questionnaire was developed. It consisted of two parts. In the first portion the respondents were asked to give details of the type of organization to which they belong, their position in the organization and their experience in number of years. In the second portion the respondents were asked to rate the probability and impact of dispute causing factors on Likert scale ranging from 0 to 5. Here 0 meant no impact/no chance of occurrence while 5 mean very high impact/ very high chance of occurrence. The survey was distributed to the professionals of the construction industry primarily targeting contractors and subcontractors. The bench mark for sample size was based on the recommendations of Dillman (2000) that suggests that at 10% confidence interval and for a population size >30,000 a sample of 96 respondents will suffice.
The probability and impact of the factors as indicated by the respondents were multiplied to determine a cumulative effect. A similar methodology has been applied by authors like Assaf and Al-Hejji (2006) and many others while ranking the causes of delay in construction industry. The data obtained through the survey was analyzed using SPSS

software for its reliability. Cronbach's alpha was determined for which any value above 0.8 depicts that the data is reliable (Gliem and Gliem, 2003). Afterwards the factors were ranked using the famous method of Relative importance index utilized in various researches in construction management. The relative importance of the factors was determined using the formula given in Equation (1) used by Agrawal (2011) , Muhwezi et al. (2014) , Assaf and Al-Hejji (2006) and in many more similar studies.

Where W is the weight given to each factor by the respondents and ranges from 0 to 5, A is the highest weight (i.e. 5 in this case) and N is the total number of respondents.

$$RII = \sum W / A * N \ (0 \le RII \le 1) \qquad \text{Equation (1)}$$

4. Analysis and results

Pilot survey was conducted with 13 professionals of the construction industry out of which 11 had an experience of more than 15 years. The professionals were satisfied with the overall factors considered for the study. As a result of this survey 21 factors were narrowed down for further research. A detailed questionnaire was developed and distributed all over the country in all four provinces of Pakistan through emails and direct visits to the site on the basis of recommendations made in pilot survey. It was deemed necessary that in order to have reliability of data only project managers or above stature of professionals should be contacted for answering the survey. A total of 98 responses were obtained out of which 30% respondents belonged to contractor organization, 25% subcontractors, 24% consultants and 21% clients. It was the target of the survey that mostly contractors and subcontractors should be involved. However on actual ground, when responses were obtained these two prime parties corresponded to 55% of the respondents. But there is not much difference between the number of contractors and subcontractors hence the data is not subjected to biasness towards any particular party. Moreover since clients and consultants are also an integral part of the projects, therefore there observation and experience of these parties regarding this matter also counts. Moreover they do not have any biasness towards any of the two subject parties. Out of these respondents 77% have more than 20 years of experience and they are mainly construction and project managers, contract managers, project directors and owners. It can be therefore assumed that the data is very authenticated and based on actual ground facts.

The data was arranged in spread sheets and their probability and impact was multiplied. These numbers were exported to SPSS software to determine the overall reliability of data using Cronbach's alpha method. The value of alpha came out to be 0.867 which indicates that the data is quiet reliable. Afterwards the factors were ranked using RII, whose results are shown in Table 1.

Table 80: Causes of disputes between the contractor and subcontractor

Description	Contractor Rank	Subcontractor Rank	Consultant Rank	Client Rank	Mean Rank
Delays in Payments	1	1	4	1	1
Unfair risk allocation	12	2	2	2	2
Delays in work	11	3	1	1	3
Incompetent subcontractor	10	5	3	4	4
Negative attitude of parties	9	4	8	7	5
Poor quality of works	4	7	7	14	6
Lack of proper supervision by the subcontractor	5	11	6	9	7
Exaggerated claims by the subcontractor	3	12	9	15	8
Change orders	6	14	12	11	9
Estimation errors in bill of quantities	2	17	16	12	10
Either delays or poor quality of contractor provided material	16	10	11	8	11
Lack of communication	14	15	10	5	12
Absence of general contractor from site	15	9	5	19	13

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Errors in drawings and specifications	7	19	15	10	14
Avoiding instructions given by general contractor	18	6	19	13	15
Acceleration/ suspension of work by the general contractor	8	20	13	17	16
Delay in reply to queries by either party	13	15	17	16	17
Extra works	20	8	20	6	18
Changed conditions	17	18	14	18	19
Assigning part of subcontracted works by general contractor to some other subcontractor	19	12	18	20	20
Absence of subcontractor from site	21	21	21	21	21

The findings are somewhat in agreement with the earlier studies on causes of disputes in the Pakistani construction industry. According to Khahro and Ali (2014) delays in payments is the most significant cause of dispute in Pakistan industry. When it comes to the general contractor and subcontractor the situation is not different and delays in payment occur in Pakistan resulting in disputes weather it is an owner-general contractor relationship or general contractor-subcontractor relationship. The agreement of contractor, subcontractor and the owner that it is the major cause of dispute agree with the findings of the researches carried out earlier on. Unfair risk allocation is the second most significant cause of dispute. However contractor does not agree with it and have placed it on the 12ᵗʰ position. But it is in perfect agreement with the findings of Choudhry et al. (2012) that there are no standard contract conditions for the subcontract in Pakistan and owner imposes onerous conditions on the subcontractor. This leads to unfair risk allocation. FIDIC should therefore be applied to the contractor subcontractor relationship as well. Delays in work has been ranked 3ʳᵈ position but contractors have placed it on the 11ᵗʰ position. This is also evident in the research carried out by Farooqui et al. (2014) in which this factor was not considered while assessing causes of disputes from contractor's perspective. This point out towards an important aspect that contractors are not much bothered about the delays in work in the Pakistani construction industry. An awareness regarding its downfalls should be communicated to the contractors of Pakistan. Incompetent subcontractor has been ranked 4ᵗʰ most significant cause of dispute. Around 83% of contractors are selected on the basis of lowest bid in Pakistan (Khan and Abdul Qadir Khan, 2015). This may lead to selection of an incompetent subcontractor that leads to disputes at later stages. Owing to the low bid practice, incompetent contractor selection is a significant dispute in Pakistani industry. A new factor made it to the top 5 list i.e. Negative attitude of parties. This is due to the adversity in the relationship of contractor and subcontractor as indicated by Greenwood (2001)

5. Conclusion

This analysis identifies the most important root causes of disputes between the contractor and subcontractor in the construction industry of Pakistan that include *delays in payment, unfair risk allocation, delays in work, incompetent subcontractor and negative attitude of parties.* An attention towards these factors can put off the strain in the contractor subcontractor relationship. This will in turn bring fruitful results for the project. A study to determine a framework/ methodology to avoid these disputes or mitigating them once they occur is recommended.

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Benchmarking the Current State of Construction Safety Practices in KP, Pakistan.

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Abstract

Risk to human health and safety is the common issue throughout the world in different industries, but it is commonly present in construction industry. Study shows that the issue almost exists in developing countries. In developing countries, Pakistan is also facing the problem of safety practices and their implementation in construction industry. People are affecting because of this serious problem in routine life. The objective of this study is to ensure the safety of workers, exposed to hazard on construction sites. One of the main objectives is to establish such culture that should have a batter awareness of worker's health and safety. Pilot survey and structured interview was used to collect critical factors influencing work site safety. These factors were included in questionnaires that are distributed in different construction sites to get response from technical experts. Collected data was analyzed on statistical package for social sciences (SPSS). Two tests run i.e. Frequency test and the 2nd one Descriptive test. The response shows that there is no sophisticated system of safety rules and regulations. It is a collective effort, so the management and workers, all had to respond positively and get awareness, education and safety training to maintain safe work environment.

Keywords Construction safety, Critical factors, Construction industry, SPSS, KP.

1. Introduction

Developed and developing countries relies heavily on economic growth .economic growth depends upon most of factors, one of the most important factor in construction industry in European countries, gross national product comes from construction industries. Construction industries are socially important such as socially. However, the construction industry, at the same time, is also

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recognized to the most hazardous. Safety practices adopted in different construction industries throughout the world should be discussed thoroughly.

Construction industry plays vital role in increasing the economy of many countries. It Provide the platform required for other parts for the development, thus reflecting the level of economic development of the countries. However, it is also noted that the construction industry consist huge rate of accidents among all industries. Statistics of construction safety in developing countries is often at lower levels mainly due to an ignorance of strict safety regulations. In Pakistan the importance of construction industry can't be negotiated, because it is vital rules in overall development a lot of infrastructural project are ruining through outwit modern needs and requirements. For this purpose the improvement of technology is must.

1.1 Technology Advancement

The use of modern technology is very important and beneficial but some time in construction industry it becomes dangerous and hazardous to the environment of the construction industry. This hazard can result the loss of human life, loss of capital as well as lose of money.

1.2 Labor Safety Issue

Labor safety is an important issue of concern in developing as well as the developed countries because work hazards which exist at the construction sites are either alleged to be less dangerous than the severity they have inexperienced employee cause accidents which effects development of industry as well as country.

1.3 European Construction Industry

European countries have a great achievement to mitigate hazards and risks at sites. They consists modern technology but they have controlled technology according to safety rules and regulation. In Europe safety is preferred to be the first and foremost responsibility because it is directly in touch with human life. There are number of firms and organizations working to ensure the safety practices at European countries. They have issued standards for work and activities with keeping in mind the safety rules and regulations. In fact, safety rules and regulations are devised also by these organizations to prevent accidents.

1.4 Safety Practices in Developing Countries

Companies related to construction works around the world are implementing safety, health, and environmental management systems to reduce injuries, mitigate work-related illnesses, and to give a safe work environment for their employees. In developing countries, a lot of factors are obstacles in implementation of safety practices at these industries; one of the main factors is type of project and contractor working in an industry.

1.5. Research Significance:

This research discusses safety and encouragement of employee health by preventing and eliminating risks, accident and mishaps at the construction project. This study totally focuses on health of employee and discusses the weak areas of health and safety at the different construction sites. This research is helpful to decline accident rate and also aware the worker concerning safety. This study intends to develop a safety basics model that can help all construction companies develop and implement an effective safety program.

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2. Literature Review

The study of literature relevant to safety practices in Pakistan is a key factor to collect solid and effective information. Different study throughout the world identified the common root causes of occurring accident in the construction industry of Pakistan. Study showed the key factors affecting Pakistani construction industry's safety environment, initiatives to mitigate the problem and recommendation regard maintaining safe work environment in the construction industry of Pakistan.

By (OSHA,2016) A risk assessment is not about creating huge amounts of paperwork , but rather about identifying sensible measures to control the risks in your workplace. You are probably already taking steps to protect your employees, but your risk assessment will help you decide whether you have covered all you need to. Think about how accidents and ill health could happen and concentrate on real risks – those that are most likely and which will cause the most harm OSHA, 2016.

Bielby, S and Gilbertson , A L CIRIA (2008) Company general policy in written statement is provided by employer with few employees. The employers that should keep it updated and have to share it with all the employees working in the   construction industry.

(Thompson et al. (1998) Empirical show that middle management which consist on supervisor have an important role in safe work environment .A model which show the safety affect of manager and supervisors is focused on two central path ways

- From organisational politics to manager support for safety to safety conditions
- From supervisor fairness to supervisor support for safety to safety compliance.

Thompson et al. (1998)For safety has found that management support has positively ruins supervisor support its means that safety conditions are managed by top management but the work force managed with safety regulation by the middle management (supervisor).

O'Dea (2002) Found that middle management rule for safety was predictive of worker intensions to safety actions, and obeying rules.

(Eich, 1996) Found that construction is the occupation which is exposed to a high level of hazards. It is dangerous and demanding industry in USA.by Hinze (2002), "most of the firms related to construction works have mentioned the safety as a man factor in reducing injuries rate and cost related to workers accidents. The cost becomes 20 times more when worker's compensation losses are added to the cost of injuries (Nelson, 1996).

The dynamic nature of the work – construction sites are constantly changing and a large number of trades may all be carrying out tasks potentially dangerous to their health and that of others.

 (Rogers, 1994) Mentions that work is an essential part of our lives and most adults spend their time in work and perceive it as a part of their self-identity. The access to health care and health status is not too good in various countries which causes to dangerous diseases such as respiratory illness, gastrointestinal disease, and other health problems (Dembe 1999).

Risk appreciation – there is generally a low awareness of health risks and the controls needed. It can take many years for serious ill health conditions to develop and the immediate consequence of a harmful workplace exposure may often be dismissed as not significant compared to the immediate impact of injuries caused by accidents.

Employment – many workers are either self-employed, work for small companies, or frequently change employers. Others work away from home. These situations can make it problematical for workers to easily look after their own health and they often have little or no contact with occupational health professionals.

A careful review of 15 research articles was studied to identify the key factors related to the subject. A lot of research has been done regarding this important matter to overcome this issue through

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effective recommendation and suggestions. Following are some important factors about safety of construction industry those are being discussed by different researchers in their research

3. Methodology
The research methodology consist on the following steps

3.1 Location of Survey
The ground reality show that the issue of safety practices in construction sector existing throughout Pakistan .But our study mostly focus on the KP(Pakistan) which locate at north Pakistan, because this is the region which has fast going rate of infrastructure projects. In this research we strongly focus on the four region of KP (Pakistan).

3.2 Development of Questionnaire
Questionnaire was prepared on Likert scales which consist upon three different parts (areas) of information. In first part of the questionnaire , personal information of the stakeholder (related to construction works) are mentioned, the second part of the questionnaire, information about the organization , company or firm of stakeholder (client ,consultant , contractor) are mentioned. The third part consists on the factors causing accidents.
The Questionnaire is prepared which consist on different safety factors which cause accidents and increase the fatality rate of Pakistan construction industry. This questionnaire was based on a five-point Likert type scale,
Strongly Agree 5, Agree 4, Undecided 3 , Strongly Disagree 2, and Disagree 1

3.3 Structured Interview
Before the questionnaire survey some common factors which cause accident and increase fatality rate are collect through structured interview from some experts. Structure interview was conducted for the purpose of modification of the questionnaire through adding new factors.

3.4 Collection of Data
Site inspection survey were conducted on 55 construction sites and distribute a questionnaire to stakeholders (contractor, engineers, employee) and get their feedback about the safety climate of Pakistan construction based on Likert scale.

3.5 Analysis of Collected Data
Analysis of the factors representing manager's attitude, worker's perception, safety practices and contractor's behavior through questionnaire distribution.
The effects of g manager attitude, worker perception, safety practices and contractor behavior on the current state of construction safety practices of Pakistan will assess through regression analysis. Different SPSS tests were run on the collected data through questionnaire.

4. Results and Discussion

Table 1: Frequency Table

S/No	Factors (code)	Strongly agree%	Agree %	Undecided %	Strongly Disagree %	Disagree %	Maximum % value
1	F1	32	42	0	19	7	42
2	F2	17	32	2	33	16	33
3	F3	61	36	0	1	2	61

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4	F4	11	39	1	24	25	39
5	F5	65	29	0	5	1	65
6	F6	39	25	0	10	26	39
7	F7	11	26	1	15	47	47
8	F8	11	22	6	22	39	39
9	F9	33	29	0	15	23	33
10	F10	13	18	3	27	39	39
11	F11	20	39	5	20	16	39
12	F12	28	15	0	11	46	46
13	F13	26	25	0	14	35	35
14	F14	52	45	1	1	1	52
15	F15	11	17	4	23	45	45
16	F16	41	23	0	8	28	41
17	F17	25	57	1	7	6	57
18	F18	26	36	5	18	15	36
19	F19	6	18	0	36	40	40
20	F20	7	18	1	34	40	40
21	F21	14	9	2	30	45	45
22	F22	36	25	0	19	20	36
23	F23	41	54	1	2	2	54
24	F24	32	28	0	15	25	32
25	F25	44	24	0	13	19	44
26	F26	35	31	2	18	14	35
27	F27	9	55	10	10	16	55
28	F28	16	11	0	16	57	57
29	F29	15	11	1	22	51	51
30	F30	11	18	0	31	40	40
31	F31	17	38	0	22	23	38
32	F32	10	21	0	21	48	48
33	F33	22	38	0	24	16	38
34	F34	9	12	0	13	66	66
35	F35	11	34	1	17	37	37
36	F36	10	19	6	21	44	44
37	F37	47	44	0	5	4	47
38	F38	36	41	4	2	17	41
39	F39	41	42	0	8	9	42
40	F40	63	28	1	6	2	63

4.1 Frequency Test:

The Frequencies procedure can produce summary measures for categorical variables in the form of frequency tables, bar charts, or pie charts. Frequency test was basically used to find the frequency percentage and valid percentage of each factor's opinion given by technical participators.

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Table No.2 Descriptive test

S/No	Factors (code)	No	Minimum	Maximum	Mean	Std. Deviation
1	F1	100	1.00	5.00	3.6100	1.47638
2	F2	100	1.00	5.00	2.8400	1.57454
3	F3	100	1.00	5.00	4.5400	.70238
4	F4	100	1.00	5.00	2.8800	1.43041
5	F5	100	1.00	5.00	4.4800	.95853
6	F6	100	1.00	5.00	3.5700	1.47199
7	F7	100	1.00	5.00	2.7100	1.30496
8	F8	100	1.00	5.00	2.6100	1.34010
9	F9	100	1.00	5.00	3.4200	1.51211
10	F10	100	1.00	5.00	2.5100	1.39621
11	F11	100	1.00	5.00	3.2300	1.45543
12	F12	100	1.00	5.00	3.0300	1.48021
13	F13	100	1.00	5.00	3.1400	1.48406
14	F14	100	1.00	5.00	4.4600	.67300
15	F15	100	1.00	5.00	2.4800	1.31410
16	F16	100	1.00	5.00	3.6100	1.45571
17	F17	100	1.00	5.00	3.9500	1.08595
18	F18	100	1.00	5.00	3.3700	1.46787
19	F19	100	1.00	5.00	2.1800	1.26635
20	F20	100	1.00	5.00	2.2400	1.28802
21	F21	100	1.00	5.00	2.3200	1.36241
22	F22	100	1.00	5.00	3.3900	1.58844
23	F23	100	1.00	5.00	4.3000	.77198
24	F24	100	1.00	5.00	3.3700	1.51528
25	F25	100	1.00	5.00	3.6700	1.51127
26	F26	100	1.00	5.00	3.5100	1.52749
27	F27	100	1.00	5.00	3.3700	1.16042
28	F28	100	1.00	5.00	2.5400	1.32893
29	F29	100	1.00	5.00	2.4600	1.35154
30	F30	100	1.00	5.00	2.3800	1.37642
31	F31	100	1.00	5.00	3.0500	1.47966
32	F32	100	1.00	5.00	2.5100	1.30651
33	F33	100	1.00	5.00	3.1800	1.53991
34	F34	100	1.00	5.00	2.3800	1.13511
35	F35	100	1.00	5.00	2.8500	1.35121
36	F36	100	1.00	5.00	2.5300	1.29064
37	F37	100	1.00	5.00	4.2400	1.01623
38	F38	100	1.00	5.00	3.9200	1.12528
39	F39	100	1.00	5.00	3.9900	1.22676
40	F40	100	1.00	5.00	4.4000	1.05409

4.2 Descriptive Test:

The descriptive test was basically run over data to find mean and std. Deviation of each factor. Descriptive statistics can be used to summarize the data. If data is scale level than descriptive test

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is used to analyze data. This test shows values of factor, numbers, minimum, maximum, mean and standard deviation.

5. Conclusion:

Construction managers and firms have the goal to overcome safety issues in their sites but majority of people and firms have no intensions regarding this important issue. Survey shows that the large numbers of contractors are mostly focuses on investment and profit from their projects. Regulatory authority doesn't have devised any safety rules and regulations system to be follow by organizations that are in touch with construction works. Structure interviews also helped in identifying facts about the safety of workers in construction industry.

Result of Factor 1 shows that huge amount (74%) of respondent have strongly agreed that there is lack of awareness in top management. After that factor no 6 No Risk assessment and factor no 16 Rules and Regulations are also considered to be a critical factor because of significance response by technical experts.

26% of people agreed with the factor that is about the availability of safety rules regulations which means very less number of people have positive response in terms of availability of safety rules and regulations.

Result shows that how critical these eight factors are in any construction industry of Pakistan that should be managed properly with a committed effort from both contractors and regulatory authority of Pakistan.

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