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3rd Conference on Sustainability in Civil Engineering

BOOK OF ABSTRACTS

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Department of Civil Engineering

Capital University of Science & Technology, Islamabad, Pakistan

Foreword

Welcome to the CSCE 2021, 3rd Conference on Sustainability in Civil Engineering (CSCE'21) is going to be held by Department of Civil Engineering, Capital University of Science and Technology, Islamabad, Pakistan. The main focus of CSCE'21 is to highlight sustainability related to the field of civil engineering. It aims to provide a platform for civil engineers from academia as well as industry to share their practical experiences and different research findings in their relevant specializations. We hope all the participants experience a remarkable opportunity for the academic and industrial communities to address new challenges, share solutions and discuss future research directions. The conference accommodates several parallel sessions of different specialties, where the researchers and engineers interact and enhance their understanding of sustainability in the civil engineering dynamics.

This year, we have wonderful and renowned keynote speakers for this edition of CSCE. We have received 188 manuscripts from different countries around the world including UK, USA, KSA, Hongkong, Turkey, China and Pakistan. All papers have under gone a comprehensive and critical double-blind review process. The review committee comprised of 54 PhDs serving in industry and academia of UK, Hungry, Australia, New Zealand, Chile, Poland, Germany, China, Malaysia, Hongkong, KSA, Oman, Sri Lanka and Pakistan. After the screening and review process, 62 papers are to be presented in Conference.

We are grateful to all the reviewers and keynote speakers who have dedicated their precious time to share their expertise and experience. With this opportunity, we would also like to express our gratitude to everyone, especially all the faculty and staff at the Capital University of Science and Technology for their great support and participation.

In this regard, the participation and cooperation of all the authors, presenters and participants is also acknowledged, without whom this conference would not have been possible. Last but not the least, an appreciation to our advising and organizing committees whose hard work and dedication has made this day possible.

Conference Chair of CSCE'21

Dr. Majid Ali

Professor, Civil Engineering Department

Capital University of Science & Technology,
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Dr. Nasir Shafiq *Professor* *Universiti Teknologi PETRONAS, Malaysia*	***Towards Sustainable Development in Infrastructure Management: Challenges and Issues***
Dr. Noor Muhammad Khan *Director Center of Excellence in Water Resources* *UET, Lahore, Pakistan*	***Inflow Variability for Improved Water Resources Management***
Dr. Furqan Qamar *WSP UK*	***Assessment Process for Various Bridges as Per BS Standards***
Dr. Shaukat Ali Khan *Associate Dean, FoE&C* *Abasyn University Peshawar, Pakistan*	***A Monte-Carlo Simulation-Based Earthquake Risk Assessment Framework for Developing Countries***
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A REVIEW ON FRP REPAIRING OF FIRE DAMAGED RC MEMBERS

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Abstract- The mechanical properties of concrete are highly affected by the fire event. Load bearing-capacity of reinforced concrete (RC) structural members reduced due to reduction in concrete strength caused by the elevated temperature. This study presents a review on repairing techniques of fire damaged RC structural members. The investigations covered physical dimensions, loading-effect method and bonding behavior and residual-strength assessment. The advantages of fiber reinforced polymers (FRP) recall of RC members' performance/strength over the steel coating, enlargement of the section, steel-plate bolting (SPB) and fiber reinforced polymers (FRP) are discussed. The fiber reinforced polymers (FRP) post-fire repairing technique reviewed to achieve the design or more strength, as compared to pre-heated, of damaged RC member. It was observed that FRP coating, around the RC members, enhanced the strength up to or more than the pre-heated design strength of concrete.

Keywords- Fire Damaged RC Members, Fire Exposure, Post-Fire Assessment, Post-Fire Repairing Methods.

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COMPRESSIVE TOUGHNESS AND EMPIRICAL MODELLING OF NATURAL FIBER REINFORCED SILICA FUME BASED CONCRETE

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Abstract- The use of natural fiber is increasing day by day because it is an economical and waste material as well as has advantages from the environmental aspects. Among the natural fibers, coconut fibers (CF) have the maximum toughness. The addition of supplementary cementitious materials like silica fume together with coconut fiber will lead to complementary benefits in terms of mechanical performance and environmental aspects. Additionally, the establishment of an empirical equation will be helpful for the researchers to predict the experimental stress-strain response. Therefore, in this study, the control mix, silica fume concrete, coconut fiber reinforced concrete, and coconut fiber reinforced silica fume based concrete are investigated for compressive toughness and empirical modeling. Furthermore, scanning electron microscopy (SEM) is also performed to study the microstructure of the matrix. It was found that the addition of coconut fiber and silica fume in the matrix improved the compressive toughness and microstructure of concrete. In addition, the stress-strain curves obtained from the empirical equation showed the goodness of fit with the experimental data.

Keywords- Coconut Fiber, Silica Fume, Concrete, Compressive Toughness, Empirical Modeling.

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IMPACT OF CHOPPED BASALT FIBRES ON THE MECHANICAL PROPERTIES OF CONCRETE

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Abstract- Basalt fibre is a novel inorganic fibre which is produced from basalt rock. In this study the impact of chopped basalt fibres on the concrete workability, compressive and tensile strength, and concrete's modulus of rupture at 7 and 28-days was investigated. The concrete used in this research was normal strength concrete with a target compressive strength of 30/37 MPa. In this research, fibre reinforced concrete samples were produced using basalt chopped fibres of two quantities (4 kg/m^3 and 8 kg/m^3) and three different fibre lengths, namely 25.4-mm, 12.7-mm, and 6.4-mm. The test findings revealed that slump decreased as the quantity of fibres increased and shorter fibres were used. The mechanical properties of concrete were affected by the fibre dosage and length. Overall, the results indicated that adding chopped basalt fibres improved the compressive, tensile, and flexural strength of concrete, particularly at early age, while slightly reducing the compressive strength at 28-days by an average of 3.9%. The results indicated that adding 4 kg/m^3 of 25.4-mm long chopped basalt fibre into concrete provided the best performance of concrete in compressive and tensile strength, and modulus of rupture.

Keywords- Basalt Fibres; Fibre Reinforced Concrete; Mechanical Properties; Workability

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EVALUATING THE FLEXURAL PERFORMANCE OF FUNCTIONALLY GRADED CONCRETE USING STEEL FIBRES AND RECYCLED AGGREGATES

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Abstract- The objective of this research is to compare the flexural performance of functionally graded concrete (FGC) to that of conventional Steel fibres reinforced concrete (SFRC). In this study, four concrete mixes were prepared, containing one SFRC mix, and three combinations of FGC mixes. The hooked end steel fibres were used in 0.75 % of the total mix volume in the SFRC and FGC mixes. In FGC mixes, recycled plastic aggregates (RPA) and recycled concrete aggregates (RCA) have been substituted for natural aggregates by 15% by weight. Under third-point loading, the flexural performance of beam-shaped specimens with the dimensions of 100x100x500mm was assessed. In addition, an Ultrasonic pulse velocity test was conducted on cubic specimens having dimensions of 100x100x 100mm to find the quality of concrete under the influence of steel fibres and recycled aggregates. According to the findings, FGC has a lower post-cracking flexural efficiency than ordinary SFRC. Furthermore, UPV values of FGC are higher than conventional SFRC. This research reveals the economic advantages of using the functionally graded materials (FGMs) concept to minimize the use of fibres.

Keywords- Recycled Concrete Aggregate, Recycled Plastic Aggregate, Functionally Graded Concrete, Steel Fibres Reinforced Concrete, Sustainability.

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AN OVERVIEW ON COMPRESSIVE BEHAVIOUR OF COCONUT FIBER REINFORCED PLASTER

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Abstract- Plastering is one of the general applications of earth-based mortars used for earthlike building conservation or latest architecture. Regarding the compressive strengths, there are contrasting findings presented in past studies. It is found that the mixture of coconut fibers with cement mortar decreased its compressive strength when increasing the fiber content. The extensive research has been done on the use of natural fibers as a stabilizer in building materials. The use of fibers, or natural fibers, in the plaster does more to enhance the wall strength than fibers in blocks or mortar. This paper adds to the effort to review the properties of the coconut-reinforced paper machine by focusing directly on any changes in the changing behavior of the composite. The research and conclusions of various researchers are reviewed to better understand the combined behaviors. According to the review, the dynamic nature of the hardened coconut compounds has been greatly improved.

Keywords- Plaster, Compressive behavior, stabilizer, coconut fiber

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EFFECT ON WORKABILITY, COMPRESSIVE, AND TENSILE STRENGTH OF GEOPOLYMER CONCRETE INCORPORATED WITH QUARRY ROCK DUST, FLY ASH, AND SLAG CURED AT AMBIENT AND ELEVATED TEMPERATURES

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Abstract-This paper presents the effect of ambient (27°C) and heat (100°C) curing on the properties viz. workability, compressive, and tensile strength of quarry rock dust (QRD) based geopolymer concrete (GPC) comprising fly-ash (FA), and slag (SG) as a binder. The SG was replaced with QRD up to 20% by weight to develop QRD-SG-FA based geopolymer concrete (QFS-GPC). A total of 12 types (6 cured at ambient and 6 cured at 100°C) of mixes were prepared and tested. The workability of the mixes was reduced by the replacement of SG with QRD. The ambient cured GPC-D27°C and oven-cured GPC-D100°C mixes with FA/SG contents of 50/35% and QRD of 15%, yielded the maximum compressive strength of 33.55MPa and 35.45MPa respectively. The strength properties i.e., compressive, and splitting tensile strengths of the above optimal mixtures have shown improved strength by curing at higher temperature and have depicted more strength than the control OPC concrete specimens.

Keywords- Ambient Temperature Curing, Elevated Temperature Curing, Geopolymer Concrete, Quarry Rock Dust.

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EVALUATING THE MECHANICAL AND DURABILITY PERFORMANCE OF CONCRETE UTILIZING PLASTIC FINE AGGREGATE

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Abstract- This study evaluates the mechanical and durability characteristics of eco-friendly concrete comprising of electronic plastic waste (EPW) as partial replacement of fine aggregate. Such an approach not just only reduces the negative effects of EPW on the surrounding world, but also helps in avoiding excessive quarrying for the production of natural aggregate. For this purpose, four M20 grade concrete mixes were prepared, substituting natural fine aggregates with plastic fine aggregates (PFA) using 0%, 10%, 15%, and 20% substitution levels. The mechanical efficiency of EPW concrete was evaluated based on the compressive strength while some of the durability properties were assessed through, sorptivity coefficient and alternate wetting and drying. The findings showed that by 10%, 15%, and 20% PFA replacement, compressive strength decreased by 2.6%, 9%, and 13.6%, respectively. Conversely, EPW concrete provided acceptable to excellent performance in the workability, and also shows positive results for required durability properties such as sorptivity coefficient, and alternate wetting and drying.

Keywords- Eco-friendly concrete; Electronic plastic waste; Natural aggregates; Plastic fine aggregate (PFA).

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EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF NANO GRAPHITE PLATELETS ON THE COMPRESSIVE STRENGTH OF CONCRETE WITH RECYCLED PLASTIC AGGREGATES

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Abstract- The rapid increase in industrialization, population, and modern life style has significantly increased the rate of waste production. As a result of technological advancement and up gradation of technological innovations, the rate of obsolescence in the electronic equipment's has also increased making it one of the fastest growing waste streams in the world. The current annual production rate of Electronic or E-waste is 3-4% in the world. E-waste will be increased approximately to 55 million tons per year by 2025. This E-waste significantly damages the environment because of its non-biodegradable nature. In order to diminish this problem one of the ways is to utilize this E-waste in the concrete production. Past works have used the E-waste plastic as a raw material for production of plastic aggregate to be used as a substitute for natural aggregates. However, the results have shown the plastic aggregate reduces the compressive strength of resulting concrete. In order to enhance the strength properties, different dosages of nano graphite platelets (NGPs) (i.e. 1, 3 and 5%) have been introduced into concrete with replacement of 25% coarse aggregates by plastic aggregates. Dispersion test is carried and a ratio of 0.6:1 (surfactant/NGPs) is found to yield maximum dispersion. NGPs are nanofillers which significantly improve the density and hardness of the cementitious composite due to reduction in porosity and reinforcement in microstructure. The specimen that contained 25% (by volume) of E-waste as an aggregate, and 5% of NGPs (by weight of cement) was proved effective in increasing compressive strength by 13.56%.

Keywords- E-Waste, Nano Graphite Platelets, Dispersion, Compressive Strength.

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PREDICTING THE IMPACT OF CHEMICAL AND PHYSICAL VARIABILITY IN BINARY AND TERNARY CEMENTITIOUS BLENDS

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Abstract- To reduce the quantity of CO_2 emitted within the construction industry, cementitious by-products will need to be implemented on a larger scale. In relation to the use of by-products, one of the biggest disadvantages is that not only from source to source, obtaining a by-product from the same source could result in a variation in the chemical and physical properties which will then impact the mechanical properties. Therefore, the paper reviewed binary and ternary cementitious pastes that were produced from 7 different by-products and predicted the impact of variation in the chemical and physical properties on the 14-day compressive strength. The predictions and analysis were done with the use of artificial neural networks (ANN). Overall, ANN successfully derived an accurate prediction which correlated with the trends that were expected. This study noted that if parameters of the overall mix were taken into consideration, the increase in SiO_2 will have a negative impact while increase in CaO would have a positive impact on the 14-day strength. The most accurate form of understanding the impact of chemical and physical variability of cementitious replacements, took into consideration both Ca/Si ratio and the average particle size.

Keywords- ANN, Cement Replacements, Predicting Compressive Strength, Binary and Ternary Cementitious Pastes.

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EFFECT OF JUTE FIBER AND RECYCLED COARSE AGGREGATES ON THE COMPRESSIVE STRENGTH AND POROSITY OF CONCRETE

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Abstract- In construction, concrete is mostly used for different projects. The drawback of plain cement concrete is that it is strong in compression but weak in tension. Nowadays, a lot of effort is made to minimize this problem by using additives e.g. fibers and cementitious material. Moreover, recycled coarse aggregates (RCA) are seeking more attention towards substituting natural coarse aggregate (NCA) because of their related economic benefits and sustainable development. Hence, this paper examines the combined influence of jute fiber (JF) and recycled coarse aggregates (RCA) on the concrete properties. In this investigation, the length of JF is kept at 10 mm. Two types of mixes are investigated i.e. with 0% RCA (control mix) and 100% RCA. In each of these mixes, 0%, 0.30%, and 0.60% of jute fiber (JF) by volume of concrete are used. The mechanical and durability properties are evaluated by compressive strength test and porosity test respectively. This investigation shows that the addition of 0.30% of JF has a positive influence whereas the addition of 0.60% has a negative influence on the mechanical property of concrete in both 0% RCA and 100% RCA cases. In both cases (0% RCA and 100% RCA), the compressive strength is slightly improved up to 0.30% of fibers but upon further increase of the fibers, the compressive strength is decreased. While in the durability test, the concrete porosity increases with the increasing quantity of JF and RCA in both 0% RCA and 100% RCA cases. In a higher dosage of fibers (0.60%), the effect of porosity is more as compared to lower dosages.

Keywords- Durability Properties, Jute Fiber, Mechanical Property, Recycled Coarse Aggregates

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INFLUENTIAL ASSESSMENT OF MACRO SYNTHETIC FIBERS ON MECHANICAL PROPERTIES OF CONCRETE CONTAINING E- WASTE COARSE AGGREGATES

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Abstract- In this modern era, concrete has become a basic construction material whose production on large scale, is leading towards the huge usage of natural resources. That is why, the natural resources are going on depletion consistently. To overcome this fact, it has become essential to find out alternate resources for the ingredients of concrete. Usage of non-biodegradable waste items is one of the sustainable solutions. However, some researchers are working on the fruitful utilization of electronic waste in concrete as a partial substituent for coarse or fine aggregates. Basically, electronic wastes or E-wastes are any electronic appliances that have paid off their effective working life e.g. discarded old computers, CDs, VCRs, TVs, radios. In this experimental-based investigation, shredded electronic waste materials are utilized as coarse aggregates in concrete with a constant volume replacement of 30%. Moreover, to overcome the brittle nature of concrete, polypropylene macro synthetic fibers are used in concrete. Results show that the fibrous materials have a better effect on the mechanical performance of E-waste aggregated concrete. The addition of 0.75% fibrous material in concrete increases the compressive strength of E-waste aggregated concrete about 30% while tensile strength increases about 75% as compared to the reference specimen. Main purpose of this research work is to reduce the high consumption of natural resources of ingredients of concrete by the utilization of E-waste material as coarse aggregates in concrete.

Keywords- Macro Synthetic Fiber, Reference Specimen, Relative Density, Shredded E-Waste.

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RETROFITTING OF REINFORCED CONCRETE COLUMNS BY NSM REINFORCEMENT

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Abstract- Near surface mounted (NSM) method is one of the promising solutions for increasing the flexural and shear strength of deficient reinforced concrete (RC) members. It has also been used to increase the load-carrying capacity and ductility of poorly detailed RC columns. This paper presents the results of an experimental program aiming to study the compressive behavior of small sized RC column specimens strengthened with different configurations of near-surface mounted (NSM) steel reinforcement. The parameters considered were the number of stirrups added at (48mm and 96mm), diameter of stirrups (6.35mm and 9.5mm), bonding material (grout and epoxy), and type of confining material (steel rebar and wire). Test results indicated that both the peak and post-peak strengths were significantly increased by all the different configurations considered. NSM steel reinforcement also changed the failure mode from brittle to ductile. In general, providing additional steel stirrups to poorly detailed RC columns can significantly improve the post-peak behavior without changing the member sizes.

Keywords- Near Surface Mounted Reinforcement; Retrofitting; RC Columns; Stirrups.

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MECHANICAL PROPERTIES OF NATURAL FIBER REINFORCED CONCRETE

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Abstract- It is well known that the mechanical properties of concrete can be improved by incorporating discrete fibers to produce more durable and sustainable concrete for construction industry. The purpose of the current research work is to investigate the effect of locally available mazri plant leaves in concrete to improve its mechanical properties. Mazri leaf straw of an average length of approximately 20 mm were mixed with concrete at a percentage of 0.5 and 1.0 by mass of wet concrete. For compressive and split tensile tests, standard cylindrical specimens were prepared, while flexural strengths were obtained from small beams. Test results showed that compared to the plain concrete the compressive strength was decreased with an increase in content of mazri leaf straw. On the other hand, both the split tensile and flexural strengths were found to be increased with the addition of natural mazri leaf straw. It is also interesting to note that the cracking pattern of mazri leaf straw reinforced concrete (MLSRC) exhibited improved ductile behavior compared to the reference specimens, however, in most of the cases pullout of straws was observed which needs further investigation on fiber-concrete bond behavior. In general, mazri leaf straw has the potential to be used in cement concrete composites for different non-structural applications.

Keywords- Mazri Leaf Straw Reinforced Concrete (MLSRC), Mechanical Properties, Natural Fiber.

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AXIAL COMPRESSIVE BEHAVIOR OF NON-BONDED NATURAL FIBER ROPE-CONFINED CONCRETE: EXPERIMENTAL STUDY

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Abstract- In this research, an experimental investigation was carried out to determine the compressive behavior of normal (20 MPa) and medium (40 MPa) strength plain concrete confined by non-bonded cotton fiber rope reinforced polymer (FRRP). For this purpose, a total of 20 circular concrete cylinders were tested monotonically under axial compression. The study parameters covered the number of FRRP layers, strength of concrete and FRRP spiral spacing. Experimental results showed that the non-bonded manually wrapped cotton FRRP significantly enhanced the axial deformation of both normal (20 MPa) and medium (40 MPa) strength concrete, although less improvement was observed in the ultimate strength. The results also indicated that the effectiveness of cotton FRRP decreases with an increase in strength of concrete, increases with an increase of the FRRP layers and decreases with an increase of spiral spacing. Overall, the use of non-bonded manually wrapped cotton fiber ropes can result in improving the axial load and deformation capacity of concrete specimens.

Keywords- Axial Stress-Strain Behavior, Cotton FRRP Layers, Strength Of Concrete And Cotton FRRP Spacing.

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EFFECT OF CARBON NANOTUBES AND FLY ASH ON MECHANICAL AND MICROSTRUCTURAL PROPERTIES OF CEMENT MORTARS

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Abstract: This paper aims to evaluate the effect of various dosages of carbon nanotubes (CNTS) and fly ash (FA) on the mechanical and microstructural properties of mortar cubes. Cement was replaced with varying dosages of fly ash (5%, 10%, 15%, 20% and 25%) and CNTS (0.125%, 0.25%, 0.137% and 0.5%). In addition 10% fly ash was added independently with 0.125%, 0.25%, 0.137% and 0.5% carbon nanotubes. The addition of 10% fly ash in cement as an optimum dosage increased the compressive strength by 21.9%, 17.4%, and 80.2%, however, increase in fly ash dosage (25%) led to a decrease in mortar strength by 50.8%, 56.9% and 55.1% when specimens were subjected to compressive strength test at 7,28 and 90 days respectively. The study shows that the addition of 0.125% CNTS as an optimum dosage increased mortar strength up to 12.7%, 62.6%, and 48.7% at 7, 28, and 90 days respectively due to the bridging effect of CNTS. Similarly, the introduction of 10% fly ash with 0.25% CNTS as an optimum dosage led to an increase in compressive strength by 8.2%,20%, and 21.4% at 7,24, and 90 days respectively, however higher dosages of CNTS decreased mortar strength. Microstructural analysis shows improvement in bonding between matrix and aggregates due to the filling and bridging effect of fly ash and carbon nanotubes.

Keywords: Carbon Nanotubes, Fly Ash, Mortar, Mechanical Properties, Compressive Strength, Microstructural Properties

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TO STUDY THE BEHAVIOR OF FIBER REINFORCED CONCRETE AGAINST FIRE BY USING SIKAFIBER®12

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Abstract- Concrete has not very much resistance against fire because of its brittle behavior therefore to check improvement in crack resistance and compression strength against fire, SikaFiber®12 with dosage (0, 0.4,0.8,1.5,2.5,3 % by weight of cement) was used as polypropylene fiber with addition of superplastisizer ("Sika Viscocrete 3110" used 0.70% by weight of water for workability) and w/c of 0.45 to cast 60 M25 Grade standard size cylinders (150 x 300 mm) of fiber reinforced concrete tested against fire under compression according to ASTM C39 (cured in water for 28 days) for duration of 0.5,1,1.5&2 hours in gas furnace using infrared thermometer to maintain a temperature of 200,400,600&700°C respectively to find optimum dosage of SikaFiber®12. Six series of concrete mixes (each with 10 cylinders) including five series of SikaFiber®12 and one series of plain concrete cylinders were tested at an age of 28 days after exposure to fire and cooled down. Reinforcement of SikaFiber®12 increased compressive strength of FRC cylinders after exposed to fire for 2 hours at 1.5% dosage and minimized splitting and crack width, delaying the appearance of concrete fragmenting. The addition of polypropylene beyond optimum value decreased the workability of concrete which results in rapid compression strength loss. At 1.5% dosage using SikaFiber®12 increase of 25.39% compressive strength was obtained and strength remained same at 0.4% dosage.

Keywords- Compression Strength, Cylinders, Fire, Sikafiber®12.

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PERFORMANCE EVALUATION OF AMBIENT CURED QUARRY ROCK DUST (QRD) INCORPORATED GEOPOLYMER CONCRETE (GPC) BEAMS

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Abstract- Geopolymer concrete (GPC) an alternative of Ordinary Portland Cement concrete (OPC) is prepared by mixing three waste/by-products that are Fly-ash (FA), ground granulated blast furnace slag (GBS) and quarry rock dust (QRD) at the rate of 50%, 35% and 15% of binder respectively. Since GPC has gained interest of many researchers due to the harm that OPC is causing to the environment. However, GPC exhibit somewhat brittle behavior. To improve this property of GPC the steel fibers (SF) and natural fibers called sisal fibers (SsF) are incorporated into the GPC both separately and in hybrid form. The purpose of this research work is to prepare natural fiber (i.e SsF) reinforced GPC which can be a potential sustainable construction material having good mechanical properties and lesser environmental impact. The SsF is used individually and also in hybrid form with SF for purpose of replacing the SF with natural counterpart. The control sample with no fibers and fibers reinforced matrices with increasing content of SsF (varying from 0.8 to 2.4 %) and novel hybrid SsF and SF (by keeping SF fixed at 0.5% and increasing the amount of SsF from 0.5 to 1.5%) were casted and mechanical tests were performed for optimum values. Then the four types of shear deficient GPC beams were casted that are unreinforced control GPC and GPC reinforced with optimum values already calculated which are SF at 0.75%, SsF at 2.4% and hybrid fiber reinforcement at 0.5% and 1% of SF and SsF respectively. To ensure shear is dominant mode of failure moderate shear reinforcement along with required flexural reinforcement were provided. The load carrying capacity through four-point loading was then checked for GPC and fiber reinforced GPC beams. The load carrying capacity of simple GPC versus 2.4% SsF reinforced GPC, hybrid fibers reinforced GPC (having 0.5% SF and 1% SsF) and 0.75% SF reinforced GPC beams was found to have increased by 22.22%, 38.89% and 75% respectively.

Keywords- Geopolymer, Steel Fibers, Sisal Fibers, Ambient Curing

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STRENGTHENING OF AMBIENT CURED QUARRY ROCK DUST INCORPORATED GEOPOLYMER CONCRETE BEAMS

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Abstract- Geopolymers concrete (GPC) has gained attraction in construction field due to low-carbon, cement less composite materials possessing considerably high mechanical properties and being used in numerous structural applications. On the other hand, strengthening the structural members using advanced materials is a contemporary research in the field of repairs and rehabilitation. Carbon fiber reinforced polymer (CFRP) composite is becoming prominent in strengthening and rehabilitation to improve the flexure and shear strength of the structural members due to ease of installation, lower cost and time saving, strength and confinement gain and long-term durability. Most of the research works depicts the properties of GPC at elevated temperature which is costly and limit the field application but in this research work the beams were casted using quarry rock dust (QRD) which helps to improve the properties at ambient temperature. Very limited literature is available to improve the shear capacity of fiber reinforced GPC beams using CFRP. The purpose of this paper is to strengthen the pre-damaged shear deficient ambient cured GPC beams incorporated different combination of steel fibers (SF) and Sisal fibers (SsF) in mix design, with externally bonded CFRP composites. This paper also discuss the effect of natural fibers (i.e SsF, which has less environmental effect, used individually and in hybrid form) on fresh and mechanical properties of GPC and compare the ultimate load bearing capacity of strengthened and unstrengthen GPC beams. For this purpose a total of twenty four beams spanning 1000x150x150 mm were cast and tested under four point loading. Twelve of the beams were tested to failure while the remaining twelve were partially damaged by applying 60% of the ultimate load. The damaged beams were strengthened by applying CFRP strip at soffit of beams and U-shaped CFRP sheet near supports. The results showed that by applying CFRP strips and sheets, the ultimate load carrying capacity has increased significantly up to 45% relative to load capacity of the unstrengthen beam. The results demonstrated that the application of CFRP is an effective way to repair and strengthen the shear deficient/damaged GPC beams.

Keywords- Geopolymer Beams, Strengthening, Sisal Fibers, Steel Fibers, CFRP Strips And Sheets.

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EVALUATION OF PERFORMANCE OF SELF COMPACTING CONCRETE WITH MINERAL ADMIXTURES BY ARTIFICIAL NEURAL NETWORKS

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Abstract- Bentonite a natural pozzolan can reduce the amount of CO_2 produced as an output of cement production. The mechanical properties of cementitious materials used in concrete can be enhanced using bentonite. Durability of structures has become a critical issue in management of reinforced concrete structures. This research work emphasis on analyzing the performance of self-compacting concrete (SCC) using mineral admixtures such as BASF manufactured Super Plasticizer (SP), silica fume and bentonite. Total 16 samples by adding bentonite and silica fume in binder and using 0.8% super plasticizer ultimately have developed SCC. Artificial Neural Network (ANN) model is used for the prediction of mechanical properties of SCC using Levenberg Marquardt (LM) Algorithm having certain inputs/variables and compression strength at 28 and 91 days as output. The ANN model results show overall accuracy of 97%. It was concluded that the bentonite in addition with constant silica fume used in SCC increases the compressive strength of concrete by reduces the chloride ion diffusion, but excess of Bentonite reduces the w/c too much and causes decrease in compressive strength and in workability.

Keywords- Artificial Neural Network, Bentonite, Self-Compacting Concrete (SCC), Super Plasticizer (SP)

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MECHANICAL AND DURABILITY PROPERTIES OF POLYPROPYLENE CONCRETE CONTAINING BENTONITE AND SILICA FUME

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Abstract- This paper reports the mechanical and durability properties of bentonite and silica fume (SF) concrete containing fibrillated micro polypropylene fibers (PPF). The fresh property was investigated by slump test and mechanical property was investigated by compressive strength and ultrasonic pulse velocity (UPV) tests. For durability properties, permeability test was performed. This research is based on the previous published research and selected the optimum percentages of supplementary cementing material (SCMs) for bentonite and SF. The concrete mixture consists of total of nine mixes: control mix (CC), two binary mixes (i.e., 10% bentonite (B10SF0P0), 10% SF(B0SF10P0)), ternary mix (B10SF10P0), also known as ternary control mix (TCC) and then additional mixes by adding polypropylene fiber equal to 0%, 0.25%, 0.50%, 0.75%, 1% and 1.25% in TCC. It was concluded that all the binary and ternary mixes showed decrease in the workability. The UPV test indicated good quality of concrete for binary mixes and ternary mixes up to the PPF content equal to 0.75%. It was observed that compressive strength and permeability properties of concrete were improved for both the binary mixes and ternary mixes up to addition of PPF equal to 0.5%. PPF increased the deformability properties and completely changed the failure pattern of concrete as compared to ternary mix without PPF.

Keywords- Workability, Supplementary Cementing Material, Bentonite, Compressive Strength, Ultrasonic Pulse Velocity, Permeability.

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WORKABILITY OF RICE HUSK REINFORCED CONCRETE FOR EASY POURING

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Abstract- In the construction industry, the universally used material is reinforced concrete, because of its best durability and cost effectiveness compared to others. The fibre reinforced concrete is also produced by adding fibres and different kinds of fibre in concrete gets importance nowadays. The factor of strength and the quality of the concrete directly depend on the workability property. In this work, in addition to the workability, the compressive strength of the rice husk fibre reinforced concrete is investigated experimentally. The properties of plain cement concrete used as a reference to evaluate the effect of rice husk fibre. It is noted that the workability of the rice husk fibre reinforced concrete is reduced by 8% and the compressive strength is also reduced as compared to the plain cement concrete. Furthermore, the concrete handling becomes harder when the mix is less workable.

Keywords- Rice Husk (Rh), Fibres, Concrete Workability, Fibre Reinforced Concrete

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WORKABILITY OF BANANA FIBERS REINFORCED CONCRETE FOR EASY POURING

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Abstract- Concrete is the most widely used construction material in construction industry. Workability is the property of concrete which is directly related to the strength factors and quality of work. Workability of concrete is determined to ensure ease of handling. Natural Fibers are added in concrete to achieve desired properties and results in reduction of cost and light weight structures. The purpose of this study is to check the workability of specimen having banana fibers of 50 mm length for easing pouring and handling. For the study of workability banana fiber reinforced concrete (BFRC) slump cone test is performed. Banana fiber is added 2.5% by mass of cement content. The value of BFRC slump test is compared with the value obtained by the slump test of plain concrete (PC). The results revealed that by the addition of banana fibers the value of slump decreased. It is concluded that the workability depends upon the ingredients of concrete as well as the additional materials which are used to enhance or achieve desired properties.

Keywords- Banana Fibers, Banana Fibers Reinforced Composites. Slump Test.

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EFFECT OF CARBON BLACK ON PROPERTIES OF STEEL FIBER-REINFORCED CONCRETE

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Abstract- In this research work, hybrid conductive materials like carbon nano black (CNB) and macro steel fiber (SF) are integrated into the cementitious composite to investigate the mechanical properties and self-sensing properties of the conductive concrete flexural members. For that purpose, 70 kg/m^3 steel fiber with three different dosages of carbon black is evaluated. The mechanical properties like compressive strength, flexural strength and toughness are evaluated. Furthermore, the relationship of fractional change in resistance (FCR) and crack opening displacement (COD) has been determined to study the effect of different types of conductive materials on the gauge factor. The results reveal that the mechanical properties (compression strength, toughness, and flexural strength) are improved with diphasic conductive admixture. Furthermore, the gauge factor is enhanced with the addition of CNB.

Keywords- Self-Sensing Concrete; Steel Fiber; Carbon Nano Black; The Fractional Change In Resistance.

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ELECTRICAL PROPERTIES OF CARBON NANOTUBE AND CARBON FIBER REINFORCED CEMENTITIOUS COMPOSITES

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Abstract- The addition of nano/micro scale carbon-based materials into cement-based composites is of significance for achieving reliable electrical properties in different civil engineering practices. The present study aims to disperse carbon-based materials homogenously for the improved electrical performance for non-structural functionalities. The investigation addresses the different mixing methods of carbon nanotubes (CNT) and carbon fibers (CF) on the electrical properties of cement mortars. To do this, two mixing methods for each carbon-based material were applied and the electrical properties of cement mortars were evaluated via alternating current (AC) measurements. Although both carbon-based materials were able to improve the electrical properties, CFs were more pronounced in terms of reducing the electrical resistivity values of specimens compared to CNT-based and reference specimens. It is worth noting that proposing different methods may also further enhance the electrical properties for the specific mixture design of cement-based composites.

Keywords- Carbon Fibers, Carbon Nanotubes, Cementitious Mortars, Electrical Properties.

Structural Analysis

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MODERN METHODS OF RESIDUAL STRENGTH ASSESSMENT OF FIRE DAMAGED RC STRUCTURE-A REVIEW

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Abstract- Structures have been severely damaged by fire. As far as fire safety is concerned, it is necessary to build cost-effective but fire-resistant constructions. Reinforced concrete (RC) buildings do not sink during fire exposures, and the building may be able to be used again after the fire. Despite this, fire can cause a permanent loss of concrete strength. Following a fire assessment, many researchers are looking at post-fire assessments; however, they haven't yet looked at recent residual strength evaluation methodologies. The focus of this research is on current methodologies for determining the residual strength of fire-damaged reinforced concrete (RC) structures. As a result of the findings, it has been determined that current methods for determining residual strength are required. The purpose of this research is to determine future directions for investigating new methods of residual strength assessment to improve the utilization of fire-damaged structures.

Keywords- Reinforced Concrete (RC) Buildings, Residual Strength Assessment.

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FIRE DAMAGE ASSESSMENT OF REINFORCED CONCRETE STRUCTURES A-REVIEW

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Abstract- Event of fire is major hazard come across in civil engineering structures, and consequently given that suitable fire safety methods is a key constraint in a design of building for guaranteeing of safety to the occupants. Fire is the supreme destructive factor that creates deterioration of reinforced concrete structures (R-C-S). Even that the concrete is a not explosive construction material, when R-C-S are in contact to elevated temperature, their mechanical, chemical and physical properties weaken. The fire damage levels of R-C-S considerably depends upon dimension and fire time period. Intensity of fire is minor and small; the loss is expected to be lesser in R-C-S elements. Overall aim of this research is to explore the behaviour of R-C-S for high rise (H-R) buildings after the sever event of fire, firefighting (F-F) deficiencies and implementation of precautions for recovering the severe effect of damage by fire. The current study is review of previous studies related to fire damage for reinforced concrete structures. Several case studies have also been reported in this work. After detail literature review results shows that the popularity of fire damages to R-C-S. It was found that the main incorporated fire source occurrence is electric defects, fire detection system not in active condition and lack of firefighting equipment's, barriers in emergencies exits way and due to human mistakes. Further study should be carried out in detail, because of limited scope of this work for fire related apprehensions of H-R building.

Keywords- Damages Due To Fire, Damaged Reinforced Concrete Structures, Safety Measures For High Rise Buildings.

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ASSESSING DAMAGE GRADES OF BUILDINGS AND THEIR RELATIONSHIP WITH SEISMIC RISK PERCEPTION, A CASE STUDY OF PABBI, KHYBER-PAKHTUNKHWA

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Abstract- The aim of the study is to accomplish seismic vulnerability appraisal of buildings in the town of Pabbi (Nowshera district) of Khyber Pakhtunkhwa (KPK) province and to observe the relationship between risk perception and vulnerability assessment, if any. The paper describes building structures, damage grades and their relationship with people risk perception, based on the current physical condition of buildings. The vulnerability assessment of the existing buildings was carried out using customized FEMA P-154 form. The investigation of the present condition of buildings revealed that due to old age, plan and vertical irregularities, unplanned settlement, rapid urbanization, buildings constructed on soft soil and no implementation of seismic design codes; most of the buildings were vulnerable to earthquake loading. It was observed that most of the buildings (>50%) fall in damage grade 3 and 4, implying strong probabilities of heavy structural and non-structural damages and require detail evaluation. The people risk perception study was carried out using face to face interviews which revealed that the people perceive the chances of earthquake in future. An empirical relationship between damage grades and people seismic risk perception were developed using regression analysis. The results revealed that people risk perception and damage grades of their buildings have a reasonably good relationship with an R^2 value of 0.57. The study is an important step for the institutions, policy makers, designers and researchers to reduce the risk associated with earthquake and thereby reducing loss of lives and assets.

Keywords- Damage Grades, Earthquake Risk Perception, Rapid Visual Screening, Vulnerability Assessment.

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MODERN REPAIRING TECHNIQUES OF RC BUILDINGS DAMAGED DUE TO EARTHQUAKE DISASTER –A REVIEW

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Abstract- Earthquake is the natural hazard which is caused by movement of tectonic plates underneath the earth and has severe impact like collapse of buildings, bridges and roads. Due to these characteristics it has a great influence on economy, social life of humans of a country as natural hazard. Reinforced concrete (RC) buildings get damaged by the high intensity earthquakes along with the loss of life of occupants. The purpose of the study is the impact of earthquake on human life, damages due to earthquake and its influence towards economy. The aim of this paper is to study the modern techniques that are being used to repair and strengthen earthquake damaged RC buildings. The state of the art literature is reviewed and it has been observed that retrofitting is widely used in strengthening and repairing of RC building. This paper focuses on the damages of RC buildings due to earthquake in Pakistan and different types of retrofitting for repairing and strength enhancing. Since there are limited techniques present to rehabilitate the earthquake damaged RC building so there is a need of experimental work to find out new ways of repairing.

Keywords- Earthquake, Fiber Reinforced Polymer (FRP), Repairing Techniques, Retrofitting.

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EARTHQUAKE RISK ASSESSMENT FOR SINGLE STOREY RESIDENTIAL BUILDINGS- AN OVERVIEW

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Abstract- Earthquake is the most dangerous natural hazard as compared to other natural hazards. New methods and technologies are being explored for earthquake risk assessment. Many scholars have looked into earthquake risk assessment for high-rise buildings, but none have looked into earthquake risk assessment for single-story residential buildings. This study focuses on earthquake risk assessment for single storey residential buildings. Many researchers investigated that single storey buildings have more ability to stand against earthquake than high rise buildings. The results have established that buildings are designed to bear shaking along horizontal X and Y direction to counter earthquake inertia force. This study determines the future directions for exploring the earthquake risk assessment for single storey residential buildings to reduce the consequences of the earthquake.

Keywords- Earthquake Risk Assessment, Inertia Force, Natural Hazard, Residential Buildings

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A STATE OF THE ART REVIEW, IMPACT OF WINDSTORM ON STEEL STRUCTURE IN EAST ASIA

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Abstract- Damages, losses and social problems occurs every year due to the natural disaster in all over the world. The range of the damages caused by the windstorm on the build environment increase gradually. A number of the commercial and residential steel structure are collapse just because these building are not design to resist the high speed wind. In this work, more than 35 papers of different authors are reviewed on the windstorm related disasters. Although, the literature related to steel structure, which are collapse or partially damages due to the windstorm are very limited. Numerous authors focus on the design parameters and some of them studied the effects of high speed wind on the structure and their losses when the event happened. In results, it is found that due to extreme wind pressure roof and wall cladding of the structure damages, and it is observed that numerous buildings are not designed against the high speed wind load, design engineer should be consider the impact of high speed wind load, surrounding trees, anchoring, outdoor equipment and the direction of wind during design phase to mitigate or minimize the losses due to windstorm.

Keywords- Windstorm, Steel Structure, Wind Load, Natural Disaster

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NUMERICAL ANALYSIS OF COMPRESSIVE BEHAVIOR OF GFRP REINFORCED HOLLOW CONCRETE COLUMNS

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***ABSTRACT*:** Glass-fiber-reinforced-polymer (GFRP) reinforcements provide a valuable substitute to conventional reinforcements in reinforced concrete frame structures, especially in vertical elements such as columns, due to improved anti-corrosion properties. On the other hand, the compressive behavior of GFRP-reinforced hollow concrete columns has been very rarely discovered. This purpose of this paper is to investigate the compression response of hollow concrete columns reinforced with GFRP bars and spirals. A concentric axial load of 20 KN was applied onto hollow circular columns of 250 mm external diameter and 1000mm height, having six GFRP bars of 14mm diameter each. FEA models of the columns were constructed using ABAQUS, by applying the same geometry, loading and boundary conditions. Numerical analysis of the modelled samples was performed after calibration and sensitivity analysis of the control model. The FEA analysis illustrated that hollow column achieved greater confinement efficiency than the solid one. Moreover, hollow columns reinforced with GFRP showed higher compressive strength and deformation capacity than those reinforced with steel. The results of FEA analysis were in good agreement with the previously carried out experimental work.

***Keywords*-** ABAQUS, GFRP Columns, GFRP Bars, Hollow Circular Columns, Finite Element Modeling (FEM)

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INVESTIGATION OF HIGH STRENGTH CONCRETE BRIDGE PIERS RETROFITTED WITH CFRP UNDER SEISMIC LOADING

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Abstract: One of the most challenging natural calamities under the umbrella of Civil Engineering, which may damage the structures and life as well is Earthquake. On 8th October 2005, a similar type of catastrophe was faced significantly in the Northern areas of Pakistan. Many Bridges got damaged due to this but some remained unaffected in various regions. It is essential to improve their strength and soundness which can be achieved with the help of Retrofitting with FRPs (Fiber Reinforced Polymers). Now a days, High strength concrete (HSC) is being employed in Bridge construction. This research targets the behavior of HSC before and after retrofitting. An experimental study was performed by applying Quasi static cyclic loadings (QSCT) with axial load applied on scaled down (1:4) RC bridge piers under different drift levels. The scaled down pier models were retrofitted with carbon fiber reinforced polymer (CFRP) sheets. The specimens were tested under QSCT against various drift levels ranging from 0 to 5%. Hysteresis loops are generated against each category of drift level which shows the lateral load carrying capacity of the Bridge pier against that specific Drift level. Results show that load carrying capacity of retrofitted bridge piers was enhanced due to the external confinement by CFRP sheets due to which the vulnerability/failure zones of structures were also upgraded. The amount of lateral load carried by the retrofitted model was more than the original or un-retrofitted model. The bridges made of HSC after the revision of building code need structural assessment and their load carrying capacity can be increased after retrofitting with single or double layer of CFRP and be brought within the safety limits as per new building code requirements. In the light of results of this research, it is considered that these bridges after retrofitting will become capable of resisting considerably more loads as per requirements of the new Building Code.

Keywords: CFRP, Energy Dissipation, High Strength Concrete, Quasi Static Cyclic Loading, Retrofitting.

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ANALYTICAL INVESTIGATION OF TYPICAL SCALE DOWN BRIDGE PIER RETROFITTED WITH CFRP UNDER SEISMIC LOADING

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Abstract: An earthquake measuring magnitude Mw 7.6 struck the Pakistan-administered part of Kashmir on 8 October 2005.As a result, many bridges experienced earthquake-associated damage of varying degree. It was essential to improve their strength and soundness. One of the modern techniques of Rehabilitating structure includes Retrofitting of bridge pier with Fiber Reinforced Polymers (FRP). This confines the concrete and cause a considerable improvement in strength of column. In order to investigate the effectiveness of Carbon Fiber Reinforced Polymers (CFRP), simulation of scaled down (1:4) High Strength Concrete (HSC) circular bridge pier models was carried out in current research using state of the art engineering simulation software "Seismo-struct". The model was subjected to Quasi-Static Cyclic Tests (QSCT) and Pushover Analysis to determine improvement of strength, ductility and other dynamic properties. A load mass of 42.4 kips (19.24 tf) was added at top of model as gravity load. The model was retrofitted with CFRP wraps and analysed till failures at their potential plastic zones. The purpose of this simulation was to evaluate seismic response of Bridge piers. The results showed that retrofitting of R.C columns with CFRP improves their strength and renders them capable to dissipate more energy.

Keywords: CFRP, High Strength Concrete, Quasi Static Cyclic Tests, Pushover Analysis, Retrofitting

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FEASIBILITY STUDY OF HYBRID TIMBER-CONCRETE TALL BUILDINGS

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Abstract- Adverse impacts of global warming are increasing worldwide. The construction industry accounts for more than 40% of CO_2 emissions worldwide. To lower the carbon footprint of the construction industry, sustainable construction methods and materials should be adopted. Timber is an alternative sustainable construction material, as timber construction produces far less CO_2 emissions during production and service life compared to conventional construction materials such as concrete and steel. Using timber alone for constructing high-rise structures has limitations due to its lightweight (higher floor accelerations), fire resistance, flexibility, etc. Also, there are disadvantages related to ductility properties to provide seismic resistance in tall timber buildings and the hesitancy on the part of designers and contractors to build high-rise timber structures. One possible solution is the use of hybrid structures, combining two or more materials by taking advantage of their individual strengths. The current work is focused on exploring the feasibility of high-rise hybrid timber-concrete structures over high-rise concrete structures in terms of their seismic and sustainability performance. The purpose of this study is to help designers and engineers towards understanding the behavior of hybrid timber-concrete tall buildings, instigating the development of more sustainable and practical design using timber.

Keywords- Sustainable Construction, Green Building Material, Hybrid Timber-Concrete High Rise.

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SEISMIC VULNERABILITY ASSESSMENT AND RETROFITTING OF REINFORCED CONCRETE BRIDGE BY RC JACKETING

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Abstract- Seismic vulnerability assessment of Reinforced Concrete (RC) bridges is of paramount importance in developing countries due to poor design and construction practices, especially in an earthquake-prone zone. A case study of a typical bridge in Pakistan was carried out and results were analyzed. The overall aim of this research was to perform an equivalent static analysis of the existing bridge and measure its adequacy against existing loading conditions and new seismic requirements. This paper aims to highlight the use of SAP2000v14 in seismic analysis of the RC bridge piers, in the existing as well as post remedial measures stage. The bridge was modeled on the software as per existing structural parameters and loading was applied as per relevant seismic criteria which indicated that the bridge was under-designed. The goal was the introduction of an effective remedial measure to accommodate seismic loading in the structural design, which in this case was retrofitting in the form of RC jackets, the results were successful.

Keywords- Reinforced Concrete Bridge, Earthquake-Prone Zone, SAP2000v14, Retrofitting

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STRUCTURAL PERFORMANCE OF GFRP-REINFORCED BCJ THROUGH FINITE ELEMENT ANALYSIS

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Abstract- Glass-fiber reinforced polymer (GFRP) rebars are being employed as a good substitute to steel in reinforced concrete (RC) structural elements due to their superior performance. The main objective of the present study is to evaluate the structural behavior of beam-column joints (BCJ) reinforced with GFRP rebars using non-linear finite element analysis (NLFEA) under the seismic loading. In the present study, three-dimensional NLFEA of BCJ reinforced with steel and GFRP rebars was conducted using a finite element (FE) code ABAQUS. The FE model was verified against the experimental load-deflection curves of BCJ. A sensitivity analysis of the proposed FE model was carried out to investigate the effect of different parameters, including mesh size, dilation angle (ψ), stress ratio, viscosity parameter (VP), eccentricity, and shape factor of concrete material on the load-deflection response of BCJ. The FE modeling using ABAQUS software predicted the experimental load-deflection curve of BCJ with sufficient accuracy. The results concluded that the currently proposed FE model can accurately pretend the load-deflection performance of BCJ.

Keywords- GFRP; Finite Element Modeling; Concrete Damaged Plasticity; BCJ; Failure Modes; Parametric Study

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EXPERIMENTAL TESTING, FE MODELLING AND ANALYSIS OF GEOPOLYMER CONCRETE COLUMNS WITH STEEL REINFORCEMENT

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Abstract- This paper focuses on experimental testing and Finite Element (FE) modelling of steel reinforced Ordinary Portland Cement-OPC and Geopolymer Concrete-GPC columns. GPC was prepared by combining Fly Ash-FA, furnace slag-SG and adding steel fibres SF with volume fraction of 0.75%. Twelve 200x200mm columns having length of 1000mm with concrete cylinder compressive strength (fc') of 40 MPa were casted and tested for static loading on 5000KN Universal Testing Machine (UTM). Experimental results were validated through FE modelling on commercial software ABAQUS. Concrete Damaged Plasticity (CDP) model was used to define behaviour of concrete. It was found that axial load-deflection response closely matched with the laboratory results for columns loaded with zero eccentricity while load capacities for columns loaded with different eccentricity were over predicted in FE Model. It has been observed that load bearing capacity of GPC columns is lower than corresponding OPC columns but can be improved by addition of steel fibre. A constitutive model derived for high strength concrete has shown close agreement with experimental results [1] [2] [3].

Keywords- FE Modelling, Geopolymer Concrete, Quarry Rock Dust, Steel Fibres

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DESIGN OPTIMIZATION OF STEEL STRUCTURES THROUGH INTERNAL STRESS DIAGRAMS OF LOW-RISE BUILDINGS

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Abstract- Steel has high strength to mass ratio. This is the reason to used steel in construction industries against heavy loading. Generally, Hot rolled section & cold formed sections are used in steel buildings. But, the loading effects through-out the member (Beam/Column) in not same, that is why these sections are not recommended and to attain optimum use of steel the tapered sections are to be used. In this study, a building with 24 m width, 126 m length and 9 m Eave height is selected for study. The loading is applied according to MBMA-2006 and Design is done as per AISI-ASD Design code. In addition to that, 2 different 3D Frames having 7m and 9m of Bay Spacing's are selected for steel building. At these two Bay spacing's, the building is analyzed by STAAD.pro, which is a well-known software for structural analysis. A comparative study is made for Base Reactions, Eave Moments, Horizontal defection, Vertical deflection and Weight of Steel required for the building. The results indicate that the building designed by following the internal stress diagrams gives Less values of Base Reactions, Horizontal deflection and Steel Weight of building as compared to building designed at maximum values of Shear and bending moments, which make it comparatively economical. In addition to that the results shows that while following the internal stress diagrams the segment length of 1.5m to 3.5m gives most economical results.

Keywords- Design Optimization, Steel Structure, Low-Rise Building

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PREDICTING THE COMPRESSIVE STRENGTH OF FLY ASH BASED GEOPOLYMERS BY ANFIS MODELS

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Abstract- Fly ash-based geopolymers are widely used material as precast and cast in situ round the world. But several factors influence its mechanical strength. Therefore, this work was designed to incorporate such factors in the prediction of mechanical strength through Artificial intelligence. In this work, four parameters were incorporated such as: (i) curing temperature (20, 60 and, 100 ^{o}C), (ii) molarity of NAOH solution (8-16), (iii) alkali particle to precursor ratio (0.3–0.5) and (iv) Sodium silica to sodium hydroxide ratio (2–3). Adaptive neuro fuzzy inference system (ANFIS) was used for optimization in order to predict the corresponding compressive strength as output of geopolymer. A large database was used for purpose of training and after worth testing the model as required by ANFIS model. Analytical results by ANFIS were used to construct relationship between mechanical property as output e.g. compressive strength of geopolymers and different constituent parameters. It was observed that training and testing errors were in acceptable range (about 9%). Developed ANFIS model was used to prepare geopolymers which contains low calcium and it is FA based sustainable material, with compressive strength ranging from 25–35 MPa. Hence, validating the significance of the artificial-intelligence based modeling approach ANFIS to bring forth a novel application for design of low calcium, FA based-geopolymers.

Keywords- Hybrid Model, Adaptive Neuro Fuzzy Inference System (ANFIS), Influencing Parameters, Fly Ash-Based Geopolymers, Optimization.

Construction Management

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AN OVERVIEW ON FIREFIGHTING PROBLEMS IN REINFORCED CONCRETE BUILDINGS

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Abstract- Fire is the most common hazard which may cause damage of structures along with loss of lives of occupants. It cause reduction of reinforced concrete structure strength, weakness of steel and concrete bond and change in color of concrete. During a fire event, firefighting is the initial step to prevent huge damage that involves numerous difficulties and complications e.g. obstacles in timely response and firefighting resources. The purpose of the study is to analyze the firefighting problems faced by firefighters. This paper provides an overview on the challenges of firefighting in reinforced concrete buildings and their remedial measures. The damages due to fire, preparedness of firefighting and firefighting barriers are discussed by a brief study of state of the art. The outcomes provide fathom to firefighting and possible solutions.

Keywords- Firefighting Problems, RC Buildings Firefighting, Fire Damages.

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BARRIERS TO SUPPLY CHAIN MANAGEMENT IN THE CONSTRUCTION INDUSTRY OF PAKISTAN

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Abstract: Construction in Pakistan is mostly project-based, requiring productive and systematic use of available resources. In the modern world, the SCM approach has become a central component in developmental initiatives in the construction industry which helps in enhancing the productivity and efficacy of construction projects. Since, the implementation of SCM requires a systematic management technique along with effective technological aid, it may discourage the contractor especially in developing countries like Pakistan. Consequently, this paper highlights the identification of constraints to SCM in the construction industry of Pakistan. For acquisition of data, a questionnaire survey was conducted. After an in-depth literature review, extensive research led to the recognizance of nineteen crucial barriers to the successful commencement of the SCM approach. These obstructions were sorted into four more extensive classifications, specifically, Strategic Barriers, Technical Barriers, Individual Barriers, Organizational Barriers and Cultural Barriers. These recognized barriers were incorporated into the questionnaire in the form of Likert Scale items with a range of five possible responses to rank their perceived significance of each barrier. Due to the ongoing pandemic, quantitative technique of data collection was used which included the circulation of questionnaire among various construction organizations. The collected data was analyzed statistically and using Factor Analysis, the results helped identify seven major factors. This study helps identify the deep-rooted hindrances faced by construction industry of Pakistan for the initiation of Supply Chain Management system and will help us better understand the challenges that may pave the way for the establishment of Supply Chain Management in the construction industry of Pakistan and similar developing countries in the years to come.

Keywords- Supply Chain Management, Barrier Analysis, Factor Analysis, Construction Supply Chain, Principal Components Analysis

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ANALYSIS OF MINERAL WOOL INSULATION ON RESIDENTIAL BUILDING

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***Abstract* –** Cooling and heating systems consume the major portion of total energy production to meet the thermal comfort needs of the masses. Providing resistance to the heat flow is one of the efficient and environmentally friendly methods to reduce the consumption of energy. For this purpose, thermal insulation is widely used. Material with high thermal resistivity is used to reduce heat loss and heat gain. This results in the reduction of energy consumption that is used for heating and cooling purposes hence cutting energy costs. This study is aimed to investigate the effects of insulation material on energy cost and energy performance on a house. A house is modelled using BIM technology. BIM can evaluate the building's energy performance and energy cost savings. Autodesk Revit 2021 is used for modeling the house. A comparison of the energy cost of the house is done before and after the installation of insulation material in the exterior walls and roof of the house. Mineral wool is used as an insulation material for the house. Mineral wool has two variants known as rock wool and glass wool. It contains 70% recycled material that makes it a greener material. It can be a costly product but it has less health risk during installation. It is easy to install. Mineral wool products are manufactured in different shapes and properties depending on the requirement. It covers a temperature range from -250 to 800+ degrees acting as a good physical barrier to heat transfer. It also performs well for soundproofing and fire protection.

Keywords- Building Information Modelling (BIM), Energy-Efficient Buildings, Insulation Material, Mineral Wool

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ZERO ENERGY DESIGN: A CASE STUDY OF RESIDENTIAL BUILDINGS WITH SOLAR ENERGY AS ENERGY SOLUTION

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Abstract- According to International Energy Agency, existing buildings are responsible for 40% of world's total primary energy consumption and 24% of global carbon emissions. In order to protect our environment from destruction the only effective solution is to cut down the emissions of CO_2 and reduce the consumption of non-renewable energy resources. This case study is about sustainable and energy efficient development of buildings at domestic level (residential buildings) in Punjab, Pakistan. As it is about sustainable development so our main focus is Triple Bottom Line (TBL). This can be achieved through zero energy design concept. It is a case study of two different existing residential buildings in Lahore. Each building is analyzed and the yearly primary energy consumption of each building is calculated individually. Calculations are made to determine the number of solar panels based on experimentally proved formulae. Area required to accommodate these panels is also calculated. At the end recommendations are given to make optimum use of solar energy. Energy saving passive solar techniques are proposed that can highly reduce the energy demand and carbon footprint.

Keywords- Adaptation To Climate Change, Green Buildings, Residential Buildings, Zero Energy Design

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GENERAL OVERVIEW OF SAFETY PRACTICES IN THE CONSTRUCTION INDUSTRY OF PAKISTAN

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Abstract- Construction Industry of Pakistan is growing rapidly. Whereas accidents and fatalities, rates are also increasing day by day. Because of the lack of seriousness and honesty from concerned regulatory bodies, the Situation is worsening on sites. There is no proper system in Pakistan to check the safety and risk management on Construction sites. Several researchers have proposed solutions to improve the quality of safety management but from the higher management to the lower, but no one is aware of the importance of safety rules. Since there is no safety training and workers are unskilled, the quality of construction is giving an alarming situation. It is a dire need of the hour to take necessary steps and implement the rules for the safety of workers and indeed improve the quality of construction. This research work highlights the current situation and provides a general overview of safety practices in the construction industry of Pakistan.

Keywords- Construction Industry, Pakistan, Safety Management,

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BUILDING INFORMATION MODELLING FOR HISTORIC STRUCTURES: A CASE STUDY OF HISTORIC SHRINES OF MULTAN

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Abstract- Digital documentation is a new technology that works to secure quality information and helps in technical decision-making. This technology can also be used for infrastructure conservation and maintenance. In this study, one digital documentation technique as a securing and handling instrument of the essential information has been used. In this study, the methodology of the historical building information modeling (HBIM) system has been adopted to study the historic shrine building. In two stages, this technique was applied, the first one was portrayed by the exploratory exercises needed for the building, and the second one was to thoroughly define the calculation of a portion of the complicated, historical building information modeling (HBIM) system. The model development process also revealed few challenges, which were encountered during the information collection processing and analysis procedure. This study provides a pattern to apply the HBIM technique that will help to monitor and record the time to time conservation and rehabilitation process for historic buildings.

Keywords- Building, Historic Structures, Shrines, HBIM

Water Engineering

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AN OVERVIEW ON THE CAUSES AND IMPACTS OF FLOODS ON BUILDING CONSTRUCTION

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Abstract- This paper reviews the causes of Floods, Effects of floods on Buildings and Infrastructure, and socioeconomic disruption due to flood effects. Different researcher investigates different causes for floods, like Massive rainfall, Climate changes, urbanization, and deforestation, etc., and effects of floods on buildings are Buildings are partially destroyed or destroyed and due to flood effects on different areas social and economic losses like deaths, migration of residents from one place to another Infrastructure (Residential Buildings, Commercial Buildings, Road network's, etc.) are completely or partially destroyed. The Paper Concludes the causes of floods, effects of the flood on building construction, and socioeconomic disruption due to flood.

Keywords- Floods, Rainfall, Urbanization, Deforestation.

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APPLICABILITY AND EVALUATION OF IMERG PRECIPITATION PRODUCT: A SYSTEMATIC REVIEW

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Abstract- The hydro-meteorological communities face major difficulty in accurately estimating precipitation over wider areas. One of the critical and influential factors in water resources management is the accuracy of integrated Multi-Satellite Retrieving for Globed Precipitation Measuring (IMERG) with their calibrated SPP denoted as IMERG Final and uncelebrated SPPs is known as IMERG Early and IMERG Late over different complex or simple topographical area. The purpose of this systematic review study is to conduct for accurate estimation of precipitation by using IMERG SPP. To achieve the aim we use the PRISMA Statement technique for deriving the related articles for detailed review those are published in recent years. From the years 2011 to 2021, the SCOPUS database was chosen to derive research publications written in English with keywords of "IMERG" AND "Precipitation" AND "IMERG Precipitation product". A total of 28 articles was extracted and after screening the titles and initial abstract thoroughly, only 8 articles were left for additional assessment. It was discovered that the IMERG-Final satellite precipitation product has the lowest likelihood of mistakes and the highest correlation with ground-based measurements and In addition, as compared to IMERG Early and IMERG Late satellite rainfall products, it demonstrated superior and capable accomplishment in estimating heavy precipitation occurrences over both highly complicated and less complicated topography regions. It is therefore recommended to apply the IMERG satellite rainfall product data before the commencement of design and construction of hydraulic structures.

Keywords- IMERG, Precipitation, SCOPUS, Satellite Precipitation Product (SPP), Hydraulic Structures

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GIS-BASED IDENTIFICATION OF RIVER BANK EROSION AND FLOOD WATER MANAGEMENT

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***Abstract*:** Indus River in Southern Punjab, Layyah started to erode the residential as well as agricultural land at the left bank (31°4'0.321"N, 70°49'41.066"E) in 2000. At that time the local Government constructed the spurs on the left bank to tackle the erosion problem of the flowing river. It proved to be a short-term solution because in 2010 despite the construction of spurs the river started to erode, eventually resulting in the construction of spurs at the left bank once again. The present research emphasizes, training the river in the peak flow duration and analyzing the river shifting behavior as well as applying the Geological information sources (GIS) and Remote Sensing (RS) methods for geomorphology analysis progress. To gather Remote Sensing information and topographical information for 20 years shifting of the river bank. Because the geomorphology of the Indus River is continuously changing, causes a decrease in the area of the Indus River day by day. GIS mapping of river erosion shows that from 2000 to 2010 the natural river cross-section is disturbed by 50km^2 to 48. 83km^2 and from 2010 to 2020 reduction of river area is from 48. 83km^2 to 31.02km^2. The Results Show that the change in the stream bank is because of different common and synthetic exercises like a flood, flow velocity, deposition of eroded materials, uprooting of the vegetation covers, and soil stability disturbances. Furthermore, around 200 interviews were also conducted with local community individuals discussing river erosion and floodwater management during the month of peak discharge. The statistics show that 59% of remarks were related to "inappropriate river training works" and 43% of remarks were about "poor floodwater management".

***Keywords-*:** Land Sat Images, Geographic Information System, Erosion, Remote Sensing.

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NUMERICAL INVESTIGATION OF FLOW BEHAVIOUR IN A ROUGH BANK OPEN CHANNEL WITH VEGETATION PATCHES

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Abstract- In natural streams there exists a variation of roughness in stream-wise and transverse directions. In the present study, a numerical technique has been utilized to investigate the flow structure in an open channel comprising of various kinds of hydraulic roughness's. The channel roughness was consisted of roughness elements along the banks of the channel and circular vegetation patches along the center line of the channel. Bank roughness elements of two different lengths l_r were used {0.06 m,0.04 m} having pitch to height ratio *p/k* {9.67, 10.33}. Results captured by RSM model are presented in the form of depth-averaged velocities, contours of stream-wise velocity distribution and turbulent intensity. The results showed flow velocities in regions downstream of vegetation patches and roughness elements are small and supports the ecological habitat nourishment. Turbulence of minimum magnitude is observed and uniformly distributed in the free unobstructed regions. However, maximum of 5.8% turbulence has been observed in the flow zones of patches and bank roughness elements.

Keywords- Roughness Elements, Vegetation Patches, Computational Fluid Dynamic (CFD), Reynolds Stress Model (RSM), Open Channel Flow.

Paper ID: 410

Transportation Engineering

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AN OVERVIEW OF COASTAL EROSION IMPACTS ON ROAD INFRASTRUCTURE

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Abstract- The most important areas for human and economic activities, as well as the environment, are coastal zones. To protect the natural beauty of the coasts, the vulnerability of coastal areas to natural impacts should be carefully studied. Coastal erosion is a concern at many coastal locations, and it is triggered by both natural and manmade factors. Coastal erosion places the lives of millions of people who live along the coast in jeopardy, and puts coastal infrastructure like roads and bridges at risk. Coastal erosion has a fast effect, making it a significant coastal threat. Coastal areas with road networks close to the shoreline are particularly vulnerable to the impact of climate change-related sea level rise. Coastal erosion has placed these areas road networks in jeopardy. Drastic reductions in water flow of Indus River into the delta, overexploitation of mangroves forests, dredging and channelization, various uses of coastal resources by different industries, and increase in sea level due to climate change and global warming are all anthropogenic factors leading to coastal erosion. Between 1984 and 2015, approximately 28,000 km^2 of the world's coastline is eroded, roughly twice as much as those created by accumulation processes. By 2100, the total "Cost of Coastal Environmental Degradation" (CoCED) in a group of 4 (four) countries affected by coastal flooding and erosion could exceed $3 billion. One of the main factors affecting road networks is sea level rise. When groundwater moves into the pavement base layers, sea level rise caused ground water to reach pavement layers. This groundwater results in reduction of pavement life by 50% and a up to 90% increase in rutting due to fatigue distress. Following the Hurricane Katrina, the Federal Highway Administration (FHWA) performed an inventory of coastal bridges and found that there are around 36, 000 bridges within 15 nautical miles that could be damaged by coastal storms.

Keywords- Coastal Erosion, Global Warming, Infrastructure, Pavements, Sea Level Rise

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A DIFFUSE DAMAGE MODEL FOR ASPHALT CONCRETE

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Abstract- Distress in a pavement is a serious problem which can reduce the service life of a pavement. For an efficient design and analysis of pavements, use of efficient yet accurate computational models play a key role. Several numerical models have been used in the past to understand the mechanics of cracking in asphalt concrete. Interface elements with cohesive zone model have been successfully employed by many researchers however, the method requires the crack path to be known a priori and the cracks can only grow along element boundaries. On the contrary, continuum damage/ plasticity models offer the ease of damage modeling, but these methods show mesh dependency. In this paper a phase field diffuse damage model integrated with cohesive zone concept is used to simulate damage in asphalt concrete. The proposed model can simulate multiple interacting cracks propagating arbitrarily through the finite element mesh without the need of any *ad hoc* criterion. The effectiveness of the model is demonstrated using a single edge notch beam. Numerical results are validated against experimental observations. The obtained load versus crack mouth opening displacement curve quantitatively and damage profile qualitatively show good agreement with the experimental observations. The proposed model successfully simulated sharp crack and does not suffer from mesh dependency problem. Additionally, the model is also able to overcome the issue of complaint material behavior before cracking due to the presence of dummy stiffness in the interface element formulations.

Keywords- Asphalt Concrete, Finite Element Method, Phase Field Method, Mode-I Fracture.

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UTILIZATION OF BAGASSE ASH FOR SERVICEABILITY ENHANCEMENT OF BITUMINOUS PAVEMENTS

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Abstract- The serviceability of bituminous pavements can be enhanced by controlling the amount of deterioration. The filler of bituminous concrete has a vital role in reducing its deterioration. Stone dust is one of the materials that are commonly utilized as a filler in bituminous pavements. Numerous researches are carried out to replace the stone dust with suitable material. Sugarcane bagasse ash (SBA) can be used as a filler because of its low thermal conductivity compared to stone dust. Therefore, the overall aim of the research work is to select the best appropriate filler material for the serviceability improvement of bituminous pavements. The specific aim is to investigate sugarcane bagasse ash as a filler for reducing the degree of degradation in bituminous concrete. The rutting depth of the bituminous concrete incorporating SBA as a filler is evaluated. Various tests, i.e., softening point, grade penetration, flash and fire point, and wheel tracking test, are performed. AASHTO standards are followed to perform the tests. For the wheel tracking test, the percentage of coarse aggregates, SBA, and asphalt of grade 60/70 is 90.70%, 5%, and 4.30%, respectively. While two other samples with the same ratio instead that SBA is replaced with stone dust in the same amount are also prepared for comparison. It is concluded that replacing stone dust with SBA as a filler decreased the rutting depth of bituminous concrete. Based on the research results, the serviceability of bituminous pavements is expected to be enhanced by replacing the stone dust with sugarcane bagasse ash.

Keywords- Bituminous Pavements, Serviceability, Deterioration, Sugarcane Bagasse Ash as A Filler**.**

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COMPARISON OF ACTUAL TRUCK TRAFFIC WITH LIVE LOAD MODELS USED FOR DESIGN OF BRIDGES IN PAKISTAN

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Abstract- Live load models representing truck traffic, primarily governs design of bridges in Pakistan. Bridge design is done using Pakistan Code of Practice for Highway Bridges 1967 (CPHB) and AASHTO LRFD Bridge Design Specifications (AASHTO Specifications). Legal limits are imposed by National Highway Authority (NHA) to prevent overstressing of bridges. . In order to meet heavy load carrying demands from various industries, the service-level truck traffic has changed significantly in axle configuration, axle weights, traffic volume and gross vehicle weights. In this study, characteristics of live loads (axle weights and Gross Vehicle Weight (GVW)) of actual truck traffic are compared with live load models NHA legal load specifications to elaborate the significance in change in code of practice. The samples truck traffic data recorded at Ayub Bridge Peshawar (411 trucks) have been used for Analysis. From the analysis it was found that all types of vehicles surpass the limitation by significant value. Approximately, 60% vehicle violates the GVW limit prescribed by NHA with nearly equal contribution by both light and heavy vehicles. Similarly, 84% vehicle violates the axle load limit that includes almost all 6-axles and 5-axles trucks. The live load models of NHA Specification projects much less load effects as compared to the effects caused by actual truck traffic and hence the bridges are stressed much greater than considered during design. Hence, existing live load model are not the true representations of actual truck traffic, and requires development of a new live load model in addition with strict enforcement of load limitations.

Keywords- Bridge Design Load, Axle Load, Gross Vehicle Load, NHA Legal Limits.

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THE EFFECT OF USING JUTE FIBER ON DEFORMATION RESISTANCE OF ASPHALT CONCRETE

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Abstract- Pavement distresses are a major problem not only in Pakistan but throughout the world which leads to premature pavement failures. As the pavement construction is expected to increase with passing time, studies and research have been done for the improvement of asphalt pavements performances from both sustainability and functional perspectives. Reinforcing the bituminous mixture with fibers could provide an improvement in Asphalt Concrete (AC). Asphalt concrete modified with fibers is termed as Fiber Reinforced Asphalt Concrete (FRAC). In this study jute fiber is used as a reinforcing material to investigate the FRAC materials specifically its effect on deformation resistance. The effects of jute fiber modification on mixing procedure and performance of modified AC were observed later by several laboratory tests. Results showed that the optimum binder content increases 4-5% and the stability of jute fiber modified asphalt concrete increases up to 29% however, the flow value decreases up to 7% at 0.5% jute-fiber concentration. Addition of jute fiber significantly improved the deformation resistance of asphalt concrete. Whereas from the sustainability perspective, it leads to concept of the new market to utilize waste fibers thereby lessening the environmental consequences.

Keywords- Asphalt Concrete, Fiber-Reinforced Asphalt Concrete (FRAC), Jute Fiber.

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DEVELOPMENT OF USER- FRIENDLY TOOL FOR SPECIFICATION OF HIGHWAY WORKS

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Abstract- In the construction industry, worldwide, there are certain standards or specifications for the design, construction and maintenance of infrastructure. In the United Kingdom, Standards for Highways are used for the preparation of the construction contracts. Depending on the type of works, different guidance documents are available. These guidance documents are very lengthy and consist of various appendices. It is commonly acknowledged that these are not user friendly and require improvement in preparation and implementation. Review of literature has shown that no such tools are readily available for highway contracts. The aim of this paper is to develop a tool for the preparation of specification for highway works, to reduce the preparation time, to develop the consistent document and improve quality. Volume 1 and 2 of The Manual of Contract Documents for Highway Works (MCHW) was considered in the development of this tool. After the addition of technical data, using the MCHW, past specifications were examined to determine a consistent format. Macros were used to program the tool on a Microsoft Word document. First, the variable words, within the template, were identified and tagged so they could be coded. The user interfaces were then created and reviewed to ensure that they were user friendly. The specification was then tested on a project where works were to be completed. After testing, it was concluded that, with the step by step guide, the tool was user friendly and easy to use. This helped save time, when completing the specification, by more than 50% and reduced the overall cost of project.

Keywords- Manual Of Contract Document For Highway Works (MCHW), Highways England (HE), Specifications, Appendices, Tool.

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FRACTURE RESISTANCE OF WARM MIX ASPHALT MODIFIED WITH RECLAIMED ASPHALT PAVEMENT

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Abstract- The two-key requirement of asphalt pavement are sustainability and durability. Sustainability of pavement includes replacing percentages of virgin aggregate with Reclaimed Asphalt Pavement (RAP) with the help of Warm Mix Asphalt (WMA) additives, however durability involves performance parameters like fracture resistance of asphalt. The addition of RAP content increases the production temperature of asphalt and may degrade its performance. Therefore, researchers recommend different percentages of WMA additives to lower mixing and compacting temperature of asphaltic pavement. The current research work has been carried out to optimize the percentages of RAP and Sasobit that have best fracture resistance as compared to Hot Mix Asphalt (HMA) and thus allow us to minimize the construction cost of pavement structure. Varying percentages of RAP (0%, 20%, 40% and 60%) and Sasobit (0%, 2%, 4% and 6%) as WMA additive were used. Fracture resistance of asphalt was evaluated by Semi Circular Bending (SCB) test in the laboratory. The resistance of WMA to fracture was improved with the increase in percentages of RAP and Sasobit up to certain limit, whereas the addition of RAP to HMA showed a decrease in fracture resistance due to the stiffer nature of aged binder in RAP.

Keywords- Fracture Resistance, Sasobit, Warm Mix Asphalt (WMA) And Reclaimed Asphalt Pavement (RAP),

Geotechnical Engineering

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ASSESSMENT OF GROUND TO AIR HEAT TRANSFER SYSTEM FOR LOCAL SOIL CONDITIONS

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Abstract- Northern Pakistan has an extremely cold climate that requires a heating system during the winter season. On the contrary, extreme heat with high humidity and electric power cutoff cause inhabitant discomfort in summer. In this paper, an assessment of shallow geothermal feasibility is proposed to provide heating during winter and cooling during summer. The capital is considered the study area; nevertheless, it can be extended to other regions of the country, such as Northern areas that are extremely cold during winter and southern areas that are very hot during the summer. Furthermore, for the location under consideration, it is found that the soil strata in different regions are not the same. Therefore, the current paper also focuses on assessing shallow geothermal energy for different soil types in the selected region. Isotherms and precipitation contours have been developed that are based on 36 years of data. Islamabad receives the highest precipitation throughout the year; therefore, wet, and dry soil conditions are considered. The numerical model is validated with the analytical expression with the soil of Madinah Saudi Arabia. The result showed that different soil conditions affect the ground temperature for the same region having a similar climatic condition.

Keywords- Geothermal, Renewable Energy, Climatic Condition, Ground Temperature

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APPRAISAL OF AN ENVIRONMENT-FRIENDLY GEOPOLYMER FOR CIVIL ENGINEERING APPLICATIONS

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Abstract- The phenomenon of growing urbanization compels planners to think about those regions where soils are problematic. The deficient engineering properties imply the use of conventional stabilizers such as Portland cement (PC) and lime but these cause huge CO2 emissions which impart detrimental effects on the environment. Further, the recycling of waste to produce value-added products is the need of time. Ground granulated blast furnace slag (GGBS) is generated during iron manufacturing as an industrial waste byproduct. The eggshell is food waste. Geopolymer formation utilizing these base precursors in the presence of alkaline activators comprising sodium hydroxide (NaOH) and water glass (Na2SiO3) can prove alternate construction material. Four precursor composites (ESP: GGBS) – 70:30, 50:50, 30:70, and 0:100 were selected to evaluate the influence of growing slag content on the mechanical strengths of composites. Optimum activator content (OAC) and Maximum dry density (MDD) were determined by modified proctor test whereas mechanical properties were examined via unconfined compressive and split tensile strength test. The primary aim of this study is to examine the mechanical strengths of GGBS and eggshell-powder-based geopolymers. All composites have shown significantly greater strength values than achieved via cement stabilized soils required for subgrade and subbase construction. This new geopolymer product offered a cost-effective and eco-friendly solution to the issue of waste disposal and vulnerable soil improvement at the same time.

Keywords: Eggshell Powder, GGBS, Geopolymer, Alkali Activation, Cheap Geopolymer

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EXPERIMENTAL INVESTIGATION OF SHEAR STRENGTH OF SAND MIXED WITH TIRE SHRED

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Abstract- The rapid increase in industrialization, urbanization, and modernization has significantly increased the scrap tire production rate. The innovations, advancements, and continuous up-gradation of the technological products also enhance its production rate, making it one of the emerging waste streams in the world. About 13.5 million tons of scrap tires are generated every year around the globe. Scrape tires significantly damage the environment because of their complex degradation process. In this research work, the shredded scrap tires of different sizes (i.e., 50mm, 75mm, and 100mm) are introduced to the sand for investigating its shear strength characteristics, which is utilized in earth embankment, mechanically stabilized walls (MSE) and landfill. In this study, an attempt is carried out to examine the shear strength properties of the sand mixed with various sizes of tire shred by using large-scale direct shear test apparatus in order to investigate the optimum values of tire shred size as well as the mix ratio of sand tire mix at which maximum shear strength is obtained.

Keywords-Tire Shred, Mixing Ratio, Shear Strength**,** Large Scale Direct Shear Test

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DEVELOPMENT OF EMPIRICAL CORRELATIONS BETWEEN INDEX AND STRENGTH PROPERTIES FOR INDIGENOUS SUBGRADE SOILS

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Abstract-The California Bearing Ratio (CBR) is an important design parameter for the subgrade layer in a flexible pavement structure. Determination of CBR value is a very common laboratory test to estimate the stiffness modulus and shear strength of sub-grade soil for the pavement design. CBR test is technically an extensive and time-consuming process and may lead to delay in execution of construction projects and thus cause an increase in construction costs. Therefore, it is extremely important for the geotechnical engineer to develop a predictive model for quick assessment of geo-material behavior which is used in civil infrastructures. In this study, an attempt has been made to develop regression models both Single and Multiple linear Regression Analysis (SLRA & MLRA) to determine the soaked CBR value from soil basic properties like Liquid limit, Plastic limit, Plasticity index, optimum moisture content, and Maximum Dry Density of some subgrade sample gathered from twenty-one different locations of Rawalpindi Division, Pakistan. From both SLRA and MLRA models coefficient of correlation, the R^2 value is found in between (0.80 –0.98) indicating a very good correlation between soaked CBR and soil basic properties. Predicted CBR values were also compared with actually calculated values and a very good agreement was found between the two.

Keywords- SLRA, MLRA, Predictive, LL, PL, PI, OMC, MDD, Soaked CBR

Environmental Engineering

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IDENTIFYING AND RANKING OF CRITERIA FOR THE SUSTAINABLE LOCATION OF WASTE TRANSFER STATION: A WAY OUT FOR WASTE TO ENERGY AND THREE R'S APPROACH

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Abstract- Solid waste becomes a civic concern in this contemporary world. The public is more conscious about its possible hazards to the environment, health, and societal standard. To get rid of this, the countrywide concept is to reduce and recycle solid waste and build up large and distant landfills. In this circumstance, the waste transfer station is an attractive substitute to lessen solid waste by extracting recyclable and energy potential material and creates an incorporating nexus that lead to cost-effective deliveries from household to remote landfill facilities. Siting the waste transfer station in populated urban centres required the key functional role from a technical and financial perspective that assures environmental threats, people's health, and safety. Locating a waste transfer station is a complex assignment that comprises the evaluation of various factors: economic, social, and environmental. The purpose of this study is to identify and rank criteria for the sustainable location of the waste transfer station. For this, existing literature was studied and different factors were identified and ranked according to its frequency in literature. The study found that environmental concern is on priority following social and economic factors for locating waste transfer stations. Moreover, river, population density, and proximity to road constraint were ranked first in environmental, social, and economic factors respectively.

Keywords- Solid Waste Management. The Waste Transfer Station, Waste To Energy, Three R's Approach

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EFFECT OF HEAVY CONSTRUCTION ON THE AMBIENT ENVIRONMENT OF AL-MASJID-E-NABAWI (ﷺ) AND HAREM AL-MADINAH

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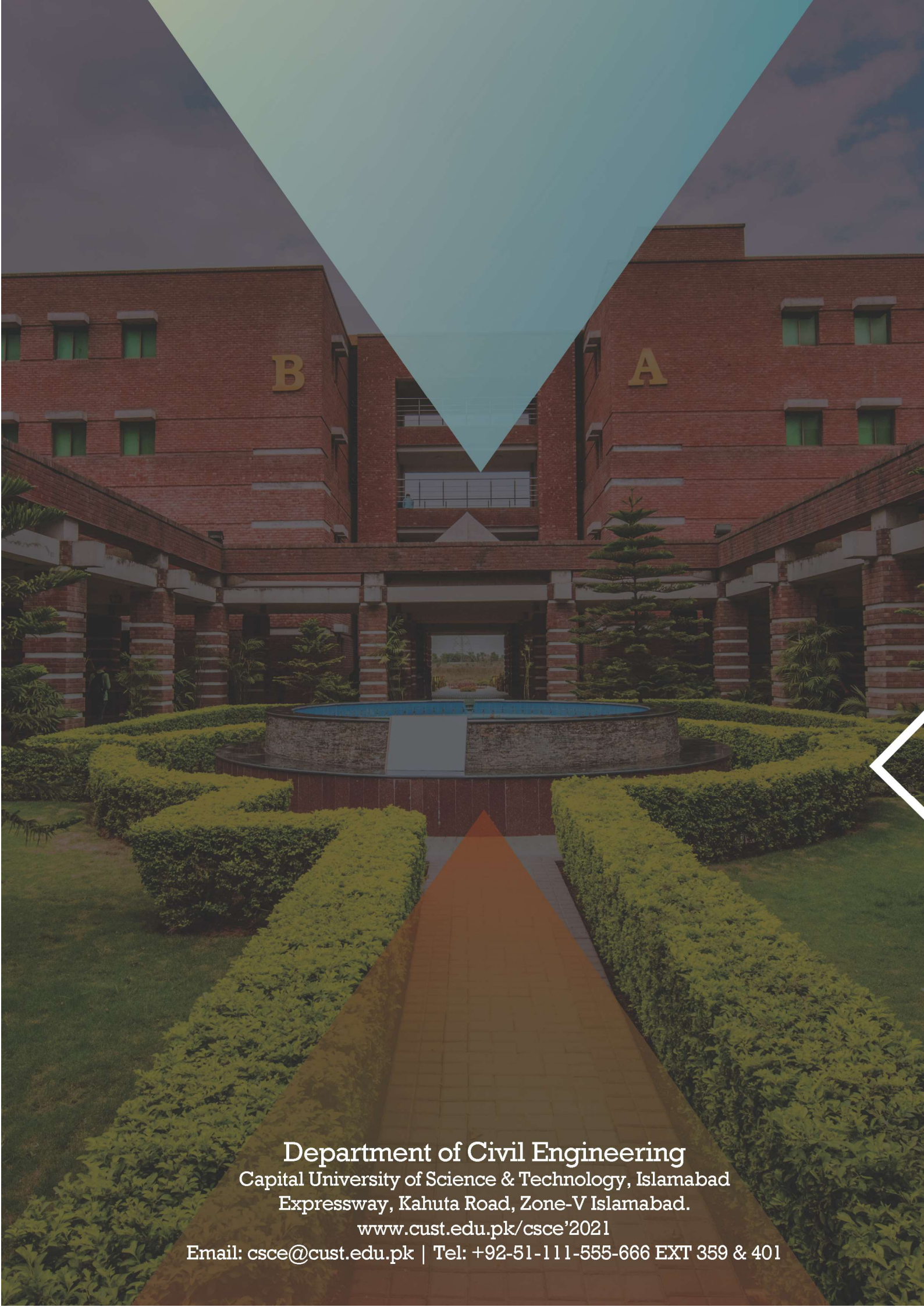
Abstract- Al Masjid-e-Nabawi sharif is one of the holiest places in Islam. Everyday thousands of pilgrims from each part of the world, visit the masjid to offer regular and optional prayers. To accommodate the rapidly increasing number of pilgrims, throughout history, the complex of Harem Al-Madinah undergoes various expansions. The most recent expansion was announced in 2012 and construction was in full swing during the 2014-15 fiscal year. The expansion project not only involves heavy construction but also requires demolishing of pre-existing buildings in the surroundings. The key objective of this investigation is to monitor the effect of nearby heavy construction activities on the critical environmental indicators of the prophet's masjid and surrounding areas. In this study, the vital ambient air quality parameters and noise levels were measured at different locations of Masjid during peak hours. The results are then compared with international health and safety standards. It has been observed that overall indoor air quality (IAQ) was within tolerable limits. However, there were noise impacts at some locations. The health and safety measure adopted by the authorities comply with international standards and similar procedures can be applied to the other parts of the world where heavy construction is required in the built-up urban areas.

Keywords- Harem Al Madinah, Air quality, Dust concentration, Carbon oxides, Noise Level.



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