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Abstract Book

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Capital University of Science and Technology, Islamabad
Department of Civil Engineering

Foreward

Welcome to the CSCE 2022, 4th Conference on Sustainability in Civil Engineering (CSCE'22) is held by Department of Civil Engineering, Capital University of Science and Technology, Islamabad, Pakistan. The main focus of CSCE'22 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 six wonderful and renowned keynote speakers for this edition of CSCE. We have received 225 manuscripts from different countries around the world including UK, Ireland, Cyprus, China, Egypt, Malaysia, KSA, and Pakistan. All papers have under gone a comprehensive and critical double-blind review process. The review committee is comprised of 51 PhDs serving in industry and academia of UK, USA, Australia, New Zealand, Hong Kong, Poland, Italy, Thailand, Chile, Malaysia, China, Turkey, Oman, KSA, and Pakistan. After the screening and review process, 67 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 authors, presenters and participants are also acknowledged, without whom this conference would not have been possible. Last but not least, an appreciation to our advising and organizing committees whose hard work and dedication has made this day possible.

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Self-Compacting Concrete- an innovative and sustainable material

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Asian Institute of Technology, Thailand

IT applications in construction

Dr. Anas bin Ibrahim

UTM Cawangan Pulau Pinang Malaysia

Assessment of railway's ground track degradation and subgrade-induced mud pumping

Dr. Tariq Umar

University of the West of England

Improving safety performance in construction

Dr. Naveed Ahmad

Stanford University, California, USA

Methodology for developing seismic fragility functions to support risk assessment at national level

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PHYSICAL, MECHANICAL, AND NON-DESTRUCTIVE EVALUATION OF GRIT IRON SCALE HEAVY-DENSITY CONCRETE

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Abstract - In this study, heavy density grit iron scale aggregate is composed of concrete to assess its physical and mechanical properties. Grit iron scale aggregate was utilized in 25%, 50%, 75%, and 100% as coarse aggregate by replacing normal weight aggregate. Moreover, a control mix for comparison purposes was also developed. It was found that increasing the content of the grit scale tends to increase density and slump. The Compressive strength in rebound hammer was found maximum for concrete mix having a 50% grit scale. At the same time, ultra-sonic pulse velocity (UPV) tends to decrease by increasing the content of the grit scale. This study will help assess heavy-density concrete as a biological shield.

Keywords- Heavy density, grit scale, density, compressive strength.



EFFECT OF STEEL SLAG ON CONCRETE HAVING VARYING AMOUNT OF CEMENT

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Abstract- Concrete with cement as main ingredient has a high demand in construction industry. Due to its increasing demand, new materials in combination with cement are used for improving its properties. A concrete needs higher paste volume when using cement alone, which may lead to greater heat of hydration with excessive shrinkage and increased cost. It is reported that cement is one of the largest source of CO₂ emission on the planet. Now-a-days serious efforts are being made for finding a suitable substitution of cement. In this research, cement was partially replaced by steel slag (steel slag). Preliminary tests like strength activity index and XRF indicated its chances to use as a partial substitute of OPC. Control specimens with varying cementitious contents of 220kg, 310kg and 400kg were prepared. In modified specimens, cement was replaced by steel slag (30% by mass of cement). The mechanical strengths (compressive, tensile and bending) were examined at 7 and 28 days. The outputs show an increase in strength with steel slag. It is also observed that the strength increment is more pronounced at higher binder content.

Keywords- Concrete, steel furnace slag, cement, sustainability, mechanical strength.



COMPARATIVE ANALYSIS OF CEMENT-SAND MORTAR AND GEOPOLYMER MORTAR UNDER FIRE

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Abstract- Fire hazard is the most common hazard and causes a significant reduction in physical and mechanical properties. Under high temperatures, the structural integrity of conventional cement mortar decreases drastically. Along with that, the dependency of the construction industry on cement should be reduced and alternatives must be considered as the production of cement requires a high rate of fuel consumption with excessive CO₂ emissions. Geopolymer is an emerging alternative binder to cement as it is more sustainable. In addition, it has superior fire resistive properties due to its in-organic polymeric nature. In this paper, cement-sand and geopolymer mortar was prepared and a comparative analysis was performed by observing the residual physio-mechanical properties after exposure at elevated temperatures. It was observed after performing various tests that the physical and mechanical strength of cement-sand mortar specimens were found to be extremely affected in contrast to geopolymer mortar. This study focused on the fire-resistive approach of geopolymer composite as compared to cement composites, in order to consider it as a surrogate to conventional cement in the future.

Keywords- Cement mortar, fire hazard, geopolymer mortar, residual strength.



EFFECT OF HUMAN HAIR FIBER ON MECHANICAL PROPERTIES OF CONCRETE

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Abstract- In the whole world tons of hair are wasted annually, which creates many health problems by damaging our ecosystem. Thus, it is very fruitful for us to use concrete and increase its properties of concrete and save the environment from future crises. The construction industry needs a lot of natural assets like limestone, aggregate, sand etc. to make concrete. These resources are finite and have to consume/expand someday, so an alternative must be adopted to overcome the needs. This paper presents the mechanical properties of concrete when human hair fiber is used as a fiber. A detailed experiment was carried out on three types of concrete specimens i.e. cube, beam and cylinder having different percentages of human hair fiber such as 0%, 1%, 2% and 3 % by weight of cement. In addition, in research different lengths of human hair fiber which varied from 20mm to 60mm were used. All the specimens were cast at two different concrete mix proportions i.e 1:2:4 and 1:1.5:3 with a 0.50 water-cement ratio. Furthermore, specimens were tested in Universal Testing Machine at 28 days curing period, for compressive strength, splitting tensile strength and UPV test and flexural strength of concrete. The conclusion from the experiments shows that there is a reduction in the workability of fresh concrete besides that there is an increment found in density and water absorption. Moreover, with increasing the percentage of the human hair fiber, mechanical properties were enhanced.

Keywords- Workability, human hair, compressive strength, ultrasonic pulse velocity, flexural and split tensile strength.



REDUCING THE WATER ABSORPTION OF MORTAR BY USING ECO-FRIENDLY WASTEPAPER SLUDGE ASH

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Abstract- The aim of this research is to utilize the paper waste in mortar mixtures as a cement replacement in form of Wastepaper Sludge Ash (WPSA) to make them more efficient and enhance their required properties such as water resistance, permeability, sorptivity. Mixture was then investigated to understand its chemical, mechanical and physical properties. Depletion of natural resource can be reduced by using WPSA as cement replacement. Carbon dioxide (CO₂) and Sulphur dioxide (SO₂) emissions can be reduced as well because of less usage of cement proportions. The physical and chemical properties of WPSA was compared with the cement. As the result of testing, WPSA showed similar cementitious properties and at 25% cement replacement by weight with the WPSA, it showed favorable ultimate strength of 19.05 MPa. Also by using WPSA, water absorption was reduced approximately up to 60% hence it increases water resistivity and decreases permeability and sorptivity thus making the structure more durable.

Keywords- Ecofriendly, mortar, wastepaper sludge ash, water absorption.



INFLUENCE OF SILICA FUME, STEEL, AND POLYPROPYLENE FIBERS ON MECHANICAL PROPERTIES OF PLASTIC CONCRETE

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Abstract. Recently many researchers have introduced the concept of using waste plastic in concrete to save natural resources and control environmental pollution. Because the strength of concrete decreases when plastic is used to partially substitute coarse aggregates, such concrete cannot be used for structural purposes. The goal of this research is to see how silica fume, stainless steel fibers, and polypropylene fibers affect the mechanical properties of plastic waste concrete to improve its strength and durability. Normal control mix was prepared for the comparison of results with plastic waste concrete. In plastic concrete, the proportion of coarse aggregates replaced by plastic aggregates was kept constant (20 %). Cement was replaced with silica fume by weight and fibers (steel and polypropylene) were added by volume of concrete. The addition of silica fume and fibers in mixes was optimum based on the literature review. When compared to the control mix, the split tensile, compressive, and flexural strength of plastic concrete with 20% replacement decreased by 50%, 16.29 %, and 33.25 %, respectively. By incorporating silica fume and steel fibers split tensile, compressive, and flexural strength of plastic concrete was reduced only by 4.72%, 4.56 %, and 1.376 %, respectively. Polypropylene fibers and silica fume improved the tensile, compressive, and flexural strength of plastic concrete by 86.18%, 69.75%, and 97.93% respectively. The mechanical properties were enhanced with the inclusion of steel fibers, polypropylene fibers, and silica fume. Hence, it is concluded that plastic concrete can be used for structural elements by adding some additional constituents to it.

Keywords- Mechanical properties, plastic concrete, polypropylene, steel fiber.



THE EFFECT OF POLYPROPYLENE FIBERS ON TENSILE STRENGTH OF SELF COMPACTING CONCRETE

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Abstract- The mechanical characteristics of fiber reinforced self compacting concrete in the hardened condition are investigated in this study. The goal of this experiment is to see what impact polypropylene fibers (PPF) have at different doses, such as 0%, 0.50%, 1%, and 1.50% and to estimate the maximum amount of polypropylene fibers (PPF) that can be added safely. Furthermore, Silica fume was used to displace up to 10% of the cement, which was consistent across all blends. The replacement of fine aggregate was carried out with 10% fly ash for blends (M1, M2, M3 and M4). Then percentage increased up to 20% for mixtures (M5, M6, M7 and M8). The purpose of the experimental study programme was to look at split tensile strength after 14 and 28 days of curing. The mix containing varied amounts of polypropylene fibers was then compared to conventional concrete. Tensile strength was improved by adding polypropylene fibers to the mix. At 1% polypropylene fiber insertion, the tensile strength reaches its maximum.

Keywords- Polypropylene fibers, split tensile strength, self-compacting concrete.



MECHANICAL BEHAVIOUR OF MORTAR USING POZZOLANA AS PARTIAL REPLACEMENT OF CEMENT

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Abstract- Lightweight concrete structures are being built by human beings since ancient time for shelter and other purposes. These structures are composed of different materials like concrete, wood, glass, steel, stones and mud. But in the modern world, the use of lightweight concrete is increasing. After water, concrete is the most widely used material on our planet. Due to its relatively low cost, it is commonly used building material. The major binding material of concrete is cement. This leads to the production of cement in very large amount. The excess use and production of cement leads to environmental problems and concrete structure disintegration. We can reduce the production of cement by adding different types of pozzolanic materials as partial replacement of cement which will also decrease the dead load of the building. In this study we will evaluate the results of adding different proportions of Pozzolana as partial replacement of cement. The type of pozzolanic material used in this study is pumice. Pumice is available naturally in the form of stones. The pumice stone is always easily available everywhere and having low density then all the other aggregates used in the concrete mortar. The light weight mortar cubes are prepared by partially replacing the cement with powdered pumice aggregate by 12, 24, and 36%. The mix design and all the respective percentages are prepared by mixing it with water. After proper curing the mechanical and the durability properties of conventional control mix and the partially replaced mortar cubes are compared by conducting compressive strength and porosity tests for specific replacement of the cement with pumice.

Keywords- Lightweight concrete, admixtures, durability, control mix.



MECHANICAL PROPERTIES OF BAMBOO CORE SANDWICH PANELS

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Abstract- Bamboo is a material that has been used in construction for generations. One of the biggest disadvantages to this material is the natural variability, however, there is the potential for it to be used as core material in sandwich panels. Therefore, to maximise bamboo's potential for usage as a structural material and limit the impact of natural variability, bamboo core sandwich panels were developed. The experimental procedure was broken down into 3 stages. The first stage reviewed the impact of different core configurations on the modulus of rupture and compressive strength of sandwich panels produced with plywood as the outer skin and bamboo rings as the core. The second stage took the best configuration from stage 1 and produced a 2m beam to review the mechanical properties and was thereafter compared to a control beam with no bamboo rings. The final stage of the experimental procedure reviewed the compressive strength of the bamboo rings both parallel and perpendicular to the grain to validate the results obtained in stage 1 and 2. Results showed that the core configuration has a big impact on the modulus of ruptures and that there was a clear relationship between density and modulus of rupture. Stiffness of the beams and cubes tested increased as the cross-sectional area of rings increased and allowed for a greater contact area. Finally, the testing of the bamboo rings aligned with results that were expected when testing parallel and perpendicular to the samples, with split bamboo rings producing good strengths in comparison to good rings.

Keywords- Bamboo, sandwich panels, mechanical properties.



AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF BITUMEN USING WASTE ENGINE OIL & CRUMB RUBBER

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Abstract- Bitumen is a strong hydrocarbon that is often used as a binding material in flexible pavement and is produced as a by-product of petroleum refineries. Bitumen is non-toxic at room temperature, although when heated between 165–200 C to cover all the aggregates, it generates a poisonous smoke which is extremely damaging to someone's health also environmental destruction, depletion of petroleum resources, and rising prices were among the consequences. Other binder sources for pavement structure will be investigated by researchers. This experiment will examine the impact of using wasted crumb rubber and engine oil to reduce emissions. The amount of bitumen used was a combination of crumbs rubber and wasted engine oil. Both Modifiers are manufactured from waste products, are easily accessible, and are low-cost. This technique of recycling these waste items reduces clutter and helps to keep the environment clean. AASHTO and ASTM standards were used to examine the rheological and physical properties of modified binders in the laboratory. To determine if the unique mixture might be utilized on an industrial level, the results will be compared to a sample group of neat bitumen. To determine the relationship between factors such as shear modulus and phase angle at different frequencies, master curves were produced. According to the study findings, bitumen could be replaced up to 12.5 percent as a sample of W5CR7.5, resulting in comparable or better performance based on rutting resistance, stability, and flow. This work directly makes a unique contribution to highway and transportation developments in the establishment of alternate materials for pavement structure by providing improved binder composition from waste resources.

Keywords- Bitumen, waste materials, wodified binder, pavement material.



MICROSTRUCTURAL STUDY OF COCONUT SHELL CONCRETE

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Abstract- Rapid growth of the construction industry results in high demand for the aggregate. However, the aggressive consumption of aggregate significantly affects the environment when mining and quarry activities need to be carried out to supply the aggregate. This study was conducted to use agricultural waste, i.e., crushed coconut shells as an alternative to coarse aggregate in the concrete mix known as coconut shell concrete (CSC). A series of experiments were carried out to determine the compressive strength of CSC and to study the micro-morphologies of the CSC at 1, 7 and 28 days. The strength development of the CSC was observed and validated with the compressive strength of the samples at different ages. The use of crushed coconut shells as aggregates replacement does not change the micro-morphologies of normal concrete mix.

Keywords- Agricultural wastes, coconut shell concrete, lightweight aggregate concrete, sustainability.



FRESH AND MECHANICAL PROPERTIES OF HIGH STRENGTH SELF-COMPACTING CONCRETE MODIFIED WITH FLY ASH AND SILICA

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Abstract- The effects of Fly Ash (FA) and Silica Fume (SF) on the fresh and mechanical properties of high-strength self-compacting concrete (HSSCC) are examined in this research. Slump, J-ring, and L-box tests are used to study fresh properties, while compressive strength, split tensile test, and flexural test are used to investigate mechanical properties. This research is based on the previously published research and selected the optimum percentages of supplementary cementing material (SCMs) for FA and SF. The concrete mixture consists of total of seven mixes: control mix (CC), M1 (5%SF and 0%FA), M2 (5%SF and 10%FA), M3 (5%SF and 20%FA), M4 (5%SF and 30%FA), M5 (5%SF and 40%FA) and M6 (5%SF and 50%FA). The study indicates that adding up to 5% SF and 20% FA to HSSCC mixes improves the fresh qualities of the mixtures. On all ages, the mechanical parameters of HSSCC, such as compressive strength, flexural strength, and split tensile strength, are shown to be higher than the control. In comparison to control mixtures at the appropriate ages, the addition of SF and FA at the optimum dose (5% SF and 20% FA) results in a rise in compressive strength, flexural strength, and split tensile strength. It is concluded that 5% SF and up to 20% FA mixes show improvement in the fresh properties as well as mechanical properties of HSSCC while further increment of FA decreases the fresh and mechanical properties of HSSCC.

Keywords- Workability, supplementary cementing material, compressive strength, flexural strength, split tensile.



STRENGTHENING OF A FLAT PLATE SLAB -CASE STUDY

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Abstract- Flat Plate Slab is a popular structural floor system. The popularity of this structural system is due to the speed of construction, which has become a critical consideration in many projects. The slab could be deficient because of under-design or lack of quality control. Strengthening of reinforced concrete slab for flexural is crucial to enhance the capacity of the deficient slab. This study describes the strengthening methodology for a badly designed-story building having Flat Plate slab flooring system. A visual and detailed inspection of the building was carried out, and the bottom and top cracks on the flooring system were inspected thoroughly. The deflection on each floor panel was observed in detail. The pattern of the cracks was noted in the soffit of each slab panel and at the top and in the middle and column strips. The cracks were measured using a digital vernier caliper. The deflections were measured using auto level and inverted staff rod. The whole building was modeled in ETABS software considering all the in-situ parameters. The design was reviewed and found that the slab was under-designed in flexural and shear reinforcement. This paper deals with the flexural strengthening of reinforced concrete (RC) slab which is deficient in flexural steel. This work conducted a detailed field investigation and modeling to control slab deflection and crack using several strategies such as column jacketing, drop panels, creation of beams. This study suggested the best economical and safer solution for a badly designed plate slab flooring system. The innovation of this case study is real big scale commercial building where in literature small scale structures have been discussed.

Keywords- Flat Plate slab, strengthening, flexural capacity, column jacketing, drops panels.



CHARACTERIZATION OF ASPHALT USING NEURAL NETWORK AND IMAGE ANALYSIS TECHNIQUE

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Abstract- Artificial neural networks (ANN) and image processing (IP) are significant computer science methodologies. These methods are employed to forecast the properties of asphalt binder. To evaluate the asphalt binder's parameters, i.e., homogeneity and volumetrics, by performing a job mix formula. Several tests were conducted in the laboratory with different types of aggregate, i.e., Margallah, Sargodha, Sakhi Sarwar, and Rohi with bitumen material. The IP and ANN approaches were used in this investigation are appropriately mixed and are used to forecast the volumetrics of asphalt, i.e., air voids (Va), percent voids filled with asphalt (VFA), and voids in mineral aggregate (VMA). For this specimen, bitumen and aggregate were cast with 3.5, 4.0, 4.5, 5.0, and 5.5 aggregate grading. Two sets of specimens were created from them: (i) to determine air voids (Va), percent voids filled with asphalt (VFA), and voids in mineral aggregate (VMA); and (ii) to create an image database. An image of the top view is needed for image capturing which is taken by a smart phone. Preprocessing is performed on the obtained data (converted to grayscale, cropped, and resized to 256 256 pixels), and using the ANN method, the statistical features are collected to evaluate the VA, VMA, and VFA. The actual values of the job mix formula were differentiated from the relative values evaluated by the given methods, i.e., IP and ANN. The data set has a massive effect on the reliability of the conclusions.

Keywords- Artificial neural network, image processing, job mix formula, volumetrics.



INFLUENCE OF AGING ON THE PENETRATION PERFORMANCE OF WASTE POLYMER MODIFIED ASPHALT BINDER

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Abstract- A promising strategy that has been widely accepted for improving the pavement deficiencies, is the use of commercial polymers for asphalt binder modification. However, their high cost is the major hurdle in their use, especially in the developing countries. Instead of these commercial polymers researchers are using waste plastic polymers to attain the same benefits. Their cost effectiveness and environment friendly quality is making them the most popular asphalt binder modifier all over the world. The current study aimed at studying the impact of aging on the penetration performance of waste polymer modified asphalt binder. Two such polymers, waste PET (polyethylene terephthalate i.e., plastic bottles) and waste LDPE (low-density polyethylene i.e., plastic bags) were collected from the vicinity, then cleaned, uncapped and shredded to a size less than 0.5mm and blended separately with 60/70 penetration grade bitumen using 2%, 4%, 6% and 8% waste polymers by weight of bitumen. Penetration test was performed on the unaged modified binder samples, short term aged (using rolling thin film oven test (RTFO)) modified binder samples, and long term aged (using pressure aging vessel test (PAV)) modified binder samples. To sum up, it could be said that the use of these non-biodegradable waste polymers enhances the physical performance of the binder and save the cost of material and environment from pollution as well.

Keywords- Aging, modified asphalt binder, waste PET polymer, waste LDPE polymer.



EFFECT OF AGGREGATE REPLACEMENT WITH WASTE TIRE RUBBER ON PROPERTIES OF CONCRETE – AN OVERVIEW

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Abstract- Tire rubber never decomposes, hence it's a waste product. When tires are piled up at landfills, harmful chemicals are released into the air, ground, and water. Toxic black smoke may be emitted into the air when rubber tires catch fire. Many of the dangerous compounds typically utilized in tire manufacture may be found in this smoke. There are chemical substances in this Fire that are wiped away when water is sprayed. These pollutants then permeate the soil and contaminate lakes and ponds. In this situation, it is preferable to repurpose rubber. This paper focuses on the strategies adopted by researchers to utilize waste rubber as an additive in concrete. Studies have been conducted for the replacement of coarse and fine aggregate ranging from 0-100% and investigation of mechanical properties including flexural strength, tensile strength, compressive strength and physical properties including ductility, unit weight density, etc. have been part of the studies. Dynamic properties like impact resistance and energy absorption have been investigated at different ages and results were compared with normal concrete (NC). It has been discovered, as a result, that rubberized concrete (RC) is better in durability, ductility, lightweight, and has greater crack resistance but reduced mechanical properties. However, RC's capacity of energy absorption and impact resistance is higher than NC. The mechanical properties of RC can be enhanced by adding different types of admixtures.

Keywords- Rubberized concrete, mechanical Properties, dynamic properties, physical properties, energy absorption.



EXPERIMENTAL STUDY OF FIBRE SYNERGY TO INVESTIGATE THE TENSILE & COMPRESSIVE STRENGTH OF FIBRE REINFORCED CONCRETE

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Abstract- The goal of this experimental research was to analyze the addition of carbon and glass fibers on the split-tensile and compressive strength of concrete cylinders. An approach to increase the strength of structures was carried out using fiber synergy. In this investigation, an effort was made by testing hybridized and mono fiber reinforced concrete (FRC) cylinders. Eighteen concrete cylinders were cast including six cylinders with different percentages of carbon fibers, six cylinders with different percentages of glass fibers, three control cylinders, and three hybridized cylinders were tested up to failure point. Eighteen samples each for split-tensile and compressive strength were tested in this experimental research. It was observed that the split-tensile and compressive strength of fiber reinforced concrete cylinders was improved using fiber synergy.

Keywords- Carbon fibers, compressive strength, energy absorption glass fibers, hybrid fibers, split tensile strength.



PERFORMANCE EVALUATION OF A PARTIALLY SYNTHETIC BITUMEN COMPOSED OF INDUSTRIAL WASTE

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Abstract- Bitumen is produced from non-renewable natural resources. Depletion of non-renewable resources intrigued researchers to look for alternative binders. Bitumen has been modified with many additives to enhance its properties and performance. The improper disposal of waste materials such as crumb rubber and use engine oil poses a significant threat to the environment. The addition of these industrial waste products to asphalt not only provides a safe and cost-effective way to dispose of them, but also improves the asphalt binder's performance. In this study, various combinations of waste engine oil and crumb rubber have been used with 60-70 penetration grade bitumen to produce a partially synthetic bitumen. Adhesion being one of the key characteristics of the bituminous binder has been assessed by using bitumen bond strength test along with penetration and softening point. The experimental results revealed that partially synthetic bitumen with 35% waste and 40% percent waste improves the adhesion along with conventional properties. Furthermore, the results of partially synthetic bitumen demonstrate that this bitumen is more suitable for cold regions of the country. A detailed and extensive testing program is needed to reach authentic findings but based on the results authors are hopeful that a handsome percentage of waste can replace the virgin binder giving a cost effective and environmentally friendly solution.

Keywords: - Synthetic bitumen, adhesion, waste engine oil, crumb rubber.



A REVIEW ON REPAIRING FIRE-DAMAGE GYPSUM BOARD

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Abstract- Recently, different types of gypsum board composition are being used in buildings due to their excellent thermal properties. Thus, the requirement for fire safety concerns rose. As a result, the goals of these studies are to first reduce the fire risk of gypsum board at normal temperatures, and then to increase the maximum failure time of gypsum-based boards when exposed to fire. Finally, maintenance or repair of fire-damaged gypsum-based material. Fire-resistant plasterboards were used because of their thermal, physical, and heat transfer properties. Various types of gypsum board were manufactured around the globe and studied for their chemical composition and thermal effects at high temperatures. By executing fire tests on gypsum-based boards, the results showed that gypsum board slows the process of extinguishing fire, and it performed well up to 400 °C. When the temperature was raised to 600 °C, cracking and volume shrinkage were observed. When the temperature rises by up to 1000 °C, the gypsum board crumbles. According to the findings of this study, increasing the thickness of the board, decreasing the density of the main element pure gypsum, the initial mass friction dehydration process, then hemimeration process, air cavity filled with insulation material, and the addition of mixed proportions of PCM with gypsum all help to improve the failure time.

Keywords - Gypsum board, high temperature, fire test, shrinkage, cracking, falling off.



A REVIEW ON THE USAGE OF MODERN TECHNIQUES TO OVERCOME THE ISSUES IN RAPID SETTING CONCRETE FOR EXTREME TEMPERATURE ZONES

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Abstract- Rapid setting concrete has a wide range of use in the construction industry which has helped it gain significance. Conventionally admixtures are used to reduce the setting time of concrete for extreme temperature sites, underwater construction, and pavements where the waiting time is a crucial issue. Therefore, extensive research is being carried out around the globe to find solutions that can help, overcome the issues arising in the conventional rapid setting concrete. The objective of this study is to discuss all the major flaws and propose remedies based on the literature. A comprehensive review of the literature, mostly from articles published in the last decade, was carried out to find the issues observed in the conventional rapid setting concrete, the governing properties, and finally, solutions have been given based upon the conclusive remarks of the authors of the reviewed articles. After a careful study of the literature, it was deduced that using Polyurethane in fresh concrete along with some kind of natural fiber can result in effective outcomes. The study will help in exploring modern ways that can be of great significance for the construction industry.

Keywords- Fiber reinforced concrete, hydration, polyurethane elastic concrete, rapid Setting concrete.



COMPARISON OF EXPERIMENTAL SHEAR CENTRE OF VARIOUS SECTIONS WITH THEORETICAL ANALYSIS THROUGH RESPONSE SURFACE METHODOLOGY

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Abstract- In this experimental study, three cross-sections of mild steel were studied to locate their shear center concerning the rotation of the load. Z-cross section was symmetrical, whereas L-section and semicircular section were symmetrical on one axis and unsymmetrical on another. The shear center's location is vital to designers in structural analysis. For the symmetrical section, the shear center was found to be zero in experimental as well as in Response Surface Methodology (RSM). The location of the shear center for the L-section was 43 mm, and for semicircular, the shear center was 28.5 mm. At the same time, the difference in error for L-section and semicircular section was found to be 45% and 0.77%. This study shows that an excellent theoretical and experimental relation has been established through RSM.

Keywords- Shear center, symmetrical, unsymmetrical, response surface methodology.



MASS DISTRIBUTION EFFECT ON THE FINITE MODEL UPDATING USING OPERATIONAL MODEL ANALYSIS TECHNIQUE

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Abstract- The findings of a model update investigation on a planar steel shear frame modal are presented in this paper. The operational modal analysis from the modal ambient vibration data were utilized to update the finite element model of the structure. The model of the structure was created using information from the model design paperwork. To increase the connection between observed and estimated modal parameters, several model parameters were adjusted using an automated approach. The parameters to be adjusted by the updating program were chosen with care to guarantee that the model modifications were meaningful, physically reliable, and realistic. The model update procedure is highlighted in the study.

Keywords- Ambient vibration, finite element model, model parameters, operational modal analysis.



NUMERICAL SIMULATION OF FRACTURE IN CONCRETE USING PHASE FIELD MODEL

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Abstract- In this paper, a phase field-based numerical model has been presented to study fracture in concrete. All nonlinearities in the fracture process zone are modeled using cohesive zone approach with traction-separation constitutive law for concrete. A localized band of finite width is used to regularize the crack path using scalar phase-field. The phase-field discriminate between intact and broken surface using numeric values of 1 and 0. The critical fracture energy is modeled as the algebraic sum of the critical fracture energy of mode I and mode II. A finite element method is used to implement the proposed model. Numerical simulation for mode I fracture is performed on a three-point notched concrete beam. The concrete response under applied loading is represented using load-displacement curve. A study related to effect of mesh size and length scale parameter on the output results is carried out. The results indicated that the length scale parameter and finite element size has little effect on the model. It is concluded that the phase-field model has the ability to simulate crack growth in concrete under the given loading condition.

Keywords- Mode I fracture, mixed mode fracture, phase-field, fracture energy, length scale parameter.



OUT-OF-PLANE RESPONSE OF ENGINEERED CEMENTITIOUS COMPOSITE FACED BLOCK MASONRY

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Abstract- The purpose of this study is to propose and demonstrate the effectiveness of engineered cementitious composite (ECC) for strengthening block masonry. Two cases have been studied: ECC only on the tension face and ECC on both tension and compression faces. Out-of-plane response of tension reinforced beam, and both tension and compression reinforced beam has been experimentally investigated under four-point loading systems. The findings of this study show that both the strength and ductility of masonry beams enhance using ECC, which advocates the use of ECC as a block masonry reinforcing material.

Keywords- Block masonry, bending response, ECC, four-point loading.



NUMERICAL STUDY OF SHAPE MEMORY ALLOY (SMA) REINFORCED BEAM SUBJECTED TO SEISMIC LOADING

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Abstract- To safeguard against the loss of life and to maintain integrity, reinforced concrete structures are designed and constructed to withstand severe damage, impact and permanent displacement during a strong earthquake. Due to the dissipation of energy after a major earthquake, steel reinforcement undergoes large strains which lead to damage in the plastic hinge zone. Furthermore, the structure will be unserviceable due to the large residual deformations caused by the permanent strain in steel. Implementation and development of smart materials in structures will help to achieve these qualities. Shape Memory Alloy (SMA) is an example of a smart material, the use of such super elastic material in reinforced structures helps to recover the strain upon unloading which leads to improved recovery. without significant degradation or permanent deformation through repeated cycling. This ability gives a promise in civil engineering infrastructure applications specifically in seismic design. The primary objective of this study is to review the use of SMA in reinforced concrete at the plastic hinge region and to review the behavior of the hybrid beam using finite element software. After validation of the finite element model with the experimental results gathered from past literature, a parametrical study is conducted to understand the behavior of the hybrid beam with a change in parameters.

Keywords- Numerical study, reinforced concrete beam, shape memory alloy, vector2.



NUMERICAL INVESTIGATION OF CFRP RETROFITTED, QUARRY ROCK DUST, FLY ASH, AND SLAG BASED GEO POLYMER CONCRETE BEAMS

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Abstract- Geopolymers concrete (GPC) has gained popularity in the construction industry as a low-carbon, cement-free composite material with strong mechanical qualities that may be employed in various structural applications. In this paper, the behavior of simply supported geopolymer concrete beams employing symmetrical conditions is simulated using Abaqus (Finite Element Analysis) tool. A simplified version of the Concrete Damage Plasticity Model (CDP) is used as a nonlinear constitutive model. Using Abaqus (CAE), four geopolymer concrete beams were modeled with varying parameters depending on their compressive strength, and the experimental force-deflection curve. These beams were shear deficient and failed along the shear path experimentally, while the model followed the identical shear trajectory path in simulation. The same damaged beams were then strengthened by wrapping CFRP sheets around them and simulating the retrofitted beams using the ACI perfect bond condition method to validate the experimental force-deflection curve. The model has been validated against experimental load-deflection curves and shear trajectory failure paths for both controlled and CFRP-wrapped beams. The comparison of results from the experimental and numerical study suggests that the FEM is a good technique for the simulation and prediction of the elemental behavior under different loading conditions and restraints.

Keywords- Geopolymer, concrete damage plasticity, abaqus, sisal fibres, steel fibres.



COMPUTATIONAL MODELING OF DAMAGES IN BRIDGE PIERS

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Abstract- Bridges are one of the most vulnerable structures to an earthquake damage. Due to an obsolete code for bridge design and poor construction practices in Pakistan, most of the bridges are seismically deficient. Experimental tests are helpful in assessment of bridge piers but requires considerable resources. In that account, numerical tools are also used for the assessment of bridge piers and various numerical techniques are available which can be utilized in this regard. This work focuses on non-linear modeling of bridge piers and validation of proposed computational scheme with experimental data using a Finite element based software–Abaqus. A single circular bridge pier subjected to a monotonic lateral load is modeled in the finite element software. For this purpose, a plasticity based damage model Concrete Damage Plasticity (CDP) is used for modeling damages in Abaqus. CDP considers concrete crushing and tensile cracking as the main failure mechanism. A constitutive model for concrete compression–Modified Kent and Park model–and tensile cracking–exponential relation for the tension stiffening– to obtain the CDP parameters are used. Mesh sensitivity analysis is performed to select a suitable mesh size as well as configuration for the numerical modeling. Additionally, the effect of step size on percentage of kinetic energy produced during the analysis is studied. Computational analysis demonstrates that the proposed scheme predicts damages in accord with the experimental results.

Keywords- Abaqus, bridge piers, concrete damage plasticity, explicit analysis, finite element method.



INVESTIGATION OF PUNCHING SHEAR RESPONSE OF GFRP REINFORCED CONCRETE FLAT PLATE SLAB USING CDP MODEL IN ABAQUS

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Abstract- In this paper, the punching shear of glass fiber reinforced polymer (GFRP)-reinforced concrete two-way square flat slabs was investigated using the non-linear finite element analysis (NLFEA) and its comparison with experimental results from 2500 mm x 2500 mm x 200 mm including top and bottom square column stubs. The size of stubs was 300 mm reinforced with GFRP bars along with conventionally steel bars being tested under the monotonic loading. A commercial software ABAQUS Standard 6.14-1 was used for the NLFEA model of the concrete flat slab's specimens. The numerical results were calibrated by using the varying material strengths along with different geometric properties likely dilation angle, element types, mesh sizes, and viscosity parameters which are based on the earlier experimental test results. Furthermore, Concrete Damaged Plasticity (CDP) model is used for the reinforced concrete behavior, while linear elastic behavior for GFRP and steel bars is used in ABAQUS. Calibration of these 3D slab model analyses is completely done by simulating the slabs without shear reinforcement. Failure of punching shear and cracking patterns are examined by using these test prototypes. Finite Element Analysis (FEA) of these prototypes using GFRP bars also showed identical shear failure and the patterns of cracking at failure. The numerical modeling of flat plate slabs in Abaqus presented the load-deflection curves with a close relation with experimental results.

Keywords- Punching Shear, flat plate slabs, non-linear finite element analysis, failure behavior.



OPTIMUM DESIGN OF PRESTRESSED CONCRETE GIRDER USING JAYA ALGORITHM

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Abstract- In the past few decades, there has been a significant rise in utilization of meta-heuristic algorithms, such as Genetic algorithm (GA), Ant colony optimization (ACO), Particle Swarm Optimization (PSO), Harmony Search (HS), Big Bang-Big Crunch (BB-BC), Artificial Bee Colony Algorithm (ABC) and Whale Optimization (WO), etc., for design and analysis of concrete structures. The objective of this paper is to apply one such algorithm, known as Jaya Algorithm, to optimize the design of Prestressed Concrete I Girder. Jaya Algorithm has been successfully applied in the field of structural engineering in the past. However, its robustness and efficacy for optimal design of prestressed girder is yet to be tested. For this study, a program was created on MATLAB, following the design guidelines of American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications for prestressed I girder design. Cross sectional dimensions and number of strands per tendon were used as variables. Flexural stress, shear stress, deflections limitations, and minimum geometric dimensions were used as constraints. To demonstrate the effectiveness of this technique, design optimization for a 40m long prestressed I Girder was successfully carried out in this study. The favorable results of this study indicate that Jaya Algorithm is highly effective and can be recommended for use in the industry.

Keywords- Jaya algorithm, optimization, prestressed post-tensioned I girder, meta-heuristic techniques.



3D FINITE ELEMENT ANALYSIS OF REINFORCED CONCRETE BEAMS UNDER FIRE

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Abstract- This paper presents a numerical investigation of the fire behaviour of reinforced concrete beams reinforced with carbon steel. The main aim of this paper is to propose and validate a detailed finite-element model that considers the nonlinear behaviour of the materials and the heat transfer parameters that affect the fire performance of steel reinforced concrete beams using commercial FE software ABAQUS. The analysis was performed using sequentially coupled thermal stress analysis, for which the thermal analysis was firstly performed, and the structural analysis was then conducted. The EC2 constitutive material models for concrete in tension and compression at elevated temperature were simulated while the steel was modelled using either elastic-perfectly plastic or with strain hardening suggested in the EC2. Regarding the heat transfer, models with and without radiation heat transfer were conducted. The numerical results were compared with three tested beams. It was found that numerical models without radiation heat transfer provided results in good agreement with the test results. The elastic-perfect plastic material model for steel rebar at elevated temperatures can be utilized in FEA to reduce the computational time. However, the steel model with strain hardening provided more accurate predictions.

Keywords- Abaqus, fire analysis, material modelling and reinforced concrete.



REVIEW OF INFILL WALL MODELLING TECHNIQUES: MACRO AND MICRO MODELS

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Abstract- Infilled masonry frames are integral part of reinforced concrete (RC) structures for almost 200 years. They are present in interior and exterior walls in both RC and Steel frames all around the world. The interaction of infills with the surrounding frames has a major influence on the structural response of the full composite structures. Their most influential property is that of a high initial stiffness and considerable strength. However, even today during the design process and during the assessment of the existing structures they are considered as non-structural members and their contribution in the structural response is overlooked. Numerous researchers have considered the influence of infills on the response of RC structures in the recent past and the need for inclusion of these members in the design and assessment of structures has been recognized. This study therefore aims to provide a thorough review of the work of several researchers to include the in-plane effect of infill panels in the behavior of RC frames.

Keywords- Macro modelling, micro modelling, infill walls.



STRUCTURAL SYSTEMS IDENTIFICATION USING WEIGHTED TRANSMISSIBILITY OPERATOR UNDER FORCED VIBRATIONS

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Abstract- The structures are in a continuous state of deterioration due to aging, natural disasters, and other environmental agents, resulting in local or global damages after a specific time. The timely identification of such damages can prevent the huge loss of assets and it can provide an ample opportunity for repair and maintenance. Therefore the service lifespan of the structure can be enhanced by modeling the system and identifying its parameters. Operational modal analysis (OMA) is one of the efficient possible approaches for identifying an unknown, in operation structure and estimating its modal properties like mode shapes, natural frequencies, and damping ratios. Many system identification approaches are being investigated in the literature but most of them are based on time-domain system identification methods which have certain limitations. So there is a need to develop a frequency-based structural systems identification technique that provides clear modal peaks and is more efficient in suppressing fault peaks. In this work, Weighted transmissibility-based operational modal analysis (WTOMA) is applied to a three-floor structure excited by a randomly simulated earthquake. Three sensors are placed on three floors: one of them is attached to the ground floor to record the ground excitations and the remaining two are placed on two floors. The response of the structure in terms of acceleration -time is recorded. The proposed algorithm is then applied to the structural response to obtain its modal parameters.

Keywords- Singular values, loading conditions, weighted-transmissibility based OMA.



STRENGTH PREDICTING OF FLY ASH-BASED CONCRETE VIA MACHINE LEARNING ALGORITHMS

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Abstract- The application of the support vector machine (SVM) and random forest (RF) algorithms to anticipate the compressive strength of fly ash-based concrete has been investigated in the study. A predictive performance comparison was performed for these two algorithms, where statistical metrics, such as coefficient of determination (R^2), mean square error (MSE), root mean square error (RMSE), and mean absolute error (MAE), were used for the evaluation. The results reveal that the RF algorithm outperforms the support vector machine model in terms of predicting the compressive strength of concrete containing fly ash. The statistical checks and the investigation of k-fold cross validation also give confirmation of higher precision for the random forest model. The employed machine learning approaches successfully predicted the strength property of selected concrete and gives the indication that it can reduce the time, experimental efforts, and cost of the construction projects.

Keywords- Concrete, fly ash, machine learning, modelling, validation.



INVESTIGATION OF STRESSES IN A CONCRETE GRAVITY DAM UNDER COMBINED LOADINGS OF SEISMIC AND FLOOD WAVES

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Abstract- This research is carried out to check the stability of a concrete gravity dam under the extreme loadings of combined seismic and flood waves. Concrete gravity dams are provided in highly seismic regions. These dams are not designed on experimental validation, but are simulated by finite element method on software. The environmental and other loadings and actions are then implemented on these simulated models and response of the system is checked. One drawback or ignorance of such system is, if a peak wave is generated and at the same time any seismic activity happens, then what will be the response of the dam, will it be stable in safe limit or not, will it survive combined loadings or not? That's why this study is based on such response prediction to evaluate the maximum stresses generated in the dam under such extreme loadings. In this study, a gravity dam is modelled on SAP2000 with finite element method. Blue Stone Dam from USA is selected and modelled on SAP2000. After that combined loadings i.e., seismic and flood wave are applied and response is predict of this simulation based model of the dam. After the successful run of the model, it is predicted that maximum stresses are generated on the top of the dam.

Keywords- Concrete gravity dam, seismic loads, flood wave loads, finite element method.



COST OVERRUNS AND DELAYS IN CONSTRUCTION: A STUDY ON CAUSES AND CONTROL MECHANISMS

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Abstract- Triple constraints of a project i.e. cost, time and scope are considered as the key factors for defining the success of a project. At the same time, construction industry faced the challenges of time delays and cost overruns from the very beginning of its evolution till present. Multiple efforts are made by researchers in the past to identify the causes of such problems and proposed solution for them. This study focusses on the review of all the past studies conducted over the period of last decade. For this, number of relevant research papers are retrieved and filtered. After that frequency analysis was performed to find major factors throughout the world which significantly affect the project time and cost. Findings of this research show that lack of planning and design changes are the most important factors which affect the timely completion and total cost of a project. Further, emerging technologies like Building Information Modeling (BIM), Fuzzy techniques and Symbiotic Organism Search (SOS) can be used to control these problem in a project.

Keywords- Cost overrun, fuzzy techniques, time and cost control, time delays.



CONSTRUCTION COST ESTIMATION OPTIMIZATION USING BUILDING INFORMATION MODELLING (BIM)

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Abstract- Compare commercially available BIM estimating tools, performance, and new construction workflows in a 5D BIM-based construction project. At this point in the design process, the cost of the project is usually approximated due to industry segmentation and the design line's segmentation. Very far along in the design process, which means it's too late to assist various stakeholders in making well-informed judgments. Perform In the design phase, value engineering and calculating early expenses have the ability to speed things up. High-quality, cost-effective buildings are the result of a more efficient project delivery procedure. There is a focus on changes in the workplace as part of the initiative. The Building Information Model (BIM) Estimation Process has been implemented in the construction project. Several BIM-based cost estimation software packages have been evaluated to support the various stages of design in this project. Examined the benefits and drawbacks of working with this software. The project's BIM-based estimation process was analyzed for its work practices and workflow. Ultimately, we came up with a multi-stage technology adoption plan.

Keywords- BIM, informed-decisions, multi-stage technology, stakeholders, workflows.



BARRIERS TO IMPLEMENT BIM IN PAKISTAN

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Abstract- Building Information Modeling (BIM) is a 3-D Model-Based process of creating and managing data, which assists designers, contractors and engineers. Moreover, contemporary technologies are assisting engineers to fulfill the expectations of customers in an effective way, as the demands of designs are getting complicated with every passing day. As a result, by utilizing the theory of BIM, engineers can build, design and handle infrastructures and buildings in a facile way. The implementation of BIM in Pakistan is very low as compared to the gulf and other developed countries. In Pakistan, the ratio of BIM is only 11% because of using traditional methods, which can easily be handled with the help of BIM. BIM is more economical than using traditional methods of construction in terms of cost and time. The implementation of BIM in Pakistan faces many barriers, for instance, awareness issues, shortage of BIM professionals, problems of investment in new technologies, etc. This paper aims to identify the problems that hinder the acquisition of Building Information Modelling (BIM) in Pakistan. Also, we highlight the solutions to implement Building Information Modelling (BIM) in Pakistan. Furthermore, we have suggested a roadmap to improve the implementation of BIM in Pakistan.

Keywords- Building nformation modelling, barriers in BIM implementation, solutions, road map.



FIBERGLASS AS AN INSULATION LAYER IN ROOF GARDENING

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Abstract - The purpose of this case study, document review is to create awareness among people about the benefits of fiberglass insulation and to recommend its use to reduce heat loss in summer as well as prevent heat loss in winter. A low-cost option is based on the use of a fiberglass insulation layer to ensure light barriers and insulation with reflective elements. Anyone can use it and install it on the roof of their house. The insulation layer is one of the essential layers of roof gardening. After providing insulation material to the roof building use less energy for heating and cooling. Just like in summer it prevents the building from overheating and in winter it prevents the building from getting too cold. So fiberglass insulation is the best way to protect the building from overheating. Fiberglass insulation makes building more energy-efficient. There is a lot of pollution in Pakistan cities like noise pollution, water pollution, and air pollution. Fiberglass keeps noise out of our homes. The major purpose of writing this paper is to make fiberglass more efficient and economic so that people can easily use it as insulation material in buildings to prevent heat and cold.

Keywords – Insulation layer, roof gardening, advantages of roof gardening, cost estimation.



AN OVERVIEW ON THE 3D PRINTING TECHNOLOGY IN CONSTRUCTION INDUSTRY

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Abstract- Innovations have started to emerge in the construction sector with the developing technology. One of these innovations is the utilization of 3-dimensional printing technology. Civil engineers build structures using materials and techniques available in the times. 3D printing technology attracts attention since it is faster than traditional construction, less costly, less labor and less error margin in today. It is possible to produce structures with complex designs and small scaled various products, under favor of this technology. First of all, 3D model design is needed in order to produce structures with 3D printing printers. Optimized cement-based mortar material is used in 3D printing printers. In order to be able to build layers on top of each other without collapse, and to perform 3D printing without shrinkage cracks, a building material recipe should be prepared by obtaining appropriate mixing ratios. While placing the building material, layered production is made without using a mold, and the width and thickness of the printing layer is constantly controlled during placement. Attention is paid to the use of sustainable building materials in buildings built using this technology. In addition, studies are carried out for zero waste in the use of materials. In this study, it is aimed to briefly introduce this new generation method along with its benefits, shortcoming and possible use as future of construction industry after eliminating these shortcomings.

Keywords- 3D printing, cementitious material, construction automation, digital construction, sustainability.



APPRAISAL OF DESERT SAND AS A SOURCE OF SUSTAINABLE DEVELOPMENT

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Abstract- Sustainable development demands exploring innovative construction materials and waste recycling techniques. However, the desert sand present in huge volumes remains unexplored for its suitability as construction material for decades. The stone processing industry produces large volumes of marble dust (WMD) waste, and its uncontrolled disposal poses a serious environmental hazard. The current study aimed to evaluate the physical and engineering properties of dune sand collected from Thal, a famous desert in Pakistan. After the initial exploration, the research work further evaluated the effectiveness of WMD as an additive for improving this sand. WMD was mixed with sand in proportions varying from 5-30 %. The experiments yielded promising improvements in dry density and unconfined compressive strength (UCS). Fifteen Percent (15%) by volume was identified as the optimum dosage of the WMD. The research work paves the path for utilizing desert sand in civil engineering projects and proposes fruitful recycling of WMD, reducing environmental pollution. Further studies are recommended to expand the scope of the investigation to evaluate its suitability as a mortar for masonry works and a potential concrete ingredient.

Keywords- Desert, WMD, soil improvement, pollution, dune sand.



CONCEPTUAL DESIGN OF RESIDENTIAL BUILDINGS FOR DAYLIGHT EMPLOYING CONTEMPORARY BEST PRACTICES

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Abstract- With the increasing energy demands and greenhouse gas emissions, daylight has been considered one of the crucial aspects of passive design strategies to be incorporated in buildings. The literature review indicated a lack of studies to guide the utilization and suitability of such daylight systems for buildings. This article studies contemporary passive daylight incorporating strategies that can be adopted in buildings considering the local context's thermal and visual comfort and privacy. After a thorough review, this study recommends having WWR near 50% for the sun-facing walls with a light shelf and solitude to be part of the conceptual design.

Keywords- Energy efficiency, daylight, building envelope, residential units.



OPERATIONAL ENERGY LIFE CYCLE ASSESSMENT OF RESIDENTIAL HOUSES – ANALYTICAL STUDY OF AN URBAN DISTRICT OF PAKISTAN

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Abstract- Energy consumed by the buildings at their operational stage is considered one of the main factors burdening the environment. This consumed energy releases greenhouse gases (GHG) emissions due to the rising energy demands from cities' domestic and residential sectors. The domestic sector of Pakistan consumes 45.9 % of its annual energy. Heating, ventilation, air conditioning (HVAC), and lighting appliances consume about half of the total building energy. There is a rising need for more innovative and sustainable approaches to buildings operations to cope with this global issue. To fill this gap in sustainable construction and operations of residential buildings efficiently, this research was conducted based on Energy Life Cycle Assessment (ELCA) methodology for the residential houses. Researchers collected data from 13 houses in district Central of Karachi. It included information related to building envelope and operational energy details. The life cycle assessment framework was applied over the collected inventory data, and life cycle inventory analysis was performed, leading to the integration of the Life Cycle Impact assessment. The results evaluated that studied houses produce 48120 Tons of carbon footprint throughout the life cycle stages of the buildings for a reference study period of 60 years. Global warming potential was found to be the highest, followed by acidification and eutrophication potential.

Keywords- Life cycle assessment, energy efficiency, energy, carbon footprint.



APPLICATION OF CONSTRUCTION AND DEMOLITION WASTE FOR SUSTAINABLE PAVEMENT CONSTRUCTION- A REVIEW

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Abstract- Over the past few decades, there has been a sharp rise in the production of construction and demolition waste (CDW) on a global scale, which has led to environmental issues as a result of its unregulated disposal. The use of recycled materials has increased within the same time period, mostly for sustainable development and environmental protection. In lieu of inefficient disposal and management of this type of trash, the objective of this research is to examine the HMA production for pavement construction utilizing recycled construction and demolition waste aggregates. These materials can be utilized to construct unbound layers like base, sub-base, and subgrade of pavement. For the preservation of natural resources, sustainable pavements composed of recyclable materials have recently become essential. In place of natural aggregates like broken rocks, CDW has been considered as a recycling material, potentially lowering environmental effects and boosting the economic potential of recycling. It has been demonstrated that doing so reduces the carbon footprint of the construction industry, conserves natural resources, reduces hazardous emissions, and lowers total costs for paving construction and maintenance. This paper examines the investigations that have been conducted on the usage of aggregates made from building and demolition waste in asphalt and unbound pavement layers. Therefore, the primary goal of this paper has been to conduct a literature review that would identify alternate strategies to use CDW in pavement projects. In order to encourage highway administrations to create new technical criteria and recommendations on CDW recycling, this paper aims to propose techniques that will do just that. This study seeks to announce the beginning of a new age of economic innovation in pavement engineering.

Keywords- Construction, demolition, pavement, sustainability.



CHALLENGES FOR INCORPORATING BIM BASED LCA IN A NEW COMMERCIAL BUILDING PROJECT & CONSTRUCTION FIRM IN PAKISTAN: A REVIEW

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Abstract- This paper presents the gap in current infrastructure development method in Pakistan's construction industry and other. Construction Industry consumes the natural raw material to turn it into usable construction product which release embodied carbon dioxide in environment which has highest percentage in Green House Gases (GHGs), which trap heat in atmosphere. Gradual annual temperature increases per year due to global warming caused by the conventional practice by both developed and developing nations construction industry has sparked an outrage in common people. Hence, environment friendly construction techniques were developed. Building Information Modelling (BIM)-based Life Cycle Assessment Technique (LCA) is critically reviewed for its usage in a developing country. By utilizing BIM based LCA, the environmental load can be reduced, however, lack of resources and data is the biggest hurdle for unlocking its true potential.

Keywords- Building information modeling, commercial building, construction industry, life cycle assessment.



EXPERIMENTAL STUDY OF SCOURING AROUND ELLIPTICAL PILE-CAP BY USING THE SUBMERGED BROAD CRESTED TRAPEZOIDAL WEIR AT DOWNSTREAM

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Abstract- Bridge piers fail for a variety of reasons but scouring around the pier is the most common. It is during the scouring procedure that the piers are decontaminated. As a result, the foundation of the bridge is exposed, which ultimately results in its collapse. The scouring effect around bridge piers was reduced by employing a different method. An Elliptical Pile-Cap of dimension (D) six centimeters by six centimeters was installed at the upstream side of a submerged trapezoidal broad crested weir (TBCW), and the height of the weir (Z) was five centimeters without piers and with weirs at various separation distances (S), two-dimensionally (S), and four-dimensionally (S). The experiment was conducted in a channel at the Hydraulics Engineering Laboratory, University of Engineering and Technology Taxila, utilizing a uniform bed material, flow depth-flowing under clear water conditions. The upstream face of the pier had its scouring depth compared to the local scouring in both the presence and absence of TBCW. Experiment results demonstrate that by using the submerged TBCW- at downstream $S = 2D$, $S = 4D$, as opposed to without it, the scour depth at Elliptical Pile-Cap may be reduced by 48%.

Keywords- Elliptical pile, trapezoidal broad crested weir, reduction, scouring.



EXPERIMENTAL ANALYSIS OF SCOURING AROUND THE ROUND NOSE BRIDGE PIER USING DIFFERENT BED MATERIAL CONDITIONS

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Abstract-Unexpected weather events, manufacturing defects, shoddy workmanship and poor building maintenance are all common causes of bridge collapse. However, scour damage to bridge pilings is far and away the most common cause of serious damage. Sediment is removed from bridge piers by running water's hydraulic force, a process called scouring. Scour around the piers of a bridge must be taken into account when determining its safety. It's been studied in a number of different ways. Through the use of three different discharge rates (0.32-0.37-0.032m³/s), the round nose bridge was successfully integrated into the sandbed, which was measured at 0.57mm in diameter by this research team's team of engineers and engineers. A uniform distribution of particles in the bed resulted in a geometric standard deviation (g) of grain sizes between 1.22 and 1.30. sg of gravel particle size distribution is less than 1.4, and the round nose bridge pier was incorporated into a gravel bed with gravel sizes from 4.1 mm to 14.25 mm Flexible vegetation should be used at distances of 0, 4, and 6 D from the round Nose Bridge Pier, where D is the diameter of the round nose of the Pier. Vegetation upstream served as a water filter. Each test required three hours to complete. At each of the diagonals (upstream, downstream, left, right, and upstream and downstream) a point gauge was lowered into the water to measure the depth of local scour. In an experiment, scouring around the round nose bridges pier employing flexible vegetation was reduced by up to 50% at 0D, 38.11 percent at 4D, and 30.15 percent at 6D distances. Stubborn vegetation reduces scouring by 33.44 percent, 30.92 percent, and 27.38 percent at zero, four and six dimensional distances. A lower scouring rate was observed for flexible vegetation than for rigid vegetation in the vicinity of round nose bridge pilings. A distance between the pier and the vegetation was increased in order to reduce scouring caused by flexible and rigid vegetation.

Keywords- Wide crested trapezoidal weir, scour depth, flexible vegetation, rigid vegetation.



DESIGN OF CIVIL COMPONENTS OF MICRO HYDRO POWER PLANT: A CASE STUDY

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Abstract- Northern areas of Pakistan are endowed with vast hydropower generation potential. Many micro-hydropower plants (MHPP) working in private and public sectors are without proper engineering design. The proposed project has been designed on a stream in the peochar valley, Swat, Pakistan. The stream is having enough discharge and most importantly adequate head that can be easily available to generate electricity. The flow data of the stream was collected from SRSP's office. For suitable positioning of civil components of the hydropower plant, a survey has been made to mark proper points. Such point was marked which had a large head because greater the head, the more is the capacity of the plant. A favorable point on the stream was selected where diversion works were designed to divert a part of water from stream to a canal. Canal conveys water to the settling basin and forebay. Through the penstock, water strikes the blade of turbine and generate electricity. The net head obtained at the site is 76ft. The designed discharge was determined to be 10 cusec. After determining these parameters, the design of civil components was undertaken. The approach channel dimensions were designed to be 2.5 ft × 2.24 ft. Settling basin forebay were designed according to the design discharge. This plant was designed to have a power generation capacity up to 40 kW.

Keywords- Micro-hydro power plant, hydropower generation, stream water flow, green energy.



ANALYZING THE LAND-USE IMPACT ON FLOOD REGIME IN SOAN BASIN

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Abstract- Increase in population results in rapid urbanization. As a result, imperviousness increases, infiltration decreases, runoff discharge, and flood peak rise. Different patterns of urbanization and understanding its impact on flood responses are getting the attention of researchers. This study focuses on the changing urbanization impact on the flood peak of the Soan basin (SRB) using HEC-HMS v. 4.9 (Hydrologic Engineering Center - Hydrologic Modeling System). The input variables for the HEC HMS model were estimated using the Digital elevation model, Land use/ Land cover maps, and Soil and rainfall data. The urbanization trend has been increasing in the 20th century and the Soan river basin (SRB) has been experiencing an expansion from 3% to 17% from 1997 to 2020. The response to land use land cover (LULC) change on the calibrated event of 1997, simulated peak discharge for 1997 land use land cover (LULC) was 2383 m³/sec, for 2010 land use land cover (LULC) it was 2442 m³/sec and for 2020 land use land cover (LULC) LC it was 2462 m³/sec. HEC- HMS modeling shows an elevated increase in simulated peak discharges (flood flow) and runoff volume as shown due to an increase in a built-up area in (SRB) between 1997 and 2020. The study showed that urbanization has a larger impact on flood peaks rather than flood volume.

Keywords Flood intensity, flooding, HEC-HMS, HEC Geo-HMS.



EXPERIMENTAL STUDY OF BRIDGE PIERS OF DIFFERENT SHAPE SURROUNDED BY MESH WIRE TO MINIMIZE THE LOCAL SCOUR

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Abstract -It is the local scour that is causing the most serious damage to the bridge. One of the most important considerations in pier design is how to minimize scouring. The experimental decrease of scouring around various kinds of bridge piers using mesh wire is investigated in this paper. There are many kinds of mesh wires that are put above the streambed level around the piers of bridges to decrease scouring. Using mesh wire to around the circular pier gave us the finest results. Compared to conventional bridge piers, scouring on the circular pier with mesh wire was reduced by up to 52% after 48 hours of testing. In comparison to square and rectangular bridge piers with mesh wire, the scouring on circular and square bridge piers was reduced by 52% each. This means that the most effective mesh wire bridge pier is a circular bridge pier.

Keywords: Scouring; mesh wire; rectangular bridge pier, scour reduction, piers.



TO STUDY THE IMPACT OF FLOATING DEBRIS ON BRIDGE PIER

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Abstract- Storms and flooding caused significant damage to buildings and bridges. The waterborne debris created during such natural disasters will cause significant damage to many structures unless they were designed for these loads. Flood field survey findings suggested large objects such as wooden logs, cars, vessels, storage barrels, and other containers intensify the damage. For this cause, a driftwood approach was established to test tree washout, floating trees movement, and collisions with the pier. This paper addressed the findings of experimental analysis on the frameworks to measure the debris impact force and dynamic properties on pier. It also analyzed the formulas, which were defined with the experiment results in the recently released design guidelines (FEMA P-646, 2012). This resulted in impact force on bridge pier (different shapes of pier) with different debris mass and also vibrational characteristics (dynamic properties) of pier by using sensors. Moreover, different hydraulic jumps were observed while observing water surfaces in different situations.

Keywords- Experimental modeling, flood born debris, floods, flow channel.



FEM-BASED APPROACH TO STUDY THE IMPACT OF DRAINAGE ON HYDRAULIC BEHAVIOUR OF EARTH DAMS

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Abstract- Small homogenous dams are an integral part of the water resource management system yet their failures are common and result in massive life and economic losses. Piping, uplift, and porewater pressure buildup, are the primary reasons behind the hydraulic failure of the dams. The dam drainage system is of great importance in the hydraulic stability of the retaining structure. In this paper, FEM-based analysis has been done to examine the effect of drainage material's geotechnical properties on the hydraulic behavior of homogenous small-scale earthen dams. The study results reflect the extent of variation in, pore water pressure, flow net patterns, and overall seepage velocity with changes in the toe drainage characteristics. With the selection of appropriate drainage material, more than 10-m of head loss has been reported at downstream. The results can be applied for the upgrading of hydraulic and geotechnical considerations for the design of homogenous dams.

Keywords- Toe filter, porewater pressure, flow nets, hydraulic conductivity.



TO CALCULATE THE DISCHARGE COEFFICIENT FOR A BROAD CRESTED WEIR WITH NON-SUBMERGED FLEXIBLE VEGETATION

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Abstract- Broad crested weirs are generally used as an embankment weir in flood plains for discharge measurement. Due to erosion these weirs are susceptible to failure. To avoid failure of these structures the energy of flowing water must be dissipated. In this research work, flexible vegetation with varying density were used to investigate their effect on the discharge coefficient and energy dissipation of broad crested weir (BCW). For this an experimental study was performed in the hydraulic laboratory of Civil Engineering Department UET Taxila. Flexible vegetation cover was installed over the crest of BCW, and three different densities of vegetation were used. Coefficient of discharge (C_d) and energy dissipation (ΔE) were calculated for non-submerged condition of the vegetation. From experimental work it was observed that, as the density of vegetation was changed from dense to sparse, the value of C_d increases. Lowest value of C_d was observed for 2cm c/c spacing (maximum density) and highest value of C_d was observed for 6cm c/c spacing (minimum density). It was also observed that for non-submerged condition of weir, overflow head (H) increases with increasing discharge values. As far as the energy dissipation is concerned, the ΔE decreases as the vegetation density is reduced from denser to sparse vegetation cases. Highest value of ΔE was observed in case of 2 cm c/c spacing, and lowest value of ΔE was observed in case of 6 cm c/c spacing.

Keywords- Broad crested weir, discharge, coefficient of discharge, energy dissipation.



EXPERIMENTAL STUDY OF T-SHAPED SPUR DIKE WITH DIFFERENT INCLINATION TO MINIMIZE THE LOCAL SCOUR

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Abstract- River bank erosion is controlled through spur dikes. The River banks scouring around spur dikes is complex, especially when they are engaged in the straight position. This is due to the interaction of the spur dike's flow pattern with the vortex helical currents. Experiment findings are presented in this research that flow around a T-shaped spur dike minimize through inclination. The impact of the inclination of the spur dike with unique geometry. Experiments are carried out in a rectangular channel with a recirculating flow. The findings indicate that the minimum scour depth, as well as the volume and dimensions of the scour hole, decreases as the inclination of the T-shaped spur dike rises. The height of the ridge downstream of the spur dike grows as the length of the spur dike is increased. The highest scour depths are found at a 0⁰ inclination of T-Shaped dyke. After 36 hours of experiment, showing a maximum of 58% reduction in scouring for 15⁰ inclination compared spur dyke without inclination. So, the more efficient T-shaped spur dyke with inclination.

Keywords: Scouring, inclination, spur dykes, depth, flume, T- shape.



AN OVERVIEW OF SUSTAINABLE REPAIR STRATEGIES FOR POTHoles IN FLEXIBLE PAVEMENTS DURING REHABILITATION PHASE

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Abstract- The formation of distresses on pavement causes the Pavement Management System to provide an activity of rehabilitation which not only costs money but also has environmental impacts. A pothole is the most occurring flexible pavement distress that not only causes comfort issues but also leads to the degradation of the remaining pavement. It is very significant to address this problem in a sustainable way that would decrease the effect on the environment. This paper aims to study different researches on pothole formation and its repair strategy that would not only increase the capability of the pavement but also be a sustainable solution. A number of research has been done on potholes to find feasible and sustainable solutions. An extensive literature review has been carried out in this paper regarding different materials that are helpful in minimizing the moisture susceptibility of flexible pavement distresses mainly potholes. The analysis indicates that pothole formation is dependent upon many factors including the type of aggregate, binder type, and external factors like moisture infiltration. Moreover, the binder type is a significant factor. The combination of non-woven fabric and ultra-thin asphalt overlay is very susceptible to reducing pothole formation which is also considered to be more environmentally friendly as compared to other strategies like rubber-modified asphalt and hence can be called a sustainable solution.

Keywords- Potholes, sustainable pavement solution, pothole repair.



RUTTING-DENSIFICATION MITIGATION MEASURES FOR PAVEMENTS OF PAKISTAN-SUSTAINABLE WAY FORWARD

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Abstract- The concept of having layers in flexible pavement is to sustain and distribute the heavy traffic load of the vehicles to the subsequent layers. Due to insufficient compaction of the asphalt concrete, the surface layers (wearing and base) continue to densify under loads resulting in the rutting densification. Rutting in the pavement considerably reduces the service life. For this purpose, different factors resulted into insufficient compaction of pavements in Pakistan need to be identified. Mitigation measures for rutting densification are required to be proposed for improvement of pavement life-cycle. Roads exhibiting rutting-densification were identified. Core samples of asphalt concrete surface layers (wearing and base) were collected from the roads. Density of these core samples were determined and compared with volumetric of mix design adopted during construction. The laboratory samples were prepared in accordance with volumetric of the extracted road core samples. These samples were tested in wheel tracking machine for determination of the rut-depth. Rutting depth determined in laboratory is compared with actual field data of rutting. Results indicate that NHA class B is 43% more susceptible to rutting than NHA class A. Effects of different factors like mix volumetric, aggregates shape, and asphalt content etc. on laboratory and field rutting were evaluated. Necessary mitigation measures to control rutting densification phenomenon for future sustainable pavements in Pakistan are also proposed.

Keywords- Mitigation, pavements, rutting densification, sustainable.



CALCULATION OF REALISTIC ESAL VALUES FOR FUTURE DESIGN OF RURAL ROADS

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Abstract- The pavement structure is subjected to recurrent vehicle loads throughout its design life. If the vehicle is overloaded over the limitations set by the authorities, substantial damage to the pavement structure will occur before the design life is reached. Therefore, a study was done for the Equivalent Single Axle Load calculations (ESAL) and road structural design to examine the influence of heavy vehicular loadings. The research was based on the results of the famous American Association of State Highway and Transportation Officials (AASHTO) road test of 1961, whose findings are still widely used in road design today. The research was carried out on three rural roads: Topi Road Sawabi, KDA Road Kohat, and Nasir Bagh Road Peshawar, Pakistan. Data on average daily traffic was collected and anticipated for the next 20 years. After that, the ESALs were determined. The structural number was determined according to the AASHTO design guide from 1993. The thicknesses of road layers were determined using structural numbers. As a result of the findings, it was discovered that huge trucks cause greater pavement damage than passenger automobiles. These vehicles are sometimes overloaded over the limits set by the authorities, causing damage to the pavement structure. It is vital to have a good check and balance on the load limitations set by the involved authorities to protect the pavement structure from adverse impacts.

Keywords- Average annual daily traffic, daily Traffic, ESAL, pavement damage, pavement design.



SMART AND SUSTAINABLE BRIDGE ABUTMENTS - A CASE STUDY

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Abstract- The use of off-site manufactured (OSM) elements is increasing in the Construction industry due to its benefits in terms of cost, site labour and speed of construction. It is commonly acknowledged that off-site production also offers other advantages that are less evident, but still bring significant improvements on both Health & Safety and Sustainability if compared to more traditional in-situ construction methods. The aim of this paper is to explain how the design and use of OSM reinforced concrete abutment panels contributed to a smarter delivery of the A34 new Overbridge in Perry Barr, Birmingham, UK. After describing the site and project specific constraints, the paper shows the options considered for the new bridge abutments in the early design stages and the factors that contributed to the final choice. Details of the definitive solution are then illustrated with a focus on Health & Safety and Sustainability improvements. The paper then highlights a few key aspects that were considered in the design to ensure accurate production in the factory and efficient assembly on site for the abutment panels. The conclusion then summarizes the direct and indirect savings and benefits that the use of OSM abutment panels brought to the project.

Keywords- Off-site manufactured, bridge abutments, embodied carbon, sustainability.



USE OF MARBLE DUST AS A FILLER MATERIAL IN FLEXIBLE PAVEMENTS

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Abstract- Pakistan is leading towards a major motorway system. Infrastructure growth especially highways and most of the roads are flexible pavements which have higher susceptibility to Rutting. To overcome this issue we have to find ways to solve these problems. Keeping in view the current economic conditions, one must find material which is cost effective and locally available. One such material is the use of Marble Dust with the replacement of filler material in Flexible Pavements. Therefore different tests were conducted to investigate the effect of Marble Dust, on various Mechanical Properties such as Marshall Stability, Dynamic Stability and Rutting resistance. Marble Dust is cheap and locally available material. The modified asphalt mix were prepared by wet process which involves direct mixing of bitumen (60/70 penetration grade) and Marble dust at a high temperature (160-165°C) followed by aggregates during mixing process. The modified asphalt concrete specimens were prepared with the Marble dust percentages of (1%, 2%, 3%, and 4%). Both modified and unmodified Samples were prepared by Marshall Mix design (ASTM D6926), using NHA Class A gradation. Prior to sample preparation, the bitumen (60/70 penetration grade) and aggregates (Margalla aggregate) were tested to check their compatibility according to the standards of NHA. The optimum binder content (OBC) 4.4% was found using Marshall Mix design (ASTM D6926), which was then used in the preparation of both conventional and modified samples. Performance tests including Marshall Stability, flow, Rutting resistance and Dynamic stability were performed to check performance of modified mixes. The tests results revealed that modified mix containing 50% replacement of filler material with marble dust of the total replacement percentage provides best resistance against rutting and enhances dynamic stability of flexible pavement than the other modified percentages. The whole analysis concluded that replacement of filler material with marble dust gives better results regarding pavement performance.

Keywords- National highway authority, optimum binder content, hot mix asphalt, specific gravity.



TO EVALUATE THE SELF-HEALING OF ASPHALT MATERIALS AT DIFFERENT TEMPERATURES

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Abstract- It is common for asphalt pavement to develop micro cracks over time, largely owing to weather and traffic conditions. Pavement fatigue life is shortened as a result of these fissures. When the temperature of an asphalt mixture rises, cracks that previously appeared begin to close. The purpose of this study is to use microwave induction to determine the effect of temperature on the self-healing ability of asphalt pavement material. Asphalt's fatigue resistance was measured using a four-point beam fatigue apparatus. This experiment required a certain amount of condition time and temperature. Before and after conditioning, the specimens were tested. The first recovery cycle results in a significant loss of fatigue resistance, however the loss of fatigue resistance from the second healing cycle to the third healing cycle was minimal. Asphalt's self-healing properties improved with temperature, too. Temperature was shown to be the most important determinant in asphalt's ability to self-heal. Temperatures ranging from 37 to 40 degrees Celsius had the highest healing index.

Keywords- Four-point beam test, microwave oven heating, self-Healing.



EFFECT OF RAINFALL INTENSITY AND DURATION ON STABILITY OF NATURAL SLOPES OF UNSATURATED FINE SOILS

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Abstract - Rainfall infiltration is a major cause of slope failures in soft and cohesive soils. The water infiltration increases the pore water pressures, ground water level and decreases the matric suction of unsaturated soils, which has been proved as a critical factor for stability of slopes. As a result of increased pore water pressure and decrease in matric suction, the shear strength of the soil decreases which increases the likelihood of the failure of slope. This paper investigates the failure mechanism of natural slopes subjected to high and low intense rainfall with various duration of rainfall events. Finite element analysis was carried out using commercially available PLAXIS 2D software, which is considered to be a comprehensive tool for geotechnical modelling. It was observed that in addition to slope geometry, soil physical characteristics and hydraulic properties, rainfall intensity and duration also play a key role in stability of unsaturated soil slopes.

Keywords- Unsaturated slopes, matric suction, pore pressure, slope stability.



HELICAL PILE: AN INNOVATIVE AND SUSTAINABLE FOUNDATION TECHNIQUE

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Abstract- Helical pile is an advanced sustainable deep foundation technique. Its importance in the construction sector is growing very hastily. However, being an advanced foundation technique, there is still an ambiguity about its usage, that whether to use helical piles or conventional piles in a construction project. The main objective of this paper is to compare helical piles with the conventional piles (i.e., Driven piles and Cast-in-situ piles) on the basis of different factors and draw conclusion between them. These factors include axial capacity, lateral capacity, method of installation, soil condition, cost, impact on environment and construction time. After extensive literature review the authors of the paper came to a conclusion that helical piles in many aspects are far better than conventional piles. Moreover, they cover several aspects of green construction like, less cost, fast construction, less carbon emission, low environmental impact, reusability etc.

Keywords- Cast in situ piles, driven piles, helical piles, sustainable foundation technique.



EXPERIMENTAL STUDY ON LOAD CARRYING CAPACITY OF INDIVIDUAL PILES IN A PILED RAFT FOUNDATION SYSTEM

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Abstract- Raft foundations are provided, in case isolated footing fills more than 70 % area of building under a superstructure. The term "piled raft foundation" refers to a foundation that incorporates the usage of piles and rafts. When high-rise buildings are constructed on soil of low bearing capacity or on fill material, piled raft foundation system have proven to be cost-effective without compromising serviceability and bearing capacity requirements. The use of tactically positioned piles beneath a raft can increase the raft's load bearing capacity and decrease differential settlements. Current study is focused on evaluation of individual piles' load carrying capacity in a piled raft foundation system embedded in poorly graded sand with relative density of 35 %. A small-scaled model was prepared in the laboratory containing galvanized iron piles and aluminum raft. The piles were instrumented through strain gauges in order to measure the load resisted by each pile. The piled raft model was placed in the center of sand container and subjected to vertical load. It was found that the load bearing capacity of piled raft is much greater as compared to isolated pile and raft only.

Keywords- Piles, raft, piled raft foundation system, load sharing capacity, small scaled model.



AN EXPERIMENTAL STUDY ON LATERAL CONTRIBUTION OF RAFT AND PILE IN A PILED RAFT FOUNDATION SYSTEM

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Abstract- In the recent past, with increasing height of the buildings, the pile raft foundation is becoming an efficient choice to transmit the load safely to the ground. The high rise buildings and communication towers are exposed to vertical loads from superstructure and lateral loads from earthquake, wave action and wind etc. In such situation, to increase the load carrying capacity of the foundation and to decrease lateral and vertical displacement, piles are provided under the raft. This type of foundation system is call piled raft foundation system. In pile raft foundation system, the load is distributed between the piles and the raft, making the system economical as compared to old traditional methods in which the piles were taking all the loads. A lot of research work has been carried out on vertical contribution of raft in the pile raft foundation system. There is very limited literature available on contribution of raft to resist lateral loads. If raft contribution to resist lateral loads is considered, foundation design could be made more economical. In this research work, a small-scale model pile raft foundation model was used for experimentation. It was observed that a considerable amount of lateral load was resisted by the raft component. From the test results it came to know that with increasing the number of piles, the load carrying capacity/ contribution of raft decreases. It was also observed that rear piles resist more lateral load compared to the front piles in a pile group.

Keywords- Pile raft foundation system, deep foundation, high rise structure, lateral load contribution.



EXPERIMENTAL STUDY OF INFLUENCE THE BEARING CAPACITY OF SANDY SOIL BY USING CEMENT GROUTING

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Abstract- Due to the presence of weak soil with poor engineering features, such as structures built in the coastal zone require deep foundations. In these places, the soil profile is primarily loose sand, which is subsequently underlain by clayey soil at a depth of 3 to 4 meters. The constructions that have been built here have seen a lot of settlement. To improve this type of sand grouting is used to increase the bearing capacity of soil to decrease settlement in this study. The shear strength of the grouted sand improves as the cement quantity increases, effects of cement grouting sand shear strength and bearing capacity of the soil improves to experimental findings show that 4% cement grout is more effective than 2% and 6% cement grout. The findings of numerous studies indisputably show that grouting may be utilized to greatly improve the strength properties and reduce the permeability of sandy soils.

Keywords- Cement grouting, sand replacement, permeation.



SPATIO -TEMPORAL ANALYSIS OF PRECIPITATION IN PUNJAB PROVINCE, PAKISTAN

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Abstract- The monthly ground-based precipitation data from 39 stations were utilized to analyze the variation in Punjab Province from 1960-2019. The Mann–Kendall method was employed to evaluate precipitation spatial-temporal trends. There are also major periods, from 1974 to 1977 and 2009 to 2015, with rising yearly precipitation. The southern Punjab area noted a greater value of the coefficient of variation (CoV) for yearly precipitation. Summer & winter season showing increasing trend on overall stations. In contrast, autumn and spring show a decreasing trend for many stations. It can be found that the Punjab province has become wetter in summer and winter from the period of 1961 to 2019.

Keywords- Precipitation, punjab, spatio-temporal analysis, stations data.



REMOVAL OF ARSENIC AND PHARMACEUTICAL COMPOUNDS FROM DRINKING WATER: A META-ANALYSIS

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Abstract- Arsenic being a global contaminant and highly toxic metalloid has gained much attention for many years. Intending to provide potable water to millions of people around the globe, the research community has practiced intensive efforts to remove arsenic. This review is focused on the possible treatment methods which can be deployed to curb arsenic contamination. Apart from discussing arsenic, this review also explored the occurrence and removal strategies of pharmaceutical contaminants. Unlike conventional contaminants, the problem associated with pharmaceutical contaminants is not their presence in abundance but rather very minute concentrations. Nearly undetectable concentration of pharmaceutical compounds, and their unpredictable impacts on the environment and humans are fundamental concerns for the research community. It has been found that conventional treatment technologies are insufficient for the remediation of pharmaceutically contaminated environmental segments; therefore advanced oxidation processes, membrane technologies, adsorption processes, and various integrated approaches have been evaluated in this paper. This review provides an insight into the advances being made till now in removing such contaminants from water

Keywords- Arsenic, emerging contaminants, meta-analysis, pharmaceutical compounds, water treatment.



IDENTIFICATION AND COUNTERMEASURES OF SPATIAL CONCENTRATION FACTORS FOR PARTICULATE MATTER 2.5

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Abstract-As we know PM_{2.5} has adverse effects on human health and decrease the progress of humanity. For this purpose, air quality monitoring departments try to find the composition of the PM_{2.5} and their source of origin and identify the high polluted areas. Geographic information systems (GIS) provide useful tools, providing the spatial concentration of a region and by these spatial concentrations, an equation is made to predict the values of PM_{2.5} concentrations. The research's basic purpose is to identify the PM_{2.5} concentrations and create an Equation which is composed of main factors of meteorology, which are collected using an inverse distance raster analysis, results to carry out analysis at temporal resolution and finer spatial, and to identify the yearly and monthly PM_{2.5} concentrations in Ohio Country. Factors of meteorology and concentration of PM_{2.5} are studied and projected at a large scale in the Ohio state, by using measurements from 55 meteorological stations in the study region Ohio for annual and for three months (July, August, September). A GIS spatial interpolation procedure is used for them. An Ordinary least squares method was used for each of these three months' data, and in this way, models were created. The research results show the model performance was at this accuracy level (98, 99, and 97). To validate the results of these models, the predicted value of PM_{2.5} data was compared with the value of PM_{2.5} data observed, and the accuracy level for that is at (97, 98, and 96 percent, respectively). The show results of the models have a very strong fit of the Ordinary least Squares model to the data observed, which confirms, that the results of this work will examine and forecast PM_{2.5} accurately.

Keywords- GIS, IDW, OLS, PM 2.