Abstract Book

6th CSCE

1st August 2024

ISBN 978-969-23344-5-7

Department of Civil Engineering

Capital University of Science and Technology, Islamabad

Foreword

Welcome to the CSCE 2024, 6th Conference on Sustainability in Civil Engineering (CSCE'24) is held by Department of Civil Engineering, Capital University of Science and Technology, Islamabad, Pakistan. The main focus of CSCE'24 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 eight wonderful and renowned keynote speakers for this edition of CSCE. We have received 160 manuscripts from different countries around the world including UK, Ireland, Canada, New Zealand, Italy, Estonia, Thailand, China, Hong Kong, Malaysia, UAE, KSA, and Pakistan. All papers have under gone a comprehensive and critical double-blind review process. The review committee is comprised of 64 PhDs serving in industry and academia of UK, USA, Australia, New Zealand, Thailand, China, Hong Kong, France, Poland, Malaysia, Oman, Bahrain, Morocco, UAE, KSA, and Pakistan. After the screening and review process, 50 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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Dr. Hammad Anis Khan *University of Sydney, Australia*	*Penetrability in concrete - A perspective to develop durable concrete for sewer environment*
Dr. Mehran Khan *University College Dublin, Ireland*	*3D Printing Concrete: Transforming Construction through Innovative Technology.*
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Dr. Muhammad Shakeel *AECOM, Hong Kong*	*Applications of Centrifuge Modelling in Geotechnical Engineering and Research*
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Abstract- Concrete's mechanical properties are significantly influenced by the addition of steel waste fibers. This study investigates the impact of varying dosages of steel waste fibers on the performance of concrete cube specimens. Compression strength tests on cubes reveal a 39% increase in maximum strength when 1% steel waste is added, attributed to improved bonding between steel waste and the concrete matrix. However, it was concluded that higher dosages lead to fiber clustering and inadequate bonding, causing non-uniform distribution and localized stress concentrations, resulting in a modest loss in compressive strength. This study provides valuable insights into how different dosages of steel waste affect the mechanical properties of concrete, informing sustainable building practices and waste management strategies.

Keywords- Concrete, Mechanical properties, Steel Waste, Sustainable Construction

MECHANICAL AND PERMEATION PROPERTIES OF CONCRETE USING INDIGENOUS VOLCANIC ASH AS PARTIAL REPLACEMENT OF CEMENT

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Abstract- The current study aims to examine the effects of indigenous Volcanic Ash (VA) on mechanical and permeation properties of concrete upon partial substitution of Ordinary Portland Cement (OPC). The study further aims to search out the most probable benefits and the constraints of use of VA in concrete mixes as partial replacement of cement. The VA has been used as partial replacement as percentage of Binder (with ratios as 0% (the Control Mix), 5%, 10%, 15%, 20%, 25%, 30%, 35% and 40% of Binder) to examine the impacts on mechanical and permeation properties of concrete. The W/B ratio (0.5) was kept the same for all the mixes. Slump Test was also performed to determine the workability of concrete for each above-mentioned ratio of VA. It was found that increasing the ratio of VA content in concrete reduced workability. The ideal concrete mix is known to have a 10% VA component in place of cement since it meets the requirements for both the Control Mix's mechanical and permeation qualities.

Keywords- Indigenous Volcanic Ash, Workability, Compressive Strength, Splitting Tensile Strength, Water Absorption, Permeability

PHYSICAL AND DURABILITY PROPERTIES OF STEEL SLAG PARTICLES FOR USE IN ROAD AND CONCRETE WORKS

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Abstract- This study aimed to assess the viability of steel slag as a substitute for natural coarse aggregates for road and concrete works. The slag aggregates underwent evaluation based on impact value, crushing strength, bulk density, abrasion value, and flakiness index. Concrete samples incorporating steel slag aggregates were then prepared and compared against those containing natural coarse aggregates in terms of physical and durability performance. For this investigation, a 1:2:4 (M15) concrete mix design was targeted. Results indicated that the slag aggregates exhibited an impact value of 29.5%, a bulk density of 1208 kg/m³, an elongation index of 10.8%, a crushing value of 31.3%, and a flakiness index of 10.95%. The prepared concrete samples demonstrated a water absorption rate of 4%, a Rebound number of 22, and a wet surface skid resistance of 56 on the British Pendulum scale. The findings suggest that steel slag aggregates hold promise as a viable alternative to natural aggregates in concrete production. This substitution offers several advantages, including the environmentally sound disposal of slag waste, the promotion of green concrete and road practices, and potential cost reductions in construction projects. These benefits align with the sustainable development goals outlined by the United Nations.

Keywords- Concrete, Performance, Road, Slag Aggregates

PERFORMANCE EVALUATION OF SUSTAINABLE COMPRESSED STABILIZED EARTH BRICKS

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Abstract- Manufacturing of bricks with compression and stabilization is an ancient technique used from the decades. In this technique, mainly locally available soil is used as raw material along with certain stabilizer. Cement and lime are mostly used as stabilizers in the previous researches. Soil along with stabilizer is molded in the compression machine which applies a pre-defined amount of pressure to cast a brick sample. Cement is used as stabilizer in this study and due to adverse environmental effects of cement production process, the amount of cement used as stabilizer was kept minimum 5%. Comparison is done between controlled samples (CS) of 0% cement stabilizer and 5% cement stabilizer used for the preparation of compressed stabilized earth bricks (CSEBs). Water absorption test is a durability test done on CSEBs resulting 12.23% water absorption of CSEBs while CS units completely deteriorated during 24-hour submersion in water. Compression test was done on the brick samples in the universal testing machine and 28 days average compressive strength was found 416.4 psi for stabilized brick unit and 212.4 psi for controlled samples. This 96% increase in the compressive strength of stabilized units depicts the strengthening behavior of minimum (5%) cement content. Masonry prisms of 18"x18" was fabricated using the designed stabilized brick unit and mortar used was mud mortar with the compressive strength of 291.5 psi. The compressive strength and modulus of elasticity of masonry prism was found to be 171.27 psi and 41.4 ksi which indicates that the designed brick unit can be used as a construction material for single storey building.

Keywords- CSEB, Stabilized, Cement, Masonry, Brick Unit, Compression Test

AN EXPERIMENTAL INVESTIGATION INTO THE COMPRESSIVE STRENGTH BEHAVIOR OF ULTRA HIGH-PERFORMANCE CONCRETE

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Abstract- This study investigates the behavior of Ultra High-Performance Concrete (UHPC), a material renowned for its exceptional strength and durability. UHPC has garnered global attention for its potential to enhance sustainability and prolong the lifespan of buildings and infrastructure. Despite its growing prominence, challenges such as limited knowledge, the absence of standardized design codes, and high production costs hinder its universal acceptance. To address these challenges, research initiatives have been undertaken globally, including substantial programs in Germany, South Korea, and Malaysia. This research work encompasses comprehensive mix design, sample preparation, and compressive strength testing. Notably, UHPC specimens achieved an average compressive strength of 80 MPa at 7 days and 121 MPa at 28 days, significantly outperforming conventional concrete. The factors contributing to this exceptional strength include high-performance cement, low water-to-cement ratio, silica fume and class F flyash. These findings underscore the potential of UHPC to revolutionize the construction industry, and ongoing research efforts aim to develop sustainable formulations that reduce environmental impact and production costs.

Keywords- Ultra High Performance Concrete (UHPC), Compressive Strength, Sustainable Construction, Mix Design Optimization

ASSESSMENT OF FLOW AND MECHANICAL PROPERTIES OF GEOPOLYMER COMPOSITE FOAM CERAMIC FILLERS

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Abstract- While creating cellular geopolymer mortar with geopolymers (GPL) has attracted a lot of attention, little study has been done to determine how particle fillers affect the final porosity. The goal of this research is to thoroughly examine the necessary elements for producing composite cellular geopolymer mortar. Analyzing the viscosity of the GPL slurry, which contains small particles derived from fireclay and ceramic dichroite, is one of the main goals. For GPL with fireclay and dichroite fillers, the viscosity values at 100 s^{-1} were 4.99 Pa. s and 4.23 Pa. s, respectively. Due to a significant distribution of linked porosity and big pores in the matrix, composite cellular geopolymer mortar reinforced with ceramic fillers has compressive strengths ranging from 1.51 to 10.1 MPa.

Keywords- Cellular Geopolymer Mortar, Compressive Strength, Fireclay Ceramics, Flow Properties

ENHANCING LOAD-CARRYING CAPACITY OF DAMAGED GEOPOLYMER CONCRETE COLUMNS BY RETROFITTING WITH CFRP WRAPS

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Abstract- An environmentally friendly substitute for conventional concrete is geopolymer concrete, which are created from by-products of industry such as fly ash, slag, quarry rock dust (QRD) and other aluminosilicate minerals. This test study includes eight specimens of 200mm x 200mm x 1000mm which were already tested to the Ultimate load carrying capacity. The specimens include four GCD columns with 0% fiber and four GCD columns with 0.75% fiber. The damaged specimens were first repaired by GCD (Geopolymer concrete with QRD), and then retrofit with CFRP sheets by wrapping around the column using epoxy adhesives and tested under the compression testing machine (5000 KN) at concentric and eccentric loading (at 15E, 35E, 50E) with a 20 mm magnetic LVDT. As a result, the column's load-bearing capacity, flexural strength, ductility, is improved by retrofitting columns with CFRP sheets, which is a minimally invasive, high strength-to-weight ratio, and low thermal expansion.

Keywords- Geopolymer Concrete, Strengthening, Retrofitting, Carbon Fiber Reinforced Polymer (CFRP)

ENHANCING CONCRETE MECHANICAL PROPERTIES THROUGH GRAPHITE NANO-MICRO PLATELETS

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Abstract- This research explores the enhancement of conventional concrete properties through the incorporation of graphite nano-micro platelets (GNMPs). The experiment involved the addition of GNMPs in varying concentrations of 0.1%, 0.3%, and 0.5% with a testing period of 28 days. The findings revealed a significant improvement in both compressive and tensile strength with the inclusion of 0.3% GNMPs. The research concludes the potential advantages of using GNMPs as an additive in concrete, especially for enhancing strength and increasing the durability and efficiency of conventional concrete. These findings are particularly promising for the construction sector, which is constantly seeking to develop concrete materials that are stronger and more durable.

Keywords- Nano Micro Graphite, Strength Improvement, Durability, Material Testing.

UTILIZATION OF INDUSTRIAL WASTES IN BRICKS AND TUFF TILES

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Abstract- This study aims to address the problem of pollution caused by carbon dioxide emissions from cement production in Pakistan by investigating the feasibility of using waste to produce tuff tiles. The utilization of industrial wastes in clay bricks is also explored. A variety of organic and inorganic wastes are considered potential substitutes for traditional building materials. This study explored different ways to integrate these waste materials into the manufacturing process while maintaining a strong and durable design. The resulting product are carefully evaluated for their overall mechanical performance. The results show that replacing part of the cement in the tuff tiles with waste materials, especially glass powder and marble powder, up to 5%, can achieve good results. Optimum replacement percentage of clay with rice rusk ash in brick is found as 6%.

Keywords- Sustainable Construction Materials, Tuff Tiles, Wastes, Bricks

PERFORMANCE EVALUATION OF SELF-CURED BIO GEO-POLYMER CONCRETE REGARDING MECHANICAL STRENGTH AND DURABILITY

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Abstract- The process of geo-polymerization widely occurs by heat or steam curing of geopolymer concrete (GPC) to improve its mechanical properties. Heat curing is the usual method for the development of its strength, which poses a challenge for in-field applications. This study emphasizes preparing fly ash based geopolymers under ambient settings without an external heat source. Using low calcium fly ash and 20% ordinary Portland cement (OPC) accelerates the curing of geopolymer concrete, eliminating the requirements for enhanced heat applications. During the experimental phase, samples were cured at room temperature (25 oC) and relative humidity of 65 ± 10%. Additionally, self-curing of geopolymers has been investigated in ambient curing conditions by utilizing bio additives including Terminalia chebula and natural sugar (honey). To achieve desired mechanical properties, such as compressive strength, optimized percentages of these bio additives have been determined. Moreover, durability properties of the GPC have been analyzed by conducting sorptivity test on the specimen. Both bio-additives were incorporated in different percentages by the weight of aluminosilicate minerals and prepared mixes of geopolymer concrete i.e. GPC1 and GPC2 respectively. Experimental results showed that GPC2 prepared by adding 1.5 % Terminalia chebula and 0% honey has improved the compressive strength by 3.10% as compared to controlled specimen (GPC0) cured at ambient conditions for 28 days. Durability analysis showed that with these percentages of Terminalia chebula and honey, the sorptivity coefficient (S) obtained for GPC2 is 1.88% less in comparison to controlled specimen GPC0, indicating the improved durability properties of prepared geopolymer concrete.

Keywords- Bio Additives, Geo-polymerization, Geopolymer Concrete, Mechanical Properties, Sorptivity Coefficient

TENSILE STRENGTH OF TEXTILE WASTE COMPOSITE

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Abstract: The increasing numbers of textile waste in Malaysia are alarming when in 2018 approximately 195300 tonnes of textile waste were dumped and occupied about 6.3% of the landfills. Textiles made of synthetic fibers such as nylon, lycra, polyvinyl chloride, polyurethane, and spandex could be detrimental to the environment and take up to 200 years to decompose in landfills. The tensile strength of the textile could achieve up to 800 MPa and potentially be used as retrofitting materials. This study aims to utilize textile waste as one of the structural retrofitting materials with specific objective to determine the tensile strength of two types of textile waste (cotton and nylon) layered with epoxy namely textile waste composite (TWC). The tensile strength of TWC of with different layers (1 layer, 2 layers, and 3 layers) was determined by conducting a tensile test. The TWC of nylon textile showed better strength than cotton textile with tensile stress value up to 17.9 MPa. This material is possible for low-cost concrete retrofitting materials options in improving or restoring the capacity of structures.

Keywords- Cotton, Nylon, Sustainability, Textile Waste Composite, Tensile Strength

BOND BEHAVIOR OF DEFORMED STEEL REBAR EMBEDDED IN A RECYCLED BRICK AGGREGATE CONCRETE

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Abstract: The demolition of old structures creates a lot of waste, particularly in Asian countries, producing brick waste as most of the old structures are made of brick, which needs to be tackled. Researchers have tried to use it as aggregate in concrete and study its effect on different concrete properties. In this study, the bond behavior of steel rebar with recycled brick aggregate concrete (RBC) has been studied and compared with natural aggregate concrete (NAC) and recycled aggregate concrete (RAC). For this purpose, a number of cubes were cast along with cylinders to relate the effect of compressive strength with bond strength. Two types of ratios were chosen: one is R50%-50%, containing 50% coarse and 50% fine aggregate, and the second is R33%-67%, containing 33% coarse aggregate and 67% fine aggregate. A cement content of 20% by weight of aggregate was used. It was found that for the ratios R33%-67% and R50%-50%, the bond strength of RBC is 24% and 13% more than that of RAC, respectively. For the ratios R33%-67% and R50%-50%, the bond strength of RBC is 9% and 60% less than that of NAC, respectively. The practical results were then compared with the equation proposed by Md. Mozammel Haque to find the bond strength of RBC using compressive strength, and the difference was found to range from 0.4 to 0.9 for all the different ratios used. Further, the study showed the direct relation of compressive strength with bond strength: the greater the compressive strength, the greater the bond strength

Keywords- Bond Strength, Concrete, Compressive Strength, Recycled Aggregate

OPTIMIZED PREDICTION MODELING FOR CHLORINATED MARINE CONCRETE USING DECISION TREE

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Abstract- Chloride concentration (Cs) at the surface of concrete is an essential metric for designing resilience and estimating the lifespan of concrete structures in aquatic settings. Consequently, due to chlorine action, many reinforced concrete constructions cannot reach their intended or planned lifespan and experience early degradation. This study utilizes the independent machine learning technique Decision Tree (DT) to forecast concrete's surface chloride concentration (Cs). A comprehensive database consisting of 642 observations of Cs exposure data in the marine field, including the applicable mixture quantity of constraints, conditions of the environment, and exposure time, has been created through a thorough investigation of relevant literature. Diverse statistical criteria evaluated the model's accuracy and suitability. During the validation process, the DT model demonstrated enhanced accuracy with correlation coefficients (R) of 0.95 for training and 0.96 for validation and mean absolute errors (MAE) of 0.009. The results indicate that by including more diverse datasets and considering new variables, the predicted accuracy of standard models may be improved. The DT machine learning model, trained on a vast database, can effectively include 13 key characteristics that pose challenges for conventional models. However, to lessen the problem of overfitting, it is advisable to use a more extensive dataset, including synthetic or genuine experimental data.

Keywords- Regression, K-Fold Method, Semi Exponential Model, Particle Swarm Optimizer (PSO)

RUBBERIZED CONCRETE: OPTIMUM DURATION OF PRETREATMENT OF RUBBER PARTICLES WITH ALKALINE SOLUTIONS

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Abstract- Rubberized concrete incorporates waste rubber particles as a partial replacement for sand, providing an innovative solution for the disposal of waste rubber tires and reducing the demand for natural sand in concrete production. Despite its environmental benefits, untreated rubber particles adversely affect concrete workability, density, and strength. However, pretreatment with alkaline solutions can mitigate these effects. This study investigates the impact of pretreatment with NaOH and bleaching powder solutions on the workability and density of rubberized concrete, focusing on the effect of soaking time. The results indicate that a 2-hour soaking time optimally enhances the workability and reduces the density of the concrete mix. Soaking beyond 2 hours results in a reduction in both slump and density, which could be detrimental to the concrete's strength.

Keywords- Rubberized Concrete, Pre-Treatment, Soaking Time, Alkaline Solution.

SUSTAINABLE CONCRETE PRODUCTION: UTILIZING WASTE AND GREEN TECHNOLOGIES

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Abstract- Concrete, the most widely used construction material globally, has a significant environmental impact due to the extraction of virgin materials and high carbon dioxide emissions. This paper specifically investigates methodologies to enhance concrete sustainability, focusing on the incorporation of waste materials and the development of green technologies. Through detailed analysis, trends such as the use of recycled aggregates, industrial by-products like fly ash and slag, and innovative materials like nano-silica were reviewed. Key findings include improved mechanical properties and reduced environmental footprints of these sustainable concretes. The paper also addresses challenges in market adoption, advancements in material processing techniques, and the potential for these practices to significantly support sustainable urban development.

Keywords- Sustainable Concrete, Waste Utilization, Green Building Materials, Environmental Conservation

CONVENTIONAL EMPIRICAL AND MACHINE LEARNING MODELS: A REVIEW OF CHLORIDE CONCENTRATION IN MARINE CONCRETE

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Abstract- The measurement of chloride concentration (Cs) on the surface of the concrete is a crucial parameter for durable design and predicting concrete buildings' longevity in aquatic habitats. As a result of the effects of chloride, numerous reinforced concrete structures cannot achieve their intended or planned lifespan and undergo premature degradation. This study reviews both independent and ensemble machine learning methods applied previously, along with standard empirical provisions now in practice in the design industry. However, the empirical models have some uncertain calculation fallouts in some areas with different onsite constraints, which results in the diversion from experimental onsite measured chloride content. On the other hand, the machine learning model, which utilizes experimental data rather than an empirical calculation foundation, yields much better results but cannot be practiced in design fields due to its reliability on a small set of experimental data. Additionally, the statistical quality of experimental data and onsite experimental and environmental setup constraints are another chapter that needs to be addressed carefully. The overfitting issue is another drawback of machine learning models, though evolutionary models can derive the most superficial and complex empirical equations from surpassing the classical work in this field. The most recent machine learning model, trained on an extensive dataset, successfully incorporated 13 essential features that present a way to confront traditional model limitations. In Swift, all the findings suggest that the predicted accuracy of standard models could be enhanced by incorporating more varied datasets and considering novel variables. It is recommended that a more extensive dataset using applied Physics Informed Neural Networks (PINNs) be employed to reduce overfitting and increase the application of ML models in design disciplines.

Keywords- Conventional Models, Diffusion constraints, LNEC model, PINNs

6th Conference on Sustainability in Civil Engineering (CSCE'24)
Department of Civil Engineering
Capital University of Science and Technology, Islamabad Pakistan

RETROFITTING OF CONFINED MASONRY STRUCTURE WITH FIBER REINFORCED POLYMER (FRP)

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Abstract- The following experiment presents a method for evaluating the earthquake resistance of confined masonry buildings before and after being strengthened using fiber-reinforced polymer (FRP). The results of this research are anticipated to substantially impact future studies' direction and design guidelines' development, contributing to the global understanding of seismic retrofitting in confined masonry structures. A 1:3 scale-down single-story confined masonry structure (CM) constructed by ERRA guidelines was subjected to a novel application of a consistent vertical force and displacement-based reverse cyclic lateral loading up to maximum resistance. The damaged model underwent a retrofit using fiber-reinforced polymer (FRP) and was then tested again until it failed under the same conditions. The efficiency of FRP retrofitting was assessed through a thorough examination of the damage distribution and force-displacement characteristics of the retrofitted confined masonry structure (RCM) compared to the original confined masonry structure (CM). The experimental data, presented as force-deformation parameters, clearly demonstrate the benefits of FRP in improving lateral displacement and deformability.

Keywords- Confined Masonry, Retrofitting, Seismic

A CASE STUDY ON REMEDIAL MEASURES FOR FIRE-DAMAGED STRUCTURE

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Abstract- This paper addresses solutions for buildings damaged by fire and the measures needed for their future usability. Some buildings suffer severe damage from intense fires, while others can be salvaged with a swift response. The case study focuses on Galaxy Heights, a five-story multipurpose building in Gulberg Greens, Islamabad, which, despite significant fire damage, remained usable. During the site visit, no major structural damage was observed, indicating that the building could be rehabilitated using a proposed solution that includes various strengthening chemicals, fire-resistant paint, and the installation of a proper firefighting system. The implementation of this restoration methodology successfully restored the building to its normal usage.

Keywords- Deterioration, Thermal, Strengthening, Retrofit

SUSTAINABLE REHABILITATION OF FIRE-DAMAGED LOW-RISE RC STRUCTURES: ASSESSMENT, RETROFITTING, AND BAMBOO FIBER SOLUTIONS

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Abstract- Urban fires pose significant risks to structures, lives, and the environment, necessitating efficient post-fire rehabilitation methods. This paper explores the assessment, retrofitting techniques, and sustainable solutions for fire-damaged low-rise reinforced concrete (RC) structures. Understanding fire behavior and its impact on concrete integrity is crucial, with post-fire assessments playing a pivotal role in determining structural viability. Various parameters, including temperature variations and concrete conditions, are evaluated to quantify fire damage accurately. Retrofitting techniques aim to restore structural integrity, with bamboo fiber reinforcement emerging as a sustainable alternative. Bamboo fibers enhance strength and durability while reducing reliance on non-renewable materials, offering cost-effective solutions for urban infrastructure repair. This research emphasizes the importance of sustainable rehabilitation practices to mitigate the impact of fires on urban infrastructure.

Keywords- Assessment, Bamboo Fibers, Retrofitting Techniques, Sustainable Solutions, Urban Fires.

A SIMPLIFIED NUMERICAL MODEL FOR REINFORCED CONCRETE BEAM-COLUMN JOINTS

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Abstract- Reinforced Concrete Beam Column joints are most critical regions of any reinforced concrete structures. The performance of RC joints determines the performance of whole building during seismic loading. Many researchers have focused on the experimental study of RC joints to determine the seismic performance of RC structures. However, experimental tests are expensive and time consuming. Therefore, the alternative approach of numerical modeling is preferred to study a wide range of parameters affecting the behavior of beam-column joints. This study presents the result of macro modeling of RC beam-column joints using finite element based software SeismoStruct. The results of the numerical model are compared with the experimental results and found to be in excellent agreement. The peak strength of the numerical model was found to be 75.2 kN, which is 8% higher than that of experimental model and drift ratio at which peak strength of the numerical model was obtained is 4.33%, which is higher than that of experimental model by 2%. This shows good agreement of numerical results with the experimental results. It is also observed that the initial stiffness of numerical model is higher than that of the experimental model. The numerical model may be used for more comprehensive parametric study of the beam-column joints.

Keywords- Calibrated, Modelling, Macro Model, Stiffness

PLASTIC STRENGTH OF EXTERNALLY WELDED CHS-TRANSVERSE PLATE T-JOINTS

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Abstract- Utilizing tube-like hollow sections (HSS) as columns in Moment Resisting Frames (MRFs) offers beneficial resolutions for overall structural performance. Nonetheless, the adoption of HSS columns is limited by the intricacy in engineering connections between columns and Double Tee Beams. One of most common approach for such types of joints is welding the beam externally to the chord using either fillet or full penetration butt welds. As per the EC3:1.8 guidelines, a so-called component method approach can be used for such types of joints to predict their plastic strength. The component method approach simplifies the joint design by breaking down the joint into its fundamental components, allowing for a detailed examination of each component's behaviour and interaction, thus ensuring precise evaluation of joint performance and reliability. In this study, the emphasis lies on delineating the strength attributes of welded joints in a T-shape, connecting Circular HSS chords and externally welded transverse plates. The component's mechanical response seeks to mimic connection dynamics between beam flange and chord in connections connecting CHS chords and welded IPE profiles. More precisely, this critical element has been isolated and thoroughly examined using results from theoretical approaches and numerical simulations, culminating in identification for the most suitable analytical design equation.

Keywords- Component Method, Parametric Analysis, Finite Element Modelling, Circular Hollow Sections, Externally Welded Double-Tee Beams, Resistance.

PREDICTING THE INITIAL STIFFNESS OF EXTERNALLY WELDED CHS-TRANSVERSE PLATE JOINTS AT VERTICAL AND HORIZONTAL CONNECTIONS

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Abstract- This study performs an analytical examination of how transverse T-type plate-to-circular hollow section (CHS) connections behave when subjected to tension or compression forces from the branch plate. At present, EC 3: 1.8 focuses only on resistance prediction of tubular joints and does not address stiffness prediction. Consequently, in practical applications, tubular joints are frequently modelled using simplistic assumptions of either pinned or fully restrained conditions, resulting in inaccurate predictions due to the omission of stiffness considerations. This paper addresses the identified gap in Eurocode 3 Part 1.8 by proposing two equations, using Clapeyron theorem, for initial stiffness prediction of transverse plate-to-CHS joints using the Clapeyron theorem. The proposed equations aim to provide guidelines for stiffness prediction, which is currently absent in the code. Numerical comparisons were conducted with results from another study, analyzing 40 cases. The findings demonstrated that both equations accurately predicted stiffness, with mean values close to 1 and 1.03 and coefficients of variation (CoV) of 12% and 15%, respectively.

Keywords- Component Method, Finite Element Modelling, Parametric Analysis, Circular Hollow Sections, Externally Welded Double-Tee Beams, Stiffness.

6th Conference on Sustainability in Civil Engineering (CSCE'24)
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THE DEVELOPMENT OF FRAGILITY CURVES FOR MASONRY BUILDING- STATE OF ART REVIEW

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Abstract- A significant portion of buildings worldwide are made of masonry, that is the reason that buildings are more vulnerable to earthquake damage. Fragility curves are crucial tools for evaluating seismic risk as they provide a quantitative measure of the probability of a building exceeding a particular damage condition in response to a given ground motion intensity. This review study provides a thorough analysis of the current knowledge in the development of fragility curves specifically for masonry buildings. The review starts by explaining the significance of fragility curves in earthquake mitigation techniques. The review article then investigates numerous methods for developing fragility curves for masonry buildings, such as the empirical method, analytical method, expert judgment, and hybrid approach. Following that, various findings of the researchers, the methodology they employed, and the crucial aspects they studied in order to construct the fragility curves are discussed.

Keywords- Fragility Curves, Fragility Analysis, Risk Assessment of Buildings, Non-Linear Analysis

STRENGTHENING OF UNREINFORCED MASONRY STRUCTURE WITH FIBER-REINFORCED POLYMER

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Abstract- This study investigates the effect of carbon fibre-reinforced polymer (CFRP) in improving the seismic capacity of rural masonry structures prevalent in central Asia, where an overwhelming majority of masonry buildings lack reinforcement, rendering them susceptible to seismic events. Considering the situation, it is essential to reinforce these buildings using an efficient, cost-effective, and practical approach. CFRP partial bonding has been more economical compared to full jacketing; though, it comes with potential challenges such as interface delamination. As a result, this study utilizes the partial bonding method coupled with a CFRP anchorage system applied on the exterior of the structure. Two one-third scale unreinforced masonry structures (URM), designed to replicate typical village rooms, were constructed and subjected to displacement-controlled lateral loading and a constant normal load. The specimen reinforced with CFRP exhibited satisfactory performance in terms of observed failure modes and load response curves compared to the URM structure. In addition, the strengthening technique resulted in keeping the masonry structure intact over large drift ratios.

Keywords- Carbon Fiber Reinforced Polymer (CFRP), CFRP Anchorage, Masonry Structures, Seismic Performance

EXPERIMENTAL INVESTIGATION OF BRIDGE PIER SCOURING WITH RIP RAP ENCLOSED IN MESH

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Abstract- Bridge pier scouring poses a significant risk to the stability and safety of transportation infrastructure, necessitating effective countermeasures to mitigate its impact. This study presents an experimental investigation aimed at evaluating the effectiveness of rip rap enclosed in mesh for reducing scour depth around bridge piers. Scaled models representing bridge piers were constructed in a laboratory flume, and rip rap enclosed in mesh was installed around the piers. Controlled experiments were conducted to simulate varying flow conditions and sediment transport processes. Data on water flow velocity, sediment transport rates, scour depth, and rip rap stability were collected and analyzed. The results demonstrate that the use of rip rap enclosed in mesh significantly reduces scour depth compared to unprotected scenarios. Taking Oblong pier as reference before installing riprap value of scouring was 0.83 which later was reduced to 0.62. Furthermore, the overall scouring that was reduced is 74.5%. Insights gained from this study contribute to the understanding of scour processes and the effectiveness of rip rap with mesh in mitigating bridge pier scouring. Practical recommendations are provided for the design and implementation of rip rap protection systems to enhance the resilience of bridge infrastructure against hydraulic scour.

Keywords- Bridge, Mesh, Rip Rap, Scouring

ASSESSING STRUCTURAL BEHAVIOUR OF FRP-CONFINED CFST COLUMNS THROUGH FINITE ELEMENT METHODS

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Abstract- While several studies have examined the use of sparse and limited data to predict the load-carrying capacity (LC) of fiber-reinforced polymer (FRP)-confined concrete-filled steel tube (CFST) compression members (FCC). But none have examined the predictive accuracy of different modeling approaches with a large and comprehensive dataset. Creating a finite element model (FEM) to forecast the axial compressive performance of FCC compression components is the main goal of this research. The steel tube and FRP wraps are represented by bilinear and linear elastic models, respectively. The concrete is represented by a concrete damage plasticity model. The proposed FEA model showed minor variations of only 6.70% and 3.10% for the maximum LC and related axial shortening of FCC columns, respectively.

Keywords- Database, Finite Element Analysis, CFST, Damaged Plastic Model, Axial Strength

ENHANCING STRUCTURAL INTEGRITY AND RESILIENCE: A SYSTEMATIC APPROACH FOR RETROFITTING DESIGN OF A TWO-STORY HOSPITAL BUILDING IN KARACHI

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Abstract- This paper presents a case study on the structural assessment and retrofitting design of a two-story hospital building in Karachi, Pakistan, constructed in 1992. To overcome this, a systematic approach was adopted, involving site visits, data gathering, the creation of as-built drawings, and detailed analysis and design using ETABS software. The assessment revealed vulnerabilities in the existing structure, particularly in the columns, which necessitated retrofitting measures. The retrofitting design included the incorporation of shear walls and the increase in column and beam sizes to enhance the building's seismic resilience. The successful completion of this project underscores the importance of a systematic approach in ensuring the structural integrity and resilience of existing buildings, especially in earthquake-prone regions. By prioritizing the preservation of human life and the enhancement of building safety, this study contributes to a more resilient built environment.

Keywords- Seismic Resilience, Structural Assessment, Retrofitting Design, Non-Destructive Testing

A REVIEW ON FIRE DAMAGE ASSESSMENT OF REINFORCED CONCRETE STRUCTURES OF A BUILDING

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Abstract- Performance-based engineering methods have been recently developed for fire hazards providing enhanced prediction of the structural response and subsequent damage and loss assessments. In this context, this paper presents an overview of the fire damage and loss assessment of reinforced concrete structures under fire hazards by utilizing performance-based assessment methodologies. Hence, fire hazard models and the stages of fire initiation, propagation, and decay are discussed. Then, a six-step methodology is formulated comprising hazard modeling, structural modeling, performance modeling, collapse fragility assessment, building response assessment, and loss assessment. Finally, the methodology is illustrated by utilizing a four-story building model built in the OpenSEES framework.

Keywords- Buildings, Damage, Fire-hazard, Performance-Based, Reinforced-Concrete

BRIDGE BEARINGS REPLACEMENT CHALLENGES – A REVIEW

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Abstract **-** Bearings are a critical element of bridge structures and play a key role in the distribution of loads from superstructure to substructure. Bearings are of various types and installed in bridge structures based on articulation requirements. Depending on the type of bearing, there is a variation in service life. Bearings also require different types of maintenance work ranging from routine cleaning and greasing to full replacement. This paper focus is based on major maintenance works i.e. full replacement of bearings during their design life. The replacement of bearings poses various design and construction challenges which are highlighted in this paper. Various solutions, which have been implemented in numerous past schemes, are proposed to overcome these design and construction challenges. These solutions provide insight to the reader to overcome these challenges in their schemes at preliminary design stages and can help in the preparation of efficient and economical design.

Keywords **-** Bearings, Design challenges, Construction Challenges, Jacking, Replacement.

DESIGN AND ANALYSIS OF GREEN HIGH-RISE BUILDING USING RECYCLED MATERIALS

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Abstract- This project deals with the design and analysis of high-rise building by using eco-friendly building materials. The locally developed building materials from recycled waste were used as concrete and bricks. A ten-story high-rise building was designed using the software ETABS. The concrete comprised of 10% partial replacement of cement by red brick powder (RBP) and the bricks contained 25% mass of clay replaced by the RBP. These materials were cast and their properties were determined as per ASTM standards. The characteristics were incorporated in the software and the building was designed and analyzed. The designed building was compared with that containing conventional concrete and bricks. It was found that the design having waste materials resulted in the saving of 160 tons of cement, and 440 cubic meters of fertile clay. This will avoid a Carbon emission of 144 tons to the atmosphere and a significant saving in energy required to manufacture cement. The building containing waste materials is also PKR. 5.67 million less in cost than that containing conventional materials.

Keywords- Green Design, High-Rise Buildings, Recycling, Waste, Environmental Impact, Cost

ENHANCING STRUCTURAL DESIGN EFFICIENCY IN PAKISTAN: A CASE STUDY ON THE IMPACT OF BIM INTEGRATION

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Abstract- This study explores the implementation of Building Information Modeling (BIM) workflow in traditional structural design processes, with a focus on interoperability challenges and comparative analysis. A live project served as the basis for examining both conventional and BIM-based approaches to structure design. The study reveals significant differences in time consumption, coordination, error reduction, and rework between the two methods, with the BIM-based approach demonstrating notable advantages. Through the integration of 3D modeling and project browser features in Revit, stakeholders benefit from enhanced visualization, collaboration, and flexibility in design adjustments. Overall, BIM-based design in Revit proves to be a highly efficient and error-minimizing solution for structural design processes.

Keywords- Automation, BIM, Design Workflow, Structure Design

SUSTAINABLE DESIGN OF A MULTI-STORY BUILDING USING WASTE MARBLE AND CERAMIC

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Abstract- This project deals with the design of a high-rise building by using waste materials. The locally developed building materials from recycled wastes were used in manufacturing concrete and bricks. A ten-story high-rise building was designed using the software ETABS. The concrete comprised of 10% partial replacement of cement by waste marble powder (WMP) and the bricks contained 12% waste ceramic powder and 15% waste brick powder as replacement of clay. These materials were developed in the lab, and their properties were determined as per ASTM standards. The characteristics were incorporated in the software and the building was designed and analyzed. The designed building was compared with that containing conventional concrete and bricks. It was found that the design having waste materials resulted in the saving of 164 tons of cement, and 475 m3of fertile clay, while meeting the stability standards as documented in the building codes. The design prevents the emission of 148 tons of carbon into the atmosphere and significantly saves energy required for cement manufacturing. Additionally, the building incorporating waste materials costs Rs. 5.8 million less than one made with conventional materials.

Keywords- High-Rise Buildings, Recycling, Waste Marble, Waste Ceramic, Environmental Impact, Cost Effectiveness

AN OVERVIEW ON FIRE DAMAGE QUANTIFICATION AND RETROFITTING OF LOW-RISE REINFORCED CONCRETE STRUCTURES

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Abstract- Reinforced concrete (RC) structures are exceedingly susceptible to fire damage, which may induce substantial degradation of the material. Concrete does not ignite at ambient temperature; however, it can significantly alter its mechanical, chemical, and structural characteristics when subjected to elevated temperatures. The extent of a fire damage is primarily determined by its severity and duration. Small fires for short duration, burning, results limited damage, larger fires that persisting over time leads to substantial damage or even structural collapse. This study examines the response of concrete to fire, the potential damage that reinforced concrete buildings may sustain, and the retrofitting solutions that are currently available. Additionally, it contains an incident report regarding a textile market fire that was precipitated by a short circuit. This case study examines ecological retrofitting solutions and concentrates on reinforced concrete buildings on lower stories. In this investigation, we investigate the potential of natural fiber laminates to retrofit buildings and the ability of cement slurry to repair damaged concrete.

Keywords- Bamboo Fiber Laminates, Concrete Structures, Fire, Retrofitting Techniques

OPERATION AND MAINTENANCE OF GREEN BUILDINGS: A CASE STUDY

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Abstract- Conventional construction has played a massive role in contributing towards pollution and global warming which eventually leads to different diseases that have caused death but also created energy problems. To tackle this major issue, we need to convert our construction to green buildings and operate and maintain buildings according to Leed rating system. There are different systems for green buildings like Breeam, Green Globes etc. but we opted for Leed rating system as it covers more aspects of the building than any other system. A case study has been done on 3 Marla (816.752 square feet) house to show how we can operate and maintain a house according to Leed rating system. We use energy efficient sources, materials and items that can not only reduce pollution but also have a positive impact on the environment. We mainly focus on the sources, materials and items which are easily available in our country to make it more convenient and easy for the people. But the most important part of constructing or operating and maintaining a house according to LEED rating system is the return on investment (ROI) factor.

Keywords- Green Buildings, Leed, Rating Systems, Operation and Maintenance

OPTIMIZING ENERGY PERFORMANCE OF BUILDINGS IN PAKISTAN USING BIM

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Abstract- An unprecedented increase in global and national energy demand has arisen due to the rapid development of infrastructures and population growth. The residential sectors consume the major share of energy resources, up to 22% of the world's total energy consumption. In Pakistan, the residential sector consumes an average of 45% of the nation's energy resources. To address this issue and mitigate the escalating demand, the optimization of energy resources is required. The Phase Change Material (PCM) has been approved as a vital source for enhancing energy usage worldwide. In PCM, the material can store and release energy as it undergoes the transition stage. Utilizing the PCM in the building envelope, particularly in Peshawar, with distinct heating and cooling requirements, makes it possible to reduce energy consumption substantially. Extensive analysis reveals that PCM A25H exhibits the highest performance, achieving an impressive energy efficiency of 8.82%. To further investigate the impact of PCM thickness and its strategic placement within walls and roofs. The analysis outcomes demonstrate that applying a 40mm PCM coating on the interior side of building walls and roofs in Peshawar can significantly reduce energy consumption.

Keywords- Energy Performance. BIM, Phase Change Material, Energy Model

FACTORS EFFECTING STAKEHOLDER ENGAGEMENT IN DESIGN BID BUILT

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Abstract- This study examines stakeholder management in Design-Bid-Build (DBB) projects, a previously under-researched area. Using a mixed-method survey with expert input, we highlight the critical role of early stakeholder involvement, particularly during project selection. The research also identifies opportunities for improvement, such as ongoing needs assessment, culturally adaptable project structures, and fostering stakeholder awareness of social, economic, and environmental (SEEEEPLL) considerations. We propose a strategic approach focused on early engagement, continuous needs evaluation, and culturally sensitive structures. This approach, combined with enhanced SEEEEPLL understanding, can significantly improve stakeholder participation and project outcomes in DBB environments.

Keywords- DBB Projects, Stakeholder Management, Project Management, Stakeholder Engagement

AN INSIGHT INTO PROSPECTS AND CHALLENGES OF 3D PRINTING IN DEVELOPING COUNTRIES

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Abstract- The incorporation of 3D printing technique in construction demonstrates substantial promising opportunities for developing and under developing countries, that includes notable improvements in productivity, considerable cost minimizing, and eco-friendly construction provisions. This paper reviews the achieved milestones, prospects, and challenges linked with the integration of 3DP in the construction industry. Regardless of its benefits, such as reduced construction time and less material wastage, several challenges restrict its prevalent implementation. These challenges include high initial capital, lack of skilled labour, insufficient codes and regulatory frameworks, and technical risks related to material properties and printability. This review focuses the need of strategic resource allocation, organizing the training programs, and the establishment of regulatory guidelines. Emphasis is also placed on the importance of collaborative efforts between governments, academia, and industry stakeholders to encounters these challenges and utilize the full potential of 3DP technology in the construction sector.

Keywords- Additive manufacturing, Material optimization, Process efficiency, Regulatory challenges

OPTIMIZING ENERGY EFFICIENCY IN GREEN BUILDINGS USING BIM-INTEGRATED ENERGY ANALYSIS TOOLS

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Abstract- The construction industry is one of the major contributors of GHG (Greenhouse Gas) Emissions, in which commercial and residential buildings play a major role. Most of these emissions are attributed to lack of energy conservation measures, outdated methods of design and construction. In this project, an analysis is made based on the comparison of energy consumption of a building constructed from conventional materials, having no sustainable design strategies. And another building that is designed with consideration to sustainable techniques such as energy efficient materials that have low thermal conductivity, lower U-value (thermal transmittance) glazing, and oriented at different angles to suit the best conditions of sun path for optimum heat transfer. A BIM-based approach is adopted. Both the models are designed in Autodesk Revit and then analyzed through the built-in Revit plug in: Autodesk Insight, which performs iterative energy analysis on cloud. The results for both the buildings are compared and conclusions are drawn based on energy and cost savings in the long run. The study concludes with the design and energy audit of a commercial plaza building, revealing the large energy and cost savings available via intelligent design decisions.

Keywords- Green Buildings, Energy Simulation, BIM, Sustainable Buildings, Energy Efficiency

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ASSESSMENT OF ABLUTION WASTE WATER QUALITY FOR VARIOUS MOSQUES IN PESHAWAR CITY

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Abstract- Ablution water refers to the water utilized by worshippers for washing (wudhu) before engaging in prayers. Different researchers have described the usage of ablution water for different purposes by channeling it through basic treatment. In this case study, ablution water quality of various mosques for Peshawar city is assessed on the basis of various parameters i.e. biological oxygen demand(BOD), chemical oxygen demand (COD), total dissolved solids(TDS), total suspended solids(TSS), PH and electrical conductivity(E.C) so that it can use in functional purposes without any initial treatment. Water samples were collected from different mosques, and tests were conducted for the mentioned parameters. The results were compared with the National Environmental Quality standards and other international standards for water usage in various applications. The laboratory test comparisons indicated that the ablution water in Peshawar city can be used directly for irrigation after primary treatment to remove suspended particles, industrial use, and concrete mixing without any initial treatment.

Keywords- Ablution Water, Biological Oxygen Demand, Chemical Oxygen Demand, Wudhu

ENHANCING ASPHALT PAVEMENT PERFORMANCE WITH PHASE CHANGE MATERIALS

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Abstract- This study aims to utilize Phase Change Materials (PCM) technology to protect and maintain asphalt pavement from temperature changes, thereby preventing cracks. PCM assists in temperature regulation by exploiting latent heat characteristics, thereby maintaining the workability of asphalt surfaces. Asphalt pavement, often exposed to temperatures up to 60°C in summer, becomes prone to cracking due to sunlight. The issue can be resolved by using PCM, which will extend the life and performance of asphalt pavement. In this investigation, the asphalt mixture had gravel and sand as fine and coarse particles, respectively, and a bitumen penetration grade of 50/60. To implement PCM in asphalt pavement, we took into account the mechanisms for temperature regulation, road efficiency, and mix design techniques. According to the findings, there was a maximum temperature difference of 4.72°C between the top and the bottom, with peak surface and bottom temperatures of 43.41°C and 46.47°C, respectively. This study demonstrates the potential of PCM technology to effectively mitigate temperature fluctuations within asphalt pavement, thereby improving its durability and performance.

Keywords- Asphalt Pavement, 50/60 Grade Bitumen, Surface and Bottom Temperature, Phase Change Materials

TO ASSESS THE IMPACT OF ORGANOPHILIC NANOCLAY ON MARSHALL PROPERTIES OF ASPHALT MATERIAL

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Abstract- In recent years, the escalation in traffic volume and loads, alongside fluctuating temperatures, particularly high summer temperatures in winter, pose a significant challenge for pavement construction companies and engineers. This research aims to explore the impact of Organophilic Nano Clay on the Marshall Properties of Asphalt Mixture. The study investigates the Marshall properties of both Nano clay- modified asphalt mixture and conventional asphalt mixture. In the Nano clay-modified asphalt mixture, filler aggregates were substituted with varying percentages of Nano clay, ranging from 3.5% to 5.5%, with an optimum value of binder (OBC) of 4.33%. The OBC value was determined through Marshall Stability testing on the conventional asphalt mixture. Findings reveal that the addition of Nano clay enhances the Marshall Stability of the asphalt mixture, with the maximum stability observed at 4.5% Nanoclay content. Conversely, the Marshall Flow of the asphalt mixture decreases with the inclusion of Nano clay.

Keywords- Marshall Stability Test, Marshall Flow, Modifiers, Nano clay

ASSESSING THE COMBINED EFFECTS OF STEEL SPEED HUMPS AND ROAD STUDS ON SPEED REDUCTION

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Abstract- The safety and efficiency of roadway design greatly influence traffic flow and accident prevention. In this paper, the effects of road studs and steel speed bumps on vehicle behavior when combined are studied. The study is intended to provide an in-depth understanding of traffic calming devices on vehicle dynamics and road safety. To investigate the effects, selected designs, or a combination of designs of steel speed hump and road studs were used to conduct an extensive field study of two months from Dec-2023 to Feb-2024 in a controlled urban area. The number of vehicles tested were hundred in total which involved 50 Cars, 30 Bikes, and 20 Heavy Traffic vehicles. The test area consisted of steel speed humps and strategically placed road studs. In our study, we analyzed data that profiled a sample of cars based on the speed data readings and the acceleration and deceleration patterns in graphical charts. The findings show that using road studs in combination with a steel speed hump adequately reduces the speed of a vehicle and by extension help in a safer way of driving in areas where illegal speeding is rampant. Road studs enhance the visual perception of the driver and, thus, consistent engagement in the deceleration and speed decline. Moreover, a drastic decrease in the number of cases of sudden braking occurred when both speed bumps and road studs were implemented as cars rolled over the humps rather than braking to drive over them. Although the implementation of the above components dramatically improves traffic safety, our study identifies numerous challenges. Firstly, humps and studs should be designed optimally as cars experience increased wear and tear of the suspensions and wheels, whereas, at high speeds, the drivers may feel uncomfortable. Based on our study outcomes, substantial attention seems appropriate regarding speed bump height and spacing and the number and location of road studs that should be factored into their use to avoid unfavorable effects and maximize safety benefits. In summary, combining steel speed humps and road studs has great potential to improve road safety. More investigations should focus on designing and positioning them to achieve a traffic-calming-vehicle performance tradeoff in a balanced way. This article contributes to the body of knowledge for urban planners, traffic engineers, and policymakers to make roads safer in urban areas.

Keywords- Traffic Calming, Speed Humps, Road Studs, Traffic Engineering

A CROSS-SECTIONAL ANALYSIS OF SUSTAINABLE MOBILITY FOR FEMALE UNIVERSITY STUDENTS IN KARACHI

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Abstract- Limited mobility restricts educational opportunities for female students in Karachi, Pakistan. This study investigates the various factors related to their travel patterns. Safety concerns regarding harassment on public transport and deserted streets are key deterrents. Data was collected through in-person questionnaire survey. It was found that the female students are from diverse backgrounds, which in turn affects their travel pattern and mode choice. This research found that public transport such as bus and chingchi are cost effective as well as sustainable and are also more utilized by female hostel students as compared to car and ride-hailing services. It is recommended that increasing the accessibility and safety of public transport services will not only improve female mobility but also help achieve sustainability.

Keywords- Cost, Gender, Mobility, Public Transport, Student

EXAMINATION OF THE EFFECT OF ILLEGAL PARKING ON CAPACITY REDUCTION OF URBAN ROADS

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Abstract- The city of Karachi has more than 20 million residents which face severe traffic congestion due to infrastructure problems and inefficient traffic management. One of the reasons for the congestion is the habit of illegal parking which results in the formation of bottlenecks. This study investigates the impact of illegal parking on traffic congestion, which is a major cause for air pollution and increased emission levels. On-site surveys were conducted to measure vehicle flow, illegal parking extent, and operational lanes during peak hours. Data was collected manually at Allama Shabbir Ahmed Usmani Road, in Gulshan-e-Iqbal Town. It was found that an average of 2.05 lanes are operational which cater a traffic volume of 2575 PC/hr in front of Blue Ribbon Bakery and 1.88 lanes are operational with a traffic volume of 3144 PC/hr in front of Manpasand Foods. The calculated road capacity was found to be 2075.6 PC/hr/lane. This slightly higher peak hour volume, indicates a near saturation condition and that congestion is inevitable. This congestion leads to increased fuel consumption and emissions, adversely affecting commuters' health. The study underscores the need for improved traffic management to mitigate these issues.

Keywords- Sustainability, Illegal Parking, Congestion, Emissions

THE IMPACT OF GYPSUM ON THE STABILIZATION OF PEAT SOIL

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Abstract- Peat soil, characterized by its high organic content, presents significant challenges in construction due to its compressibility and low strength. This study investigates the potential of gypsum as a stabilizing agent for peat soil. Laboratory experiments were conducted by adding varying amounts of gypsum (5–15%) to the soil, and the effects on dry density, optimum moisture content (OMC), Atterberg limits, and California Bearing Ratio (CBR) were evaluated. Results showed a 38.89% reduction in OMC at 15% gypsum, with the maximum dry density decreasing from 0.802 g/cc to 0.715 g/cc. The liquid limit decreased from 49% to 39%, and the plastic limit from 20% to 16%, reducing the plasticity index. Furthermore, unsoaked CBR values increased from 1.802% to 2.94% and soaked CBR values improved from 0.801% to 1.634%. These findings highlight gypsum's effectiveness in enhancing the engineering properties of peat soil.

Keywords- Gypsum, Maximum Dry Density, Optimum Moisture Content, California Bearing Ratio

EFFECT OF ASPECT RATIO ON BENDING MOMENT AND SHEAR FORCE DISTRIBUTION OF AXIALLY LOADED PILES

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Abstract- Piles are categorized as a type of deep foundation and are generally adopted as an appropriate foundation system for high-rise structures, bridges, offshore structures etc. Generally, piles are constructed in a group to enhance their efficiency and capacity to resist loads. The procedure to evaluate the axial load-carrying capacity of piles is well documented in various codes adopted around the globe, however, determination of the variation in moment and shear with pile length is not explicitly incorporated in codes. In this study, an attempt is made to determine the bending moment and shear force distribution along the length of piles constructed in group of 2x2 pile configuration, in layered soil for different aspect ratios. Numerical simulations based on the finite element method were performed by considering three pile diameters to obtain a comprehensive understanding on the effect of aspect ratios on bending moment and shear along pile lengths. The results showed higher moments and shear at the top of the pile. Furthermore, bending moment and shear force decrease with an increased aspect ratio.

Keywords- Aspect Ratio, Layered Soil, Finite Element Method, Bending Moment, Shear Force

6th Conference on Sustainability in Civil Engineering (CSCE'24)
Department of Civil Engineering
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EXAMINING IMPACT OF GROUP CONFIGURATIONS ON PILE RESPONSE USING NUMERICAL METHOD

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Abstract- The anticipation of load transfer mechanism of piles has been topic of interest in the domain of geotechnical engineering. Many researchers have proposed various methods to anticipate load transfer mechanism and effect of pile spacing on the load deformation characteristics of piles. However, understanding the effect of pile configuration on bending moment and shear force distribution, when installed in groups remains area to be further explored, particularly in layered soil conditions. This study aims to investigate how the arrangement of piles in groups affects the bending moment and shear force experienced at the pile heads in layered soil. Numerical simulations using the finite element method were conducted, varying the configurations of pile groups to gain a comprehensive insight into the changes in bending moment and shear force. The findings indicate that both bending moment and shear force increase as the number of piles in a group is increased

Keywords- Pile Configuration, PLAXIS 3D, Bending Moment, Shear Force

INVESTIGATING LOAD TRANSFER BEHAVIOUR OF BORED PILES IN LAYERED SOIL

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Abstract- Piles foundation is considered as an appropriate foundation system for structures subjected to higher axial or lateral loading. In general, piles are constructed in a group to enhance their efficiency and capacity to resist loads. This study investigates the effect of pile configuration and diameter on the pile group efficiency factor, ultimately affecting the overall pile group capacity. Additionally, pile load transfer behavior was also examined to enhance understanding on the pile group response constructed in layered soil. A total of three pile group configurations i.e., 2 x 1, 2 x 2 and 3 x 3 along with three pile diameters of 0.76m, 1.0m and 2.0m with a constant length of 55m, were used for the present study. The results highlight the group efficiency factor reduces with piles. Furthermore, it was observed that major percentage of the load is transfer to the soil around the pile length instead of pile tip in bored piles.

Keywords- Load Transfer Behavior, Bored Piles, Axial Load Capacity

OPTIMIZED PREDICTION MODELING FOR TIO2-CATALYZED PHOTO-DEGRADATION RATE CONSTANTS OF WATER CONTAMINANTS USING MACHINE LEARNING

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Abstract- Titanium dioxide (TiO_2) is widely recognized as a photocatalyst in water contaminant treatment applications. Generally, obtaining the kinetics of photo-degradation rates requires extensive experimentation, involving significant labor and experimental resources. This study presents a unique approach to employing multi-expression programming (MEP) and artificial neural networks (ANN) to forecast the photo-degradation of water contaminants using TiO_2. The collected dataset for model development consists of 446 data points with six input variables. The MEP model exhibited higher prediction accuracy for the TiO_2-photocatalytic degradation of organic water contaminants. The MEP model exhibited predictions with R values of 0.946, 0.862, and 0.869 for training, testing, and validation, respectively. While the ANN model exhibited good accuracy during the training phase, its performance in testing and validation was poor, with the R-value significantly lower than the recommended threshold of 0.80. Among both developed models, MEP is a better choice to forecast the degradation of organic water contaminants using the TiO_2-photocatalytic process.

Keywords- Machine learning; Titanium Dioxide; Photo-degradation of Water Contaminants; Water Treatment

EVALUATION OF ENERGY CONTENT IN MUNICIPAL SOLID WASTE OF LOW-INCOME AREA TEHKAL AND HIGH-INCOME AREA HAYATABAD OF PESHAWAR K.P.K PAKISTAN

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Abstract- In developing countries like India and Pakistan, municipal waste creation is increasing rapidly because of ongoing population, urbanization, and industry growth. In addition to having a detrimental impact on the environment. Managing MSW effectively and producing sustainable non-fossil fuel, energy can both be accomplished by converting trash to energy. This study aims to provide a thorough assessment of the energy content of municipal solid waste (MSW) from high-income area Hayatabad and low-income area Tehkal of Peshawar city KPK Pakistan. First, selected the solid waste sample in plastic bags from the dumpsite in the low-income area Tehkal and high-income area Hayatabad of Peshawar city K.P.K Pakistan. Each sample was 100 kg from both the areas. The collected waste is separated to different component of solid waste. Then find the moisture content of each component in MSW. It almost took 3 to 4 weeks to collect this data. After finding the dry weight, find the energy content of high-income zone, which was found out to be 28026.7292kJ/100 kg, and for low-income zone, it was 14794.7395kJ/100kg.

Keywords- Energy Content, Municipal Solid Waste (MSW), Moisture Content, Waste Composition