UTHM
Universiti Tun Hussein Onn Malaysia

GCOMSE 2021

THE 3RD GLOBAL CONGRESS ON

CONSTRUCTION, MATERIAL AND STRUCTURAL ENGINEERING

23 - 24 AUGUST 2021 | VIRTUAL CONFERENCE

https://intl-conference.com/gcomse2021

ABSTRACTS & PROGRAMME

organised by

UTHM COMMERCIAL SDN. BHD.

JAMILUS RESEARCH CENTER FOR SUSTAINABLE CONSTRUCTION
FACULTY OF CIVIL ENGINEERING AND BUILT ENVIRONMENT
UNIVERSITI TUN HUSSEIN ONN MALAYSIA

3rd Global Congress on Construction, Material and Structural Engineering

23 – 24 August 2021
Virtual Conference

Organisers

UTHM Commercial Sdn. Bhd. (UCSB)

Jamilus Research Center for Sustainable Construction (JRC)
Faculty of Civil Engineering and Built Environment
Universiti Tun Hussein Onn Malaysia

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Welcoming Remarks

Assalamu'alaikum and sincere greeting to all.

Alhamdulillah, I am very grateful that this international conference is convened today to gather more than forty speakers presenting papers pertaining to the field of 3rd Global Congress on Construction, Material and Structural Engineering, GCoMSE 2021 organized by Jamilus Research Centre for Sustainable Construction (JRC) as a platform for scientists, researches and engineers to share their knowledge and experiences in creating better world for the present and the future. We all know that this world is borrowed from the next generation and in order for us to ensure that it is well looked after, we have to maintain the three important pillars of sustainability i.e., construction, structures and materials. These three pillars are the catalyst to ensure that the world is liveable, continues to exist and at the same time is developed to enhance the socio-culture of mankind.

GCoMSE 2021 brings the theme "Transforming Construction, Fostering Sustainable Structures and Materials" with the aims to gather both industries and academia experts to share their researches, to explore new knowledge and to expand professional networks. There is widespread consensus on big demands modern societies nowadays need to address in the face of population growth, climate change, and shifting local and global socio-economic factors. At the same time, these demands concern environmental sustainability, clean water and air, energy, efficient building as well as the construction technologies, and the needs of next generation communications, health and transportation system. These areas pose big challenges for engineers and researchers, and can only be addressed with the advanced design and development of materials and structures, without compromising the sustainability elements.

As we can see, these days, the construction industry poses many challenges. Apart from the sustainability issue, the industry should also serve for better adaptation materials management, which requires further actions for a positive difference. In order to promote and encourage the usage of greener building materials, more research could be the way forward. One thing we should be highlighting here

is, research is remarkably important for a better future of a construction industry especially for sustainable and adaptable buildings and infrastructures, technology and innovation in construction, and also visualisation and simulation in construction. And later, all of the research outcomes can be integrated, developed, expanded and further explored in ensuring the suitability of a construction in rapidly changing environments. Engineering Accreditation Commission emphasizes the globalisation in general criteria to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Together with the sustainability and globalisation challenges, we, as the key players must move forward and courteously address those needs in a proper construction for the development of our country without contradicting the engineering ethics and manner and not contrary to the development itself. We are delighted, in this congress; we are gathered here from different platforms; industry and institution, for the same aim, to share knowledge and experts in addressing the challenges, and expand networks in the similar field of interests.

I would like to congratulate and thank all the GCoMSE 2021 committee members for their hard work and diligence. I would like to thank UTHM Commercial Sdn. Bhd. and FKAAB UTHM for their cooperation in managing the conference. Lastly, I am grateful to the Vice Chancellor, Prof. Datuk Ts. Dr. Wahid Razzaly and the Dean of FKAAB, Prof. Ir. Ts. Dr. Irwan Juki for their trust in the committee members to organize this conference on behalf of the university. May Allah bless you all.

Thank you.

Sincerely,
Ir. Dr. Sallehuddin Shah Ayop
Chairman of GCoMSE 2021

Keynote Speakers

GCoMSE 2021 would like to express our most heartfelt gratitude to the following distinguished keynote speakers for gracing our congress with their presence and providing us with insightful and inspiring keynote addresses.

Prof. Datuk Ir. Dr. Wahid Omar
Universiti Teknologi Malaysia

Assoc. Prof. Ir. Dr. Noor Yasmin Zainun
Universiti Tun Hussein Onn Malaysia

Programme

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Note:
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b. Please refer to the presentation schedules for more detailed information about the title and author.
c. All times shown are Malaysia (MYT) / Singapore (SGT) standard time

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01.00 PM	**Break**	

Note:
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Day Two (Tuesday, 24 August 2021)		
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Note:
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Presentation Schedules

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Date	: 23 August 2021 (Monday)
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Chairman	: Ts. Dr. Noorasyikin Mohammad Noh

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043-033	Shear Strengthening of Reinforced Concrete Beams Using Fibre Reinforced Polymer: A Critical Review	Seyed Jamalaldin Seyed Hakim
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Chairman	: Ir. Dr. Mohd Norazam Yasin

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032-018	Sensor Modules for Enhancement of Safety Performance in Construction Safety Management	Tuck Kiong Mak
035-020	Talent as A Spearhead of Construction 4.0 Transformation: Analysis Their Challenges	Santi Edra Nisa Lau
049-039	Barriers to The Adoption of Engineering Controls in Reducing Risk Due to Dust Exposure to Masonry Work	Nor Haslinda Abas
053-043	Readiness of Malaysian Small and Medium Enterprises (SMEs) Construction Companies for Building Information Modelling (BIM) Implementation	Muhammad Fikri Hasmori
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037-023	Prediction of Traffic Vibration Effect on Heritage Building at Muar, Johor, Malaysia	Tuan Norhayati Tuan Chik
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Abstracts

Keynote Address 1

Recent Development in Confinement of High Strength Concrete

Wahid Omar, Chau-Khun Ma, Chee-Loong Chin and Nazirah Mohd Apandi
Faculty of Civil Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
drwahid@utm.my

Abstract: The primary advantage of high strength concrete (HSC) compared to normal strength concrete (NSC) is the higher strength to weight ratio. This enables smaller size of structural elements and hence less self-weight of structures. However, the higher strength of HSC is associated with a major drawback, brittleness. Research showed that confinement can improve both the strength and ductility of concrete. Conventional confinement technique relies on the expansion of concrete cores to activate the confinement effect. This passive activation means that confinement is only effective after a certain portion of concrete is being damaged, hence reducing the efficiency of confinement. In view of this, a research group was created with a primary aim to solve brittleness of HSC using efficient confinement. Our initial work introduced steel strapping tensioning technique (SSTT) confinement to enable active activation of confinement. The confinement effect is activated through mechanical prestressing during the installation process of SSTT confinement. This has shown to improve the efficiency of confinement, especially in confinement of HSC. Since then, we have collaborated with the government, seven international universities, and five international companies in completing our research work. To date, we have successfully graduated four PhD holders and our studies have been published in 80 international journal articles and conferences. Our studies have demonstrated that SSTT confinement can be used to improve the ductility of various structural elements, such as columns, beams, beam-column joints, and anchorage. This talk will present about recent research and development related to the mechanisms and materials properties of SSTT confinement, and the huge potential in improving the structural performance. Subsequently, the application

of SSTT confinement on various structural elements, including short column, slender column, beam, beam-column joint and anchorage will be demonstrated. We are currently looking at introducing SSTT confinement as both strengthening and retrofitting solutions for the construction sector.

Keynote Address 2

Sustainable Food Waste Management Using Black Soldiers Fly Larvae: A Case Study in Pura Kencana, Johor

Noor Yasmin Zainun
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
nryasmin@uthm.edu.my

Abstract: Sustainable waste management can be described as the reduction of waste generation from any material source where this way benefits the social, economic and environment. About 70% of the solid waste generated is disposed of in landfills and typically contains more than 50% of food waste from the total daily waste. This indicates that food waste is one of the important factors which need to be focused in waste management. Therefore, this research is conducted to identify the production of food waste in Taman Pura Kencana, Johor, and establish decomposition rate of food waste by using Black Soldier Fly (BSF). The sample of respondents consists of residents and restaurant owners in Taman Pura Kencana. Food waste generation data were collected for 3 months from April to June 2021. Decomposition rate of food waste using black soldier flies (BSF) were determined based on five sample with 2.0, 2.5, 3.0, 3.5, and 4.0 kg of food waste while control sample was done with 2.0 kg of food waste without BSFL. Each of the samples received equal weight of larvae (0.1 g) which were 5-6 days old. The result showed that 889.9kg of food waste was produced every month in Pura Kencana. Results of the time taken for food waste to decompose by using BSFL showed that, the higher the amount of food waste, the higher the time taken for food waste to decompose. It can be supported by calculated coefficient of determination (R) which is 94%. It showed that 94% of the variation in the time taken for food waste to decompose is explained by the amount of food waste. Therefore, 1.0 kg of food waste will take 9 days to decompose by BSFL. In conclusion, BSFL can increase time taken to decompose food waste compare to natural composting process.

GCoMSE 2021 002-001

The Compressive Strength and Water Absorption of Railway's Concrete Sleepers Containing Palm Oil Fuel Ash (POFA) as A Cement Replacement Material

A S Nurfarhanna, A Suraya Hani, O Mohamad Hairi, J Zalipah, A H Noor Azlina, S Norhafizah and A Anizahyati
Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia, Pagoh, Malaysia
suraya@uthm.edu.my

Abstract. Railway's concrete sleepers demand high consumption of cement which generates higher energy assumption and carbon emission. Meanwhile, in Malaysia, around 100 tonnes of palm oil fuel ash (POFA) were disposed of in the landfill, which endangering environmental health. However, this POFA have pozzolanic properties that can be employed as cementitious material. Therefore, this study aimed to produce a sustainable concrete sleeper by using POFA as a cement replacement material focusing on the compressive strength and water absorption performance. Concrete samples with a strength grade of 55MPa and w/c of 0.35 were prepared with three design mixes containing 0% (control), 20% (POFA20), and 40% (POFA40) of POFA. For the compressive strength test, a compression machine was used. Meanwhile, the water absorption was measured at atmospheric pressure. Both tests were conducted at 7 and 28 days of curing age. The results show that as the curing age increases, their water absorption and compressive strength improves, indicating a pozzolanic reaction. In terms of POFA content, the water absorption increases by 14% and 54% for POFA20 and POFA40, respectively. Meanwhile, the compressive strength reduced by 39% for POFA20 and 67% for POFA40. Since POFA20 meets the standards, it is however applicable in slab tracks.

GCoMSE 2021 006-003

A Study on Mechanical Properties of High-Performance Concrete with Hybrid Fibers: Steel and Polypropylene

N V N Prabath and P Ramadoss
Department of Civil Engineering, Pondicherry Engineering College, India
prabathnvn5@gmail.com

Abstract. Due to extended use of concrete structures in military applications and runways, concrete structures are subjected to

heavy/impact loads that vary both in velocity and intensity. Addition of fibers helps concrete overcome its shortcomings such as low durability, high shrinkage, and less resistance to impact loading. The addition of fibers in high performance concrete (HPC) can overcome its shortcomings such as low durability, high shrinkage and less resistance and improve the brittle behavior and the energy absorption capacity. In this study, we focused to develop the strengthening of HPC using steel and Polypropylene fibers. Moreover, an increase in volume fractions of both steel and polypropylene fibers leads to an increase in the compressive, splitting tensile and flexural strengths of concrete. The experimental results showed that the use of hybrid fibers with 1.5% in HPC concrete has improved the strength of the concrete when compared to HSC and single fibers with HPC.

GCoMSE 2021 007-004

Investigation of Dynamic Factor, Rail Stress and Track Foundation Modulus of Ballasted Railway Track for Different Bed Conditions

Shanmugasekar Thenappan
Faculty of Civil Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
shanmugasekar@gmail.com

Abstract. The performance of track on structural condition are associated with the track deflection and stiffness. The track stiffness is the primary function of roadbeds thickness and subgrade characteristics. A simple numerical accurate method is required to determine the track stiffness. For this purpose, numerical scale track finite element technique representing the ballasted track with multi layered substructure founded on subgrade was simulated. The track deflection, stress was abstracted in static and dynamic conditions. The track significant design parameters; Foundation modulus i.e.,.(C) value, rail fatigue strength, rail bending stress, stress on subgrade levels were evaluated by using improved current track design numerical methods and compared against field test results which were carried out on MG Double track high speed main line, Gemas - Johor Bahru stretch. The investigation on the dynamic factor adopted in the design for the maximum designed speed of 160 kmph for the project track design was studied and compared with current methods. Mathematical equations were developed to correlate the variables; ballast thickness, settlement, track stiffness, rail bending stress and rail fatigue strength on varying subgrade soil modulus. Incorporation

of this parametric study will improve and optimise the conventional track design and maintenance standard.

GCoMSE 2021 014-005

Initial Implementation of Structural Health Monitoring System of A Railway Bridge

D A Purnomo, W A N Aspar, W Barasa, S M Harjono, P Sukamdo and T Fiantika
Center of Technology for Transportation System and Infrastructure, Indonesia
dwi.agus@bppt.go.id

Abstract. In order to determine the actual condition of the railway bridge structure in the field, predictive monitoring is needed by installing a structural health monitoring system (SHMS). In the process of applying the SHMS, a bridge design review was applied to have railway bridge characteristics. The purpose of conducting this design review is to determine the allowable threshold for deflection and vibration of the bridge. This paper will present the analysis of the steel frame structure; with a span of 51.60 meters, 4.45 meters wide, of 5.00 meters high, respectively. According to the applicable standards, the loads used following the function of the bridge on the railroad tracks are calculated. The purpose of this paper is to (1) analyze the strength of the attached profile against the working forces, especially the live load of the rail line, (2) to know the deflection that occurs, (3) to know the natural frequency that occurs, and (4) to develop expert systems. The simulation results are used as the basis for placing sensors on the bridge and as the basis for determining the threshold for the railway bridge SHMS.

GCoMSE 2021 013-007

Triaxial Testing on Geogrid-reinforced Granular Soils

Tigo Mindiastiwi, Po-Kai Wu, Agus Bambang Siswanto and Mukhamad Afif Salim
Department of Civil Engineering, Semarang University, Semarang, Indonesia
tigomindiastiwi@untagsmg.ac.id

Abstract. In this research study**,** a series of consolidated drained (CD) triaxial tests were performed to investigate the mechanical behaviour of unreinforced and geogrid-reinforced granular soils. The tested sand having its mean particle size (D_{50}) equal to 0.6 mm was adopted.

Three PET geogrids with different longitudinal and transverse nominal strength were used. The dimensions of the cylindrical soil specimen were 70 mm (diameter) × 160 mm (height). The relative density was equal to 70% for all tests. The reinforced sand specimens with one or two PET geogrid layers were sheared under effective confining pressures (σ'_3) equal to 50 kPa. The experimental results of unreinforced sand tests indicate that the maximum deviatoric stress $\Delta\sigma_d = (\sigma_1 - \sigma_3)$ increases with the increase in effective confining pressure (σ'_3), while the maximum principal stress ratio (σ'_1/σ'_3) decreases with the increase in effective confining pressure (σ'_3). Compared to unreinforced soil, all reinforced granular soil specimens have a higher peak shear strength that occurred at a larger axial strain and a reduced post-peak loss of the strength. The increased peak shear strength becomes more pronounced as the number of geogrid reinforcement layers and the nominal geogrid strength increases. The pseudo-cohesion concept theory was also implemented to interpret the increased shear strength of reinforced soil.

GCoMSE 2021 016-008

Effects of Different Expansive Agents on The Properties of Expansive Cementitious Materials

Abir Mahmood, A. B. M. Amrul Kaish, Sudharshan N. Raman, M. Jamil and Roszilah Hamid
Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Bangi, Malaysia
P108539@siswa.ukm.edu.my

Abstract. Cracking happens in the case of restricted volumetric shrinking in cementitious materials which has a negative influence on the mechanical characteristics and longevity of concrete materials and hence, reduces the life of concrete structures. Many techniques have been developed to reduce the shrinkage cracking of concrete among which, usage of expansive agents (EA) has been utilised for decades. Different types of EA create divergence due to its chemical characteristics. In this paper, three main categories (CaO, MgO & Sulphoaluminate based) EA have been reviewed based on four criteria of concrete structures, such as strength, expansibility, durability and flowability. The review clearly indicates that CaO-based EA boosts the strength but unable to control the temperature rise, which results in thermal cracking in the long run. While MgO-based EA is vastly used in China and Sulphoaluminate based EA have been

industrially used worldwide for decades, both of these agents can successfully compensate thermal shrinkage while maintaining adequate mechanical strength and durability. Beside all this differences, all types of EA have been reported to decelerate the flowability of the concrete.

GCoMSE 2021 020-012

A Competency Model of Thai SME Contractors for Owner Satisfaction in Construction Projects

Grit Ngowtanasuwan
Faculty of Architecture, Urban Design and Creative Arts, Mahasarakham University, Thailand
grit_n@hotmail.com

Abstract. For construction projects, service quality involves the project owners' perception of the process in terms of interactions, activities, and the attainment of acceptable levels of performance from construction activities. The competency of contractors includes the personality hidden within them and that can drive them to perform well or meet the criteria set in the construction projects for which they are responsible. The purpose of this study was to formulate a competency model for Thai SME contractors undertaking construction projects in northeast Thailand in order to influence the satisfaction of project owners by using a structural equation model (SEM). A total of 198 questionnaires that were completed and returned by project owners were analyzed to confirm the model. The research found that the competency of contractors comprised three factors, namely: (1) knowledge, (2) skills, and (3) attributes. Guidelines for strategies to improve the competency of Thai SME contractors are discussed and presented in the results of this research paper.

GCoMSE 2021 026-014

Numerical Analysis of Crack Propagation in Tubular Glass Column

Ahmed Waled Ahmed Abdullamohamed, Mohd Khairul Kamarudin and Mustafasanie M. Yussof
School of Civil Engineering, Universiti Teknologi MARA, Shah Alam, Malaysia
mkhairul3965@uitm.edu.my

Abstract. The demand for transparency has increased in the construction industry and contemporary architecture over the last decade. The prior researchers focused on columns made from glass because its uniqueness and its transparent characteristics generate an impressive visual feature. Past studies on structural glass entailed numerous experimental investigations, but FEA was applied in a few investigation exercises. The objectives of this study are to validate the experimental data and crack analysis in the tubular glass column and to determine the effectiveness of different slenderness ratios of the glass column. This study investigated the column structural behaviour under compression with different geometrical dimensions of hollow section laminated glass column to determine their load-carrying capacity, buckling performance, and failure mechanism. Finite element analysis using the explicit method was performed by using ABAQUS. The study found that the failure mechanisms depend on the slenderness ratio classified into two failure modes either buckling or crushing. The glass column failed due to buckling when the slenderness ratio is more than 40, while it failed due to crushing when the slenderness ratio is less than 40. The finite element analysis did not correlate perfectly with the experimental data since the FEA underestimating the glass performance.

GCoMSE 2021 027-015

Partial Replacement of Fine Aggregate Using Waste Materials in Concrete as Roof Tile: A Review

K Supar, F A A Rani, N L Mazlan and M K Musa
Centre of Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh, Malaysia
khairis@uthm.edu.my

Abstract. The use of waste material as a partial replacement has become popular in concrete mixture studies. Many researches have utilized waste materials like cement, fine aggregate, coarse aggregate, and reinforcing materials substitute. The current paper

focuses on some of the waste elements that are utilized in a concrete mortar (use in roof tile) as a partial replacement for fine aggregates such as rubber ash, sawdust, seashells, crumb rubber, pistachio shells, cinder sand, stone dust, and copper slag. There are many variations of mix proportion and water-cement ratio for every waste material. Compressive strength was compared and found that stone dust and the combination of seashell and coconut fiber shows an incensement when used to replacing fine aggregate. The suitable replacement level for stone dust is 25% and 50%. While the suitable replacement levels for the combination of sea shell and coconut fiber are 20% and 30%. Material from the rubber families such as rubber crumb and rubber ash is only suitable for replacement levels. Rubber families especially rubber crumbs have shown low water absorption value which is good in the production of roofing products. As we know, the roof should have waterproof properties to prevent any leaks from happening when it rains. Most of the waste materials added as fine aggregates in concrete have increased the amount of water absorption and found that sawdust is the most abundant material with a high percentage of water absorption compared to the others. Research on the partial replacement of fine aggregates replaced with waste materials is needed more extensively to provide more confidence about their use in concrete mortars, especially on roof tiles.

GCoMSE 2021 029-016

Study on End-of-Life Tires (ELTs) Recycling Strategy and Applications

Habiba Afrin, Nazmul Huda and Rouzbeh Abbasi
School of Engineering, Macquarie University, Australia
habiba.afrin@students.mq.edu.au

Abstract. Due to modernization and urbanization, the number of vehicles on the road is increasing day by day. Around 3 billion tires have been sold, and an equivalent amount of tires has been discarded each year. Even though the lifetime of the tires has been increased and the global pandemic issue, but according to the Australian Bureau of Statistics, the number of end-of-life tires is going to rise approximately 5 billion in a year. Because of its complex composition, this is the most tricky and difficult waste in the world to handle. Because it creates significant health and environmental problem by emitting harmful chemicals in the environment, working as a birthplace for pests, and prone to fire hazards. A significant number of

alternatives have been developed to dispose of waste tires. Application of waste tire as reinforcing layers in landfill, road pavement, drainage system, fuel source in the kiln, playground surface makes it an ideal material for affordable, medium-density, low-rise buildings that are highly valued worldwide. Moreover, the sound insulation and absorption with enhanced seismic resilience properties of the end-of-life tire can provide novel and effective engineering solutions. This paper focuses on different recycling strategies and civil engineering applications of end-of-life tires.

GCoMSE 2021 030-017

Enhancing The Shear-Resisting Capabilities of Concrete by Using Hybridized Synthetic Fibers

S M Iqbal S Zainal, Farzad Hejazi, Farah N A Abd. Aziz and Mohd Saleh Jaafar
Civil Engineering Program, Universiti Malaysia Sabah, Kota Kinabalu, Malaysia
iqbal.zainal@ums.edu.my

Abstract. There are numerous advantages of using fibers in cementitious composites especially in improving the mode of failure of concrete from brittle to either quasi brittle or ductile. Hence, this study was conducted to improve the shear strength and toughness of conventional concrete through fiber hybridisation of different types of synthetic fibers. A total of 16 Hybrid Fiber Reinforced Concrete (HyFRC) were developed to observe the impact of crucial synthetic fiber parameters such as fiber size, length, volume fraction, bonding power, materials and form on concrete shear-resisting capabilities. Direct shear tests were conducted for the hybrid concretes and it was observed that the fiber hybridization improved concrete shear strength by 32% (F-U hybrid), 24% (F-S hybrid), 44% (F-E hybrid) and 24% (F-N hybrid). The hybridisation compatibility between the combined fibers in HyFRC were further assessed for their synergistic effect under direct shear, and have been shown to produce positive synergy for all combinations especially during large crack openings. The application would be used for Reinforced Concrete (RC) structures in seismic-prone regions whereby the shear-load demand caused by vibrations may impose excessive load on critical structural components.

GCoMSE 2021 032-018

Sensor Modules for Enhancement of Safety Performance in Construction Safety Management

Mak Tuck Kiong, Loh Seng Yap, Eeydzah Aminudin and Rozana Zakaria
School of Civil Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
maktuckkiong@gmail.com

Abstract. The purpose of this study is to develop a Sensor module for enhancement of construction safety management for preventing and responding fast to accidents at construction sites. Safety management is very important in our construction as safety will taking into consideration the site characteristics. The technologies utilised in this research was a sensor module that consisted of device that gathered signals to become beacon signals. Therefore, this paper review, the whole understanding of the devices in order to ensure that the sensor module works well in the whole understanding of merging it with our safety performance to prevent accidents occurred on construction site. By providing location-based safety management services to the workers and allowing a speedy response in the event of accident. To develop a prototype sensor module that incorporated with vibrational and alarm signal for recognising accidents upon occurred for enhancement safety management at construction sites. The findings showed that the real-time location and context-aware information collected from the sensor module can be used to prevent accidents and respond quickly in the event of a fall.

GCoMSE 2021 029-019

An Overview of Eco-Friendly Alternatives as The Replacement of Cement in Concrete

Habiba Afrin, Nazmul Huda and Rouzbeh Abbasi
School of Engineering, Macquarie University, Australia
habiba.afrin@students.mq.edu.au

Abstract. Due to the global urbanization, economic development and growth of the world's population, the demand for the new buildings and infrastructure is increasing day by day. Manufacture of concrete has become an essential part of our life all over the world. Emitting 5-8% of Carbon-dioxide (CO_2), this is the main obstacle to reach into global climate action under the Paris Agreement. Reuse of waste or recycled waste materials in concrete as an environmentally friendly

construction material has become drawn attention as a sustainable feature of great concern, because of its potential environment and economic benefits. The goal of this review is to assess application of alternative eco-friendly replacement of cement for an innovative, economically attractive and environmentally friendly technology, and the underpinning science, to maximize resource implementation in concrete through waste recycling system and the transition towards of circular economy by reducing the amount of natural resources consumed. Based on the existing studies, waste material (fly ash, bottom ash, coal ash, tyre, steel slag, plastic etc) incorporated with concrete accepted performance in environment and economic perspective by reducing energy consumption, greenhouse gas emissions, costs and other indicators. However, transport distance of recycling waste, leaching with heavy metals or recycling process may hinder the potential benefit. In future, we need to focus on maintenance and rehabilitation besides new construction. Foremost it is the increasing use of cementitious materials that can serve as partial substitutes for Portland cement, those materials that are by-products of industrial processes, such as fly ash and ground granulated blast furnace slag, wood ash, waste glass, and so on. But also, the substitution of various recycled materials for aggregate has made significant progress worldwide, thereby reducing the need to quarry virgin aggregates. The most important source among these is recycled concrete aggregate, post-consumer glass, scrap tires, plastics, construction and demolition waste and by-products and other industrial products.

GCoMSE 2021 035-020

Talent as A Spearhead of Construction 4.0 Transformation: Analysis of Their Challenges

Santi Edra Nisa Lau, Eeydzah Aminudin, Rozana Zakaria, Chai Chang Saar, Ahmad Farhan Roslan, Zuhairi Abd Hamid, Maria Zura Mohd Zaina and Abdul Hadi Ahamad
School of Civil Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
santiedranisalau@gmail.com

Abstract. Many industries are investing in technology to accelerate digital transformation. Construction is also most likely to be digitalised based on current technology trends. However, technology adoption is only one of the ingredients in the overall recipe for successfully transforming the construction industry to an era of the fourth industrial

revolution (4IR). This transformation will also require additional changes for the employees. It is expected to significantly impact the talent landscape, ranging from job categories to skill sets. While this transformation holds excellent benefits, it also poses many challenges. This paper discusses the challenges that individuals, construction companies and governments faced from a talent perspective. The data is obtained from literature review results and content analysis through focus group discussion. A focus group discussion was conducted among experts with high knowledge in both the construction industry and 4IR. Information obtained from the discussion was used to identify and categorise the determining challenges. The study revealed nine (9) major talent challenges that the construction industry is currently facing, such as inadequate high skilled talent, lack of education and training to widen talent readiness, talent job security, lack of awareness or clarity of 4IR, dependency on outside talent, employer's readiness, negative attitude of future talent towards changes, the potential of emigration of highly trained or qualified talent, and strong resistance towards new changes and technologies. 4IR can be implemented effectively in the Malaysian construction industry if key challenges that hold the talent are overcome. In conclusion, an active role from quadruple helix collaboration will assist the transformation.

GCoMSE 2021 037-023

Prediction of Traffic Vibration Effect on Heritage Building at Muar, Johor, Malaysia

J S Ng, T N T Chik and N A Yusoff
Jamilus Research Centre, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
thayati@uthm.edu.my

Abstract. The vibration produced by road traffic can contribute to the long-term adverse effects on heritage structures. The objectives of this study were to analyse the dynamic response of the heritage building under time-dependent loads caused by traffic vibration by carried out the transient analysis in ANSYS and to determine the level of Vibration Criterion of the heritage building due to traffic vibration by using VSATs in MATLAB software. This research was to predict the traffic vibration effect on the old building of Telecom Muar at Johor, Malaysia. A field testing was carried out using a mobile application, iDynamics, to obtain the vibration signal induced by road traffic. The data obtained were analysed using ANSYS and MATLAB software. Two types of

analysis were carried out using ANSYS, which are modal analysis and transient analysis. MATLAB was used to obtain the vibration criteria plot (VC) for the building. The natural frequency of the fundamental mode shape was 2.57Hz. The natural frequency of the building is acceptable as it is below the human sensitivity frequency range. On the other hand, the level of vibration criteria of the building falls on VC-E, which is the lowest level in the Generic Vibration Criteria Plot implemented by Gordon (1991). In conclusion, both natural frequency and the vibration criteria of the selected building is acceptable according to the results obtained from the analysis conducted.

GCoMSE 2021 040-024

Soil Stabilization Using Polypropylene Clamshell Food Containers

N A C M Salwi and N Hamzah
School of Civil Engineering, Universiti Teknologi MARA, Shah Alam, Malaysia
nurazura03@gmail.com

Abstract. Soil stabilization is the method of improving the physical properties of soil such as shear strength and bearing capacity of soil by using controlled compaction or addition of admixtures to produce an improved soil material which has all the desired engineering properties. The new technique of soil stabilization using plastic wastes as an alternative material since plastic wastes are non-biodegradable and remained intact after being buried in soil for many years. The present study is focused to investigate the effectiveness of utilizing polypropylene clamshell food containers as soil stabilizer. The physical properties of the untreated clayey soil are determined by conducting moisture content, specific gravity, particle size distribution, and Atterberg limit test. Also, the Standard Proctor compaction test as well as Unconfined Compressive Strength test are carried out to determine the compaction and strength parameters of the soil sample before and after reinforcing with different percentage of polypropylene clamshell food container strips such as 0.4%, 0.8%, and 1.2%. Test results are analysed and investigated to determine the effectiveness of polypropylene clamshell food container strips on strength characteristics of clayey soil. Successful implementation of polypropylene plastic in soil stabilization can help to minimize the volume of plastic waste in the environment which then lead to develop a sustainable future by utilizing recyclable material as alternative sources in geotechnical field.

GCoMSE 2021 038-025

The Study of Kenaf Powder Performance in Mortar

S S Ayop, S Rasli, S N Moharam, M S Wahab and N Sa'ude
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
sallehs@uthm.edu.my

Abstract. As cement is essential in producing mortar, reforms and innovations are needed to reduce the adverse effects of CO2 in the future. The objectives of this study were to determine the optimal amount of kenaf powder in mortar strength and to examine the mechanical and flexural properties of kenaf powder in the mortar. Thirty-six mortar cubes of 50 mm x 50 mm x 50 mm and 12 number of mortar prism were cast using mix ratio of 1:3 with two different water-cement ratios. The replacement of kenaf powder ranging from 10% to 20% to the cement matrix were tested to investigate the mechanical parameters such as workability, density, compressive strength, and water absorption capabilities. Furthermore flexural strength were assessed using a similar mix proportion. The mortar containing 10% of kenaf powder and superplasticizer additives had demonstrated the best performance in compressive strength and flexural strength besides it improved the water absorption rate.

GCoMSE 2021 041-026

Numerical Modelling Observations of Settlement for Pad Footings Supported on Soft Clay Soil

O A Arab and A J M S Lim
Research Centre for Soft Soil, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
alvin@uthm.edu.my

Abstract. Settlement calculation is an important part in the design of shallow foundations resting on soft soils. The size of the foundation, the depth of the footings, and the rise in ground water level are thought to have an effect on settlement and have been the subject of much research for many years. Thus, this study compared several pad footing sizes using numerical techniques as the basis. The first objective of this study was to analyse soil and pad footing settlement, and to determine the optimal size of footing that withstands excessive settlement due to variation in the water table and the depth of the foundation. Three footing embedment depths of 1.5, 2, and 3m with

three water table positions, at the GL (0m), 1.5 m, and 3 m with an applied foundation concentrated load of 440 kN using five footing models of 1.5 m x 1.5 m, 2 m x 1.5 m, 2 m x 2 m, 2.5 m x 1.5 m, and 2.5 m x 1.5 m pad footing with a uniform thickness of 0.5 m were considered. In this study, a 3D Plaxis simulation is used for predicting the settlement of shallow foundations on soft clay soils. Settlement results were discovered at various water table positions and foundation depths. The study found that the 2.5 m x 2 m footing was deemed the best among the simulated foundations, and the 3 m foundation embedment was considered the best at shallow depths due to less excessive settlement than the other tested foundations. The settlement had a significant impact on the size of the foundation and the depth of the footing. The depth of the water table has a small impact on the settlement. Parametric analysis is also being used to gain a better understanding of the behaviour of the elastic settlement of various shallow foundations.

GCoMSE 2021 034-027

Optimisation of Bolted Connection in Steel Corbel Attach to RC Column of MRT Viaduct

Yazmin Sahol Hamid, Hazrina Mansor, Amir Atif Abdul Razak, Haikal Ajmal Bin Bukhory and Nursafarina Ahmad
School of Civil Engineering, Universiti Teknologi MARA, Shah Alam, Malaysia
yazminsahol@uitm.edu.my

Abstract. Mass rapid transit (MRT) is at the forefront of metro rail developments in Malaysia, and it is one of the backbones of a city's public transportation system, capable of carrying large crowds. The use of a portal frame in the design of an MRT train station has raised significant concerns about how the portal frame's load will be supported by the extended structure element known as a corbel. A corbel is a protruding structural element that supports weights like primary beams and girders. Engineers must then decide how to properly bolt the steel corbel structure to the concrete pier segment. This research studies the strength of steel corbel connection using a finite element software i.e., STAAD.Pro. In this study, both directions of the load will be applied on the corbel which is the vertical and horizontal load which causes creep, shrinkage and temperature deformation of the beams. The results obtained from the finite element modelling assess the stress distribution gradients on the bolt, nuts and steel plates which are compared with Eurocodes and British

Standards. Optimisation are done in terms of bolt numbers, bolt diameters, end plates thickness and beam web thickness. Apart from FEA modelling, the manual calculations are carried out to assess the bolt adequacy against deflection, shear resistance, bearing resistance, tension resistance, slip resistance and block tearing. Besides, the design of end plate is checked whether it can resist the shear resistance and local buckling. These parameters are important to ensure that the design is adequate, economical yet safe according to the relevant code of practice.

GCoMSE 2021 036-028

Industrial Building System (IBS): A Unique Intra-Module Connection on Modular Steel Building (MSB)

M A Gapar, M F Razali, H Mansor and Y S Hamid
School of Civil Engineering, Universiti Teknologi MARA, Shah Alam, Malaysia
hazrina4476@uitm.edu.my

Abstract. Modular Steel Building (MSB) provide benefits towards green building technology such as minimum wastage, faster build time and cost efficient. To effectively tie a module together, an intra-module connection must has sufficient strength to cater vertical and horizontal loads. The intra-module connection is the most important element in MSB construction as it strongly influences the overall structural stability and robustness. Recent shows that lack of study in intra-module connection especially in progressive collapse. In the progressive collapse design, a connection must be able to resist large tensile demands under catenary-like mechanism and bridge over the axial load that was initially carried by a failed member. A novel intra-module connection was proposed for MSB. The proposal was designed to suit the illustrative of five-storey hexagon shape modular steel building that possibly imagine by Architect. Two analyses phases being proposed, namely Macro and Micro analysis model. The former is the stage for global analysis design of the proposed five-storey hexagon shape modular steel building and the latter is the analysis of the local intra-module connection behaviour. Linear and nonlinear static analysis were carried out on the intra-module connection under shear and lateral load respectively. It is anticipating that the proposed novel intra-module connection, will give a promising contribution and promote flexibility for Architects to use modular steel construction design without limited only for conventional modular construction which are designed either in square or rectangular shape.

GCoMSE 2021 042-029

Performance of Eco Engineered Cementitious Composites Containing Supplementary Cementitious Materials as a Binder and Recycled Concrete Fines as Fine Aggregate

M R Md Zain, C L Oh and L S Wee
School of Civil Engineering, Universiti Teknologi MARA, Shah Alam, Malaysia
raizam@uitm.edu.my

Abstract. Engineered cementitious composites (ECC) mixtures demand a large cement content, which is detrimental to their sustainable development because mass cement production is hazardous to the environment and human health. Thus, this paper investigates the mechanical performance of eco engineered cementitious composites (ECC) under axial compressive loading and direct tensile strength tests. The eco ECC used in this investigation was comprised of cement, superplasticizer, fly ash (FA) or ground granulated blast furnace slag (GGBS), water, polypropylene (PP) fibre and recycled concrete fines (RCF). Two (2) eco ECC mixture series were designed and prepared. G70 (70 percent GGBS + 30 percent cement), F70 (70 percent Fly Ash + 30 percent cement), G80 (80 percent GGBS + 20 percent cement), and F80 (80 percent Fly Ash + 20 percent cement) are the four Cement-GGBS and Cement-Fly Ash combinations examined in this study. Also, every combination had two different RCF percentages, R0.2 (0.2 percent RCF) and R0.4 (0.4 percent RCF). The main objective of this study is to determine the optimum mix design for eco ECC that contains supplementary Cementitious Materials (SCMs) such as GGBS or FA. Additionally, recycled concrete fines (RCF) were used as a substitute for fine aggregate. The influence of different cement replacement materials and RCF content on compressive and tensile strength was experimentally investigated. The inclusion of GGBS as a partial replacement of cement in the eco concrete mixture results in greater compressive strength than Fly Ash (FA). The test results revealed that increasing the RCF content in the ECC mixture resulted in higher compressive and tensile strength. When the sand to binder ratio was adjusted between 0.2 and 0.4, the compressive and tensile strength of the ECC mixture increased.

GCoMSE 2021 015-030

Thermal Comfort Assessment of an Office Room Under High Air Conditioning Setting Temperatures with Fan-Assisted Ventilation

M A Zakaria, M S Amran, S A Rozmi, PC Leng, M N Yasin and M H Hanipah
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
azuanz9595@gmail.com

Abstract. The usage of air-conditioning system to provide comfortable indoor condition is found necessary especially for hot-and warm country. However, the excessive use of air-conditioning system or without properly controlled will significantly affected the energy consumption of the building and also environment badly. This study investigates the strategy to reduce energy for cooling in an office building by utilizing high setting temperature of air conditioning system with the addition of fan ventilation by field measurement. About 9 study cases have been investigated which includes the air-conditioning setting of 27°C to 28°C, with and without fan assisted ventilation. The measured physical thermal comfort parameters are the air temperature, relative humidity, wind speed and black globe temperature. The operative temperature and Predicted Mean Vote value (PMV) have been calculated for each study cases for analysis. The results revealed that the comfortable condition with neutral sensation can be achieved by air-conditioning setting of 28°C with air speed of 1 m/s-1.2m/s. Moreover, the results shows that the room with 27°C-28°C setting temperature was under comfortable condition before afternoon hours, while fan-assisted ventilation is required to enhance the comfortable hours through the rest working hour. By this practice, it is expected the energy consumption and cooling load of building can be reduced.

GCoMSE 2021 043-033

Shear Strengthening of Reinforced Concrete Beams Using Fibre Reinforced Polymer: A Critical Review

S J S Hakim, M A H Mohd Rodzi, S S Ayop, S N Mokhatar and N Salleh
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
seyedhakim@uthm.edu.my

Abstract. The primary purpose of reinforcing bar stirrups in a reinforced concrete beam is to improve shear strength. The FRP system may significantly improve a concrete beam's ultimate shear strength, serviceability, and ductility. The application of FRP for the repair and reinforcement of the structures has become very popular due to its low weight, high tensile strength, and simplicity of installation on uneven surfaces. FRP material outperforms other traditional materials in strengthening applications due to its high strength-to-weight and stiffness-to-weight ratios, resistance to corrosion, and ease of handling. The overall objective of this research is to investigate and improve the understanding of the recent research in the area of shear FRP strengthening of reinforced concrete beams. In this paper, recent publications were reviewed to see how different anchoring procedures, different factors that affect FRP performance and different failure scenarios affect the shear strengthening of concrete beams. The benefits and limits of FRP systems, as well as some current research trends are discussed in this project. From the research, it can be stated that type of anchorage technique and different parameter give a different impact to failure mode of the beam.

GCoMSE 2021 045-034

Numerical Simulation of Modified Rubberized Concrete Block Under Impact Loads

S N Mokhatar, T Y Pei, N A N A Mutalib and S J S Hakim
Structural Dynamics and Computational Engineering Focus Group, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
shahruln@uthm.edu.my

Abstract. Rubberized Concrete was innovated by many researchers to enhance energy absorption under impact load and by reusing scrap tires. Thus, this research was aims to develop the numerical procedure using the Finite Element Method (FEM) to simulate

modified rubberized concrete under impact loads and predict its energy absorption under different impact loads. Three existing constitutive models: Concrete Damage Plasticity (CDP), Drucker-Prager (DP), and Modified Drucker-Prager Cap (MDPC) available in ABAQUS software were used to replicate the rubberized concrete with 10% of Rice Hush Ash (RHA) as cement substitution and different percentages (0%, 5%, 10%, 15%, and 20%) of crumb rubber as sand replacement. All three models produced successful FEM results with reasonable modelling assumption, and the CDP model was more effective in simulating rubberized concrete under impact to predict energy absorption than DP and MDPC models. Further, it was concluded that crumb rubber could enhance the energy absorption of concrete. Generally, the energy absorption of the concrete increased as the crumb rubber increase. However, the strength decreased as the crumb rubber increased, but 10% of RHA in concrete mix can maintain the concrete strength. Overall, this study reveals that FEM incorporated with CDP model are able to predict the impact response of modified crumber rubber as an application of concrete road barrier.

GCoMSE 2021 044-035

A Review on The Performance of Waste Glass as Partial Replacement of Fine Aggregate

Norfaniza Mokhtar and Nurul Atikah Jalani
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
norfaniza@uthm.edu.my

Abstract. Waste glass is one of the biggest contributors in waste production in Malaysia. Waste glass is one of the materials that can be used as partial sand replacement in concrete. Silica exists in waste glass components made it is a pozzolanic material and suitable to be used in a concrete mixture. The performance of the waste glass as fine aggregate on the workability of fresh concrete, the compressive strength, and the split tensile of hardened concrete was reviewed. The waste glass replacement percentage that was selected for review are 0%, 10%, 20% and 30%. The influence of the waste glass on the microstructure of the concrete was also been evaluated. A total of Eleven previous research papers were collected to extract the data based on the parameters. The review results shows that all parameters show a positive result mostly at 20% waste glass replacement. The microstructure of the waste glass concrete shows that more voids created after 20% waste glass replacement which

affects the compressive strength and split tensile strength of the concrete thus make the optimum replacement percentage is 20% replacement.

GCoMSE 2021 046-036

Study on Mechanical Properties of Foamed Concrete Incorporating Palm Oil Fuel Ash and Mussel Shell as Partial Cement Replacement

A F Rahman, W I Goh, N H Othman and M S Kamaruddin
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
wigoh@uthm.edu.my

Abstract. Concept of sustainable construction has gradually become one of the concern issues in our construction industry in recent years. Concrete which acts as an important construction material has contributed to excessive consumption of natural resources. Simultaneously, tonnes of waste materials were produced from agricultural activity in form of palm oil fuel ash (POFA) while mussel shell from marine hatchery. Utilization of agricultural waste as cement replacement is an option to reduce the environmental impact from the construction industry. In this study, these waste materials were used as partial cement replacement to produce foamed concrete in wet density of 1800 kg/m 3 . The main purpose of this research is to study the workability and mechanical properties of foamed concrete which contain uniform 20% of POFA combined with 5% to 10% of mussel shell powder and mussel shell ash respectively. The cube specimens were cast in dimension 100 mm x 100 mm x100 mm to test the compressive strength at 7th and 28th. The cylinder specimens were cast in 100 mm diameter x 200 mm diameter for split tensile test to determine the tensile strength and compression test to determine modulus of elasticity at 28th day. The result showed workability of foamed concrete decreased as more cement was replaced by POFA combined with MSP and MSA. Foamed concrete mixture with 20% POFA and 5% MSP was selected as optimum percentage of cement replacement due to reduction less than 5% compromised performance in compressive strength at 16.52MPa while tensile strength at 1.83MPa.

GCoMSE 2021 049-039

Barriers to the Adoption of Engineering Controls in Reducing Risk Due to Dust Exposure to Masonry Work

N H Abas, M Mad Ali and N A Abas
Jamilus Research Centre, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
nhaslin@uthm.edu.m

Abstract. The construction industry is known to be among the most vulnerable industries in terms of occupational safety and health. One of the riskiest activities in construction involves masonry, which reports several cases involving occupational health diseases due to the exposure to silica dust. Thus, this study aims to investigate the perception toward health risks due to exposure to dust in masonry work. A survey research method was adopted for this study, which involved the participation of 25 active construction contractors in Selangor and Kuala Lumpur. The findings reveal that respiratory problems and health diseases are the most perceived risks associated to dust exposure in masonry work. There are various barriers to the adoption of engineering control in masonry work such as high costs, lack of awareness of dust hazards, and workers' attitudes. The current practical intervention methods used by contractor firms are respiratory protection, wet method, and sweeping compound. This study provides information on the current masonry work environment and the barriers of the adoption of engineering control technologies. Additionally, this study suggests that the key players in the construction industry should take an active part to increase the implementation of engineering controls in a construction project, and not rely solely on the use of PPE.

GCoMSE 2021 050-040

Study on Workability High Strength Concrete Containing Pineapple Leaf Fiber (PALF)

J Hadipramana, F V Riza, T.Amirsyah, S N Mokhatar and M Ardiansyah
Faculty of Engineering, Universitas Muhammadiyah Sumatera Utara, Indonesia
fetravenny@umsu.ac.id

Abstract. The addition of fibers in concrete increases bridging force in interfacial transition zones inside the concrete matrix. Pineapple Leaf Fiber (PALF) is a natural fiber that has the potential to replace artificial fibers as reinforcement on concrete. As reinforcement fiber in

concrete, PALF will undergo fibrillation and water absorption in concrete mixture and will change the mechanical properties of fresh concrete. So the purpose of this study is to study the workability characteristics of fresh state concrete given PALF. Some variations of PALF composition are 0.04, 0.09, and 0.15 % wt. of cement is mixed into fresh concrete mixture with water-cement (w/c) ratio variations of 0.35, 0.38, and 0.41. The planned concrete is high-strength concrete, then the provisions of determination of coarse and fine aggregates using sieve analysis according to high-strength concrete material standards and concrete mixtures are given superplasticizer 0.09% wt. of cement constantly for all mixtures. Determine the workability of fresh concrete using the slump test as a test tool. The increase in concrete strength was achieved in the addition of PALF composition in concrete compared to control (normal concrete), in addition to the tendency of the relationship between w/c ratio, slump value, and compressive strength in all PALF variations achieved in this study.

GCoMSE 2021 051-041

Effects of Section Properties on Structural Behaviour and Failure Mode of Built-Up CFS Columns

W H Cheah, Z M Jaini, S N Mokhatar, S J Seyed Hakim, M Abu Seman and M Kozlowski
Structural Dynamics and Computational Engineering Focus Group, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
rizuan@uthm.edu.my

Abstract. Built-up CFS column is a type of structures that can be classified as industrialized building system. This column has been widely used in the construction industry. It has relatively lightweight, easy to fabricate and provide efficient installation, thus suitable for the construction with difficulty in accessibility. However, main issue that arise from built-up CFS column is its bearing capacity. The ultimate strength and displacement of built-up CFS column are prominently governed by its section properties such as size and thickness. Therefore, this study intends to investigate the effects of section properties on the structural behaviour and failure mode of built-up CFS column. The three-dimensional of built-up CFS column was modelled in WELSIM, taking into account the nonlinearities of geometry, material criterion and contact surface. It was found that the built-up CFS column attains ultimate strength of 53.33 kN to 210.6 kN and displacement around 1.33 mm to 2.98 mm. When the size and thickness of square hollow sections are increased, the ultimate

strength increases simultaneously but the displacement shows a decrement trend. Under compression force, it was observed that the built-up CFS column suffers distortional and flexural buckling as well as connector and stiffener failures.

GCoMSE 2021 052-042

A Study of The Practical Use of Green Engineering-Based Technology for Building Sustainability: Users' Perspective

Amirul Hakim Hasan and Sushilawati Ismail
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia Parit Raja, MALAYSIA
sushila@uthm.edu.my

Abstract. Sustainable construction has been the main priority in the global construction industry. For that reason, Malaysia is moving towards green building approach to promote built environment sustainability. Therefore, it is essential to raise awareness about the environmental-responsible practice among construction players particularly on the implementation of green engineering-based technology. This study aims to explore the existing green engineering-based technology and to investigate the preferred green engineering-based technology to upgrade the sustainability of existing residential buildings. The study focuses on the existing technology to be incorporated in the operation of buildings. A comprehensive literature review was carried out and 384 feedback was collected from questionnaire survey distribution among respondents in Johor Bahru. Various green engineering-based technology includes solar energy, wastewater treatment, rainwater harvesting, window shading, housing landscape, natural ventilation, smart PDLC film glasses, roof thermal insulation, and smart home control panel are discussed in this paper. From this study, it was found that that the housing landscape is the most preferred with the highest mean index value followed by daylighting system and solar panel. The results indicate the preferred green engineering-based technology is because of low cost and familiarity among users. The future study should consider relating the awareness of individuals on sustainability with their preferred green technology. Perhaps, the coverage of this study should be extended by involving respondents from all over Malaysia.

GCoMSE 2021 053-043

Readiness of Malaysian Small and Medium Enterprises (SMEs) Construction Companies for Building Information Modelling (BIM) Implementation

Nur Khaliesah Arif, Muhammad Fikri Hasmori, Mohd Norazam Yasin and Mohd Afiq Mohd Yassin
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
mfikri@uthm.edu.my

Abstract. Building Information Modelling (BIM) has shown its efficiency in helping the construction industry players. The BIM has thus helped to achieve better integration of project information and to enhance collaboration between stakeholders and the industry players from the early phase of projects. Small and medium-sized companies (SMEs) have been under-represented in studies on BIM adoption. Despite the fact that the technology to implement BIM is readily available and rapidly maturing, the adoption of BIM is still slow. Many governments support adoption of BIM-oriented Integrated Design (ID) approaches on their national markets, however the implementation of BIM software support system among Small and Medium Enterprises (SMEs) in Malaysia is considered inadequate. In terms of the implementation of information technology, the construction sector in Malaysia still lags behind other sectors. In order to have a better knowledge of BIM in SMEs, it is important to first identify the major barriers to BIM adoption in SMEs and then examine potential solutions. Hence, the main motivation of this study is to investigate the readiness of Malaysian SMEs construction companies for BIM implementation, determine the challenges to implement BIM and develop strategy to overcome the challenges. An online questionnaire survey was planned to accomplish these aims and Statistical Package for the Social Science (SPSS) data analysis are carried out. Quantitative approach was used which the data obtained from a set of questionnaires encoded in the form of numbers and put in as a statistical analysis. This study uses a descriptive research method which uses structured questionnaires by revising research questionnaires from previous study. The findings of this research have expected to bring a result that determine contemporary barriers and challenges and have provided an adequate strategy to help organisations to fully implement BIM that will lead to the total readiness of BIM implementation.

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Strength of Modified Foam Concrete Filled Hollow Section Using Fly Ash as Sand Replacement

Norashidah Abd Rahman, Nurul 'Adilah Anati Murad, Ahmad Hazim Ahmad Firdaus, Nurul Syahirah Ramli and Siti Amirah Azra Khairuddin

Composite Structural Engineering Technology Focus Group, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia

nrashida@uthm.edu.my

Abstract. Concrete-filled hollow section (CFHS) application has widely used. It has been a decade where the steel construction industry using hollow section for the columns, beams and trusses. CFHS used due to its aesthetic efficiency and to improve the load carrying capacity. However, the use of normal concrete infilled hollow section (NCFHS) has increased the dead load of the structure. To reduce the structure's dead weight, a modified foam concrete filled hollow section using fly ash as sand replacement (FCFHS-FA) is proposed. The purpose of this study is to determine the strength performance of FCFHS-FA structure by using two types of steel hollow section thickness and compare the strength between foamed concrete filled hollow section (FCFHS) and FCFHS-FA. Steel, preformed foam and fly ash is used to increase the strength. 9 specimens were prepared and compression test was conducted. The strength index was calculated to compare the strength of NCFHS with FCFHS-FA. The result from this study is show the FCFHS-FA has similar strength index compare to FCFHS.

GCoMSE 2021 057-046

Assessments of Acoustical Performance of Classrooms and Teachers' Acoustical Comfort in The School Environment – A Case Study in Sek. Keb. Bukit Soga, Batu Pahat, Malaysia

Tong Yean Ghing, Noordina Md Amin, Mohd Hanifi Othman, Udom Ewon, Mohamad Amerul Zuwairi Mohd Zaim and Daisyanne Asha Robert Dass
Faculty of Civil Engineering and Built Environment, University Tun Hussein Onn Malaysia, Parit Raja, Malaysia
ygtong@uthm.edu.my

Abstract. An acoustic comfort in a classroom is significant to preserve the health and enhance scholastics performances of both students and teachers. The aim of this study is to evaluate the acoustic comfort in the primary school of SK Bukit Soga, Batu Pahat through objective and subjective evaluations. Field measurements were carried out to measure the background noise and reverberation time inside the classrooms. A total of six classrooms were tested to investigate the acoustic performance of the learning spaces of this school. Besides, questionnaires survey and interviews also have been conducted to assess the acoustic comfort of the teachers during the teaching and learning process. The background noise and reverberation times inside all tested classrooms were very high compared to the recommended values. The results from the survey showed that teachers were not satisfied with the acoustics comfort of this school environment.

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Comprehensive Review of 3D Concrete Printing by Using Ground Granulated Blast-Furnace Slag

Nur Syahera Jamalulail and Norhafizah Salleh
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
nhafizah@uthm.edu.my

Abstract. 3D building printing is a technology for producing 3D models of an object to build any shape or size in layers by using computer software. The development of 3D printing was going to be more famous and commercial in the future to reduce the construction cost and labor demands, sustainability, and to the greenest way. Concrete

is the mixture that consists of the ingredients of water, binder (cement) and aggregates (rock, sand, gravel). The productions of Portland cement in construction leads to the emissions of carbon dioxide (CO2) gas into the air. Waste material has been used as cement replacement in this research study to reduce carbon dioxide (CO2) gas emissions. This research study was going to evaluate the viability of concrete for 3D printing and printing emphasizing the impact on potential opportunities of this innovative industry. The behaviour of 3D concrete printing and potential of modified mortar in 3D concrete mix design by using Ground Granulated Blast-Furnace Slag (GGBS) is used to evaluate the potential uses of GGBS in concrete mixture for 3D building printing. This research study involved the review of concrete compressive strength and workability of 3D concrete printing with the control aspect during process manufacturing. The result shows that the mix design of 3D concrete printing with 30% and 40% produced concrete strength of 47.33MPa and 47.67MPa respectively. Furthermore, control aspect requirements of concrete for 3D printing were discussed in the field extrudability, flowability, buildability, strength between layers, aggregates, and water-cement ratio. Throughout this study, the manufactures of 3D building printing materials using environmentally friendly elements can contribute effectively create a sustainable environment automatically.

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Study of Life Cycle Assessment of Bricks and The Impacts to The Environment in Malaysia

Haikal Adnan and Ali Tighnavard Balasbaneh
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
wanhaikalhakim@gmail.com

Abstract. Life cycle assessment (LCA) is conducted in order to evaluate the environmental impacts of products chosen from the manufacturing phase and the end-of life cycle of the material and in clay brick and concrete were chose as the observed products. Brick is one of the important construction materials that can be seen at the surrounding. Main objective for this study is to investigate the impact of production of different types of brick to the level of emissions of carbon dioxide to the environment. Four stages of life cycle assessment were conducted before the result for the study analysis can be obtained and that stages including goal and scope definition, life cycle inventory (LCI), life cycle impact assessment (LCIA) and the

interpretation part. The results obtained from the simulation of the Simapro shown that the concrete contributes more negative impact compared production of clay brick in terms of global warming, ozone depletion, formation of fine particulate matter and ozone formation. Manufacture of clay brick contributes more negative impact to the ionizing radiation, freshwater eutrophication and mineral resource scarcity.

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Flexural Capacity of RC Beams with Opening Strengthened Using CFRP Sheet

M M Jusoh, N Ali, N A Abdul Hamid, N Salleh, S R Abdullah and S Shahidan
Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Malaysia
wirda@uthm.edu.my

Abstract. The use of Carbon Fibre Reinforced Polymer (CFRP) in strengthening has found to be an effective material which comprises of characteristic that comply to the requirement of structural component. CFRP was selected as strengthening material because of the capability to resist the corrosion and could regain the loss capacity due to presence of opening. The opening in structural member was essential in order to provide the route for the utility pipe, air conditioning, water supply and electrical conduit. However, the presence of opening has contributed to the reduction of stiffness, increase of deflection and extension of cracking of the beams. Therefore, this research was conducted to overcome the problem where the flexural capacity and the load deflection behavior of RC beam with opening strengthened by using CFRP sheet was analyzed. The specimens consist of five beams with different type of opening which are rectangular and circular. The size of all specimen was 200 mm width, 250 mm height and 2000 mm for total length. The size of circular opening was 150 mm in diameter while rectangular opening was 150 x 200 mm. Bi-directional CFRP sheet were applied at the opening area as strengthening material and all beams were tested until failure. All of specimen were produced by using 30 mm concrete cover, 6 mm link size and 10mm main bar size. The testing of specimens comprises of cube compressive test and four-point load for beam testing in order the determine the flexural strength of RC beam. The result from this research indicated that strengthened beam with

circular opening which is SBOC-BI exhibit the highest ultimate load of 71.5 kN with flexural failure as the mode failure.

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Key Design Issues in Construction Project: Conceptual and Detail Design Review Phases

N N Sarbini, A N Abdul Aziz and A N Mazlan
School of Civil Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
noornabilah@utm.my

Abstract. Malaysian construction industry among the highest industry which contributes to the accident and fatality rates. The occupational, safety and health in construction industry management (OSHCIM) has introduced a design risk reduction in construction industry by determining root causes and mitigate the risk by control the causation of accidents. The objective of this study is to identify the key design issues during the conceptual and detail design review phases in construction project. Although some of the design consideration has been proposed by the guideline of OSCHIM, however, further implementation need to be diverse and versatile by considering the current design practice that already being practices by the industry practitioners. The methodology of this research involves document reviews and survey questionnaire that was collected from the respondents in the construction industry. The results was found that the key design issues are; site condition, environmental influence, ground/ground water condition, existing structure, demolition, services/utilities, proximity to major infrastructure, traffic disruption, access for works, proximity to other property & projects, site restriction, mechanized construction system, installation of prefabrication, ease of process, structural opening, edge line, fall hazard, accident prevention, layout optimization, ease of activities, permanent safety features, provision of access and fall hazard. However, it is a duty of construction industry practitioners to make sure that all other design issues to be also included into their construction project risk analysis. As proposed by the OSHCIM guideline, the review of design risks in construction project should considered a safe construction, operation, maintenance, modification and demolition stages.