The 5th International Conference on Geotechnics, Civil Engineering Works and Structures

ABSTRACT BOOK

CIGOS 2019

INNOVATION FOR SUSTAINABLE INFRASTRUCTURE

Editors

Cuong Ha-Minh – Dong Van Dao

Farid Benboudjema – Sybil Derrible

Dat Vu Khoa Huynh – Anh Minh Tang

Table of contents

Unsorted abstracts

Keynote lectures

Four Decades of Computing in Civil Engineering

Hojjat Adeli *† [1]

[1] The Ohio State University, Columbus, Ohio – United States

This paper presents the author's perspective on four decades of computing in civil engineering. Examples of research by the author and his associates published during the past four decades are briefly described. They include artificial intelligence and expert system technology, computer-aided design and engineering (CAD/CAE), computer animation, object-oriented technology, database management, solid modelling, parallel processing and supercomputing, distributed computing on a cluster of workstations, neural networks, evolutionary computing and genetic algorithms, case-based reasoning, machine learning, fractality and chaos theory, wavelet transform, and web-based computing. It is argued that the introduction of novel computing ideas into the oldest engineering field has made the field more exciting. It has helped create new technologies such as semi-active vibration control and health monitoring of large structures and intelligent freeways, and automate processes that were unthinkable otherwise.

Keywords: artificial intelligence, machine learning, structural health monitoring

*Speaker
†Corresponding author: adeli.1@osu.edu

Industrialized construction of medium span concrete bridges using movable false work

Jose Turmo *† [1]

[1] Universitat Politècnica de Catalunya, 08034 Barcelona – Spain

Modern geometrical requirements for high capacity ground infrastructure, as highways or high speed train lines, imply increasing numbers of long tunnels and viaducts in mountainous countries. Moreover, for the sake of the environment, only some selected construction methods are eligible for sensitive areas. Long viaducts are usually solved by means of medium span concrete viaducts. For the sake of quality and health and safety, industrialized construction methods, as launching girders or precast construction, is usually preferred. The paper will describe the pros and cons of some construction methods using movable trusses to hold in place either the formwork or precast segments, emphasizing the possibilities of reducing the critical path. New construction sequences, non-standardized structural details, static and dynamic tests, reinforcing criteria, structural response, finite element model analysis and recent already built examples will be described to illustrate the possibilities of the methods.

Keywords: Movable Scaffolding System, Industrialized Construction, Medium Span Bridges

*Speaker
†Corresponding author: jose.turmo@upc.edu

Using Simulation to Estimate and Forecast Transportation Metrics: Lessons Learned

L. R. Rilett *† [1]

[1] University of Nebraska-Lincoln – 1400 R StreetLincoln, NE 68588, United States

In recent years transportation planners and engineers have begun to utilize traffic simulation models to estimate and forecast new transportation operations and reliability metrics. For example, the Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis (HCM-6) has recently adopted 1) passenger car estimation methods that are based on the microsimulation model VISSIM, and 2) urban arterial reliability estimation methods that are based on a Monte Carlos simulation technique. The advantage to simulation methods is that the metrics, which may be based on central tendency (e.g. mean, median), dispersion (variance, percentile), or even a combination of other metrics (e.g. reliability index), may be easily calculated and/or estimated. For this reason, the number of metrics developed and used has continued to increase. As one example, many researchers over the past decade have focused on developing and estimating metrics related to network reliability and resilience. However, it is an open research question on when and where these simulation approaches are appropriate to use. This paper will discuss a number of issues related to using simulation for estimating transportation metrics with a focus on model assumptions and model calibration. Specific examples from real-world test beds will be provided. Lastly, the paper will provide an overview of lessons learned and areas of future research.

Keywords: Calibration, Validation, Simulation, Transportation Metrics

*Speaker
†Corresponding author: lrilett2@unl.edu

eHighway – An Infrastructure for Sustainable Road Freight Transport

Manfred Boltze *† [1]

[1] Technische Universität Darmstadt (TU Darmstadt) – Karolinenplatz 5, 64289 Darmstadt, Germany

In all countries, road transport with heavy vehicles will have a high share in future freight transport. When using fossil fuels for those vehicles, the resulting emissions of carbon dioxide and pollutants such as particulate matter and nitrogen dioxide put a risk on the environment and on human health. Since heavy vehicles are already contributing significantly to greenhouse gas emissions, the "eHighway" system was developed, and it was identified as a possible solution to counteract these problems.
The eHighway system allows trucks to be fed with electric energy from a catenary which is mounted above the road. An efficient implementation of such system requires studies in different fields to understand the impacts of the eHighway system on today's road infrastructure. For that purpose, the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is funding three field trials, and the ELISA project is the most advanced of them. In ELISA, a 5 kilometer section of the motorway A5 in the German Federal State of Hessen is equipped with the eHighway system in both directions. The project is led by the respective road authority Hessen Mobil, and Technische Universität Darmstadt is responsible for the accompanying research.
This contribution explains the contribution of road freight transport to greenhouse gas emissions and discusses approaches to make this transport sector more sustainable. The basics of the eHighway technology are briefly presented. The layout of the ELISA test track on motorway A5, the arrangements for the test operation, and the research program for the field test are described.

Keywords: Road infrastructure, road freight transport, electric road systems.

*Speaker
†Corresponding author: boltze@verkehr.tu-darmstadt.de

Austenitic and Lean Duplex Stainless Steel Bolted Connections at Elevated Temperatures

Yancheng Cai* [1], Ben Young † [2]

[1] Department of Civil Engineering, The University of Hong Kong – Hong Kong SAR China
[2] Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University – Hong Kong SAR China

There is currently no design rule on bolted connections of cold-formed stainless steel structures at elevated temperatures. In this study, 51 cold-formed stainless steel double shear bolted connection specimens at elevated temperatures were conducted using steady state test method. The bolted connection specimens were fabricated by three different types of stainless steel, including the austenitic stainless steel of types EN 1.4301 and EN 1.4571 as well as lean duplex stainless steel Type EN 1.4162. The bearing failure mode was mainly observed in the connection tests. The test strengths were compared with the nominal strengths calculated from the American Specification, Australian/New Zealand Standard and European Codes for stainless steel structures at ambient temperature. It should be noted that in calculating the nominal strengths of the connections, the material properties of stainless steel obtained at elevated temperatures were used. It is shown that the strengths of the bolted connections predicted by the specifications are generally conservative at elevated temperatures. The austenitic stainless steel type EN 1.4571 generally had better resistance than the other two stainless steel types EN 1.4301 and EN 1.4162 at elevated temperatures in this study.

Keywords: Cold, formed stainless steel, Double shear bolted connections, Elevated temperatures, Experimental investigation, Steady state tests.

*Corresponding author: yccai@hku.hk
†Speaker

Innovation Reduces Risk for Sustainable Infrastructure

Suzanne Lacasse *† [1]

[1] Norwegian Geotechnical Institute (NGI) – N-0806 Oslo, Norway, Norway

Society and standards require more and more "risk-informed" decisions. The paper demonstrates the potential of reducing risk by implementing reliability and risk concepts as a complement to conventional analyses. Reliability evaluations can range from qualitative estimates, simple statistical evaluations to full quantitative probabilistic modelling of the hazards and consequences. The paper first introduced recent innovative developments that help reduce risk. Risk assessment and risk management are briefly touched upon. An example of the application of the new stress testing method is given. The usefulness of the seminal (1969) Observational Method is discussed. The need for developing sustainable and holistic civil engineering solutions is also briefly mentioned. The paper concludes that reliability-based approaches provide useful complementary information, and enable the analysis of complex uncertainties in a systematic and more complete manner than deterministic analyses alone. There is today a cultural shift in the approach for design and risk reduction in our profession. Reliability and risk-based approaches will assist preparing sustainable engineering recommendations and making risk-informed decisions.

Keywords: Risk Assessment, Risk Management, Remote Sensing, Stress Testing.

*Speaker
†Corresponding author: sl@ngi.no

Applying a national BIM model to Vietnam's National Implementation of BIM: Lessons learned from the UK-Vietnam collaboration for the Industry

Adam Matthews *† [1], Binh Ta [2]

[1] Centre for Digital Built Britain, University of Cambridge, Cambridge CB2 1TN – United Kingdom
[2] Institute of Construction Economics, Ministry of Construction Vietnam – Vietnam

This paper applies the national BIM strategy method as described by the EU BIM Task Group and the UK's Centre for Digital Built Britain to Vietnam's development of a national digitalization vision. It will describe UK experience in promoting digital construction through BIM application in construction and facility management activities toward Smart city based on 4 strategic areas: Foundation of Public leadership; Communicate vision and foster communities; Build a common, collaborative framework; and Grow Industry Capacity. International collaboration on the national introduction of BIM is growing between countries and between governments. In 2018, the UK and Vietnam signed an MOU for collaborating on the introduction of BIM to the national plan of Vietnam started under the Prime Minister's decision no. 2500/Q-TTg dated December 22nd, 2016. This paper applies the national BIM method to identify (1) the experience of the UK's national BIM strategy, (2) Vietnam's lessons learned of its national implementation of BIM and (3) proposals and recommendations for Vietnam's Construction Industry.

Keywords: BIM, UK, VN collaboration, Vietnam BIM Program, GIP.

*Speaker
†Corresponding author: Adam.Matthews@cdbb.cam.ac.uk

Advanced Modeling and Characterization of Structures

Advanced Analysis Software for Steel Frames

Phu-Cuong Nguyen *† [1], Nghia Nguyen [1], Minh-Hoang Le [1]

[1] Ho Chi Minh City Open University (HCMC-OU) – 97 Vo Van Tan St., Wd. 6, Dist. 3, Ho Chi Minh City, Vietnam

This paper presents an advanced analysis software for steel frames. The pre-post processing is coded in the programming language of Visual C++ while the solver is coded in the FORTRAN programming language. An user-friendly graphic interface of the advanced analysis software is developed to easy the modeling process and result performance of the analyzed problem. The proposed software solver uses the stability functions for predicting the second-order effects of framed members aims to minimize modeling and computational time. The plastic hinge beam-column element and the distributed plasticity beam-column element are integrated in the proposed advanced analysis software. The generalized displacement control method is employed to solve the nonlinear static equilibrium equations. The proposed software is validated for the accuracy and computational efficiency through the Orbison six-story space steel frame.

Keywords: Advanced analysis, geometric nonlinearity, nonlinear analysis algorithm, plasticity, steel frames, Visual C++, FORTRAN

*Speaker

†Corresponding author: cuong.pn@ou.edu.vn

Finite Element Modelling for Axially Loaded Concrete-Filled Steel Circular Tubes

Duc-Duy Pham * [1], Phu-Cuong Nguyen * † [1]

[1] Ho Chi Minh City Open University (HCMC-OU) – 97 Vo Van Tan St., Wd. 6, Dist. 3, Ho Chi Minh City, Vietnam

This study presents a Finite Element Analysis modelling (FEA) for Concrete-Filled Steel Circular Tubes (CFSCT) subjected to axial compressive load using the commercial FEA software ABAQUS. A new stress-strain relationship for concrete is established using the experimental data collecting from literature review. Concrete-Damaged Plasticity Model (CDPM) is employed in this study. A new softening regime is proposed for the behavior of confined concrete, and this study also introduces new parameters for constitutive model of concrete when we input into the ABAQUS sofware. The proposed analysis result is more accurate than the one of previous studies in the case of high-strength concrete or thin-walled steel tubes.

Keywords: Concrete, filled steel circular tube, Axial compressive load, Finite element analysis, ABAQUS, Stress, strain relationship, Confinement effect

*Speaker

†Corresponding author: cuong.pn@ou.edu.vn

Behavior of earth concrete wall under shear: from experimental to numerical approach

Loan Bui * [1,2,3,4,5]

[1] Tien Dung NGUYEN (University of Transport and Communication, Hanoi, Vietnam) – University of Transport and Communication, Hanoi, Vietnam, Vietnam
[2] Xuan Huy NGUYEN (University of Transport and Communication, Hanoi, Vietnam) – University of Transport and Communication, Hanoi, Vietnam, Vietnam
[3] Mounsif Ibnoussina – University Caddi Ayad Marrakech, 40000, Maroc – France
[4] Ali Limam (University of Lyon, 69100 Lyon, France) – University of Lyon, 69100 Lyon, France – France
[5] Tan Trung BUI (INSA de Lyon, FRANCE) – University of Lyon, INSA Lyon, 69100 Lyon, France – France

This paper is devoted to the study of a novel construction material based on "raw earth" with stabilizer which is called "earth concrete". "Earth concrete" is a novel concrete including sandy, aggregate, "raw" earth (or soil), water, superplasticizer and to improve its physical behavior, a small quantity of Portland cement, only 4% cement instead of 15% cement as in the ordinary concrete. The objectives of this construction material are to take the advantages of the traditional raw earth construction, such as its low embodied energy, its interesting hydrothermal behavior and environmentally friendly; but also, the ones of the ordinary concrete by improving the strength, durability and resistance to water erosion. Although this kind of material has recently started to be studied and developed in some countries, for example in France, Australia or UK, the conducted studies are mainly concentrated at the material level such as manufacturing method, compressive strength, thermal-moisture properties and rheology. To our knowledge, at the structural level, no research has yet addressed, and "earth concrete structures" behavior under mechanical loading is not sufficiently understood. This paper presents experimental results on the compression-shear capacity of an earth concrete wall. Tests were conducted on 1 m $\times$ 1 m $\times$ 0.3 m wallet manufactured in the laboratory. Numerical simulations using finite element method (FEM) are also conducted. Verification of the conformity and accuracy of the numerical model was made by comparing the numerical results to the experimental ones.

Keywords: Earth Concrete structure

*Speaker

EXPERIMENTAL MODELLING OF SELF-EXCITED RESPONSES OF A SQUARE CYLINDER SUBJECTED TO WIND LOADING

Cung Nguyen* [1], John Macdonal [2], Khang Huong [3,4], Van Vu † [5]

[1] Industrial University of Ho Chi Minh City (IUH) – Vietnam
[2] University of Bristol – United Kingdom
[3] Technology University of Ostrava – Technology University of Ostrava, Ostrava 70833, Czech Republic, Czech Republic
[4] Ton Duc Thang University – Vietnam
[5] University of Architecture Ho Chi Minh City – Vietnam

A slender structure with a non-circular cross section under wind actions can be prone to aeroelastic instability such as Vortex-induced vibration (VIV) or galloping, resulted from self-excited wind loading. Numbers of studies have been carried out to understand the self-excited phenomena and determine the aeroelastic responses of the structure. Wind tunnel experiments on prismatic cylinders have been widely used to model the responses. Most of them focus on one-degree-of-freedom (1DOF) model, in which the cylinder is allowed to vibrate only in a direction normal to wind. It has been shown in the literature that the experimental results do not always agree with theoretical predictions. Also, structural vibration in a normal wind direction is not the case in practice as the structure may vibrate in different directions, depending on how its principal structural axes relate to the wind direction. This paper discusses the issue of how to model the self-excited responses of slender structures under wind actions in wind tunnel, where the structures can vibrate in directions not normal to the wind. To address the issue, a series of novel wind tunnel tests on a square cylinder have been conducted. In the modelling, the cylinder is allowed to vibrate in different directions. The VIV and galloping responses are then estimated. This study provides a further insight of the aeroelastic phenomena of square-section prisms.

Keywords: Wind and structure interaction, galloping, VIV, square cylinder, wind tunnel, slender structure

*Corresponding author: nguyenhuycung@iuh.edu.vn
†Speaker

Fracture analysis of crack propagation on the diaphragm of steel bridge structures

The Truyen Tran * [1], Tung Bui [1], Hieu Nguyen [1], Quoc Doan [1], Anh Nguyen

[1] University of Transport and Communication (UTC) – Lang Thuong, Dong Da, Ha Noi, Vietnam

The crack failure of the steel diaphragm of Vam Cong Bridge during construction stage in Viet Nam has raised issues that it is necessary to control the behavior of steel bridge structures with considering construction method, boundary conditions, and specially pre-defects of steel materials. Fracture theory should be applied in this case to analyse the brittle failure of steel diaphragm, that was totally different from conventional failure due to plasticity appeared. This study analyses the fracture mechanism of steel diaphragm structure in some typical steel bridges that are similar to the structure of Vam Cong bridge. Pre-cracks in steel material will be considered. The result would contribute to clarify the reason of the brittle failure in steel bridge structures as well as crack parterns which appeare with different boundary conditions.

Keywords: fracture mechanics, crack propagation, brittle failure, steel bridge, and diaphragm.

*Speaker

A Study on Combination of Two Friction Dampers to Control Stayed-cable Vibration under considering its Bending Stiffness

Duy-Thao Nguyen *† [2,1], Duy Hung Vo *

[2]

[2] The University of DaNang – University of Science and Technology – 54 Nguyen Luong Bang Street, Danang city, Vietnam, Vietnam
[1] The University of Danang - University of Science and Technology – 54 Nguyen Luong Bang Street, Danang city, Vietnam, Vietnam

The stayed-cable is one of vital component of cable-stayed bridges. Stayed-cable is often very long with a small diameter and low mass, which can be considered horizontal flexible structure with very low natural frequency. Under the influence of cyclic load in specific conditions, stayed-cable can store the energy and vibrate with a large amplitude. This paper focuses on studying the methods of two-friction damper combination for reducing the cable vibration, and evaluates the capacity of friction-damper parameters in mitigating the vibration of stayed-cable. The results show the relationship between the damping factor of stayed-cable and various parameters such as Equivalent viscous constants, friction, spring constant, points attached damper to stayed-cable. For long-span cable-stayed bridges, cable has relatively large diameter and it is normally covered by grouting mortar or Epoxy. Consequently, its bending stiffness is considerably increased. Therefore, it is necessary to take into account its bending stiffness during the vibration analysis process. From these results, designers can assess and choose the attaching point as well as parameters of friction damper, which are optimal for specific stayed-cable.

Keywords: Stayed, cable, damping ratio, natural vibration frequency, friction damper.

*Speaker
†Corresponding author: ndthao@dut.udn.vn

DESIGN PROPOSAL AND BEHAVIOR SIMULATION OF PRESTRESSED CONCRETE SLAB TRACK AT HIGHWAY-RAILWAY GRADE CROSSINGS

Pham Van Hung * [1], Tran The Truyen *

[2], Tran Anh Dung * † [2], Doan Bao Quoc *

[2], Le Hai Ha *

[2], Nguyen Hong Phong *

2

[1] University of Paris-Est – Marne-la-Vallée – University of Paris-Est – Marne-la-Vallée, University of Paris-Est Marne-la-Vallee – France
[2] University of Transport and Communications – Vietnam

This paper presents the design proposal of the prestressed concrete slab (PSCS) track used for highway-railroad grade crossings in Vietnam. A new type of highway-railroad grade crossings is being proposed to replace the traditional panel crossings made by reinforced concrete, asphalt concrete and rubber. Numerical simulation was carried out to analyze the structural behavior of the PSCS. The results show that the structural proposal of the PSCS meets the requirements of stability and strength under the standard loads of truck and train engines recommended in Vietnamese specifications.

Keywords: Highway, railway grade crossings, Slab track, Prestressed concrete slab.

*Speaker
†Corresponding author: trananhdung@utc.edu.vn

Effects of Random Road Unevenness on Dynamic Impact Factor of multi-span Super T Girder Bridge with Link Slab due to Moving Vehicles

Xuan-Toan Nguyen [1], Duy-Thao Nguyen *† [1]

[1] The University of Danang - University of Science and Technology – 54 Nguyen Luong Bang Street, Danang city, Vietnam, Vietnam

The purpose of paper analyzes influence of random road unevenness on dynamic impact factor of Bridge subjected to a moving vehicle. The random road unevenness is simulated by a zero-mean stationary Gaussian random process. The bridge is modeled by finite element method. The moving vehicle has three axles and is idealized by 6-DOFs. The governing equation of dynamic vehicle-bridge inter-action is derived by means of dynamic balance principle. Galerkin method and Green theory are employed to discrete the governing equation in space domain. The solution of equation is solved by Runge-Kutta method. Monte-Carlo simulation is applied to generate the random road unevenness input. After analyzing, it is going to obtain the response of bridge output which are also the random process. The numerical results are in good agreement test results at KhueDong Bridge, Danang city, Vietnam. Also, the effects of road surface condition on dynamic impact factor of bridge are investigated detail. The numerical results show that dynamic impact factor of bridge has increased significantly when road unevenness has changed from Grade A to Grade E.

Keywords: Road unevenness, Moving vehicles, Dynamic vehicle, bridge interaction, Finite element method (FEM), Monte, Carlo simulation method.

*Speaker

†Corresponding author: ndthao@dut.udn.vn

Advanced Design Software for Steel Cable-Stayed Bridges Using Nonlinear Inelastic Analysis

Viet-Hung Truong *† [1], Seung-Eock Kim [2]

[1] Faculty of Civil Engineering, Thuyloi university (TLU) – 175 Tay son, Dong Da, Hanoi, Vietnam
[2] Department of Civil and Environmental Engineering, Sejong university (SJU) – 98 Gunja Dong, Gwangjin Gu, Seoul 05006, South Korea

Cable-stayed bridges have gained much popularity owing to their esthetic appearance, efficient utilization of structural materials, and technical advantages. When the main span length becomes longer, more accurate analysis methods are required to predict the realistic behaviors of structures, especially in design of steel cable-stayed bridges where nonlinear behaviors such as structural material and geometric nonlinearities are considerable.
Conventional design methods (for example ASD, PD, LRFD, etc.), that are based on the effective length factor (K-factor) to determine the strength of structural members by considering them as isolated members, seems tedius, although they can provide acceptable structural designs and have been widely used in practical design. The indirect approach using the effective length factor cannot give a precise indication of the factors against failure since the strength and stability interactions between the whole structure and its elements are not directly considered. In addition, the moment redistribution between structural members is not accounted when using these methods.
This paper presents an innovative software, named as PAAP3D, for nonlinear inelastic analysis of steel cable-stayed bridges subjected to static and seismic loadings. The solver of the PAAP3D is developed using the FORTRAN programming language, while the pre- and post-processors of PAAP3D are written using C++ programming language with a user-friendly and easy-to-use interface. The pythons, girders, and cross-beams are modeled as plastic-hinge beam-column elements where and effects, the initial geometric imperfection, and the gradual stiffness degradation are considered. The stay cables are modeled as catenary elements to capture the cable sag effect. The generalized displacement control method (GDC) is used to solve the static analysis, and a time-history dynamic analysis is employed for seismic analysis. Some examples of steel cable-stayed bridges subjected to both static and seismic loads are studied.

Keywords: Cable, stayed bridge, nonlinear inelastic analysis, advanced analysis, beam, column, catenary

*Speaker
†Corresponding author: truongviethung@tlu.edu.vn

Blind source separation technique for operational modal analysis in presence of harmonic excitation

Van-Dong Do *† [1], Thien-Phu Le [2], Alexis Beakou [1]

[1] Université Clermont Auvergne, CNRS, SIGMA Clermont, Institut Pascal – Sigma CLERMONT, SIGMA Clermont – F-63000 Clermont Ferrand, France
[2] LMEE, Univ Evry, Université Paris-Saclay – Univ Evry, University of Paris Saclay – 91020 Evry cedex, France

The dynamic behavior of a linear structure can be characterized by modal parameters involving natural frequencies, damping ratios and mode shapes. The knowledge of these modal parameters allows several applications such as: updating finite element models, damage detection and structural health monitoring ...
Classically, modal parameters are extracted from an experimental modal analysis where both excitation artificially generated by a hammer or a shaker, and its structural responses are measured. These dynamic tests are commonly used in laboratory conditions. For real structures, operational modal analysis which requires structural responses only is more adequate because of several advantages: simple equipment thus low cost, continuous use, real boundary conditions. This is extremely useful for large structures in civil engineering where the excitation is not known or is difficult even impossible to be measured. The excitation of natural form that cannot be controlled and measured such as wind, noise, operational loadings is always assumed as white noise in operational modal analysis. In presence of harmonics on excitation for instance structures having rotating components such as buildings with fans/air-conditioners, gravity dams comprising turbines and generators or human-induced narrowband vibrations in pedestrian bridges, the white noise assumption is not validated. Consequently, the harmonic components cohabit with structural modes and that makes the modal identification process difficult, even leading to biased results.
Blind Source Separation (BSS) technique is known as a statistical signal processing tool that has been widely used to extract sources signals from the output signals only without requiring explicit information about the source signals or mixing process. This technique has found research interest and application in a variety of areas comprising medical image, telecommunications, speech recognition systems, and lately in vibration and acoustics. This study proposes thus to apply a new BBS technique termed Sparse Component Analysis (SCA) for modal identification in presence of harmonics. The proposed SCA based-approach comprises two main stages: mixing matrix estimation and source recovery. In the first stage, K-means clustering algorithm is used to estimate the mixing matrix. Once the mixing matrix has been obtained, mono-component sources containing structural modes and harmonic components are recovered in the second stage, via l1-minimization sparse recovery technique. Kurtosis value and histogram are then used to identify the mono-component sources and to remove the sources corresponding to harmonic excitation. The performance of the proposed method is investigated using numerical examples of a two-degrees-of-freedom system and a cantilever beam.

*Speaker
†Corresponding author: van_dong.do@sigma-clermont.fr

Investigation into the response variability of a higher-order beam resting on a foundation using a stochastic finite element method

Ta Duy Hien [1], Do Thi Hang * [1], Thanh Bui Tien [1], Long Nguyen Ngoc [1], Thuan Nguyen Van [2]

[1] Department of Construction Engineering, University of Transport and Communications, Ha Noi, Vietnam – Vietnam
[2] Department of Transportation Engineering, Nha Trang University, Nha Trang, Vietnam – Vietnam

This study deals with the response variability of a beam resting on an elastic foundation using a stochastic finite element method (SFEM). Use of SFEM for a higher-order beam on an elastic foundation with a random field of elastic modulus is proposed. This random field of elastic modulus is assumed to be a one-dimensional Gaussian random field. A random field is discretized by a weighted integration method to build the stochastic finite element formulation. A numerical example is presented to validate the proposed formulation, and the results are compared with those obtained using Monte Carlo simulation. The response variability of the beam and effect of the parameter of the random field are investigated in detail.

Keywords: Higher order beam, weighed integration method, SFEM, random field.

*Speaker

FATIGUE ANALYSIS OF JACK-UP LEG STRUCTURES IN TRANSIT CONDITION

Vu Dan Chinh * [1], Dinh Quang Cuong† [1]

[1] Institute of Construction for Offshore Engineering – Vietnam

In transit condition, jack-up platform is a type of floating structures with large dimension. In towing duration, legs of the self-elevating unit are elevated, so they do not directly subject to wave and current loads but only resist inertia loads due to motion induced wave and other loads.

Actually, fatigue damages of the jack-up legs structure in transit condition have not been studied clearly yet. However, Registers and Consultancy have been used 20% of total fatigue life for transit life time in the analyses and designs [1]. The percentage is approximately value, which has not accurately reflected the fatigue life in transit condition.

To have the more accurately results, it is necessary to solve two important problems which are motions analysis and determination of inertia forces on the legs structure induced by the motions. These problems will be made clearly in the article and applied for 400ft jack-up platform fabricated in Viet Nam.

Keywords: Self, elevating unit legs structure, Transit condition, Fatigue analysis.

*Speaker

†Corresponding author: cuongdq.vctb@gmail.com

Finite element modeling of the TECCO protection system for rock-fall under impact loading

Van Dang Tran *† [1], Dong Tran *

[2], Dannis Gross [3]

[1] Thuyloi University – 175 Tay Son, Dong Da Districit, Hanoi, Vietnam
[2] National Civil Engineering University – 55 Giai Phong, Hai Ba Trung District, Hanoi, Vietnam
[3] 3 Geobrugg AG – Aachstrasse 11 , CH-8590 Romanshorn, Switzerland

The TECCO protection system consists of the high strength components such as the high tensile steel (HTS) wire mesh and the high strength thread bar. This system is used in the construction for slope stabilization, ground support, landslide protection, especially rock-fall protection. The purpose of this study was to predict the behavior of the wire mesh under impact loading of rock-fall. A finite element has been constructed in order to model the impact between a rock of 0.5 tons and a rectangular wire mesh with high velocity. The mechanical response of the HTS material is assumed as elastic-plastic-isotropic material. Further, the contact behavior within the steel wire mesh and rock-fall are also considered in the model using the Coulomb friction model. Thanks to ABAQUS/Explicit based on finite element method, the impact phenomenon will be clarified. The model may help to reduce the number of experiments with high cost.

Keywords: Rockfall, TECCO protection system, finite element method

*Speaker
†Corresponding author: tranvandang@tlu.edu.vn

THE STUDY ON THE BEHAVIOR OF THE SIMPLY SUPPORTED BEAM STEEL BRIDGE STRUCTURE WITHOUT THE INTERMEDIATE BRACING SYSTEM IN THE CONSTRUCTION STAGE

Van Nam Le [1], Anh Rin Nguyen * [1], Lien Thuc Pham [1], Ngoc Thi Huynh† [1]

[1] VIETNAM NATIONAL UNIVERSITY HO CHI MINH CITY - UNIVERSITY OF TECHONOLOGY (VNUHCMU-University of Technology) – Hochiminh City University Of Technology - 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam

Steel bridge structure without intermediate bracing systems (IBS) has been proposed. This structure has only been applied to the continuous I beam bridges in Japan. The construction of continuous bridges has many difficulties because of the solution of the deck cracking at the negative moment positions. That solution is complicated and time-consuming. Moreover, the overall instability of main girder during construction stage is not considered. For simplifying the construction process as well as avoiding above mentioned problem, the steel bridge structure without IBS has been innovated for the simple span structure. Then, the models of the proposed structure and the traditional steel bridge structure are simulated in construction stages in which the overall instability usually occurs . In addition, the destruction of structure caused by construction load exceeding the bearing capacity of this structure also frequently happens. Therefore, from analyzed data of those simulation the result could be found that 1) the influence of the bar density (number of bars over unit area) on the stability of the proposed structure is only really clear when it reaches a specific value; 2) meanwhile, the thickness of steel plate strongly affects to overall stability of this structure; and 3) despite this structure's collapse due to the overall instability its material is still not used to its full ability.

Keywords: bracing systems, composite beam bridge, overall instability

*Speaker

†Corresponding author: huynhngocthi@hcmut.edu.vn

Analysis of Two-Directional Seismic Deterioration of Steel Box Columns

Tran Tuan Nam *† [1]

[1] Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HUTECH), Ho Chi Minh, Vietnam – Vietnam

This paper addresses the deterioration of the steel box column subjected to simultaneous biaxial moment and axial force, which caused local buckling, consequent decrease in base shear capacity and eventual collapse of a full-scale 4-story steel building tested at the E-Defense shake table. Two-directional deterioration was observed in the columns which were subjected to a major few cycles in a particular direction and later to the largest cycle in a significantly rotated direction. The multi-spring (MS) element that consists of springs discretizing the column cross section was used to simulate the moment deterioration by local buckling.

Keywords: Collapse test • Steel box column • Local buckling • Two, directional deterioration • Multi, spring (MS) element

*Speaker
†Corresponding author: tt.nam@hutech.edu.vn

Numerical analysis of double layered asphalt pavement behavior taking into account interface bonding conditions

Minh Tu Le *† [1,2], Quang-Huy Nguyen [3], Mai-Lan Nguyen [4]

[1] University of Transport Technology (UTT) – 54 Trieu Khuc Street, Thanh Xuan Distr, Hanoi,, Vietnam
[2] Institut National des Sciences Appliquées - Rennes (INSA de Rennes) – INSA de Rennes – 20, avenue des Buttes de Coësmes - CS 70839 - 35708 Rennes cedex 7, France
[3] Institut National des Sciences Appliquées - Rennes (INSA de Rennes) – INSA de Rennes – 20, avenue des Buttes de Coësmes - CS 70839 - 35708 Rennes cedex 7, France
[4] IFSTTAR / département MAST / LAMES (IFSTTAR) – IFSTTAR – Centre de Nantes Route de Bouaye CS4 44341 Bouguenais CEDEX, France

Bonding conditions between pavement layers have an important influence on the responses of pavement structure. This paper deals with numerical analysis for the stresses, strains and deflections of double-layered asphalt pavement structure. The constitutive relations are based on the layered homogeneous half-space theory developed by Burmister (1943). In this work, in order to improve the modelling, the actual interaction between the layers is taken into account by considering a horizontal shear reaction modulus which represents the interface bonding condition. The numerical model is validated and applied through an original case study where falling weight deflectometer (FWD) tests are carried out on two full-scale pavement sections with two different bonding conditions at the interface between asphalt layers. The results indicate that the considered numerical model allows evaluating and quantifying the interface bonding condition in determining by backcalculation the horizontal shear reaction modulus at the pavement interface.

Keywords: Asphalt pavement, Interface bonding, Analytical, Shear reaction modulus, Numerical analysis, FWD

*Speaker
†Corresponding author: minh-tu.le@insa-rennes.fr

Parametric numerical study on a novel energy harvester using iron-gallium alloy and strain response

Tuan Minh Ha *† [1], Saiji Fukada [2], Toshiyuki Ueno [3]

[1] Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HUTECH) – Vietnam
[2] Professor, Faculty of Geosciences and Civil Engineering, Kanazawa University – Japan
[3] Associate Professor, Faculty of Electrical, Information and Communication Engineering, Kanazawa University – Japan

With the aim of contributing to efficient structural health monitoring approaches, this study proposes a micro energy-harvesting strain gauge, utilizing iron-gallium alloy, capable of generating electrical energy from dynamic strain responses. The iron-gallium alloy is a ductile magnetostrictive material with a high piezomagnetic constant, good machinability, and a large inverse magnetostrictive effect by which magnetization can be varied by mechanical stress. The device has a simple structure: a combination of a flat plate of iron-gallium alloy and a stainless steel frame, the former attached to the latter. A variation in stress applied at the alloy plate yields a time variation of the flux generating a voltage on the wound coils. The strain data is also measured at the same time. To achieve high efficiency in both power generation and deformation measurement, effective design for the novel device is required. Therefore, prototype finite element models were constructed based on the number of commercial designs available on the market. Then, parametric studies were carried out by changing the shapes, heights, and widths of the devices in order to examine their possible effects on the deformation behavior of the proposed structure. Finally, design procedures for the proposed device were recommended based on these numerical studies.

Keywords: energy harvester, iron, gallium alloy, dynamic strain response, parametric numerical study, magnetostrictive material

*Speaker
†Corresponding author: hm.tuan@hutech.edu.vn

Numerical investigation of derailment loading on composite fibre transoms for implementation in the Sydney Harbour Bridge

Olivia Mirza * [1], Micah Fountain *

[1], Maryam Hosseini *

1

[1] Western Sydney University (WSU) – Locked Bag 1797, Penrith, NSW, 2751, Australia

Since the development of railway systems in 1925, timber has been the predominant material used to manufacture railway transoms. Over 2.5 billion timber transoms are currently installed in worldwide railway systems, including the railway track of the Sydney Harbour Bridge. As timber transoms require frequent maintenance and achieve short service lifespans of approximately 20 years, alternative transom solutions have been developed.
Steel and concrete transom alternatives achieve elongated service lives, however each possess unique limitations associated with installation and serviceability. Recent studies have focussed on the development of composite fibre transoms, which achieve service lives of between 50 to 100 years, whilst exhibiting timber-like performance properties. A review of established literature has verified that limited research is available, regarding the performance of composite fibre transoms, subjected to derailment loading.

In order to bridge the existing knowledge gap, this thesis presents a numerical analysis of the behaviour of Wagner's Composite Fibre Technology (CFT) transoms, subjected to derailment induced impact loading. ABAQUS finite element software has been utilised to investigate the internal stress distribution and detailed failure behaviour of Wagner's CFT transoms, under impact loading. The numerical analysis revealed that neither the Ajax or Lindapter transom experienced global failure, but rather experienced areas of local failure at the stringer-transom junction and around the bolt holes of the shear connectors. The Ajax shear connectors provided a greater degree of confinement than the Lindapter shear connectors, since the Ajax bolts had a larger surface area in contact with the inside of the transom panel. Consequently, the Ajax transom experienced lower peak deflections and higher critical stresses than the Lindapter transom. Since the Lindapter transom experienced lower critical stresses and hence less damage than the Ajax transom, Lindapter Hollobolt shear connectors were determined to outperform the Ajax Oneside shear connectors.
Parametric investigations were conducted to derive relationships between insert modulus, deflection and critical stress, as well as impact energy, deflection and critical stress. It is intended that the developed regressions will contribute towards a guideline for industry practice and optimise the design of composite fibre transoms, for implementation in the Sydney Harbour Bridge.

*Speaker

Keywords: Numerical Investigation, derailment loading, retrofitting

Finite Element Analysis of Reinforced Concrete beams subjected to combined actions

Tuan-Anh Nguyen * [1,2], Quang-Huy Nguyen [1], Hugues Somja [1]

[1] Institut National des Sciences Appliquées - Rennes (INSA Rennes) – INSA Rennes – 20, avenue des Buttes de Coësmes - CS 70839 - 35708 Rennes cedex 7, France
[2] University of Transport and Communications - UTC (VIETNAM) – Vietnam

An enhanced multi-fiber beam element suitable for the analysis of reinforced concrete members subjected to combined loadings is presented. The model is developed using displacement-based formulation with small displacement assumption. The section kinematics is based on the kinematic assumptions of a two-node Timoshenko beam and enhanced by introducing additional degrees of freedom at each section in order to take into account the warping phenomenon. A system of fixed points is created and interpolated by Lagrange functions and polynomials. In order to take into account the contribution of stirrups, a discretization of control sections into different regions following its material response is applied. As a result, the basic assumptions of the Modified Compression Field Theory with a secant-stiffness formulation is used to represent the constitutive material model for reinforced concrete. The model is validated by comparing to the theoretical formulations and several experimental tests. The simulations include a variety of monotonic load conditions under bending, shear and torsion for specimens with rectangular section.

Keywords: 3D beam multi, fiber, multi, axial efforts, torsion, warping, reinforced concrete

*Speaker

Resistance of Cross Laminated Timber members under axial loading - a review of current design rules

Xin Li [1], Mahmud Ashraf [*†] [1], Mahbube Subhani [1], Bidur Kafle [1], Paul Kremer [1,2]

[1] Deakin University – Australia
[2] XLam Australia and New Zealand – Australia

Cross laminated timber (CLT) has become an important type of engineered timber product due to its superior material properties, making it suitable for mass timber construction. Nonetheless, as CLT is manufactured from naturally grown sources, it offers significant environmental benefit within the construction sector in comparison to its traditional counterparts such as concrete and steel. CLT was first developed in the mid-1990s in Europe and has been recognized for its obvious beneficial properties around the world including Canada, US, China, Australia and New Zealand, to name a few. As a naturally grown material, timber products possess some inherent variabilities in material properties. These uncertainties make it difficult to develop universally accepted design rules for timber products, as the basic material properties may vary significantly based on its origin. This paper presents a review of current design rules for CLT under axial loads, with an emphasis on the in-plane and out-of-plane compressive and tensile properties. Design procedures outlined in EN 16351, EN 14080, EN 1995-1-1, NDS 2018, GB 50005 and other relevant CLT handbooks have been thoroughly investigated. Experimental evidences available from literature have been used to compare the performance of those design guidance in predicting axial resistance of CLT members as well as that for timber lamina, where appropriate, under tension and compression. Overall, it was observed that despite considerable variations in mechanical properties of CLT, similar reliability concepts are adopted for specifying characteristic values, design values as well as design rules for CLT structures. Once the design rules are critically evaluated based on test evidences, some design rules for CLT members under ultimate limit states have been summarized herein.

Keywords: Cross laminated timber, Wood, Timber, Axial, Handbook

[*]Speaker
[†]Corresponding author: mahmud.ashraf@deakin.edu.au

A current-state-of-the-art on design rules vs test resistance of Cross Laminated Timber members subjected to transverse loading

Xin Li [1], Mahbube Subhani [1], Mahmud Ashraf *† [1], Bidur Kafle [1], Paul Kremer [1,2]

[1] Deakin University – Australia
[2] XLam Australia and New Zealand – Australia

Cross laminated timber (CLT) is one of the well-known construction material and is gaining more attention in recent years. CLT is an engineered timber product which has superior in-plane and out-of-plane bending strength compared to conventional timber products. Accordingly, CLT panels can, be used as both wall and floor elements in mid-rise construction. However, the shear and bending strength (along with other material properties as well) of these CLT panels can vary significantly depending on the species used to manufacture these products. As a result, in-depth research with respect to the variations in bending and shear properties of CLT panels from different parts of the world is required in order to generate a common standard. However, there is no standardised design procedures for CLT can be found in the open literature, at this stage. The main purpose of this paper is to investigate the applicability of various available design rules outlined in Eurocodes, NDS, Chinese GB and handbooks for CLT in regards to in-plane and out-of-plane bending and shear design of panels subjected to transverse loading. In addition to the theoretical review, test procedures to obtain these material properties will also be included. Moreover, factors affecting the bending properties of CLT will be discussed. For out-of-plane shear properties, shear and rolling shear will be referred, whilst for in-plane shear properties, three district failure mechanisms will be elaborated. Furthermore, the ultimate limit states design method based on different theoretical models available in CLT handbooks (such as, Gama method, composite theory and shear analogy method) will be discussed along with the concepts of reliability i.e. to obtain design properties of material by introducing material safety factor and property modification factors. Lastly, recommended design values and design rules for CLT elements subjected to transverse loading will be summarized at the end.

Keywords: Cross laminated timber, Wood, Bending, Shear, Design Guideline

*Speaker
†Corresponding author: mahmud.ashraf@deakin.edu.au

A further study on stayed-cable galloping in dry weather condition

Hung Vo *† [1], Thao Nguyen [2]

[1] The University of DaNang – University of Science and Technology (DUT) – 54 Nguyen Luong Bang Street, Danang city, Vietnam
[2] The University of DaNang – University of Science and Technology (DUT) – 54 Nguyen Luong Bang Street, Danang city, Vietnam, Vietnam

Wind-induced cable vibrations can be classified into several types such as buffeting due to wind gust, vortex-induced vibration, classical galloping with iced cables, wake galloping, parametric excitation, Reynolds number related drag instability, rain–wind induced vibration, high-speed vortex excitation and dry galloping. Among these vibration types, vortex induced vibration and buffeting due to wind gust are generally small amplitude while the last three types are mainly related to stay cables with larger amplitude vibration and the rain–wind induced vibration is the one most frequently observed on site of bridge. Furthermore, mechanism of rain–wind vibration has been fully elucidated in recent years, and some effective control methods have been successfully applied in practice. In particular, dry galloping is still less understood and it would require research that is more intensive. Hence, the aim of this paper is to elucidate the cable vibration characteristic in no rain condition (called "Dry galloping") by wind tunnel test. Furthermore, the detail of its generation mechanism will be investigated and discussed.

Keywords: stayed, cable vibration, dry galloping, Scruton number effect, generation mechanism, low frequency

*Speaker
†Corresponding author: vdhung@dut.udn.vn

Investigation and potential modelling of composite truss beams

Bujnak Jan * [1], Peter Michalek [2]

[1] Faculty of Civil Engineering, University of Žilina, – ŽILINSKÁ UNIVERZITA V ŽILINE Univerzitná 8215/1, 010 26 Žilina, Slovakia
[2] University of Zilina (UNIZA) – Slovakia

Composite structures consist of steel girders, a concrete slab and connectors, whose function is to provide the interaction between slab and girder. Particularly innovative composite steel-concrete trusses can be considered as one of the most economical systems for building, especially for greater spans allowing better use of internal space without restricting columns. The trusses are appropriate also to meet the requirements for building height limitation as well as the need to run complex electrical, heating, ventilating, and communication systems. Also composite steel bridges with deck supported on a filigree steel truss structure and slim piers are presently preferable especially to conventional concrete structures. But design specifications of composite trusses are only partially included in actual standards. To create an interaction between steel truss and concrete, it is similarly necessary to prevent the relative slip at the steel and concrete interface using the shear connectors. But the local effects of a concentrated longitudinal shear force between steel truss chord and concrete slab, as special task, should be appropriately examined. The finite element analyses can be used to investigate numerically this structural system behaviour, exploiting several computer procedures. The experimental research has tested these procedures. The outputs of this study would be presented in the eventual paper.

Keywords: composite truss beams, advanced modeling of shear connaction

*Speaker

Stress-dependent permeability of the fractured rock masses: numerical simulation based on the Embedded Fracture Continuum approach

Hong Lam Dang * [1], Duc Phi Do [2], Dashnor Hoxha [2]

[1] University of Transport and Communications, Civil Engineering Faculty, Vietnam – No.3 Cau Giay Street, Lang Thuong ward, Dong Da District, Hanoi, Vietnam, Vietnam
[2] Lamé Laboratory – Univ. Orléans, Univ. Tours, INSA CVL, Lamé, EA 7494, France – France

Albeit a huge number of studies on fractured rock masses in the past, their modelling is yet a challenging and dynamic research topic with two principal trends grouping continuum and discontinuum approaches. Recently, effective properties of fractured rock masses were studied with the help of Embedded Fracture Continuum (EFC) approach in which effective properties of fractured rock mass was evaluated. However, in the previous studies, the propagation of fractures are not considered and only the linear behavior of fractures was taken into account. In this work, the EFC approach will be used to model the stress-dependent permeability of the fractured rock masses in which we account for the non-linear behavior as well as the propagation of fractures. This novel approach allows to incorporate explicitly the fracture networks in the porous rock mass by using the fracture cell concept which represents the grid mesh intersected by at least one fracture. More precisely, in the EFC approach, each fracture cell represents an equivalent porous medium that the concept of continuum model can be straightforwardly applied. The numerical simulations will take into account the closure/opening effect due to the non-linear behavior of fractures with respect to normal stress as well as the shear-dilation effect. A damage law of the intact rock that undergo yield tensile strength is also considered to model the new flow connections between fractures. Through some numerical applications, we highlighted the influence of different parameters on the effective permeability of fractured rock masses.

References:

1. Dang, H.L.: A hydro-mechanical modeling of double porosity and double permeability fractured reservoirs, PhD thesis, University of Orleans, France (2018).

2. Dang, H.L., Do, D.P., Hoxha, D.: Fractured Reservoirs Modeling by Embedded Fracture Continuum Approach: Field-Scale Applications. Lecture Notes in Civil Engineering, vol 18. Springer, Singapore (2019).

3. Figueiredo, B., Tsang, C.F., Rutqvist, J., Niemi, A.: A study of changes in deep fractured rock permeability due to coupled hydro-mechanical effects. Int. J. Rock Mech. Min. Sci., 79, 70-85 (2015)

4. Min, K.B., Rutqvist, J., Tsang, C.F., Jing L.: Stress-dependent permeability of fractured rock masses: a numerical study. Int. J. Rock Mech. Min. Sci., 41, 1191-1210 (2004).

*Speaker

Keywords: stress, dependent permeability, fractured rock, EFC approach, non, linear behavior, fracture propagation, and Coulomb failure criterion.

Improved rigid-plastic method for predicting the ultimate strength of concrete walls restrained on three sides

Jeung-Hwan Doh* [1], Nhat Minh Ho † [2], Tim Peters [3]

[1] Griffith University – Griffith School of Engineering and Built Environment, QLD 4222, Australia
[2] EDGE Consulting Engineers – EDGE Tweed Heads, NSW 2486, Australia
[3] EDGE Consulting Engineers – EDGE Gold Coast, QLD 4212, Australia

The modern day popularity of tilt-up construction, shear walls and concrete cores in multi-storey buildings means that the construction of concrete walls with various boundary conditions and higher slenderness ratios, along with the presence of the openings, has become common. The design of such elements under eccentric axial loads, however, could be outside the restrictions of current major design codes such as the Eurocode 2 (EC2-2004), the American Concrete Institute Code (ACI318-2014) and the Australian Concrete Standard (AS3600-2018). There have been many experimental and numerical studies on the behaviour of both one-way action walls (OW walls) and two-way action walls supported on four sides (TW4S walls), with and without openings in the range of high slenderness ratios (up to 50). Efforts have also been made to develop design models capable of predicting the axial load capacity of such walls. However, research into the behaviour of two-way action walls supported on three sides (TW3S walls) is still relatively unexplored and further studies in this area are needed. Recent research has demonstrated that a rigid-plastic approach, also known as yield line theory, could be used to describe the behaviour of TW3S walls with and without openings. Although predictions obtained using the rigid-plastic approach showed reasonably good agreement with experimental test data, the scope of the analysis approach is considered limited. In this study, a validated finite element method (FEM), using the ABAQUS program, was employed to improve the rigid-plastic model, covering a broader spectrum of designs for axially-loaded TW3S walls. The reliability of the modified model was confirmed through comparisons with the available test data.

Keywords: concrete walls, axial load, aspect ratio, slenderness ratio, openings, yield line

*Corresponding author: j.doh@griffith.edu.au
†Speaker

Flexural Capacity Accounting for SBHS500 Steel of Composite Bridge Girders

Dang Viet Duc *† [1], Okui Yoshiaki [2]

[1] Dang Viet Duc (Thuy Loi University) – Vietnam
[2] Yoshiaki Okui (Department of Civil and Environmental Engineering, Saitama University) – Japan

A bridge high performance steel with a yield strength of 500MPa has been standardized as SBHS500 in Japanese Industrial Standard (JIS) since 2008. SBHS500 steel shows advantages, such as high yield strength and good weldability, but it has different inelastic behavior, such as almost no yield plateau, smaller ductility, and greater yield ratio comparing to conventional grade steels. So far, this steel grade has been applied just to a few construction projects such as NagataBridge and TokyoGateBridge (Nippon Steel, 2012a; Nippon Steel, 2012b). In all of these constructions, SBHS500 steel grade was applied to truss structures whose steel members are only under compression or tension. Only a few studies (Tonegawa et al., 2005; Okada and Kato, 2009) have ever tried to investigate the bending moment capacity of SBHS500 composite girders. Hence, it is necessary to implement more intensive studies to design composite girder bridges with application of SBHS500 steel. The positive bending moment capacity of composite steel girders is examined through parametric study employing elasto-plastic finite element analyses. The web slenderness limits of section classification for homogeneous and hybrid girders with bridge high performance steel are explored. Beside, the effects of initial bending moment due to unshored construction method on the web slenderness limit are investigated. It is shown that the noncompact web slenderness limits in conventional design standards are conservative for composite sections. Many sections, which are classified as slender by current specifications, demonstrate sufficient flexural capacity as noncompact.

Keywords: Bridge high performance steel, hybrid girder, flexural capacity, composite girders.

*Speaker
†Corresponding author: dangviet.duc@gmail.com

The inadequacies of the existing Structural Health Monitoring systems for cable stayed bridges in Vietnam

Minh Chính Lng * [1]

[1] Thuy Loi University (i hc Thy Li) – 175 Tay Son Street, Dong Da Dist., Vietnam

Since 2000 when the My Thuan Bridge, the first cable-stayed bridge in Vietnam, was put into operation, and now Vietnam has more than 20 types of cable-stayed bridges. Therefore, the Structural health monitoring (SHM) system is gradually being designed and installed for cable stayed bridges to ensure economic exploitation and safety. Due to the limited of financing sources, these systems are very limited, and their quality have a lot to be desired. Also, due to the lack of appropriate classification personnel with experience in the SHM system, these systems encountered a lot of problems. In this article author will deeply analyze the mistakes and problems of these SHM systems to find solutions for the future. Therefore, this will open up new prospects, new challenges and possibilities for the development of these systems in the near future.

Keywords: SHM system, concrete cable, stayed bridge, monitoring system, AE sensors, cracks

*Speaker

Riding comfort assessment of high-speed trains based on vibration analysis

Van Nguyen Dinh [2,1], Ki-Du Kim [3], Tuan Hai Dinh * [4]

[2] MaREI Centre for Marine and Renewable Energy (MaREI Centre) – Beaufort Building, Haulbowline Road, Ringaskiddy, Co. Cork, Ireland
[1] Department of Civil, Structural and Environmental Engineering, University College Cork (UCC) – College Road, Cork T12 YN60, Ireland
[3] Konkuk University – 120 Neungdong-ro, Gwangjin-gu, Seoul 05029, South Korea
[4] Department of Urban Management, Hanoi Architectural University – Vietnam

This paper proposes a method to assess riding comfort of high-speed multi-car trains and railway systems by using three-dimensional train-bridge interactive models. Each train car is modeled as a multi-axle double-layer of mass-spring-damper system having 27 degrees of freedom and the bridge modeling is adaptive to various finite elements. The case study considers a real train of fifteen cars travelling at a speed range of 50-400 km/h over a railway section having a bridge and rail irregularities of U.S. Federal Railroad Administration class 6. The riding comfort of each train car is found to reduce considerably when it is crossing the bridge. The car body accelerations and bridge deflection are compared with the allowable values specified in the design codes for high-speed railways in Korea, Japan and Taiwan. The assessment shows that riding comfort of the considered railway section is poor and that the design of the railway section or the car body suspensions need to be revisited.

Keywords: Riding Comfort, High Speed Train, Car Body Acceleration, Train Bridge Dynamic Interaction

*Speaker

Assessment of methods of riprap size selections as scour countermeasures at bridge abutments and approach embankments

Huy Mai *† [1], Noi Doan [1]

[1] The University of Transport and Communications – No.3 Cau Giay Street, Lang Thuong ward, Dong Da District, Hanoi, Vietnam

In flood seasons, abutment scour is one of the main cause of bridge damages or even bridge collapse resulting in the interruption of traffic and possibility death. The most commonly employed method of protecting bridge abutments against scour is the application of bank-amouring method. Riprap is the most common amouring scour protection method used at bridge abutments and approach embankment. The selection of riprap size is based on the assumption of riprap layer failure mechanisms. Despite the widespread use of riprap protection in Vietnam, the guidelines for its design at bridge abutments and approach embankment are based on limited research. This article presents assessment of methods of riprap size selections as scour countermeasures at bridge abutments and approach embankments and procedure of design guidelines for their uses.

Keywords: riprap, abutment scour, scour countermeasures, approach embankments

*Speaker
†Corresponding author: mqhuy@utc.edu.vn

A review on protection methods against debris accumulation for bridge in mountain areas

Huy Mai *† [1], Phong Nguyen [1]

[1] The University of Transport and Communications – No.3 Cau Giay Street, Lang Thuong ward, Dong Da District, Hanoi, Vietnam

In the mountainous region of Vietnam, in the flood season, the phenomenon of debris is very common, causing danger to bridges. Debris affects the scour morphology at bridge piers, thus increasing the bridge failure potential. During the flood in October 2017, the Thia Bridge collapsed in Yen Bai, Vietnam. After the survey, the large trees attached to the piers are believed to be the main cause of this bridge collapse. Debris accumulation countermeasures can be classified into two main categories, including structural and non-structural methods. So, this paper presents details of these methods, and their applicability in Vietnam.

Keywords: bridge collapse, pier scour, debris, ...

*Speaker
†Corresponding author: mqhuy@utc.edu.vn

Numerical modeling of thermo-mechanical performance of small-scale CFRP reinforced concrete specimen using near surface mounted reinforcement method

Phi Long Nguyen *† [1], Xuan Hong Vu [2], Emmanuel Ferrier [2]

[1] Ho Chi Minh City University of Transport (UT-HCM) – Number 2, Vo Oanh Street (precedent name: D3 street), Ward 25, Binh Thanh Disctrict, Ho Chi Minh City, Vietnam., Vietnam
[2] Université de Lyon, Université Lyon 1, Laboratory of Composite Materials for Construction (LMC2) – Laboratoire des Matériaux Composites pour la Construction : LMC2 – 82 bd Niels Bohr, F-69622 Villeurbanne, France, France

Carbon fiber reinforced polymer (CFRP) is commonly used in civil engineering in strengthening concrete structure such as slabs, beams, and columns using externally bonding reinforcement method (EBR) or near surface mounted method (NSM)...Under thermo-mechanical condition that is close to fire case condition, CFRP reinforced structures are under actions of mechanical load and elevated temperature at the same time. In the literature, the evaluation of the thermo-mechanical performance (such as fire performance) of CFRP-reinforced concrete structures requires complicated-and-expensive experimental works on full scale or large scale structures and therefore this may exceed time limit and financial budget for multi-variables observation. This paper introduces a hybrid method (numerical based and experimental validated method) to evaluate the fire performance of CFRP reinforced concrete structure over a small scale laminate-CFRP reinforced concrete specimen which is then capable to evaluate fire performance of more general CFRP reinforced concrete structures.

Keywords: numerical modeling, carbon fiber reinforced polymer (CFRP), elevated temperature, thermo, mechanical performance, small scale laminate, CFRP reinforced concrete specimen, near surface mounted reinforcement method.

*Speaker
†Corresponding author: long.nguyen@ut.edu.vn

Experimental characterization of multi-full-culm bamboo to steel connection

Nischal Prasad Nhuchhe Pradhan * [1], Themelina Paraskeva [2], Elias Dimitrakopoulos† [1]

[1] the Hong Kong University of Science and Technology – Hong Kong SAR China
[2] Edith Cowan University, Joondalup – Australia

The present research examines the performance of newly developed multi-full-culm bamboo to steel connections under monotonic axial loading. The culms are of Kao Jue (*Bambusa pervariabilis*) bamboo species. Findings reveal that the plain (unreinforced) connections fail early by undesirable brittle longitudinal splitting of bamboo culms. The confinement provided by hose-clamps inhibits this brittle failure mode, and with sufficient end-lengths, drastically increases the strength and ductility of the connection. Compared to the hollow-section connections with hose clamps, adding mortar infill further increases the strength. However, it also restricts bolt-deformation and thus diminishes the ductility. More importantly, the European Yield Model (which refers to dowelled timber connections) can analytically estimate the obtained experimental yield loads with satisfying accuracy. This is a promising direction towards a more rational and safer structural design of bamboo structures.

Keywords: bamboo structures, full culm bamboo, round bamboo, bamboo connections, European Yield Model

*Speaker
†Corresponding author: ilias@ust.hk

FE modelling of RC frames with Link Column Frame System under in-plane loading

Joel Shelton Joseph * [1], Hemalatha Gladston [2], Venkatesh Vellapandi [3]

[1] RGM College of Engineering and Technology – Nerawada 'X' Roads, Kurnool District, Nandyal, Andhra Pradesh 518501, India
[2] Karunya Institute of Technology and Sciences – India
[3] St. Mary's Integrated Campus – India

The purpose of the link column frame is to provide acceptable collapse prevention performance and also easily repaired following a moderate earthquake. Linked column frame system (LCF) for steel structures was proposed by Peter Dusicka et.al (2009) with the objective of utilizing replaceable components that are strategically placed to protect the gravity load carrying system. In this paper, the concept is extended to Reinforced concrete structures. The analytical studies were presented in this paper mainly focuses on the behavior of normal and link column RC frames with different connection configurations. Quasi-static cyclic load analytical results are presented and discussed for three 1:3 scaled RC frames with and without link column. Link column with various connections between the main beam and the link column i.e. rigid and hinged connection as per IS 12303-1987. With respect to experimental results, by using ANSYS software, the finite element model related to these frames is made and calibrated, and then analysis under cyclic static loading are performed. The test results showed a significant increase in the energy dissipation with a decrease in relative storey drifts for the link column frames with hinged connection. Greater amounts of energy were dissipated by the link column frame which has a hinge connection designed according to IS 12303-1987.

Keywords: Storey drifts, gravity load, Link column frame, hinged connection, Energy Dissipation.

*Speaker

MECHANICAL BEHAVIOUR OF FOUR-LEG BASE CONFIGURATION ON COLD-FORMED STEEL LATTICE COLUMN

Mohd Syahrul Hisyam Mohd Sani * [1], Fadhluhartini Muftah [1]

[1] Faculty of Civil Engineering, Universiti Teknologi Mara Cawangan Pahang – 26400 Bandar Jengka, Pahang, Malaysia

Steel lattice structure has often been used as column or girder, which is connected to each other by bolting, screwing or welding. Steel lattice is normally made using hot-rolled steel (HRS) and rarely used cold-formed steel (CFS). CFS is becoming popular in the building and construction sector due to less maintenance cost and ease of fabrication. The stability of the steel lattice structure either by using HRS or CFS is necessary to be studied and investigated, which is by checking their mechanical behaviour for the overall structure and focusing on the base configuration. The CFS lattice structure, member section, configuration, connection or fastener, end support and span must be checked to determine the mechanical behaviour. However, the failure of CFS, such as buckling, must be revised to ensure that the CFS lattice column is stable. The effect of CFS lattice structure mainly fails or become unstable due to the slender section of the structure, especially on the compression member. The slender section of the structure must be intentionally replaced with a short section or get added by bracing. There are four types of four-leg base configuration that have been tested. From the testing, the B.CFS 4 specimen showed the highest value of ultimate load among the specimens.

Keywords: Mechanical Behaviour, Lattice, Cold, formed Steel, Buckling

*Speaker

Finite Element Simulation of Member Buckling of Cold-rolled Aluminium Alloy 5052 Channel Columns

Ngoc Hieu Pham *† [1], Cao Hung Pham *

[1], Kim Rasmussen *

2

[1] School of Civil Engineering, The University of Sydney – Australia
[2] School of Civil Engineering, The University of Sydney – Australia

This paper presents the numerical investigation of cold-rolled channel columns made of 5052 aluminium alloy subjected to member buckling. A detailed Finite Element (FE) model using software ABAQUS v 6.14 was developed to simulate an experimental program recently performed at the University of Sydney. In the FE simulations, actual measured properties and geometric imperfections were incorporated into the FE models. The FE results are compared and validated against the experimental results. These accurate and reliable FE models will be used for the future parametric study to extend the data range for the development of the design guidelines for the cold-rolled aluminium alloy channel columns subjected to member buckling.

Keywords: Cold, rolled Aluminium Alloy, Numerical Study, Member Buckling, Channel Columns

*Speaker
†Corresponding author: ngochieu.pham@sydney.edu.au

Lateral Buckling Tests of Cold-rolled Aluminium Alloy 5052 Zee Beams

Ngoc Hieu Pham *† [1], Cao Hung Pham *

[1], Kim Rasmussen *

[2]

[1] School of Civil Engineering, The University of Sydney – Australia
[2] School of Civil Engineering, The University of Sydney – Australia

This paper presents a series of four-point bending tests of cold-rolled aluminium alloy 5052 Zee beams subjected to lateral buckling. Six Zee beams with three different lengths were selected for testing. A dual-actuator loading system was specifically designed to keep the load always in vertical direction and through the shear centre of the cross sections during testing. Lateral buckling failure modes were observed in long beams, while local-lateral interaction buckling was seen in short ones. The test results in this study will be used to calibrate the new proposed design guidelines for cold-rolled sections subjected to lateral buckling in an ongoing research project at the University of Sydney.

Keywords: Cold, rolled Aluminium Alloy, Lateral Buckling, Zee Beams.

*Speaker
†Corresponding author: ngochieu.pham@sydney.edu.au

Elastic Buckling Solution for Perforated Thin-walled Channel Sections in Shear with an Aspect Ratio of 2.0

Cao Hung Pham *† [1], Duy Khanh Pham *

[2], Gregory Hancock *

2

[1] School of Civil Engineering, The University of Sydney – Australia
[2] School of Civil Engineering, The University of Sydney – Australia

Thin-walled channel members subjected to shear are commonly perforated with web openings to provide access for building service systems. The changes in the stress distribution due to the presence of holes can cause the changes in the critical buckling load and the overall strength of the perforated members in shear. Recent research by S.H. Pham has provided buckling solutions based on Finite Element Method for determining the shear buckling loads of channel sections with web holes with shear aspect ratio up to 2.0. However, the research only focused on square and circular holes. With the same methodology, this paper provides a buckling solution for perforated channel members with elongated web holes in shear. FE models were constructed to generate the elastic buckling loads with a very wide range of hole dimensions. The assumptions about the stress distribution from the previous studies were also utilized in this study. A dimensional transformation is also proposed in this paper.

Keywords: Thin, wall structures, cold, formed steel, shear buckling, web openings, finite element method

*Speaker
†Corresponding author: caohung.pham@sydney.edu.au

The Behaviour of Cold-formed Channel Sections with Elongated Web Holes in Shear

Duy Khanh Pham * [1], Cao Hung Pham† [2], Song Hong Pham [1], Gregory Hancock [1]

[1] School of Civil Engineering, The University of Sydney – Australia
[2] School of Civil Engineering, The University of Sydney – Australia

Cold-formed C-sections with circular and square web openings in shear have been studied thoroughly. However, the web holes are likely to be elongated along the span length due to limited web depth to allow more access for building services in practice. This paper summarizes an experimental study on channels in shear with elongated web holes. The study uses a dual actuator test rig with the aim of minimizing the effects of bending moments at the two ends of the shear span and obtaining the pure shear capacity with an aspect ratio up to 2.0. A comparison of Direct Strength Method design loads for shear with the test results is conducted. The shear yield loads based on the previous proposals for the DSM in shear for perforated channels with square and circular web holes are used in this paper to assess the applicability of those proposals to the cases of elongated web openings.

Keywords: Cold, formed steel, shear strength, elongated web openings, direct strength method.

*Speaker
†Corresponding author: caohung.pham@sydney.edu.au

Experimental Investigation of Cold-Rolled Aluminium Alloy 5052 Columns Subjected to Distortional Buckling

Le Anh Thi Huynh *† [1], Cao Hung Pham * ‡ , Kim J.r. Rasmussen

[1] The University of Sydney – Australia

The behaviour and strength of cold-formed columns are mainly influenced by local, distortional and global buckling or coupled instability phenomena. Distortional buckling may govern the column strengths of open cold-formed sections with intermediate lengths. The objective of this paper is to investigate the distortional mode and ultimate capacity of cold-rolled aluminium channel sections in compression. A total of nine columns with three different cross-sectional geometries were performed at the University of Sydney. These commercially available cross-sections were fabricated by using the cold-rolling process instead of extrusion. The geometric imperfections of channel specimens were measured using a specially designed measuring rig. Tensile coupon tests were also conducted from the flat portions and the corner regions of the cross-sections to determine the material properties. The specimens were tested in axial compression between two fixed ends. The ultimate loads and observed failure modes in the column tests are reported.

Keywords: Aluminium alloys 5052, Cold, rolled channel sections, Section capacity, Distortional buckling.

*Speaker
†Corresponding author: leanhthi.huynh@sydney.edu.au
‡Corresponding author: caohung.pham@sydney.edu.au

Numerical Simulation of Cold-Rolled Aluminium Alloy 5052 Columns Subjected to Distortional Buckling

Le Anh Thi Huynh * [1], Cao Hung Pham† , Kim J.r. Rasmussen

[1] The University of Sydney – Australia

This paper describes Finite Element (FE) analyses of cold-rolled aluminium alloy 5052-H26 columns subjected to distortional buckling using the program ABAQUS. The results of distortional buckling tests in an experimental program performed at the University of Sydney are fully described in a companion paper. The simulation results are compared and validated against the distortional buckling tests. In detailed FE models, effects of such input parameters as mechanical properties of flat and corner areas and initial geometric imperfections are considered. The FE ultimate strengths are in good agreement with the experimental results. Therefore, the FE analysis can be used to predict the ultimate loads of cold-rolled aluminium alloy members including the post-buckling behaviour of thin-walled aluminium sections in compression subjected to distortional buckling. It is indicated that the reliable FE models in this study can be used to extend data range for future calibration of distortional buckling strength curve for design of cold-rolled aluminium columns.

Keywords: Aluminium alloys 5052, Cold, rolled channel sections, Distortional buckling, Finite Element Model

*Speaker

†Corresponding author: caohung.pham@sydney.edu.au

Use of Kriging metamodels for seismic fragility analysis of structures

Cong Thuat Dang* [1], Thanh Tran [2], Duy-My Nguyen † [1], My Pham [1], Thien-Phu Le [3]

[1] University of Science and Technology - The University of Danang – Vietnam
[2] Yokohama National University – Japan
[3] Universite d'Evry-Val-d'Essonne – Laboratoire de Mécanique et Energétique d'Evry – France

In civil engineering, a seismic fragility curve is popularly used to predict failure probability of structures under different earthquakes, and hence propose essential rehabilitation strategies through risk assessment for future earthquakes. The curve shows the failure probability as a function of seismic intensity, e.g., spectral acceleration at fundamental frequencies of structures (Sa,T1), and can be obtained using one of three approaches: engineering judgment, empirical studies or numerical simulations. The paper focuses on constructing seismic fragility curves using numerical simulations, where robust approaches of seismic reliability analysis are based on direct Monte Carlo simulation technique. The MCS based method usually requires a relatively large number of simulations to obtain a sufficiently reliable estimate of the fragility. It therefore becomes computationally expensive and time consuming as generating the simulations using the actual model or called full model of the structure. In this regard, this paper suggests using Kriging metamodel as a viable alternative of the actual model to reduce computational costs in seismic fragility computation. The Kriging metamodel is constructed based on the training samples of input and corresponding output responses of the structure. The validation of this method is performed on two numerical examples.

Keywords: Monte Carlo Simulation, Kriging Metamodeling, Fragility Curves

*Corresponding author: dangcongthuat@dut.udn.vn
†Speaker

Application of Structural System Identification to composite bridges built in cantilever

Jose Lozano-Galant , Gonzalo Ramos , Jose Turmo * [1]

[1] Universitat Politècnica de Catalunya BarcelonaTech (UPC) – Universitat Politècnica de Catalunya C. Jordi Girona, 31. 08034 Barcelona, Spain

Bridges built in cantilever are a very convenient solution for medium to long span bridges. The industrialized process of construction linked with the fact that the surroundings of the piers are free from scaffoldings and shuttering leads to a safe, standardized and environmentally friendly construction method very popular in many countries. The method however is technologically challenging. One of the problems to be accounted for is the fact that deflections at the tip of the cantilever has to be foreseen, as segments, either in situ or precast, have to be built with a certain precamber.
Recently, heavy concrete webs of such bridges have been substituted in some cases by crippled steel webs. That means that the bridge is more flexible and, to some extent, shear effects can affect the behavior of the cantilever, especially in the first construction steps, when the structure behaves like a deep beam. It is very convenient to have an accurate and updated model of the bridge in order to calculate deflections and hence, precamber. In order to update the construction model, real data from the construction site can be used in an inverse analysis.

The paper will explore different methods of structural system identification to update construction models, comparing the results when shear effects are taken into account and when they are neglected. The paper will explore the possibility of applying such methods to the modelling of a steel web cantilever bridge.

Keywords: Structural System Identification, Shear Behaviour, Cantilever Bridge, Composite Bridge

*Speaker

Models for studying the shear strength of circular members

Jose Turmo * [1], Gonzalo Ramos , Angel Aparicio

[1] Universitat Politècnica de Catalunya BarcelonaTech (UPC) – Universitat Politècnica de Catalunya C. Jordi Girona, 31. 08034 Barcelona, Spain

Qualitatively, most of the researchers and codes state that the shear strength of a beam is the combination of the contribution of the concrete and the contribution of the shear reinforcement if present. The first one takes into account the shear stress transferred by the compressed zone of the element, the dowel action, the aggregate interlock and the arch effect. As the value of steel contribution can be easily calculated with rational models, such as the truss analogy, research focuses on the elaboration of methods for an accurate evaluation of the concrete contribution. Regarding the shear strength of the concrete members of solid and hollow circular members, it is to highlight that very few codes (e.g. USA, New Zealand) explicitly refer to the application of the shear design formulae to circular concrete members, but with simplified methods.
This paper will present an analytical model for evaluating the contribution of the transverse reinforcement in concrete members of solid and hollow circular cross section. This will cover the shear contribution of hollow and solid circular members with both transverse or spiral reinforcement. Assumptions made for the calculation of this formulation have been deduced theoretically and then checked empirically.

Keywords: Shear truss analogy, reinforced concrete, circular members, shear strength

*Speaker

Application of weighted Latin hypercube sampling in stochastic modelling of shear strength of RC beams

Khuong Le Nguyen *† [1]

[1] University of Transport Technology – Vietnam

Stochastic modelling and probabilistic analysis of concrete members are very time-demanding, especially for nonlinear finite element analysis of concrete structures. This paper presents an application of weighted Latin hypercube sampling method in stochastic modelling of shear strength of reinforced concrete beams, which takes into account the sensitivity factors regarding the behaviour of the considered system. The results show with only a few simulations the statistical values of the load-bearing capacities of concrete structures can be determined with high accuracy if weighted Latin hypercube sampling is used.

Keywords: weighted Latin hypercube sampling, stochastic modelling

*Speaker
†Corresponding author: khuongln@utt.edu.vn

Predicting onset and orientation of localisation bands using a cohesive-frictional model

Linh Le * [1], Giang Nguyen * † [2], Ha Bui [3]

[1] The University of Adelaide – Australia
[2] The University of Adelaide – Australia
[3] Monash University – Australia

In this study, a localisation band idealised as zero-thickness surface and represented by a cohesive-frictional model is directly incorporated into the structure of a new constitutive modelling approach and is activated once a stress-based condition is met. The embedded cohesive-frictional model provides a natural way to detect both the onset and orientation of localisation bands. This is different from existing continuum approaches based on the loss of positiveness of the determinant of the acoustic tensor. The formulation in this approach also creates a strong link between quantities describing the localisation band in the model and experiments, facilitating the calibration of model parameters.

Keywords: Bifurcation analysis, Geomaterials, Localised failure, cohesive frictional models

*Speaker
†Corresponding author: g.nguyen@adelaide.edu.au

Sustainable Construction Materials and Technologies

Preparation of low cement ultra-high performance concrete

Norzaireen Azmee *† [1], Nasir Shafiq [1]

[1] Universiti Teknologi PETRONAS (UTP) – Universiti Teknologi PETRONAS 32610 Seri Iskandar, Perak Darul Ridzuan, Malaysia, Malaysia

Technology advancement in concrete industry and expanding interest for high quality construction materials have prompted the development of ultra-high performance concrete (UHPC). Despite of many advantages gained using UHPC, however, conventional UHPC recipe raises many concerns especially on sustainability issues. Producing UHPC, requires relatively high amount of cement content and often the compositions are not optimized. Low cement UHPC was proposed to minimize the economic and environmental disadvantages of current UHPC by incorporating high content of supplementary cementing materials (SCM). An experimental program was carried out to evaluate the effect of SCM combinations on workability and compressive strength. It was found that good consistency and highest strength of low cement UHPC could be achieved with binary combination of fly ash and ultrafine calcium carbonate as SCM replacing up to 50% of cement. Enhancement of compressive strength as early as 7 days at 12.5% followed by 8% at 28 days and 20% at 90 days were observed in this low cement UHPC.

Keywords: Ultra high performance concrete, High volume fly ash, Ultra fine calcium carbonate, Compressive strength

*Speaker

†Corresponding author: norzaireen@gmail.com

Matrix dependent piezoresistivity responses of high performance fiber-reinforced concretes

Duy-Liem Nguyen [1], Thi-Bich-Nga Vu* , Huynh-Tan-Tai Nguyen , Van-Ben Nguyen †

[1] Université de Ho Chi Minh – Vietnam

An experiment was conducted to investigate the matrix dependent piezoresistivity responses of high performance fiber-reinforced concretes (HPFRCs) under direct tension. Three comparative HPFRCs were produced from following matrice: M1 was the controlled matrix while amount of cement in M2 or M3 was partly replaced by CB or GGBS, respectively. All HPFRCs contained same amount of twisted steel fibers 2% volume fraction. The investigated HPFRCs exhibited strain-hardening and both self strain-sensing and self damage-sensing abilities. The replacement of cement by CB and GGBS produced high enhancements of first-cracking strengths but great reductions of gauge factors within first-cracking points. Besides, as CB and GGBS were used in M2 and M3, respectively, there were not clear effects on post-cracking strengths but slight enhancements of gauge factors within post-cracking points were observed.

Keywords: High Performance Fiber Reinforced Concretes, Gauge Factor, Carbon Black, Furnace Slag, Self Sensing

*Corresponding author: ngavtb@hiu.vn
†Speaker

Influence of elastic modulus under uniaxial tension and compression on the first-cracking flexural properties of UHPFRCs

Duy-Liem Nguyen* [1], Minh-Thuan Duong † [2]

[1] Université de Ho Chi Minh – Vietnam
[2] Hochiminh City University of Technology and Education – Vietnam

This paper investigated the influence of elastic modulus under uniaxial tension and compression on the first-cracking flexural properties of ultra-high-performance fiber-reinforced concretes (UHPFRCs). The elastic modulus of a uniaxial stress versus strain response curves is defined as the slope of linear portion within the first crack and it refers to the stiffness of the tested material. Unlike metal exhibiting same elastic modulus in both tension and compression, the elastic modulus of UHPFRCs, observed from experimental tests in previous studies, were considerably different, and, they much influenced on the first-cracking flexural resistances from sectional analysis. Relationships between compressive strength and elastic modulus of UHPFRCs were also investigated and discussed.

Keywords: Ultra High Performance Concrete, Elastic Modulus, First Crack, Flexural Resistance, Uniaxial Tension

*Corresponding author: liemnd@hcmute.edu.vn
†Speaker

Investigation on shear resistances of short beams using HPFRC composited normal concrete

Duy-Liem Nguyen* [1], Van-Toi Do † , Minh-Phung Tran , Luu Mai

[1] Université de Ho Chi Minh – Vietnam

This paper presents an investigation on shear resistances of short beams using high performance fiber-reinforced concrete (HPFRC) composited normal concrete (NC). Total twelve short beams with identical span-length/depth ratio of 2 were tested under three-point bending. HPFRC and NC had their compressive strength of 80 MPa and 20 MPa, respectively. HPFRC layer was placed in extreme top or bottom fiber with various thicknesses; for each thickness, steel reinforcing-bar and no reinforcing-bar embedded inside beams were examined. The results of experimental test were evaluated and discussed.

Keywords: High performance fiber reinforced concretes, Shear resistance, Composited beam, Shear strain, Short beam

*Corresponding author: liemnd@hcmute.edu.vn
†Speaker

Application of Fluidized Power Coating for Propellers

Phan Anh Tuan *† [1], Pham Thi Thanh Huong

[1] Hanoi University of Science and Technology (HUST) – 1 Dai Co Viet Road,Hai Ba Trung Dist., Hanoi, Vietnam

Fluidized bed powder coating is a process where a pre-heated part is dipped into a tank of fluidized thermoplastic powder, which is typically PVC or nylon. This work creates a beautiful and durable conformal coating for the surface of metal parts, machinery and equipment with a plastic film to protect against corrosion and environmental effect. In the shipbuilding industry, the fluidized bed powder coating method has been applied to the interior details, shell machinery and marine equipment. However, the application to the surface of the propeller has not been popular. This paper presents a study on the applicability of fluidized bed powder coating to surfaces of propeller. The authors have conducted research and experiments for a three-blade ship propeller. Research has compared the performance of the initial propeller and itself after applying the fluidized bed powder coating method. From research study result, the authors make an assessment and recommendations for the application of fluidized bed powder coating to propeller blade surfaces in shipbuilding

Keywords: Fluidized bed powder coating, Surface, Metal, Corrosion, Propellers, Shipbuilding

*Speaker
†Corresponding author: tuan.phananh@hust.edu.vn

Design of a Drinking Water Disinfection Systems using Ultraviolet Irradiation and Electrolysis Cell

Phan Anh Tuan *† [1], Nguyen Minh Tan

[1] Hanoi University of Science and Technology (HUST) – 1 Dai Co Viet Road,Hai Ba Trung Dist., Hanoi, Vietnam

In this paper, the authors develop a concept design of a safety drinking water disinfection system powered by wind energy. The idea for carrying this study is to develop a safety Drinking Water Disinfection System (DWDS) for rural/island/mountain and removed areas in Vietnam as such as in ASEAN developing countries where the national electric grids may be lacked. The drinking water disinfection will use electricity from a small wind turbine. The study will focus to develop two main parts: development an energy-efficient UV treatment technology as main disinfection step with a small-scale electrolysis cell and development a small wind turbines for supporting the electric to the UV treatment and electrolysis cell. A prototype product of the safety drinking water disinfection powered by wind energy was created.

Keywords: Drinking water, Disinfection, UV treatment, Electrolysis cell, Wind turbine

*Speaker
†Corresponding author: tuan.phananh@hust.edu.vn

The effect of mineral admixture on the properties of the binder towards using in making pervious concrete

Dong Nguyen Van * [1]

[1] Phan Quang Minh, Nguyen Viet Phuong, Pham Huu Hanh, Nguyen Van Tuan – Vietnam

Pervious concrete has not been much studied and applied in Vietnam, the outstanding feature of this concrete is the open pore system for water flowing through. The two most important indicators for evaluating the quality of pervious concretes are the permeability coefficient and compressive strength but these are two opposite functions. Research into the properties of this type of concrete, such as workability, strength, etc ... is one of the most effective measures that will improve the quality of the binders. The purpose of this article is to improve the characteristic of binder by separately using silicafume (SF) and fly ash (FA) with a content of 10%; 20% and 30% and by using the combination compound of 10% SF with 10-30% FA. The two typical properties of binders are: the viscosity of the binders through the flowing time of Marsh cone, the instantaneous viscosity determined by the SV-10 viscosimeter and the cstrength of the binders.

Keywords: Pervious concrete, Fly ash, silicafume, compressive strength, permeability coefficient

*Speaker

Horizontal response of base-isolated buildings supported to high damping rubber bearings

Dung Nguyen * [1], Phong Le [2], Minh Tran [3]

[1] Thuyloi University – 175 Tay Son - Dong Da - Ha Noi, Vietnam
[2] Thuyloi universiity – Vietnam
[3] State Audit Office – Vietnam

Seismic isolation is one of the most efficient techniques to protect structures against earthquakes. Rubber bearings are suitable for low-rise and medium-rise buildings due to its durability and easy fabrication. This paper presents the horizontal response of a six-storey base-isolated building using high damping rubber bearings (HDRBs) under two ground motions of earthquakes as types I and II in JRA (2002) by finite element analysis. In this analysis, these bearings are modelled by the bilinear hysteretic model which is indicated in JRA and AASHTO. Comparison of horizontal response including base shear force and roof level acceleration between the two cases: base-isolated building and fixed-base building is carried out to evaluate the effectiveness of the use of HDRBs on the protection of buildings from earthquakes. The numerical results show that the peak value of roof floor acceleration of the fixed-base building is two times higher than that of the base-isolated building, and the floor accelerations depend on the peak values of ground acceleration. In addition, the step-by-step design procedure for determining the size of HDRBs used for buildings is also presented in this paper.

Keywords: High damping rubber bearings, seismic responses, earthquakes, buildings

*Speaker

A Study on Behavior of Reinforcement Concrete Beam using the Recycled Concrete

Anh-Thang Le * [1], T. Hung Nguyen , C. V. Duc Phan

[1] Hochiminh City University of Technology and Education – Vietnam

The demand for concrete materials in construction becomes huge due to the development of the economy and urbanization in Vietnam. Recently, recycled aggregate concrete has been studied for partly replacing natural stone of concrete in the worldwide. It could save cost for land filling, and con-serve the national resources such as river sand and aggregate. Recycling concrete gives the benefit for environment. However, it may affect to the strength and performance of the construction containing the concrete waste. The paper is a discussion based on the experiments of reinforcement concrete beams with and without recycled concrete. Testing results are simulated by the ATENA program on exploring the behavior of beams. The analysis and experiment results show that replacing 20% of natural stone with recycled aggregate concrete does not affect both the bearing capacity and performance of beams.

Keywords: recycled concrete beams, simulation of a beam, ATENA 3D, the flexural be, havior of the beam

*Speaker

Geochemical modelling for prediction of chloride diffusion in concrete exposed to seawater

Hoang Long Nguyen [1], Van Quan Tran [*†] [1], Long Khanh Nguyen [1], Tuan Anh Pham [1], Quoc Trinh Ngo [1], Van Loi Giap [1]

[1] University of Transport Technology – No. 54 Trieu Khuc Street, Thanh Xuan District, Hanoi, Vietnam

Corrosion is one of major problems that affect the durability of reinforced concrete structures. Chloride concentration is major cause induced to the corrosion of reinforced concrete exposed to seawater. Therefore, the durability of reinforced concrete can be evaluated by the prediction of chloride concentration into the reinforced concrete. Numerous numerical models have been developed to predict the chloride concentration in concrete however these numerical models have not yet fully simulated the nature of the chemo-physical processes taking place between the concrete and seawater. In this study, the prediction of chloride concentration is carried out by using the geochemical model including chemo-physical process. The geochemical model can improve the accuracy of the durability prediction of reinforced concrete. The accuracy of durability prediction is proved by the comparisons between modelled results and experiments results found in the literature.

Keywords: Reinforced concrete, seawater, durability, chloride, geochemical model.

[*]Speaker
[†]Corresponding author: quantv@utt.edu.vn

Application of Asphalt Concrete using Limestone with Cement & Admixture

Hoang Nguyen* [1], Hung Pham [2], Khanh Tran † [1], Huy Nguyen [2]

[1] Ho Chi Minh City University of Transport (HCM-UT) – No 2 Vo Oanh Str, Ward 25, Binh Thanh Dist. HCM City, Vietnam
[2] Institute of Transport Science and Technology (ITST) – 111111- No.3 Pham Ngoc Thach, Ward 6, District 3, Ho Chi Minh City, Vietnam

Vietnam is one of the countries in the world that will likely suffer from climate change predictions. The natural state of severe seasonal weather patterns in Vietnam, when combined with heavy trucks, makes the current conventional types of asphalt concrete are no longer able to bear the load. This results in common defects, such as rutting resistance and fatigue cracking of the current asphalt concrete roads surfaces. This article aims to introduce a type of high strength asphalt concrete using limestone filler, combined with cement and an adhesion additive that will help to solve the mentioned problem. The place of the pilot project was on a ten kilometres road (Km 1613+00 to Km 1623+00) on the National Highway number 1, which suffers from the heaviest traffic loads. The asphalt concrete was designed with a Marshall- Bailey Modification Method. After four years of use, the road was recently tested and remains in an operational and stable condition. There are many solutions proposed to apply the solution of high-intensity asphalt concrete using limestone filler combined with cement and admix. Wetfix®BE increased adhesive is the best solution due to the product's cost-effectiveness, the availability of materials: like sand and stone. The asphalt concrete is high in strength, heat resistant, rutting resistance and fatigue cracking.

Keywords: Asphalt concrete, limestone, admix

*Corresponding author: hoang_ba2001@yahoo.com
†Speaker

Experimental Investigation of a Self-powered Magnetorheological Damper for Seismic Mitigation

Daniel C *† [1], Hemalatha G [2], Sarala L [2], Tensing D [2], Sundar Manoharan S [3], Xian-Xu Bai‡ [4]

[1] Karunya Institute of Technology and Sciences – India
[2] Karunya Institute of Technology and Sciences – India
[3] Sathyabama Institute of Science and Technology – India
[4] Hefei University of Technology (HFUT) – Tunxi Road No.193 Hefei.Anhui 230009, China

The present work investigates the effectiveness of Magnetorheological Damper (MR) damper coupled with the smart self-powered system, MR damper acts as electromagnetic induction (EMI) device in controlling seismic vibration. The proposed smart damping system with an EMI device is capable of converting vibration energy into electrical energy. Thus, the EMI device attached with MR damper can be used as an effective and alternative power source for the MR damper, making it a self-powering system. The primary aim of the experimental study is to identify the performance of the proposed smart damping system using time history loading (El Centro earthquake). For experimentation, the MR damper with EMI was designed and fabricated. To reduce sedimentation, nano Fe3O4 was used in the preparation of MR fluid. The performances of the proposed smart damping system are compared with the passive, semi-active and active control system in force and displacement to evaluate the effectiveness of the self-powered smart damping system in reducing seismic vibration. The experimental results show that the self-powered smart damping system produces more damping force and reduction in displacement. The maximum damping force obtained is 0.67 kN. In an active system, a force was increased by 12.9% and displacement was reduced by 13.4% when compared with the semi-active control system. The results revealed that the proposed EMI can act as a sole power source for the damping system.

Keywords: Self, powered, Nano Fe3O4, Magnetec oil, MR Damper

*Speaker
†Corresponding author: danielckarunya@gmail.com
‡Corresponding author: bai@hfut.edu.cn

Effect of Ground Granulate Blast Furnace Slag in Replacement of Cement in Ternary Binder on Performance of Sand Concrete

Sang Nguyen Thanh * [1]

[1] Long Hai Chu – Vietnam

With plentiful material resources including dune sand from Central Coastal provinces and fly ash – a by-product of burning coal at electronic power plants, sand concrete is widely used in Vietnam in respond to both technical and economical requirements. In this research, with the proportion of 18% cement, 37% crushed sand, 33% dune sand, and 12% fly ash, the length change and strength development tests were conducted in order to evaluate the effect of ground granulated blast furnace slag (GGBFS) in replacement of cement in 0%, 20%, 30%, 40%, and 50%, respectively on performance of sand concrete. The criteria for assessment performance of this concrete include free flow, water absorption, resist of chloride ion penetration, and strength in both compression and flexure. Besides, the relevant microstructural changes due to GBFS proportion and 03 different curing conditions were observed to support the assessment on potential alkali-silica reactions by conducting scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDX) and X-ray diffraction (XRD). As a result of these tests, it is confirmed that 30% GGBFS in replacement of cement is suitable content in this sand concrete.

Keywords: GGBFS (Ground Granulated Blast Furnace Slag), Potential Alkali Silica Reaction (ASR), XRD, SEM/EDX, Strength, Sand Concrete.

*Speaker

Experimental Study on Effect of Ground Granulated Blast Furnace Slag of Strength and Durability of Sand Concrete

Sang Nguyen Thanh* [1], Khoa Nguyen †‡ [2]

[1] University of Transport and Comunications (UTC) – 03 Cau Giay, Lang Thuong, Dong Da, Hanoi, Vietnam
[2] Dong A University (UDA) – 33 Xo Viet Nghe Tinh, Danang, Vietnam

Concrete for building structures in the marine environment requires a high level of durability, and an effective method to improve the durability of concrete is the use of ground granulated blast furnace slag (GGBFS). The paper presents an experimental study on the effect of the replacement cement by 20%, 30%, 40%, 50% GGBFS on workability, mechanical properties and durability properties of sand concrete (SC). The results show the compressive strength, splitting tensile strength, elastic modulus and abrasion resistance of SC that werehad the highest value corresponding to 20% GGBFS. The lowest chloride penetration corresponded to SC containing 30% GGBFS.

Keywords: sand concrete, high performance sand concrete, fly ash, blast furnace slag, chloride ion penetration

*Corresponding author: nguyenthanhsang@utc.edu.vn
†Speaker
‡Corresponding author: ntkhoa2013@gmail.com

MECHANICAL PROPERTIES OF FLY ASH BASED GEOPOLYMER CONCRETE USING ONLY STEEL SLAG AS AGGREGATE

Dong Dao *† [1], Son Trinh [1]

[1] University of Transport Technology – 54 Trieu Khuc, Thanh Xuan, Hanoi, Vietnam

Dong Van Dao, Son Hoang Trinh
University of Transport Technology, 54 Trieu Khuc, Thanh Xuan, Hanoi, Vietnam

Corresponding Author: Dong Van Dao, email: dongdv@utt.edu.vn

Abstract: Geopolymer concrete (GPC) is a sustainable construction material in which industrial byproducts containing Si and Al such as fly ash and slag are polymerized using an alkaline activating solution to create hardened binder or inorganic polymer cement. GPC is an eco-friendly alternative to Portland cement concrete in construction applications. This study evaluated GPC mixtures using fly ash as a geopolymer binder and granular slag materials in place of natural coarse and fine aggregates. A large sample of slag was taken from the Thai Nguyen Iron and Steel Factory in Vietnam. It is a mix of blast furnace and steel slag materials. The sample was crushed and fractionated into two fractions of coarse and fine aggretates. Three GPC mixtures were designed to achieve specific compressive strengths (f'c) of 25, 30, 35 MPa by varying (1) the sodium solution (NaOH) between 10 and 14M, (2) the ratio (by mass) of alkali activating solution to fly ash (AAS/FA) between 0.4 and 0.5, and (3) the ratio (by mass) of sodium silicate (Na2SiO3) to sodium hydroxide solution (NaOH) (or SS/SH) between 2 and 3. The mixtures were prepared for testing in fresh and hardened conditions. The results showed that the fresh GPC mixtures with slag aggregates had an average workability property (ranging from 42 to 73 mm) due to the high absorption of slag aggregates. The hardened GPC specimens (air-cured) yielded good compressive strength (between 29 and 49 MPa), flexural strength (ranging from 4.1 to 6.2 MPa), elastic modulus (between 29 and 34 GPa) and abrasion resistance (ranging from 0.09 to 0.2 g/cm2). These properties are likely a result of the high strength of slag aggregates and a chemical reaction between steel slag aggregates and the geopolymer binder, improving the interfacial transition zone (ITS) and GPC microstructure. This study suggests that slag agregates can be used in place of natural aggregate materials to improve GPC's mechanical properties without heat curing for construction applications.

Keywords: Key words: Steel slag aggregate, fly ash based geopolymer concrete, mix design, design of experiments.

*Speaker
†Corresponding author: dongdv@utt.edu.vn

Effect of fly ash on the mechanical properties and drying shrinkage of the cement treated aggregate crushed stone

Quan Ho *† [1], Tuoi Nguyen‡ [2], Chau Nguyen§

[1] The University of Danang - University of Technology and Education (UTE) – 48 Cao Thang, Hai Chau, Danang, Vietnam
[2] Central Transport College No.V, Da Nang, Viet Nam – 28 Ngo Xuan Thu, Lien Chieu, Danang, Vietnam

This paper presents the influence of fly ash on the mechanical properties and drying shrinkage of cement treated aggregate crushed stone (CTACS) mixture. The fly ash can replace 20-40% the weight of cement for the mixture of 4% CTACS, while it can supplement 3-9% the weight of aggregate crushed stone for both mixtures of 3% and 4% CTACS. Furthermore, the experimental findings indicated that the reduction in the compressive strength and the splitting tensile strength of CTACS was inversely proportional to the fly ash content replaced partially by the cement. However, the increase in the compressive strength and the splitting tensile strength of CTACS was directly proportional to the fly ash content. It was observed from the test results that the drying shrinkage of all mixtures was smaller than the control mixture without fly ash. The drying shrinkage of mixtures reduced inversely to the proportion of the fly ash content when 20-40% cement was replaced by the fly ash. When adding 3-9% fly ash, the 6% fly ash gave the smallest drying shrinkage.

Keywords: Aggregate crushed stone, cement and fly ash treated aggregate crushed stone, compressive strength, splitting tensile strength, drying shrinkage

*Speaker
†Corresponding author: vanquan0877@gmail.com
‡Corresponding author: Tuoinguyen79@gmail.com
§Corresponding author: nguyenvanchau.cienco5@gmail.com

Strength of Granulated Blast Furnace Slag during Hydration Reaction Process

Tran Thanh Nhan *† [1], Hiroshi Matsuda [2], Tran Xuan Thach [3], Nguyen Dai Vien [4], Ho Trung Thanh [1]

[1] University of Sciences, Hue University (HUSC, HU) – 77 Nguyen Hue street, Hue city, Vietnam
[2] Yamaguchi University – 2-16-1 Tokiwadai, Ube, Yamaguchi, 755-8611, Japan
[3] Ha Tinh Department of Construction – 14 Vo Liem Son, Ha Tinh city, Ha Tinh Province, Vietnam
[4] Thua Thien Hue Department of Construction – 02 Nguyen Truong To street, Hue city, Vietnam

Granulated Blast Furnace Slag (GBFS) is a by-product of iron production process in which the molten slag from the blast furnace is cooled down rapidly by the highly pressurized water. In many counntries, GBFS has been widely used as a geo-material in civil works, meanwhile in Vietnam, due to the lack of technical standards and development, iron and steel slags including GBFS have not been used in construction. In this paper, firstly, typical properties and chemical content of Formosa GBFS (produced by Formosa Steel Plant in Ha Tinh province, Vietnam) were observed and it was shown that physico-mechanical properties and chemical components of Formosa GBFS are similar to those of GBFS produced in Japan which have been widely used in the port and habor works as alternative sands. Secondly, the hydraulic property and its effects on the unconfined compressive strength were then clarified for different GBFS samples and based on which, an estimation method of unconfined compressive strength was then developed.

Keywords: Granulated blast furnace slag, Hydraulic property, Unconfined compressive strength

*Speaker
†Corresponding author: ttnhan@hueuni.edu.vn

Use of coal ash of thermal power plant for highway embankment construction

Tung Hoang *† [1], Viet-Phuong Nguyen [1], Hong-Nam Thai

[1] Highway and Traffic Engineering Department, National University of Civil Engineering – No.55 Giai Phong street, Hai Ba Trung district, Hanoi, Vietnam, Vietnam

The highway embankment construction allows to consume a huge volume of coal ash up to hundreds of thousands of tons per km. However, this is a material with very different physical and chemical properties from traditional materials, which requires different design, construction and acceptance solutions. This article first presents the results of the laboratory experiments to evaluate and classify coal ash according to the AASHTO M145 and ASTM C618, TCVN 9436-2012 standards. These results help to define the composition, construction and acceptance solutions of the road bed made of ash in Vietnamese conditions. The proposed solutions have been experimented at a road section constructed in 2017 in Ha Nam with the large scale (100m of grade IV, 12m wide, 2.2m high, 960 tons of coal ash) and conduced to analytical results.

Keywords: subtainable construction materials, coal ash, embankment, highway.

*Speaker

†Corresponding author: hoangtungcd@gmail.com

Impact of porosity of coarse aggregates on the structuration of paste-aggregate interface: Elementary model study

Duc Long Tran *† [1], Franck Cassagnabere [2], Michel Mouret [2]

[1] LMDC, University of Toulouse Paul Sabatier France; University of Technology and Education, the University of Da Nang, Vietnam – University of Toulouse Paul Sabatier – France
[2] LMDC, University of Toulouse Paul Sabatier France – University of Toulouse Paul Sabatier – France

In the context of sustainable development, the production of concrete with local natural resources or recycled materials is a legitimate concern as much as the limitation of the clinker content in the concrete design. However, local aggregates and recycled aggregates can be porous and of lower quality. As a result, the intrinsic high porosity of aggregates decreases the compressive strength and adversely the transport properties (permeability, diffusivity, absorption) and the durability of concrete. In a preliminary understanding and with a view to accentuating phenomena occurring in the concrete, the elementary model, which is composed by paste and gravel, was studied. In this paper, the effect of water porosity, moisture state and volume of coarse aggregates, as well as the nature of mineral admixture on the water porosity (WP) of elementary model (EM) was taken into account. Five kinds of aggregates (more or less porous), two moisture states (oven dry (OD) and saturated surface dry (SSD)) and four kinds of mineral admixture (metakaolin, limestone filler, slag and fly ash) were the design parameters investigated with the variation in aggregate volume. The objective was to assess i) the impact of such design factors on WP of EM, and ii) the interaction between aggregate and cement paste. The data were analyzed by statistic and ranking methods, and results indicated that volume and water porosity of aggregate are the two most important factors affecting WP of EM. Besides, it was shown that aggregate porosity has the same direction impact on the WP of EM while does not have the same trend impact concerning the effect of the paste/aggregate interface on the WP of EM whatever the nature of mineral admixture and aggregate, moisture state and volume of aggregate. Explanatory attempts are proposed from SEM/EDS analyzes to support statistic and ranking conclusions.

Keywords: aggregates, porosity, transport properties, durability, mineral admixture, cement paste

*Speaker
†Corresponding author: duclongxdcd@gmail.com

Strength and engineering properties of cementless paste produced by GGBFS and MgO

Chao-Lung Hwang [1], Duy-Hai Vo [*†] [2], Khanh-Dung Tran Thi , Damtie Yehualaw Mitiku

[1] Department of Civil and Construction Engineering; National Taiwan University of Science and Technology (NTUST) – 43, Sec.4, Keelung Rd., Taipei, 10607, Taiwan, R.O.C, Taiwan
[2] Faculty of Civil Engineering; University of Technology and Education, The University of Danang (UTE) – 48 Cao Thang street, Hai Chau district, Danang, Vietnam, Vietnam

This study aims to investigate engineering properties of cementless pastes which were produced by reactive magnesium oxide (MgO) and ground granulated blast furnace slag (GGBFS). The mixtures were designed in various levels of MgO at 2.5%, 5%, 7.5%, 10%, 15% and 20% of total binder weight. The slump flow test, compressive strength test, ultrasonic pulse velocity test (UPV) and thermal conductivity test were conducted to examine the engineering properties of the pastes until 28 curing days. The results indicate that the high proportion of MgO causes the decrease of flow-ability of fresh pastes. Increasing MgO content significantly promotes the hydration process and improves the compressive strength and hardened properties of pastes through the UPV and thermal conductivity testing results.

Keywords: cementless paste, compressive strength, engineering properties, thermal conductivity

[*]Speaker
[†]Corresponding author: duyhai88@gmail.com

A non-paraffinic PCM modified textile reinforced concrete sandwich panel

Zakaria Ilyes Djamai *† [1], Amir Si Larbi , Ferdinando Salvatore

[1] DJAMAI Zakaria – 2 – Laboratoire LTDS , site jean parot , ENISE Saint etienne, France

There is growing interest in the use of phase change materials (PCMs) in the building industry, particularly in cementitious materials.
In the present study, a modified mortar matrix with different amounts of pcm (5wt %, 10wt%, 15wt %) have been prepared. The different pcm-mortar matrixes have been mechanically characterized. It was found that pcm drastically decreases the mechanical performance of mortar.

The 10% PCM-mortar matrix has been reinforced with 2 layers of AR glass Fabric and has been used as a skin of textile reinforced concrete (TRC) foamed sandwich panel.
The performance of the 10% PCM modified TRC sandwich panel has been compared with a reference TRC sandwich panel (without PCM).It has been found that the mechanical performance of the PCM modified sandwich panel decreases comparing to the reference, however TRC ductile behaviour is conserved during bending which is very encouraging in view of developing new sustainable TRC sandwich panels with high mechanical and thermal efficiency

Keywords: : phase change materials, textile reinforced concrete, sandwich panels, building envelope.

*Speaker
†Corresponding author: zakaria-ilyes.djamai@enise.fr

DESIGN METHOD FOR OPTIMIZING GEOPOLYMER CONCRETE PROPORTIONS UTILISING ENTIRELY STEEL SLAG AGGREGATES

Dong Dao *† [1], Trinh Son *

[1] University of Transport Technology – 54 Trieu Khuc, Thanh Xuan, Hanoi, Vietnam

DESIGN METHOD FOR OPTIMIZING FLY ASH BASED GEOPOLYMER CONCRETE PROPORTIONS UTILISING ENTIRELY STEEL SLAG AGGREGATES

Dong Van Dao, Son Hoang Trinh

University of Transport Technology, 54 Trieu Khuc, Thanh Xuan, Hanoi, Vietnam

Corresponding Author: Dong Van Dao, email: dongdv@utt.edu.vn

Abstract: *Fly ash and steel slag, which are byproducts from thermal power and steel plants respectively, have been used as construction materials. Fly ash can be mixed with an alkaline activation solution to make a binder in geopolymer concrete (GPC), an eco-friendly alternative to conventional Portland cement concrete. Steel slag can be used with or in place of natural aggregate in construction applications. When combined, fly ash-based GPC using steel slag aggregate (GPCS) is effective in solving environment concerns caused by the excess of by-products and production of Portland cement. However, compared to Portland cement concrete, GPC is a newer material, and its mix design method to target a specific compressive strength and workability level is not as well defined as that for the conventional cement concrete mixture. To help make the GPCS mix design process more efficient, this paper discusses a statistical model that can be used to estimate the compressive strength of fly ash-based GPC mixtures with 100 percent steel slag aggregate based on three important mixture variables, including the sodium solution (NaOH) concentration, the mass ratio of alkaline activation solution to fly ash (AAS/FA), and the mass ratio of sodium silicate (Na2SiO3) to sodium hydroxide solution (SS/SH). The model was developed based on an experimental design in which the three variables were varied as follows: (1) the NaOH concentration was varied between 10 and 14M, (2) the AAS/FA ratio was changed from 0.4 to 0.5, and (3) the SS/SH ratio was varied from 2 to 3. GPCS specimens were prepared based on the experimental design and tested for the compressive strength to develop and validate the model. Results of the validation specimens show that the model can reasonably estimate the compressive strength of GPCS mixtures based on the three variables, so it is recommended for use in GPCS mix design in the future.*

Key words: Steel slag aggregate, fly ash-based geopolymer concrete, design of experiments, mix design, propotions.

*Speaker

†Corresponding author: dongdv@utt.edu.vn

Keywords: Steel slag aggregate, fly ash, based geopolymer concrete, design of experiments, mix design, propotions.

Experimental measurement and modeling of the complex Poisson's ratio of bituminous mixtures

Quang Tuan Nguyen *† [2,1], Thi Thanh Nhan Hoang [1,2]

[2] Research and Application Center for Technology in Civil Engineering, University of Transport and Communications – Vietnam
[1] Faculty of Civil Engineering, University of Transport and Communications – Vietnam

A complete characterization of linear viscoelastic properties of bituminous mixtures requires the measurements of the complex Poisson's ratio. The complex Poisson's ratio of bituminous mixtures is not easy to obtain because of the high precision required and the limited accuracy of the experimental device. In this paper, three dimensional cyclic tension-compression tests were performed to measure the complex Poisson's ratio. Two bituminous mixtures were tested: one prepared with classical bitumen and one prepared with polymer-modified-bitumen. In order to measure the complex modulus and the complex Poisson's ratio, the sinusoidal loadings were applied on the specimens at different temperatures and frequencies. The experimental results show that the complex Poisson's ratios of bituminous mixtures vary as a function of reduced frequency. The master curve of the complex Poisson's ratio can be built using the same shift factor for the master curve of the complex modulus. It was verified that the Time-Temperature Superposition Principle and the Partial Time-Temperature Superposition Principle can be applicable for the complex Poisson's ratio of the classical bituminous mixture and the polymer-modified-bitumen mixture, respectively. A linear viscoelastic model with a continuum spectrum called 2S2P1D is used to simulate the 3D linear viscoelastic behavior of tested bituminous mixtures.

Keywords: bituminous mixtures, linear viscoelasticity, complex Poisson's ratio, linear viscoelastic model, complex modulus

*Speaker
†Corresponding author: quangtuan.nguyen@utc.edu.vn

Evaluation of Macro-Synthetic Fibre Reinforced Concrete as a Sustainable Alternative for Railway Sleepers

Christophe Camille *† [1], Dayani Nayantha Kahagala Hewage [1], Olivia Mirza‡ [1], Fidelis Mashiri [1], Brendan Kirkland [1], Todd Clarke [2]

[1] Western Sydney University (WSU) – Locked Bag 1797, Penrith, NSW, 2751, Australia
[2] BarChip Australia Pty Ltd – Australia

Sleepers are among the most essential components within the track infrastructure and are characteristically made from timber, steel and prestressed concrete. However, due to recent concerns in regard to the inferior quality, degradation, durability, high-cost and environmental impact of the conventional materials, researchers are now focused towards sustainable alternatives such as composite materials. Correspondingly, even if these new sleepers provide the adequate strength characteristics towards the redistribution of high static and dynamic loads, their practical implementation remained fairly limited due to their unknown long-term behaviour and high production cost. This paper presents a review of the Macro-Synthetic Fibre Reinforced Concrete (MSFRC) sleepers which uses BarChip fibres towards the optimisation of the mechanical properties. In addition, the effects of different fibre dosages and aspect ratios will be thoroughly assessed. Further, the sustainability aspects of the MSFRC sleepers will be discussed with respect to durability and resource minimisation. As a result, the implementation of the recycled fibres within the concrete sections is expected to reduce the overall carbon-footprint of the sleeper towards a characteristically adequate and sustainable alternative material for railway sleeper applications.

Keywords: Synthetic fibre reinforcement, Railway sleepers, Sustainable performance

*Speaker
†Corresponding author: C.Camille@westernsydney.edu.au
‡Corresponding author: o.mirza@westernsydney.edu.au

THE REPAIRING EFFECTS OF LITHIUM SILICATE BASED MATERIAL TO THE SURFACE OF HARDENED CONCRETE

Nguyen Xuan Tung * [1]

[1] University of Transport and Communications – Lang Thuong, Dong Da Hanoi, Vietnam

There are many damage types on concrete structures. Crack and spalling on concrete structures are the most popular damages. The causes of these damage are variable but mostly originate from the corrosion of reinforcement that cause by the salty, humidity air, carbonation or ion chloride penetration via appeared cracks on the concrete surfaces that lead to the expansion of the reinforcement cross section. It is necessary to protect the surface area of concrete in order to prevent concrete structures from being deteriorated. The method of applying a surface protective agent has been developed as one of the methods to protect concrete. In this study, the repairing effects of lithium silicate based surface protective agent in high permeability and chloride resistance will be evaluate. As a result, reduction of coefficient of water permeability and effective diffusion coefficient of chloride ion of hardened concrete that had been repaired by the lithium silicate based surface protective agent were confirmed

Keywords: Lithium silicate Surface protective agent, Coefficient of water permeability, Chloride ion diffusion coefficient

*Speaker

Research on fabricating flowforms from ultra-high performance concrete with local admixtures for use in processing contaminated water

Thi Thuy Ha Ung *† [1], Tuan Hung Pham * ‡ [1], Tho Bach Leu [1]

[1] National University of Civil Engineering, Hanoi, Vietnam (NUCE) – 55 Giai Phong road, Hai Ba Trung district, Hanoi, Vietnam

In the recent years, flowforms have emerged as an effective natural aeration solution to provide dissolved oxygen (DO) for treatment processes of contaminated water. Flowforms are usually made from materials such as: cement, concrete, ceramic, glass, composite stone, metals... Among which, concrete and ceramic are most common due to the low production cost of the former and relatively good durability of the later. However, plain concrete has some disadvantages such as: heavy weight, difficult maintenance and prone to corrosion of the surface, i.e. peeling of fine aggregates on the surface resulting in loss of smoothness needed, while ceramic surface can develop cracks over time. Recent studies on ultra-high performance concrete (UHPC) with admixtures available in Vietnam such as silica fume and fly ash showed that, with high workability, this material would satisfy well the requirements for fabrication of flowforms in terms of smooth surface, high mechanical durability, corrosive resistance of finish product. The research team has successfully fabricated flowforms prototype from UHPC and tested it in practice. The test results on waste water in 2 years showed that UHPC has a distinct advantage over the most common materials in flowforms fabrication: it preserves the smooth surface, unlike the etched surface of cement or cracked surface of glass enameled ceramic (tested in same condition). In addition, flowforms made from UHPC also has the advantage in production cost, compared to ceramic and a good potential in reuse of industrial wastes. This article will cover the process of fabricating flowforms from UHPC with silica fume and fly ash admixtures as well as the results of testing flowforms prototype in waste water treatment.

Keywords: Water treatment, ultra, high performance concrete, UHPC, fly ash, silica fume, flowforms, aeration, dissloved oxygen, DO.

*Speaker

†Corresponding author: uttha2002@gmail.com

‡Corresponding author: pthhuce@gmail.com

A model of local kinetics of sorption to understand the water transport in bio-based materials

Nicolas Reuge , Florence Collet , Sylvie Pretot , Sophie Moissette , Marjorie Bart , Christophe Lanos * [1]

[1] Laboratoire de Génie Civil et Génie Mécanique (LGCGM) – Université de Rennes I : EA3913 – IUT Génie Civil – Construction Durable 3 rue du Clos Courtel - BP 90422 35704 Rennes Cedex 7 - France, France

Abstract The classic models describing the hygric mass transfers inside porous materials seem unsuitable in the case of bio-based materials. They are based on the assumption of instantaneous local equilibrium between relative humidity and water content (Künzel 1995). These two parameters evolve according to the diffusive fluxes following the sorption isotherms. This study shows that it leads to predict much shorter times of stabilization than those experimentally obtained. A new approach is presented here, it frees from the local instantaneous equilibrium introducing a local kinetics to describe the transformation of water from vapor state to liquid state and vice versa. The local kinetics of sorption is coupled with the well-known hysteresis phenomenon. It is adjusted from bibliographic data (Collet et al. 2013) giving mass evolution of three hemp concretes under adsorption / desorption conditions. 1D cylindrical simulations allows an excellent fitting on the experiments. Finally, a semi-empirical model is proposed, allowing to determine the kinetics parameters more easily. The effect of the local kinetics model on the hygrothermal transfers occurring through bio-based walls is then studied. The case of cyclic hygrothermal exposures is full of interests.

Keywords: bio, based porous materials, hemp concrete, local kinetics, sorption, hygric transfer, modeling

*Speaker

Air permeability of cover concrete quality of precast box culverts affected by casting direction

May Huu Nguyen * [1], Kenichiro Nakarai * † [2], Saeko Kajitar *

3

[1] May Huu Nguyen – Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshima University, 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-527, Japan; Department of Bridge and Tunnel, Faculty of Civil Engineering, University of Transport Technology, 54 Trieu Khuc, Thanh Xuan, Hanoi 100000, Vietnam, Japan

[2] Kenichiro Nakarai – Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshima University, 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-527, Japan, Japan

[3] Saeko Kajitar – Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshima University, 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-527, Japan, Japan

Casting direction is an external factor that can influence the properties, including air permeability of concrete structures. In the current study, the effect of this factor on the air permeability of precast box culverts was investigated. The Torrent air permeability test was used to measure coefficient of air permeability kT for two box culvert specimens produced using ordinary Portland cement, water-to-binder ratio of 0.485, different casting directions (vertical and horizontal) at the age of 3 months. The obtained results show the different cover concrete qualities between the surfaces of the horizontal casting specimen, whereas the shortcomings during casting process were detected of the vertical casting specimen.

Keywords: Cover concrete, Air permeability, Box culvert, Casting direction.

*Speaker

†Corresponding author: nakarai@hiroshima-u.ac.jp

Effects of amounts and moisture states of clay-brick waste as coarse aggregate on slump and compressive strength of concrete

Phuong Trinh Bui* [1], Xuan Nam Nguyen [1], My Ngoc Tang † [1], Yuko Ogawa [2], Kenji Kawai [2]

[1] Ho Chi Minh City University of Technology, VNU-HCM (HCMUT, VNU-HCM) – 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2] Hiroshima University – 1-4-1 Kagamiyama, Higashi-Hiroshima City Hiroshima, 739-8527, Japan

Effects of clay-brick waste (CBW) from demolition in construction on slump and compressive strength of concrete were investigated to promote the reuse of such waste at Vietnam for concrete technology towards sustainable development. The replacements of coarse aggregate by CBW were 0, 10, 20, and 40% by volume. To evaluate the effects of moisture states of CBW on properties of concrete, two states of CBW with a size range of 5–25 mm were prepared: (1) under oven-dry condition and (2) under saturated-surface dry condition. Results showed that the higher the replacement of CBW, the lower the slump of fresh concrete. The moisture states of CBW also affected slump of fresh concrete and compressive strength of hardened concrete. Although CBW under saturated-surface dry condition reduced the compressive strength at the age of 3 days, internal water released from CBW promoted the cement hydration after 3 days, leading to an increase in compressive strength of concrete at the ages of 7 and 28 days. Consequently, CBW can be reused as coarse aggregate for making concrete towards sustainable development of construction materials.

Keywords: Clay Brick Waste, Compressive Strength, Slump.

*Corresponding author: buiphuongtrinh@hcmut.edu.vn
†Speaker

Assessment on the performance of EPB-TBM in the construction of pilot metro line in Ho Chi Minh city (Vietnam)

Thu-Hang Tran* [1], Manh-Tuan Hoang † [2]

[1] University of Transport and Communications - UTC (VIETNAM) (UTC) – 3 Cau Giay street - Dong Da district - Hanoi, Vietnam
[2] Shimizu – Maeda Joint Operation, Package CP1B - Line 1, HCM city Urban Railway Project – Vietnam

Line 1 (Ben-Thanh – Suoi-Tien) of the Ho Chi Minh city Urban Railway Project is the pilot metro in Vietnam, also the first transport tunnel constructed by the earth pressure balanced single shield tunnel boring machine (EPB-TBM), of which the outer diameter is 6.79m. Two parallel 781-meter-tunnels (West Bound and East Bound) have been constructed from May 2017. They mainly locate in loose sand layers with small SPT values and the small overburden heights: 8.7 to 9m of the former and 8.7 to 22.3m of the latter. EPB-TBM have proven the suitability for the metro line in such geological conditions and the narrow construction site in urban areas of Ho Chi Minh city. In this paper, for the assessment of EPB-TBM during the tunnel construction, some main operation parameters of the machine in each performance routine have been analysed and the influence of the geological conditions along the alignment to the machine journey was initially studied. The study's goal is the better understanding of the EPB-TBM performance in the first TBM metro line in Vietnam, as an experience learning for the next ones which have been scheduled to be soon appeared in Ho Chi Minh city and Hanoi.

Keywords: EPB TBM, performance assessment, metro, Ho Chi Minh city

*Corresponding author: tranthuhang.utc@gmail.com
†Speaker

Investigation of the use of reclaimed asphalt pavement as aggregates in roller compacted concrete for road base pavement in Vietnam

Giang Nguyen *† [1], Lan Nguyen [2], Cay Bui [3], Hieu Tran Trung [1], Dong Dao [4], Dung Nguyen [3]

[1] University of Transport Technology (UTT) – 54 Trieu Khuc Str., Thanh Xuan Dist., Hanoi, Vietnam, Vietnam
[2] Laboratoire Auscultation, Modélisation, Expérimentation des infrastructures de transport (IFSTTAR/MAST/LAMES) – Institut français des sciences et technologies des transports, de l'aménagement et des réseaux – Centre de Nantes Route de Bouaye - BP 4129 44341 Bouguenais Cedex, France
[3] University of Transport and Communications - UTC (VIETNAM) – Vietnam
[4] University of Transport Technology – Vietnam

When reinforcing existing asphalt pavement while the pavement elevation must be maintained, old surface asphalt layers are generally milled to apply the new ones. The use of the reclaimed asphalt pavement (RAP) recovered from road deconstruction is very important and an actual need due to the rise of asphalt cost and the lack of natural aggregates which respects sustainable development. On the other hand, in order to reduce pavement rutting which is the most issue in traditional asphalt pavement in Vietnam, it is necessary to find efficient solutions. Roller compacted concrete (RCC), which has well-known advantages (simple, economical and high stiffness modulus), is found as a very promising technique. For these purposes, a science and technology project has been granted by the Ministry of Transport of Vietnam. It aims to investigate the use of RAP as aggregates in roller compacted concrete (RCC) for road base pavement. In this project, RAP from two different resources is selected and their characteristics are evaluated. They are then used for the RCC mix design with three different RAP contents (0, 40 and 80% in masse of aggregates) and two different cements (PCB30 and PC40). Specimens are fabricated in laboratory to determine traditional mechanical properties (compressive strength, tensile splitting strength and elastic modulus) according to their curing periods. The results show that the studied mixes have potential performances and can be used for road base pavement. Finally one mix with balanced mechanical properties has been chosen to be used for construction of a full-scale experimental pavement. This paper presents principal results and analyses of laboratory investigations and a description of the experimental site.

Keywords: reclaimed asphalt pavement, roller compacted concrete, laboratory tests, experimental site

*Speaker
†Corresponding author: giangnth@utt.edu.vn

Comparison between Critical Path Method (CPM) and Last Planners System (LPS) for Planning and Scheduling METRO Rail Project of Ahmedabad

Viraj Parekh *† [1], Karan Asnani [1], Yashraj Bhatt [1], Rahul Mulchandani [1]

[1] Civil Engineering Department, Institute of Technology, Nirma University – Ahmedabad, Gujarat, India

The purpose of this paper is to compare Critical Path Method (CPM) and Last Planner System (LPS) with respect to Planning and Scheduling of METRO Rail Project, Ahmedabad, Gujarat. Critical Path Method emphasis on updating the network for tracking the progress as well as to identify the delays. Last Planner System works on the weekly schedules prepared from the Master Plan and Look-ahead schedules to avoid the delays. One of the stretch from North-South Corridor was selected for the study from Vijaynagar to Usmanpura. The data such as activities, duration of activities, sequence and inter-relation of activities etc. was collected to prepare the network as well as weekly schedules. The network was updated and original network was compared with the updated one and the delays were spotted for the stretch selected. Weekly plans were also prepared for the selected stretch from the look-ahead schedule and Master Plan. PPC (Percent Plan Complete) were calculated to track the progress as per planned schedule. The data were collected by conducting interviews of various personnel and visual observations. Both the approaches (CPM and LPS) have been applied on the selected stretch by action research process. The delays were calculated and studied for both the methods and it was observed that Last Planner System is more appropriate to use for big infrastructure projects like this to avoid time-overrun and consecutive cost over-run. Resources can be well utilized with the Last Planner System, too. The type of this paper is a Case Study.

Keywords: Construction Planning and Scheduling, Last Planner System, Construction Project Management

*Speaker

†Corresponding author: viraj.parekh@nirmauni.ac.in

Study and propose the size of cement concrete slabs for airport road surface in Vietnam conditions

Nguyenvu Viet *† [1]

[1] Associate Professor. Ph.D . Nguyen Duy Dong (NDD) – Vietnam

Cement concrete slabs (CCS) for road pavement has many advantages such as high Young modulus and long life expectancy, but this type of road pavement needs transverse joints (contraction joints, expansion joints and construction joints) that adversely affect the using process. Recently, many scientists have been studying solutions to increase the size (length and width) of cement concrete slabs in order to increase the smoothness of the road pavement and reduce the amount of raining water penetrating into joints. In this paper, the authors study and propose solutions to use reinforcement to reduce the amount of joints on cement concrete pavement which bring a better using process of this road pavement type.

Keywords: Cement concrete slabs, road surface, slit for dilate, slit for shrink and sheet size.

*Speaker
†Corresponding author: vuducviet6666@gmail.com

Experimental study of thermomechanical behavior of the carbon textile reinforced refractory concrete subjected to the constant load and temperature heating

Tran Manh Tien* , Xuan Hong Vu †‡ [1], Emmanuel Ferrier§ [2]

[1] University Lyon 1,Laboratory of Composite Materials for Construction (LMC2) (LMC2) – Université de Lyon, Université Claude Bernard - Lyon I – 82 bd Niels Bohr, F-69622 Villeurbanne, France
[2] Laboratoire des Matériaux Composites pour la Construction (LMC2) – Université Claude Bernard Lyon 1 : EA7427 – 82 bd Niels Bohr69622 Villeurbanne Cedex, France

Abstract. Textile reinforced cement (TRC) material is an alternative material to strengthen or reinforce the structure in elevated temperature environment or usually subjected to fire. The use of carbon textile and refractory mortar is an interesting solution. This composite is one perfect combination between carbon textile reinforcement which ensures high capacities (mechanical strength and stiffness) at elevated temperature, and refractory concrete matrix which ensures thermal protection and loading retransmission into textile reinforcement. The aim of this paper is to identify the rupture temperature and exposure duration of carbon TRC in thermomechanical condition.
This paper presents original experimental results on carbon TRC specimens subjected to 5 applied force levels (from 10% to 75% in comparison with the maximal strength of this material at room temperature) and temperature increasing. As the results, the studied carbon TRC specimen can exhibit up to the temperature of 670 ∘C in 23 minutes corresponding with applied force level of 50%. The rupture temperature and exposure duration of carbon TRC decreased progressively with increasing of applied force level. In comparison with experimental result on carbon textile specimen, the contribution of refractory matrix as thermal protection was found and analyzed. The exposure duration of the carbon TRC in case of fire could be calculated thanks to the temperature heating curve according to the standard ISO – 834.

Keywords: Textile, reinforced concrete (TRC), Carbon textile, Refractory concrete, Elevated temperature, Thermomechanical behavior.

*Corresponding author: tranmanhtien2712@gmail.com
†Speaker
‡Corresponding author: Xuan-Hong.Vu@univ-lyon1.fr
§Corresponding author: emmanuel.ferrier@univ-lyon1.fr

A study on improvement of early - age strength of super sulfated cement using phosphogypsum

Ngoc Lam Nguyen * [1]

[1] National University of Civil Engineering (NUCE) – 55 Giai Phong Road, Hai Ba Trung District, Hanoi, Vietnam

Supersulphated cement (SSC) is a newly developed non-burned cementitious material. It is a kind of environmentally-friendly cementitious material due to its energy-saving, low-carbon emission, and waste-utilization. Compared with ordinary Portland cement (PC), SSC has many advantages such as low hydration heat, excellent property of resistance to sulfate, using less clinker but more gypsum. However, the setting time of this binder is quite long, so the strength development is slow at early age. The aim of this paper is to improve the early-age strength for SSC binder samples with 30% Phosphogypsum, 60% ground-granulated blast-furnace slag, the rests are cement or lime and activator Na2SO4 with different content. The research results show that compressive strength at 3-day age can be improved almost twice. Microstructural analysis by infrared spectroscopy revealed that ettringite formed earlier in the case of using activators and improved the microstructure and strength at early age of the binder. However, the strength of the SSC at the later age was reduced when compared to the control sample without activator. The results also show that the optimum content of activator Na2SO4 for improving SSC strength at early age is 1%.

Keywords: Super Sulphated Cement, Compressive Strength, Activators.

*Speaker

Effect of calcium sulfate type and dosage on early strength and porosity of self-leveling underlayments

Ngoc Lam Nguyen * [1]

[1] National University of Civil Engineering (NUCE) – 55 Giai Phong Road, Hai Ba Trung District, Hanoi, Vietnam

In recent years, self-leveling underlayments (SLUs) are often used due to high flow ability and self-smoothing properties. Besides the strength, other characteristics of SLUs such as workability, rapid drying, rapid hardening, shrinkage compensation, etc...are required. This paper presents the effect of calcium sulfate type and dosage on early-age strength and porosity of SLUs based on ettringite binders. The raw materials used for making SLUs binders are calcium aluminate cement (CAC), Portland cement (PC) and calcium sulfate (C$Hx). Two types of calcium sulfates (hemihydrate and anhydrite) were used in this research. The ettringite formation is the reaction that controls the mechanical properties at early age of SLUs such as rapid hardening, early strength gain, etc. It was found that using hemihydrate in SLUs gives higher compressive strength than using anhydrite at the same content of calcium sulfate. On the other hand, the pore size of SLUs will decrease with increasing the amount of calcium sulfate in SLUs thanks to the higher amount of ettringite.

Keywords: Self, leveling Underlayments, Ettringite Binder, Calcium Sulfate, Early, age

*Speaker

Heat resistant mortar using Portland cement and waste clay bricks

Ngoc Lam Nguyen * [1]

[1] National University of Civil Engineering (NUCE) – 55 Giai Phong Road, Hai Ba Trung District, Hanoi, Vietnam

The waste materials of clay bricks are usually come in different ways. Some are created in factories during and after the production process as a result of human mistakes, inappropriate materials, or a mistake in production process, some others are formed in transportation and distribution stage and finally a large part of waste materials are formed as a result of destroying buildings. The amount of waste materials may account to millions of tons annually. Recycling waste clay brick by incorporating them into building materials is a practical solution for pollution problem. The aim of this study is to investigate the use of waste brick as aggregates and as a partial replacement for Portland cement in the production of heat-resistant mortar, which is used for the potential fire structure, created by flammable materials stored or used in the building. This mortar is capable of working in the heat range of 800∘C and 1000∘C. Mechanical properties of mortar are based on the finding a suitable content of additives from waste brick used for binder and a reasonable aggregate gradation. The research results showed that the use of additives from waste brick in different proportions by weight (20-45%) for the cement increase heat resistance of the binder. In addition, aggregate particles from waste brick having sintered structure can be able to improve the thermal stability of mortar at high temperature.

Keywords: Heat Resistant Mortar, Waste Clay Brick, Portland Cement.

*Speaker

Performance of Recycled Coarse Aggregate Concrete with Different Nylon Fiber Content

Seungtae Lee * [1], Youngkyu Chu [1], Sangwook Ha [2], Yong Kim [1], Jaehong Jeong [1]

[1] Kunsan National University – South Korea
[2] Buildchem Co. Ltd. – South Korea

In the present study, the effect of nylon fiber (NF) on the permeability as well as the mechanical properties of concrete incorporating 100% recycled coarse aggregate (RA) was experimentally investigated. Concrete was produced by adding 0, 0.6 and 1.2 kg/m3 of NF and then cured in water for the predetermined period. Measurements of compressive strengths, ultrasonic pulse velocity and total charge passed through concrete were carried out, and the corresponding test results were compared to those of concrete incorporating natural coarse aggregate (NA). Test results indicated that recycled coarse aggregate concrete (RAC) showed lower performance than natural coarse aggregate concrete (NAC) because of the adhered mortars in RA. However, it was obvious that the addition of NF in RAC mixtures was much effective in enhancing the performance of the concretes due to the crack bridging effect from NF. In particular, high content of NF (1.2 kg/m3) led to a beneficial effect on concrete properties compared to low content of NF (0.6 kg/m3) with respect to mechanical properties and permeability, especially for RAC mixtures.

Keywords: Recycled Coarse Aggregate, Nylon Fiber, Mechanical Properties, Permeability.

*Speaker

Air permeability coefficients of expansive concrete confined by rebars

Anh Le * [1], Kenichiro Nakarai† [2], Nguyen Huu May * ‡ [3], Yasutaka Kubori§ , Toshikazu Matsuyama¶ , Hajime Kawakane‖ , Shintaro Tani**

[1] Le Anh Van – Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshi-ma University, 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8527, Japan, Japan
[2] Kenichiro Nakarai – Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshima University, 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-527, Japan, Japan
[3] Nguyen Huu May – Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshima University, 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-527, Japan; Department of Bridge and Tunnel, Faculty of Civil Engineering, University of Transport Technology, 54 Trieu Khuc, Thanh Xuan, Hanoi 100000, Vietnam, Japan

Torrent air permeability tester has been widely used as one the most reliable non-destructive test for evaluating the quality of the concrete cover. In this study, the Torrent tester was employed to evaluate the influence of rebar confinement on the surface layer quality of expensive concrete. Blast furnace slag cement was used with the expansive agent to prepare two types of specimens with/without embedded rebars. The results comparing the variation of the measured air permeability at the ages of 28 and 56 days indicated that the concrete cover confined by rebars obtained a better quality than that of the plain one without rebars.

Keywords: Air permeability, Concrete cover, Expansive concrete, Rebars.

*Speaker
†Corresponding author: nakarai@hiroshima-u.ac.jp
‡Corresponding author: maynh@utt.edu.vn
§Corresponding author: m174898@hiroshima-u.ac.jp
¶Corresponding author: mtoshi@hiroshima-u.ac.jp
‖Corresponding author: kawakane@kkn.co.jp
**Corresponding author: tani@kkn.co.jp

Application of Six Sigma on METRO Rail Construction Project

Viraj Parekh *† [1], Kushal Solanki [1], Nishit Prajapati [1]

[1] Civil Engineering Department, Institute of Technology, Nirma University, Ahmedabad, India – India

Six Sigma is a Quality Improvement Technique widely used in Manufacturing Industry. Application of Six Sigma is yet to be explored exhaustively in the field of Construction. This study explores the possibility of application of Six Sigma in METRO Rail Construction. This paper defines and analyse Construction Performance of Pier Construction in METRO Rail Project of Ahmedabad using Six Sigma Technique. A stretch of 4 km from North-South Corridor is selected for the study from APMC to Shreyas. The data such as Work Breakdown Structure, List of Activities, Time of Activities, Dependency of Activities, Construction sequence etc. is collected and analysed using software Primavera and Minitab. Process Capability Analysis is used to determine how well an actual process meets a set of specification limits in scheduled plan. Data is represented and analysed by preparing different charts and graphs such as I – Chart, Moving Range Chart, Capability Histogram and Capability Plot. A comparison was done between the actual works done at site and the schedule planned for the progress to calculate the Sigma value. It is found from the result that the calculated Sigma value is near to the ultimate Sigma Level. This work provides valuable insights for the implementation of Six Sigma Technique in Construction Industry. Six Sigma Technique can evaluate the quality of current construction activity and quantify the improvement goals so as to control succeeding critical activities for the project. Improvement in Quality of Construction can be observed at large extent if Six Sigma Technique is applied to more complicated, volatile and multistep projects with a linkage to Lean Principle.

Keywords: Six Sigma, Construction Project Management, Quality Management, Lean Construction

*Speaker

†Corresponding author: viraj.parekh@nirmauni.ac.in

Experimental investigation of loading rate effects on the shear capacity of reinforced concrete deep beams

Vanny La * [1], Nakarai Kenichiro† [1], Saifullah Alfisa Halwan [1,2], Mizobe Asuka [1]

[1] Department of Civil and Environmental Engineering, Graduate School of Engineering, Hiroshima University – 1-4-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-527, Japan
[2] Department of Civil Engineering, Faculty of Engineering, Universitas Sebelas Maret – Surakarta, Indonesia

Unlike slender RC beams, shear failure mechanism of RC deep beams is mainly governed by shear compression; a considerable amount of the load is carried by the compression struts of concrete. For this reason, when subjected to a long-term sustained load, the shear strength of RC deep beam could be reduced as the sustained load might have negative impacts on the compressive strength of concrete. The purpose of this study is to investigate the influence of sustained loads on the shear capacity of RC deep beams. In this experiment, different loading rates were chosen as an alternative method to clarify the effect of sustained loads. Two different types of loading rate, a normal loading rate of 10 mm/hr and a very slow loading rate of 0.01 mm/hr, were applied. 100x320x1200 mm RC beams with a ratio of shear span to the effective depth a/d=1 were tested under two-point loading. The test results showed that under very slow loading rate, the ultimate shear capacity was moderately reduced.

Keywords: Sustained load, Loading rate, RC deep beam, Shear capacity

*Speaker
†Corresponding author: nakarai@hiroshima-u.ac.jp

Fatigue characterization of conventional and high rutting resistance asphalt mixtures using the cyclic indirect tensile test

H.t. Tai Nguyen * [1,2], Anh-Thang Le [3], Vu-Tu Tran [3], Duy-Liem Nguyen [3]

[1] BMT Construction Investment J.S.C. (BMT) – Vietnam
[2] Ho Chi Minh City University of Technology and Education (HCMUTE) – 1 Vo Van Ngan Street, Linh Chieu Ward, Thu Duc District, Ho Chi Minh City, Vietnam
[3] Ho Chi Minh City University of Technology and Education (HCMUTE) – 1 Vo Van Ngan Street, Linh Chieu Ward, Thu Duc District, Ho Chi Minh City, Vietnam

In this paper, the fatigue behavior of several asphalt mixtures that are widely used in Vietnam such as the dense graded asphalt concrete (AC) produced with 60/70 pen bitumen and high rutting resistance asphalt mixtures (HRRA) are investigated using the cyclic indirect tensile (IDT) testing device equipped at Ho Chi Minh City University of Technology and Education (HCMUTE). Several level of stress magnitudes were applied to determine the characteristic fatigue line (CFL) of mixtures. The results show that the widely used power law of CFL is applicable for all investigated mixtures. Although the stiffness of the HRRA is twice that of conventional AC, its resistance to fatigue is much higher. The effect of strain magnitude on the stiffness of mixtures or the nonlinearity effect was also recognized. It was observed that the impact of binder type on the nonlinearity effect is insignificant compared to that due to the volumetric design of mixture.

Keywords: Asphalt mixtures, Indirect tensile fatigue test, Characteristic fatigue line, Nonlinearity effect

*Speaker

Assessment of Design Guidelines for Fiber-Reinforced Polymer Shear Contribution of Prestressed Concrete Beams Strengthened by Fiber-Reinforced Polymer Sheets

Dien Vo Le *† [1]

[1] Ho Chi Minh city University of Technology (Faculty of Civil Engineering) – 268 Ly Thuong Kiet, District 10, Ho Chi Minh City, Vietnam

This research is mainly focussed on statistical assessment and analysis of the accuracy of predicting the shear resistance of the fiber-reinforced polymer (FRP) sheets for prestressed concrete beams strengthened by FRP sheets presented in the current design guidelines. The evaluation of the current prediction models is based on a database of experimental results from the previous and current author's research. The specifications of the beams are diverse and wide enough such as beam types (prestressed concrete beams using bonded tendons - BPC beams and unbonded tendons - UPC beams), cross-section shape, concrete strength, effective pre-stress stress, and shear span to depth ratio - a/d .... The results of the evaluation have shown that the formulas in recent design guidelines overestimated the shear contribution of FRP sheets for prestressed concrete beams.

Keywords: Shear, strengthened, FRP sheets, prestressed concrete beam, design guidelines

*Speaker
†Corresponding author: voledien@gmail.com

Experimental study on the valorisation of poplar by-products in cement-based materials

Chafika Djelal [1], Jonathan Page *† [1], Yannick Vanhove [1], Hassina Kada [1]

[1] Laboratoire de Génie Civil et géo-Environnement (LGCgE) – Université d'Artois : EA4515 – 1230 rue de l'Université, 62400 Béthune, France

An experimental investigation was undertaken to evaluate the potential use of poplar by-products in cement mortars. Two by-products from poplar processing were studied: sawdust (from sawing wood) and milled fiber (from wood waste obtained during cutting). The fibers and sawdust were incorporated into the mortars as a sand substitution with rates from 10 to 100%. The introduction of these poplar by-products has a significant on the composite properties in both fresh and hardened state. It was noted that the workability of the mixtures with the poplar wood varies with the substitution rate. Moreover, the increase in the amount of fibers or sawdust causes a continuous increase in the porosity of the material, which leads to a decrease in density. A significant decrease in the mechanical properties of bio-sourced mortars was noted, again related to the rate of fibers or sawdust introduced in mixtures. The high internal porosity of the wood particles and their low density can explain these lower mechanical strengths.

Keywords: Poplar sawdust, Plant fibers, Mix design, Workability, Mechanical strength, Porosity.

*Speaker

†Corresponding author: jonathan.page@univ-artois.fr

An investigation into the Mullins effect of high damping rubber

Dung Nguyen * [1]

[1] Thuyloi University – 175 Tay Son - Dong Da - Ha Noi, Vietnam

The Mullins effect has been studied for more than six decades, it is still recognized as a major difficulty for rubber-like materials behavior. Recently, the use of High damping rubber bearing is increased due to their enhanced dissipation property. However, high damping rubber is also known to possess the Mullins effect. In order to investigate the Mullins effect of high damping rubber, an experimental work was conducted on high damping rubber specimens with a computer-controlled testing machine at room temperature, a cyclic shear test with variable amplitude was carried out in the present study. Based on the experimental result, an evolution equation of the stress ratio is proposed. This equation can describe the dependence of the stress ratio on the accumulated dissipated energy and the experienced maximum strain. In addition, Healing effect is investigated with a series of triangular wave loading tests.

Keywords: Mullins effect, High damping rubber, Healing effect, Dissipated energy

*Speaker

Effect of elevated temperature on alkali activated slag cement concrete

Virendra Kumar *† [1], Rajesh Paswan [2]

[1] Dr. Virendra Kumar – Department of Civil Engineering, National Institute of Technology Jamshedpur, India
[2] Rajesh Kumar Paswan – Department of Civil Engineering, National Institute of Technology Jamshedpur, India

Ground granulated blast furnace slag (GGBFS) has been widely used in concrete industry due to the advantages of economic and environment. In place of conventional cement, GGBFS has been used as cementitious material with activator sodium hydro-oxide and sodium sulphate in powder form, resulting an alkali activated slag cement concrete (AASCC). The alkali-activated (AA) binder fulfills all the specifications when tested as cementitious materials as per standards. This paper presents properties of an alkali-activated (AA) binder that contain 94 % of ground granulated blast furnace slag (GGBFS) and 6 % of powder blended as chemical activators. From the experimental study, the performance of the new AA binder has been evaluated at ambient and elevated temperature 200 °C, 400 °C, 600 °C and 800 °C. Using AA binder, a series of standard specimens of cube, cylinder and prism were cast and water cured for 28 days of maturity to find the compressive strength, split-tensile strength and flexural strength at ambient and also after exposure at elevated temperature 200 °C, 400 °C, 600 °C and 800 °C. Specimens for cement mortar and reinforced concrete column were also cast to evaluate the residual strength when exposed to elevated temperature 200 °C, 400 °C, 600 °C and 800 °C. It has been observed that the test results of residual strength for alkali activated slag cement concrete (AASCC) is comparable to that of the conventional cement concrete. This investigation will presents the influence of exposure at elevated temperature on residual strength of new AA binder as cementitious material that is essential to evaluate the overall performance after fire in structures.

Keywords: Ground granulated blast furnace slag, alkali, activated binder, conventional cement, elevated temperature, residual strength

*Speaker
†Corresponding author: kumarvirendra57@gmail.com

Influence of High Temperature on Non-Silicate Based Activated Blast Furnace Slag

Virendra Kumar * [1], Amit Kumar *

[2], Brajkishor Prasad *

3

[1] Dr. virendra kumar – Department of civil engineering NIT Jamshedpur, India
[2] Amit Kumar – Department of Civil Engineering, National Institute of Technology Jamshedpur, India
[3] Dr. Brajkishor Prasad – Department of Civil Engineering, National Institute of Technology Jamshedpur, India

The energy consumption and the greenhouse gases emission in order to manufacture Portland cement (PC) is very high. To find an alternative, the researchers initially replace the PC partially by Fly Ash. Now a day's the researchers introduce a new binder which is being manufactured by the activation of ground granulated blast furnace slag (GGBFS). The paper presents the detail of the binder, manufactured by GGBFS and mild alkali as activator having the pH value of 10. The detailed composition of the activator would not be discussed in this paper because the patent has been applied for it. The binder is manufactured by simple blending in which 85% is GGBFS, and 15% is the chemical activator. The test results of the chemically activated binder concrete (CABC) for compressive strength, splitting-tensile strength and flexural strength were found from 100 to 800. It has also been observed that these results of the CABC at elevated temperature were very much comparable with that of the PC. The deterioration in strength starts from 200 onwards. No spalling also being observed till 800.

Keywords: ground granulated blast furnace slag, alkali, chemical, activator, temperature

*Speaker

Influence of LD Slag aggregates on strength development of concrete

Brajkoshor Prasad *† [1], Virendra Kumar *

[2], Prince Singh *

3

[1] Brajkishor Prasad – Department of Civil Engineering, National Institute of Technology Jamshedpur, India
[2] Dr. virendra kumar – Department of civil engineering NIT Jamshedpur, India
[3] Prince Singh – Department of Civil Engineering, National Institute of Technology Jamshedpur, India

This paper aims to present the feasibility of Linz-Donawitz (LD) slag as an alternative for traditional natural aggregates in concrete. The LD slag possesses good physical and mechanical properties as an aggregate and it has been incorporated in concrete as a replacement material for natural fine and coarse aggregates. The aggregates as a fine and coarse aggregates were replaced simultaneously up to 100% at an incremental increase of 20% respectively. Concrete of grades M20, M25, M30, M35 and M40 were cast, cured and tested with standard specimens following Indian Standard codes to study their mechanical strengths. The test results of compressive strength of concrete with LD slag aggregates are presented in this paper. The results obtained, show that there is an increase in compressive strength of the various grades of concrete with an increase in percentage replacement of natural fine and coarse aggregates with LD slag aggregates.

Keywords: LD slag aggregate, fine aggregate, coarse aggregate, workability, strength of concrete

*Speaker
†Corresponding author: bkkpp@yahoo.co.in

Analysis of strain measurements in large span soil-steel bridge structure

Adam Czerepak * [1]

[1] ViaCon Sp. z o.o. (ViaCon) – ul. Przemyslowa 6, 64-130 Rydzyna, Poland, Poland

In this paper the effects of live loads will be analysed. The loads are movable, but have characteristic of static passes. The results of strain measurements with relatively dense layout located around the periphery of the corrugated steel structure are used to calculate its deformations. Due to this, the solution includes the interaction of all elements of the structure i.e: corrugated steel sheets, backfill material, road superstructure (real rules of interaction) between these elements. Thus, there is faithfully (exactly) mapping the geometry and physical characteristics of the structure, equipment and the loads in structure 3D layout. Convenience of the algorithm is that the function of displacement is determined with use of a scheme of the peripheral strip of the shell in the form of a beam element with the cross-section of the steel shell in the 2D model (without the other, the aforementioned elements of the object).
In previous studies of soil-steel bridges, the difference of the courses of the displacement functions during the primary and secondary passages was observed. A characteristic feature of these test results (strains) and calculated geometrical effects (displacement) is the formation of a hysteresis loop. As proposed in this paper the two-part terms of solutions, can be seen that the deformation of the structure comes from two equivalent bending and compression components of the corrugated steel shell. On this basis the behaviour of the contact layer between the backfill and the steel shell in such a hysteresis loop is assessed.

In this paper using dense strain gauges layout any direction of the structure displacement can be calculated based on the changes of the strains in the analysed circumferential strip (part) of the structure. To implement such calculation is sufficient to use the simplest FE models. The effectiveness of the algorithm was verified by comparing displacements obtained from different measurement technics i.e: induction (sensors) and geodetic (3d laser scanning).

Keywords: soil, steel structure, moving loads, studies of shell deformations, displacement functions.

*Speaker

Development of optimised underground structures in urban areas

Rolf Katzenbach * [1]

[1] Technische Universität Darmstadt – Germany

Dear Professor Ha Minh, dear colleague and friend, I refer to your enclosed email and to my offer from 20 February 2019, to act as a Bronze Sponsor. With this email I again ask what to do in order to execute the offered sponsorship. The easiest way might be, that you send me please an invoice by email, and that I pay spontaneously with my CreditCard. Looking on the program, I unfortunatelly did not found my lecture with the title "Development of optimised underground structures in urban areas". Please inform me, when my lecture will be. Certainly I accept your suggestion, to present my lecture in the technical session "Geotechnics for Environment and Energy". I will attend CIGOS 2019 together with my Project Manager Ms. Anastasia Bychkova M.Sc. and my wife Gudrun Katzenbach. With both ladies I will come to the Banquet in the evening of 31 October 2019. We have the tickets No. 000103, 000104 and 000105. We are very happy to visit the wonderful City of Hanoi and hope to seeing you soon. With all best regatds, Yours Professor Rolf Katzenbach

*Speaker

Geotechnics for Environment and Energy

Evaluation of the At-Rest Lateral Earth Pressure Coefficient of Fibre Reinforced Load Transfer Platform and Columns Supported Embankments

Cong Dang * [1], Liet Dang * † [2]

[1] Ho Chi Minh City University of Technology (HCMUT) – Vietnam
[2] Liet Dang (UTS) – Australia

The at-rest lateral earth pressure coefficient (K0) is an essential soil property in design of geotechnical problems, but investigating its influence on behaviour of embankments supported by load transfer platform and columns improved soft soils has remained very limited. In this study, numerical modelling of a novel ground improvement technique utilising fibre reinforced load transfer platform (FRLTP) and columns supported embankment founded on top of multilayers of soft soils is proposed and investigated by finite element analysis (FEA). This research aims to assess the influence of a new ground improvement technique using FRLTP on the embankment behaviour supported by columns in soft soils. Moreover, a numerical assessment by varying the K0 value of FRLTP is performed through an extensive parametric study to investigate the K0 influence on the behaviour of FRLTP and column-supported embankments over soft soils. Results of the numerical modelling show that the final settlement, the difference in settlement between columns and foundation soil, the lateral deformation can significantly be reduced by the insertion of FRLTP into a column-supported embankment system. The predicted results also indicate that the changes in the K0 value were found to have no notable effects on the embankment behaviour.

Keywords: Embankments, Fibre Reinforced Materials, FRLTP, Soft Soils, DCM Columns, Sustainable Civil Infrastructure.

*Speaker
†Corresponding author: dangchiliet@gmail.com

Nonlinear Behavior Analysis of SFRC Foundation Considering Homogeneous and Inhomogeneous Soil Interactions

Tran-Trung Nguyen * [2,1], Cajka Radim [2], Phu-Cuong Nguyen [3], Tuan Tran [4]

[2] Technical University of Ostrava (VSB) – 17. listopadu 15/2172 708 33 Ostrava – Poruba, Czech Republic
[1] Van Lang University (VLU) – 45, Nguyen Khac Nhu street, Co Giang ward, district 1, Ho Chi Minh city, Vietnam
[3] Ho Chi Minh City Open University (HCMC-OU) – 97 Vo Van Tan St., Wd. 6, Dist. 3, Ho Chi Minh City, Vietnam
[4] Kunsan National University, Republic of Korea (KSNU) – South Korea

Current structural design and analysis commonly use numerical simulation. Interactive problems often use this method to express the behavior of different types of structures when working together subject to external loads. This study shows the relationship between compression forces and displacements of a slab foundation that are directly interactive with inhomogeneous soil when using the stress-strain curve of steel fiber reinforced concrete material proposed by Barros and Figueiras [1]. The obtained results are better than the previous study of Vaskova and Čajka [3] when both experimental test results are compared. Otherwise, only using one type of element for both the foundation and the soil does not affect this interaction problem. The material model is an essential part of the simulation, and the problem should consider nonlinear behavior analysis.

Keywords: ANSYS, Finite element analysis, Homogeneous soil, Inhomogeneous soil, Steel fiber reinforced concrete

*Speaker

Analyses on drainage capacity and sliding resistance of large diameter vertical wells for deep-seated landslide stabilization

Bathao Vu * [1,2], Van Minh Pham† , Quoc Dung Nguyen , Huy Vuong Nguyen

[1] Department of Geotechnical Engineering, College of Civil Engineering, Tongji University – Shanghai 200092, China, China
[2] Department of Geotechnical Engineering, Hydraulic Construction Institute, Vietnam Academy for Water Resources (HyCI - VAWR) – 3/95 Chua Boc Street, Ha Noi, Viet Nam, Vietnam

Deep-seated landslides occurring near roads and building areas cause serious damages. High groundwater level due to long periods of rainfall or infiltration from reservoir saturates and softens soils landslides. This article introduces an approach which combines the restraining effects of stabilizing piles and the dewatering effect from large diameter vertical wells, to increase the stability of landslides. Effectiveness in resisting sliding force and lowering the groundwater level was evaluated using the finite-elements method. Our results show that the saturation line drops significantly, and the safety factor of the slope increases by approximately 20% compared to the case without the wells.

Keywords: Deep, seated landslide, Slope stabilization, Slope drainage, Large diameter vertical well.

*Speaker
†Corresponding author: vanminhvtc@gmail.com

Shape effects in the dynamical response of flints/boulders during pile driving – a numerical study.

Emilio Nicolini * [1], Ivan Terribile [2]

[1] Cathie – Cathie – 177 Av Georges Clemenceau 92000 Nanterre, France
[2] Cathie – Cathie – 177 Av Georges Clemenceau 92000 Nanterre, France

Today, more than eighty percent of the total power of the active offshore wind turbines is installed in Europe, where the offshore wind industry has gained full reliability and is now targeting to continue reducing the construction cost. About 20 to 30% of the cost of an installed turbine is the foundation, where installation plays a major role and thus cost reduction will be mostly impacted by developments . This paper presents the following of a study of the dynamic reaction offered by a flint to the pile tip, which was presented in the 2018 Hanoi Conference, taking into consideration a circular shape and the possibility of a non-centered impact of the pile wall on the boulder/flint. The presented work is aimed at the exploration of the effect of the shape of the boulder/flint and allows concluding with a simple prediction method to reduce the risk of pile tip damage.

Keywords: piles, tip damage, flint, boulder

*Speaker

The failure envelope of new shaped cross-plates foundation for deepwater soft soils

Emilio Nicolini * [1], Alessandro Alberio [2], Matteo Castelletti [2]

[1] Cathie – Cathie – 177 Av Georges Clemenceau 92000 Nanterre, France
[2] Cathie – via A. da Giussano, 76 - 20833 Giussano (MB), Italy

The offshore deep-water oil&gas fields are very often facing the need of installing heavy structures on soft seabed soils, with complex loading acting on the foundations. Service structures which are installed to control the oil&gas production and flowlines like PLETS, ITA, seabed manifolds, are examples of such structures. Different types of foundations are today available for the deep-water seabed (mudmats, suction piles and anchors, etc.), which require a fit for purpose construction and thus are not well suited for automated installation. As it is believed that automated construction will be favourable to the necessary cost reduction of deepwater fields, a research in this direction has been activated. This paper will introduce the results of part of this research program aimed at the study of a new foundation concept, which is being developed within a wider project of automated deep-water foundation construction. Results that will be presented regard a further step of the optimisation study to find the best shape of a foundation formed by crossed plates inserted vertically in soft soils. Geotechnical verification of the resistance of the foundation will be presented in terms of shear and axial force failure envelopes obtained by numerical analyses. The optimisation process will take into account, additionally to the geotechnical performance, the structural compatibility.

Keywords: foundation, deepwater

*Speaker

Enhanced Oil Production in the lower Miocene reservoir by Multistage Fracturing, Offshore Viet Nam

Truong Nguyen Huu * [2,1]

[2] Petrovietnam University (PVU) – 762 Cach Mang Thang Tam, Long Toan wards, Ba Ria city, Ba Ria- Vung Tau province, Vietnam
[1] Petrovietnam University (PVU) – 762 Cach mang Thang Tam street, Long Toan ward, Ba Ria Town, Ba Ria-Vung Tau province, Vietnam

Abstract Oil production has been declined in the fractured basement reservoir from these fields of the Cuu Long Basin as those reservoir pressures were highly decreased. To produce oil, those reservoirs from these fields have been stimulated by using various techniques for enhanced oil production. Water injection at secondary recovery to maintain the reservoir pressure has been flooded because this technique has still brought high efficiently oil production, but the high-water cut has been very challenged while producing oil from the reservoirs. The best way to recover oil in the Cuu Long basin is stimulated in the lower Miocene reservoir by hydraulic fracturing. This study presents the effective multi-stage hydraulic fracturing in the lower Miocene reservoir for single X well of the Cuu Long basin on the continental shelf offshore Viet Nam. The results of multistage fracturing show the average effective wellbore radius, average pseudo-skin, average productivity ratio, fracture conductivity higher than those of the blanket and un-stimulated case. The integrated model of multistage fracturing consists of fracture geometry, fracture parameters, conductivity and production model.

Keywords: Multistage fracturing, Lower Miocene reservoir, effective multistage hydraulic fracturing

*Speaker

A Case Study on Slope Stabilization by Bio-engineering in Taiwan – National Chi-Nan University

Tai-Yi Liu * [1], Nelson N.s. Chou [2], Po-Han Chen [3]

[1] Tai-Yi Liu (Deputy Chief Engineer, New Asia Construction and Development Corporation) – Tajikistan
[2] Nelson N.S. Chou (Adjunct Professor, Civil Engineering Department, National Taiwan University) – Taiwan
[3] Po-Han Chen (Professor, Civil Engineering Department, National Taiwan University, Taiwan) – Taiwan

Taiwan was hit by a magnitude 7.3 Chi-Chi earthquake at 1:47 a.m. September 21, 1999. It is the most severe one ever on this island for the past 100 years. These major earthquake and aftershocks caused many major landslide and mudflow. National Chi-Nan University (NCNU), located in Puli, Nantou County in central Taiwan, the worst-hit area, was suffered a major slope landslide.

During the earthquake, massive soil collapse from a slope that measures 70 to 80 m in height and 250 m in width, and this collapse blocked the entrance road to NCNU completely. The NCNU slope renovation project used soil nailing, reinforced soil wall, and vegetation to enhance the stability of this slope and was completed in 2002.

After completion of this project till today, the renovated slope had withstood several earthquakes/typhoons and became a successful case of ecological engineering for slope protection in Taiwan.
In this paper, the detailed design for ecological engineering with sustainable construction for the renovation project is presented.

Keywords: Chichi earthquake, soil and rock collapse, soil nailing, reinforced soil wall, National Chi, Nan University

*Speaker

Investigating the properties of geopolymer modified sludge designed by Taguchi method

Minh Chien Vu * [1], Tomoaki Satomi *

[2], Hiroshi Takahashi *

3

[1] Doctor student, Graduate School of Environmental Studies, Tohoku university – Japan
[2] Assistant Professor, Graduate School of Environmental Studies, Tohoku university – Japan
[3] Professor, Graduate School of Environmental Studies, Tohoku university – Japan

In recent years, the development of sustainable construction materials has been being the attention of research efforts. Portland cement is of extreme importance due to high levels of carbon dioxide emissions associated with its manufacturing process. Due to the excellent properties and less effect on the environment, Geopolymer, a kind of inorganic polymer, has been the subject of intense studies. However, few researchers focused on the possibility of geopolymer in term of modified the soft soil (sludge) that constitutes a major problem in geotechnical engineering projects. The main reason is that the geopolymerization reaction required the heat treatment for activating the fly ash component. The solutions to avoid heat treatment have already been investigated by many scholars but in return, it generates complex manufacture processes. Therefore, instead of heat treatment, the other important factors for synthesizing the geopolymer matrix in the soft soil environment, is the main focusing of this paper. The Taguchi method was used to determine the most important factor that affects on several properties of geopolymer modified sludge by minimizing the effects of variation, but without eliminating the cause. The results indicate that the geopolymer content, clay content in sludge, initial water content and apparent water content play a unique role in different properties of modified sludge. Therefore, depending on the requirement of construction, the most important specific factor could be considered.

Keywords: Sludge, fly ash, geopolymer, Taguchi method

*Speaker

Granular flows through a model-scale forest: Influence of tree density and implications for landslide mitigation

Hang Luong *† [1], James Baker [2], Itai Einav [3]

[1] Hanoi Architectural University (HAU) – Km 10, Nguyen Trai Street, Thanh Xuan, Hanoi, Vietnam
[2] The University of Sydney (USYD) – School of Civil Engineering Room 418, Building J05, 225 Shepherd St, Darlington NSW 2006, Australia
[3] The University of Sydney (USYD) – School of Civil Engineering Room 418, Building J05, 225 Shepherd St, Darlington NSW 2006, Australia

Landslides pose a severe threat to the man-made and natural environment. As a result, many different artificial structures have been employed to attempt to mitigate the damage from these hazards. However, natural systems, such as forests of trees, can also play a defensive role by dissipating energy and reducing flow speed. This study uses a small scale model forest to investigate the effectiveness of such sustainable measures. It examines how granular flows interact with arrays of tree-structures at different densities, comparing the results to flow down a bare plane. Using image analysis of high-speed camera recordings, we track the lateral spread-out area and the speed of the flows. The results show that the trees have a strong decelerating effect in the downstream direction, and also slow the rate of lateral spread out. The knowledge gained from these experiments can be applied to the field scale, and could provide useful practical guidelines for the alternative, sustainable hazard mitigation in mountainous areas.

Keywords: Flow, obstacle Interaction, Hazard Mitigation, Mass Movement, Granular Flow, Small, scale Experiments, sustainable

*Speaker
†Corresponding author: thi.luong@sydney.edu.au

Dynamic properties of loose sand using numerical analysis-A case at Hong Thai Tay coal transportation road project (Vietnam)

Nguyen Hung [1], Nguyen Dung * [1], Tan Do† [1]

[1] Hanoi university of Mining and Geology – Vietnam

In this paper, a study was conducted to investigate the dynamic behaviors of loose sand collected from Hong Thai Tay coal transportation road project (Vietnam). Cyclic direct simple shear tests (CDSS) were performed on the soil using a finite element method program. The CDSS test was controlled under drained strain condition with the vertical effective consolidation stress of 100 kPa. In addition, the other dynamic control parameter, cyclic stress ratio, was subjected to vary in the range of 0.04-0.1. A total of 30 cyclic direct simple shear tests were performed with respect to the number of uniform cyclic cycle and cyclic stress ratio to determine the dynamic parameters of the sand plasticity model. Eventually, the dynamic properties of the investigated sand were observed through various dynamic aspects. As a result, the strain amplitude of the loose sand in this study slightly increased within the first fifteen-loading cycles. From the sixteenth cycle, huge increments were observed during the cyclic test. This result agreed well with that of excess pore water pressure ratio, that is, the development of excess pore water pressure reached about 1.0 after fifteen cycles of loading. Moreover, the obtained results of the shear modulus reduction ratio from this study were compared to those of sand from the literature reviews.

Keywords: Dynamic properties, loose sand, numerical analysis, Hong Thai Tay coal transportation road

*Speaker

†Corresponding author: domanhtan@khoaxaydung.edu.vn

Experimental and numerical assessments of seepage effect on embankment behaviours by the time

Thanh Quang Nguyen * , Truong-Linh Chau *

[1], The Hung Nguyen

[1] CNRS – France

The incidents of dam failure occur due to some different reasons, in which the reason for seepage accounts for 35%. The seepage leading to the dam incidents can be divided into piping, internal erosion, solution of soluble rock, excessive internal pressures and/or saturation and excessive uplift, heave, or blowout. Currently, empirical method is commonly used to study the influence of seepage on the dam incidents. This paper presents a research work on the development of the experimental equipment and procedure for evaluating seepage effects on several physical properties of embankment, which include cohesion, friction angle, density and permeability coefficient. The testing results provide important material inputs to the finite element model used for the stability analysis of the main dam of Ta Trach reservoir (Thua Thien Hue Province, Vietnam) caused by the seepage phenomenon.

Keywords: Dam failure, Earth dam, Seepage, Physical properties of embankment.

*Speaker

A numerical homogenized law using discrete element method for continuum modelling of boundary value problems

Trung Kien Nguyen * [1,2], Jacques Desrues [2], Gaël Combe [2], Duc Hanh Nguyen [1]

[1] National University of Civil Engineering (NUCE) – 55 Giai Phong Road, Hanoi, Vietnam
[2] Laboratoire sols, solides, structures - risques [Grenoble] (3SR) – Université Joseph Fourier - Grenoble 1, Institut Polytechnique de Grenoble - Grenoble Institute of Technology, Institut National Polytechnique de Grenoble, Centre National de la Recherche Scientifique : UMR5521, Université Grenoble Alpes – Domaine Universitaire BP53 38041 Grenoble Cedex 9, France

This paper presents a new way to define constitutive laws based on particles interactions within the Discrete Element Method (DEM). The concept is based on Volume Element (VE) for which the constitutive law is constructed through a numerical homogenization process. The new law fully accounts for the discrete nature of granular materials. By using the response envelope diagrams proposed by Gudehus [1], a graphical representation of the constitutive law is obtained. The results suggest that the current law can fully capture the main features of granular materials such as anisotropy, path dependence and non-linearity.

Keywords: Homogenization, FEM, DEM, constitutive law, granular materials

*Speaker

Influence of heterogeneous fractured fault damage zones on shear failure onset during fluid injection

Trung Kien Nguyen * [1], Jeremy Rohmer [2], Ba Thao Vu [3]

[1] National University of Civil Engineering (NUCE) – 55 Giai Phong Road, Hanoi, Vietnam
[2] Bureau de Recherches Géologiques et Minières (BRGM) (BRGM) – BRGM – France
[3] Hydraulic Construction Institute, Vietnam Academy for Water Resources – Vietnam

Fault stability analysis is traditionally performed by assimilating fault systems to surfaces. Yet, faults are complex and heterogeneous geological systems, whose compartmentalized architecture generally corresponds to an inner core (FC) of small thickness (i.e. principal fault plane) surrounded by outer, often fractured damage zones (DZ). Depending on the fractures' network characteristics, the latter compartment can be related to complex spatial distribution of hydro-poro-elastic properties, which can strongly influence the shear failure tendency of the fault zone during massive injection of fluid into reservoirs. Using the upscaled DZ properties derived from outcrop surveys at Cirques de Navacelles (South of France), we investigate this issue using coupled hydro-mechanical simulations in the framework of fully saturated orthotropic elastic porous media. By comparing the shear failure tendency for the heterogeneous DZ cases to the ones with homogeneous DZ, we highlight that: 1. Whatever the stress regime (extensional or compressional), the maximum injection pressure is greater in the heterogeneous cases; 2. Under extensional regime, the presence of the DZ limits the development of shear failure tendency in the center of the first DZ compartments directly adjacent to FC, whereas shear appears to rapidly develop along the whole reservoir thickness for the homogeneous case; 3. Under compressional regime, the presence of the DZ enhances the localization of shear failure along FC-DZ interface, whereas shear failure preferably develops in the injection zone in the homogeneous case.

Keywords: Fluid injection into porous reservoirs, fault shear reactivation, orthotropic poroelasticity Stress regime

*Speaker

Influence of Compaction Factor on the mechanical behavior of the soils used for the earth dams in the North Central region, Vietnam

Tran Van Toan *† [1], Tran Van Hien [2]

[1] Thuyloi university (TLU) – 175 Tay Son, Dong Da, Hanoi, Vietnam
[2] Hydraulic Engineering Consultants Corporation No.II (HECII) – 169 Tran Quoc Thao, District 3, HCM City, Vietnam

Almost all the earth dams constructed in the North Central region of Vietnam usually encounter problems related to the use of cohesive soils during dam construction under humid climate conditions with long and heavy rain periods. Therefore, it is very difficult to compact the soil to achieve the compaction factor of $K \geq 0.9$ required by the designer. In this paper, the authors present experimental results to determine the correlation between the compaction factor (K) with the mechanical behavior of the soils used for the earth dams in the North Central region of Vietnam. The research results are applied to select the reasonable value of compaction factor for the soils used in dam construction, which is suitable with the requirements of the design standard.

Keywords: Earth dam, compaction factor, mechanical behavior, permeability coefficient, soil moisture content

*Speaker
†Corresponding author: tranvantoan@tlu.edu.vn

In-plane seismic behaviour of rammed earth walls: a numerical investigation with time history analysis

Quoc-Bao Bui *† [1], Tan-Trung Bui [2]

[1] Ton Duc Thang University (TDTU) – Vietnam
[2] University of Lyon, INSA Lyon, GEOMAS – INSA - Institut National des Sciences Appliquées – France

Rammed earth (RE) is a construction material manufactured from the soil. This material attracts numerous scientific investigations because of its sustainable properties: low embodied energy, benefic hygro-thermal behaviour. This paper presents a numerical study to investigate the in-plane seismic behaviour of RE walls. First, an in-situ RE wall was modelled by using the discrete element method (DEM). The relevancy of the numerical model was verified by comparing dynamic properties of the model with that measured on the in-situ wall. Then, a real earthquake excitation was applied to the model to evaluate the seismic performance of the RE wall studied. The excitation was also scaled at different amplitudes to assess the damages following different earthquake intensities. The results showed that for seismic excitations lower than 2.3 m/s2, RE walls studied had satisfying in-plane earthquake performance.

Keywords: rammed earth, seismic behaviour, time history analysis, discrete element modelling

*Speaker
†Corresponding author: buiquocbao@tdtu.edu.vn

Enhanced oil recovery: A selection technique for the energy and recovery of Bach Ho field in Vietnam

Van Hung Nguyen *† [1], Nguyen Minh Quy [2], Hoang Long [2], Le Quoc Trung [2], Quan Le Vu [2]

[1] Department of Petroleum Drilling and Production engineering, Faculty of Petroleum, Petrovietnam University (PVU) – 762 Cach mang thang Tam street, Long Toan ward, Ba Ria - Vung Tau City, Vietnam

[2] Vietnam Petroleum Institute (VPI) – 167 Trung Kinh street, Yen Hoa - Cau Giay, Ha noi city, Vietnam, Vietnam

With the increase in energy demand in years to come and the decrease in oil discoveries during the last decades, it is believed that the enhanced oil recovery (EOR) technologies will play an important role in energy balance. This paper presents a full review of EOR status and opportunities to increase the recovery factors in some typical reservoirs known as in-situ combustion, CO2 flooding, hydrocarbon flooding, water flooding... These methods were applied to the lower Miocene reservoir at the Bach Ho (White Tiger) oil field. Several parameters including produced oil characteristics, oil production rate, reservoir depth, etc. were considered. It was observed from some preliminary results that the immiscible gas injection is the most feasible and practical EOR method for the Bach Ho oil field.

Keywords: Bach Ho oil field, EOR, Energy demand

*Speaker

†Corresponding author: hungnv@pvu.edu.vn

Overview of Geomechanics and its applications to petroleum industry – a case study for minimum overbalance pressure calculation

Van Hung Nguyen *† [1]

[1] Petrovietnam University, Department of Petroleum Drilling and Production engineering, Faculty of Petroleum (PVU) – 762 Cach mang thang Tam street, Long Toan ward, Ba Ria - Vung Tau City, Vietnam

Geomechanics plays an essential role in drilling and production petroleum industry from beginning with pre-drill well planning and continuing with wellbore stability support while drilling and sand production management. This paper will cover an overview about geomechanics from its fundamental knowledge and geomechanical models to its applications in practical problems of oilfield operations such as wellbore instability, sand production. Additionally, a full review about input data and how to get them by measuring in laboratory and calibration with field measurement will be presented. The result shows that the Mohr – Coulomb criterion can be used for the wells with the borehole inclination from 0 to 60 degrees in this study area.

Keywords: Geomechanics, Petroleum, Drilling, Reservoir, Mohr, Coulomb, Hoek, Brown, Modified Lade, Rock Mechanics

*Speaker
†Corresponding author: hungnv@pvu.edu.vn

Numerical model of hydro–mechanical coupling DEM–PFV and application for simulation of settlement of soil saturated in embankments due to static loading

Anh Tuan Tong* [1], Nguyen Hoang Phuong Luong † [2]

[1] University of Transport and Communications (UTC) – 3 Cau Giay Street, Hanoi, Vietnam
[2] Dong A University (UDA) – 33 - Xo Viet Nghe Tinh - Hai Chau - Da Nang, Vietnam

This paper presents the numerical model of hydro–mechanical coupling DEM–PFV using a combination of the discrete element method (DEM) for the solid phase and a pore–scale finite volume (PFV) of the flow problem. Numerical results at the microscopic scale on settlement of an embankment with soil saturated are presented denoting that the capable apply of the model DEM – PFV for predicting the settlement of granular material used in road embankments subjected to static loading. Comparison between the numerical result and the Terzaghi's analytical solution of a soil consolidation problem shows the validation of the model DEM – PFV.

Keywords: Numerical model DEM–PFV, settlement, soil saturated, consolidation.

*Corresponding author: tatuan@utc.edu.vn
†Speaker

Abnormal pore pressure and fracture pressure prediction for Miocene reservoir reservoir, field X in Vietnam

Van Hung Nguyen *† [1]

[1] Department of Petroleum Drilling and Production engineering, Faculty of Petroleum, Petrovietnam University (PVU) – 762 Cach mang thang Tam street, Long Toan ward, Ba Ria - Vung Tau City, Vietnam

In order to drill a well safely and economically, it is necessary to know the pore pressure and fracture pressure so that the mud density can be optimized to provide sufficient overbalance. In areas where exploration and production histories are established, offset data sets can be used to provide detailed profiles of expected pressure for those wells about to be drilled. Seismic data, log information and direct pressure measurements, production testing can be used. This article focuses on abnormal pore pressure and fracture pressure prediction by using modern methods and industry accepted concepts. Relationships between petroleum geology and drilling engineering are interpreted to give the accurate estimations of Miocene rock reservoir, field X in Vietnam. The results show that there is an abnormal pressure zone appearing from the depth of 4900ft that selecting a favorable mud density is a good solution to ensure the success and safety of the well drilling process.

Keywords: Pore pressure, abnormal pressure, fracture pressure, Leak, off test

*Speaker
†Corresponding author: hungnv@pvu.edu.vn

Study the influence of adherence edge to steel strip and soil interaction in Mechanically Stabilized Earth Wall with a self-made strip

Chau Truong - Linh * [1], Nguyen Thu - Ha [2]

[1] University of Science and Technology - The University of Danang – 54 Nguyen Luong Bang Street, Lien Chieu District, Danang City Tel (+84.0236) 3842308, Vietnam
[2] University of Science and Technology - The University of Danang – 54 Nguyen Luong Bang Street, Lien Chieu District, Danang City tel:(+84.0236) 3842308, Vietnam

Nowadays, high embankments are popular in many transportation networks. A method of Mechanically Stabilized Earth Wall (MSE wall) has been used for increasing the stability of backfilling soil in road embankments soil because of its economic, technical and landscape advantages. This paper presents a series of experiments on different categories of adherence edge to demonstrate the effective of edge on strain, stress-strain, and displacement of MSE wall. A FLAC software also was used to verify the experimental results. The study could provide the instructions for the design, construction and project management of MSE wall. It can also be used for suggestion of soil improvement solutions, backfilling material selections to increasing the stability of MSE wall.

Keywords: Mechanically Stabilized Earth Wall, fill material, adhrence edge, physical modeling, numerical modeling

*Speaker

Formation of Rust Scales on Mild Steel Pile in Brackish Water of Phu My Port - Vietnam

Vinh-Dat Vuong * [1,2,3], Anh Quang Vu [1], Eiji Katayama [4], Shunsuke Usami [4], Thang Van Le [1,2], Nguyen Danh Thao† [5]

[1] Department of Energy Materials, Ho Chi Minh City University of Technology (HCMUT) – 268 Ly Thuong Kiet Street, Ward 14, District 10, Ho Chi Minh City, Vietnam
[2] Material Technologies Laboratory, Ho Chi Minh City University of Technology (HCMUT) – 268 Ly Thuong Kiet Street, Ward 14, District 10, Ho Chi Minh City, Vietnam
[3] Graduate University of Science and Technology, VAST – 18 Hoang Quoc Viet Street, Cau Giay District, Ha Noi, Vietnam
[4] JFE Steel Corporation – 2 Chome–2–2–3 Uchisaiwaicho, Chiyoda, Tokyo 100–0011, Japan
[5] Department of Port and Coastal Engineering, Ho Chi Minh City University of Technology (HCMUT) – 268 Ly Thuong Kiet Street, Ward 14, District 10, Ho Chi Minh City, Vietnam

Corrosion test of mild steel (graded JIS-STK400) was investigated in brackish water environment of Phu My industrial port (Ba Ria - Vung Tau Province, Vietnam). Steel sample was exposed in 3 years. X-ray diffraction (XRD) results show that formed rust powder was composed of α-FeOOH, Fe3O4 and α-Fe2O3 in which the amount of first component is larger than second and third one. It demonstrates that natural corrosion products evolved from low to high oxidation state of iron by presence of dissolved oxygen in brackish environment. The mechanism of phase conversion is revealed by metallographic of rust layer cross section. α-Fe2O3 (white phase) was gathered at bank of cracking paths where was favouring diffusion of oxygen and water into inner layer. After contacting Fe3O4 (dark gray phase), corrosive agents converted it to α-FeOOH and α-Fe2O3. The phase conversion change the weight density of materials and create the porous tunnels in rust scales. The growth of micro tunnels to form the tunnel network allowed internal stress and cracks of rust scales evolved.

Keywords: rust peeling off, rust formation, metallography, brackish water, industrial port

*Speaker
†Corresponding author: ndthao@hcmut.edu.vn

Modeling Stress Distribution Around Boreholes

Khanh Do Quang* [1], Thanh Nguyen Thi Tam [2], Phuc Kieu † [3], Nhan Vo Huynh [4], Quang Hoang Trong [3]

[1] Faculty of Geology and Petroleum Engineering, HoChiMinh City University of Technology (HCMUT), Vietnam National University - HoChiMinh City (VNU-HCM), Vietnam – Room 201, Block B8, 268 Ly Thuong Kiet Street, District 10, HoChiMinh City, Vietnam, Vietnam
[2] Faculty Of Heat – Refrigeration Engineering, Industrial University of HoChiMinh City (IUH), Vietnam – Vietnam
[3] Faculty of Geology and Petroleum Engineering, HoChiMinh City University of Technology (HCMUT), Vietnam National University - HoChiMinh City (VNU-HCM), Vietnam – Vietnam
[4] Faculty of Geology and Petroleum Engineering, HoChiMinh City University of Technology (HCMUT), Vietnam National University - HoChiMinh City, Vietnam – Vietnam

The stress distribution around boreholes plays an important role for wellbore problems. This study aims to model the stress distribution around boreholes of offshore petroleum wells. The stress model around boreholes, which is associated with the in-situ stresses, rock properties as well as the wellbore pressure and configuration, is developed. The new approach uses transformation formula of a full stress tensor including its orientations and magnitudes. A calculating program for the stress analysis of wellbores (SAoWB), which is written in Matlab language, has described and calculated all components of the stress tensor at the wellbore wall as well as around boreholes. In this study, case studies are considered using the program SAoWB based on the new approach. The field case studies are applied for boreholes of the studied wells at Cuu Long basin, offshore Vietnam. The obtaining results from our program SAoWB are in good agreement with the failure observations from high solution image logs of the studied wellbore as well as coring data. They are the bases to study its implications which benefit for offshore petroleum industry activities such as wellbore stability, optimmum drilling wellbore trajectories for well planning, drilling mud selection, sanding prediction and control, hydraulic fracturing, etc. Modelling the stress distribution around boreholes from the program SAoWB not only enhances knownledge of in-situ stress tensors but also impacts on well problems, especially for offshore petroleum wells.

Keywords: In, Situ Stress, Stress Distribution, Stress Model, Boreholes, Failure Observations.

*Corresponding author: dqkhanh@hcmut.edu.vn
†Speaker

A mathematical model for fault activation by water injection

Son Nguyen * [1], Jonny Rutqvist , Bastian Graupner , Yves Guglielmi

[1] Canadian Nuclear Safety Commission (CNSC) – Canada

Many industrial operations (such as water reservoir impoundment, waste water disposal by injection and the sequestration of carbon dioxide) can potentially trigger seismic events through the injection of fluids into the underground. Due to fluid injection, the pore pressure in existing faults can increase, potentially leading to fault slip and induced seismicity. Another area of activity where mechanical and fluid transport processes in faults need to be assessed is the geological disposal of radioactive waste. Faults in the host rock that might exist in the vicinity of a deep geological repository (DGR) for radioactive waste, might constitute preferential pathways for radionuclide migration. Their hydro-mechanical characteristics need to be understood, and be taken into account in the safety assessment and design of the DGR. In the very long time frame associated with the DGR, several processes can trigger a pore pressure increase in the fault that might increase the risk of fault slip and induced seismicity, and also might increase the fault permeability.
The response of rock formations and the faults to pore fluid pressure variations is governed by the classical laws of poro-mechanics. With pore fluid pressure increase, the normal effective stress across the fault decreases, leading to a loss of shear resistance according to Coulomb's law. The fault then slips, and can trigger earthquakes. The classical theoretical framework of poromechanics and Coulomb friction is well established; however its application for the assessment of fault behaviour is an elaborate endeavour due to the intricate architecture of the fault, the uncertainty on the initial stress field and the complex evolution of the permeability of the fault with the changing stress-field. Therefore, model verification with large-scale fault slip in-situ experiments is needed if the models are to be used as reliable tools for performing risk assessments of fault reactivation. In this paper, we will focus on experiments of controlled water injection performed in faults in Opalinus Clay, at the Mont-Terri Underground Research Laboratory in Switzerland. We will provide a summary description of the geological setting, the experimental setup and discuss the development and calibration of a mathematical model to interpret the experiments.

Keywords: Fault activation, induced seismicity, radioactive waste disposal, fluid injection

*Speaker

Full-scale Pullout Testing of Ground Anchors to Evaluate the Applicability of French Design Practice TA95 for Vietnam

Thanh Nguyen *† [1], Duy Nguyen *

[2]

[1] Hanoi Architecture University – Vietnam
[2] University of Transports and Communications – Vietnam

Ground anchors have been playing an important role in reinforcing dykes, underground, stabilizing structures of earth retaining walls, subway stations, and anchoring abutments of bridge or in sea port, etc. In Vietnam, the design of ground anchors is generally based on the international design guidelines, in particular the Eurocode. As there is a diversity of current design practices in different countries, it is necessary to carefully verify and validate an international design of ground anchor before adopting it to Vietnam. This paper aims at presenting a series of full-scale pullout tests of ground anchors recently performed in several projects in Hanoi and Ha Long city, Vietnam. The testing results in terms of the ultimate load-holding capacity, the pullout performance and the skin friction are discussed and compared with the French design practice TA95 in order to evaluate as well as to improve its applicability in Vietnam.

Keywords: Ground anchor, trial testing, post grouting

*Speaker
†Corresponding author: nnthanhxd@gmail.com

Durability Evaluation of a Geothermal Grout

Pascal Monnot , Philippe Blanc , Amandine Rojo , Laurent Molez , Christophe Lanos * [1]

[1] Laboratoire de Génie Civil et Génie Mécanique (LGCGM) – Université de Rennes I : EA3913 – IUT Génie Civil – Construction Durable 3 rue du Clos Courtel - BP 90422 35704 Rennes Cedex 7 - France, France

The installation of vertical geothermal-heat-exchangers is confronted with the difficulty of sealing continuously and perennially the borehole. A method to evaluate the durability of a geothermal grout used to seal vertical geothermal probe were developed. The study was conducted on a commercial product provided by an industrial partner.
The study integrates an experimental approach and geochemical simulations. The accelerated ageing of the geothermal grout is evaluated in laboratory subjecting the grout to realistic geochemical and thermal aggressions: mechanical loading, aggressive solutions and accidental freezing. The parameters related to the thermal conductivity and the permeability are particularly monitored.

In a decoupled device, different degradation conditions are studied: in a first case, the grout samples are exposed to different aggressive solutions (water, gypsum water, acidic water) under isothermal temperature conditions; in the second case, in addition to the aggressive solutions, the specimens are exposed to daily freeze / thaw cycles.

A second experimental setting were developed to reproduce the operating conditions of a geothermic probe under realistic containment conditions. A coupled device comparable to an oedometer cell were developed. During a test, different temperature cycles are carried out, which can lead to freezing and thawing. Simultaneously, a vertical load is applied to the grout and fluid pressures are controlled to generate a vertical fluid pressure gradient.

The coupled and decoupled devices allow to study the alteration phenomena of the geothermal grouts with a good measuring reproducibility.

The geochemical degradation models were calibrated with experimental results and long time scale simulations of the degradation around the pipe were performed.
The performance parameters (for geothermal application) of the studied material were not altered. However, an intrinsic variability of the material may have covered the evolutions of the properties. Indeed, the geochemical models suggest a total disappearance o the hydraulic binder in 30 years.

Keywords: geothermal grout, thermal conductivity, permeability, geochemical model, freeze thaw cycles

*Speaker

Reusability of muds dredging at urban lakes in Hanoi from geotechnical engineering characteristics

Pham Tri Thuc * [1], Phan Huy Dong * † [2]

[1] Military Academy of Logistics (MAL) – Ngoc Thuy Street, Long Bien District, Hanoi City, Vietnam
[2] National University of Civil Engineering (NUCE) – 55 Giai Phong Street, Hai Ba Trung District, Hanoi City, Vietnam

This study is aimed at discussing on the typical geotechnical engineering characteristics of sludge dredging from typical lakes in Hanoi city. Based on which, the possibility of recyclability as filling material will be clarified. In doing so, sludge samples were collected from Westlake and Hoan Kiem Lake. A series of laboratory tests on the typically physical and chemical characteristics has been conducted. The test results indicated that at shallow depth up to about 1.0 m, the muds have very high water content as it ranges from 195.4% to 212.3%; the organic carbon content from 11.4 to 22.3% was also observed. The pH value is from 9.05 to 9.46. finer content in the West Lake is 22.3-36.9% and in Hoan Kiem Lake, it is relatively high from 46.2 to 54.3%. In addition, X-ray diffraction tests (ASTM C114) and plasma spectrum analyzer tests (TCNB-ICP 01/04) were also conducted to investigate the chemical components of the muds. The test results show that the although the muds were collected from various disposal resources, the chemical component meet the National technical regulation on hazardous waste threshold (QCVN 07: 2009/BTNMT). Overview on the experiences in Japan reveals that the muds dredging from lakes in Hanoi City have high possibility for recycling as filling material.

Keywords: Sludge, dredging, embankment material, heavy metal

*Speaker
†Corresponding author: dongph@nuce.edu.vn

Numerical study of pile reinforced slope-A case at Khe Cham coal preparation construction site project (Vietnam)

Nguyen Dung * , Nguyen Hung , Tan Do [1]

[1] Hanoi university of Mining and Geology – Vietnam

Within the framework of Khe Cham coal preparation construction site project, evaluation of slope stability and solution of slope reinforcement are essential. A site investigation was performed first along a slope located in Khe Cham coal preparation construction site. The slope reinforcement was recommended due to a group of joints and cracks observed along slope surface. The main purpose of this study is to confirm the stability condition of the unreinforced slope and optimize the pile reinforcement (i.e., pile position, pile spacing). A numerical modeling software, Flac program, was used for this investigation. Soil properties using in the simulation model were obtained by the site investigation. Groundwater table, which was assumed to be in the top of the slope, was also considered in the model. The safety factor based-optimization analysis was performed with respect to pile position and pile spacing. Shear strength reduction method was established to determine the safety factor of the slope. As a result, the same conclusion as site investigation was found for the unreinforced slope, that is, the slope should be reinforced for the long-term stability. In addition, the sensitivity of the slope safety factor on pile position and pile spacing was discovered. Eventually, the optimization of pile reinforced slope was chosen and proposed based on the sensitivity of safety factor.

Keywords: Numerical study, pile reinforced slope, Khe Cham coal preparation construction site

*Speaker

Experimental Correlations for the Swelling Pressure of Expansive Clays in the City of Tebessa, Algeria

Adel Djellali *† [1], Behrooz Saghafi [2], Mohamed Salah Laouar [3]

[1] Mining institute, Larbi Tebessi University – 12002 Tebessa, Algeria
[2] Highway Engineer and Highways Innov8 Champion, Capita Real Estate and Infrastructure – United Kingdom
[3] Engineering Department, Larbi Tebessi University – 12002 Tebessa, Algeria

This paper aims to describe the dependency of the swelling pressure (Ps) of Tebessa clay soils to the conventional soil properties namely; Plasticity index (PI), dry density (gd), initial moisture content (W) and carbonate content (Ca). A statistical model, capable of obtaining an indirect estimation of Ps based on these soil parameters, is provided. High correlation coefficient (R2) of 0.93 demonstrated predictability of swelling, using multiple regression modeling. Although the above-mentioned parameters play important roles in the swelling behavior of the clayey soils, there is not any universally accepted, simple and quantitative method to classify swelling pressure at present. The equation, proposed in this paper, helps the engineers with evaluating soil pressure in practice. In addition, it can be popularized when environment conditions are satisfied for application in field explorations and design of structures over expansive soils.

Keywords: Expansive Clays, Swelling pressure, geotechnical parameters, regression analysis.

*Speaker
†Corresponding author: adel.djellali@univ-tebessa.dz

Design of Experiments (DOE) techniques To Predict Swelling Pressure of Expansive Soils In Tebessa (Algeria).

Yacine Berrah *† [1], Abderrahmane Boumezbeur [1], Nouar Charef [2], Serhane Brahmi

[1] University of Tebessa (Algeria) – Algeria
[2] Mohamed Cherif Messaadia University [Souk Ahras] – Souk Ahras, Algeria

This research work aims to study the swelling behavior of clayey soils in Tebessa area (Algeria) using the Design of experiments (DOE) method, based on mechanical, physical and clay mineralogy test results. The effect of different parameters such as dry unit weight, degree of saturation, water content, plasticity index, etc. on the swelling behavior of soil is evaluated and the statistical contribution of each variable in the calculated swelling pressure is also discussed. Besides, relationships between factors affecting the expansion process have been determined. The swelling pressure generated within the soil, which is useful in the design of foundations and civil engineering structures is taken as output process in the screening design methodology. Optimization of the parameters that affect the swelling behavior by Response Surface Method (RSM) allows finding the best set of factor levels to establish the mathematical model. Hence, the efficiency of this model is assessed by comparison of its output results with those obtained from laboratory tests. All of these techniques allow choosing the appropriate model that can be used for all soil conditions.

Keywords: Swelling Soil, Design of experiments (DOE), Soil parameters, Response Surface Method (RSM).

*Speaker
†Corresponding author: yacine-berrah@univ.tebessa.dz

Analysis of Landslides In The Region Of Souk Ahras (Zaarouria Sector) North- east Of Algeria Using pseudo-static method

Nouar Charef * [1], Yacine Berrah * † [2], Abderrahmane Boumezbeur‡ [2]

[1] university of Annaba – Algeria
[2] University of Tebessa (Algeria) – Algeria

The increasing development in the region of Souk Ahras (Algeria) is more and more threatened by several landslides, i.e. mass movements of materials. Sustainability of structures and in particular roads are threatened by this widespread phenomenon in the region. Landslides cause significant damage and casualties to people and property. Practical observations of the lands in movement can establish a correlation between geological, hydrogeological conditions and the landslide phenomenon. In this study, the main objective is to combine geology with soil mechanics in order to study causes of landslides in three important sectors (Mechroha, Zaarouria, Hammam Tassa) all over the wilaya of Souk Ahras territory. In addition, we study particular landslide in sector of (Zaarouria) by modeling the mechanical behavior of the field using numerical calculations and discuss the influence of pore water pressure variation on the safety factor. Finally, the resulting model will experience the use of pseudo- static method to perceive the influence of seismicity on safety factor.

Keywords: Modeling, Pseudo, static method, Pore water pressure, Cohesion, Safety factor.

*Speaker
†Corresponding author: yacineberrah29@gmail.com
‡Corresponding author: boumezbeura@yahoo.fr

Solving the stability problem of vertical slope according to the effective stress field

Thang Do * [1]

[1] Thuyloi University (Dai hoc Thuy loi) – 175 Tay Son, Dong Da, Hanoi, Vietnam

Soil mechanical behavior does not agree with the elastic theory, but complies with Mohr-Coulomb yield criterion and Terzaghi's effective stress principle. The deformation of soil as well as its shear strength depends on the effective stress. In this paper, a new direct method has been developed to determine the effective stress field in soil based on the shear potential. The method allows solving the stability problem of vertical slope.

Keywords: effective stress field, shear potential, stability problem, vertical slope

*Speaker

Finite Element Simulation of water content-influenced progressive failure of sensitive clays

Nhat-Phi Doan * [1], Seung-Wook Woo [1], Yao-Long Hou [1], Sung-Sik Park† [2]

[1] School of Architectural, Civil, Environmental, and Energy Engineering, Kyungpook National University – 80 Daehak-ro, Buk-gu, Daegu, South Korea
[2] Department of Civil Engineering, Kyungpook National University – 80 Daehak-ro, Buk-gu, Daegu, South Korea

Large-scaled landslides often occur in sensitive clay deposits in horsts and grabens, typical of spreads. Most large deformation numerical analysis based on the strain-softening behavior of undrained shear strength. In practice, water infiltration into soils may result a variation of non-uniform crack and shear band emergence at a low soil resistance. In this study, the mechanism of water content effect on the stress-strain relationship was implemented in Mohr-Coulomb (MC) model using the user material subroutine of the commercial software Abaqus/Explicit. The coupled Eulerian-Lagrangian method (CEL) was used to model such large deformation analysis. The developed model was verified by a simulation of Saint-Jude landslide, which occurred in 2010 in Quebec, Canada. There was a good agreement among numerical results with water content effect comparing to an analytical function. A larger mobile soil mass movement with a significant reduction of soil resistance was simulated successfully using the developed model.

Keywords: progressive failure, sensitive clays, water content effect

*Speaker
†Corresponding author: sungpark@knu.ac.kr

Non-microbial carbonate precipitation as an improvement technique of sand.

Sung-Sik Park [1], Trung-Tri Le [*†] [1], Kim Seong-Heon [1], Nong Zhenzhen [1]

[1] Department of Civil Engineering, Kyungpook National University – 80 Daehak-ro, Buk-gu, Daegu, South Korea

In this study, the formation of artificial Calcium Carbonate (CaCO3) from the reaction between Calcium Hydroxide (CH) and Carbon Dioxide (CO2) was taken into account to improve sand properties. Firstly, Jumunjin sand was mixed with 2% of CH and water at a constant water-solid weight ratio of 0.1 before curing in a carbon dioxide chamber. The precipitated calcite content was investigated by the variation of CO2 chamber pressure and number of repeatable treatment. Then, unconfined compression test of such samples were carried out to evaluate the influence of calcite content on mechanical properties of sand. It indicated that as increasing of repeatable treatment, the UCS of treated sand increased due to the higher of calcite precipitation. The first and fifth cycle do not lead to any significant variations of precipitated calcium carbonate content (CCC) and unconfined compressive strength (UCS) with the change of carbon dioxide chamber pressure from 100 kPa to 200 kPa, but the higher CCC and UCS can be seen clearly at the tenth cycle. After 10 treated cycles, the UCS of CP1.10 and CP2.10 were 5 times greater than CP1.1 and CP2.1, respectively. The maximum UCS was 361 kPa of CP2.10 specimen. The stress-strain curves obtained from UCS test at 200 kPa CO2 gas pressure exhibited more strain at peak stress than that at 100 kPa and the samples subjected to 10 treated cycles has more ductile behavior than other samples.

Keywords: Calcium carbonate binder, mechanical properties, compressive strength

[*]Speaker
[†]Corresponding author: ltrungtri@gmail.com

Modeling on Cuttings Transport in Inclined and Horizontal Well Drilling

Khanh Do Quang* [1], Dat Truong Trong Tuan [2,3], Phuc Kieu † [3], Huong Tran Thi Mai [3], Quang Hoang Trong [3]

[1] Faculty of Geology and Petroleum Engineering, HoChiMinh City University of Technology (HCMUT), Vietnam National University - HoChiMinh City (VNU-HCM), Vietnam – Room 201, Block B8, 268 Ly Thuong Kiet Street, District 10, HoChiMinh City, Vietnam, Vietnam
[2] PetroVietnam Drilling and Well Services Corporation (PVD), Vietnam – Vietnam
[3] Faculty of Geology and Petroleum Engineering, HoChiMinh City University of Technology (HCMUT), Vietnam National University - HoChiMinh City (VNU-HCM), Vietnam – Vietnam

In inclined and horizontal well drilling, cuttings transport is playing a very important role in obtaining a safe and efficient drilling plan. The paper presents two empirical models, namely Larsen's model and Rubiandini's model, which were considered to evaluate the cuttings transport in both inclined and horizontal well drilling in offshore Vietnam. A parametric study considering different drilling parameters such as mud weight, rate of penetration (ROP), mud rheology, etc. indicated that the two empirical models provided the same trends of the flow velocity and flow rate required for transportation of mud cuttings. It is concluded from all simulations that the flow rates predicted by both Larsen's model and Rubiandini's model are reasonably close to the actual flow rates in the drilling operation. Moreover, it is also observed from the analyses of the horizontal drilling case that the use of Rubiandini's model could generally result in larger flow rate required for cuttings transport compared to Larsen's model.

Keywords: Cuttings transport, Empirical models, Inclined and horizontal well drilling, Offshore Vietnam.

*Corresponding author: dqkhanh@hcmut.edu.vn
†Speaker

Study on Cement-Treated Soil with RoadCem Additive in Construction of Rural Traffic Road: A Case Study in Viet Nam

Vu Ba Thao [1], Nguyen Quoc Dung [1], Ngo Thi Thanh Huong [*†] [2], Ho Si Lanh [*]

3

[1] Institute for Hydrauic Construction, Vietnam Academy for Water Resources – No. 3 Alley 95 Chua Boc Street, Dong Da, Ha Noi, Viet Nam, Vietnam
[2] Faculty of Civil Engineering, University of Transport Technology; Address – Vietnam
[3] Faculty of Civil Engineering, University of Transport Technology – 54 Trieu Khuc, Thanh Xuan, Ha Noi, Viet Nam, Vietnam

The use of soil in place for road construction could reduce construction cost and environmental impact because this method can replace the traditional materials that are depletion such as sand, gravel. This paper presents the laboratory results for selecting proportion and inspection testing results of experimental road construction using cement-treated soils with RoadCem additives. RoadCem additive improved the hydration of cement when cement reacts with soil particles, thus increasing the strength of reinforced soils, especially tensile strength. The results of inspection tests showed that the average of compressive strength, tensile strength, and modulus elastic in the saturated condition of reinforced soil satisfied the designed and standard requirements in TCVN 10379-2014. In comparison with the cement concrete pavement, the pavement made from cement-treated soils using RoadCem could reduce 15% of cost; furthermore, this pavement has smooth and environmentally friendly.

Keywords: Rural traffic road, RoadCem additive, Soil in place, Cement, treated soils

[*]Speaker
[†]Corresponding author: huongntt@utt.edu.vn

Application of Steel Pipe Piles with Wings installed in Soil Cement Column for Building Structure in Vietnam

Hoang Kien Pham *† [1], Daisuke Ito [2]

[1] University of Transport and Communications - UTC (VIETNAM) (UTC) – No.3 Cau Giay Street, Lang Thuong ward, Dong Da District, Hanoi, Vietnam
[2] Asahi Kasei Construction Materials Corporation – Japan

The steel pipe piles with wings installed in soil cement (referred to as ATT) developed in Japan and Vietnam are composite foundation piles made of steel pipes with wings with foundation improvement pillars (referred to as columns) in soil cement and spiral wings attached to the shaft intermittently. This kind of composite foundation pile has large vertical and horizontal bearing capacities and is a construction method of foundation piles with con-sideration of environments with little surplus soil, using steel pipes with small diameters. In this study, after introducing ATT's overview and construction process, application of this composite foundation piles for a building struc-ture was introduced. The in situ loading test results was also presented. Fur-thermore, from results of loading tests done in the application project, the loading capacity and consideration of ATT's applicability in Vietnam was verified.

Keywords: loading test, composite foundation pile, Steel Pipe Piles with Wings, Soil Cement Column

*Speaker
†Corresponding author: phkien@utc.edu.vn

Modelling the hydromechanical behaviour of expansive assembly of clay granules upon hydration using discrete element method

Benjamin Darde *† [1,2], Anh Minh Tang [1], Jean-Noël Roux [1], Jean-Michel Pereira [1], Patrick Dangla [1], Jean Talandier [2], Minh Ngoc Vu [2]

[1] Université Paris-Est, Laboratoire Navier, UMR 8205 (Ecole des Ponts ParisTech - Ifsttar - CNRS) – Ecole des Ponts ParisTech – France
[2] French National Radioactive Waste Management Agency – ANDRA – France

Bentonite-based materials are considered as a sealing material for the isolation of galleries in the French radioactive waste disposal concept because of their low permeability, radionuclides retention capacity and ability to swell upon hydration. This latter is an important property to fill the technological voids. Within this context, bentonite pellet mixtures have been studied owing to operational convenience. Pellets are installed in a dry state as a granular assembly. The mixture homogenises upon hydration from the host rock pore water. At full saturation, homogenised pellet mixtures are thought to behave as classic compacted bentonite materials. However, before homogenisation, the granular nature of the material controls the macroscopic behaviour of the mixture. The interaction between the pellets and its consequences on the macroscopic behaviour of the mixture has to be studied to carry out predictive simulations of the evolution of engineered barriers.

In this work, the influence of the granular nature of the material is studied through Discrete Element Method (DEM) simulations. In DEM simulations, each pellet is modelled individually and represented by a sphere of same mass and density as real pellets. An elastoplastic model describing the hydromechanical behaviour of a single pellet upon suction decrease is proposed from grain-level experimental characterisation. Swelling pressure tests of pellet mixtures, carried out at laboratory scale, are simulated using the proposed model. The mixture behaviour is satisfactorily reproduced upon hydration from 89 MPa (initial state) to 9 MPa of suction. Then, the model is used to study the behaviour of large granular assemblies of bentonite pellets on the same hydration path.

Results highlight that the mixture assembling process, the pellet strength and stiffness, and the mixture density have an influence on the swelling pressure development upon hydration. Numerical results obtained through DEM simulations will be of interest for further Finite Element Method simulations of the full hydration path using double structure models where pellets correspond to the microstructural level.

Keywords: Expansive soils, Partial saturation, Pellets, Discrete element method

*Speaker
†Corresponding author: benjamin.darde@enpc.fr

Spatially-varying non-stationary seismic bedrock motions

Van Nguyen Dinh * [1,2], Biswajit Basu [3]

[1] MaREI Centre for Marine and Renewable Energy (MaREI Centre) – Beaufort Building, Haulbowline Road, Ringaskiddy, Co. Cork, Ireland
[2] Department of Civil, Structural and Environmental Engineering, University College Cork (UCC) – College Road, Cork T12 YN60, Ireland
[3] School of Engineering, Trinity College Dublin (TCD) – Dublin 2, Ireland

Seismic bedrock motions required for full soil-structure seismic analysis have not always been available and are simulated in this paper. The stochastic bedrock Fourier spectrum used accounts for source spectrum, attenuation, geometrical spreading and source-to-bedrock amplification effects. Earthquake magnitude, geometrical properties of the source and the bed, and geological profile including the source and path rock are the input. The simulation is further enhanced by authors' new developments as follows. The frequency-dependent source-to-bedrock amplification factor evaluated by a numerical scheme improves the bedrock Fourier amplitude spectrum. The parametric modulating functions obtained for a specific earthquake magnitude and source properties facilitate the spatiality and non-stationarity. The parametric forms of lagged coherency compatible to specific bedrock sites also ensure the spatiality content. The case study consists of three consecutive examples of the same geometry, where the variation of source-to-bedrock amplification factors at several bedrock depths is investigated. The formulated bedrock Fourier spectrum is then validated. The spatially-varying non-stationary site-compatible bedrock motions are finally simulated where the differences between the averaged Fourier spectra of a realization of 100 simulated accelerograms at two bedrock sites are observed.

Keywords: Seismic Bedrock Motions, Spatial Variation, Nonstationary, Parametric Coherency, Parametric Modulating Function

*Speaker

An experimental investigation on bearing capacity behaviour of rectangular footing over reinforced soft soil slope

Raju Sarkar * [1], Ankur Mudgal [2], Amit Shrivastava [3]

[1] Center for Disaster Risk Reduction and Community Development Studies, Royal University of Bhutan – Bhutan
[2] Department of Civil Engineering, Delhi Technological University – Delhi, India, India
[3] Department of Civil Engineering, Delhi Technological University – Delhi, India

Various Geotechnical engineering work demands the construction of foundation over soft soil slope. The construction of foundation over the soft soil may cause higher settlement which can obliterate the overlying structure. On the other hand, the use of reinforcement techniques in soft soil is also increasing rapidly. Amongst them, the use of geosynthetics to reinforce the foundation soil is one of the cost effective option. In the present study, a number of model footing tests were performed in laboratory to check the effect of geosynthetics in the development of bearing capacity on shallow foundation resting over soft soils slope. For this purpose, two types of geosynthetics were chosen as reinforcement materials (a) geotextile with high stiffness (b) bi-oriented geo-grid. Parametric studies such as depth of reinforcement layer, number of layers, width of reinforcement were carried out in the present study. A total of 40 laboratory tests were conducted and their results were analyzed. From the analysis it was observed that soft soil reinforced with geosynthetics overlain by rectangular footing showed substantial increase in ultimate bearing capacity of the reinforced soil, thus signifying the potential of reinforcements in soil.

Keywords: Soft soil, geosynthetic reinforcement, bearing capacity, improvement factor, settlement reduction

*Speaker

Rheological and Microfabric Characteristics of Gold Tailings Stabilized With Fly Ash

Joon Kyu Lee * [1]

[1] Department of Civil Engineering, University of Seoul – Department of Civil Engineering, University of Seoul, Seoul 02504, South Korea

This paper presents the rheology and microfabrics of gold tailings and fly ash mixtures. The flow curves of the ash-tailings mixtures were obtained by using a rotational viscometer, and the pore size distributions of the cured mixtures were examined with mercury intrusion porosimetry. The test mixtures were prepared by varying the sample preparation method, fly ash content, water content, pore water chemistry, and temperature. The results indicate that the flow curve and pore size distribution of the gold tailings and fly ash mixtures are affected by the packing and arrangement of particles as well as the hydration of fly ash.

Keywords: Tailings, Fly ash, Rheology, Microfabrics, Hydration.

*Speaker

Meshfree SPH modelling of shrinkage induced cracking in clayey soils

Hieu Tran [1], Nhu Nguyen [1], Giang Nguyen [2], Bui Ha H. * [1]

[1] Department of Civil Engineering, Monash University – Victoria 3800, Australia, Australia
[2] School of Civil, Environmental and Mining Engineering, The University of Adelaide – SA 5005, Australia, Australia

In this study, a computational approach that combines the mesh-free Smoothed Particle Hydrodynamics (SPH) and a simple anisotropic damage constitutive model is proposed to model shrinkage induced cracking in clayey soils. To assess its performance, a numerical soil shrinkage test is conducted and simulation results are compared with experimental data. Numerical results show that the proposed approach can capture complicated cracking patterns with multiple fracture networks in clayey soils, which demonstrates the potential of SPH for simulating desiccation cracking in these materials.

Keywords: SPH, desiccation cracking, clayey soil.

*Speaker

Numerical predictions of post-flow behaviour of granular materials using an improved SPH model

Bui Ha H. * [1], Nguyen Giang D. [2]

[1] Monash University – Australia
[2] The University of Adelaide – Australia

This paper presents the recent development of the smoothed particle hydrodynamics (SPH) method for accurate predictions of granular flows. Granular materials are described within the classical plasticity theory framework, while the large deformation and flow behaviour of the materials are simulated by the mesh-free SPH. To improve the accuracy of SPH for the post-flow prediction at which stress fluctuation under large shear deformation is usually observed, a stress regularisation technique recently proposed by the authors is adopted. Through several numerical validations with experiments under 2D and 3D conditions, the proposed SPH model shows significant improvements in the accuracy and stability of SPH not only for simulations of granular flows, but also for general applications for solid materials.

Keywords: SPH, granular materials, granular flows, plasticity, post failure.

*Speaker

Stochastic site response analysis in consideration with various probability distributions of geotechnical properties

Tuan Tran *† [1,2], Phu-Cuong Nguyen [3], Seung-Ryong Han [4], Dookie Kim [2]

[1] Quy Nhon University (QNU) – Vietnam
[2] Kunsan National University (KSNU) – 558 Daehak-ro, Gunsan-si, Jeollabuk-do (Miryong-dong), South Korea
[3] Ho Chi Minh City Open University (HCMC-OU) – 97 Vo Van Tan St., Wd. 6, Dist. 3, Ho Chi Minh City, Vietnam
[4] Korea Electric Power Corporation Engineering Construction (KEPCO-ENC) – South Korea

Site response and soil profiles are a function of one another, and the probability distributions of soil profiles have significant effects on the site response. This study presents the effects of random variations of geotechnical properties on the site response using the different probabilistic distributions. The uncertainties of soil properties including shear wave velocity , the density, and the nonlinear soil properties are investigated and applied for the realistic site profile in the United States. A computer program, PSHAKE, written in Python has been developed for solving the variabilities in soil properties via Monte Carlo Simulations. The effectiveness and the good adaptability of the proposed procedure are verified based on the agreement with the reference solution given by the program Strata. Additionally, the results in sensitivity analysis indicate that uncertain unit weight has a smaller impact than the material degradation curve on a probabilistic model.

Keywords: Site Response Analysis, Probabilistic Distribution, Stochastic Analysis, Response Spectral, PSHAKE.

*Speaker
†Corresponding author: tranthanhtuan@hotmail.com.vn

Urban Planning, Transport and Environment

SMART MONITORING FOR URBAN BIODIVERSITY PRESERVATION

Thi Hai Yen Pham * [1], Isam Shahrour† [1], Ammar Aljer‡ , Alain Lepretre§ , Céline Pernin¶ [1], Sana Ounaies‖ [1]

[1] Université de Lille – LGCgE – Lille, France

The rapid urbanization causes increased pressure on biodiversity, with dramatic consequences such as reduction of green areas, space fragmentation, and species loss or transformation. Considering the importance of biodiversity for the quality of life in cities as well as for the biological and environmental equilibrium, cities should take great care for the protection and enhancement of the biodiversity. All the stakeholders of the city should be involved in the realization of this objective.
The biodiversity conservation requires first of all monitoring in order to scan the current situation, to track the biodiversity evolution and to take the right measurements to stop the biodiversity degradation and even more to ensure its development. However, the biodiversity monitoring is very complex, because of the huge variety of parameters of the biodiversity as well as the long-term timescale. The recent developments in the field of Smart Technology which could be used for biodiversity monitoring in cities.

Keywords: Keywords: Smart city, urban biodiversity, biodiversity indicators, sensors networking, smart monitoring

*Speaker
†Corresponding author: isam.shahrour@univ-lille.fr
‡Corresponding author: ammar.aljer@univ-lille.fr
§Corresponding author: Alain.Lepretre@univ-lille.fr
¶Corresponding author: celine.pernin@univ-lille.fr
‖Corresponding author: Sana.Ounaies@polytech-lille.fr

A landscape structure proposal for a sustainable development – Quy Non City

Rute Sousa Matos* [1], Huyen Nguyen †‡ [2], Tho Phan [2], Thuy Phan [2]

[1] University of Évora [Portugal] Center for Art History and Artistic Research (UÉvora - CHAIA) – Palácio do Vimioso Largo Marquês de Marialva, 8 7000-809 Évora, Portugal
[2] Truong Dai Hoc Quy Nhon - CHAIA Uévora (QNU - CHAIA) – 170 An Duong Vuong street, Tp Quy Nhon city, Binh Dinh Province, Vietnam

According to *Asia 2050* (ADB 2011) the Southeast Asia's urbanization rate will increase from 42% in 2010 to 65% in 2050. In face of this the Viet Nam government approved its *National Green Growth Strategy* (2012) which complements the Framework Master Plan for Urban Development in Viet Nam to 2025 and the 2050 Vision. This framework comprises a balanced and strategic growth through the development of secondary and tertiary cities, as Quy Nhon, as hubs within provincial urban systems. The Green Cities Action Plan embodies ADB's new *Green Cities* approach to urban development by means of the 3E lens (environment, economy, and equity) aiming to develop cities in a sustainable way to be green, competitive, and inclusive in an environmental, economic and social way. Within the *Greeen Cities* framework we propose a new design approach to Quy Nhon city planning. This approach based on landscape systems is materialized in a continuous and productive landscape structure promoting the occurrence of ecologic, economic and social processes, as well as fluxes. This multifunctional structure is fundamental for the sustainable growing of cities such as Quy Nhon, enabling a real-time response to environmental degradation, inefficient resource consumption, inequitable growth, increased risks of climate change and natural disasters, preservation of cultural values, heritage and identity, aesthetic concerns and leisure. It also enables partnerships among local government, civil society, the community residents, the private sector, industry, and small and medium-sized enterprises. These partnerships will address the problems and identify and implement the adequate solutions to these issues without compromising social equity.

Keywords: Quy Nhon City, landscape structure, green cities, urban development, sustainability

*Corresponding author: rsm@uevora.pt
†Speaker
‡Corresponding author: nguyenthihuyen@qnu.edu.vn

Travel behavior change patterns under adverse weather conditions - A case study from Ho Chi Minh City, Vietnam

Anh Tuan Vu [1], Thi Thanh Huong Nguyen [*†] [2]

[1] Vietnamese-German University (VGU) (Vietnamese-German Transport Research Centre (VGTRC)) – Vietnam

[2] University of Transport and Communications Campus in Ho Chi Minh City (Section of Transport Planning and Management) – Vietnam

In major cities, road flooding caused by heavy rain and/or high tidal rise frequently happen and cause road traffic congestions and accidents. To help design effective traffic management measures for HCMC, this paper focuses on a survey of the people's travel behavior changes under the adverse weather conditions. A revealed adaptation interview survey was conducted on 400 road users in 2018. Typical patterns of travel behavior changes and influential factors were analyzed based on the surveyed data and by using the Pearson Chi-square Independence Test. While trip cancelation, delayed departure, waiting for resuming of trip, route change, and destination change are significant, mode change is very modest. A road flood causes the changes more strongly than a heavy rain. Influential factors to such changes are trip characteristics, including trip purpose, trip length and frequency, and personal characteristics. The results would be input data for travel demand forecasting model in adverse weather conditions, and then helpful in formulating traffic management strategies to mitigate the negative traffic impacts of urban floods and heavy rains.

Keywords: bad weather, flooded road, travel behavior, Ho Chi Minh City

[*]Speaker

[†]Corresponding author: huongclc11@gmail.com

Application of Box-Behnken Design in Optimization of Fracture Treatment Design for Lower Oligocene Reservoir, Offshore Viet Nam

Truong Nguyen Huu * [2,1]

[2] Petrovietnam University (PVU) – 762 Cach mang Thang Tam street, Long Toan ward, Ba Ria Town, Ba Ria-Vung Tau province, Vietnam
[1] Petrovietnam University (PVU) – 762 Cach Mang Thang Tam, Long Toan wards, Ba Ria city, Ba Ria- Vung Tau province, Vietnam

The paper presents an approach for optimizing the design of hydraulic fracture treatment in the low permeability lower Oligocene sandstone reservoir in the Cuu Long Basin, offshore Viet Nam. Several design variables including low behavior index, leak-off coefficient, pumping time, injection rate and proppant, which are generally affecting the fracture mechanics, were considered in the optimization process in order to improve oil production. The influence of those variables and interaction variables on fracture conductivity and net present value (NPV), hence, the production performance was analyzed using Box-Behnken design–based statistical modeling, which are experimental designs for response surface methodology. The results show that the maximum NPV was 50.5 million USD from optimal variables including injection rate of 36bpm, injection time of 78 minutes, slurry concentration end of the job of 9.1ppg and the leak-off coefficient of 0.0034ft/min0.5

Keywords: Optimum variable Conditions, Improved Oil Production, Lower Oligocene reservoir, Net Present value, Box Behnken design

*Speaker

Traffic Impact Assessment of Infrastructure Development Projects for Sustainable Urban Growth

Toan Trinh Dinh * [1]

[1] Thuy Loi University – Vietnam

Abstract

Infrastructure development projects, depending on their nature and magnitude, often impose impacts on the environment. As the size of the project increases, undesirable effects such as traffic congestion, traffic accidents, and environmental problems may become unacceptable to the community. It has been realized in some cases that attempts to push physical growth impose devastating social and environmental consequences, thus objectives in sustainable urban development are spoiled in the long run.

Traffic Impact Assessment (TIA) is a study to collect and analyse data to anticipate potential effects of additional traffic from proposed developments on the existing transport network. TIA is an important document that helps planning authorities issue proper investment decisions on new or changed developments. It is used to evaluate whether the proposed development project is appropriate and what improvements in transport facilities would be necessary to mitigate potential impacts from the project. In these regards, TIA is a crucial instrument to control urban growth for sustainable development.

In many developed countries, TIA is statutorily required before an investment decision is made. In Vietnam, TIA is not yet institutionalized, thus TIA is not requested as an integral part of the project proposal that the developer must submit to planning authorities in seeking for approval. In other words, there is actually no official obligation in considering traffic impacts in the projects' decision-making process. Consequently, there are many cases the project cause unbearable traffic problems on the surrounding network as soon as it enters the operation.
For TIA implementation, there should be a statutory document that requires conducting TIA in the project appraisal, and a technical framework that guides the content, procedure and method for TIA. This paper reviews international perspectives in TIA implementation in some countries, specifically addresses issues and challenges in execution of TIA in Vietnam, and proposes solutions to actualize the execution of TIA. It also figures out key points that a technical guidance needs to address for TIA implementation.

Keywords: Key words: Traffic impact assessment, infrastructure development projects, sustainable urban growth.

*Speaker

Reasons for cyclists denying new-built bicycle lanes

Duc-Nghiem Nguyen * [1,2,3]

[1] Nguyen Duc-Nghiem – Vietnam
[2] Nguyen Viet-Phuong – Vietnam
[3] Hisashi Kubota – Japan

In recent decades, cycling has been considered as one of the most potential sustainable transport modes in the cities. Therefore, a great deal of bicycle facilities has been built there. One of the most popular facilities could be bicycle lane (BL). However, in some cases, cyclists tend to deny using the new-built BLs. This can be viewed as a significant waste of resources. The present study aims to indicate some factors that prevent cyclists from using BLs. To do so, initially, the effects of the impacts factors on facility choice of cyclists were investigated, based on an objective camera-observation survey in daily cycling environment. Then, the impact trends were validated and somewhat explained based on an independent subjective stated preference survey. The results showed that perceived safety was the most important aspect that decides whether they choose BL or not. Several factors, including high vehicle volume, existence of real-time stopping vehicle on BL, gender of woman, narrower width of traffic lanes, narrower width of BL, and wider sidewalk were found negatively affected the probability that cyclists chose BLs to ride. These findings can help developers, planners, and designers to adopt more reasonable investment decisions as well as better designs while developing bicycle facilities.

Keywords: Deny Using Bicycle Lane, Facility Preference, Facility Choice

*Speaker

Sustainable and Health-Oriented Transport Planning and Urban Planning

Karin Menges * [1], Manfred Boltze [1]

[1] Technische Universität Darmstadt – Germany

Health is of high importance for the citizens, and the awareness for health impacts is increasing due to more welfare in our societies. Urban and transport planning have manifold interactions and can have a decisive impact on the health of the urban population. While both fields recently focus on specific targets, as for example reducing the number of accidents or reducing negative impacts on the climate, other impacts on human health are often not considered sufficiently. An integrated approach for a sustainable and health-oriented transport and urban planning is needed to provide a high quality of life in a healthy environment.
In addition, basic knowledge is missing on how to deal with the imminent goal conflicts of health conservation with other goals such as accessibility and economically efficient developments. Examples for such goal conflicts are found in current developments with the aim of reducing emissions, including measures for climate protection, which are often striving for high densities in urban areas around public transport stations (transit-oriented development). However, these high densities may also promote high levels of air pollution, stress causing noise and other factors influencing human health in areas, where people spend their time for living and commuting. The existing high local concentrations of air pollution are mainly caused by existing vehicle technologies in motorised private and public transport and by limited air exchange due to unsuitable building structures in many urban quarters. For future urban as well as transport planning it must also be considered that major changes are ongoing regarding traffic technologies and travel behaviour (e.g. automatic driving, low emission vehicles, sharing services, active transport). To allow a sustainable development, such changes need to be considered carefully when developing the urban structure and the transport infrastructure.
The aim is to present first results of a research project dealing with this topic, which will be funded by the German Federal Ministry of Education and Research and the Vietnamese Ministry of Science and Technology. The project addresses a research area which is of strong interest for both, Germany and Vietnam, despite the different conditions in the two countries. As a first basis an overview of identified interdependencies, which should be considered to optimise the health effects that result from urban structure and the transport systems, will be shown. With the help of a more detailed analysis of selected examples, such as the influence of the share of motorised individual transport on exposure, the awareness of the importance of the existing interdependencies will be raised and different chains of effects will be presented. Based on these findings, the health-related goal conflicts arising in urban and transport development will secondly be deduced and described by selected but concise examples. During the project exemplary measurements of existing air pollution in selected quarters with different building densities and structures, as well as traffic volumes and compositions will be done in both participating countries. The methodical framework of these measurements will be presented.

*Speaker

Keywords: Transport Planning, Urban Planning, Health, Interdependencies

Integrated transport planning for sustainable urban development – Singapore' approach and lessons for Vietnam

Toan Trinh Dinh *† [1]

[1] Thuy Loi University – Vietnam

Abstract

This paper examines Singapore' approach to integrated transport planning for sustainable urban development, and draws lessons that may be applicable for large cities in Vietnam. The paper explores strategic planning approaches Singapore applies for transport and land use integration, and the planning instruments Singapore deploys to integrate different transport modes physically and institutionally. It learns the way Singapore plans a city to make the city liable and sustainable, and proposes relevant points under the subject of integrated transport planning for Hanoi and HoChiMinh cities in Vietnam.

.

Keywords: Integrated Transport Planning, Land Use Plan, Sustainable Urban Development.

*Speaker

†Corresponding author: trinhdinhtoan@tlu.edu.vn

Transitioning Different Stages of Transport Planning in Urban Areas: Experiences of Singapore and Vietnam

Maria Cecilia Rojas Lopez* [1], Toan Trinh Dinh † [2], Yiik Diew Wong [1]

[1] Nanyang Technological University [Singapour] (NTU) – 50 Nanyang Ave, Singapour 639798, Singapore
[2] Thuy Loi University, Hanoi, Vietnam – Vietnam

Level of urbanisation – as population density and transport demand – is rapidly increasing in many cities. Planning approaches vary from city to city and authorities everywhere are being challenged to provide sustainable infrastructure that meets social needs, maximise space and benefits. Transport planning, especially in urban areas, is crucial as it influences sustainable city-growth and space-usage. Transport planning can be classified into three stages, which evolve with level of urbanisation and other city's characteristics: (1st) vehicle-based, (2nd) person or trip-based, and (3rd) liveable-city. This study presents an overview of the three transport planning stages and relevant examples. For each stage, the study discusses factors such as capacity, social needs, different modes of transport, features of the built-environment, emerging technologies (where applicable), and sustainability impacts. The focus is on planning approaches from Singapore to enhance the long-term vision for sustainable urban development of big cities in Vietnam. Singapore, being currently in the 3rd stage of planning, is focusing efforts in providing inclusive infrastructure and promoting sustainable modes of transport. Ho-Chi-Minh City and Hanoi are still focused on motorised transport with low rates of walking and cycling. Lessons from Singapore to Vietnam are delineated accordingly.

Keywords: Stages of transport planning, vehicle, based, person or trip, based, liveable city, Singapore, Vietnam

*Corresponding author: mariacec001@e.ntu.edu.sg
†Speaker

Analysis of Mode Choice Behavior under Adverse Weather Conditions Using RA and SP Surveys - A case study from Ho Chi Minh City, Vietnam

Anh Tuan Vu [1], Thi Thanh Huong Nguyen *† [2]

[1] Vietnamese-German University (VGU) (Vietnamese-German Transport Research Centre (VGTRC)) – Vietnam

[2] University of Transport and Communications Campus in Ho Chi Minh City (Section of Transport Planning and Management) – Vietnam

This paper analyzes mode choice behavior in different weather conditions, with population groups, on travel purposes and travel distances to support the formulation of weather responsive traffic management measures. Revealed and stated adaptation surveys are carried out with 400 respondents and 100 respondents, respectively. The survey shows that the rate of mode change due to adverse weathers is much smaller than the figure in developed countries. The major patterns of mode change are shifts from motorcycle to car or taxi, accounted nearly half of mode changes, thus causing severer traffic congestions. The mode choice modeling show travel time, travel cost, gender, income, specific jobs, motorcycle ownership, bus ticket holding, provision of weather information prior to the trip are significant factors to mode choice decision under bad weather conditions. The results suggest focusing on "avoid or reduce unnecessary mobility demand" and "improve public transport" measures.

Keywords: mode choice, value of saved travel time, adverse weather, road flood, revealed and stated adaptation survey, Ho Chi Minh City

*Speaker

†Corresponding author: huongclc11@gmail.com

A Study on Motorcycles Overturning due to Strong Wind and its Warning System

Hung Vo *† [1], Vu Do *

[2]

[1] The University of DaNang – University of Science and Technology (DUT) – 54 Nguyen Luong Bang Street, Hoa Khanh, Lien Chieu, Da Nang City, Viet Nam, Vietnam
[2] The University of DaNang – University of Science and Technology (DUT) – 54 Nguyen Luong Bang Street, Hoa Khanh, Lien Chieu, Da Nang City, Viet Nam, Vietnam

Motorcycle is a typical transportation mean in Vietnam. In present, motorcycles travel in strong wind conditions is always difficult and can lead to unacceptable accidents, that may have an adverse effect for people who ride the motorbike. In this case, so many accidents are in relation to motorcycle because of strong wind when the resident move on the bridges. In general, there are various researches about car overturning in development country (ex: Japan, America, France...) but the overturning of motorbikes is quite new and not so much researches mentioned about this. In this study, the authors give an overview of the effects of motorcycles when subjected to win. Furthermore, authors try to build the risk curves, analyze the data and provide a regulation system for motorcycle in strong wind conditions. The warning work is based on wind speed and wind direction. Specifically, this paper also used the basic system for measuring the wind speed and wind direction. Then, based on the relationship of the wind speed and wind direction with motorbikes velocity, the system will send the warning messages for motor-riders. Especially, the renewable power also uses to operate the warning system which can make it become more efficiency and sustainable.

Keywords: Motorcycle, overturning, warning system, wind speed, vehicle velocity, wind direction...

*Speaker
†Corresponding author: vdhung@dut.udn.vn

Bus signal priority by active signal program (ASP) – A case study in Ho Chi Minh City

Thi Thanh Huong Nguyen * [1]

[1] University of Transport and Communications Campus in Ho Chi Minh City (Section of Transport Planning and Management) – Vietnam

The bus signal priority (BSP) has been applied in many cities worldwide. However, it has not been implemented in Vietnam, particularly in Hanoi and HCMC where traffic congestion happens every day due to i) the limitation of space for expand road infrastructure; ii) the limited level of technology integration in Vietnam; iii) the budget constraint; iv) the poor traffic management system; v) the traffic participants' awareness; and so forth. Although the BSP has been suggested by many experts, no feasible solution of BSP for HCMC has been proposed. Therefore, this research shall focus on the application of ASP (active signal controller program) aiming to prioritize buses in mixed traffic flow in HCMC. The traffic management theory is combined with, the smart signaling system technology (automatic vehicle location (AVL) and advanced signal control systems) in this research. The BSP is expected to improve the bus quality service, which will encourage people to use bus in daily activity instead of motorbike. Besides, the economic loss and the air pollution caused by time delay and petrol consumption is also expected to reduce.

Keywords: Bus in reserved lane, Signal priority, active signal program (ASP), Ho Chi Minh City

*Speaker

MODELING LAND USE CHANGE BASED ON REMOTE SENSING, GIS AND ALGORITHM CELLULAR AUTOMATA DECISION SUPPORT SYSTEM FOR URBAN SUSTAINABILITY PLANNING IN QUY NHON, BINH DINH PROVINCE CENTRAL VIETNAM

Van Tho Phan *† [1], Anh Tu Ngo * ‡ [1], Thuc Trang Dang * § [2], Rute Sousa Matos * ¶ [3], Thi Huyen Nguyen * ‖ [1]

[1] Quy Nhn University (QNU) – Vietnam
[2] ScenePlus Architects (SP) – Vietnam
[3] University of Évora – Portugal

Quy Nhon is a coastal city in central Vietnam, located in the southeast of Binh Dinh Province which has favorable natural conditions. Quy Nhon is today regarded as a center of economy, politics, culture, science, technology, and tourism investments. In recent years, the economic development and tourism changed drastically Quy Nhon growth. However, the city expansion, with the high population density and the demand of land for economic development, did the management of land use and land use planning difficult to ensure balance with nature. In this sequence, the assessment and prediction of land use changes is considered an important solution to Quy Nhon city planning and sustainable development. To this study the prediction of land use change and its spatial and temporal variability had been studied for Quy Nhon city for a period of 18 years (2000 - 2018) via land change model with approaches based on remote sense images obtained from sensors Landsat 7,8 and Markov - CA string was used to model land use change in Quy Nhon city during two periods of time: 2000-2009 and 2009-2018. In order to predict land use changes, the study conducted to the creation of mapping land use classification from remote sensing image and to assess the accuracy of classification result by the Kapa index. Then, we evaluated the land use changes between 2000 - 2018 determining the trend of these changes. The next step will be researching using Markov-CA model to predict the land use changes in 2018 and the evaluation with results of the same period. Validation will be essential to the prediction of land use changes and future urban expansion, until 2020 and 2030, contributing to the orientation of future land use planning. Finally, we propose an effective and sustainable solution to Quy Nhon City's land use.

*Speaker
†Corresponding author: phanvantho@qnu.edu.vn
‡Corresponding author: ngoanhtu@qnu.edu.vn
§Corresponding author: sceneplus.arch@gmail.com
¶Corresponding author: rutesousamatos@gmail.com
‖Corresponding author: nguyenthihuyen@qnu.edu.vn

Keywords: Modeling, Land use change, Quy Nhon city, Urban growth, Urban sustainability

Modeling and applying heuristics for optimization of solid waste collection under consideration of vehicle capacity

Hai Dung Dinh * [1]

[1] Vietnamese - German University (VGU) – Vietnam

The main contribution of this paper is to propose a general network flow optimization model for the problem of solid waste collection related to garbage management and transportation route planning. A model is formulated for a specific case in a big city in Vietnam. With the continuous increase of urban population in big cities of a developing country and the arising problem of waste management over the years, attempts have been made to organize the process of collecting solid waste from households and a series of tasks to ensure the best logistical steps. Considering the network of depots and information about the vehicles, we propose to apply heuristic algorithms from Operations Research to optimize the routes for vehicles to travel to depots and back. The research question thus concentrates on sequencing and routing with similar solution concepts as a classical Traveling Salesman Problem. For generating solution and implementation, we apply Evolutionary Algorithm using a commercial Solver tool. In general, network problem include cost of moving materials through a network involving varying demands, parameters, and constraints depending on the locations that the materials are being brought to. Problems of these type are characterized network flow optimization. The consideration of the connections between different parts of the network with inputs and outputs is what makes these problems difficult, but on the other side quite practical and applicable. The visual effect of a network flow model makes it useful for planning activities on the management level. Using numerical examples, we show that the efficiency of the evolutionary algorithm in the defined problem instances is better than any greedy approach. Finally, we discuss the similarity between the proposed model for solid waste collection and the problem of routing order pickers in multiple block warehouses.

Keywords: operations research, network flow optimization, heuristics, garbage management, routing problem

*Speaker

SOLUTIONS TO USE CAPITAL EFFICIENTLY FOR MAINTENANCE IN THE ROAD TRAFFIC INFRASTRUCTURE DEVELOPMENT IN VIETNAM

Nguyen Thi Tuyet Dung *† [1], Nguyen Quynh Sang [2]

[1] Hanoi Architectural University (HAU) – Km.10 Nguyen Trai, Thanh Xuan, Hanoi, Vietnam
[2] University of Transport and Communications [Hanoi] (UTC) – Vietnam

In recent years, the road infrastructure system in Vietnam has developed rapidly, sustainably, in modern direction with key points. The competitiveness index for road quality in the period of 2015 - 2016 is ranked 93rd , increasing 11 levels compared to the period 2014 - 2015. Achieving such results, besides increasing investment both in width and deepth, the road maintenance has been important, the capital for maintenance work is increased significantly. From 2009 to 2012, the capital for national highway maintenance is average 2615.13 billion VND/year, meeting 30-40% of demand. After 2013, when the Road Maintenance Fund is put into operation, the tolls on motorized vehicles are collected and the capital allocated for the national highway maintenance in 2013-2016 is average 6,392.24 VND billion/year, it is many times higher than previous period. However, the management of capital use is still inadequate. By analyzing the policies and status of management of capital use for road maintenance in Vietnam, the article offers a number of solutions to improve the management of capital use for maintenance, to ensure the efficiency and sustainability in the exploitation of road traffic infrastructure.

Keywords: capital, maintenance, road traffic infrastructure

*Speaker
†Corresponding author: khuongdungkt@yahoo.com

Perspectives of the use of GPS in travel survey: Research on identification of missing trips in a GPS pilot survey in Hanoi

Thanh Tu Nguyen * [1]

[1] University of Transport and Communications (UTC) – No.3, rue Cau Giay, Dong Da, Hanoi., Vietnam

GPS-based data collection methods have become particularly popular in travel behavior research, mainly because of the worldwide coverage and the accuracy of the GPS system. This paper identifies the missing trip data obtained by two methods: survey reported and GPS recorded in the same days. This study shows that the GPS survey can be used successfully to complete the conventional transport surveys, but it is still too early to predict the complete substitution of conventional survey by the GPS mobility survey.
The paper aimed at two main objectives. First, it examined the influencing factors for the missing trips by using a logistic regression. Secondly, it analyzed the differences in the characteristics of travel for matched trips. The findings from this research can inform both survey-reported as well as GPS-recorded travel data collection approaches.

In terms of missing trips (non-recorded as well as non-reported), trip distance and the frequency of trip making are the main influencing factors: there are more unmatched for short trips and for days with a high number of trips. Male, those are an employee or retired are the more likely unmatched trip.

For matched trips, departure time, arrival time, trip duration and trip distance were compared between diary and GPS. Because of cold start, the departure time recorded by GPS is generally later than that reported in the diary, while there is less difference between the two measurements for arrival time. Trip duration and trip distance are over-estimated in the diary for about 80% of trips, but the difference is usually less than 15 minutes or 5km.
Overall, there is a large difference in the measurement of daily mobility between GPS recorded and survey reported trips. These results suggest that improvements are needed in both methods to yield more accurate and un-biased data. So we recommend that the GPS-only survey should be conducted with caution. Future research could involve the development of more complex choice models to explain other margins of transport choice (e.g. the decision to own a car). Furthermore, the travel survey by GPS only should strongly consider to develop the algorithms to impute trip purpose. In addition, the GPS seems to be a method dealing the younger, more technology savvy individuals as well as those that have high travel propensities or characteristics associated with trip chaining, in order to ensure that all trip details are recorded. However, for the elderly and more leisurely travelers, the traditional survey method is recommended.

Keywords: Missing trips, GPS, Travel diary, Logit model

*Speaker

Remote sensing application for evaluating the impact of land cover change on Danang city's land surface temperature.

Ngoc Duong Vo * [1], Binh Nguyen

[1] Ngoc Duong Vo – Vietnam

The infrastructure development for economy is really imperative towards developping countries. Therefore, this process brings several unexpected impacts. Landcover change caused temperature increase is one of the most noticeable thing in this process. This impact along with global warming bring out significant consequences about the health, the economy and the society. There are many approaches for analysis the link between the landcover change and the temperature change. However, the satellite image processing is considered as a modern, quick and accurate method. For analyzing the effect of urbanisation on temperature variation in Danang City, Vietnam where the urbanized process is taking place in high speed and complicatedly, this study processes the Landsat satellite image over past years. The result showes that the temperature in Da Nang city changes from 28.770C to 32.240C over seventeen years (2001 – 2017). The analysis also demonstrates that there is a relation between the urbanisation process and city warming. It might be the crucial basic for planning the urban area more effective and more sustainable, as well for mitigating the negative impact of temperature change due to urbanisation on the public health, economy development. Futhermore, the paper is hoped to present a new approach in applying satelitte image for evaluation the impact of urbanisation on temperature change for lack of observed data.

Keywords: Lansat image, image processing, urbanisation, surface temperature change.

*Speaker

Dambreak Simulation At Thuan Ninh Reservoir, Binhdinh, Vietnam.

Ngoc Duong Vo * [1], Anh Huynh , Dung Vo

[1] Ngoc Duong Vo – Vietnam

With more than 160 reservoirs, Binhdinh is considered as the province having the most reservoirs over the country. This system have contributed importantly for provincal socio economic development. Therefore, the reservoirs in Binhdinh comprehend many potential risks due to their ages, noticeably the Thuan Ninh reservoir (Vhi= 32.26 106m3) which was contructed for 1970s. In order to help the local authority to respond actively with urgent incident, the study is to simulate dambreak incident for Thuan Ninh reservoir. The study is realizes relied on MIKE FLOOD model. The modelling scenario is supposed following the standard of TCKT 03:2015/TCTL. The simulation demonstrates that the Thuan Ninh dambreak incident might affect 33.35 km2 at downstream area. The lag time, inundated time and flood depth are also considerd in the study.

*Speaker

Flood Mapping For Downstream of Ben Hai River, Vietnam.

Ngoc Duong Vo * [1], Son Ho

[1] Ngoc Duong Vo – Vietnam

Flood map nowadays is seen as an indispensable tool in urbanism, flood prevention and mitigation. For this reason, establishing flood map is mighty necessary for developing the socio economy of a river catchment. Ben Hai is the second largest river at Quang Tri province – Viet Nam central region. Besides the positive role towards the local socio ecenomic development, the Ben Hai river in resent years has caused lots of disasters, specially on inundation. With the aim of providing an overview for mitigating the natural disaster consequences, the study is used the MIKE FLOOD-DHI to repersent the Ben Hai river flooding. The model is set up for an area up to 100 km2. The flood maps are established with five historical flood events and several assumptions. The result is expected to provide the basic secientific evident for local authority to redude the impact of natural disaster, also for sustainable development.

*Speaker

Research on application of flowforms in combination with planted constructed wetland for improving water quality of urban polluted lakes

Thi Thuy Ha Ung *† [1], Tuan Hung Pham * ‡ [1], Tho Bach Leu [1], Thi Hien Hoa Tran [1], Hong Nhung Chu [1]

[1] National University of Civil Engineering, Hanoi, Vietnam – Vietnam

With continuously increasing urbanization in Vietnam, urban lakes pollution by domestic wastewater has become a serious issue, which results in degradation of lake water quality and consequent deterioration of landscape as well as environment for urban residents. Finding low-cost, simple and sustainable solutions would help to overcome that issue in Vietnam's context. This study aims at proposing a solution which includes low-cost, nature- and landscape-friendly processes such as wetlands and flowforms for improving polluted urban lakes. The study was carried-out on a pilot system consisting of a cascade of flowforms and a planted constructed wetland with flow recirculation. Water samples used in this study have been collected from an urban lake in Hanoi, which receives wastewater from a densely populated residential area. The research results have demonstrated that this solution could achieve high treatment efficiencies: Color - 92%, Chemical oxygen demand (COD) - 92%, Ammonia (NH4+-N) - 98% and Total Phosphorus (TP) - 87%. The effluent quality could meet requirement by Vietnam's National technical regulation on surface water quality QCVN 08-MT:2015/BTNMT, level B1 in terms of the above mentioned parameters.

Keywords: Urban, lake, pollution, water, landscape, flowform, wetland, low, cost

*Speaker

†Corresponding author: uttha2002@gmail.com

‡Corresponding author: pthhuce@gmail.com

A Framework for Last Planner System implementation in Egypt

Eyad Aboseif *† [1], Rana Khallaf [2]

[1] Cairo University – 1 Gameat El Kahera St, Giza, Egypt
[2] Future University in Egypt – 90th St, Fifth settlement, Cairo, Egypt

The Last Planner System (LPS) has been the focus of several studies in the Lean Construction community. Previous research has focused on defining lean in construction, its implementation in various projects, and the challenges facing the implementation. However, no research has addressed lean implementation in Egypt.Therefore this paper will address the obstacles facing LPS adoption in the Egyptian construction industry and will propose a framework for LPS implementation in Egypt. A questionnaire survey is carried out involving a number of construction industry stakeholders to identify the current market knowledge on LPS and the challenges expected from its implementation in Egypt. The proposed framework details the techniques to be followed during the project life cycle and how to measure the effect of LPS on the overall project performance. The framework also tackles the expected challenges and proposes key solutions for each one. This paper aims to push the boundaries of the current state of the construction industry in Egypt by proposing the implementation of LPS and the steps needed to be taken for its adoption in Egypt.

Keywords: Construction Industry in Egypt, Last Planner System, People and Culture, Construction Planning, Framework and Theory

*Speaker
†Corresponding author: eyad.hamid95@eng-st.cu.edu.eg

Climate Change Impact on Urban Flooding in Quynhon City, Vietnam

Duc Phuoc Vo * [2,1], Bhuiyan Muhammed [1], Ngoc Duong Vo† [2]

[2] University of Science and Technology, The University of Danang (DUT) – 54 Nguyen Luong Bang, Lien Chieu, Danang, Vietnam
[1] School of Engineering, RMIT University [Melbourne] – GPO Box 2476 Melbourne VIC 3001 Australia, Australia

Flooding is one of the major problems in many cities. Adequate development of a drainage system is a primary measure the city used to deal with. However, the risk of exceedance of design flood is more likely to increase due to the impact of urbanization as well as climate change. Changes in rainfall pattern and sea level rise increase the risks of inundation of city dwellings and amenities. This paper investigates the changing of flooding performances using Stormwater Management Model (SWMM) to describe the impact of climate change on drainage in Quy Nhon city, Vietnam. Climate scenarios are developed for future 2030, 2050 and 2100 by following the emissions proposed in IPCC representative concentration pathways (RCP) of greenhouse gases. The results examined the future flooding areas and its duration. It also highlights the inappropriateness in drainage design which could contribute to flooding increase in the city.

Keywords: Key words: Urban flooding, Climate change, Extreme rainfall, Sea level rise, Stormwater Management Model (SWMM)

*Speaker
†Corresponding author: vo.ngoc.duong@dut.udn.vn

Health impacts of traffic-related air pollution: Cause-effect relationships and mitigating measures

Huong Le Thi * [1,2]

[1] Transport Planning and Traffic Engineering, Technische Universität Darmstadt (IVV-TUD) – Otto-Berndt-Str. 2, Darmstadt 64287, Germany
[2] Vietnamese-German Transport Research Center, Vietnamese-German University (VGTRC-VGU) – Le Lai Street, Hoa Phu Ward, Thu Dau Mot City, Binh Duong Province, Vietnam

The health impacts of traffic-related air pollution (TRAP) are one of the major concerns regarding the sustainability of the transport sector. Particularly in urban areas, transport is a main contributor to air pollution and affects a large part of the population due to the high number of motor vehicles and urban population. Recently, the evidence from epidemiological studies on the health impacts of TRAP has increased significantly. The major evidence indicates that TRAP increases the risk of mortality and morbidity. Despite the significant improvements in reducing vehicle emissions, TRAP is still increasing in many areas worldwide and becoming a global threat to human health. In order to solve the problem, a clear understanding of the existing situation is necessary. Therefore, a comprehensive cause-effect relationship between TRAP and its health effects is developed, using the Driving Force-Pressure-State-Exposure-Effect-Action (DPSEEA) framework. Then, some measures for mitigating the health impacts of TRAP are presented

Keywords: Traffic related air pollution, Health impacts, DPSEEA framework

*Speaker

Sustainable Measures to Achieve Better River-Crossing Access in the Rural Areas of Developing Countries

Yoshinori Fukubayashi *† [1], Makoto Kimura [2]

[1] University of Miyazaki (UOM) – 1-1, Gakuen Kibanadai Nishi, Miyazaki, Japan
[2] Graduate school of Kyoto University (KU) – Katsura Campus, Nishikyo-ku, Kyoto, Japan

At rural area of developing countries, all-year access to markets and social services for communities are not ensured due to poor condition of road infrastructure. Because of the limited budget and number of engineers at local road authorities, rural roads surface tend to be left natural and not paved with engineered design and maintained technically. Consequently, in rainy seasons, at mountainous area, area prevailing problematic soil such as expansive soil, flooded area and section crossing river, trafficability are not kept, which disturb people's livelihood by blocking them to go to school, hospital and markets.
For the purpose of providing better access to rural communities, considering the above mentioned constraints, local resource based approach with community participation for improving road infrastructure can be said as one of sustainable and practical measures. In this paper, a design and implementation structure to improve accessibility at the section crossing river of rural road are proposed specifically through the actual project in the Philippines.
In 2014, through the survey and the meetings with the community at the vicinity of the crossing river and local government facilitated by the local and international NGOs, the vented ford with 7 lines of 6 pieces of RC culverts in 900 mm diameter was designed and agreed to construct in the partnership among the community, local government and NGOs. Any contractor was not involved. This structure still allows overflows while only flood occur. All the parties contributed to the construction of the vented ford and in 2015 May, it was completed. In 2018 October, the conditions, maintenance activities by the local community and government, and impact to the area of the project were assessed. Then, it was found that the vented ford has been in the reasonable condition and maintained in partnership with local government and community for more than four years after completion of the structure. Though the section still has not been passable during flood, which has occurred only six to seven times per year, the communities and local authorities have appreciated the vented ford as infrastructure providing them better access to town.
The scope of the approach and performance of the structure, application criteria for construction in partnership between local government and community have been analysed and defined. This will help to replicate and disseminate this approach in other areas for extending access to rural people in developing countries.

Keywords: Access, Rural road, Road stream Crossing, Community participation, Developing countries

*Speaker
†Corresponding author: fukubayashi@cc.miyazaki-u.ac.jp

EVALUATION OF THE EFFECTS OF TRAFFIC MANAGEMENT AT SCHOOL AREAS

An Ngoc *† [1], Hung Khuat * ‡ [2]

[1] University of Transport and Communications (UTC) – 3 Cau Giay, Lang Thuong, Dong Da, Hanoi, Vietnam
[2] National Traffic Safety Committee (NTSC) – 80B Tran Hung Dao, Ha Noi, Vietnam

Traffic accidents are known as one of the leading causes of mortality among teenagers and young adults in Vietnam. Specifically, the risky road behavior lead to 6.2 per cent of killed and injured persons are youth aged between 0 and 18 years. While children injured or killed when walking or travelling as passengers in motorcycles are a serious concern in Vietnam, it is obviously that road users perceive on traffic safety for children is one of the most significant factors affecting accident reduction. The proper application of traffic management measures at school areas needs to be recognized as one of the most common and vital ways to improve traffic safety for children.

Keywords: Children, traffic accidents, school zones

*Speaker
†Corresponding author: anminhngoc@utc.edu.vn
‡Corresponding author: kviethung.mt@gmail.com

Policy Implications from Traffic Accident Analysis: A Study Case from Vietnam

Ngoc An *† [1], Thanh Truong‡ [2]

[1] University of Transport and Communications (UTC) – 3 Cau Giay, Lang Thuong, Dong Da, Hanoi, Vietnam
[2] University of Transport Technology (UTT) – 54 Triu Khúc, Thanh Xuan, Ha Noi, Vietnam

According to the statistics of Vietnam, the impact of traffic accidents cost accounts for 2.5% of GDP. Thus, evaluating and analyzing the damages caused by traffic accidents has become more significant during the last decades. It is necessary to find out the effective approaches to identify the influencing factors of traffic accidents. Among many regression accident-frequency models, Classification and Regression Tree Analysis (CART), one of the most popular data mining techniques and has been applied in many areas of business administration, medicine, industry, and engineering fields, etc., is invited in analyzing traffic safety problems. The results showed that when there are motorcyclists involved in accident, the probability of fatality increases up to 61%. Therefore, searching the solutions for ensuring motorcycle safety should be placed on the first priority in Vietnam.

Keywords: Road traffic accidents, fatality, injury, model

*Speaker
†Corresponding author: anminhngoc@utc.edu.vn
‡Corresponding author: thanhttm@utt.edu.vn

Analysis of Tourist Travel Behavior and Recommendation for Active Transport Encouragement Strategies, the Case of Hue City

Thi My Thanh Truong *† [1], Dong Van Dao [1], Hai Bang Ly [1]

[1] University of Transport Technology (UTT) – 54 Trieu Khuc, Thanh Xuan, Hanoi, Vietnam

Over the past years, several transport encouragement strategies have been implemented to stimulate the mode shift from motorized transport to walking and cycling from international studies. However, information concerning the effectiveness of such strategies in tourism cities in Vietnam is still limited. This study aims at recommending strategies to encourage active transport usage of tourists through the analysis of travel behavior. The study firstly reviewed literature to propose travel modal shift measures that specified for local travel characteristics. Secondly, travel interview survey was conducted in Hue city to understand the current travel status of 259 tourists and the possible encouragement measures on mode shifting to walking and cycling. Finally, the study showed the core encouragement measures concerning the possibility of mode shift under tourist perspective. Combination of more than one measures revealed the most possible effectiveness and applicability to implement mode-shift strategies.

Keywords: Tourist Travel Behavior, Active Transport, Mode Shift, Transport Demand Management, Tourism Cities

*Speaker
†Corresponding author: thanhttm@utt.edu.vn

The impacts of urbanization on urban flooding in Danang City, Vietnam

Thuy Nga To [1], Huy Cong Vu [*†] [1], Hung Le [1]

[1] The University of Danang, University of Science and Technology, Vietnam – Vietnam

Danang City is undergoing rapid urbanization during the past decades. The changes in land use associated with urban development have an adverse impact on the urban rainfall-runoff processes, which may result in the increase of urban flood risk. The paper aims to evaluate temporal and spatial processes of urbanization affecting flood events in this city. In the paper, Mike 11 and Mike 21 models were set up to simulate flood processes for different land-use scenarios. The possible effects of urbanization on flood characteristics were checked in study. The results show an increase in the risk of flooding in the area where there is a major change in urban infrastructure. The study outcomes can provide essential information for urban planning as well as propose solutions to respond to flooding in the context of rapid urbanization epoch

Keywords: Urbanization, rainfall runoff, flooding

[*]Speaker
[†]Corresponding author: vhcong@dut.udn.vn

Factors influencing the choice of Bike Sharing System: An investigation of visitors and local people in Vietnam

Thanh Tu Nguyen * [1], Thu Huyen Le

[1] Faculty of Transport Economics - University of Transport and Communications (UTC) – No.3, rue Cau Giay, Lang Thuong, Dong Da, Hanoi., Vietnam

Bike Sharing System (BSS) has become a popular travel mode to satisfy urban residents' travel in many cities in the world. This paper examines the influencing factors of BSS choice of 2 group: visitors and local people. For tourists, they are the person who has used the bicycle in the past; have travel duration from 3 to 7 days and most of them come from the US (for foreign tourists). Besides, the visitors who use the car/coach during their trip are negative for BSS. The residents who are students or individual business, have habit to use bike, undertake 3-4 trips per day with the short travel distance and have lower income, are more likely to use the BSS. The identification of these influencing factors plays an important role in the deployment of bike-sharing systems in the big cities in Vietnam. Several policy recommendations are proposed based on these results for government and BSS investor in order to have the effective BSS in Vietnam.

Keywords: Bike, sharing system, Factors, Travel behavior, Mode choice

*Speaker

Flood risk assessment in the planning of new urban in Quangnam province, Vietnam

Thuy Nga To [1], Hung Le [1], Huy Cong Vu *† [1]

[1] The University of Danang, University of Science and Technology, Vietnam – Vietnam

During the last 10 years, Central Vienam has observed rapid urbanization. The construction of new urban areas along rivers is developing strongly. Urban flooding is a new disaster and few studies were carried out in this area. Researching to determine the frequency of flood control for these urban areas as well as assessing the flooding impacts of surrounding areas is very urgent. This study will show the importance of determining the frequency of flood prevention of new cities. This frequency must be chosen to both ensure flood protection for the project and not to flood the surrounding areas. In this paper, urban area of Canh Dong Nhong in Quangnam province was chosen as case study

Keywords: Urbanization, rainfall runoff, flooding

*Speaker

†Corresponding author: vhcong@dut.udn.vn

Low Impact Development, a novel technique for cutting down urban flooding in Quynhon city, Vietnam

Duc Phuoc Vo * [1,2], Muhammed A. Bhuiyan [1], Ngoc Duong Vo† [2]

[1] School of Engineering, RMIT University, Melbourne – Australia
[2] University of Science and Technology, The University of Danang – Vietnam

Many coastal cities are becoming more vulnerable to flooding due to increases in extreme precipitation as a consequence of climate change and reduction of infiltration due to urbanization. Application of Near-natural stormwater management measures such as Low Impact Development techniques (LIDs) is considered as an alternative option to reduce the risks of urban flooding caused by climate change and urbanization. This technique reduces inundation possibility by using natural or man-made systems to filter and recharge stormwater into the groundwater. In this research, applicability of two LIDs, infiltration trend and swales, was evaluated with case study in Quynhon, Binhdinh province, Vietnam. The results show that, the LIDs work effectively to reduce peak flood and enhance recharged amount groundwater in short duration rainfall. Their effects, however, depend on reaching saturation points of applied measures.

Keywords: Stormwater management, urban flooding, low impact development, climate change, extreme precipitation.

*Speaker
†Corresponding author: vo.ngoc.duong@dut.udn.vn

Vehicle usage/ownership control for a Sustainable Transport system in the Motorcycle Dependent Cities

Thu Huyen Le [1], Thanh Tu Nguyen * [2]

[1] University of Transport and Communications (UTC) – Vietnam
[2] University of Transport and Communications (UTC) – No.3, rue Cau Giay, Dong Da, Hanoi., Vietnam

There is a distinguishing characteristic between traffic flow in Vietnam (and in many other Asian countries) and those in developed countries: two-wheeled vehicles (so-called motorcycles) consist a high percentage in the road traffic system. Motorcycles, for their special advantages, play a dominant role in the traffic flow in Vietnam cities, leading to the context of traffic depending on motorcycle (so-called motorcycle dependent cities- MDCs). The transportation system in MDCs is facing with a lot of chaotics and problems, such as congestion, pollution and traffic accidents. Recently, there have been a lot of traffic control measurements conducted in the effort of solving the problems. Unfortunately, there is still very little that cities know about managing this mode. This article describes work undertaken to provide a better understanding of motos and what might be done to better position their role in providing urban mobility. Lessons learned and potential solutions for Vietnam could be widely informative across East Asia and other regions where developing cities are facing similar challenges.

Keywords: transportation management, motorcycle dependent cities, motorcycle usage control, sustainable development

*Speaker

Typhoon Wave Modelling For Viet Nam Central Region.

Ngoc Duong Vo * [1], Binh Nguyen , Phong Nguyen

[1] Ngoc Duong Vo – Vietnam

Coastal zone plays a very important role in Vietnam socio-economic development, especially with the central region. However, the coastal line in Vietnam central region has been changed seriously. It becomes more complicately in recent years when shoreline erosion has occurred in many localtities. The consequence of this natural phenomenon has affected significantly to these area. The sea level rise and typhoon wave are considered as the main causes of unexpected phenomenon. With the aim of mitigating the impact of typhoon wave to coastal line in cetral Vietnam, this study is realised. By using Mike softwave family of DHI for coastal zone from Binh Dinh to Binh Thuan, Viet Nam, the result will allow not only us to understand, predict and design mitigation measures to combat the effects of these typhoons, it will also allow us to develop a methodology to be used elsewhere on the Viet Nam coast. The model is calibrated and validated versus water leve data of Quy Nhon station and of two other temporary stations in central area, also comparered to WAVEWATCH III model result with high performance. Result from four different typhoon scenario (from level 6 to level 12) are analysed to provide basic information about the wave situation then estimating their impact to study area.

*Speaker

Development of Disaster Resilient and Sustainable University Framework : Case of Bandung Institute of Technology (ITB)

Krishna Suryanto Pribadi *† [1], Rahma Hanifa‡ [1], Eliya Hanafi§ [1], Giovanni Pradipta¶ [1]

[1] Research Center for Disaster Mitigation, Bandung Institute of Technology (RCDM ITB) – RCDM ITB, PAU Building 8th Floor, Bandung Institute of Technology, Jalan Ganesa 10, 40132, West Java, Indonesia

Indonesia is an archipelagic and seismic active country, home to 241 million people, with 3,225 higher education institutions, comprising of 121 state and 3,104 private universities, with a total of 6 million student body and 170 thousands of academic staffs. Indonesia has hosted catastrophic earthquakes such as Sumatera-Andaman Megathrust Tsunamigenic earthquake 2004 (M9.2), Yogyakarta 2006 earthquake (M6.3), Padang 2009 earthquake (M7.6), and recently the sequences of Lombok earthquake (M6.4, M7.0, M6.9), and Palu Earthquake (M7.4). Those earthquakes have impacted local universities severely. Following the Sendai Framework for Action (SFDRR 2015-2045), Sustainable Development Goals (2015-2030), APRU has declared that Universities need to ensure the safety of students, faculties, staffs and assets during natural disaster. This is further framed as building Disaster Resilient University. The Bandung Institute of Technology (Institut Teknologi Bandung- ITB) is a state owned university which currently has three campuses located in three different locations within West Java Province, Indonesia. It main campus is located in Bandung city and home to about 21 thousand students (undergraduate and graduate) and 2600 permanent faculties and staffs. Bandung is vulnerable to flood, rain storm, fire, earthquake, landslide and volcano. Several old big trees fell down in ITB campus during rain storms, causing damage to properties. Fires have happened several times affecting building and laboratories. While fire drill and safety management has been well considered in ITB, earthquake has not been so much considered until 2016. Seven kilometers to the north of ITB lie the Lembang Fault, capable of M6.6 earthquake, with intensity of VI-VIII MMI (PuSGeN, 2017, BMKG 2017). To the south, the Java megathrust is capable of generating an earthquake of M8.7-9 (PuSGeN, 2017, Hanifa et al, 2014), potentially causing intensity of VI MMI (PuSGeN, 2017, BMKG 2018) in the area. Since 2017 the Research Center for Disaster Mitigation (PPMB) work together with Unit for Security, Safety, Health and Environment (K3L) to promote the concept of Disaster Resilient University. The ultimate goal of the program is the establishment of ITB as a Disaster Resilient University by 2025,a s part of Bandung sustainable city, through the achievement of the following objectives: Strong partnerships within the campus community as well as with various related government institutions in managing disaster risks in ITB campuses, built in awareness and safety culture among the academic community of ITB, and improved capacity of ITB in reducing disaster risk and managing disaster emergency. The activities consist of 4 phases : Phase 1 – Organize Resources, Phase 2 – Hazard

*Speaker
†Corresponding author: kspribadi@gmail.com
‡Corresponding author: rahma.hanifa.2016@gmail.com
§Corresponding author: eliyahanafi@gmail.com
¶Corresponding author: giovannicynthiap@gmail.com

Identification and Risk Assessment, Phase 3 – Developing the Mitigation and Response Plan, Phase 4 – Adoption and Implementation, with the following output : Campus DRU policy and action plan for development of means for the achievement of DRU in 2025; organized campus resources for DRU, disaster risk assessment of ITB Campuses; annual Campus-wide emergency response exercises and drill; trained campus staffs and students in the procedure and practices of emergency response. The DRU best practices will be shared with other universities and higher education institutions in Indonesia.

Keywords: resilient university, sustainable city, risk assessment

APPLICATION OF WIN-TR55 FOR CALCULATING DESIGNED FLOOD IN SMALL WATERSHEDS IN MOUNTAINOUS REGION OF VIETNAM

Noi Doan *† [1]

[1] The University of Transport and Communications (UTC) – No.3 Cau Giay Street, Lang Thuong ward, Dong Da District, Hanoi, Vietnam

Transportation infrastructure plays a significant role in the development of a nation. Development of this infrastructure in Vietnam is facing difficulties, especially in mountainous areas due to lack of rainfall and flow data for calculation of designed flood. Additionally, many water drainages have been damaged by heavy rain and severely affected by climate change. The program Win-TR55 based on SCS method is a technical procedure for calculating storm runoff volume, discharge, and hydrography. In order to use TR55, parameters for calculating designed flood including rainfall, soil type, and land use map are required. This program is widely used in many countries but has not been applied to the small basins in Vietnam because of data missing. In this study, scientific research on rainfall and detailed ground surface conditions was developed using Win-TR55 program for small watersheds. A watershed covering Ban Chat bridge on National highway 31 Dinh Lap district, Lang Son province, Vietnam was selected as a case study. The study shows a great potential of the Win-TR55 method to estimate the hydrograph for the small and medium watersheds in Vietnam.

Keywords: Win, TR55, designed flood, rainfall, soil type, land use, Ban Chat bridge

*Speaker
†Corresponding author: dtnoi@utc.edu.vn

Using HCM Method in estimation the highway capacity and recommendation traffic management for a section of national highway #5 - VietNam

Tran Trung Hieu *† [2,1]

[2] Trinh Xuan Lam – Vietnam
[1] University of Transport Technology (UTT) – 54 Trieu Khuc Str., Thanh Xuan Dist., Hanoi, Vietnam, Vietnam

The HCM method estimated the highway capacity base on the ideal conditions and the speed-flow relationship and other data collected in many state highways in the US, which support to define the capacity in conjunction with the level of services that a road or a highway facilities will adapt or could serve in the specific conditions of traffic, terrain, geometry. In order to define the level of services and estimate the capacity of a roadway, the traffic and infrastructure feature data collection and evaluation of study section will be implemented firstly, then the highway will be divided by the sections which have same natures to estimate the capacity. This paper includes the evaluation the existing conditions of National Highway 5 section KM 55+582 to KM77+830. This paper also implements the analysis and estimation the capacity and level of services of study section base on the Highway Capacity Manual approach.

Keywords: HCM, highway capcity, management of transportation, technical transportation

*Speaker
†Corresponding author: trantrunghieu@utt.edu.vn

Green infrastructure modelling for assessment of urban flood reduction in Ho Chi Minh city

Hong Quan Nguyen *† [2,1], Hieu Nguyen [1], Thu Tran [1], Matthew Buchanan [3], Canh Nguyen [4], Mariana Santos [5], Luan Pham [1], Hoang Tran [6], Phung Huynh [7], Canh Khuu [8], Mitchel Smith [3]

[2] Institute for Computational Science and Technology, Ho Chi Minh City – Vietnam
[1] Center of Water Management and Climate Change (WACC), Vietnam National University – Ho Chi Minh City (VNU-HCM) – Vietnam
[3] TUFLOW FV, BMT group, Brisbane – Australia
[4] Faculty of Environment and Labour Safety, Ton Duc Thang University – Vietnam
[5] Institute of City Planning and Urban Design, University of Duisburg-Essen, Essen – Germany
[6] Sub-Institute of Hydrometeorology and Climate Change, Ho Chi Minh city – Vietnam
[7] Department of Science and Technology Ho Chi Minh city – Vietnam
[8] Center of applied GIS, Department of Science and Technology Ho Chi Minh city – Vietnam

Urban flooding has become a severe problem in Ho Chi Minh City. Green infrastructure (GI) have been considered as a promising solution. GI is not only beneficial for urban flood reduction but also improved microclimatic conditions, landscape values. Recently, with the advancement of science and technology, the mathematical models have been developed and applied in various fields including urban flood. This paper presents the initial results of applying 2 urban water models, namely Tuflow and SWMM (Stormwater management model). The Tuflow mathematical model was used to simulate 2 dimensional (2D) surface model while the SWMM was developed for 1 dimensional (1D) surface and drainage water system. These models are later served in assessing the effectiveness of green infrastructure development in urban flood reduction. The models were developed at a specific study area (Tham Luong - Ben Cat Catchment) in Ho Chi Minh city. Results can be used for urban planning especially for urban flood management in Ho Chi Minh city

Keywords: 1 and 2 D urban flood models, green infrastructure, Ho Chi Minh city, Tuflow, SWMM

*Speaker
†Corresponding author: nhquan@wacc.edu.vn

Review of Unmanned Aerial Vehicles (UAVs) Operation and Data Collection for Driving Behavior Analysis

H.q. Pham *† [1], M. Camey [2], K.d. Pham [3], K.v. Pham [4], L. R. Rilett [1]

[1] University of Nebraska at Lincoln - Prem S. Paul Center – 2200 Vine Street, Lincoln NE 68503, United States
[2] University of nebraska at lincoln - Bureau of Business Research – 730N 14th Street, Lincoln, NE 68503, United States
[3] University of North Texas – 1155 Union Cir, Denton, TX 76203, United States
[4] University of transport and communication – 3 Cu Giy, Láng Thng, ng a, Hà Ni, Vietnam

In recent years, several innovative transportation data collection technologies have been developed, including global positioning satellites, Bluetooth detectors, video detectors, lidar detectors, and radar detectors. While these technologies have been useful for data acquisition of both points (e.g., volume counts at a given location) and space data (e.g., travel time between two locations), they are still limited with regards to gathering data on multiple vehicles over both time and space. This paper will examine the use of unmanned aerial vehicles (UAV) for transportation data collection. First, a literature review will be provided over the framework of UAV operations and current popular platforms with a focus on their capabilities, costs, and limitations. The review emphasis on the use of UAVs for speed behavior analysis, gap acceptance and merging behavior... Lastly, the challenges and consideration of UAV technologies for collecting traffic data in developing countries will be discussed with applications in Vietnam situations.

Keywords: UAVs, Drones, Driving Behavior

*Speaker
†Corresponding author: huong.pham@huskers.unl.edu

New cooperative approach between universities and enterprises, towards a reality urban planning. Lesson learnt from Nhon Ly, Quy Nhon city

Huyen Nguyen *† [1], Trang Dang *

[2]

[1] Institute of International Training and Cooperation-Hanoi Architectural University (LITC-HAU) – Vietnam
[2] Scene Plus Architects – Vietnam

In the process of development and international integration, the question of training associated with the practice has always been a challenge for all universities. Among the training, which requires a practical environment, the architectural formation in Vietnam is also in the process of transforming itself to adapt to the reality needs and international integration. From 2017, Hanoi Architectural University has been a pioneer in developing new international training model, in co-operation with schools of architecture in France and en-terprise, which calls work-shop. The organization of the workshop is based on the cooperation between Hanoi Architectural University, the city authorities where the workshop takes place and an architectural cabinet. The workshop proposes to understand the complex relationship between space and time, the process and mutations of space at different scales and human influence on the transformation of the community. In this paper, by experiences from our work-shop at Nhn Lý, Quy Nhn province, we wish to introduce the advantages of the method in this new specialized training as well as pointing out the difficul-ties in the training process towards a reality urban planning.

Keywords: Landscape architect training, Vietnam, urban planning, cooperation, workshop

*Speaker
†Corresponding author: thaihuyennguyen@gmail.com

Data mining & Machine Learning

Machine Learning-based Models to Forecast Energy Consumption in Residential Buildings

Jui-Sheng Chou* [1], Dinh-Nhat Troung † [1], Duc-Son Tran [1]

[1] National Taiwan University of Science and Technology (NTUST) – No. 43, Section 4, Keelung Rd, Da'an District, Taipei City, Taiwan 106, Taiwan

Forecasting the energy consumption in buildings has become crucial for improving energy efficiency and sustainable development. This study presents a comprehensive analysis of least squares support vector regression (LSSVR)-based technique for forecasting energy consumption time series in residential buildings. Real-time data were collected from a smart grid that was installed in an experimental building and used to evaluate the efficacy and effectiveness of statistical and machine learning techniques. The LSSVR-based forecasting models are classified into three categories, namely single, ensemble, and hybrid according to their prediction components. The comprehensive comparison demonstrates that the LSSVR-based hybrid model is more accurate than the LSSVR-based single and ensemble models. Both the accuracy of prediction and the suitability for use of these models are evaluated to support users in planning energy management.

Keywords: Energy Consumption, Residential Buildings, Time Series Forecasting, Machine Learning, Least Squares Support Vector Regression, Particle Swarm Optimization

*Corresponding author: jschou@mail.ntust.edu.tw
†Speaker

A Daily Work Report Based Approach for Schedule Risk Analysis

Chau Le *† [1], H. David Jeong [1]

[1] Texas AM University [College Station] – College Station, TX 77843, United States

The Critical Path Method (CPM) has been the dominant scheduling method for the past several decades. Most State Departments of Transportation (DOTs) in the U.S. currently apply CPM to estimate project duration for major and complex projects. The method, however, has limitations, and one of them is its poor ability to analyze schedule risks. While previous studies have identified various factors that cause uncertainties in schedules, the estimated duration from CPM is deterministic. To quantify schedule risks, the Program Evaluation Review Technique which uses three-point estimates for activity duration and Monte Carlo Simulation (MCS) based methods that assign uncertainties to work activities through the probability distributions of activity durations have been limitedly used in the industry. After running the simulation thousands of times, the probability distribution of the total project duration can be developed to assist risk analysis, such as determining a schedule contingency for the project. In current practices, the use of the MCS method is still limited due to various reasons. One of the most challenging issues is the difficulties in estimating the probability distributions of activity durations objectively. This study aims to leverage historical digital daily work report (DWR) data available in the DOTs' databases to determine the probability distributions of the production rates of work activities then estimate the distributions of activity durations when quantities of the activities are provided. Since the DWRs record the daily accomplished quantity of each work item in the construction phase, the actual production rates of the work items can be calculated to obtain a more accurate and realistic duration estimate for a future project. DWR data collected from a DOT were used to conduct a case study that demonstrates the value of this new approach for schedule risk analysis.

Keywords: Critical Path Method, Monte Carlo Simulation, Daily Work Report Data, Project Scheduling, and Schedule Risk Analysis.

*Speaker

†Corresponding author: chle@tamu.edu

A Deep Learning-Based Procedure for Safety Evaluation of Steel Frames Using Advanced Analysis

Manh-Hung Ha* [1], Quang-Viet Vu † [2], Viet-Hung Truong [3]

[1] National University of Civil Engineering – 55 GiaiPhong Road, Hanoi, Vietnam, Vietnam
[2] Department of Civil and Environmental Engineering, Sejong University – 98 Gunja-dong, Gwangjin-gu, Seoul 143-747, South Korea
[3] Faculty of Civil Engineering, Thuyloi university (TLU) – 175 Tay son, Dong Da, Hanoi, Vietnam

Advanced analysis methods for design of steel frames have been widely used in recent years since they can directly consider the material and geometric nonlinearities of the structure and then eliminate the separate member capacity checks encompassed by the effective length factor (K-factor) based methods. However, the biggest challenge of an advanced analysis is that it is time-consuming compared to an elastic analysis. This leads to the limitation of application of advanced analysis in complicated design problems such as optimization design and structural reliability analysis of the structure where a very large number of structural analysis is required. An interesting approach to solve the above problem is to use the machine learning methods to estimate the performance of the structure. Among many machine learning methods, the deep learning (DL) technique, a newest branch of the representation learning methods, has advanced in addressing various design and analysis problems of structures such as damage detection, health monitoring, etc.
In this study, a DL-based procedure for safety evaluation of steel frames is introduced. An advanced analysis is presented first to capture the nonlinear inelastic behaviors of structures. Two DL models are then proposed for estimation of the structural load-carrying capacity and evaluation of the strength safety of the structure by predicting the structural ultimate load factor greater or smaller than 1.0. The ultimate load factor is defined as the ratio of structural load-carrying capacity and applied loading. Several steel frames are carried out to demonstrate the efficiency of the proposed procedure.

Keywords: Advanced analysis, Steel frame, Deep learning, Machine learning

*Corresponding author: hunghm@nuce.edu.vn
†Speaker

Prediction of buckling coefficient of stiffened plate girders using deep learning algorithm

George Papazafeiropoulos * [1], Quang-Viet Vu† [2], Viet-Hung Truong‡ [3], Minh-Chinh Luong [4], Van-Trung Pham [5]

[1] School of Civil Engineering, National Technical University of Athens (NTUA) – Zografou Campus, 9, Iroon Polytechniou str, 15780 Zografou, Greece
[2] Faculty of Civil Engineering, Vietnam Maritime University (VMU) – 484 Lach Tray Street, Ngo Quyen District, Hai Phong city, Vietnam
[3] Faculty of Civil Engineering, Thuyloi university (TLU) – 175 Tay son, Dong Da, Hanoi, Vietnam
[4] Faculty of Civil Engineering, Thuyloi University (TLU) – 175 TaySon, Dongda, Hanoi, Vietnam, Vietnam
[5] Faculty of Civil Engineering, Vietnam Maritime University (VMU) – 484 Lach Tray Street, Le Chan District, Hai Phong City, Vietnam., Vietnam

Stiffened web plates are designed so that local panel buckling takes place before overall buckling occurs. For the design of such stiffened plates, the buckling coefficient, kb plays a very important role since it is used to determine the buckling strength of the girder. However, the equations to calculate kb are rather complicated and have not yet covered all cases which may happen in stiffened plate girders. In addition, previous works and AASHTO LRFD requirements suggest an equation to compute kb for the stiffened plate girders based on the results obtained from simply supported plates. This tends to underestimate the value of kb for the stiffened plate girder since the effect of the presence of the flanges is not taken into consideration. This paper aims at introducing a new method to determine kb of the stiffened plate girders under pure bending using deep learning, one of the most powerful algorithms in machine learning. Firstly, output data kb is generated from eigenvalue buckling analyses based on input data (various geometric dimensions of the girder). This procedure is implemented by using the Abaqus2Matlab toolbox, which allows the transfer of data between Matlab and Abaqus and vice versa. After that, 2,200 training data are used to build the model for predicting kb using deep learning. Finally, 200 test data are used to evaluate the accuracy of the model. The results obtained from this model are also compared with analogous results of previous works with a good agreement.

Keywords: Stiffened plate girders, longitudinal stiffeners, eigenvalue buckling analysis, buckling coefficient, Abaqus2Matlab, deep learning.

*Speaker
†Corresponding author: vietvq@vimaru.edu.vn
‡Corresponding author: truongviethung@tlu.edu.vn

Monitoring Pedestrian Flow on Campus with Multiple Cameras using Computer Vision and Deep Learning Techniques

Kok-Yiu Wong * [1], Chin-Pang Cheng† [1]

[1] Hong Kong University of Science and Technology (HKUST) – Clear Water Bay Kowloon Hong Kong, Hong Kong SAR China

This paper proposes a robust method for multi-camera person re-identification (ReID), which can accurately track pedestrians across non-overlapping cameras. Closed-circuit television (CCTV) are widely used to capture pedestrian movement in different places. By integrating CCTV with computer vision and deep learning techniques, trajectory of individual pedestrian can be efficiently acquired for analyzing pedestrian walking behaviors. Many existing ReID methods aim to extract discriminative human features to distinguish a person from others. Recent state-of-the-art performance is achieved mostly by obtaining fine features from each body part. However, these part-based feature extraction methods did not consider which parts are more useful for person ReID. Therefore, this paper proposes a weighted-parts feature extraction method, such that features of specific body parts are more influential to identity prediction. After comparing the performances of utilizing each part alone, several parts are considered more view-invariant and discriminative. Higher weights are then imposed on these specific parts to extract more useful human features for person ReID. Experimental results with videos on a college campus show that the ReID accuracy of our proposed method notably outperforms many existing ones.

Keywords: Computer vision, Deep learning, Human feature extraction, Multiple cameras reidentification, Pedestrian flow analytics

*Speaker

†Corresponding author: cejcheng@ust.hk

An Image Mosaicking Method Base on The Curvature of Cost Curve for Tunnel Lining Inspection

Cuong Nguyen Kim *† [1], Kei Kawamura [2], Masando Shiozaki [3], Amir Tarighat [4]

[1] Mien Trung of civil engineering (MUCE) – 24 nguyen Du, Tuy hoa, Phu Yen, Vietnam
[2] Yamaguchi University (YU) – Tokiwadai,Ube, Yamaguchi, 755-8611,Japan, Japan
[3] Sumitomo Mitsui Construction Co., Ltd., Tokyo, Japan – Tsukoda, Chuo-ku, Tokyo, 104-0051, Japan
[4] Dept. of Civil Engineering, Shahid Rajaee Teacher Training University – Iran

The paper proposes an image mosaicking method for tunnel lining inspection. The conventional methods only used the cost value of the pixel being processed based on similarity metric to estimate an image-matching location. To improve the image-mosaicking efficiency, the curvatures of the cost curve at candidate matching points are adapted. Moreover, experimental results for an actual tunnel demonstrate that the curvature measurement can select the precise matching points accurately for assisting defect inspection.
Many concrete infrastructure structures, including buildings, bridges, and especially tunnels, have been in use for over 50 years now deteriorating. Therefore, to improve the efficiency of tunnel inspection work and obtain more accurate results, the authors propose a mobile tunnel inspection system (MOTIS) that is capable of image acquisition with reliable resolution and high running speed. Its advantages are simple structure, inexpensive cost, and quality images. Subsequently, an image stitching technique is applied to generate an overall view of the tunnel lining at high resolution.

Moreover, many researchers have considered automated crack detection on the tunnel lining surface such as Yu et al. 2007 and Zhang et al.2014. However, they did not detail about tunnel-image mosaicking generation to assist visual inspection.

This study conducts the tunnel scanning approach to provide a map for defect inspection on the tunnel lining surface. The main goals are to achieve reasonable accuracy, active image-acquisition time, and manageable inspection cost. For image mosaicking, the authors use intensity based features and the curvature measure to find the appropriate matching points. This is different from standard image matching techniques that make use of key-point (feature) based image matching methods such as SIFT, SURF which may fail when the tunnel lining images contain noises or without features.

Keywords: Image mosaicking, similarity metric, curvature metric, tunnel lining inspection.

*Speaker
†Corresponding author: nguyenkimcuong@muce.edu.vn

Application of Neural Network to Predict the workability Parameters of Self-Compacting Concrete

Cuong Nguyen Hung * [1], Khoa Ho Ngoc† , Linh Tran‡

[1] National University of Civil Engineering, Hanoi, Vietnam – 55 Giai Phong road - Hai Ba Trung - Ha Noi - Vietnam, Vietnam

The paper presents a new application of classical multi-layer perceptron neural network to approximate the parameters of fresh self-compacting concrete. The approximation is needed to determine the working parameters at construction site and can be used to estimate the components used at mixing station to achieve the desired concrete quality. A number of real field tests were conducted and six basic parameters were measured for each test. The numerical results showed the high accuracy of proposed solution.

Keywords: Self, compacting Concrete, Nonlinear Approximation, Feedforward Neural Network, Multi Layer Perceptron

*Speaker
†Corresponding author: khoahn@nuce.edu.vn
‡Corresponding author: linh.tranhoai@hust.edu.vn

Development of Artificial Neural Networks for Prediction of Compression Coefficient of Soft Soil

Binh Thai Pham * [1], Manh Duc Nguyen [2], Hai Bang Ly [1], Tuan Anh Pham [1], Vu Hoang [1], Hiep Van Le [1], Tien-Thinh Le [3], Hung Quang Nguyen [4], Gia Linh Bui [1]

[1] University of Transport Technology – Vietnam
[2] University of transport and communication – Vietnam
[3] Nguyen Tat Thanh University – Vietnam
[4] Thai Nguyen Transportation Construction Consultant Joint Stock Company – Vietnam

Compression coefficient (Cc) of soft soil is an important parameter in solving many geotechnical problems. In this study, the main of objective is to develop an Artificial Neural Networks (ANN) for prediction of the Cc of soft soil. A total of 189 soft soil samples collected from the Ninh Binh – Hai Phong national highway project were used to carry out the laboratory tests for determining the parameters for modelling of which thirteen factors (depth of sample, clay content, moisture content, bulk density, dry density, specific gravity, void ratio, porosity, degree of saturation, liquid limit, plastic limit, plasticity index, liquidity index) were considered as input variables and the Cc was considered as a output variable for prediction models. This data was divided into two parts of training (70%) and testing (30%) datasets for building and validating the models, respectively. To validate the performance of the ANN, various methods named Mean absolute error (MAE), root mean square error (RMSE), squared correlation coefficient (R2) were used. The results show that the ANN are promising method for prediction of the Cc of soft soil. This study might help geotechnical engineers to reduce the cost of implement of laboratory tests and the time for construction.

Keywords: Artificial Intelligence, Artificial Neural Networks, Compression Coefficient, Soft Soil, Vietnam.

*Speaker

Real-time detection of asymmetric surface deformation and field stress in concrete-filled circular steel tubes via multi-vision method

Yunchao Tang * [1], Kuangyu Huang [2], Lijuan Li† [3], Xiangjun Zou‡ [2], Wenxian Feng [3]

[1] College of Urban and Rural Construction, Zhongkai University of Agriculture and Engineering – China
[2] College of Engineering, South China Agricultural University – China
[3] School of Civil and Transportation Engineering, Guangdong University of Technology – China

Aiming at the characteristics of full-field asymmetric surface deformation on the surface of concrete-filled steel tubular columns, a mark-free multi-vision measurement method is proposed, and the vision system structure, curved surface measurement principle, image acquisition, preprocessing algorithm and 3D point cloud reconstruction algorithm are illustrated. An image stitching algorithm is proposed to calculate the deformation radius of the asymmetric surface and the radius of curvature and its height of the largest deformation section. In the seismic test, the stereo vision system developed by the authors is used to automatically collect and process the three-dimensional deformation and field strain of the specimens. Besides, the three-dimensional point cloud reconstruction algorithm is proposed to realize the full-field three-dimensional deformation image reconstruction. The comparison results indicate that the multi-eye vision measurement method can measure the deformation process of the asymmetric surface and the exact value of the full field strain, its accuracy meets the engineering requirements. The proposed method can evaluate the asymmetric deformation of the structure subjected to impact loads or vibration and provide real-time decision data for structural health monitoring.

Keywords: Stereo vision, Stereo matching, point cloud registration, four ocular vision

*Speaker
†Corresponding author: lilj@gdut.edu.cn
‡Corresponding author: xjzou1@163.com

A Possibility of AI Application on Mode-choice Prediction of Transport Users in Hanoi

Thi My Thanh Truong *† [1], Hai Bang Ly [1], Thai Binh Pham [1]

[1] University of Transport Technology – Vietnam

Mode choice is a significant analysis of travel demand modelling. The selection of transport mode highly depends on the travel behavior of transport users, for instance, travel distance, trip cost, trip purpose, household income... This study aims at investigating the possibility of applying Artificial Intelligent (AI) method to predict the mode choice through travel behavior survey data with a focus on Hanoi city - Vietnam. Firstly, travel interview survey was conducted with the involvement of 311 transport users at different land-use types. The study secondly applies the Ensemble Decision Trees (EDT) method to predict the mode-choice of transport users. Finally, the recommendation for a possibility of AI application on travel mode-choice is also proposed. The results of this study might beneficial for transport planners and transport authorities. The application of AI on parking demand forecast also contributes for the big data application on transport demand modeling.

Keywords: Travel Behavior, Mode Choice, Machine learning, Ensemble Decision Trees

*Speaker

†Corresponding author: thanhttm@utt.edu.vn

Machine learning based tool for cleaning up CAD to GIS converted data

Mohamed Badhrudeen* [1], Nalin Naranjo [1], Ali Movahedi [1], Sybil Derrible † [1]

[1] Complex and Sustainable Urban Networks (CSUN) Lab, Department of Civil and Materials Engineering University of Illinois at Chicago (CSUN at UIC) – United States

Recent advances in Geographic Information System (GIS) has made storage, manipulation, and analysis of spatial data easier than ever. This has spurred many government agencies to switch from the traditional Computer Aided Design (CAD) format to GIS for storing information about their infrastructure. The existing data stored in CAD therefore needs to be converted to GIS, and this process brings about at least two problems. First, GIS requires geographical coordinates that CAD data do not have, and the accurate projection and alignment of the infrastructure is not straightforward. Second, the original CAD data often possess errors such as overlapping lines or split lines to show text about dimensions. The main goal of this study is to develop and apply a tool that can identify these errors and correct them automatically without human intervention. The identification of the errors will be done using a combination of simple heuristics and machine learning techniques and the corrections will be applied accordingly. This tool can significantly reduce the time spent on cleaning up the GIS data obtained after the conversion. Finally, as a case study, this tool is applied to a small underground pipe system.

Keywords: GIS, machine learning, topological errors, CAD, error correction

*Corresponding author: mmoham55@uic.edu
†Speaker

Building Information Modeling

BUILDING INFORMATION MODELING BASED OPTIMIZATION OF STEEL SINGLE PLATE SHEAR CONNECTIONS USING DIFFERENTIAL EVOLUTION ALGORITHM

Tran-Hieu Nguyen *† [1], Anh-Tuan Vu [1]

[1] National University of Civil Engineering (NUCE) – 55 Giai Phong Road, Hanoi, Vietnam

The conventional method that steel connections are still manually designed one by one is time-consuming. In this paper, a building information modeling based framework is proposed for automated generating steel connections. The differential evolution algorithm is used to seek the optimal solution of connection where the design variables are bolt diameter, bolts arrangement as well as plate dimensions. The objective function is the minimum cost of steel connection while the design constraints adopt the specification AISI/AISC 360. The optimized steel connection is then automatically created in the BIM model. A toolkit is developed to implement the proposed framework on Tekla Structures through open application programming interface (oAPI). The toolkit is applied for single-plate shear connections, which are the most popular connection type in steel buildings. An example of a steel frame is conducted to demonstrate the effectiveness of the proposed framework. The result of the example shows that the proposed framework can shorten the design time.

Keywords: building information modeling, optimization, steel connection, single plate shear connection, differential evolution

*Speaker
†Corresponding author: hieunt2@nuce.edu.vn

Selection of Construction Design: A Knowledge-Based System Method

Phan Nghiem Vu* [1], Le Tuan Vu †‡ [1]

[1] Hu University - Quang Tri Branch – Dien Bien Phu Street, Dong Ha city, Quang Tri province, Vietnam

The optimal selection of construction designs to be used during the execution of a construction project is amajor determinant of high productivity, but sometimes this management process is performed without the care and the systematic approach that it deserves, bringing negative consequences. This study proposes a knowledge management approach that will enable the intelligent use of corporate experience and information and help to improve the management of construction designs for a project.Then a knowledge-based system to support this decision-making process is proposed and described. To define and design the system, semistructured interviews were conducted within five construction consulting companies with the purpose of studying the way that the method' selection process is carried out in practice and the knowledge associated with it. A prototype of a Construction Design Knowledge System (CDKS) was developed and then validated with construction industry professionals. The CDKS was liked as a valuable tool for construction design' selection, by helping companies to generate a corporate memory on this issue, reducing the reliance on individual knowledge and also the subjectivity of the decision-making process. The described benefits as provided by the system favor a better performance of construction projects.

*Corresponding author: vupn.phqt@gmail.com
†Speaker
‡Corresponding author: letuanvubkdn@gmail.com

BIM application for the design consultant on the irrigation and hydropower projects in Vietnam

Tran Van Toan *† [1], Nguyen Huu Hue

[1] Thuyloi university (TLU) – 175 Tay Son, Dong Da, Hanoi, Vietnam

In the recent years, the construction industry has inherited great achievements from the rapid development of science and technology to improve labor productivity, increase the scientific quality, reduce risks and increase the efficiency of construction investment. Especially BIM applications are becoming an inevitable trend of the construction industry in the country thanks to the advantages of science, technology, economics and benefits in construction management. Vietnam is a developing country, so the construction industry has been and will continue to play a very important role in the country. Therefore, the application of BIM for the construction industry is also indispensable to reduce the risk and increase the efficiency of construction investment. However, the BIM application for the construction of irrigation and hydropower projects is still limited by the peculiarity and difficulty of human resource understanding on BIM technology. This paper presents some research results on application of BIM technology for the design consultant on the irrigation and hydropower projects in Vietnam.

Keywords: BIM, design consulting, irrigation project, hydropower project

*Speaker
†Corresponding author: tranvantoan@tlu.edu.vn

BIM Adoption in Construction Projects Funded with State-managed Capital in Vietnam: Legal Issues and Proposed Solutions

Thuy-Ninh Dao *† [2,1], The-Quan Nguyen *

[1], Po-Han Chen *

[2]

[2] National Taiwan University [Taiwan] (NTU) – No. 1, Sec. 4, Roosevelt Road, Taipei, 10617 Taiwan, Taiwan
[1] National University of Civil Engineering, Hanoi, Vietnam (NUCE) – 55 Giai Phong, Hai Ba Trung, Hanoi, Vietnam, Vietnam

It is claimed that Building Information Modelling (BIM) has been adopted in the construction industry in Vietnam since early 2000. However, in practice, this proves not to be the case, particularly in the context of construction projects funded with state-managed capital. Considering that such funding accounts for the largest market share in construction funded projects in Vietnam, further investigation is warranted. A preliminary survey reveals that the owners and other stakeholders of these projects are cautious of BIM adoption, primarily due to avoiding legal issues that may arise in such projects. In this context, this paper aims to explore the potential legal issues of BIM adoption and propose solutions for the stakeholders. The results will aid in avoiding the issues outlined, which can aid in promoting BIM adoption in Vietnam. Literature shows that the legal issues are not only applicable to Vietnam, but to other countries. To identify the legal issues which arise from BIM adoption in construction projects globally, a through literature review is carried out, where then a survey is performed with stakeholders of construction projects funded with state-managed capital in Vietnam. This then provides the opportunity to verify if the literature findings apply to Vietnam, as well as to discover new issues in a Vietnamese context. According to the survey results, the biggest legal issues for BIM adoption in construction projects funded with state-managed capital in Vietnam are; (i) no expenses system for BIM implementation available, so there is no source of funding for paying consultants/contractors for BIM; (ii) rights and obligations of stakeholders in BIM projects are not defined clearly in the relevant regulations, so there is a high risk of claims and disputes arising; (iii) no digital submission system available, thereby BIM models are not accepted, but hardcopy printouts used, leading to significant work of reviewing and verification of as-built documents. Solutions for these issues are generated and validated with focus groups, which lead to the suggestions of regulation alterations as well as revisions of contract forms/articles applied in construction projects funded with state-managed capital in Vietnam

*Speaker
†Corresponding author: ninhdt@nuce.edu.vn

Keywords: Building information modeling, BIM Vietnam, construction contract

A model for soil-structure interaction - Application to small modular reactors

Liang Cui [1], Mamadou Fall [2], Nebojsa Orbovic [3], Son Nguyen [*†] [3]

[1] Lakehead University – Canada
[2] University of Ottawa – Canada
[3] Canadian Nuclear Safety Commission (CNSC) – Canada

Canada and other countries are contemplating the construction of small modular reactors (SMR) for the generation of electricity. SMRs would be built at a smaller scale than traditional nuclear reactors with anticipated lower up-front capital costs and enhanced safety features. The SMRs would need to be seismically qualified, and shown to withstand the design basis earthquake without loss of containment. In order to assess the seismic qualification of SMRs, a dynamic coupled elastoplastic-hydraulic model for soil behaviour under seismic loadings was developed. The governing equations of the model are based on conservation of momentum for the porous skeleton, and conservation of water mass. Porewater flow is assumed to follow Darcy's law while the solid skeleton is assumed to be elasto-plastic, with the adoption of the modified Cam Clay model to simulate its stress-strain behaviour. The model was tested with the simulation of dynamic triaxial tests, and a shaking table experiment. The results show that the model can capture (1) the development of permanent deformation in soil, (2) the shear induced volume change (including both contraction and expansion), (3) the generation and dissipation of excess pore water under the dynamic loading, and (4) the strain hardening and softening behaviour of soil under complex stress paths.
Finally, the model is used for the scoping analyses of the seismic response of two hypothetical SMRs, one founded on sand and the other on a slightly overconsolidated clay. The results show the influence of the types of soils, foundation depths and the position of the phreatic surface.

Keywords: poromechanics, seismic analysis, Cam Clay model, liquefaction, small modular reactors

[*]Speaker
[†]Corresponding author: son.nguyen@canada.ca

BIM-based innovative bridge maintenance system using augmented reality technology

Ngoc Son Dang * [1], Chang-Su Shim [2]

[1] Chung-Ang University [Seoul] (Ph.D. candidate) – 84 Heukseok-ro, Dongjak-gu, Seoul, South Korea
[2] Chung-Ang University [Seoul] (Professor) – 84 Heukseok-ro, Dongjak-gu, Seoul, South Korea

A smooth transportation system plays a pivotal role in the development of a country since it enables rapid connect among industrial zones or territories. Especially bridges, which commonly has around 50 years' service life, needs to be paid more attention to maintenance to keep it in a good service state. Nowadays most bridge has its own bridge maintenance system (BMS) but still bridge engineer is challenged by difficulty in term of store the damage records and repair history, as well as assess the current behavior of the structural system. This paper proposed an innovative BMS which using a schematic BIM-based information management system, collaboration with an automate inspection task using augmented reality (AR) device. According to preventive maintenance strategy, a data schema for BIM model was investigated. An integrated digital model is created to store, manipulate and share the inspection data and maintenance history. On another hand, the onsite inspection task is timely performed. The state-of-the-art lies on the versatile capacity in term of real-time data manipulate of AR device. Besides capturing feature, a chain of algorithms based on computer vision is embedded into the AR device, aims to enhance the precision and performance of inspection task. Right after, the technical damage report is fed-back to the management system and assessment model is discussed. A pilot application to an existing cable-stayed bridge is introduced, which is well applied for a year and show a good potential for bridge maintenance.

Keywords: BIM, BMS, AR, Preventive Maintenance, Image Processing.

*Speaker

Perspectives on BIM Profession of BIM Specialists and Non-BIM Specialists: Case Study in Vietnam

Ngoc Quyet Le* [1], Michael Er† [1], Shankar Sankaran‡ [1], Ngoc Binh Ta §¶ [2]

[1] University of Technology Sydney (UTS) – City campus15 BroadwayUltimo NSW 2007, Australia
[2] Institute of Construction Economics – 20, The Giao Street, Hai Ba Trung District, Hanoi, Vietnam

The adoption of Building Information Modelling (BIM) has been recently increasing within the Architecture, Engineering and Construction (AEC) industry. The current approach on adoption of BIM by the Vietnamese decision makers (e.g. government agencies and senior industry leaders) is primarily concerned with improving the adoption rate measured by the speed of diffusion and the number of adopters at basic implementation level such as 3D functions. This paper explores a different perspective on BIM adoption in Vietnam which has been neglected by proposing that the efforts of the decision makers should shift into regulatory supports and diffusion networks facilitating higher levels of BIM implementation such as 4D construction scheduling, 5D cost estimating etc. to confirm their long-term commitment to advanced BIM practices. Twenty-nine participants including BIM specialists and non-BIM specialists were selected from seven AEC organizations. Semi-structured interviews were employed for data collection. Key findings revealed general perceptions of the BIM profession such as "job insecurity", "depleted motivation", "BIM as supporting roles" and "BIM as new skill sets". Recommendations for programs supporting BIM adoption are also discussed.

Keywords: BIM Adoption, BIM Profession, BIM Specialists, non, BIM Specialists, Qualitative Case Study, Developing Countries, Vietnam

*Corresponding author: ngocquyet.le@student.uts.edu.au
†Corresponding author: michael.er@uts.edu.au
‡Corresponding author: shankar.sankaran@uts.edu.au
§Speaker
¶Corresponding author: ngocbinh.ta@BIM.gov.vn

The contextual influence on Building Information Modelling implementation : A cross-case analysis of infrastructure projects in Vietnam and Norway

Nam Bui * [1]

[1] Oslo Metropolitan University (OsloMet) – Postboks 4, St. Olavs plass, 0130 Oslo, Norway

This paper compares Building Information Modelling (BIM) implementation in two infrastructure projects in two different countries to understand the contextual influence on innovation adoption in the construction industry. These two countries are Norway and Vietnam which have different contexts in term of technology advance. In Norway, the Norwegian railway authority decided to use BIM in the InterCity project which connects various cities and Oslo. InterCity is the first Norwegian large-scale railway project that utilizes BIM. The situation is similar in the Thu Thiem 2 bridge project in Vietnam. The design package of Thu Thiem 2 bridge is a BIM-pilot project of the Vietnamese government. Using qualitative interpretive case studies, this paper reveals the importance of the BIM champions in the implementation and different consequences derived from the project organization, technological context, and the focus of BIM use. The insights obtained from the comparison might be useful for increasing the BIM uptake and overcoming the barriers of traditional requirements for innovation. This is not only applicable to the Norwegian and Vietnamese infrastructure sectors but also for other contexts which have limited BIM implementation experience.

Keywords: Building Information modelling, infrastructure, implementation, developing country

*Speaker

Application of BIM tools in technician training, a case of Ho Chi Minh City Construction College, Vietnam

Tung Lam Nguyen [1], Thi Xuan Nguyen [*†]

[1] Thi Xuan Nguyen (Xuan Nguyen) – 265 No Trang Long Str., W. 13, Binh Thanh Dist., Ho Chi Minh City, Vietnam

In vocational training, keeping up with new technology is a challenge. Building Information Modeling (BIM) tools are now increasingly replacing traditional skills, which is irreversible advance in architecture and construction sector. This leads to changes in the curriculums of training courses, teaching and learning methods, especially in Technical Vocational education and Training (TVET). This article explores an application process of BIM tools in BIM Modeler or architecture technician training courses at Ho Chi Minh City Construction College as a case study, reflecting the experience of change management toward new technology integration, its implication in and challenges for TVET's methodology. The author also recommends that cooperation between industry and TVET in training is one of the most effective solution to solve the human resource problem for the construction sector.

Keywords: TVET, BIM Modeler, competency.

[*]Speaker
[†]Corresponding author: thixuannguyen.tcxd@gmail.com

Non-linear deformational analysis of reinforced concrete frame

Tran Thi Thuy Van [*] [†] [1], Vu Thi Bich Quyen [1]

[1] Hanoi Architectural University (HAU)

The paper presents the algorithm and some results of deformational non-linear analysis of reinforced concrete frame system taking into consideration of nonlinearity of materials. The nonlinearity of materials means the use of nonlinear models of concrete and reinforcement, stress-strain relationships of concrete and reinforcement are taken according to diagrams illustrated in Russian codes. The algorithm of deformational non-linear analysis has two stages. In the first stage, the relationship between element cross-sectional stiffness and internal forces was established. In the second stage, the structural analysis software SAP2000 was used for calculation of internal forces with the results received in the first stage. The results were investigated with a gradual increase of load values according to the relationship between element cross-sectional stiffness and internal forces. This helps to observe the places of formation of plastic hinges. From there some comments and recommendations were proposed to evaluate the criterion of limit state in structural analysis.

Keywords: Nonlinear deformational analysis ; reinforced concrete plane frame ; plastic hinges ; nonlinear deformational model

[*]Speaker
[†]Corresponding author: ndthao@dut.udn.vn

Reliability Evaluation of Eurocode 4 for Concrete-Filled Steel Tubular Columns

Huu Tai Thai [*] [†] [1], Son Thai [1]

[1] Hanoi Architectural University (HAU)

This paper evaluates the reliability of the design provisions given in Eurocode 4 (EC4) for concrete-filled steel tubular (CFST) columns under axial compression. The evaluation is based on the experimental results of 2,224 tests on short and slender CFST columns (1,245 circular sections and 979 rectangular sections). Monte Carlo simulation is used to estimate probability of failure and the reliability index based on the randomness in dead and live loads, steel yield stress, concrete compressive strength and the error of the EC4 resistance model. The evaluation is carried out for both specimens within and beyond code limits of material strengths and section slenderness. The results of parametric studies indicate that the reliability index of EC4 is in the range from 2.3 to 4.2 which is quite below the target reliability value of 3.8 prescribed by EC4.

Keywords: CFST Columns ; Test Database ; Eurocode 4 ; Reliability Analysis

[*]Speaker
[†]Corresponding author: tai.thai@unimelb.edu.au

Evaluating the change in the properties of bitumen during production, transport and construction of hot mix asphalt in the conditions of Vietnam

K.H. Quang Trinh [1], T. Nhan Tran [4], H.T. Tai Nguyen [2,3 * †]

[1] Ho Chi Minh City University of Transportation, Ho Chi Minh City, Vietnam
[2] Ho Chi Minh City University of Technology and Education, Ho Chi Minh City, Vietnam
[3] BMT Construction Investment J.S.C., Ho Chi Minh City, Vietnam
[4] Ecole Centrale de Nantes, Nantes, France

In Vietnam, the total time of production, transport and construction of hot mix asphalt (HMA) can last up to more than 10 hours depending on the distance from the asphalt plan to the construction site as well as the weather conditions at that site. As a result, the properties of the onsite compacted asphalt mixture may be far different from those obtained in the laboratory, giving rise to unreliable predicted service life of the pavement. This study aims to evaluate the change in the properties of bitumen during production, transport and construction of hot mix asphalt. To simulate these processes, a 60/70 pen bitumen was heated to 150˚C for 1h, 3h and 5h and stirred continuously to allows the interaction between bitumen and oxygen. Control samples were also prepared by maintaining the bitumen at high temperature but not allowing the bitumen to interact with oxygen. The properties of the conditioned samples were then evaluated using viscosity test, penetration and softening point test, and Superpave performance grading (PG) test. The results show that the properties of the control samples almost do not change while those of the aged samples vary significantly with an increase of ageing time. The more longtime the bitumen was exposed to high temperature and interaction with air, the more stiffness gained by the bitumen.

Keywords: Hot mix asphalt, short, term ageing, hardening, performance grade

*Speaker
†Corresponding author: tainht@hcmute.edu.vn

Creep behavior and rutting resistance of asphalt pavements by experimental testing and Finite Element modelling

Van Bac Nguyen [1 †], Chau Phuong Ngo [2], Ngoc Bay Pham [2], Thanh Phong Nguyen [2], Van Phuc Le [2 †], Van Hung Nguyen [2]

[1] University of Derby - Markeaton Street, Derby DE22 3AW - United Kingdom
[2] University of Transport and Communications - 450 Le Van Viet Street, District 9, Ho Chi Minh City, Vietnam

Asphalt pavement rutting is a major safety concern because it affects the handling of vehicles. Research into effectively predicting of asphalt pavement rutting is extremely necessary as it can help develop an optimal design of asphalt mixture against rutting. The primary objectives of this study are to develop numerical models to investigate the asphalt pavement rutting. Previous study's experimental tests including triaxial repeated compression loading and wheel track testing were used to evaluate the visco-elasto-plastic behavior and rutting resistance of different pavement mixes. Based on the test results, sets of viscoelasto-plastic creep parameters for the asphalt pavement mixes were characterized and related to their rutting resistances. Numerical simulations using threedimensional Finite Element models were developed to simulate both the triaxial compression and wheel track testing. A 'strain hardening' creep material model with the material parameters developed from experimental testing was employed in the Finite Element modelling to the time-dependent characteristics of the asphalt concrete pavements. The Finite Element results were validated against the experimental results to demonstrate that the Finite Element simulations can be used to effectively evaluate the rutting behavior of asphalt concrete pavements.

Keywords: Viscoelastic, Creep, Asphalt Pavement Rutting, Wheel Track Testing, Finite Element Modelling

[†]Corresponding author: vb.nguyen@derby.ac.uk, lvphuc@utc2.edu.vn

Bridge assessment for PSC Girder Bridge using Digital Twin Model

Ngoc Son Dang [1 * †], Chang-Su Shim [2]

[1] Ph.D. candidate at ChungAng University, Seoul, South Korea
[2] Professort at ChungAng University, Seoul, South Korea

Bridge maintenance nowadays is no longer a "reactive activity" to the severe degradation or unexpected disaster. Aging and deterioration are inevitable, sometimes arises exponentially if maintenance strategy is neglected. Leading to structural failure, or worse case is the functional failure and seriously threaten the safety, interrupt the public transportation system. This paper proposes a new con- cept for preventive maintenance strategy for existing aged PSC Girder Bridge using a digital twin model. Digital Twins concept is mainly based on the use of parallel models: digital twin model (DTM), reality twin model (RTM) and me- chanical twin model (MTM). DTM authoring is introduced using an integrated BIM mod-el, while RTM is verified by a reversed engineering surface model based on 3D scanning data. The RTM is generated continuously during bridge lifecycle in or-der to make a field-verified replica of the structure, aims to records all the bridge damage time by time. The mechanical twin model is derived di- rectly from DTM through the interoperability of BIM model and adjusted by damage information from RTM. Discussion on bridge assessment model is in- duced based on the supposed analysis model and deterioration history, significant support for the decision making team in order to make a long-term strategy for bridge maintenance task.

Keywords: Digital Twin Model, BIM, Preventive Maintenance, Reality Model, 3D Scanning

*Speaker
†Corresponding author: dangngocson@cau.ac.kr

Application of Building Information Modelling, Extended tracking technique and Augmented Reality in Building Operating Management

Anh Binh Tran [1] * †, Thanh Ban Nguyen [1], Manh Tuan Nguyen [1], Van Hoan Pham [1], Khuong Le Nguyen [2]

[1] National Uiversity of Civil Engineering, 55 Giai Phong, Hanoi, Vietnam
[2] University of Transport Technology, 54 Trieu Khuc, Hanoi, Vietnam

This paper presents a combination of Augmented Reality (AR), Extended Tracking Technique (ETT) and Building Information Modelling (BIM) to interact with building information in real-time on construction site. Using this method, we have programmed an application running in mobile device to help manage and operate the building facility systems. In this application, the building model and its information are stacked and augmented on the mobile device camera when projecting on the target image mounted on the building. ETT allows extending the object displayed on the screen, even when the mobile device camera no longer captures the target image. Based on this process, engineers can interact with the software to add, change the information needed of facilities on construction site, such as size, manufacturer, date of maintenance, date of replacement, device life cycle, etc.

Keywords: Augmented Reality, Building information modelling, Building Operating Management, Extended Tracking Technique

*Speaker
†Corresponding author: binhta@nuce.edu.vn

Development of 48-hour Precipitation Forecasting Model using Nonlinear Autoregressive Neural Network

Tien-Thinh Le [1 * †], Binh Thai Pham [2], Hai-Bang Ly [2],
Ataollah Shirzadi [3], Lu Minh Le [4]

[1] NTT Hi-Tech Institute, Nguyen Tat Thanh University, Ho Chi Minh City, 700000, Vietnam
[2] University of Transport Technology, Trieu Khuc, Thanh Xuan, Hanoi 100000, Vietnam
[3] Department of Rangeland and Watershed Management, Faculty of Natural Resources, University of Kurdistan, Sanandaj, Iran
[4] Faculty of Engineering, Vietnam National University of Agriculture, Gia Lam, Hanoi 100000, Vietnam

Rainfall intensity has a significant impact on urban drainage infrastructures and the precipitation forecast therefore remains essential in urban areas. In this study, a prediction model using Nonlinear Autoregressive Neural Networks (NANN) was proposed to forecast 48-hour-ahead the rainfall intensity. The proposed NANN model, which is based on a precipitation data of five-year time series, was constructed and validated using various parameters such as Coefficient of Determination (R2), Root Mean Squared Error (RMSE) and Mean Absolute Er-ror (MAE). The results exhibited a high statistical correlation between the outputs of NANN model and the measured data for 48 hour ahead prediction, i.e. R2=0.8998, RMSE=3.2909 and MAE=1.8672. This indicates that the developed model is very promising for precipitation forecasting and could contribute to improve the urban drainage systems.

Keywords: Nonlinear Autoregressive Neural Networks, Precipitation, Time Series, Forecast-ing.

*Speaker
†Corresponding author: tienthinhle.vn@gmail.com

Ensuring success with 3D printing applications in construction

Mirosław J. Skibniewski [1,2] *

[1] Professor of University of Maryland, USA
[2] Editor-in-Chief of the journal of Automation in Construction

Additive manufacturing technology, also referred to as 3D printing, has been developing rapidly in all sectors of engineered production activity, and recently also in the construction industry. This presentation will elaborate classification of materials for 3D printing applications in construction, as well as production techniques and related equipment available to date. Future applications will be discussed, as well as engineering and business factors leading to a successful deployment of 3D-printed components of buildings and other engineering structures worldwide.

Keywords: 3D printing, construction industry.

Author Index

Organizing Committee

Chairmen

HA Minh Cuong	ENS Paris-Saclay, France
DAO Van Dong	University of Transport Technology, Vietnam
ADELI Hojjat	Ohio State University, USA

International members

BUI NGUYEN Hoang	AVSE-Global & EDF, United Kingdom
DANG Thuc Trang	Scene Plus Co.Ltd., Vietnam
DINH Van Nguyen	ANTS & University College Cork, Ireland
DO Tuan Anh	Sorbonne University, France
HUYNH Dat Vu Khoa	Norwegian Geotechnical Institute, Norway
LE Thi Xiu	ENPC, France
LE Van Nhat	EGIS, France
NGUYEN Giang	University of Adelaide, Australia
NGUYEN Hai Nam	ENS Paris-Saclay, France
NGUYEN Quang Huy	INSA Rennes, France
NGUYEN Thuong Anh	Geodynamique et Structure, France
NGUYEN Tien Long	Tractebel, France
NGUYEN Van Minh	Tractebel, France
PHAM Cao Hung	University of Sydney, Australia
PHAM Van Hung	University of Paris-Est Marne-la-Vallée, France
TA Ngoc Binh	Institute of construction economics, Vietnam
TANG Anh Minh	AVSE-Global & ENPC, France
VU Xuan Hong	University Lyon 1, France

Local members (UTT)

LE Hoang Anh	Faculty of Civil Engineering
LE Nguyen Khuong	Faculty of Civil Engineering
LE Thanh Hai	Department of Science, Technology & International Cooperation
LY Hai Bang	Faculty of Civil Engineering
NGO Quoc Trinh	Department of Science, Technology & International Cooperation
NGO Thi Thanh Huong	Faculty of Civil Engineering
NGUYEN Long Khanh	Department of Science, Technology & International Cooperation
NGUYEN Nam Hai	Faculty of Information Technology
NGUYEN Thi Thu Hien	Department of Science, Technology & International Cooperation
PHAM Thai Binh	Faculty of Civil Engineering
PHI Luong Van	Department of Science, Technology & International Cooperation
TRAN Trung Hieu	Department of Science, Technology & International Cooperation
HOANG Vu	Department of Science, Technology & International Cooperation
TRUONG Thi My Thanh	Department of Economy of Transportation
VU Duy Tung	Center of Technology of Communication

International Scientific Committee

AMCS - Advanced Modelling and Characterization of Structures

ARGOUL Pierre	IFSTTAR, France
AZENHA Miguel	Minho University, Portugal
BECQUE Jurgen	University of Sheffield, UK
BENABOU Lahouari	Université de Versailles Saint-Quentin-en-Yvelines, France
BUI Quang Hien	STECHCO Inc, Canada
BUI Tan Trung	INSA Lyon, France
COUCHAUX Mael	INSA Rennes, France
DANG Cong Thuat	University of Danang, Vietnam
ELGAWADY Mohamed	University of Missouri, USA
FERRIER Emmanuel	University Lyon 1, France
GILBERT Benoit	Griffith University, Australia
HERVE-SECOURGEONS Guillaume	IMSIA, EDF R&D, France
JALIL Alan	EGIS, France
LABBE Pierre	ESTP RENON, France
LANOS Christophe	IUT/INSA Rennes, France
LE Thien Phu	Université d'Évry-Val-d'Essonne, France
MEFTAH Fekri	INSA Rennes, France
MIRZA Olivia	Western Sydney University, Australia
NGUYEN Giang	University of Adelaide, Australia
NGUYEN Quang Huy	INSA de Rennes, France
NGUYEN Tien Long	Tractebel France, France
NGUYEN Van Bac	University of Derby, UK
PAULTRE Patrick	Université de Sherbrooke, Canada
PHAM Cao Hung	University of Sydney, Australia
POOLOGANATHAN Keerthan	Northumbria University, UK
POTIN Gildas	Tractebel Engineering, France
RAGUENEAU Frédéric	ENS Paris Saclay, France
SANSOUR Carlo	University of Nottingham, UK
TAN Ee Loon	Western Sydney University, Australia
TEH Lip	Wollongong University, Australia
THAI Huu Tai	University of Melbourne, Australia
TRAN The Truyen	University of Transport and Communications, Vietnam
TURMO Coderque José	School of Civil Engineering of Barcelona, Spain
VO Thuc	Northumbria University, UK

Building Information Modelling (BIM)

CHI Seokho	Seoul National University, Korea

CHIA Fah Choy	Universiti Tunku Addul Rahman, Malaysia
HAN Sanguk	Hanyang University, Korea
Hoang Mai Han	The BIM Factory, Vietnam
HUSSAIN Afifuddin Husairi	Universiti Kebangsaan, Malaysia
KANG Taewook	Korea Institute of Civil Engineering and Building Technology, Korea
KIM Jung In	City University of Hong Kong, China
LIKHITRUANGSILP Veerasak	Chulalongkorn University, Thailand
NGO Quang Tuan	Hanoi Architectural University, Vietnam
NGUYEN Nam Trung	Power Engineering Consultancy Jsc. 3, Vietnam
NGUYEN The Quan	National University of Civil Engineering, Vietnam
NGUYEN Viet Hung	University of California, USA
PARK Jongwoong	Chung-Ang University, Korean
PARK Manwoo	Myongji University, Korea
PHAM Hong Luan	Ho Chi Minh City University of Technology, Vietnam
PREECE Christopher	Abu Dhabi University, UAE
SHIM Changsu	Chung-Ang University, Korean
SHIN Dohyoung	Inha University, Korea
SURYANTO Krishna	Institute Tecknologi Bandung, Indonesia
TA Ngoc Binh	Institute of Construction Economics, Vietnam
THANG Anh Long	Structemp, UK
WU Wei	California State University, USA

DML - Data mining & Machine learning

BUI Tien Dieu	University of South-Eastern Norway, Norway
CHOU Jui-Sheng (Rayson)	National Taiwan University of Science and Technology, Taiwan
LE Hoang Son	Vietnam National University, Vietnam
LIU Zhongqiang	Norwegian Geotechnical Institute, Norway
NGO Ngoc-Tri	National University of Singapore, Singapore
TANG Pingbo	Arizona State University, USA

GEE - Geotechnics for environment and energy

BOUVARD Anne	INSA de Lyon, France
BUI Quoc Bao	Ton Duc Thang University, Vietnam
CHOI Jung Chan	Norwegian Geotechnical Institute, Norway
COLLIN Frédéric	University of Liège, France
DDANI Mohamed	Tractebel, INSA de Rouen, France
DIAS Daniel	University Grenoble Alpes, France
DONG Jia-Jyun	National Center University, Taiwan
GASTEBLED Olivier	Tractebel, INSA de Lyon, France
HUYNH Dat Vu Khoa	Norwegian Geotechnical Institute, Norway
KAYNIA Amir M.	Norwegian Geotechnical Institute, Norway
LEO Chin	Western Sydney University, Australia
NGUYEN Thanh Son	University of Ottawa & Canadian Nuclear Safety Commission, Canada

PHAM Thai Binh	University of Transport Technology, Vietnam
TAHERZADEH Reza	Tractebel, INSA de Lyon, France
TANG Anh Minh	Ecole des Ponts ParisTech, France
TRAN NGUYEN Hoang Hung	Hochiminh City University of Technology, Vietnam
WONG Henry	ENTPE, France
WU Li	China University of Geosciences, China

SCMT - Sustainable Construction Materials and Technologies

ASHRAF Mahmud	Deakin University, Australia
BEAKOU Alexis	IFMA/SIGMA Clermont, France
BENBOUDJEMA Farid	ENS Paris Saclay, France
BUI Ha	Monash University, Australia
BUI Quoc Tinh	Tokyo Institute of Technology, Japan
DOTELLI Giovanni	Politechnico Milano, Italy
FORTH John	School of Leeds, UK
GARIBALDI Luigi	Politecnico di Torino, Italy
GOLINVAL Jean-Claude	Université de Liège, France
GRANDE Daniel	University of Paris Est Creteil, France
GRILLET Anne-Cécile	Université Savoie Mont Blanc, France
HA MINH Cuong	AVSE Global & ENS Cachan, France
LY Hai Bang	University of Transport Technology, Vietnam
MONCHIET Vincent	University of Paris Est Marne-la-Vallée, France
MONTEIRO Eric	Arts & Métiers ENSAM Paris, France
NAKARAI Kenichiro	Hiroshima University, Japan
NGUYEN Van Bac	University of Derby, UK
NGUYEN Khanh Son	Hochiminh City University of Technology, Vietnam
NGUYEN The Duong	Duy Tan University, Vietnam
POH Leong Hien	National University of Singapore, Singapore
PROUST Gwénaëlle	University of Sydney, Australia
REGNIER Gilles	Arts & Métiers ENSAM Paris, France
SERRA Roger	INSA Val de Loire, France
SI LARBI Amir	ENISE, France
TRAN Minh Tung	Ton Duc Thang University, Vietnam
VU Xuan Hong	University of Lyon 1, France
YVONNET Julien	University of Paris Est Marne-la-Vallée, France

SSC - Smart and sustainable cities

BUTTON Cat	University of Newcastle, UK
CHAN Tak-Ming	Hong Kong Polytechnic University, Hong Kong
DERRIBLE Sybil	University of Illinois at Chicago, USA

NGUYEN Hong Quan	Vietnam National University - Ho Chi Minh City, Vietnam
HSU Mark Shu-Chien	Hong Kong Polytechnic University, Hong Kong
LE Hai Vu	Monash University, Australia
NGHIEM Duc Long	University of Technology Sydney, Australia
NGUYEN Chuong	CSIRO - Data61, Australia
NGUYEN Xuan Thinh	TU Dortmund University, Germany
QUAN LUNA Byron	DNV GL, Norway
TRINH Toan	University of California, USA

UPTE - Urban Planning, Transport and Environment

DANG Thuc Trang	Scene Plus Co.Ltd., Vietnam
DO Thuan An	Thuy Loi University, Vietnam
NGUYEN Frédéric	University of Liège, France
RILETT Laurence	University of Nebraska-Lincoln, USA

Sponsors

Tài trợ vàng
Gold Sponsor

VINTECH CITY

Tài trợ bạc
Silver Sponsor

SUN GROUP

NAFOSTED
Quỹ Phát triển khoa học & công nghệ Quốc gia

Tài trợ đồng
Bronze Sponsor

STECHCO

ĐẠI HỌC XÂY DỰNG

KATZENBACH INGENIEURE