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Civil Engineering Abstracts

Fourth Annual International Conference on Civil Engineering 26-29 May 2014, Athens, Greece

Edited by Gregory T. Papanikos

THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Civil Engineering Abstracts

4th Annual International Conference on Civil Engineering

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8 Valaoritou Street
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(In Alphabetical Order by Author's Family name)

Preface

This abstract book includes all the abstracts of the papers presented at the *4th Annual International Conference on Civil Engineering, 26-29 May 2014,* organized by the Athens Institute for Education and Research. In total there were 40 papers and 45 presenters, coming from 23 different countries (Albania, Algeria, Australia, Canada, China, Colombia, Czech Republic, India, Iran, Italy, Lebanon, Libya, Mexico, New Zealand, Romania, Russia, Saudi Arabia, Slovakia, South Korea, Thailand, Turkey, United Kingdom and USA). The conference was organized into X sessions that included areas of Concrete, Materials, Transportations and other related disciplines. As it is the publication policy of the Institute, the papers presented in this conference will be considered for publication in one of the books of ATINER.

The Institute was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world could meet in Athens and exchange ideas on their research and consider the future developments of their fields of study. Our mission is to make ATHENS a place where academics and researchers from all over the world meet to discuss the developments of their discipline and present their work. To serve this purpose, conferences are organized along the lines of well established and well defined scientific disciplines. In addition, interdisciplinary conferences are also organized because they serve the mission statement of the Institute. Since 1995, ATINER has organized more than 150 international conferences and has published over 100 books. Academically, the Institute is organized into four research divisions and nineteen research units. Each research unit organizes at least one annual conference and undertakes various small and large research projects.

I would like to thank all the participants, the members of the organizing and academic committee and most importantly the administration staff of ATINER for putting this conference together.

Gregory T. Papanikos
President

FINAL CONFERENCE PROGRAM
4th Annual International Conference on Civil Engineering, 26-29 May 2014, Athens, Greece
PROGRAM
Conference Venue: Titania Hotel (52 Panepistimiou Avenue)

ORGANIZING AND SCIENTIFIC COMMITTEE

1. Dr. Gregory T. Papanikos, President, ATINER.
2. Dr. Panagiotis Petratos, Vice-President of Information Communications Technology, ATINER & Fellow, Institution of Engineering and Technology & Professor, Department of Computer Information Systems, California State University, Stanislaus, USA.
3. Dr. George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.
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7. Dr. Howayda Al-Harithy, Professor, American University of Beirut, Lebanon.
8. Dr. Patrick Ashton, Associate Professor, Indiana University Purdue University Fort Wayne, USA.
9. Dr. Debnath Bhattacharyya, Professor, MPCTM, Gwalior, India.
10. Dr. Stella B. Bondi, Associate Professor, Old Dominion University, USA.
11. Dr. Matthew Kubik, Associate Professor, Indiana University Purdue University Fort Wayne, USA.
12. Dr. Virginia Sisiopiku, Associate Professor, The University of Alabama at Birmingham, USA.
13. Dr. Ioannis Zisis, Assistant Professor, Florida International University, USA.
14. Dr. Tanuja Bandivadekar, Associate Professor, Sardar Patel College of Engineering, India.
15. Dr. Caterina Pizanias, Instructor, University of Calgary, Canada.
16. Mr. Moamer Gashoot, Researcher, Bournemouth University, UK.
17. Mr. Vasilis Charalampopoulos, Researcher, ATINER & Ph.D. Student, University of Stirling, U.K.

Administration

Fani Balaska, Stavroula Kiritsi, Konstantinos Manolidis, Katerina Maraki, Celia Sakka, Konstantinos Spiropoulos & Ioanna Trafali

CONFERENCE PROGRAM

Monday 26 May 2014

08:00-08:45 Registration

08:45-09:00 Welcome and Opening Remarks

- Dr. Gregory T. Papanikos, President, ATINER.
- Dr. George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.
- Dr. Panagiotis Petratos, Vice-President of Information Communications Technology, ATINER & Fellow, Institution of Engineering and Technology & Professor, Department of Computer Information Systems, California State University, Stanislaus, USA.

09:00-10:30 Session I (Room D): Concrete I

Chair: Panagiotis Petratos, Vice-President of Information Communications Technology, ATINER & Fellow, Institution of Engineering and Technology & Professor, Department of Computer Information Systems, California State University, Stanislaus, USA.

1. *Juan Carlos Arteaga-Arcos, Professor, Autonomy University of Estado at Mexico, Mexico, Melissa Maria Monroy-Hernández, Student, Autonomy University of Estado at Mexico, Mexico, Lorena Romero-Salazar, Professor, Autonomy University of Estado at Mexico, Mexico & Reza Mirsham, Professor, University of North Texas, USA. Determination of Elastic Properties on Seven Different Mexican Composite Portland Cements by Atomic Force Microscopy Nanoindentation.
2. Sabaratnam Prathapan, Associate Professor, Charles Darwin Uni Anita Pettit University, Australia & Junxi Wu, Associate Professor, Charles Darwin Uni Anita Pettit University, Australia. Reinforced Concrete Design. Comparative Study of Australian and Chinese Standards.
3. Tanuja Bandivadekar, Associate Professor, Sardar Patel College, India. Comparison of Use of Metakaolin and Micro Silica for High Strength, High Performance Concrete.
4. Filippo Sangiorgio, PhD Candidate, Polytechnic of Torino, Italy, Johan Silfwerbrand, Professor, KTH Royal Institute of Technology, Italy & Giuseppe Mancini, Professor, Polytechnic of Torino, Italy. Assessment of the ACI- DAfStb Database of Shear Tests on Slender Reinforced Concrete Beams without Stirrups for Investigations on the Shear Capacity Scatter.
5. Alexis Borderon, Specialist, Architect & Engineer School of Architecture, Italy. Simple Concrete Life Extension.

10:30-12:00 Session II (Room D): Concrete II

Chair: Juan Carlos Arteaga-Arcos, Professor, Autonomy University of Estado at Mexico, Mexico.

1. Galal Fares, Assistant Professor, King Saud University, Saudi Arabia, Abdullrahman Alhozaimy, Professor, King Saud University, Saudi Arabia, Abdulaziz Al-Negheimish, Professor, King Saud University, Saudi Arabia & Omer Abdalla Alawad, Researcher Engineer, King Saud University, Saudi Arabia. Effect of Powdered Scoria Rocks on the Fresh and Hardened Properties of High Performance Concrete. (Monday 26 of May).
2. Borvorn Israngkura Na Ayudhya, Assistant Professor, Rajamangala University, Thailand. A Study of Mechanical Strength of Concrete Mixed Cotton Dust Ash as Replacement of Ordinary Portland Cement. (Monday, 26 of May, morning).

12:00-13:00 Lunch (details during registration)

13:00-14:30 Session III (Room D): Materials
Chair: Galal Fares, Assistant Professor, King Saud University, Saudi Arabia.

1. Vedat Ziya Dogan, Associate Professor, Istanbul Technical University, Turkey, Gokay Simitcioglu, Graduated Student, Istanbul Technical University, Turkey & Neslihan Genckal, Undergraduate Student, , Istanbul Technical University, Turkey. Vibration Analysis of the FGM Beams under Moving Load.
2. *Issam Tawk, Assistant Professor, University of Balamand, Lebanon, Jihad Rishmany, Assistant Professor, University of Balamand, Lebanon & Antoine Gergess, Professor, University of Balamand, Lebanon. Assessment of Residual Stresses due to Cold Bending Structural Steel Girders using Finite Element Modeling.
3. Vladimir Lysenko, Leading Scientist, Russian Academy of Sciences, Russia, Vyacheslav Mali, Leading Scientist, Russian Academy of Sciences, Russia & Alexander Anisimov, Leading Scientist, Russian Academy of Sciences, Russia. Microhardness of Ceramics Obtained by Different Methods from Nanopowders of Different Oxides.
4. Andres-Felipe Torres-Franco, Master Student, University of Valle, Colombia, Nancy Vasquez-Sarria, PhD Student, University of Valle, Colombia & Jenny-Alexandra Rodriguez-Victoria, Professor, University of Valle, Colombia. Performance of a Contact Stabilization Activated Sludge Modification for Carbon and Nitrogen Removal.

14:30-16:00 Session IV (Room D): Bridge Engineering: Design and Rehabilitation
Chair: Issam Tawk, Assistant Professor, University of Balamand, Lebanon.

1. Amde Amde, Professor, University of Maryland, USA, Jhunyawhatt Thaanasarttayawibul, Senior Structural Engineering Manager, TCC Land Company Limited, Thailand & Andreas Paraschos, Senior Structural Engineer, New York City, USA. Effects of Bridge Length and Span Variations in Curved Integral Abutment Bridges.
2. Cini Ambika, Assistant Executive Engineer, Public Works Department, Government of Kerala, India & Mohamed Sherin C.P., Design Engineer Sree Giri Consultant, India. Edathuruthu Bridge: A Novel Art of Concrete.
3. Iralda Xhaferaj, Lecturer, Building Structures and Transport Infrastructures Department, Albania & Idlir Dervishi, Lecturer, Building Structures and Transport Infrastructures Department, Albania. Assessment and Proposal Structural Repair Strategies for Damaged Bridges in Velipoja.
4. *Hamid Reza Ebrahimi Motlagh, Amirkabir University of Technology, Iran & Alireza Rahai, Professor, Amirkabir University of Technology, Iran. The Effect of Supplemental Elastic Stiffness on Reduction in Superstructure Displacements in Seismic Isolated Bridges under Near-Field Earthquakes.

16:00-17:30 Session V (Room D): Wind and Seismic Response of Structural Systems on Buildings and Other Structures
Chair: Amde Amde, Professor, University of Maryland, USA.

1. Carlos Alberto Bermudez Mejia, Professor, National University of Colombia, Colombia, Alex Horia Barbat Barbat, Professor, Politecnica University of Catalunya, Spain, Luis Gonzaga Pujades Beneit, Professor, Politecnica University of Catalunya, Spain & Jorge Eduardo Hurtado Gomez, Professor, National University of Colombia, Colombia. Stochastic Methods Apply to the Study of Seismic Vulnerability of Steel Structures.
2. Chikara Iihoshi, Visiting Academic, University of Canterbury, New Zealand & Takayuki Minagawa. Seismic Shear Response of Diaphragms of Buildings.

3. Suleyman Bahadir Yuksel, Associate Professor, Selcuk University, Turkey. Experimental Behavior of Rectangular Shear Walls Subjected to Low Axial Loads.
4. Ahmed El-Sayed, Assistant Professor, King Saud University, Saudi Arabia, Raja Hussain, Assistant Professor, King Saud University, Saudi Arabia & Ahmed Shuraim, Professor, King Saud University, Saudi Arabia. Shear Behavior of RC Slender Beams with Corrosion-Damaged Stirrups.
5. Roberto Gomez, Researcher, Institute of Engineering, Mexico. Structural Verification of the Response of a Slender Structure/ Monument under Wind and Seismic Forces.
6. Mohamadi Saddika, Doctoral Student/Doctor Assistant, Laboratory of PublicWorks, Algeria, Tounsia Boudina, Doctoral Student, Laboratory of Public Works, Algeria & Ahcene Seridi, Director of Laboratory, Laboratory of Mechanics of Systems and Solids, Algeria. Estimation of Local Site Effects and Establishing of Site Specific Response Spectrum for Contribution to Microzonation Studies of Boumedes City.

21:00–23:00 Greek Night (Details during registration)

Tuesday 27 May 2014

08:30-10:00 Session VI (Room D): Concrete III

Chair: Mbakisya Onyango, Assistant Professor, University of Tennessee at Chattanooga, USA.

1. Jin-Woong Choi, PhD Student, Sung Kyun Kwan University, South Korea, Soon-Won Kang, Master's Course, Sung Kyun Kwan University, South Korea, Ji-Eun Jung, Assistant Manager, Sung Kyun Kwan University, South Korea & Sun-Kyu Park, Professor, Sung Kyun Kwan University, South Korea. Mechanical Behaviour of the Bond Strength between Polymer Concrete and Concrete Deck.
2. Raid Daud, PhD Candidate, University of Manchester, UK, Lee Cunningham, Lecturer, University of Manchester, UK & Yong Wang, Professor, University of Manchester, UK. Non-Linear FE Modeling of CFRP-Strengthened RC Slabs under Cyclic Loading.
3. Nabi Goudarzi, PhD Candidate, University of Alberta, Canada, Michael Hatzinikolas, President, Fero Corporation, Canada & Yasser Korany, Associate Professor, University of Alberta, Canada. Out-of-Plane Behaviour of Precast Concrete Sandwich Wall Panel Cladding Systems.
4. Mohammad Hasan Meisami, Assistant Professor, University of Shahid Ashrafi Esfahani, Iran & Davood Mostofinejad, Professor, Isfahan University of Technology, Iran. Punching Shear Strengthening of Two-Way Flat Slabs with CFRP Grids.
5. Salah Khalfallah, Researcher, Jijel University, Algeria. Tension Stiffening Approach in Concrete of Tensioned Members.

10:00-11:30 Session VII (Room D): Transportation Systems

Chair: Thomas Ng, Professor, The University of Hong Kong, Hong Kong.

1. Rozalia Melania Boitor, PhD, Technical University of Cluj-Napoca, Romania & Mihai Iliescu, Professor, Technical University of Cluj-Napoca, Romania. Mobility Study in Cluj-Napoca Metropolitan Area.
2. Martin Hromadka, PhD, University of Zilina, Slovakia. Construction of Hydrant Fuelling System in Relation to the Airport Size.
3. Linda Cerna Vydrova, PhD Student, Czech Technical University in Prague, Czech Republic. Comparison of Tunnelling Methods NATM and ADECO-RS.
4. Mbakisya Onyango, Assistant Professor, University of Tennessee at Chattanooga, USA, Trisha Sen, Engineer in Training, Missouri Department of Transportation,

USA, Ignatius Fomunung, Associate Professor, University of Tennessee at Chattanooga, USA & Joseph Owino, Associate Professor, University of Tennessee at Chattanooga, USA. Evaluation of Treatment Choice, User Cost and Fuel Consumption of Two Roadways in Hamilton County Using Hdm-4. (Tuesday, 27 of May).

11:30-13:00 Session VIII (Room D): Processes and Methodologies
Chair: Alaa Salman, Lecturer, Misurata University, Libya.

1. Thomas Ng, Professor, The University of Hong Kong, Hong Kong, Kevin Lomas, Professor, Loughborough University, UK & Dennis Loveday, Professor, Loughborough University, UK. A Case-Based Sustainable Refurbishment Framework for Multi-Storey Residential Buildings.
2. Ioannis Zisis, Assistant Professor, Florida International University, USA. Towards Codification of Wind Loads on Buildings and Building Components Using the Wall of Wind Hurricane Simulator.
3. Juan Alejandro Vazquez Feijoo, Lecturer, The Regional Interdisciplinary Center, Mexico. Comparison of Interferometry Techniques of Identification of Structures of Solid Media.
4. Anita Meldrum, Senior Lecturer, Glasgow Caledonian University, UK. Using on-Line Testing for Civil Engineering Studies.

13:00-14:00 Lunch (Details during registration)

14:00-15:30 Session IX (Room D): General Issues
Chair: George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.

1. Alaa Salman, Lecturer, Misurata University, Libya. Risk Assessment Model for Buried Infrastructure Utilities. (Tuesday, 27 of May, last session).
2. Mohammed Nazief, PhD Candidate &Teaching and Research Assistant, University of Alberta, Canada & Yasser Korany, Associate Professor, University of Alberta, Canada. Finite Element Modelling Technique for Masonry Infill Shear Walls with and Without Openings.
3. Youcef Tamene, Lecturer, University of Batna, Algeria & Said Abboudi, Professor,Technologic University of Belfort-Montbeliard, France. Numerical and Economical Study of Thermal Insulation in Multilayer's Walls Exposed to Real Climatic Conditions.

15:30-17:00 Session X (Room D): Materials
Chair: Thomas Attard, Head, Civil Engineering Research Unit, ATINER & Associate Research Professor, Arizona State University, USA.

1. Hae-Kyun Lee, Master's Course, Sung Kyun Kwan University, South Korea, Bum-Jin Han, Assistant Manager, Samsung C&T Corporation, South Korea, Jin-Woong Choi, PhD Student, Sung Kyun Kwan University, South Korea, Sun-Kyu Park, Professor, Sung Kyun Kwan University, South Korea. Influence of Pavement Designs on Fatigue Stress in Orthotropic Steel Deck.
2. Zhen-Hua Xie, Professor, University of Science and Technology Beijing, China, Bing-Bing Fan, Student, University of Science and Technology Beijing, China & Dong Yang, Student, University of Science and Technology Beijing, China. Grey Correlation Analysis on Sensitive Formation of Open-Pit Slope Based on FLAC3D.
3. Nassereddine Attari, Senior Lecturer, School of Architecture and Urbanism, Algeria. Conventional Repair and Rehabilitation Techniques in the Old Medina of Algiers.

17:30-20:30 Urban Walk (Details during registration)
21:00-22:00 Dinner (Details during registration)
Wednesday 28 May 2014
Cruise: (Details during registration)
Thursday 29 May 2014
Delphi Visit: (Details during registration)

Cini Ambika
Assistant Executive Engineer, Public Works Department, Government of Kerala, India
&
Mohamed Sherin
C.P. Design Engineer, Sree Giri Consultant, India

Edathuruthu Bridge: A Novel Art of Concrete

The Edathuruthu- Cable stayed Bridge - "A Novel Bridge in Concrete" is located in the Alappad Panchayath of Kollam District in Kerala State of India. The Alappad Panchayath is a narrow strip of land between the Arabian Sea in the West and Thiruvanathapuram-Shornur Canal (TS Canal) on the East. Alappad Panchayath of Kollam District in Kerala came to be known to the World after the devastating Tsunami waves that hit the West Coast of India on 26th of December 2004. Loss of 145 lives during the devastation of the Tsunami was attributed mainly to the absence of Bridges across the TS Canal providing escape routes to secure places. Edathuruthu is an isolated Island in the Alappad Panchayath of Kollam District. Government of Kerala decided to construct a bridge to provide accessibility to the inhabitants of the Edathuruthu Island under the special package of Tsunami Rehabilitation Programm. Fig.1 shows the Edathuruthu Bridge which was completed and opened for traffic in February 2013. This bridge is aesthetically beautiful and structurally durable with single span length of 52.00m and with vertical clearance of 5.00m for facilitating the navigation. This bridge is an arch shaped suspension bridge with pre-stressed cables anchored from the top of pylon of height 16.00m. The accompanying paper is an attempt by the authors to put on record the technical and the constructional aspects, which have resulted in the completion of the Edathuruthu Bridge with very limited facility, a novelty in bridge construction. Even though the construction involved high technical complexities requiring highly skilled labour, the work could be successfully completed within the stipulated time without using any sophisticated machineries and equipments. This was the real merit of this construction. Technical and Administrative decisions should be taken on merit and based on the available technology after proper analysis. By taking bold decisions by the higher officials of the department this bridge has seen the light of the day. In the state of Kerala this is the first concrete cable stayed suspension bridge. The bridge has been successfully completed without conflicts and maintaining perfect 'Harmony' during the execution. As a time bound project, team of officers who start the project should be made to

complete the same to ensure continuity of command, accountability, efficiency and satisfaction of the team. The adoption and adaption of the latest technology will definitely expedite completion as achieved in Edathuruthu Bridge.

Amde Amde
Professor, University of Maryland, USA
Jhunyawhatt Thaanasarttayawibul
Senior Structural Engineering Manager, TCC Land Company Limited, Thailand
&
Andreas Paraschos
Senior Structural Engineer, New York City, USA

Effects of Bridge Length and Span Variations in Curved Integral Abutment Bridges

This paper presents the results of a parametric study that focuses on the effects of bridge length and span variations on the maximum stress intensity (stress concentration) in the piles of horizontally-curved steel I-girder integral abutment bridges. Over 1,700 three-dimensional nonlinear finite element models with bridge lengths up to 365 m were analyzed as part of this study. The results indicate that the stress concentration in the piles increases with increasing bridge length and reaches its maximum value at a certain bridge length. Beyond that bridge length, pile stress concentration decreases despite increase in bridge length. This represents a difference in behavior compared to straight integral abutment bridges where the pile stress concentration always increases with increasing bridge length. The study also indicates that curved integral abutment bridges of smaller radius have a larger pile stress intensity reduction due to increased number of spans compared to curved integral abutment bridges of larger radius.

Juan Carlos Arteaga-Arcos
Professor, University Autónoma del Estado of México, Mexico
Melissa Maria Monroy-Hernández
Student, University Autónoma del Estado of México, Mexico
Lorena Romero-Salazar
Professor, University Autónoma del Estado of México, Mexico
&
Reza Mirsham
Professor, University of North Texas, USA

Determination of Elastic Properties on Seven Different Mexican Composite Portland Cements by Atomic Force Microscopy Nanoindentation

Atomic Force Microscopy based naoindentation was conducted in a sample of seven different Mexican Composite Portland Cements paste at 28 days curing. The most important mechanical property determined by this characterization technique was the Modulus of elasticity of the different cement products of hydration (mainly C-S-H and Portlandite), using load versus distance curve fitting. At least two types of C-H-S were identified by nanoindentation measurements. A statistical analysis of the information was performed and the variation of the different identified amounts of C-S-H was empirically correlated against the chemical composition of each cement sample studied.

Nassereddine Attari
Senior Lecturer, School of Architecture and Urbanism, Algeria

Conventional Repair and Rehabilitation Techniques in the Old Medina of Algiers

Repair and upgrading represent safeguarding and protective actions for damaged buildings in general, particularly in seismic risk zones such as the North of Algeria. In this sense, building having historical and monumental values should be repaired and upgraded without taking into consideration the cost factor. The damages are essentially those resulting from the aging, the over use, the climatic wear, the absence of adequate maintenance and the repetition of natural seismic hazards.

Most of the damages in masonry walls are induced by shear forces and tensile forces and are thus essentially shear-tension failure, though, crushing of masonry under excessive compression forces is also recurrent in the old medina of Algiers. Shear and tension forces provoke tearing actions at the masonry joints; the mortar being very weak towards these actions, particularly in the absence of tie beams in the old masonry. The presence of ties in wood inside the masonry walls may not be sufficient enough against higher tensile and shearing forces. In effect, in the cases of shear forces resulting from earthquakes, these tearing actions are very important, particularly in the case of aging building material, poor quality workmanship or incompatibility of different building materials. The repair and strengthening of damaged masonry walls depends on the importance of the cracks in terms of width and extent. It may consist of injecting a bonding material, replacing partially or totally a wall, using a caging technique or carrying out a steel confining technique as detailed below.

Tanuja Bandivadekar
Associate Professor, Sardar Patel College, India

Comparison of Use of Metakaolin and Micro Silica for High Strength, High Performance Concrete

HPC is expensive to manufacture as it requires greater quantity of cement, use of special admixtures like super plasticizers to improve workability and high quality aggregates. Mineral binders, like fly ash, GGBS and Silica fumes (micro silica) have been in use longer, in an effort to reduce cost and improve strength and durability of concrete. Metakaolin is recently gaining popularity as a substitute for micro silica. However, with the increasing popularity of Green Buildings and Environment Friendly construction practices, alternatives to micro silica are being researched as it is not a very Environment Friendly Material. High Reactivity Metakaolin (HRM) has been found to be a viable alternative as it is available abundantly, is cheaper to produce and is more Environment Friendly while giving similar if not better performance. In India total estimated availability of Kaolin is approximately 2596 Tonnes along with calcining waste of paper sludge. In the present study two samples of Matakaolin are compared with micro silica for M100 grade of concrete. Mehta-Aitcin Method of mix design is used. For proper material gradation fly ash is also used. Various tests are carried out on Metakaolin sample like mineral composition, particle size distribution, thermal analysis, Lime reactivity test to understand its behaviour. The tests on concrete cubes include Compressive strength, ISAT, RCPT, DIN1048(Water Permeability).The test results show that Metakaolin gives high early strength by 17.0 % as compared to micro silica. Percentage strength gain of Metakaolin reduces after 7th day but the strength gain is comparable at 28 days. For the same mix design micro silica gives better strength at 28th day. On durability criteria both materials give high resistance for chloride penetration and resistance to water absorption. But performance of micro silica on durability is better than Metakaolin. In conclusion use of environment friendly Metakaolin in place of micro-silica can be considered provided proper control on calcination of kaolin can be exercised.

Carlos Alberto Bermudez Mejia
Professor, National University of Colombia, Colombia,
Alex Horia Barbat Barbat
Professor, Politecnica University of Catalunya, Spain
Luis Gonzaga Pujades Beneit
Professor, Politecnica University of Catalunya, Spain
&
Jorge Eduardo Hurtado Gomez
Professor, National University of Colombia, Colombia

Stochastic Methods Apply to the Study of Seismic Vulnerability of Steel Structures

This research focuses on seismic vulnerability of steel buildings. Using stochastic methods the seismic vulnerability of both, moment resistance frames and braced frames are studied and their results are compared with each other. Input random variables employed were: peak ground acceleration (PGA), cross sectional area (A), moment of inertia (I), specified minimum yield stress of the type of steel being used (Fy), Modulus of elasticity of steel (E), dead load factor (D), and live load factor (L). The Force-Deformation Relations for Steel Elements or Components of FEMA 356 were used. Output variables studied were: Tension rupture of the anchor rods, Yielding in the gross section of tension members, Flexural buckling, Flexural yielding, Shear yielding, Buckling in members subject to bending and axial compression, and Interstory drift index.

Rozalia Melania Boitor
PhD., Technical University of Cluj-Napoca, Romania
&
Mihai Iliescu
Prof., Technical University of Cluj-Napoca, Romania

Mobility Study in Cluj-Napoca Metropolitan Area

The urban mobility studies require a laborious process. The Romanian urban centres, which do not have any recent mobility studies may be excused to some extent on the account of the subject's complexity on one hand, and on the account of the large number of tasks involved, on the other. In the present context, when an increased need to improve the urban mobility arose, the authorities face a multitude of deficiencies in resolving the problem. In this paper, following the finish guidelines of integrated urban planning, the mobility study of Cluj-Napoca metropolitan area is going to be conducted. In the very beginning of the mobility assessment process, the data collection task is presented under a new form of an integrated methodology. Thus, we conclude that the lack of knowledge we face at this moment from the urban mobility perspective, could be overcame in the future for the more liveable and sustainable urban centres in Romania.

Alexis Borderon
Specialist, Architect & Engineer School of Architecture, Italy

Simple Concrete Life Extension

Concrete life is submitted to the influence of climate and time. Much is done to design mix to ensure the durability of concrete, as well as preventing its collapse through the use of many different coating solutions. Every process insitu is manual and therefore subject to failure. Those errors will demand maintenance in time to prevent concrete disintegration.

Using stainless steel reinforcement on exposed zones secure extended lifetime and no maintenance, as corrosion is no longer an issue. The simplicity of this solution is obvious thus very much unfamiliar to most engineers as knowledge and references they do not access. By eliminating all risks of corrosion on the bearing structure, the success of the construction does no longer depend on the skills of the people involved.

Many solutions are today available to increase service life, although none can ensure durability without maintenance nor can be executed and produced by any contractor. All these solutions require skills when stainless steel don´t: It can be processed as regular mild steel.

Simple concrete life extension is a pragmatic guideline based on leading engineers design methods to achieve durability and therefore sustainability of the structures, meeting their clients wishes to reduce maintenance costs over time.

Jin-Woong Choi
PhD Student, Sung Kyun Kwan University, South Korea
Soon-WonKang
Master's Course, Sung Kyun Kwan University, South Korea
Ji-Eun Jung
Assistant Manager, Sung Kyun Kwan University, South Korea
&
Sun-Kyu Park
Professor, Sung Kyun Kwan University, South Korea

Mechanical Behaviour of the Bond Strength between Polymer Concrete and Concrete Deck

Recently, thin polymer concrete overlay for bridge decks have been widely used in civil engineering. However, the problems associated with bond between structural elements are not yet fully solved. In consequence, lots of researchers have been proposing tests and reach better agreement for design purposes.

In this study, the polysulfide epoxy polymer concrete was selected as a thin bridge deck overlay, and the effect of polymer concrete pavement on the bond performance of the concrete deck was analyzed through the comparative analysis with the specimen applied the prominent L-type wire with concrete deck and scratched to the longitudinal direction with concrete deck. The direct double shear tests by using the method of push-out were used to estimate the bond performance. Because launching and sudden braking of the vehicle affected the slip of pavement in the thin bridge deck overlay.

The results of this study showed that the specimen applied the prominent L-type wire was higher maximum relative slip of the deck plate than the general concrete deck specimen, but there was no significant difference on the bond stress. And the specimen scratched to the longitudinal direction with concrete deck showed higher performance on both the maximum relative slip and bond stress than the general deck specimen.

Raid Daud
PhD Candidate, University of Manchester, UK
Lecturer, Alnahrain University
(Higher Committee for Education Development)/Iraq
Lee Cunningham
Lecturer, University of Manchester, UK
&
Yong Wang
Professor, University of Manchester, UK

Non-Linear FE Modeling of CFRP-Strengthened RC Slabs under Cyclic Loading

The nonlinear behaviour of an adhesive layer connecting carbon fibre reinforced polymer (CFRP) to reinforced concrete one way slabs is numerically simulated in the current study. This investigation is aimed at developing as well as validating a three-dimensional finite element model. Numerical results have been compared with those obtained from an earlier experimental study. The FE model was then subjected to the modified fatigue load protocol recommended by FEMA 461. A detailed and accurate 3D FE model of the composite one-way slab was developed using ABAQUS software. A non-linear damage plasticity model is considered for modelling the concrete, and the FE model accounted for the nonlinearity of the concrete under cyclic loading by estimating the stiffness degradation in the concrete for both compression and tension effects. A surface cohesive based model was used to describe the interaction between the CFRP and the concrete slab. For the steel reinforcement, the Bauschinger effect was adopted through the application of the Kinematic Hardening model under cyclic loading. The FE model was then validated by comparing numerical and experimental values for load-deflection, load-strain in CFRP and load-strain in embedded steel reinforcement. Furthermore, the strain profile of CFRP, slip at interface in monotonic and cyclic loading, and both reduction in the ultimate load and stiffness due to cyclic loading were observed in this study.

Iralda Xhaferaj
Lecturer, Building Structures and Transport infrastructures Department, Albania
&
Idlir Dervishi
Lecturer, Building Structures and Transport infrastructures Department, Albania

Assessment and proposal structural repair strategies for damaged bridges in Velipoja

Velipoja is considered a seismic region in Albania. In the past years, due to the mountainous landscape and presence of several rivers, in the region of Velipoja has been built different bridges. The maintenance of them has been insignificant compared to their needs. The recent earthquakes, environmental effects and vehicle loads have damaged the bridges and prompting the need for repairing and strengthening their structure. Replacement with new structures raises financial and technical problems. Rehabilitation of existing bridge is one of the most important actual problem . The main purpose of these paper is to examinate the existing structure and to develop design strategies to make the structure as insensitive as possible to the unknown charachteristic of the input seismic excitation. The most common technique implemented has been steel jacketing, concrete jackets or composite materials jackets. Fiber-reinforced (FRP) composite materials have been used for external strengthening of concrete structural components. This paper presents some retrofit practices and details used in Velipoja region bridges.

Vedat Ziya Dogan
Associate Professor, Istanbul Technical University, Turkey
Gokay Simitcioglu
Graduated Student, Istanbul Technical University, Turkey
&
Neslihan Genckal
Undergraduate Student, Istanbul Technical University, Turkey

Vibration Analysis of the FGM Beams under Moving Load

In this study, the displacement responses of the Functionally Graded Materials (FGM) beam, which is made of Aluminum-Ceramic mixture, are investigated under moving load which has a constant velocity. The material properties of the functionally graded beam are assumed to be graded in the thickness direction only according to the power-law-distribution in terms of the volume fractions of the constituents. The temperature dependency of material properties of constitutes of the FGM beam is considered. The uniform temperature rise throughout the beam is presumed. Different beam boundary combinations (SS, Fixed, Free) are considered in the analysis. Response of the beam which is solely made of aluminum is studied in order to validate the study. A finite element explicit code, LS-DYNA, is used in order to simulate the cases and their results are compared with the analytical solutions. Parametric studies will be conducted to investigate the effect of moving load speed, mixture index, temperature and boundary conditions.

Hamid Reza Ebrahimi Motlagh
Amirkabir university of technology, Iran
&
Alireza Rahai
Professor, Amirkabir university of technology, Iran

The Effect of Supplemental Elastic Stiffness on Reduction in Superstructure Displacements in Seismic Isolated Bridges under Near-Field Earthquakes

The use of seismic isolators such as Lead Rubber Bearings in bridges can considerably contribute to the reduction in forces acting on the substructure, especially in the event of near-field strong earthquakes. However, relatively large superstructure displacements necessitate the use of special expansion joints with larger dimensions at the end of bridge and also larger seats width on the piers. This research aimed to study the effect of using additional elastic stiffness in Seismic Isolated Bridges (SIB) to reduce superstructure displacements by keeping the substructure forces in the reasonable ranges. To this end, an elastomeric bearing was installed as a sample conventional Supplement Elastic Devices (SED) in parallel with seismic isolators in the space between the superstructure and substructure of a typical bridge. In order to evaluate seismic performance and compare of seismic behavior of systems, non-linear dynamic time history analyses were performed on the models of bridge using strong near-field records. Results indicated the positive effect of the application of SEDs to decrease the isolator displacements by keeping forces of substructure in control ranges in structures with seismic isolators. Moreover, by controlling the superstructure displacements and substructure forces simultaneously, the more appropriate piers may be used with smaller seats width.

Ahmed El-Sayed
Assistant professor, King Saud University, Saudi Arabia
Raja Hussain
Assistant professor, King Saud University, Saudi Arabia
&
Ahmed Shuraim
Professor, King Saud University, Saudi Arabia

Shear Behavior of RC Slender Beams with Corrosion-Damaged Stirrups

This paper presents experimental data and results on the shear behavior and strength of slender reinforced concrete (RC) beams with corroded steel stirrups. A total of nine RC beams were constructed and tested up to failure. The test beams were 200 mm wide, 350 mm deep, and 2800 mm long. The beams were tested in four-point bending under a simply supported span of 2400 mm. The shear span to depth ratio was kept constant at 3.0 for all beams. Six beams had the embedded stirrups subjected to accelerated corrosion prior to structural testing. The test variables were the corrosion damage level and the stirrup spacing. The test results indicated that the corroded beams exhibited reduced shear strength in comparison to the uncorroded control specimens. The reduction in shear strength was found to be greater at smaller stirrup spacing.

Galal Fares
Assistant Professor, College of Engineering, King Saud University, Saudi Arabia
Abdullrahman Alhozaimy
Professor, College of Engineering, King Saud University, Saudi Arabia
Abdulaziz Al-Negheimish
Professor, College of Engineering, King Saud University, Saudi Arabia
&
Omer Abdalla Alawad
Researcher Engineer, College of Engineering, King Saud University, Saudi Arabia

Effect of Powdered Scoria Rocks on the Fresh and Hardened Properties of High Performance Concrete

In the Arabian Peninsula, concrete structures are exposed to deterioration process initiated by the harsh environmental conditions. To overcome this process, the use of pozzolanic materials which are known to reduce the rate of concrete deterioration becomes mandatory. In the Arabian Peninsula region, traditional pozzolanic materials are not only unavailable but are also expensive to import. However, in this region, there is a large area of deposits (approximately 90,000 km2) of scoria rocks (SR) located along the east of the Red Sea. In the current study, the powdered SR is proposed for the use as a local natural pozzolan. The effect of different replacement levels of SR (by cement weight) on the fresh and hardened properties of high performance concrete (HPC) is investigated. The results have shown that the replacement level of 20% SR can be considered as the optimum content. HPC mixes containing the optimum SR content have shown a better performance on the mechanical and microstructural levels. The microstructural analysis using dual beam FESEM has revealed that the presence of SR in HPC mixes leads to the formation of advanced C-S-H of geo-polymeric structures. It is then recommended to use SR as a non-traditional local pozzolanic material in concrete which saves not only cement but also reduces the green-house gas emissions in the Arabian Peninsula.

Roberto Gomez
Researcher, Institute of Engineering, Mexico

Structural Verification of the Response of a Slender Structure/ Monument under Wind and Seismic Forces

Structural engineering studies developed to provide a technical opinion on the safety of a new slender structure/monument built to commemorate the bicentennial of Mexican independence are presented. The monument is a tower type structure of 105.7 m above the ground and 117.6 m, measured from the foundation where the main eight circular columns are anchored. The monument is located in a high seismicity area of Mexico City.

Previous studies and projects carried out by different companies are verified, as well as the suitability of the design criteria and analysis procedures used for the study of the structure regarding the effects of wind and earthquake forces; corresponding numerical studies are carried out as well. Analyses carried out to explore the potential and limitations of a tuned mass system (TMD) installed in the monument to mitigate the response due to the turbulent wind and seismic forces are also presented. In the light of the results of the studies and revisions, further studies are recommended. Finally, a diagnosis on the structural safety of the monument and its components is provided.

Nabi Goudarzi
PhD Candidate, University of Alberta, Canada
Michael Hatzinikolas
President, Fero Corporation, Canada
&
Yasser Korany
Associate Professor, University of Alberta, Canada

Out-of-Plane Behaviour of Precast Concrete Sandwich Wall Panel Cladding Systems

Owing to their high durability and speed of construction, the use of Precast Concrete Sandwich Wall Panels (PCSWP) as cladding systems is rapidly growing in North America. These panels resist primarily their own- weight and transverse loads, mainly wind pressure. The strength and stiffness of the shear connectors that are used to transfer the axial and shear forces between the concrete layers of these panels determine the level of composite behavior of the panel under out-of-plane loading. In this paper, a review of the behaviour of PCSWP constructed using different types of shear connectors is presented. The analytical models that have been proposed by other researchers for the evaluation of the composite action between the concrete layers of PCSWP are discussed. A recently developed PCSWP cladding system built using Z-shape steel plate shear connectors is introduced. Since steel plate shear connectors have not been used before in PCSWP construction, two full-size prototypes were cast and tested under out-of-plane loading for the initial assessment of the impact of the steel plate connectors on the composite action of the panels. The experimental results were compared to predictions from the available analytical models and the approach outlined in the Canadian concrete design standard, CSA A23.3.

The test results of this pilot investigation demonstrated that steel plate shear connectors are highly efficient in transferring shear force and limiting shear deformation between the concrete layers of PCSWP. Based on these promising results, a large scale experimental program is currently underway at the University of Alberta to fully investigate the effect of these connectors.

Martin Hromadka
PhD., University of Zilina, Slovakia

Construction of Hydrant Fuelling System in relation to the Airport Size

Airport engineering covers wide range of systems as the airport environment provides the platform for a variety of interdisciplinary processes. One of them is aircraft refuelling. It is one of the most complex processes of airport's everyday operations. Smaller airports use fuel trucks meanwhile medium-sized and big airports operate dedicated underground fuel hydrant system. Even though there are various studies covering the problem of hydrant systems, nowhere is said from what airport size it is convenient to build the hydrant system. Especially at airports with density of operation around ten million passengers per annum, it is sometimes difficult to decide between fuel truck and hydrant system. Thus, this paper draws a recommendation from what airport size the installation of such systems could be efficient. Various meanings of term airport size are assessed, e.g. scale of operations (number of aircraft movements, number of passengers handled), airport design (distances between stands and fuel trucks' filling platform), stands number, fuel throughput, hydrant system building costs, aircraft size, its range and fuel consumption etc. Based on the assessment of all factors, the term "airport size" is defined in relation to the aircraft fuelling operations. In order to draw any recommendation, the sufficient dataset must be gathered. Data was collected through the survey and case studies of airports selected as reference. Some relevant airports were also willing to provide necessary data on hydrant system investment and operation costs. The suitable methodology for assessing all mentioned airport characteristics is set. Finally, the recommendation is drawn to fill up a blank in airport engineering system design issues.

Chikara Iihoshi
Visiting Academic, University of Canterbury, New Zealand
&
Takayuki Minagawa
University of Canterbury, New Zealand

Seismic Shear Response of Diaphragms of Buildings

Common concrete structures have concrete floor/roof diaphragms without lateral brace members underneath, as well as steel deck diaphragms with steel frame. Diaphragms must resist lateral forces in buildings as well as vertical loads due to gravity and vertical response during earthquakes. These lateral forces developed in the plane of the diaphragm by earthquakes mainly consist of inertial forces due to mass tributary in the diaphragm and forces transferred from one vertical element of the seismic force-resisting system to another. These forces have been investigated respectively. However investigation into a combination of them had hardly been conducted. Diaphragm seismic response in elastic range of behavior of structures has been investigated previously, nevertheless no research on the seismic shear response of elasto-plastic seismic force-resisting system considering inertial forces and in-plane eccentricity has been found to be reported yet. Diaphragm failure can cause buildings to collapse due to unexpected excessive lateral lords applied to vertical elements in the seismic force-resisting system. It is significant to clarify the seismic response of diaphragms in order to determine the design force for conservative structural design of buildings. The objective of this study is to obtain fundamental characteristics of diaphragm local shear response for the distributed mass system of single-story elasto-plastic structure considering in-plane eccentricity. A series of time history analysis revealed insight into basic trends in the seismic behaviors of the diaphragm of asymmetric elasto-plastic systems with distributed mass.

Borvorn Israngkura Na Ayudhya
Asst.Prof., Rajamangala U., Thailand

A Study of Mechanical Strength of Concrete Mixed Cotton Dust Ash as Replacement of Ordinary Portland Cement

This research was experimentally carried out to investigate the effects of partially replacing Ordinary Portland cement (OPC) with local additive Cotton Dust Ash (CDA). The mixtures were prepared with cementitious materials containing cotton dust ash at 5%, 10%, 15%, 20% and 25% cement replacement. CDA concrete was found to be workable with a slump value of 80-100 mm. The results of an experimental study on the compressive flexural and splitting tensile strength of concrete mixed cotton dust ash showed that the incorporation of CDA in concrete resulted in increase water and enhanced strength. However, The 20% cotton dust ash replacement of cementitious material was given the highest in strengths. As a result, cotton dust ash, is an adequate additive material that can be utilized for concrete structures.

Salah Khalfallah
Researcher, Jijel U., Algeria

Tension Stiffening Approach in Concrete of Tensioned Members

This paper presents an analytical model to calibrate the tension stiffening effect of tensile reinforced concrete members. The tension stiffening behaviour is a primordial task in reinforced concrete mechanic field. In this model, the stress-strain relationship of the tension stiffening effect described in the cracking range, is proposed. The applied of the analytical expression for tensile reinforced concrete member aims principally to quantify the tension stiffening phenomenon in the cracking range. In this concern, a parametrically study is established, which concerns the influence on the tension stiffening behaviour of concrete strength, reinforcement ratio, bar diameter and instantaneous properties of concrete. Obtained results relative to the influence of different parameters of the analysis are showed and commented.

Hae-Kyun Lee
Master's Course, Sung Kyun Kwan University, South Korea
Bum-Jin Han
Assistant Manager, Samsung C&T Corporation, South Korea
Jin-Woong Choi
PhD Student, Sung Kyun Kwan University, South Korea
Sun-Kyu Park
Professor, Sung Kyun Kwan University, South Korea

Influence of Pavement Designs on Fatigue Stress in Orthotropic Steel Deck

According to increasing demand on long-span bridges, bridges are getting longer and longer. In order to elongate the span of bridge to the maximum, efforts to reduce the self-weight of the bridge have been continued. As part of the effort, the orthotropic steel bridge decks are widely used in long-span bridges because of their light self-weight compared with concrete bridge. Also research and development of the ultra thin bridge deck overlay has been proceeded.

In this study, polysulfide epoxy polymer concrete was chosen as an ultra thin bridge deck overlay, and the effect of polymer concrete pavement on the fatigue stress range of the orthotropic steel deck was analyzed through the comparative analysis with epoxy asphalt pavement and steel fiber reinforced concrete(SFRC) pavement.

Comprehensive finite-element and load models were used to investigate pavement design influence on fatigue stress range, and signed von-mises stress was used to estimate fatigue stress range, considering there were multi axis stresses which have longitudinal and lateral direction on the welded parts of the steel deck.

The analyses results showed that the fatigue stress range in rib-to-deck(RD) joint was reduced when the thickness and elastic modulus of applied pavements increased. Finite element analysis (FEA) studies, which investigate the influence of pavements thickness and elastic modulus, are presented to pavement on possible design options that mitigate or minimize the fatigue stress of the orthotropic steel bridge deck.

Vladimir Lysenko
Leading Scientist, Russian Academy of Sciences, Russia
Vyacheslav Mali
Leading Scientist, Russian Academy of Sciences, Russia
&
Alexander Anisimov
Leading Scientist, Russian Academy of Sciences, Russia

Microhardness of Ceramics Obtained by Different Methods from Nanopowders of Different Oxides

With help of the method of the spark plasma sintering (SPS), the fine-grained (of micron approximately) ceramics based on various alumina nanopowders had created. A comparison of microhardness of ceramic samples obtained from 11 alumina nanopowders and 2 their composites was held. Microhardness of the ceramics obtained both by SPS, and by the traditional method (at successive pressing and sintering) is compared. The dependence of ceramics microhardness on the phase composition of the initial nanopowder and the average size of its particles was investigated.

Besides alumina nanopowders (Al2O3), there were compared microhardness of ceramics from other 10 nanopowders of oxides (SiO2, ZnO, Fe3O4, Gd2O3, CuO, WO3, TiO2, Y2O3, ZrO2, MgO) obtained both by SPS, and by the traditional method.

It is received that the microhardness of the ceramics created on the method of the spark plasma sintering, is significantly higher than a microhardness of the ceramics received by the traditional method (at consecutive pressing and sintering); at the SPS method the average size of grain in ceramics decreases (to 1 micron and less).

Mohammad Hasan Meisami
Assistant Professor, University of Shahid Ashrafi Esfahani, Iran
&
Davood Mostofinejad
Professor, Isfahan University of Technology, Iran

Punching Shear Strengthening of Two-Way Flat Slabs with CFRP Grids

The results of an experimental program on two-way flat slabs with central loading are presented. The slabs were designed according to the provisions of the ACI 318-08 code. One slab without any modification served as control while the experimental ones were strengthened with different FRP grid configurations including one with pre-cast and three with post-cast FRP strengtheners. For strengthening in each case, 8, 16, and 24 strengtheners were used. A method is also proposed for predicting maximum loading capacity in slabs strengthened with CFRP grids and with epoxy resin used in drilled holes. The results of the experiments show that the proposed strengthening method is not only capable of enhancing maximum loading and deformation capacities but also prevents brittle failures that may occur under vertical concentrated loadings. The dominant failure mode for flat slabs strengthened with FRP grids is found to be deboning of FRP grids due to the small slab depth. In addition to the increased shear capacity of the slab up to a reasonable value, this method of strengthening is capable of changing slab failure mode from shear to flexural.

Based on the results obtained from the limited experiments carried out in the current study, the following conclusions may be drawn:

Compared to the control slab, the strengthened slab with 24 FRP grids exhibited an increased shear capacity of 56% and a shear-flexural failure mode.

Increasing the number of FRP grids not only increased the shear capacity of the slabs but also changed their failure mode from a punching to a flexural one.

Punching shear capacity increased by 30% to 65% in the strengthened slabs compared to its value predicted from the relevant equations, which indicated that the results obtained were acceptable and that strengthening with FRP grids significantly increases the punching shear capacity.

And some more results.

Anita Meldrum
Senior Lecturer, Glasgow caledonian University, UK

Using On-line Testing for Civil Engineering Studies

The use of online resources in the assessment of engineering modules is generally being encouraged in HE institutions. This paper reflects upon the experience of open book testing of first year civil engineering students in two elements of assessment in a continuously assessed two semester long module. This mode of assessment is more convenient for the large percentage of part time students on the programme, who only attend one day per week. A longitudinal study over a four year period shows that not all students like to be assessed in this way, even though evidence indicates improvement in pass rates over those achieved from more traditional modes of testing.

Mohammed Nazief
PhD Candidate &Teaching and Research Assistant, University of Alberta, Canada
&
Yasser Korany
Associate Professor, University of Alberta, Canada

Finite Element Modelling Technique for Masonry Infill Shear Walls with and Without Openings

Numerical modelling of masonry infill walls is a challenging task due to the non-homogenous nature of masonry and the difficulty of accurate modelling of the interface between the masonry units and the interface between the masonry wall and the surrounding frame. To investigate the effect of the full range of influential parameters and their interactions on the behaviour of masonry infill shear walls, an effective finite element technique capable of predicting the whole lateral load-displacement response of masonry infilled frames is needed. In this paper, the details of an effective non-linear finite element technique that was developed for accurate modelling masonry infilled frames are discussed. The technique is based on the simplified micro-modelling approach. The models were built using ABAQUS, a commercially available finite element package. The concrete damaged plasticity model was used to describe the behaviour of both concrete frames and masonry infill walls. Steel behaviour was defined with an elasto-plastic material model for both steel frames and the reinforcing rebars of the concrete frames. Cohesive elements were used to model the interface between masonry units and between the masonry infill wall and the frame. The developed finite element technique was validated using available experimental results for nine (9) masonry infilled steel frames and eight (8) masonry infilled concrete frames. The experimental data included infilled frames ranging from full scale to 1/3 scale in size and covered both solid infill walls and walls with opening. Using the developed technique, the finite element models were able to capture the lateral load-displacement history of the infilled frames up to failure and accurately predicted the failure mechanisms of the infill walls: sliding shear, diagonal tension cracking, and corner crushing. This modelling technique is being used to study the effect of the most influential parameters on the behaviour of masonry infill walls.

Thomas Ng
Professor, The University of Hong Kong, Hong Kong
Kevin Lomas
Professor, Loughborough University, UK
&
Dennis Loveday
Professor, Loughborough University, UK

A Case-based Sustainable Refurbishment Framework for Multi-storey Residential Buildings

Improving the energy efficiency of existing buildings has been identified as one of the most effective strategies to reduce the carbon emissions as a high proportion of energy is consumed by building occupants. However, the biggest challenge is to persuade owners and occupants to take up sustainable actions as any refurbishment works would involve cost and may affect their daily life. A sustainable building refurbishment scheme may fail if it focuses purely on reducing carbon emissions without addressing the owner and occupants' concerns. The problem is aggravated when a building facility is occupied by different people as their perceptions and expectations could be quite different. If successful or failure experience can be made available to owners and/or occupants when sustainable refurbishment decision is made, the potential benefits and drawbacks of different sustainable refurbishment solutions can be compared to ensure any possible concerns are dealt with satisfactorily. Case-based reasoning which solves new problems by retrieving, comparing and reusing the experience of old cases in a collective manner offers a good potential for modelling the complex and dynamic interactions amongst the building condition, human expectations and emission reductions. In this paper, a case-based sustainable refurbishment framework for multi-storey residential buildings is proposed. The model consists of five modules namely input, data and knowledge, case-based reasoning, analytical, and output. The paper begins by identifying the characteristics of sustainable refurbishment for multi-storey residential buildings. The key considerations of sustainable refurbishment viz. emission reduction, life cycle costs and possible disruption are highlighted. It is then followed by an introduction of the case-based sustainable refurbishment framework for multi-storey buildings. The paper concludes by the implications of the proposed case-based sustainable refurbishment framework and the way forward.

Mbakisya Onyango
Assistant Professor, University of Tennessee at Chattanooga, USA
Trisha Sen
Engineer in Training, Missouri Department of Transportation, USA
Ignatius Fomunung
Associate Professor, University of Tennessee at Chattanooga, USA
&
Joseph Owino
Associate Professor, University of Tennessee at Chattanooga, USA

Evaluation Of Treatment Choice, User Cost And Fuel Consumption Of Two Roadways In Hamilton County Using Hdm-4

Lack of sufficient funding for infrastructure management is an issue in many State Departments of Transportation in USA. This leads to deteriorating infrastructure that calls for proper management of resources. Pavement Management System (PMS) has demonstrated to be an essential tool for proper management of infrastructure and proper utilization of available funds. Numerous software have been developed for this purpose.

The University of Tennessee at Chattanooga conducted a study that utilized HDM-4 software to determine the optimal utilization of available funds for Hamilton County in Tennessee using PMS. The software was used to assess the existing pavement conditions and predict future conditions of one state route and one interstate. Two pavement treatment options were assessed and results indicated that although micro-surfacing seemed to cost less, it does not necessarily improve all the distresses, while an overlay improves the roadway section significantly.

In this study, HDM-4 software was used not only to provide the cost-effective maintenance treatment needed for a particular section or funding optimization, but also to estimate fuel consumption for the vehicle fleet, and to calculate the road agency and road user costs. From this study, fuel consumption was found to be higher at peak hours due to reduced traffic speeds. The road user cost was higher on the state route than the interstate due to traffic signals and stop and go motion. The road agency cost for the state route is calculated to be about four times higher than the agency cost for the interstate.

Sabaratnam Prathapan
Associate Professor, Charles Darwin Uni Anita Pettit University, Australia
&
Junxi Wu
Associate Professor, Charles Darwin Uni Anita Pettit University, Australia

Reinforced Concrete Design. Comparative study of Australian and Chinese Standards

China has been developing fast during the last few decades. It has become important that their standards for design works are comparable to the international standard. In this study the Chinese code for design GB50010-2010 is compared to the Australian standard AS3600-2009. Australian standard has many similarities to codes adapted in the European countries. Both Australian and Chinese standards are based on Ultimate design methods. Procedures and equations used are different between the two standards. The paper will initially outline the basis on which both standards are developed.

In the case of design of concrete beams for a given concrete grade, dimensions and imposed point load, design procedures from both standards were employed to calculate the amount of reinforcement required. Imposed load was varied and for several different values the calculations were repeated to obtain enough design out comes for comparison. Reverse approach of knowing the amount of reinforcement the capacity of the beam in bending moment also calculated for several different values. Similar theoretical calculations were also conducted for ultimate shear failure and Serviceability failure of Deflection. In all the cases the variations in outcome are compared.

Practical experiments were conducted to compare factor of safety of practical values to that of theoretically calculated values. Several beams based on theoretical values were made and tested for actual strength of the beams in bending, shear and deflection. The paper will describe the methodology used for the practical testing and will outline the results obtained. Comparisons will be made with the theoretical values obtained using the Chinese standard and the Australian standard. Practical experiments also studied the cracking pattern and noted the cracking load and compared it with the theoretical failure load.

The paper will analyse all the different theoretical and experimental values obtained and will try to compare and find similarities and differences between the Chinese and Australian code. Out of the discussion the paper will outline some conclusions derived.

Saddika Mohamadi
Doctoral Student and Doctor Assistant, Laboratory of PublicWorks, Algeria
Tounsia Boudina
doctoral student, Laboratory of public Works, Algeria
&
Ahcene Seridi
Director of laboratory, Laboratory of Mechanics of Systems and Solids, Algeria

Estimation of Local Site Effects and Establishing of Site Specific Response Spectrum for Contribution to Microzonation Studies of Boumedes City

A destructive earthquake of magnitude M w = 6.8 hit the region of Boumerdes and Algiers (Algeria) on May 21, 2003. After the Boumerdes earthquake, Algerian Earthquake Code (RPA 1999) was revised and Boumerdes city was upgraded from zone II to zone III which leads to a substantial increase of the design ground motion parameters. Therefore, a comprehensive study is carried out to assess the seismic hazard of Boumerdes city taking into account the local site effects. The seismicity and seismotectonic details within a 250 km radius of the study area have been considered.

A comparative study between the one-dimensional ground response analyses was carried out for 6 representative sites by the equivalent linear method using the SHAKE2000 program and the two-dimensional non- linear ground response analysis using the Finite Element method (FEM) to estimate the ground motion parameters considering the local site effects and to specify the real behavior of soils of Boumerdes city under a seismic excitation.

The ground response is represented in terms of Peak Ground Acceleration at surface, Response Spectrum and amplification factor at each site. It is found that local site effects were the main reason for the collapse of several structures during the 2003 Boumerdes earthquake.

Alaa Salman
Lecturer, Misurata University, Libya
Abdul Qader Iqdoora
Civil Engineering Student, Misurata University,Libya
&
Salem Al Sageer
Civil Engineering Student, Misurata University, Libya

Risk Assessment Model for Buried Infrastructure Utilities

Developing a strategic plan of maintaining, rehabilitating or replacing buried infrastructure utilities is a complicated process. Municipal managers and engineers deal with huge number of these utilities, which have several constraints such as limited resources, time horizon, data accuracy and required level of service. To carry out the mentioned strategy, a risk assessment model can be used . This paper presents the risk assessment model as a (4 x 4) risk matrix of buried infrastructure utilities. The 16 cells are categorized into: 4 colors (1) green-low risk, (2) yellow-medium risk, (3) orange-high risk and (4) red-extreme risk. Consequently, a strategic plan can be demonstrated based on the risk category. The first dimension of the risk matrix is "CoF", which represents the evaluation of losses after failure; in terms of economical, operational, social and environmental issues. The second dimension is "PoF", which represents the condition assessment (CA) of a utility itself. The "CA" model is developed based on age, material, diameter and depth. A multi-criteria scoring model is used to determine the results of "PoF" and "CoF". Data from 135 pipe segments of sewer, which is located in Misurata-Libya, are used as inputs for the developed risk assessment model. Post processing of the model showed that more than 40% of these segments are orange and red. Therefore, urgent replacement plan should be performed for the next 5 years; otherwise sever consequences of failure will probably occur.

Filippo Sangiorgio
PhD Candidate, Polytechnic of Torino, Italy
Johan Silfwerbrand
Professor, KTH Royal Institute of Technology, Italy
&
Giuseppe Mancini
Professor, Polytechnic of Torino, Italy

Assessment of the ACI- DAfStb Database of Shear Tests on Slender Reinforced Concrete Beams without Stirrups for Investigations on the Shear Capacity Scatter

The shear transfer mechanism of RC slender members without stirrups still presents very high uncertainties and the question has generated many controversies and debates since the beginning of the last century. Regrettably, until now the real causes of this problem are not yet clear to the scientific community and the issue is still important to investigate, especially nowadays that the minimizing of natural resources is of uppermost global interest. Due to the increased costs of laboratory, actual studies are more and more often devoted to numerical simulations based on previous experiments. Unfortunately, to find test results suitable for investigations on the shear capacity scatter in the available specialized literature is extremely difficult. Therefore, the objective of this paper is to provide different adequate sets of reported test results containing tests performed on almost identical beams. The ACI-DAStb database of shear tests on slender reinforced concrete beams without stirrups is considered and analysed through the use of both multivariate statistical methods and clustering data mining techniques. The database was firstly visually explored by scatter plots and investigated through both univariate and correlation statistical procedures, and then processed by clustering using the k-means algorithm. Similar sets of data were collected in significant homogeneous groups of comparable experiments. Clusters containing less than six data sets were removed. The criteria to establish the rate of similarity between each set of data was chosen according to the JCSS Probabilistic Model Code. The study has led to the formation of 17 groups of comparable experiments each group containing a number of tests including between 6 and 31, performed for the most by different field workers. These groups of reported test results will be of great importance both for the continuation of the authors' research and for other researchers who investigate the causes of the shear failure scatter.

Youcef Tamene
LESEI, Department of Mechanics, University of Batna, Algeria
Said Abboudi
IRTES-M3M Laboratory, University of Technology of Belfort-Montbéliard, Sévenans, 90010 Belfort Cedex, France
&
C. Bougriou
LESEI, Department of Mechanics, University of Batna, Algeria

Numerical and Economical Study of Thermal Insulation in Multi-layer Wall Exposed to Real Climatic Conditions

Global warming is not currently disputed by the scientific community, according forecasts; earth may suffer a global warming of 1.8 C to 4 C by 2010, if no action to reduce greenhouse gas emissions is taken.

One area that consumes a lot of energy and contributes significantly to the proliferation of greenhouse gas emissions is the building. A decrease of the energy consummation in buildings, through improved insulation of walls will have consistent economical and environmental benefits.

In this work we present the results of numerical simulation of heat transfer through multilayer's walls (3 and 5 layers) consist of the usual building materials, brick, mortar, plaster and polystyrene.

The equation of the transient heat transfer was resolved numerically by using the finite differences method. We have analyzed the thermal behavior, taking into account the convective exchanges with the external environment.

The temperature of the outside air and the solar flux were approached with sinusoidal equations to be equal to those measured for Ouargla (Algeria) (attitude 31°57' N, longitude: 5° 20'E, altitude 123-315 m), in summer and winter.

An economic study was presented and a solution for a good thermal insulation at a lower cost has been proposed.

Issam Tawk
Assistant Professor, University of Balamand Lebanon
Jihad Rishmany
Assistant Professor, University of Balamand, Lebanon
&
Antoine Gergess
Professor, University of Balamand, Lebanon

Assessment of Residual Stresses due to Cold Bending Structural Steel Girders using Finite Element Modeling

Cold bending is sometimes used for curving structural steel girders for horizontally curved structures. Although the process is simple and cost effective, it is not widely adopted mainly due to the ambiguity in estimating residual stresses induced at the end of the bending process that could be relatively high. This paper focuses on assessing the magnitude of these residual stresses for a proprietary cold curving technique and on finding alternatives for minimizing their effects. For this purpose, a three-dimensional non-linear Finite Element model is developed for an IPE 600 standard symmetrical steel shape using shell elements and MSC-Simxpert software. In the finite element model, bending loads are applied at intervals along the girder length, starting at one end of the girder and moving to the other end and the curved shape develops as a series of short straight segments. The effect of varying some of the key parameters (e.g. magnitude of applied loads, loading sequence and spacing between end supports) on residual stresses is then investigated and recommendations are finally made for inducing practical ranges of curvatures with acceptable limits for residual stresses.

Andres-Felipe Torres-Franco
Master Student, University of Valle, Colombia
Nancy Vasquez-Sarria
PhD Student, University of Valle, Colombia
&
Jenny-Alexandra Rodriguez-Victoria
Professor, University of Valle, Colombia

Performance of a Contact Stabilization Activated Sludge Modification for Carbon and Nitrogen Removal

Past experiences with contact stabilization activated sludge system (CSAS) evidenced the occurrence of considerable nitrification and denitrification processes in the system. Considering such background, a modification of CSAS was evaluated in order to obtain high percentages of nitrogen removal. Both traditional contact CSAS (CSASC) and a modified CSAS (CSASM) were evaluated in a pilot-scale study, where domestic wastewater was treated.

The CSASM evaluated included an additional step to the CSAS system conformed by a second contact reactor (CR) and his settler (CR2 and SS2). Additionally, the stabilization reactor was divided into four compartments to optimize organic carbon and nitrogen removal. CSASC´s removal efficiencies of COD and TAN were respectively 94 ± 4 % and 53 ± 12%, whereas CSASM`s efficiencies were 89 ± 8% for COD and 84 ± 21% for TAN. Concentrations of TAN and NO3--N in the CSASC´s final effluent were 14,3 ± 5,2 and 5,0 ± 2,9 mg.L-1 and 9,0 ± 11,0 and 8,6 ± 5,5 mg.L-1 in the CSASM´s final effluent. Results demonstrated that the proposed configuration obtained higher nitrogen removal efficiencies than traditional CSAS without affecting organic carbon removal efficiencies.

Juan Alejandro Vazquez Feijoo
Lecturer, The regional interdisciplinary center, Mexico

Comparison of Interferometry Techniques of Identification of Structures of Solid Media

This paper presents an analysis of the interrelationship, advantages and disadvantages of the three principal interferometry techniques, i. e., cross-correlation, deconvolution, and cross-coherence.

The application is on a unidimensional case of a single layered medium.

By the analytical solution of a single stratified layer model is shown how the source signature produces an amplification effect on the Green´s function. This amplification is eliminated by further process that leads to deconvolution, from which a clear Green function is obtained. Though it is not always possible to obtain such a neat and confident Green´s function in all the practical cases, a normalized Green´s function may produce a more useful tool. This normalized Green´s function is obtained from the cross-coherence that results to be nothing more than a sign function of the Green´s. It is also demonstrated that the cross-coherence produced spurious signals at any point of the data where it is taken as multiples produces of a virtual frontier on the location in which the data is taken.

The mathematical model of this multiples are obtained and it is shown that the lower order of the harmonics produced are really related with the real signal.

Linda Cerna Vydrova
PhD Student, Czech Technical University in Prague, Czech Republic

Comparison of Tunnelling Methods NATM and ADECO-RS

New Austrian Tunnelling Method (NATM) has been used almost exclusively in the Czech Republic in the last three decades. This method has many supporters, whose resistance to new methods and approaches prevents the integration of other methods to the tunnelling industry in the Czech Republic. One of the methods thus neglected is the Italian method called ADECO-RS, which has reached significant use also outside Italy. It is a method of controlled deformation, which uses mainly the horizontal anchoring of the tunnel face to reinforce the area in front of the face (advance core). This technology is especially important in weak and soft rocks where it is necessary to excavate quickly and smoothly with minimum disruption of initial stress state of the rock mass in the vicinity of the excavation. It can be assumed that the use of NATM is in some cases uneconomical and technically inadequately challenging and in such cases it would be appropriate to choose another technology.

Given the facts above, in the Czech environment there is no data available for comparison of these methods not only in terms of numerical modelling, but also in terms of feasibility and usability.

The paper briefly summarizes the history of the tunnelling methods and it is closer devoted to NATM and ADECO-RS tunnelling approaches. The basic principles of both methods are set and further the comparison of these methods is made on a theoretical level and in terms of numerical modelling, which was performed in the program PLAXIS 3D-Tunnel.

The paper hereinafter includes the analysis of fibreglass face anchors application during the construction of three-aisled Veleslavín Station and the impact assessment of tunnel face anchoring during the excavation of ventilation tunnel on the newly built part of the Prague Metro „V.A“.

Zhen-hua Xie
Professor, University of Science and Technology Beijing, China
Bing-bing Fan
Student, University of Science and Technology Beijing, China
&
Dong Yang
Student, University of Science and Technology Beijing, China

Grey Correlation Analysis on Sensitive Formation of Open-Pit Slope Based on FLAC3D

In order to determine the key position of open-pit slope reinforcement and improve the efficiency of slope treatment and slope safety management, the concept of sensitive formation of slope stability is put forward. The stability of an open-pit slope which has 9 formations was analyzed using strength reduction method built-in FLAC3D. The impact on slope safety factor, position of potential slip surface and average node displacement of slide mass was got when weakening cohesion and internal friction angle. Using grey comprehensive correlation degree to evaluate the result, the sensitive formation was determined. The results show that the change of sensitive formation parameters has significant impact on factors which considered in research while other formations have little impact.

Suleyman Bahadir Yuksel
Assoc. Prof., Selcuk University, Turkey

Experimental Behavior of Rectangular Shear Walls Subjected to Low Axial Loads

The tunnel-form system has become a primary construction technique in building industry of Turkey as well as in many European countries. In these buildings, all the vertical load-carrying members are made of shear-walls, and floor system is flat plate. Both gravity and lateral loads are transferred to shear-walls. Despite their frequent applications, there is lack of experimental studies to understand the response of the shear walls of tunnel form buildings under extreme lateral loading conditions. In this study, experimental investigation on the inelastic seismic behavior of the shear walls of tunnel form buildings (i.e., box-type or panel systems) is presented. The test was carried out on full-scale rectangular shear wall specimen. The experimental program involves static testing of a shear wall subjected to low axial load under reversed cyclic lateral loading of shear wall specimen. The experimental results indicate that reinforced structural walls subjected to low axial load may exhibit brittle flexural failure under seismic action. This failure mechanism is of particular interest in emphasizing the mode of failure that is not routinely considered during seismic design of shear-wall dominant structural systems. This type of failure takes place due to rupturing of longitudinal reinforcement without crushing of concrete, therefore is of particular interest in emphasizing the mode of failure that is not routinely considered during seismic design of shear-wall dominant structural systems.

Ioannis Zisis
Assistant Professor, Florida International University, USA

Towards Codification of Wind Loads on Buildings and Building Components Using the Wall of Wind Hurricane Simulator

Wind engineering is a special field of engineering, which has as a scope to study the wind effects on buildings and other structures. Wind tunnel experiments and full-scale field monitoring formed the basis for the modern wind standards and building codes of practice. The most recent development in experimental wind engineering methods is the availability of large-scale facilities capable to simulate realistically and accurately extreme wind events. The International Hurricane Research Center at Florida International University recently inaugurated the 12-fan Wall of Wind (WOW) Hurricane Simulator which can generate Category 5 hurricane winds.

This paper will introduce the Wall of Wind facility and will present one of the most recent experimental efforts carried out in the WOW. The selected study deals with the wind-induced loads on canopy structures attached to low-rise buildings. Current knowledge regarding wind-induced pressures on attached canopies is restricted to a limited number of studies. As a result, most wind standards and codes of practice do not provide guidelines for the design of such components. This study aims at expanding current knowledge by providing a better understanding of the behavior of pressure coefficients acting on canopies.

Two canopy models have been fabricated and were attached at six different locations on a building model with a gable roof of 3:12 slope. The six configurations, as well as the location of pressure taps on both faces of the canopy allowed a detailed investigation of the different wind loading patterns exhibited as a function of the changes in the geometry of the canopy.

The experimental results indicate that changes in the geometry of the attached canopy can result in up to 60% difference on the peak pressures. It has also been noted that the most critical uplift forces occur in canopies located above the intermediate regions of the parent wall.