2015

Civil Engineering, Structural Engineering and Mechanics Abstracts

Fifth Annual International Conference on Civil Engineering, Structural Engineering and Mechanics
25-28 May 2015, Athens, Greece

Edited by Gregory T. Papanikos

THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Civil Engineering, Structural Engineering and Mechanics Abstracts

5th Annual International Conference on Civil Engineering, Structural Engineering and Mechanics

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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 *5th Annual International Conference on Civil Engineering, Structural engineering and Mechanics 25-28 May 2015,* organized by the Athens Institute for Education and Research. In total there were 33 papers and 35 presenters, coming from 14 different countries (Albania, Algeria, Brazil, Canada, Egypt, Germany, India, Iran, Italy, Mexico, Spain, Turkey, UK and USA). The conference was organized into nine sessions that included areas of Structural Dynamics & Mechanics, Construction Engineering, Earthquake Engineering, Pavement/Asphalt Engineering 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 and/or journals 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
5th Annual International Conference on Civil Engineering, Structural Engineering and Mechanics 25-28 May 2015, Athens, Greece

PROGRAM

Conference Venue: **Titania Hotel, 52 Panepistimiou Avenue, Athens, Greece**

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20. Dr. Roberto Gomez, Academic Member, ATINER & Associate Professor, Institute Of Engineering, UNAM, Mexico.
21. Dr. Raja Rizwan Hussain, Associate Professor, Civil Engineering Department, College of Engineering, King Saud University, Saudi Arabia.
22. Dr. Ali Massumi, Academic Member, ATINER & Associate Professor, Kharazmi University, Iran.
23. Dr. R. Edward Minchin Jr., Academic Member, ATINER & P.E., Rinker (Assoc.) Professor of Construction & Director of Masters Programs, Rinker School of Building Construction, University of Florida, USA.
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32. Dr. Farrukh Arif, Academic Member, ATINER & Lecturer, Department of Civil Engineering, NED University of Engineering & Technology, Karachi, Pakistan.
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38. Dr. Talakokula Visalakshi, Academic Member, ATINER & Programme Chair, B.Tech Civil Engineering, School of Civil & Mechanical Engineering, Galgotia's University, India.
39. Ms. Olga Gkounta, Researcher, ATINER.

Administration

Stavroula Kyritsi, Konstantinos Manolidis, Katerina Maraki & Kostas Spiropoulos

Monday 25 May 2015

(all sessions include 10 minutes break)

08:00-09:00 Registration and Refreshments

09:00-09:30 (ROOM F-MEZZANINE FLOOR) Welcome & Opening Remarks

- Dr. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, UK.
- Dr. George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.
- Dr. Thomas Attard, Head, Civil Engineering Research Unit, ATINER & Associate Professor, The University of Alabama at Birmingham, USA.

09:30-11:00 Session I (ROOM F-MEZZANINE FLOOR): Structural Engineering

Chair: George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.

1. Nuray Tokyay, Professor, Metu University, Turkey & Mehmet Mert Bulbul, MSc Student, Metu University, Turkey. Drag Characteristics of Historical Bridge Pier.
2. Lan Lin, Assistant Professor, Concordia University, Canada, Adel Hanna, Professor, Concordia University, Canada, Lucia Tirce, Assistant Professor, Concordia University, Canada & Anup Ainha, Postdoctoral Fellow, Concordia University, Canada. Performance of High-Rise Building Subjected to Excessive Differential Settlement of its Foundation.
3. *Fouad Mohammad, Senior Lecturer, Nottingham Trent University, U.K. & Dana A Seyan, MSc Student, Nottingham Trent University, U.K. Optimum Design of Reinforced Concrete Rectangular Columns Subjected to Axial Compression and Biaxal Bending Moments.
4. Komathi Murugan, Ph.D. Student, Indian Institute of Technology Madras, India & Amlan K. Sengupta, Professor, Indian Institute of Technology Madras, India. Investigation of Shear Strength and Interface of Columns Strengthened by Concrete Jacketing.

11:00-12:30 Session II (ROOM F-MEZZANINE FLOOR): Earthquake Engineering

Chair: *Fouad Mohammad, Senior Lecturer, Nottingham Trent University, U.K.

1. Saman Bagheri, Assistant Professor, University of Tabriz, Tabriz, Iran & Mostafa Farajian, Graduate Student, University of Tabriz, Tabriz, Iran. Seismic Response of Base Isolated Liquid Storage Tanks under Near Fault Ground Motions.
2. Ilker Kalkan, Assistant Professor, Kirikkale University, Turkey, Sabahattin Aykac, Associate Professor, Gazi University, Turkey, Eray Ozbek, Research Assistant, Gazi University, Turkey & Bengi Aykac, Teaching Assistant, Gazi University, Turkey. Influence of Strengthening the Infill Walls with Perforated Steel Plates on the Behavior of RC Frames.
3. Mohamed Omar Mohamed Hussein, Assistant Professor, Aswan University, Egypt. Effect of Chevron Bracing on Seismic Response of Cable-Stayed Bridge Steel Towers. (Monday, 25th of May 2015, Morning Session)

12:30-14:00 Session III (ROOM F-MEZZANINE FLOOR): Pavement/Asphalt Engineering

Chair: Thomas Attard, Head, Civil Engineering Research Unit, ATINER & Associate Professor, The University of Alabama at Birmingham, USA.

1. *Xiangming Zhou, Senior Lecturer, Brunel University London, U.K., Samira Safari,

MPhil Student, Brunel University London, U.K & Shakir Mahboob, BEng, Brunel University London, U.K. Towards Microwave Curing of Alkali Activated Cement Made from Fly Ash.

2. Mohamed Larbi Benmalek, Teacher and Researcher, University of 08 May 1945 Guelma, Algeria. Effects of Crushed Waste Aggregate from the Manufacture of Clay Bricks on Rendering Cement Mortar Performance.

14:00-15:00 Lunch

15:00-16:30 Session IV (ROOM F-MEZZANINE FLOOR): Geotechnical Engineering

Chair: *Xiangming Zhou, Senior Lecturer, Brunel University London, U.K

1. *Lazhar Belabed, Professor, University of Guelma, Algeria. Determination of Anchor Lengths by Retaining Walls.
2. Hacene Benyaghla, Lecturer, University of Guelma, Algeria & Lazhar Beladed, University of Guelma, Algeria. Influence of the Compressibility and the Dilatancy of the Soil on the Behavior of a Pile under Axial Loading by the Method of Limit Analysis. Theoretical and Experimental Approach.
3. Nahid Vatanpour, Ph.D. Candidate, Politecnico Di Milano, Italy & Laura Scesi, Professor, Politecnico Di Milano, Italy. Landslide Hazard and Vulnerability Risk Assessment. An Overview.
4. Talaat Abdel-Wahed, Assistant Professor, Sohag University, Egypt, Ayman Othman, Professor, Aswan University, Egypt & Naglaa Rashwan, Lecturer, Bani Sweef University, Egypt. Utilization of Waste Iron Slag on Hot Mix Asphalt Concrete Mixtures.

16:30-18:30 Session V (ROOM F-MEZZANINE FLOOR): Structural Mechanics and Other Essays

Chair: *Lazhar Belabed, Professor, University of Guelma, Algeria

1. Sergio Trajano Moreiras, Professor, Maringa State University, Brazil & Antenor Paraguassu, Professor, Sao Carlos Engineering School, Brazil. Non Adherent Building Systems: Granite Plates Structural Behavior.
2. Thomas Attard, Associate Professor, The University of Alabama at Birmingham, USA & Hongyu Zhou, Assistant Professor, University of Alabama in Huntsville, USA. Damage Absorption of High-Impact Structural Systems Using Time-Reaction of Hybridized Epoxy-Polyurea Interfaces.
3. Zahreddine Nafa, Associate Professor, 08 Mai 1945 University, Algeria & Nadjat Djerfaf, Ph.D. Student, 08 Mai 1945 University, Algeria. Effect of H_2SO_4 Solution on the Durability of High Performance Concrete Made with Local Crushed Sand.
4. Salah Khalfallah, Professor, Polytechnic National School of Constantine, Algeria. Effect of Soil Mechanical Properties on RC Wall System Responses.

21:00-23:00 Greek Night and Dinner (Details during registration)

Tuesday 26 May 2015

08:00-10:00 Session VI (ROOM F-MEZZANINE FLOOR): Structural Dynamics/Vibrations

Chair: *Waleed Thanoon, Professor and Dean, University of Nizwa, Oman.

1. Roberto Gomez, Associate Professor, Institute of Engineering, UNAM, Mexico, Raul Sanchez-Garcia, Research Assistant, Institute of Engineering, UNAM, Mexico, Adrian Pozos-Estrada, Assistant Professor, Institute of Engineering, UNAM, Mexico & Jose Alberto Escobar-Sanchez, Associate Professor, Institute of Engineering, UNAM, Mexico. Wind Turbulence Evaluation on a Terrace of a High Rise Building.
2. *Sabahattin Aykac, Associate Professor, Gazi University, Turkey, Eray Ozbek, Research Assistant, Gazi University, Turkey & Meryem Bocek, Research Assistant, Gazi University, Turkey. Strengthening of Reinforced Concrete Beams with Externally-Bonded Steel Plates.
3. Abdelmalek Abdelhamid, Researcher, National Center of Studies and Integrated Research on Building Engineering (CNERIB), Algeria. Floor Vibration Response Assessment under a Walking-Induced Excitation Force.
4. Naima Adjou, Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria, Naima Haddadou, Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria, Farid Belhamel, Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria & Malik Bouzoualegh, Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria. Complex Modes of a Non-Classical Damping Structure.
5. *Liling Cao, Senior Project Director, Thornton Tomasetti, USA, Lauren Millman, Senior Engineer, Thornton Tomasetti, USA, Alireza Kermani, Project Director, Thornton Tomasetti, USA, Ali Ashrafi, Senior Associate, Thornton Tomasetti, USA & Christopher Pinto, Vice President, Thornton Tomasetti, USA. Early Time Dynamic Shear Spike for Beams or Columns Due to Blast Loading.

10:00-11:30 Session VII (ROOM F-MEZZANINE FLOOR): Construction Engineering and Geodetic Applications

Chair: Ilker Kalkan, Assistant Professor, Kirikkale University, Turkey

1. Wilhelm Stelling, Vice President, Georg Agricola University of Applied Sciences, Germany. Deformation Measurements of an Industrial Monument with Laser Scanner.
2. *Samer Ezeldin, Professor and Chair of Construction and Architectural Engineering, The American University in Cairo, Egypt & Ahmed El Hady, Ph.D., The American University in Cairo, Egypt. Price Estimating for Non-serial Repetitive Projects.
3. Dennis Knese, Ph.D. Student, Frankfurt University of Applied Sciences, Germany. E-Mobility: New Challenges for Urban and Transport Planning.

11:30-13:00 Session VIII (ROOM F-MEZZANINE FLOOR): Advanced Structural Analytical Methods

Chair: *Samer Ezeldin, Professor and Chair of Construction and Architectural Engineering, The American University in Cairo, Egypt

1. *Jose Turmo, Professor, Universitat Politecnica de Catalunya, BarcelonaTECH, Spain, Jose Antonio Lozano Galant, Assistant Professor, University of Castilla-La Mancha, Spain & Dong Xu, Professor, Tongji University, China. Evolutive Construction of Cable Stayed Bridges. (Tuesday, 26th of May 2015)
2. Kanta Prajapat, Ph.D. Scholar, Indian Institute of Technology Kanpur, India & Samit Ray-Chaudhuri, Associate Professor, Indian Institute of Technology Kanpur, India. Damage Quantification in Civil Structures with Bayesian Approach along with a Comparison of Different Markov Chain Monte Carlo Algorithms. (Tuesday, 26th of May 2015)
3. Altin Bidaj, Lecturer, Polytechnic University of Tirana, Albania, Enkeleda Kokona, Ph.D. Student, Polytechnic University of Tirana, Albania & Helidon Kokona, Ph.D. Student, Institute of Earthquake Engineering and Engineering Seismology IZIIS, FYROM. Assessment of Mesh Size Refinement Influence on FEM Solution of Shear Wall Structural Systems. (Tuesday, 26th of May 2015)

13:00-14:30 Session IX (ROOM F-MEZZANINE FLOOR): Structural Composites and Materials Characterization

Chair: *Jose Turmo, Professor, Universitat Politecnica de Catalunya, BarcelonaTECH, Spain

1. *Waleed Thanoon, Professor and Dean, University of Nizwa, Oman. Micro and Macro Modelling for the Inelastic Behavior of rc Beam Strengthened with CFRP.
2. Claudia von Laar, Professor, Hochschule Wismar - University of Applied Sciences, Technology, Business and Design, Germany, Natalia Lesnych, Research Associate, Hochschule Wismar - University of Applied Sciences, Technology, Business and Design, Germany & Melanie Schomann, Research Associate and Laboratory Head, Hochschule Wismar - University of Applied Sciences, Technology, Business and Design, Germany. Multifunctional Anti-Graffiti-Systems.
3. Johannes Stahl, Research Assistant, Kaiserslautern University, Germany & Paul Ludwig Geiss, Professor, Kaiserslautern University, Germany. Surface Pre-Treatment of Batch-Galvanized Components for Adhesively Bonded Assemblies.
4. Naima Haddadou, Researcher, National Center of Studies and Integrated Research on Building Engineering (CNERIB), Algeria. Experimental Study of Steel Fiber Reinforced Self Compacting Concrete with Different Aspect Ratio and Mineral Addition.
5. Nassereddine Attari, Senior Lecturer, School of Architecture and Urbanism, Algeria. Strengthening of Defected Beam – Column Joints by Using FRP.

14:30-15:30 Lunch

15:30-18:00 Urban Walk (Details during registration)
20:30- 22:00 Dinner (Details during registration)

Wednesday 27 May 2015
Cruise: (Details during registration)

Thursday 28 May 2015
Delphi Visit: (Details during registration)

Talaat Abdel-Wahed
Assistant Professor, Sohag University, Egypt
Ayman Othman
Professor, Aswan University, Egypt
&
Naglaa Rashwan
Lecturer, Bani Sweef University, Egypt

Utilization of Waste Iron Slag on Hot Mix Asphalt Concrete Mixtures

The effect of using waste iron slag on the mechanical properties of hot mix asphalt concrete mixtures was intensively investigated within this research. Waste iron slag that is produced in steel factories as a byproduct was added to the asphalt mixture as a part of the fine aggregate. The studied mechanical properties include Marshall/stiffness, indirect tensile strength and unconfined compressive strength. The effect of iron slag content on the mechanical properties of the mixtures was also investigated. Four asphalt concrete mixtures with various iron slag contents, namely; 0%, 5%, 10% and 15% by weight of total mixture were studied. Laboratory testing has revealed an enhancement in the compressive strength of asphalt concrete mixtures when iron slag was used. Within the tested range of iron slag content, a considerable increase in the compressive strength of the mixtures was observed with the increase of slag content. No significant improvement on Marshall/stiffness and indirect tensile strength of the mixtures was observed when slag was used. Even so, iron slag can still be used in asphalt paving for environmental advantages.

Abdelmalek Abdelhamid
Researcher, National Center of Studies and Integrated Research on Building Engineering (CNERIB), Algeria

Floor Vibration Response Assessment under a Walking-Induced Excitation Force

Disturbing walking-induced vibrations have been observed more frequently in recent times on long span lightweight floor systems as evidenced by the development of a number of new design guidelines for floor vibration assessment. In this article, prediction of composite lightweight floor vibrating serviceability response, according to both stiffness and resonance considerations under a walking excitation force, is evaluated. Issus concerning floor dynamic characteristics, are shown and discussed, in order to elucidate there effects on the floor response. Results in term of natural frequency and maximum amplitude are also shown and compared with International Standards recommended values.

Naima Adjou
Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria
Naima Haddadou
Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria
Farid Belhamel
Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria
&
Malik Bouzoualegh
Researcher, National Center of Studies and Integrated Research on Building Engineering, Algeria

Complex Modes of a Non-Classical Damping Structure

The determination of a structure response subjected to a dynamic loading can be done by projecting this response on the base space formed by the real eigenmodes of the structure. That allows to decouple the system on N equations describing the movement of the structure with M independent modal equations. For undamped systems, the eigenmodes are exclusively real and determined only from the matrices of mass and stiffness. However, for many real structures, the base formed by the real eigenmodes of the system, determined from its own matrices of mass and stiffness, isn't always possible to decouple the equations of motion of this system. For such structures, the damping properties lead to a model told non-classical damping. The global damping matrix of many structures isn't simply related to its mass and stiffness matrices. Therefore, the damping properties influence directly on the vibration characteristics of these structures and it isn't, strictly speaking, possible to use a standard modal method. The evaluation of the dynamic response is then done by direct time integration. This kind of calculus, numerically very expensive, can be avoided by using the notion of complex eigenmodes.

The objective of this article is to highlight the influence of non-classical damping properties on the vibration characteristics of structures through a complex approach eigenmodes. This paper presents the standard method of calculation of the real modes and a approach in complex modes. The numerical application of these approaches on a non-classical damping structure was done by the MATLAB software. The results of investigation show that the difference between the real modes and complex modes isn't negligible.

Thomas Attard
Associate Professor, The University of Alabama at Birmingham, USA
&
Hongyu Zhou
Assistant Professor, University of Alabama in Huntsville, USA

Damage Absorption of High-Impact Structural Systems Using Time-Reaction of Hybridized Epoxy-Polyurea Interfaces

A carbon-fiber reinforced hybrid-polymeric matrix (CHMC) composite was developed for vibration suppression applications, where the hybrid matrix system was created by combining two polymeric compounds - the epoxy-based phase I which has highly crosslinked morphology and the lightly-crosslinked polyurea elastomeric phase II which when reacted with curing phase I, provides high damping and fracture toughness. The chemical reactions incurring the hybrid matrix system are discussed. The microstructures and micromechanical properties of CHMC are examined through scanning electron microscopy and nanoindentation. Dynamic properties of CHMC as well as conventional carbon-fiber reinforced epoxies are investigated using free vibration and randomly excited vibration tests, and test results indicate CHMC exhibits significantly greater damping than carbon-fiber/epoxy. The influence of two material processing parameters - the polyurea thickness h_p and elapsed curing time t_c of epoxy - on material damping is investigated. Generally, damping coefficients increase with greater h_p and smaller t_c.

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

Strengthening of Defected Beam – Column Joints by Using FRP

Devastating earthquakes in the last years have shown that non-engineered concrete frames are particularly vulnerable to seismic action and are a major cause of loss of lives. This structural type constitutes a large share of the building stock, both in developed and developing countries, and hence represents a substantial exposure. Direct observation of damaged structures, following the Boumerdes-Algiers 2003, earthquake, has shown that damage occurs usually at the beam-column joints, with failure in bending or shear, depending on geometry and reinforcement distribution and type.

While substantial literature exist for the design of concrete frame joints to withstand this type of failure, after the earthquake many structures were classified as slightly damaged and, being uneconomic to replace them, at least in the short term, suitable means of repairs of the beam column joint area are being studied. Furthermore there exist a large number of buildings that need retrofitting of the joints before the next earthquake.

The paper reports the results of cyclic tests carried out on cruciform beam-column joint specimens, with different configurations of geometry and various configuration of strengthening by externally bonded FRP fabric.

Sabahattin Aykac
Associate Professor, Gazi University, Turkey
Eray Ozbek
Research Assistant, Gazi University, Turkey
&
Meryem Bocek
Research Assistant, Gazi University, Turkey

Strengthening of Reinforced Concrete Beams with Externally-Bonded Steel Plates

Bonding steel plates to the tension face of a beam is a common technique used for strengthening reinforced concrete beams against flexure. Despite being efficient in increasing the load capacity of a beam, externally-bonded steel plates result in ductility problems in strengthened beams. The present study mainly aimed at developing a strengthening technique that provides a strengthened beam with significant ductility as well as the required load capacity. Four full-scale T-beams, including an unstrengthened reference beam, were subjected to four-point bending. A beam strengthened with epoxy-bonded tension plate, a beam with epoxy-bonded tension and compression plates and a beam with tension and compression plates without epoxy bonding were tested within the study. The tension and compression plates in all specimens were connected to the beam with the help of end plates (end collars). The strengthened beams reached yielding loads about 2.4-2.6 times the yielding load of the reference beam, ultimate loads about 2.3-2.6 times the respective value of the reference beam and modulus of toughness values about 100-150 % greater than that of the reference beam. The presence of the compression plate in addition to the tension plate resulted in considerable increase in the load capacity, ductility and modulus of toughness of the strengthened beam. The lack of epoxy bonding was found to lower the yielding load, while not altering the ultimate load of the strengthened beam. However, this ultimate load was reached by the beam without epoxy bonding after excessive deformations, unlike the beam with epoxy-bonded plates.

Saman Bagheri
Assistant Professor, University of Tabriz, Tabriz, Iran
&
Mostafa Farajian
Graduate Student, University of Tabriz, Tabriz, Iran

Seismic Response of Base Isolated Liquid Storage Tanks under Near Fault Ground Motions

Among different base isolation systems, Friction Pendulum System (FPS) whose period does not depend on the weight of the system is more appropriate for isolation of liquid storage tanks. In this paper, seismic behavior of base isolated cylindrical storage tanks using FPS is investigated under near fault ground motions. Such earthquake ground motions have long-period components that may affect the long-period sloshing motion of the liquid. For the required analyses, the liquid of the tank is modeled as three lumped masses known as convective mass, impulsive mass and rigid mass. The interaction between the fluid and the structure has been taken into account by connecting these masses to the tank wall with specific springs and dampers. Nonlinear time history analyses are carried out to investigate the effects of isolation period. The results obtained indicate that friction pendulum system reduces the response parameters of the base isolated tank in comparison with the fixed-base tank.

Lazhar Belabed
Professor, University of Guelma, Algeria

Determination of Anchor Lengths by Retaining Walls

The dimensioning of the anchored retaining walls requires always the analysis of their stability. The calculation of anchoring lengths is practically carried out according to the mechanical model suggested by Kranz which is often criticized. The safety is evaluated through the comparison of interior force and external force. The force of anchoring over the cut anchor length behind the failure solid is neglected. The failure surface cuts anchoring in the medium length of sealing. In this article, one proposes a new mechanical model which overcomes these disadvantages (simplifications) and gives interesting results. The investigation are carried out after the semi-probabilistically safety approach.

Mohamed Larbi Benmalek
Teacher and Researcher, University of 08 May 1945 Guelma, Algeria

Effects of Crushed Waste Aggregate from the Manufacture of Clay Bricks on Rendering Cement Mortar Performance

This communication reports an experimental work that aimed to investigate the effects of clay brick waste, as part of fine aggregate, on rendering clay brick waste. The brick, in crushed form, was from a local brick manufacturer that was rejected due to being of-standard. It was used to replace 33.33%, 50%, 66.66% and 100% by weight of the quarry sand in mortar. Effects of the brick replacement on the mortar key properties intended for plastering wall were investigated; these are workability, compressive strength, flexural strength, shrinkage, water absorption by total immersion and by capillary suction. The results showed that as the brick replacement level increased, the mortar workability reduced. The shrinkage increases over time and decreases with the introduction of brick waste. The compressive and flexural strengths decrease with the increase of brick waste because of their greater water absorption.

Hacene Benyaghla
Lecturer, University of Guelma, Algeria
&
Lazhar Beladed
University of Guelma, Algeria

Influence of the Compressibility and the Dilatancy of the Soil on the Behavior of a Pile under Axial Loading by the Method of Limit Analysis. Theoretical and Experimental Approach

The theoretical study, present here, deals with the problem of interaction pile soil, thus making a contribution in determining the resistance and friction edge side for a single stake sought by a charge axial static. The theoretical tool used is the theorem cinematic theory analysis limit, in the case of a material Coulomb, developing a model in three dimensions. The aim of this research is to determine the limit load massive breakdown by the model proposed using the computer code mathcad. The calculation program takes into account physical phenomena, ie the expansion and contraction of soil under a load static. The results, calculated by the proposed model are compared with experimental results made in the laboratory 3SR INPG Grenoble (France) and the results of conventional methods used in the calculations of this type of constructions. The results obtained by this method are smaller than the results obtained by conventional methods and are similar to results of the experiment that we can conclude that this theory can be applied to calculations of the edge effect and the effect of friction piles.

Liling Cao
Senior Project Director, Thornton Tomasetti, USA
Lauren Millman
Senior Engineer, Thornton Tomasetti, USA
Alireza Kermani
Project Director, Thornton Tomasetti, USA
Ali Ashrafi
Senior Associate, Thornton Tomasetti, USA
&
Christopher Pinto
Vice President, Thornton Tomasetti, USA

Early Time Dynamic Shear Spike for Beams or Columns Due to Blast Loading

Terrorist attacks have increased security demands significantly in big metropolitan cities around the globe. Failure of an individual column could trigger progressive collapse in an entire structure. Therefore not only new important structures are designed to accommodate different levels of explosions, which could be intentional or accidental, but also some of the existing infrastructures are re-analyzed and retrofitted against different levels of possible blast. Example of Buildings and infrastructures vulnerable to blast include densely populated commercial structures, governmental buildings such as embassies, financial institutions and landmarks.

Standards such as UFC are developed recently to analyze structural response to blast loads. Protecting against blast can sometime be very costly when utilizing conservative approximate methods currently used by engineering firms. Therefore, it is important for researchers and engineers to have a better understanding of blast analysis, so that more refined methods can be performed to obtain realistic demands on structures. This paper develops an analytical approach to obtain the early time dynamic shear spike for beams or columns. The peak shear from the proposed derivations is significantly less than the values based on single degree freedom formulation Such as Biggs' formulations which is widely used. The new approach is based on modal analysis considering all possible modes.

Samer Ezeldin
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Price Estimating for Non-serial Repetitive Projects

Organizing the bidding of a major construction program with non-serial repetitive projects remains a big challenge that faces construction practitioners. It encompasses a huge number of variables and scenarios that affect the decision while there is still a shortage of information and enormous pressure to speed up the bidding process. Infrastructure projects are examples of non-serial repetitive projects under a major program. These projects cost governments billions of dollars, so any savings in these costs would surely make a difference. In practice, the number of contracts and contractors per categories to be called for bidding on non-serial repetitive projects under a major construction program are often estimated based on intuition and experience. It may involve emotional reactions to existing surrounding conditions. Accordingly, the factors that form the possibly different scenarios should be properly quantified and analyzed. One of the important factors affecting such decision is the prices that could be offered by contractors from different categories. The reason that gives such factor this importance is that any developer or decision maker always seeks the possible least cost for a certain program.

This study introduces a novel approach that assist in the prediction of contractors' prices that could be applied for non-serial repetitive project under a major program in order to later assist in the decision of which category to be employed. The approach integrates, contactors' bidding behavior estimation through a dynamic and visualized database, simulation for behaviors, and fuzzy logic employment. A user-friendly prototype software Excel - based decision support system (DSS) operating in windows environment was developed based on the proposed approach to facilitate all the calculation and analysis processes. The proposed approach along with the DSS has been introduced to 47 construction experts to get their feedbacks through a structured questionnaire survey. The results of the experts' feedback revealed that the DSS is robust, reliable, and flexible with an overall high level of performance. The validation of the developed DSS was performed using a real case study obtained from the Irrigation Improvement Sector within the Ministry of Water Resources and

Irrigation in Egypt. The real case study is for 42 construction contracts under the program of Integrated Irrigation Improvement and Management Project. When the DSS was applied on the real case study, it generated acceptable outputs.

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Wind Turbulence Evaluation on a Terrace of a High Rise Building

In high-rise buildings with irregular geometry, the wind is one of the most important parameters to be considered in the architectural design of facades, terraces and other areas exposed to wind. The new terrace/lookout to be built at the 43th story of the WTC, in Mexico City may present a problem of comfort for visitors, since irregular and turbulent flow of the wind inside the terrace can cause inconveniences to visitors.

In this report the results of a numerical study is presented to evaluate the wind flow inside the area of the 43th story of the World Trade Center, including the new terrace. Results are presented for different velocities of incident wind and in representations of contours of the speeds generated. In the light of the results of the CFD computations, further studies are recommended. Finally, a diagnosis on the security and comfort of visitors is provided.

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Experimental Study of Steel Fiber Reinforced Self Compacting Concrete with Different Aspect Ratio and Mineral Addition

Self-compacting concrete (SCC) offers several economical and technical benefits, the use of steel fibers extends its possibilities. Steel fibers act as a bridge by retarding crack's propagation, and improve several characteristics and properties of self-compacting concrete. Steel Fibers affects significantly the workability of SCC. Therefore, this study was performed to compare the properties of self-compacting concrete (SCC) and fiber reinforced self-compacting concrete (FRSCC).

Seven FRSCC mixtures and one SCC were elaborated in this study. The content of the cementitious materials was maintained constant (500 kg/m^3), while the water/cementitious material ratio is kept constant at 0.34.The self-compacting mixtures had a cement replacement of 30% by weight of marble powder.

The variables studied were aspect ratio (0, 50, and 30) and percentage of volume fraction (0, 0.35 and 1) of steel fibers. Slump flow time and diameter, sieve stability, and L-Box were performed to assess the fresh properties of the (FRSCC) and SCC. Compressive strength, splitting tensile strength, flexural strength and ultrasonic pulse velocity of the FRSCC and SCC were determined for the hardened properties.

A marginal improvement in the ultimate strength was observed. The addition of fiber enhanced the ductility significantly. The optimum volume fraction (V) and aspect ratio (A) of fiber for better performance in terms of strength was found to be 0.8 percent and 30. The results indicated that high-volume of marble powder can be used to produce Steel fiber reinforced self-compacting concrete, even though there is some increase in the concrete strength because of the use of steel fiber and high-volume of mineral addition.

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Influence of Strengthening the Infill Walls with Perforated Steel Plates on the Behavior of RC Frames

Strengthening the non-bearing elements of a structure is a common seismic strengthening technique due to its various advantages. First, this technique increases the overall lateral strength and stiffness of the structure by providing the non-bearing elements, whose contribution to the earthquake behavior of the structure is generally ignored, with additional strength and stiffness. Secondly, this technique causes a major amount of the earthquake-induced energy to be absorbed by the nonbearing members and therefore reduces the risk of damage in the structural components (columns, beams, etc.). The present paper focuses on a number of experiments carried out within an extensive research program, investigating the influence of strengthening the brick infill walls of an RC frame with perforated steel plates on the seismic behavior of the frame. Perforated steel plates are adopted in strengthening due to their several advantages including but not limited to the great ductilities and deformation capacities of these plates, the fire resistant, recyclable and non-cancerogenic nature of steel and the ease of application of this technique thanks to the use of anchor bolts only. A total of 38 half-scale specimens, each composed of a strong foundation, two columns, a beam, and a brick wall, were and are going to be tested within the project. Thickness of the perforated plate, spacing of the anchor bolts, connection of the perforated plate to the columns and the axial load on the columns were chosen as the test parameters. The observations from previous experiments conducted on individual brick wall specimens under monotonic diagonal and lateral reversed loading were used for detailing the strengthening plates and the plate-wall connections. The tests conducted so far indicated that this strengthening technique contributes to the load capacity and ductility of the frame. Nevertheless, the low concrete strength and the low degree of confinement as a result of the widely-spaced stirrups in the

columns were found to reduce the efficiency of this wall strengthening technique. For this reason, the columns were decided to be jacketed with a steel cage, composed of angles and plates, and the beam-column connections to be strengthened with steel plates providing additional confinement to the connection. The column and joint strengthening provided significant improvement in the seismic behavior of the specimens.

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Effect of Soil Mechanical Properties on RC Wall System Responses

The mechanical behavior of reinforced concrete (RC) structures, which are directly in contact with soil, is absolutely affected by the interaction between the soil and the structure. A non-linear analysis of wall systems with flexible base foundations under monotonic loading is considered in this investigation. This work integrates the behavior of the soil to the structure one in view to obtain the response of the whole structure. The base fixed hypothesis doesn't reflect the global behavior of the entire system. This contribution is principally based on the finite element method adopted as a numerical approach to simulate inferentially the sub-structure and the soil media responses.

In addition, this work deals to study many parameters and its influence on the soil-structure interaction. Obtained results are shown and commented in the last section where many parameters having effect on soil-structure interaction are illustrated.

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Electromobility: New Challenges for Urban and Transport Planning

Cities in Europe underlie strict emission limits by the European Union. The transport sector accounts for a large share of pollutants. Electromobility combined with renewable energies can help to reduce the emissions and enhance the quality of life in cities. But to sustainably introduce electromobility within the existing mobility system cities have to shape the right circumstances.

Important questions address the establishment of (green) charging infrastructure combined with the right marking and design of parking lots as well as the generation of intermodal connecting points. But also electric bikes and scooters need a better infrastructure as they have a big potential for reducing traffic and land consumption in urban areas.

Some cities are implementing electromobility measures in their climate action plans or urban development strategies; others try to set legally binding regulations for real estate developers in land-use plans. The royal road hasn't been found up to the present moment. Also, a new constellation of actors makes it harder to achieve short-term goals. The more important it is to work strategically on the transition of the energy and mobility system likewise.

The aim should be to develop a sustainable concept for the implementation of electromobility in the planning of new building areas, conversion areas, and within existing structures. Intelligent mobility concepts have to be combined with innovative urban planning approaches.

The presentation will point out challenges and chances for cities which come along with the introduction of electromobility and renewable energies. It will also show some exemplary approaches of cities in Germany and from abroad and discuss possible strategies. The presentation is based on the findings of the PhD project by the author, working on the integration of electromobility into urban planning and street design.

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Assesment of Mesh Size Refinement Influence on FEM Solution of Shear Wall Structural Systems

This paper present FEM modelling through structural analyses code of a Reinforced Concrete Structure "4ever green" tower.

Structure is located in the center of Tirana, capital of Albania. The tower has 6 levels underground, (pit depth 26 m) and 24 levels above ground (height 95 m). The structural system applied is reinforced concrete, composed of coupled walls located in perimeter line and staircase shafts. So, the vertical and lateral forces are fully resisted by shear walls.

From structural point of view it's necessary to develop structural model in different type of mesh refinement to achieve better results, avoiding solution errors on stress-strain and deformation state over the structural elements.

The principal goal of this paper is to present case studies with respective results that's help to achieve realistic structural behaviour directly connected to mesh refinement applied.

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Performance of High-Rise Building Subjected to Excessive Differential Settlement of its Foundation

Foundation design necessitates two different studies: one dealing with the ultimate bearing capacity of the soil under the foundation; the second is concerned with the foundation settlements due to soil compressibility. The amount of settlement which a structure can undergo without distress is large, provided it is relatively uniform. However, based on the fact that the soil under the foundation may not be uniform in nature and the loads transferred from the superstructure to the foundation are variable, differential settlements between the foundation elements are expected. This differential movement of the foundation's elements will generate additional stresses in the members of the superstructure.

The current design is based on the assumption that stresses induced in the structure due to the differential settlement between its foundation's elements are tolerated by the factor of safety. The National Building Code of Canada (NBCC), the American Association of State Highway and Transportation Officials, and the American Concrete Institute have not incorporated these stresses as a design load. Therefore, these stresses remained unaccountable for during the design stage, which may jeopardizes the servicibality and the safety of these structures.

The objective of this study is to evaluate the stresses induced in a 10-storey reinforced concrete building subjected to settlement up to 75 mm assigned to its center column, which represents the most critical case for the structure. For the purpose of the study, a three-dimensional finite element model was developed using SAP2000. In order to take into account the nonlinearity of the structure, plastic hinges were assumed at the end sections of the beams. Nonlinear static pushover analysis was then conducted. The results showed that the building behaves elastically for the settlement up to 25 mm, beyond which significant inelastic response was observed. It is also observed that larger inelastic

deformation occurs on the lower floor than higher floor. The curvature ductility of the beam members due to the settlement was also examined, and it was compared with that due to the seismic load. Furthermore, the demand capacity ratio in terms of the curvature is calculated in order to assess the potential failure of the member resulting from the settlement. Based on the results of this study, recommendations are made on the incorporation the additional stresses due to the excessive settlement of the foundation for the design of buildings.

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Optimum Design of Reinforced Concrete Rectangular Columns Subjected to Axial Compression and Biaxal Bending Moments

This study investigates the optimum design in terms of minimum cost of reinforced concrete rectangular columns subjected to axial compression force and biaxial bending moments about x and y axes. For the optimisation process, the Generalised Reduced Gradient (GRG) technique was implemented which is embedded within Excel Solver add-in tool. GRG method was adopted because of its robustness and efficiency in dealing with a wide range of engineering problems as demonstrated by several works available in the literature. GRG is regarded as one of the best deterministic local optimization methods. Equally important, the GRG is part and parcel of Microsoft Excel which means that there is no need to pay for extra licence to run any optimisation problem. The formulated models for the design of reinforced concrete columns and the imposed constraints were based on the provisions of Eurocode 2 (EC2). The design variables were the cross sectional dimensions (width and depth) and reinforcing steel area. It is worthwhile to mention that the position and orientation of neutral axis was also considered as a design variable in order to avoid solving the highly nonlinear simultaneous equations which is time consuming and not necessarily leading to a convergent solution. Several design parameters, such as materials cost ratios and depth to width ratios were tested. Consequently, optimum design charts were developed for a wide range of practical combination of axial compression forces and eccentricities in both x and y directions. Following a comprehensive investigation of the minimum cost problems carried out for different cases, one can conclude that variation of (h/b) ratio may have noticeable effect on the optimum width, depth and area of steel only when the eccentricity in y direction (e_y) is much greater than the eccentricity in x direction (e_x). Furthermore, the effect of steel to concrete unit cost ratio (Cs/Cc) is more obvious at larger loads and higher eccentricities.

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Effect of Chevron Bracing on Seismic Response of Cable-Stayed Bridge Steel Towers

The towers of cable-stayed bridge are the primary load-bearing structures which transmit the bridge loads to the ground. A cantilever approach is often used to support the bridge deck near the towers, but lengths further from them are supported by cables running directly to the towers. By design all static horizontal forces of the cable-stayed bridge are balanced so that the supporting towers do not tend to tilt or slide, needing only to resist horizontal forces from the live loads such as seismic loads. In order to enhance the seismic behavior of these towers, more efficient bridge structural systems are developed. One of these design approaches is to brace the upper parts of the towers. The bracing system of the towers can resist the lateral forces of earthquake affecting the structure. In this paper, the influence of bracing system on seismic response of cable-stayed bridge steel tower is studied. In this study, the steel tower of Tappu cable-stayed bridge located in Hokkaido, Japan has been chosen as model of study. The steel tower, Fig. 1, is taken out of the bridge and modeled as three-dimensional frame structure. The proposed braced model is to brace the tower top by Chevron (V-type) bracing elements. The study based on comparison of the seismic response of the original un-braced tower and that of proposed braced tower. A nonlinear dynamic analysis program based on total Lagrangian formulation using linearized finite displacement theory and fiber model has been developed to be used in this study. The finite element procedure for the nonlinear time history analysis of the steel tower under seismic loading is set up. Geometric and material nonlinearities are implemented and bending-axial force interaction is considered. The evaluation of the proposed bracing system response was based on displacements at tower top and reactions at tower supports. The results show that the proposed chevron bracing system can enhance the seismic response of cable-stayed bridge steel tower. The proposed chevron bracing system, in this study, has the ability to reduce the tower top displacements and the tower base reactions as well.

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Non Adherent Building Systems: Granite Plates Structural Behavior

Bending tensile strength tests are commonly used in non-adherents covering systems design. Other structural properties which are important to evaluate the structural behavior of the "granite" plates, which are not evaluated in the usual projects, are the Young's modulus and Poisson's ratio. Therefore, to further the study of the structural behavior of the White Desiree "granite" plates the stress *versus* strain behaviors and respective Young's modulus were obtained in compressive and in bending tensile strength tests. Among the five Young's modulus obtained the mean value was of 42.90 GPa, the standard deviation of 3.52 GPa and coefficient of variation of 0.082. The results indicate good correlation between the five modules and ensure that, for safety factor three, the plates work within the elastic regime.

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Investigation of Shear Strength and Interface of Columns Strengthened by Concrete Jacketing

Existing reinforced concrete multistoreyed buildings can be deficient to resist the forces generated during an earthquake. Hence, there exists a need to strengthen such structures for future seismic events. In addition to global strengthening of a building, local strengthening of individual components may be necessary. The local retrofitting methods are concrete jacketing, steel jacketing and fiber reinforced polymer wrapping. The present study is on concrete jacketing of columns for enhancing the shear strength. The jacketing involves adding a layer of concrete with additional reinforcement. In comparison with the other modes of actions, the shear behavior of columns is abrupt, exhibiting brittle catastrophic failure. Most of the previous studies on concrete jacketing focused on altering the brittle shear behavior to a ductile flexural mode. However, the enhancement in strength and performance accomplished by such strengthening scheme was not quantified since the mode of failure was changed. This study aims to quantify the enhanced shear behavior through experimental investigations.

First 38 jacketed beam-column specimens were tested to study the parameters influencing shear strength such as compressive strength and thickness of the jacket concrete, amounts of additional longitudinal and transverse reinforcements and level of axial compression. The test results indicated good predictability of shear strength of jacketed sections using existing equations for monolithic sections appropriately. Second, several large jacketed column specimens are tested under monotonic and cyclic lateral loading, in the presence of constant axial compression. Three types of interfaces between the original column and added jacket such as surface roughening of the existing concrete, surface roughening with dowel bars and surface roughening with bent-up bars are explored. The jacket is cast with a special commercial micro-concrete. The original and jacketed specimens are designed to fail in shear so that the improvement in strength and performance after jacketing can be quantified. Details of the test procedure and test results along with some practical recommendations to carry out jacketing for shear, will be included in the paper.

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Effect of H_2SO_4 Solution on the Durability of High Performance Concrete Made with Local Crushed Sand

This work focuses on the valuation of local deposits rich in limestone. After a characterization of crushed sands product in Laghouat region careers (located in the south center of Algeria), we formulate High-performance concrete HSC compositions with variable limestone fines content than we study through some sustainability criteria the resistance to sulfuric acid H_2SO_4 of the proposed formulations. Ultrasonic study and x-ray diffraction is used to determine the physical and chemical characterization of concrete attacked by sulfuric acid H_2SO_4.

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Damage Quantification in Civil Structures with Bayesian Approach along with a Comparison of Different Markov Chain Monte Carlo Algorithms

Bayesian probabilistic approach has rapidly grown as a successful and promising technique in the field of structural dynamics including model updating, damage detection and damage quantification. Many algorithms have been developed so far for the evaluation of posterior integral involved in Bayesian approach for various applications. The efficiency and accuracy of these algorithms are sensitive to different factors and parameters involved in the problem. These are completeness/incompleteness of data used, noise present in the data, starting value of Markov Chain (MC), burning period of MC, multi modal nature of posterior integral, dimensionality of posterior integral and many more. The first part of this work presents a comparative study among a few popular algorithms used for the evaluation of Bayesian posterior integral involved in a typical structural model updating problem. The algorithms considered are Metropolis-Hasting Markov Chain Monte Carlo (MCMC), adaptive MCMC and Hamiltonian/hybrid MCMC. Results of this comparative study highlight the pros and cons of these algorithms when used under different situations. The latter part of this work presents a numerical study of damage quantification in a 12-storey shear building and a 16-storey moment-resisting frame. Based on the outcome of the comparative study, Hamiltonian MCMC is adopted here for damage quantification. Damage is defined as a reduction in stiffness of a few structural members. The structure is modeled with no damage (base structure) and (simulated) damaged conditions. Frequencies and mode shapes are evaluated for both damaged and undamaged conditions. The locations of damage are evaluated using mode shape curvature based approach. Frequencies and mode shapes of a few lower modes of the damaged structure are then used as the required data points in Bayesian framework. Damage quantification is done for different cases of (1) number of unknown parameters (2) noise present in the data and (3) number of data points used in the algorithm. Mean and variance of the posterior integral of all unknown parameters are evaluated and compared with the corresponding true values. Further, a mass

modification approach is also utilized to deal with the lack of appropriate data in defining the likelihood function of Bayesian approach. In this approach, some known masses are added to the structure to get more number of datasets (modal parameters). It has been observed from this study that both the approaches are reasonably efficient in quantifying the damage in the structures.

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Surface Pre-Treatment of Batch-Galvanized Components for Adhesively Bonded Assemblies

Approximately 6 million tons of steel are protected from corrosion by galvanization in Europe each year. Because of its good performance for at least several decades, a large variety of batch-galvanized components is used in the building and construction industry. A recently completed SME-related research project on "Hot-dip galvanizing for steel and composite bridges" shows up new fields of application in this sector. In the majority of cases batch-galvanized components are connected by bolting or welding. Due to that, the zinc coating is destroyed locally. Adhesive bonding therefore offers a promising alternative to improve the joining of batch-galvanized components in respect to their specific surface characteristics.

The strength of adhesively bonded joints depends on the cohesive strength as well as on the adhesion between adhesive and adherent. To provide reliable and durable bond the adherent surface has to be pre-treated before bonding. Suitable preparation methods for the terms of constructive industry must be chosen in respect to the specific surface characteristics of the zinc coating. Compared to the sweep blasting process pickling offers an economic operation method to pretreat batch-galvanized components.

Primarily, the composition of the zinc layer depends on the galvanizing parameters and the level of silicon in the steel alloy. To characterize the layered structure of batch-galvanized steel micro-grids were prepared. Based on the composition of zinc layer, ten pickling-solutions were applied by dipping or spraying on batch-galvanized specimen and compared using the wedge test according to EN 14444. Superposition of mechanical and climatic stress is characteristic for the wedge test and demonstrates the performance of the surface pre-treatment in combination with the engaged adhesives. Two pickling solutions based on the results of wedge test were selected to verify the durability of batch-galvanized adhesively bonded joints under exposure to standardized accelerated ageing conditions.

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Deformation Measurements of an Industrial Monument with Laser Scanner

For quite some time now, terrestrial laser scanners have provided significant support when comprehensive recording and documentation of most different objects are needed. Compared to other geodetic measuring methods laser scanners have one key advantage: after evaluating the data you immediately get a point cloud of real 3D coordinates. The density and resolution of the points as well as their accuracy can be assessed during pre-planning, depending on the object and the desired result the position of the survey points can be defined. If several survey points are needed to measure an object, the individual scans have be tied via reference points. The number of tie points of two scans has to be at least three which have to be well spread across space. Here, the scan environment gains significance with regard to solar radiation, surface structure and movements within the scan field. One focus should be the accurate functionality of the measuring equipment (calibration). While the measurement usually can be done in a few hours, the time needed for the evaluation has to be defined as five to ten times higher.

The actual scan record is preceded by a highly precise geodetic 3D identification of the tie points (geo-referencing) which does not automatically require an adjustment to the national survey. Scans done to examine deformations require the evidence of unchanged control points (usually tie points) in follow-up measurements. Those can be evidenced using adjustment software based on statistics. If it can be ensured that the control points of two measuring periods to be compared have not changed their positions, the point clouds can be compared. For this purpose it makes sense to transfer them to a software product that is independent of laser scanners, for example, AutoCAD made by Autodesk. This software can now be used to carry out point analyses, for example. 2D and 3D models can be created and, in addition, any kind of sectional views or direct distance measurements of arbitrary or identical points can be conducted for the two measuring periods to be compared. Due to the experience gained the laser scanner Faro Focus 3D-S 120 is suitable for use in a measuring range of up to 30 m distance and 10 m height where it will deliver accuracies of point positions of $\sigma P = 3$ mm. Thus at a significance level of 2σ changes in object points > 10 mm can be evidenced.

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Micro and Macro Modelling for the Inelastic Behavior of rc Beam Strengthened with CFRP

The study describes a numerical approach used to investigate the non-linear behaviour of reinforced concrete beam strengthened with CFRP strip bonded on its soffit. Stiffness method was implemented for the analysis to predict the structural response of the composite beam in elastic as well as inelastic range of loading. The composite beam is divided into a sufficient number of different length segments (macro model). The cross sectional area of the composite beam is also divided into a sufficient number of layers to model different materials used in the beam (micro model). The inelastic stiffness of the beam is obtained by predicting the actual strain-stress distribution along the depth of the member using incremental-iterative approach. Based on the converged strain distribution along the cross section of different member segments, new flexural and axial stiffness are evaluated for each segment and used to assemble a new stiffness matrix for the composite member. The algorithm used can predict the inelastic response of the composite beam in terms of deformation and failure mechanism. Furthermore, the algorithm is capable of simulating the softening behaviour of the material. The results of the analysis showed good agreement with those observed in experimental testing when the beam fail in flexure.

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Drag Characteristics of Historical Bridge Pier

The construction of bridge structure requires placement of bridge piers within the river. These piers obstruct the flow and may cause an increase in water level on the upstream side of the bridge. This increase in water level has a negative impact on the stability of bridge and may be responsible for scouring action around the bridge pier. The shape of the bridge pier is an important factor. In 20th century then on, streamlined shapes for bridge piers are being used. It is also known that for the first time in history, Mimar Sinan has used streamlined shapes for bridge piers in 16th century. However, there is a historical bridge in Diyarbakır, which is called Ongözlü Köprü. This bridge is on Tigris river and built in 1065. The piers of this bridge has a shape which may be considered as streamlined shape. In the present work, the characteristics of the shape of piers of Ongözlü Köprü will be studied both numerically and experimentally, and compared with the drag characteristics of the other shapes that have been used as piers. The results may show that even at 11th century, the hydraulic works in Anatolia were ahead of its time, and built first bridge with a streamlined shape 3-4 centuries before Mimar Sinan.

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Evolutive Construction of Cable Stayed Bridges

One of the first steps in the design of any structure consists on carrying out a simulation of its construction process guarantying that the safety thresholds are not exceeded on site. In the case of statically redundant structures, such as stayed-structures, this simulation is subjected to a number of computational difficulties.

Traditionally, the simulation of the construction process of a cable-stayed bridge might be carried out from two alternative simulation approaches: the Backward and the Forward approach. In these two methods changes in geometry, boundary conditions and applied loads throughout erection are successively added to the preceding (forward simulation) or the following (backward simulation) construction stage, by the superposition of stages principle. The application of this principle is the main inconvenience of these two simulation approaches because it increases the computation time. Furthermore, intermediate stages cannot be directly analyzed.

To solve all these problems a new algorithm, the Direct Algorithm, is presented in this paper to deal with the simulation of the construction process of steel cable-stayed bridges. To speed up the computation, this algorithm takes advantage of the unstressed length concept. This assumption enables an innovative direct simulation that does not require the application of the superposition of stages. The proposed algorithm is indicated for optimization processes and simulation of changes in the tensioning process of steel cable-stayed bridges. Furthermore, this methodology is so simple that it can be implemented in any computer software.

After presenting the main assumptions of the Direct Algorithm, a cable-stayed bridge is analyzed. Finally, the obtained results are compared with those provided by two different methods in the literature.

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Landslide Hazard and Vulnerability Risk Assessment. An Overview

By development of cities especially in mountainous areas natural hazards such as landslide could become one of the major geological risks for urban areas. Nowadays, the risk assessment has become an important tool for addressing uncertainty inherent in landslide hazards. Landslide risk assessment is a complex topic consists of many different factors such as geotechnical, geomorphological, climate change and other geological engineering evaluations. Therefore, finding a solution for predicting the hazard is still difficult and there are a lot of interests for this field of study. In recent years, the researches were mainly focused on the analysis of the combination of rainfall and geological parameters and also economical and human considerations. In this paper, with reviewing some recent reports, management strategies for reducing the risk arising from landslides and vulnerability risk assessments has been proposed. From Economical aspect removing or converting existing development and discouraging or regulating the new development in unstable areas could be a solution of the risk control. Also, correction of the underlying unstable slope to control initiation of landslides and controlling of the landslide movement are illustrated a solution from Engineering point of view. The combination of hazard prediction with risk management in addition to hazard prediction and prevention issue could be a positive attitude for the future.

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Multifunctional Anti-Graffiti-Systems

In the joint project HYDRO-GAFF researchers form the Wismar University (HSW) and the industrial partner Fa. Scheidel work together on the development of a new preservation system of structures based on fluoro carbon polymeres. The team investigates the sustainability and long-term polyfuncitionality in comparison to conventional anti-grafiffi-systems (AGS). The environmental aceptabilty of the systems should be improved through the utilization of short chained fluoro-polymers, carbon atoms less eight. Regarding compostions, functionality and mode of action, the new system should replace the common on the market placed products concerning cost effectiveness, environment-friendliness and capacity.

The part project of HSW deals with the development of a suitable test method for climatic stress. With the support of this method a relevant estimation of polyfunctionality as well as anti- graffiti-function in short track approach is possible. The destruction of materials will be simulated regarding natural exposure under laboratory conditions and makes the process of testing shorter.

For estimation the quality of the treated surface condition during climatical stress were applied: dynamical measurements, wetting angle, water absorption, gloss and light intensity and roughness profiles. Concrete and sandstone were used as test bodies, representative for all open-porous, mineral building materials.

The industrial partner as producer of preservation structures for buildungs is very strong interested in accelaration of testing phase explizit in the development phase of new material compostions.

The innovative anti-graffiti-systems and the appropriate applied technologies will be used for the restauration of old buildings as well for construction of new buildings.

The article highlights development trends and studies results of multifunctional anti-graffiti-systems (AGS) with hydrophobic function for surfaces protection. The concept of accelerated tests and parameters for effectiveness evaluation were proposed.

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Towards Microwave Curing of Alkali Activated Cement Made from Fly Ash

The wide usage of Portland Cement (PC) is becoming a worrying topic due to its negative environmental impact. The development of environment-friendly new binders is therefore greatly needed. Alkali-activated binders have emerged as an alternative to PC, which removes the need for any cement to be used in the mix. This would have a significant effect on the CO2 output of that industry. Alkali activated cement can be made from precursors such as pulverised fly ash (PFA), ground granulated blast furnace slag (GGBS), metakaolin (MK), etc. most of which are industry by-products or co-products that would be treated as waste. Therefore replacing PC with alkali-activated binders will largely reduce carbon emission from construction industry. However, alkali activated cement made from PFA as the precursor usually exhibits low strength gain at early ages which is the main drawback when comparing it with PC. In this research, microwave curing is explored in enhancing early-age engineering properties of alkali-activated binders made from PFA. Compressive and flexural strength of alkali-activated binders made from PFA with and without microwave curing have been measured and compared. It has been found that a short period microwave curing of alkali activated binders made from PFA is able to significantly enhance both compression and flexural strength of those binders which can reach considerable early-age strength comparable to PC. Microstructure, geopolymerisation products etc. of those alkali activated binders are examined by SEM, XRD, XRF, EDX etc. which unveil the reason why micro wave curing is able to largely accelerate strength gain of alkali activated binder made from PFA. The findings of this research would help to promote usage of alkali activated binders in construction industry.