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GROUPS
**Historical and Masonry
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**Steel and Mixed Construction
Technologies**
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Structural Concrete
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ISISE HIGHLIGHTS

The annual ISISE Day-Out and the PhD workshop were the most significant activities performed in the second semester of 2016. Nine PhD students presented their ongoing work to the 120 participants before a very successful outdoor activity in the downtown of Guimarães. Videos are available in <https://www.youtube.com/isisechannel>. Also, in this period, nineteen new national and international R&D projects were started and two were concluded. Inside this newsletter the reader will find further details on this and on other achievements such as the nine PhD theses concluded in this period.

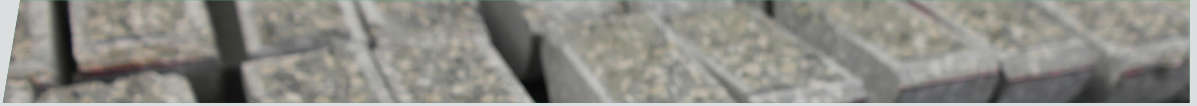


The 2016 ISISE Day-Out and 7th PhD Workshop took place last September 26th, at the University of Minho, Guimarães, with more than 120 participants. This event is always a good way of interact and share experiences in-between ISISE members. Prof. Paulo B. Lourenço opened the event, while Prof. Luís Simões da Silva made a short presentation about the main activities of ISISE.

The invited speaker, Prof. Raúl Figueiro, gave a keynote lecture entitled “Fibrous materials: challenges, opportunities and solutions”. Then the program include three sessions of Ph.D. presentations. During the afternoon, an integration activity took place, consisting of “treasure hunt” in the heart of Guimarães. The event ended with the attribution of the “Best presentation award” to Slobodanka Jovasevic with a presentation entitled “In-situ bolted connections in lattice towers for wind energy converters”.



The content and opinions expressed within the Newsletter are those of the researchers involved and are not necessarily shared by the Directors of ISISE



R&D COMPLETED PROJECTS

> SAFEBRICKTILE - Standardization of safety assessment procedures across brittle to ductile failure modes

ISISE Principal Investigator: *Luís Simões da Silva*

Budget: *Global: 1.099.131€/ISISE UC:252.139€*

ID: *RFSR-CT-2013-00023*

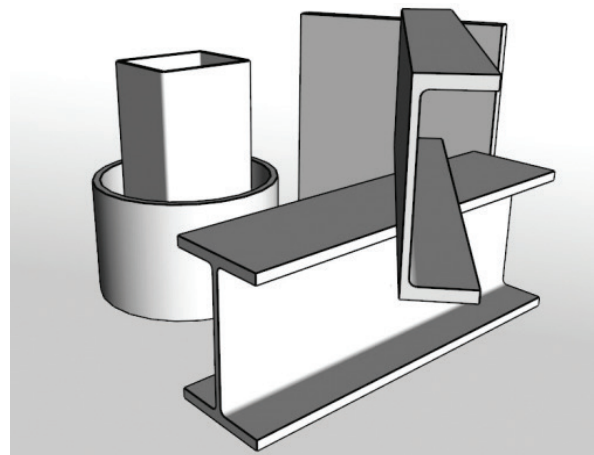
Funding Entity: *Research Fund for Coal and Steel*

Principal Contractor: *University of Coimbra*

Duration: *36 months*

Summary: In SAFEBRICKTILE an objective and consistent assessment procedure for the safety assessment of the various failure modes that are relevant for steel structures was developed. The procedure can be advantageously applied together with previous information about the basic random variables, and a database of steel properties was developed in order to provide statistical data. The procedure, using the statistical characterization from the database, was applied to several failure modes studied within the project, namely modes driven by plasticity, stability and fracture. It resulted in reassessment of many of the existing rules and proposals for new ones and thus contributing towards a harmonized safety level

throughout the many parts of Eurocode 3. The results of this project lead to major competitiveness gains: (1) faster time cycle in the development of new design procedures able to cope with innovation; (2) increased reliability in the accuracy of new design models; (3) major savings in R&D costs by avoidance of major duplication of work.



> EQUALJOINTS - European pre-qualified steel joints

ISISE Principal Investigator: *Luís Simões da Silva and Carlos Rebelo*

Budget: *Global: 1.685.076,00€/ISISE-UC:167.650,00€*

ID: *RFS-PR-12059*

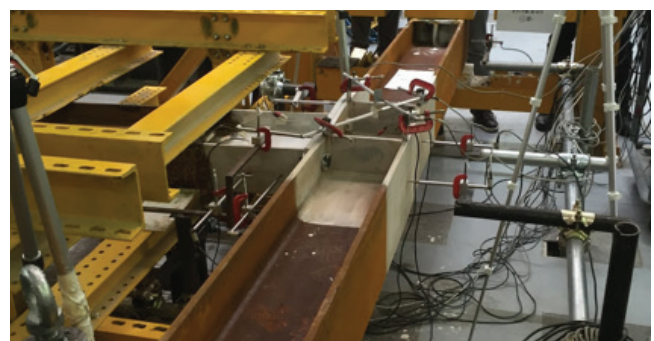
Funding Entity: *EU-RFCS (Research Fund for Coal and Steel)*

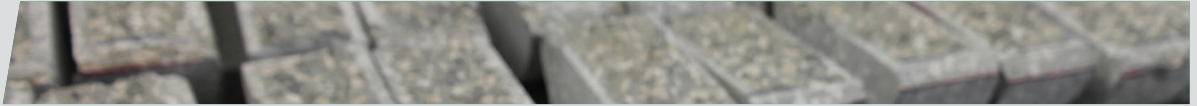
Principal Contractor: *UNINA – University of Naples Federico II*

Duration: *From 1/7/2013 to 30/6/2016*

Summary: According to EN 1998-1(2004) the design of dissipative beam-to-column joints in seismic resistant steel frames must be supported by testing, which results in an expensive and time-consuming approach, due to the lack of reliable analytical tools able to predict the seismic performance of such connections. In order to overcome such limitations, the aim of this project was to develop a prequalification procedure for typical joints used in the EU practice, on the basis of experimental, numerical and analytical investigations. The

EQUALJOINTS research project provided pre-qualification criteria of a set of selected seismic resistant steel beam-to-column joints. Hence, a large experimental programme supported by theoretical and numerical analyses has been developed. Both full-strength and partial-strength joints were examined for three types of bolted configurations and one welded dog-bone joint. Also, design tools and prequalification charts have been provided. Those include general requirements, limitations, a step-by-step design procedure and qualification data.





R&D STARTED PROJECTS

> **Invisible Woods - A dendrochronological survey of the structural woods of historic city centers of Portugal**

ISISE Principal Investigator: Jorge Branco

Budget: Global: 198.622,00€/ISISE-UM: 61.704,00€

ID: PTDC/EPH-PAT/2401/2014

Funding Entity: FCT

Principal Contractor: UC

Partners: UMINHO

Duration: From 01/07/2016 to 30/06/2019

> **FREEDAM – Free from Damage Connections**

ISISE Principal Investigator: Luís Simões da Silva/
Aldina Santiago

Budget: Global: 136.548,00€/ISISE-UC: 100.724,00€

ID: PTDC/ECM-EST/3711/2014

Funding Entity: FCT

Principal Contractor: University of Coimbra

Duration: From 01/07/2016 to 30/06/2019

> **FireComposite - Fire behaviour of reinforced concrete structures incorporating FRP composites**

ISISE Principal Investigator: Joaquim Barros

Budget: Global: 199.878,00€/ISISE-UM: 79.968,00€

ID: PTDC/ECM-EST/1882/2014

Funding Entity: IST (PI: João Ramôa Correia), ICIST

Principal Contractor: UMINHO

Duration: From 01/07/2016 to 30/06/2019

> **META_SHIELD - Vibration shielding periodic metamaterials**

ISISE Principal Investigator: Luís Godinho

Budget: Global: 197.706,00€/ISISE-UC: 132.486,00€

ID: PTDC/ECM-COM/1364/2014

Funding Entity: FCT

Principal Contractor: University of Coimbra

Duration: From 1/6/2016 to 31/05/2019

> **InOlicTower - Innovative structural system based on advanced materials for lightweight and durable Offshore Wind Towers**

ISISE Principal Investigator: A. Ventura Gouveia

Budget: Global: 197.424,00€/ISISE-UM: 197.424,00€

ID: PTDC/ECM-EST/2635/2014

Funding Entity: FCT

Principal Contractor: UMINHO

Duration: From 01/07/2016 to 30/06/2019

> **PCMs4Buildings - Sistemas com cavidades retangulares com materiais de mudança de fase para o aproveitamento de energia solar térmica em edifícios**

ISISE Principal Investigator: Paulo Santos

Budget: Global: 195.932,00€/ISISE-UC: 80.948,00€

ID: PTDC/EMS-ENE/6079/2014

Funding Entity: FCT

Principal Contractor: ADAI- Associação para o Desenvolvimento da Aerodinâmica Industrial

Duration: From 02/06/2016 to 01/06/2019

> **IntegraCrete - A comprehensive multi-physics and multi-scale approach to the combined effects of applied loads and thermal/shrinkage deformations in reinforced concrete structures**

ISISE Principal Investigator: Miguel Azenha

Budget: Global: 191.010€/ISISE-UM: 117.426,00€

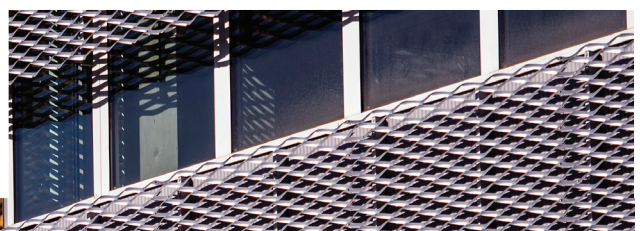
ID: PTDC/ECM-EST/1056/2014

Funding Entity: FCT

Principal Contractor: UMINHO

Partners: Universidade do Porto (UP)

Duration: From 01/07/2016 to 30/06/2019





> **PUREST – Promotion of new Eurocode rules for structural stainless steels**

ISISE Principal Investigator: Luís Simões da Silva/
Aldina Santiago
Budget: Global: 613.619,00€/ISISE-UC: 60.839,00€
ID: RFCS 709600
Funding Entity: EC
Principal Contractor: Steel Construction Institute LBG
Duration: From 01/07/2016 to 31/12/2017

> **SBRI+ – Valorisation of Knowledge for Sustainable Steel-Composite Bridges**

ISISE Principal Investigator: Luís Simões da Silva /
Helena Gervásio
Budget: Global: 1.125.080 €/ISISE-UC: 129.216 €
ID: RFCS 710068
Funding Entity: EC
Principal Contractor: ArcelorMittal
Duration: From 01/07/2016 to 31/12/2017

> **Safety evaluation and retrofitting of infill masonry enclosure walls for seismic demands**

ISISE Principal Investigator: Graça Vasconcelos
Budget: Global: 199.680,00€/ISISE-UM: 44.928,00€
ID: PTDC/ECM-EST/3790/2014
Funding Entity: FCT
Principal Contractor: Universidade do Porto (UP)
Partners: UMINHO; LNEC
Duration: From 01/06/2016 to 31/05/2019

> **ULTIMATE PANEL – Curved thin panels for structural application**

ISISE Principal Investigator: João Pedro Martins
Budget: Global: 175.068 €/ISISE-UC: 115.392 €
ID: PTDC/ECM-EST/1494/2014
Funding Entity: FCT
Principal Contractor: University of Coimbra
Duration: From 01/06/2016 to 31/05/2019

> **OUTBURST – Optimal and aesthetic design of curved steel bridges**

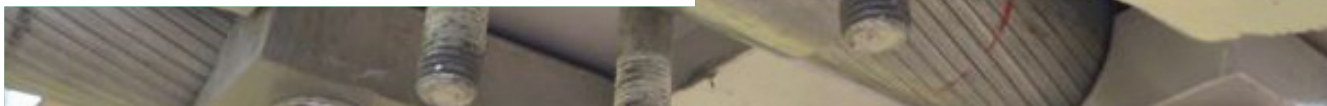
ISISE Principal Investigator: Luís Simões da Silva
Budget: Global: 1.608.410,50€/ISISE-UC: 335.052,50€
ID: RFCS-2015-709782
Funding Entity: European Commission
Principal Contractor: University of Coimbra
Duration: From 01/07/2016 to 30/06/2019

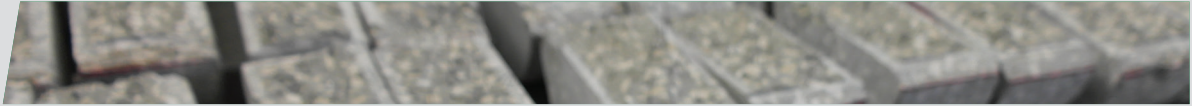
> **SafEarth – Seismic protection of earthen construction heritage**

ISISE Principal Investigator: Rui Silva
Budget: Global: 208.608,25€/ISISE-UM: 85.884,75€
ID: PTDC/ECM-EST/2777/2014
(POCI-01-0145-FEDER-016737)
Funding Entity: FCT
Principal Contractor: UMINHO
Partners: Universidade do Porto (UP); Universidade de Aveiro (UA); LNEC
Duration: From 01/06/2016 to 31/05/2019

> **FRPLongDur – Long-term structural and durability performances of reinforced concrete elements strengthened in flexure with CFRP**

ISISE Principal Investigator: José Sena Cruz
Budget: Global: 199.983,00€/ISISE-UM: 174.987,00€
ID: PTDC/ECM-EST/1282/2014
Funding Entity: FCT
Principal Contractor: UMINHO
Partners: LNEC, Empa
Duration: From 01/06/2016 to 31/05/2019





> **NEXT-SEA – Next Generation Monitoring of Coastal Systems in a Scenario of Global Change**

ISISE Principal Investigator: Eduardo Pereira
Budget: Global: 1.226.922,14€/ISISE-UM: 328.767,44€
ID: NORTE-01-0145-FEDER-000032
Funding Entity: CCDR-N
Principal Contractor: UMINHO
Partners: CMEMS-UM; CBMA-UM
Duration: From 01/07/2016 to 30/06/2019

> **HeritageCARE – Monitorização e Conservação Preventiva do Património Histórico e Cultural**

ISISE Principal Investigator: Luís Ramos
Budget: Global: 1.686.282,80€/ISISE-UM: 327.961,53€
ID: SOE1/P5/PO258
Funding Entity: Agência para o Desenvolvimento e Coesão (INTERREG V-B SUDOE)
Principal Contractor: UMINHO
Partners: University Blaise Pascal Clermont-Ferrand 2; Associação CCG/ZDGV Centro de Computação Gráfica; Universidad de Salamanca – USAL; Direção Regional de Cultura do Norte (DRCN); Université de Limoges; Fundación Santa María la Real del patrimonio Histórico; Instituto Andaluz del Patrimonio Histórico
Duration: From 01/09/2016 to 30/08/2019

> **GEO-DESIGN**

ISISE Principal Investigator: Tiago Miranda
Budget: Global: 606.621,26€/ISISE-UM: 94.901,83€
ID: NORTE-01-0247-FEDER-017501

Funding Entity: ANI

Principal Contractor: W2V, S.A.

Partners: Universidade de Trás-os-Montes e Alto Douro (UTAD); UMINHO; Francisco M. Providencia-Designer Lda; CVR - Centro para a Valorização de Resíduos

Duration: From 01/11/2016 to 31/10/2019

> **ProTimber – Probabilistic Assessment of Existing Timber Structures**

ISISE Principal Investigator: Jorge M. Branco

Budget: Global: 199.542,00€/ISISE-UM: 81.726,00€

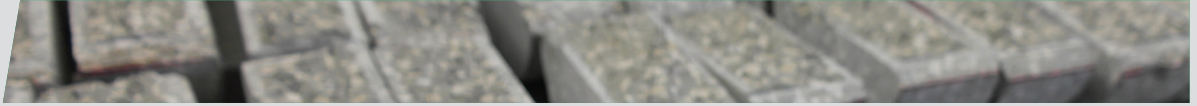
ID: PTDC/ECM-EST/1072/2014

Funding Entity: FCT/MCTES

Principal Contractor: Laboratório Nacional de Engenharia Civil

Duration: From 01/06/2016 to 31/05/2019





COMPLETED PHD THESSES

> Development of Hybrid Composite Plate (HCP) for Strengthening and Repair of RC Structures

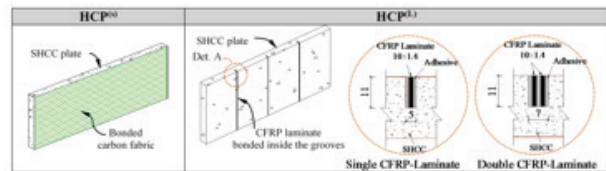
Author: Esmaeel Esmaeli

Supervisors: Joaquim Barros and Said Jalali

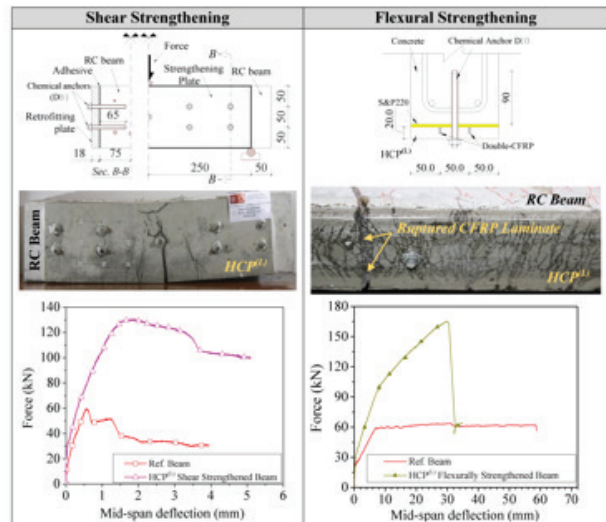
Date: 11th December 2015

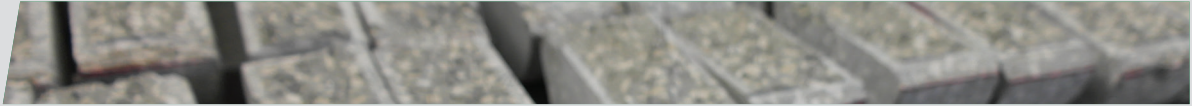
Summary: The author hypothesized the concept of an innovative retrofitting element for RC structures, designated “**Hybrid Composite Plate (HCP)**”, and adopted an interdisciplinary research approach for its development. HCP is composed of a thin **Strain Hardening Cementitious Composite (SHCC)** plate reinforced with **CFRP** bonded onto the face of the SHCC plate either in the form of externally bonded sheets or NSM laminates. Bearing capacity of SHCC is suitable to attach HCP to the RC using chemical fasteners, individually or in combination with adhesive. The excellent shear and flexural strengthening efficiency of HCP as well as its capability for enhancing energy dissipation capacity are demonstrated through sets of experimental tests on retrofitted RC beams and beam-column joints. An analytical approach along with a numerical strategy are presented to predict the load-deflection response of flexurally strengthened beams with HCP. Finally, recommendations for an optimized HCP and HCP-RC connection are provided, based on the results obtained from a combination of experimental tests and finite elements models.

CV: **Dr. Esmaeli** is currently a postdoctoral research fellow in Queen’s University Belfast. His main research interests include sustainable retrofitting solutions for the existing concrete and masonry structures, applications of advanced materials in construction industry, micromechanical models of advanced FRCs and their rheological optimisation, computational mechanics, and the mechanics of interfaces.



Structure of Hybrid Composite Plate (Patent N°. PT 107111)





> **Structural behavior of hybrid GFRP and steel reinforced FRC prestressed beams**

Author: Hadi Mazaheripour

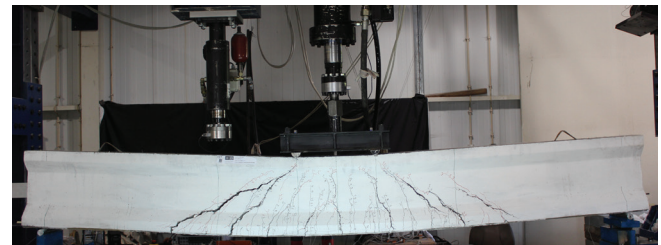
Supervisors: Joaquim A.O. Barros and José Sena Cruz

Date: 4th March 2016

Summary: This thesis intended to contribute for the development of a new generation of high durable and sustainable RC beam structures submitted to flexural loading, by combining the benefits that GFRP and steel bars can provide: the former due to their corrosion immunity, and the latter derived from their high ductility. High Performance Fiber Reinforced Concrete (HPFRC) was developed to improve the ductility of such innovative structures. To avoid corrosion, steel bar was placed with a HPFRC cover thickness, higher than 100 mm, while GFRP bars were applied in the near tensile surface of the HPFRC beams. Additionally, the GFRP and steel bars were applied with an optimized pre-stress level to improve their reinforcing capabilities, and increased the service load carrying capacity. Conventional shear reinforcements were not used and were totally replaced by HPFRC material. Due to the quite high post-cracking tensile strength and energy

absorption capacity that HPFRC attained, the system showed adequate shear resisting, and also enhancement in the structural performance at both SLS and ULS.

CV: Hadi Mazaheripour, graduated in Master of Science in Structural Engineering at Civil Engineering department at Mazandaran University, Iran, in 2007. He is the former researcher/PhD student at ISISE, and finished his PhD in March 2016 at University of Minho. His research interests are: Fracture mechanism, Fiber reinforced concrete, multi-scale modelling of cement-based material, numerical analysis, and durability of concrete structures.



Beam IB8: crack pattern at the failure

> **Continuous characterization of stiffness of cement-based materials: experimental analysis and micro-mechanics modelling**

Author: José Luís Duarte Granja

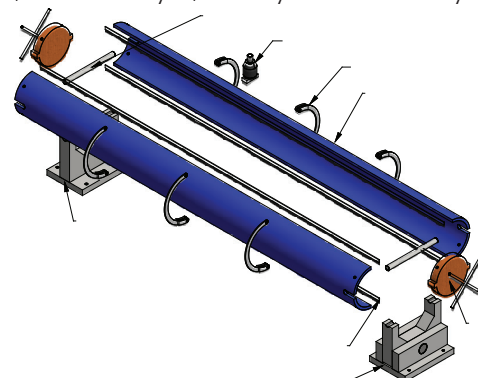
Supervisors: Miguel Ângelo Dias Azenha

Date: 3rd May 2016

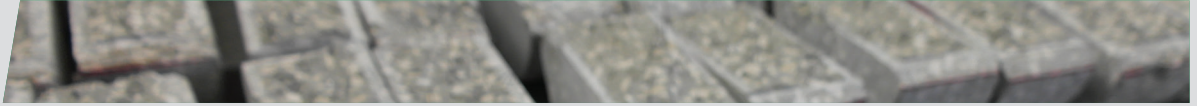
Summary: This thesis intended to achieve an improved robust tool based on EMM-ARM to provide early information of the cementitious materials stiffness. In pursuit of that goal, relevant changes were introduced in EMM-ARM. These changes allowed overcoming the identified constraints and to significantly improve the usability and robustness of the method. This thesis also presents a systematic study of the application of EMM-ARM compared to competing methods that mechanical characterization of cementitious materials at early ages with mutual validation objectives. This research also permitted demonstrating that EMM-ARM can be used to characterize a wide range of materials that undergoes chemical hardening. The thesis ends with a foray into the microstructural simulation of the stiffness evolution of cementitious materials. The stiffness evolution of cement pastes,

simulated by *mic/AMIE*, developed at EPFL was validated through comparison with EMM-ARM results.

CV: José Granja, graduated in Master of Science in Civil Engineering at Civil Engineering department at Minho University, in 2011. He is the Postdoctoral Researcher at ISISE, and finished his PhD in May 2016 at University of Minho. His research interests are: early age behavior of cement-based materials, multi-scale modelling of cement-based material, numerical analysis, fire analysis and modal analysis.



Reusable mould for EMM-ARM tests



> **Seismic Behaviour of Mixed Masonry-Reinforced Concrete Buildings. An insight into modelling approaches**

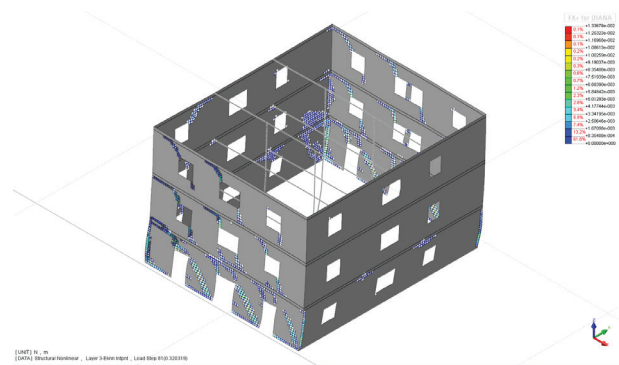
Author: Marialuigia Sangiardi

Supervisors: Paulo Lourenço

Date: 13th May 2016

Summary: The thesis was focused on the analysis of mixed masonry-reinforced concrete buildings, which constitute a building typology characterized by the simultaneous presence of structural elements realized with traditional and natural materials such as masonry or timber, and other innovative techniques like steel or reinforced concrete. Case studies have been selected among building for which extensive sets of information were available, both within ideal and real buildings; the analyses (mostly non-linear static) have been performed using the code Tremuri. Some further considerations have been derived comparing some results with the ones obtained by the finite element code Diana. The objectives of the study was to evaluate the reliability of simplified models for the analysis of mixed masonry-reinforced concrete buildings, assess the validity of current Code prescriptions, and evaluate the effectiveness of retrofitting techniques.

CV: **Marialuigia Sangiardi** graduated in 2012 in Structural Engineering at the Technical University of Bari. In May 2016 she received a Double PhD Degree defending a thesis entitled “Seismic Assessment of Mixed Masonry-Reinforced Concrete Buildings. An insight on modelling approaches”. She’s developing research projects in the field of architectural heritage and structural analysis of masonry and mixed structures.



Results of non linear-static analyses (Diana)

> **High Performance Fiber Reinforced Concrete for the Replacement of Shear Stirrups**

Author: Fatemeh Soltanzadeh

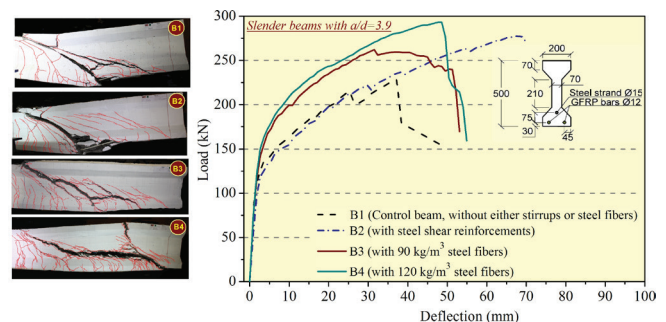
Supervisors: Joaquim Barros

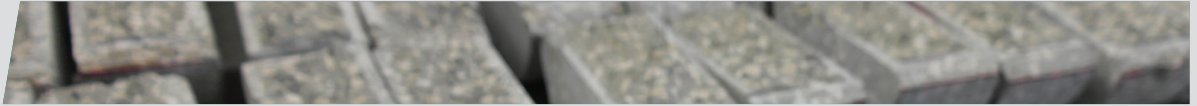
Date: 3rd June 2016

Summary: The thesis aims to introduce a new design framework for constructing durable and sustainable prefabricated concrete beams without stirrups. This objective is pursued by combining the benefits provided by development and application of a high performance fiber reinforced concrete and hybrid system of GFRP-steel reinforcements. The steel fibers assure the shear resistance of concrete elements and eliminate the necessity of using steel stirrups, while the hybrid reinforcements decrease the susceptibility of flexural reinforcement to corrosion and assure a good balance between flexural capacity and ductility of the members. The research combines experimental, numerical and analytical approaches to evaluate the possibilities of the proposed strategy for prefabricating beams of material and structural requisites at competitive costs. The

results provide an effective solution for the construction of elements of longer life cycle with first contribute on future guidelines for design purpose.

CV: **Fatemeh Soltanzadeh** is researcher in ISISE since 2011. She got PhD from University of Minho in 2016. Her research interests cover topics in the field of concrete technology and structural behavior, sustainability and durability. She has some publications in international journals and conferences under these topics and a patent related to cementitious materials that awarded 3 international medals.





> **Bond behaviour of NSM CFRP-concrete systems: durability and quality control**

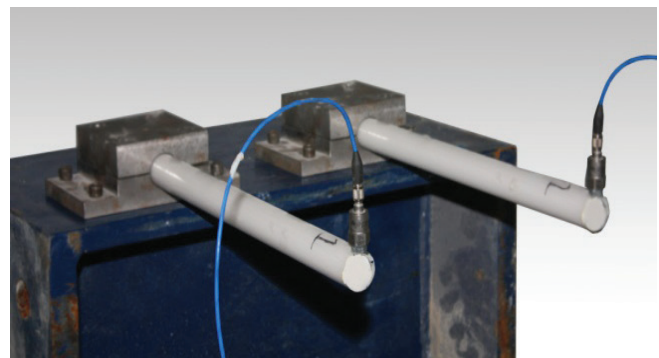
Author: Pedro Miguel Gomes Fernandes
Supervisors: José Sena Cruz and José Cardoso Xavier (UTAD)

Date: 28th June 2016

Summary: This PhD thesis intended to contribute for the knowledge on the durability and long-term performance of bond of concrete structures strengthened with CFRP laminates according to the NSM technique, and provide a non-destructive methodology (EMM-ARM) capable of giving in real-time continuous information about the curing process of epoxy resins since casting, which can be used for quality control and assistance to decision-making for in-situ FRP applications. From the durability tests, in terms of global bond behaviour of the NSM CFRP concrete system, a maximum decrease of about 12% on bond strength was attained and occurred under real environmental actions (specimens exposed to outdoor environment and to wet-dry cycles in seawater). EMM-ARM methodology has confirmed its ability in clearly identifying the hardening kinetics of epoxy adhesives measuring the material setting time and the stiffness evolution since

very early ages with adequate repeatability at temperatures of curing ranged from +20 °C to +40 °C.

CV: **Pedro Fernandes** obtained his Integrated Master in Civil Engineering at University of Minho in 2011. In 2016, concluded his Ph.D. degree in Civil Engineering by the University of Minho. Actually, he is a Postdoctoral Researcher at University of Minho and continuing his research work on long-term and durability behaviour of RC structures strengthened with FRP systems.



Experimental setup of EMM-ARM tests

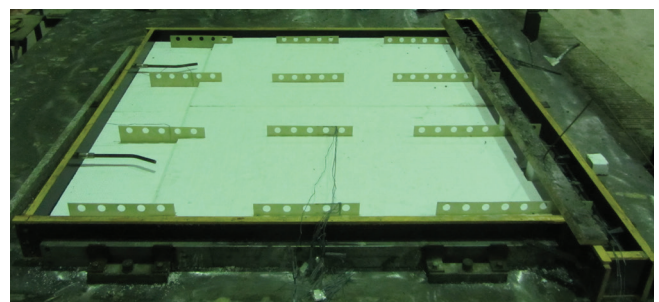
> **Sandwich structural panels comprising thin-walled SFRSCC and GFRP connectors: from material features to structural behaviour**

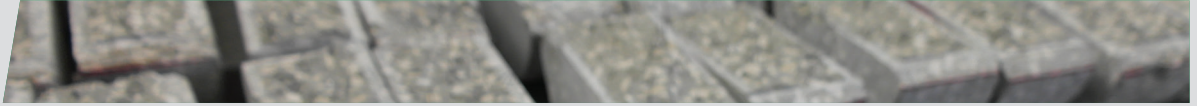
Author: Rodrigo Lameiras
Supervisors: Joaquim A.O. Barros and Miguel Azenha
Date: 8th July 2016

Summary: An innovative sandwich structural panel composed of two outer Steel Fibre Reinforced Self-Compacting Concrete (SFRSCC) thin layers, a thermal insulating core material and Glass Fibre Reinforced Polymer (GFRP) connectors was developed for the walls of a pre-fabricated housing system. An in-depth investigation in the material scale was carried out in order to assess the post-cracking behaviour of SFRSCC. Experimental research devoted to the assessment of the pull-out and push-out shear behaviour of GFRP-SFRSCC connections were performed and analytical frameworks were developed. An experimental work was also conducted with composite beam specimens using the proposed GFRP connector and the tests were FEM-based numerical simulated. Finally, the behaviour of the full-scale wall panels with and without

openings were experimentally investigated when subjected to a constant vertical load representative of the slab reaction, while horizontal reversed cyclic loading was imposed.

CV: **Rodrigo Lameiras** concluded his PhD in 2016 at University of Minho while he is a researcher in ISISE since 2009. He is currently assistant professor in the Federal University for Latin-American Integration, Foz do Iguaçu, Brazil. His research interests include the use of FRC and FRP as structural materials, early age behaviour of concrete structures and advanced modelling of concrete structures.





> **Development of Innovative Hybrid DHCC-GFRP Sandwich Panels**

Author: Mohammad Mastali

Supervisors: Joaquim A.O. Barros and Isabel Valente

Date: 22nd July 2016

Summary: A new type of composite sandwich slab is proposed for the rehabilitation of slabs in old masonry buildings. The proposed solution is composed of the following components: a Deflection Hardening Cement Composite (DHCC) layer on the top compression skin, a glass fibre reinforced polymer (GFRP) skin at the bottom tension surface, GFRP ribs to transfer shear from top to bottom layers, and foam core for thermal-insulation purposes. Parametric studies were carried out with software based on the finite

element method in order to determine the influence of the geometric and material properties of the constituent components on the structural performance of the proposed solution, in the context of its optimization. Prototypes of this innovative sandwich slab's concept were manufactured and experimentally tested under several loading conditions in order to assess their structural performance under serviceability and ultimate limit state conditions. The research was complemented with analytical studies in the context of proposing design guidelines for this constructive system. The economic competitiveness of this system was also assessed.

> **Strategies for Seismic Strengthening of Masonry Infilled Reinforced Concrete Frames**

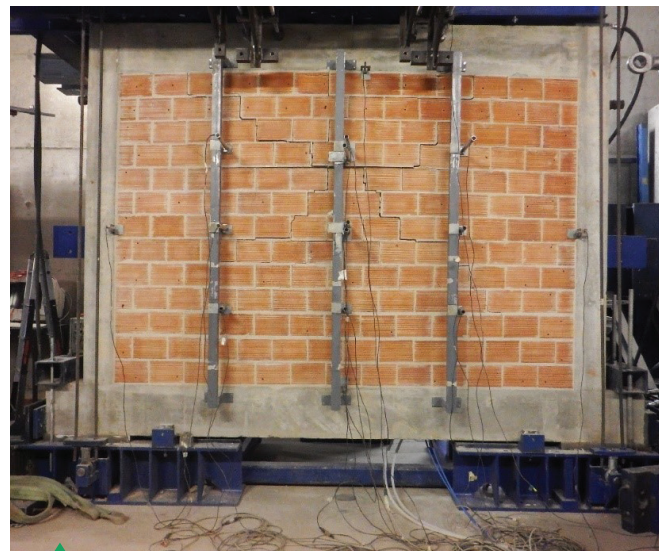
Author: Farhad Akhoundi Shikh Ahmad Loo

Supervisors: Graça Vasconcelos and Paulo Lourenço

Date: 17th October 2016

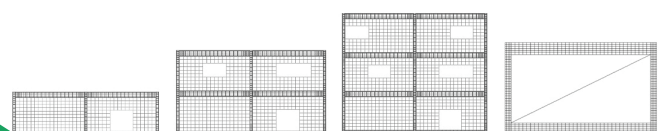
Summary: Seismic vulnerability of masonry infilled frames observed during past earthquakes in south Europe justifies the need of deep study of the seismic behavior of masonry infilled frames constructions. Therefore, the main goals of this thesis were: (1) better understanding of the cyclic in-plane and out-of-plane behavior of traditional brick infills; (2) analysis of different strengthening solutions; (3) analysis of the main parameters influencing the in-plane behavior of rc frames with brick infills. Three of the main achievements of the thesis were: (1) in-plane damage influences significantly the out-of-plane resistance of masonry infills; (2) strengthening of the masonry infills, with textile reinforced mortar or by connection both leaves of the cavity walls, increase the resistance of masonry infills and controls the damage; (3) infill panels with any type of opening can be replaced by an equivalent diagonal strut, which can simplify the modelling of the rc building with brick infills.

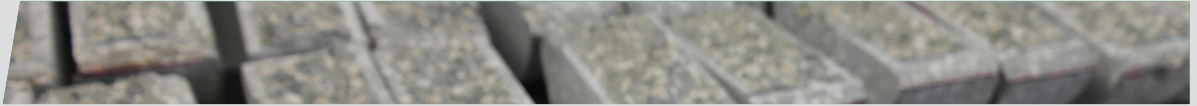
CV: Farhad Akhoundi is B.Sc. and M.Sc. in Structural Engineering from the School of Civil Engineering, Tabriz University, Tabriz, in Iran. He concluded his PhD in October 2016 in Civil Engineering at University of Minho. Presently, He is teaching at Tabriz University, Tabriz, East Azarbaijan, Iran.



Crack pattern of brick masonry infill under out-of-plane loading

Finite element modelling of infilled rc frames with different openings configuration for the calibration of simplified model with diagonal struts





> Experimental and Numerical Assessment of the Seismic Behaviour of Log and Cross-Laminated Timber Systems

Author: Chrysl Assumpta Aranha

Supervisors: Jorge M. Branco and Paulo B. Lourenço

Date: 27th October 2016

Summary: Engineered timber constructions show great potential as building solutions in seismic areas. However, the inadequacy of relevant design guidelines is a barrier to their use in engineering practise. The doctoral research undertaken aimed at improving the working knowledge on the assessment of the seismic behaviour of the log house and the cross-laminated timber systems, based on a combined approach of experimental tests and numerical simulations. Using data from prior quasi-static tests on structural components and shaking table tests on full-scale structures, 3D finite element models were developed using SAP2000. In the bi-directional seismic tests carried out as part of the SERIES project on timber buildings, neither of the structures sustained major damage in spite of the peak input accelerations reaching 0.5g. The model of the log house,

validated using linear modal analysis, revealed the importance of maintaining the box-behaviour of the log house for its seismic performance. For the CLT house, the characterisation of the load-slip behaviour of the connectors was found to be of paramount importance in evaluating its seismic performance.

CV: Chrysl Aranha has an undergraduate degree in Civil Engineering from NITK, India, following which, she graduated with an Erasmus Mundus Master's degree in Structural Analysis of Monuments and Historical Constructions. Having concluded her PhD at the University of Minho in 2016, she is currently a senior project officer at the National Centre for the Safety of Heritage Structures in India.



LOG HOUSE



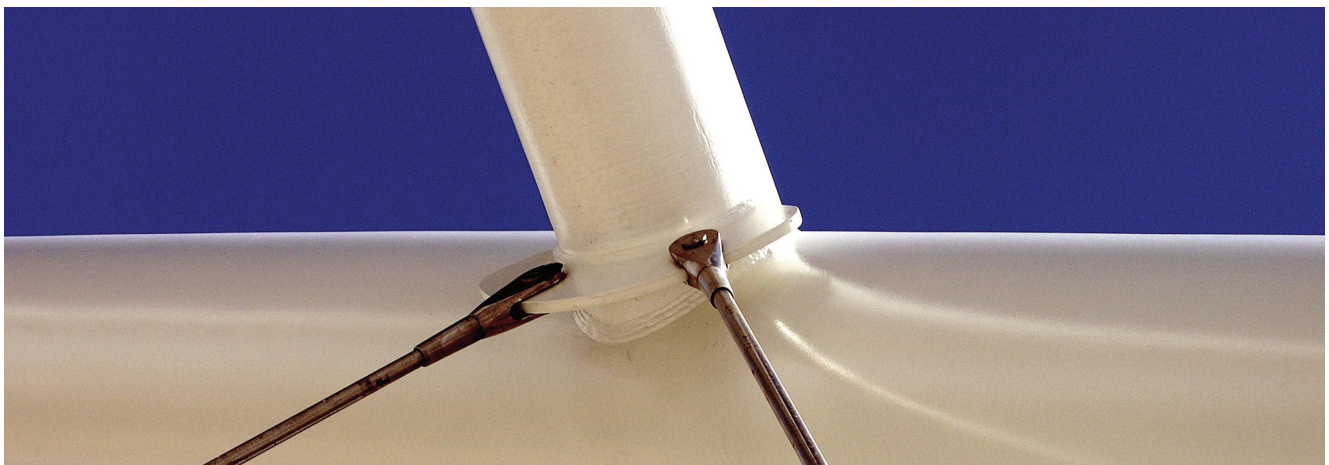
CLT HOUSE

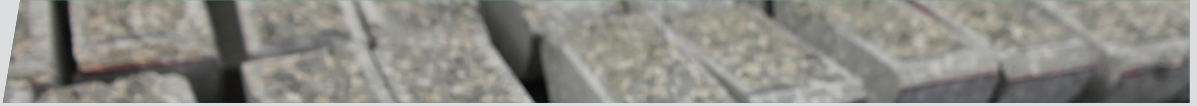
The full-scale specimens tested

AWARDS & PRIZES

> **Dr. Susana Moreira**, former SAHC student and former PhD student at University of Minho, received the 2016 Best Doctoral Dissertation Award from The Masonry Society, USA. It is a great personal achievement and all the ISISE community is happy for this great success. Further details are provided at: <http://masonrysociety.org/html/about/awards/thesis/index.htm>.

> **Professor Luís Simões da Silva**, who was awarded an honorable mention resulting from the activities and initiatives of entrepreneurship related to new research projects and other research and development initiatives and activities (R & D activities) http://www.uc.pt/fctuc/dec/destaques/fctuc_244.11





EVENTS

> Training Course on Design of Offshore Structures

Venue: Department of Civil Engineering
University of Coimbra

Date: 16 - 19 May 2016

Website: www.isise.net

Summary: The 4th edition of the course "Offshore Structure" promoted by University of Coimbra and CMM, intends to provide knowledge regarding the design of steel elements in offshore structures, through the identification of the main actions, description of steel material used in offshore structures, and of the most relevant features in sea operations. This course aims civil and mechanical engineers and technicians connected to the area of steel construction.



> SAFEBRICKTILE workshop

Venue: University of Timisoara, Romania

Date: 31st May 2016

Summary: The workshop of the European RFCS project SAFEBRICKTILE was held within a parallel session of the International Colloquium on Stability and Ductility of Steel Structures (SDSS 2016). The workshop summarized the key results achieved within the project. ISISE was represented by the project coordinator prof. Luís Simões da Silva and his doctoral student Trayana Tankova.



> Advanced Course in Materials, Techniques and Design Approaches for the Structural Strengthening

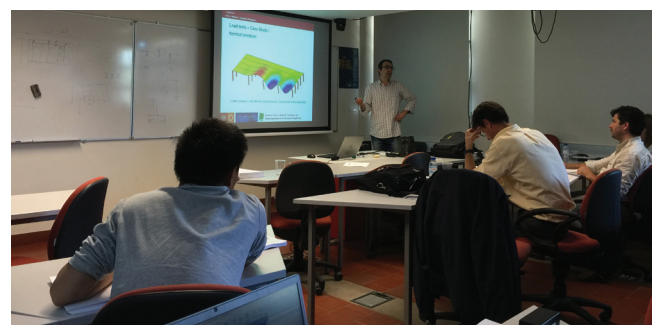
Venue: University of Minho, Azurém

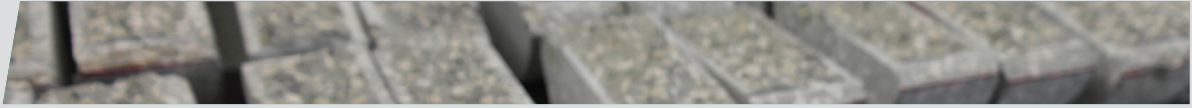
Date: 13 - 24 June 2016

Website: <http://sc.civil.uminho.pt/strengtheningtechniques/registration.php>

Summary: According to Prof. Dr. Giovanni Terrasi, Head of Laboratory for Mechanical Systems Engineering, EMPA, one of the attendants of this course, "The didactically perfect teaching style, the sound presentation of the methodologies to assess reinforced concrete structures and to evaluate and design the most appropriate strengthening strategy

impressed me". The 2nd edition is planned for 12-24 June 2017.





> **EQUALJOINTS workshop**

Venue: Naples, Italy

Date: 21st June 2016

Website: http://www.uc.pt/fctuc/dec/imagensdocumentos/ano2016/imagens_2016/EQUALJOINTS

Summary: The Equaljoints Project achievements were presented in a set of lectures and presentations, followed by discussion of the results. Following topics were presented:

- > Steel Connection Failures from the 1994 to Today: The AISC 358 Effort to Prequalify Connections
- > Design criteria and experimental performance of haunched joints, extended stiffened end-plate joints, dog-bone joints
- > Seismic design of bolted beam-to-column joints
- > The influence of joints behaviour on global behaviour of moment resisting frames, dual-concentrically

braced frames and dual-eccentrically braced frames
> Analytical models and loading protocol for EU seismic pre-qualification of joints.

> Design guidelines of pre-qualified seismic steel joints



> **Training School of COST TU₁₄₀₄ – Service life of cement-based Materials and Structures**

Venue: Danish Technical University (DTU) in Denmark

Date: 15 - 19 August 2016

Website: <http://www.tu1404.eu/training-schools/denmark-2016>

Summary: COST Action TU1404 hosted a training school on 'Service life of cement-based Materials and Structures' during the week of 15-19 August 2016 at the Danish Technical University (DTU) in Denmark. The program had intricate connections with the objectives of TU1404, with particular emphasis on subjects related to Workgroup 1 'Testing of cement based materials and RRT+'. This course followed a general structure that is similar to the well-known doctoral courses on related subjects that have been carried out at DTU for more than 15 years. It was a quite interesting opportunity that is mainly targeted to young researchers (normally enrolled in PhD programmes) and allowing them to have a deep contact with

several subjects related to cement-based materials. The course was attended by 30 people, with more than 20 grants being awarded by COST TU1404. Some of the lectures were shared with the doctoral course on 'Supplementary Cementitious Materials', raising the number of attendants to 60 (particularly during the shared laboratory hands-on sessions).





> **Materials, Systems and Structures in Civil Engineering – MSSCE 2016. Segment of COST Action TU1404 “Service Life of Cement-Based Materials and Structures”.**

Venue: DTU, Lyngby, Denmark

Date: 22 - 24 August 2016

Website: www.tu1404.eu/august-2016-copenhagen

Summary: The conference “Materials, Systems and Structures in Civil Engineering – MSSCE 2016” was part of the RILEM week 2016, which consists of a series of parallel and consecutive conference and doctoral course segments on different topics as well as technical and administrative meetings in several scientific organizations. The event was hosted by the Department of Civil Engineering at the Technical University of Denmark and the Danish Technological Institute and it is held at the Lyngby campus of the Technical University of Denmark 15-29 August 2016. In this context, COST Action TU1404 was the organizer of the conference segment “Service Life of Cement-Based Materials and Structures”. The

present conference segment dealt with a wide breadth of topics related to the service life of concrete, comprising aspects related to the 3 Workgroups mentioned above. The conference segment is attended by 80 presenters from university, industry and practice representing more than 30 different countries. All contributions have been peer reviewed.



> **3rd International conference on Transportation Geotechnics (3rd ICTG 2016)**

Venue: School of Engineering of University of Minho and Vila Flor Cultural Centre, Guimarães, Portugal

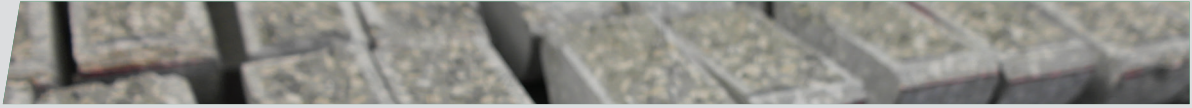
Date: 4 - 7 September 2016

Website: www.civil.uminho.pt/3rd-ICTG2016/

Summary: The 3rd ICTG 2016 have three main different events. The 1st Young Transportations Geotechnics Engineering Meeting of the ISSMGE (e-book: <http://dx.doi.org/10.5281/zenodo.143498>) and four workshops dedicated to: 1 - Geosynthetics in Transportation Geotechnics (<http://www.sciencedirect.com/science/journal/22143912/8>), 2 - Harbour Geotechnics, 3 - Non Destructive Technologies, and 4 - Ground Improvement and Soil Stabilisation. The technical sessions of the 3rd ICTG 2016 included the 1st Proctor Lecture by Prof. Buddhima Indraratna, two Keynote Lectures presented by Prof. Erol Tutumluer and Prof. Anand Puppala, the Mercer Lecture (IGS) by Prof. Jorge Zornberg, as well as 10 theme lectures, 13 special lectures, 88 oral presentations delivered in 12 technical sessions, and 2 poster sessions with 56 presentations. Furthermore, two posters' sessions and a technical exhibition took place. Additionally, a New International Group for Intelligent Construction was launched. The conference proceedings contain 182 peer-reviewed papers resulting from

292 accepted abstracts from 50 countries and more than 900 authors. The indexed SCOPUS papers are in open access and free for downloading on Procedia Engineering's website: (<http://www.sciencedirect.com/science/journal/18777058/143>).





> **Training School of COST TU1406 – Performance-based assessment of existing road bridges**

Venue: KTH Royal Institute of Technology, Stockholm, Sweden

Date: 12 - 16 September 2016

Website: <http://www.tu1406.eu/stockholm>

Summary: The objective of the COST TU1406 Training School-Stockholm is to spread the latest knowledge and developments, acquired by the Action, in the topic of performance-based assessment of existing road bridges. Besides, the school aims at teaching the most recent knowledge on performance assessment procedures with the adoption of specific goals. In particular the COST TU1406 Training School-Stockholm focuses on the findings of WG1: Performance indicators and on WG2: Performance goals. The WG1 goal was to explore the performance indicators for bridge structures, in the course of an international research cooperation, which capture the mechanical and technical properties and its degradation behaviour, already partly covered by code specifications. Considerations also include: natural aging, material quality; service life design methods; sustainable indicators; environmental, economic and social

based indicators, and performance profiles. The WG2 aim was to identify existing performance goals (where the term goal pertains to quantifiable requirement and/or threshold value) for the indicators previously indicated in WG1. The performance goals vary according to technical, environmental, economic and social factors. The training school is co-organised with IABSE in Sweden and will take place preceding the 19th Congress of IABSE in Stockholm 2016. It will cover WG1 and WG2 topics of COST TU1406, which are "the assessment of road bridges through Key Performance Indicators (KPIs)" and "the establishment of Performance Thresholds / Goals".



> **Seminário Reabilitação de Fachadas**

Venue: University of Minho, Azurém

Date: 22nd September 2016

Website: <http://civil.uminho.pt/reabilitacao2016/>

Summary: The national seminar Rehabilitation of Façades aimed at discussing the main technical advancements on the rehabilitation of traditional façades in the scope of structural and functional rehabilitation of buildings.



The program included contributions of important companies exhibiting the best practices and solutions in the rehabilitation of current traditional and historical masonry façades.

> **Building Information Modeling (BIM)**

Venue: Ordem dos Engenheiros

Date: Porto: 16th September - 26th November 2016 / Lisboa: 23rd September - 03rd December 2016

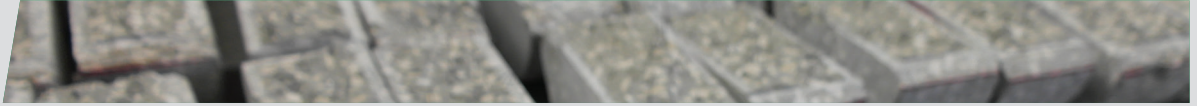
Website: <http://www.cursobim.com/>

Summary: The University of Minho has been coordinating the national course on Building Information Modelling since 2014, and has already completed three successful editions (held simultaneously in Lisbon and Porto). This course is held at the National Engineers Association

(Ordem dos Engenheiros) and aims to provide competences for BIM Management.



The 4th edition is currently ongoing, with full participation ensured. Public presentations of the final outcomes of the courses are expected in December as scheduled in www.cursobim.com.



> **AEOLUS4FUTURE WORKSHOP: Sustainability and life cycle assessment**

Venue: University of Coimbra, Department of Civil Engineering

Date: 17 - 18 October 2016

Website: www.isise.net

Summary: The workshop on sustainability and lifecycle assessment has been directed to the Marie-Curie fellows of AEOLUS4FUTURE and to PhD students of ISISE. In the first day a set of lectures given by experts from ISISE-UC, Delft University of Technology and University of Newcastle addressed topics related to Wind Energy. In the second day technical visits to three major industrial facilities working in the area of

wind energy completed the workshop.



> **WG 2 and WG 3 Workshop of COST TU 1406**

Venue: TNO Delft, Delft, the Netherlands

Date: 20 - 21 October 2016

Website: <http://www.tu1406.eu/meetings/delft>

Summary: In the first year of the COST TU1406 the main focus was on the screening process of existing European documents and establishing a database for PIs. The next step in the project is to focus on technical and non-technical bridge performance goals, followed by the establishment of quality control plans. Therefore, the workshop will be dedicated on following topics:

- > Evaluation of bridge performance (criteria, requirements, goals, thresholds);
- > Technical, sustainability and economic aspects of bridge performance;
- > Life-cycle Assessment;
- > Quality control plans;

> Reliability of testing/investigation techniques and methods;

> Qualification criteria for inspectors.

During the two-day workshop, selected manuscripts will be presented and discussed, followed by WG2, WG3 and WG5 meetings.



> **Erasmus Mundus ELARCH Master Course**

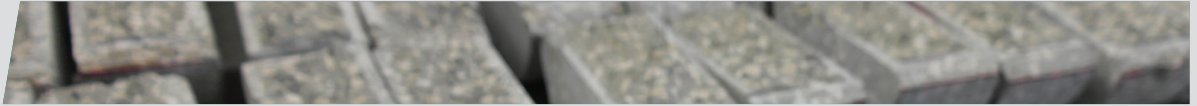
Venue: University of Minho, Portugal

Date: October 2016

Website: www.elarch.org

Summary: A new edition of the Erasmus Mundus ELARCH Master Course has just started at University of Minho. Twenty students from 8 Latin-American countries are currently in Guimarães, looking forward to learning new topics about protection of the Cultural Heritage. Details about the ELARCH Master Course are available at www.elarch.org





UPCOMING EVENTS

> 1º congresso português de building information modelling

Venue: Universidade do Minho, Azurém, Guimarães, Portugal

Date: 24-25 November 2016

Website: <http://www.ptbim.org/>

> SAHC Master Course (11th Edition)

Venue: Department of Civil Engineering, University of Minho, Portugal

Application Deadline: 20th January, 2017 (call 1)

Website: www.msc-sahc.org

> WINERCOST17-The International Conference on Wind Energy Harvesting 2017

Venue: Coimbra, Portugal

Date: 20-21 April 2017

Website: www.cmm.pt/WINERCOST17

> COST TU1406 Workshop

Venue: Zagreb University, Zagreb, Croatia

Date: 2-3 March 2017

Website: <http://www.tu1406.eu/meetings/zagreb>
<http://www.grad.unizg.hr/joint-zagreb-workshop/>

> Second International RILEM Conference on Early Age Cracking and Serviceability in Cement-based Materials and Structures

Venue: Campus of the Université libre de Bruxelles (ULB) in building R42

Date: 12-14 September 2017

Website: <http://eac2.be/>

> "XI Congresso de Construção Metálica e Mista"

Venue: iParque, Coimbra, Portugal

Date: 23-24 November 2017

Website: www.cmm.pt/congresso11

> IABSE Conference 2019 - Towards a Resilient Built Environment. Risk and Asset Management

Venue: Vila Flor Cultural Center, Guimaraes, Portugal

Date: 27-29 March 2019

Website: www.iabse.org/guimaraes2019

