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## ISISE HIGHLIGHTS

ISISE Day-Out and 5<sup>th</sup> PhD Workshop were held on September 9<sup>th</sup>, 2013, in Coimbra at the Department of Civil Engineering of University of Coimbra and at Parque verde do Mondego.

After a welcome session given by Prof Paulo Lourenço the 5<sup>th</sup> PhD ISISE Workshop started. The presentations were carried out by some of the PhD students.

The afternoon began with 2 lectures held by Konrad J Krakowiak, a Post-Doc at MIT by video-conference; and by Prof. Carlos M. Fonseca, Prof. at DEI of UC. Before dinner, ISISE members participated in a entertaining activity at Parque Verde do Mondego.

The award for the Best Presentation of 5<sup>th</sup> PhD ISISE Workshop was won by Susana Moreira. This award was delivered by Prof. Luis Simões da Silva during dinner at Restaurant Piscinas do Mondego.

This day was a great opportunity for all ISISE members to interact and to spend some enjoyable time in Coimbra.



A new scientific and technical journal was launched by Elsevier named "Transportation Geotechnics". This journal, edited by António Gomes Correia, Erol Tutumluer, Yunmin Chen, aims to publish high quality, theoretical and applied papers on all aspects of geotechnics for roads, highways, railways, airfields and waterways. Additional information in: [www.journals.elsevier.com/transportation-geotechnics](http://www.journals.elsevier.com/transportation-geotechnics)



# R&D COMPLETED PROJECTS

## > LEGOUSE - Development of Cost Competitive Pre-fabricated Modular Buildings

**ISISE Principal Researcher:** Joaquim Barros

**Budget:** Global: 1.068.301,25€/ISISE-UM: 382.161,72€

**ID:** 5387

**Funding Entity:** ADI

**Principal Contractor:** Mota-Engil

**Participating Institutions:** Civitest, PIEP, University of Minho

**Date:** October 2012

**Summary:** The present project took advantage of the appropriate use of advanced materials and computational tools for the development of cost-competitive prefabricated modular houses. "Modular system" refers to the complete structure that is built-up by assembling prefabricated sandwich structures composed of fibre reinforced self-compacting concrete (FRSCC) outer layers that are connected by cost-effective glass fibre reinforced polymer (GFRP) connectors, resulting a panel with adequate structural, acoustic and thermal insulation properties (Fig. 1).

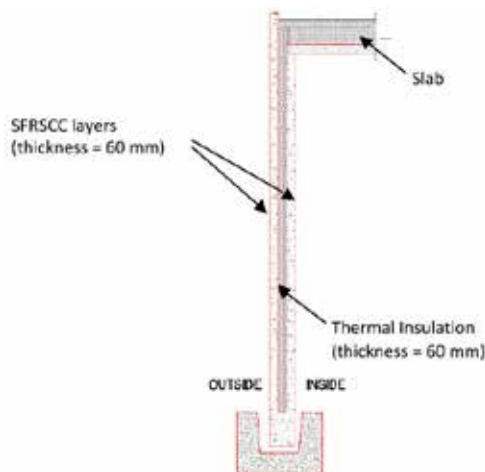


Fig 1 – Concept of sandwich FRSCC-GFRP panel.

Extensive experimental programs and advanced numerical simulations were performed at material and structural level, including real scale components (Fig. 2), to build the modular house represented in Fig. 3.

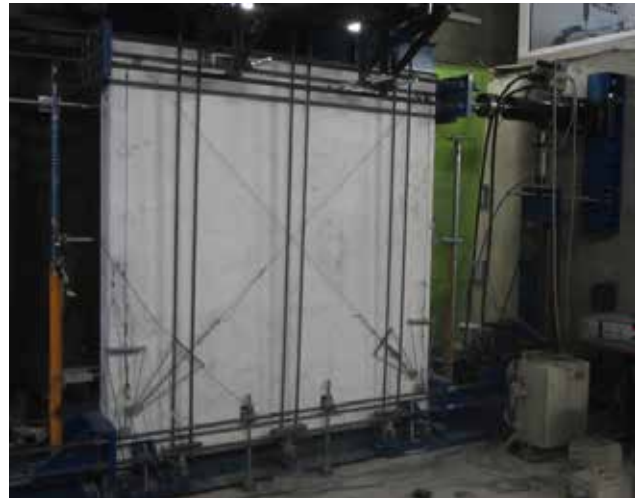


Fig 2 – Structural tests with real scale prototypes.



Fig 3 – Built modular house.

## > SPARCS: Seismic Performance Assessment of Reinforced Concrete Buildings Designed to Portuguese Codes

**ISISE Principal Researcher:** Paulo Lourenço

**Budget:** Global: 199.951,00€/ISISE-UM: 24.228,00€

**ID:** PTDC/ECM/101201/2008

**Funding Entity:** FCT

**Principal Contractor:** Laboratório Nacional de Engenharia Civil (LNEC)

**Participating Institutions:** University of Aveiro, Faculty of Engineering of University of Porto, University of Minho

**Date:** August 2013

**Summary:** The main objective of the SPARCS project was to evaluate the seismic performance of reinforced



concrete buildings representative of the Portuguese housing stock, taking into account the buildings of the first generation (pre-code) and those that have been designed according to the different codes. As result, the project contributed to the calibration of capacity and fragility curves necessary for regional scale risk analysis and provided additional basis for the development of future codes. Six case-study buildings were used to represent generic reinforced concrete frame buildings corresponding to three different design conditions. Seismic demands, capacity curves, threshold values for the definition of damage limit states and the fragility curves were assessed through the numerical evaluation of response from pushover analyses.

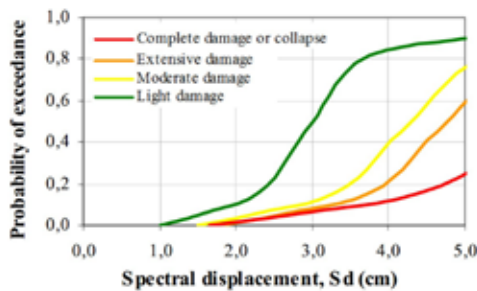


Fig. 1 – Fragility curves for reinforced concrete buildings (high-rise) of Alvalade neighbourhood (Lisbon).

Furthermore, the seismic performance of the masonry enclosures in reinforced concrete buildings was evaluated. The responses of numerical models without masonry enclosures and with two innovative solutions were assessed. Finally, a parametric study taking into account the influence of the torsion was also carried out.

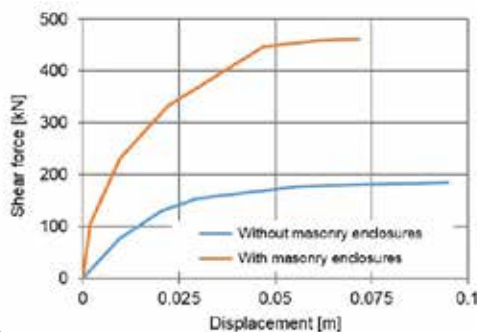


Fig. 2 – Capacity curves of the numerical model with and without traditional masonry enclosures (double leave wall solution).

> **REABEPA - Structural Rehabilitation of Masonry Walls in Old Buildings**

**ISISE Principal Researcher:** Paulo Lourenço

**Budget:** Global: 199.951,00€/ISISE-UM: 24.228,00€

**ID:** PTDC/ECM/101201/2008

**Funding Entity:** FCT

**Principal Contractor:** Laboratório Nacional de Engenharia Civil (LNEC)

**Participating Institutions:** University of Aveiro, Faculty of Engineering of University of Porto, University of Minho

**Date:** August 2013

**Summary:** The main objective of the project was to contribute to the development of knowledge in the area of seismic rehabilitation and strengthening of ancient buildings, as a base for a better supported and more efficient design and construction practices. The main achievements attained at UMinho can be summarized as follow:

- (1) the seismic behaviour assessment of traditional timber frame walls was carried out by means of quasi-static in-plane cyclic tests, taking into account different types of infill and different pre-compression loads to evaluate their influence on the timber frame;
- (2) based on the evaluation of damage observed during the first part of the experimental campaign, appropriate retrofitting solutions were proposed and implemented on the walls to improve their seismic capacity. Both traditional and innovative techniques were considered;
- (3) based on the experimental results, an analytical hysteretic model was proposed and simplified numerical analyses were carried out to assess influencing parameters.





> **Improved and Innovative Techniques for the Diagnosis and Monitoring of Historical Masonry**

**ISISE Principal Researcher:** Francisco Fernandes  
**Budget:** Global: 192.966,00€/ISISE-UM: 192.966,00€  
**ID:** PTDC/ECM/104045/2008  
**Funding Entity:** FCT  
**Principal Contractor:** University of Minho  
**Date:** October 2013

**Summary:** Combine different non-destructive tests and permanent monitoring, together with appropriate real-time processing tools, to be able to characterise the material, detect anomalies and hidden features, monitor displacements and detect crack initiation, location and crack growth. The monitoring distributed in the entire structure will allow the detection and location of "small" defects while large areas are evaluated with reasonable sensitivity. The detection and growth of defects are of primary importance, while detailed characterization is expected to be a complement. If it leads to the conclusion that better characterization is necessary then, localized inspection methods are to be used. Main achievements: prototype and international patent for a water pressure based tubejack system to obtain the state of stress of masonry walls, improvement of sonic tests for masonry testing, namely: software for automatic calculation of the wave velocity, prototype for array of accelerometers and automatic hitting device, prototype for a geoelectric device for masonry tomography analysis, algorithms for data fusion, several papers in journals and conferences, one on-going PhD thesis.



> **HISTWIN<sub>2</sub> - HIGH STEEL TUBULAR TOWERS FOR WIND TURBINES**

**ISISE Principal Researchers:** Luís Simões da Silva and Carlos Rebelo  
**Budget:** Global: 1.295.554,00€/ISISE-UC: 210.450,00€  
**ID:** RFSR-CT-2010-00031  
**Funding Entity:** RFCS-ResearchFund for Coal and Steel  
**Principal Contractor:** LTU – Luleå Technical University  
**Participating Institutions:** LTU, RWTH, FCTUC, AUTH, Martifer, Ruukki, Pöyry Building Services Oy, Germanisher Lloyd  
**Date:** October 2013

**Summary:** The use of steel tubular towers for larger wind turbines and higher hub-heights is limited by economical and technological barriers in view of recent advances of the concrete industry. In the present project, new solutions for steel and hybrid towers' stability and foundations with micro steel piling will be developed. Experimental, numerical and analytical study will lead to new market opportunities for tubular towers.

Objectives:

- > Extension of the concept of slotted friction-grip bolted connections for the longitudinal joining of steel segments.
- > Development and validation of alternative steel-intensive piled foundations.
- > Optimization and automated production of the internal fittings (accessories) in the steel tower.
- > Optimization and automatic welding procedures of the tower openings; after theoretical studies in the HISTWIN project, its implementation will be experimentally verified on the down-scaled specimens.
- > Comparative LCA evaluation of steel and hybrid (steel-concrete) towers.

Polygonal shape of cross section will be considered in the "modular tower" numerically and experimentally, and in comparison to circular cross-section.





## > SB-STEEL - Sustainable Building Project in Steel

**ISISE Principal Researchers:** Luís Simões da Silva and Helena Gervásio

**Budget:** Global: 1.274.181,00€/ISISE-UC: 201.325,00€

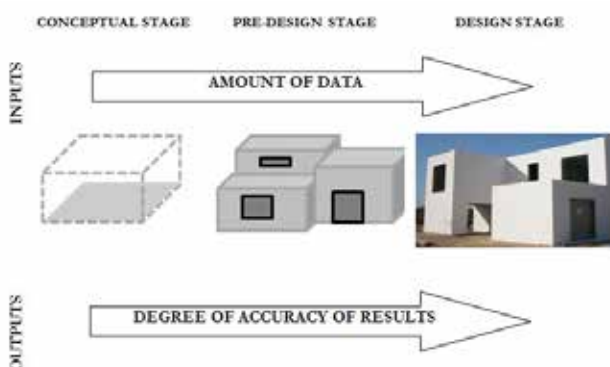
**ID:** RFSR-CT-2010-00027

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

**Principal Contractor:** Valtion Teknillinen Tutkimuskeskus - VTT

**Participating Institutions:** Valtion Teknillinen Tutkimuskeskus - VTT, Acciona Infraestructura SA - ACCIONA, Fundacion Labein - LABEIN, Universitatea "Politehnica" din Timisoara - PUT, Faculdade de Ciencias e Tecnologia da Universidade de Coimbra - FCTUC; University of Minho, Aristotle University of Thessaloniki - AUTH, European Convention for Constructional Steelwork - ECCS, Mostostal Warszawa SA - MOSTOSTAL, Arcelor Mittal

**Summary:** The proposal aims at improved competitive capacity of the steel construction sector by providing concepts and methods of sustainable steel-intensive building. A science-based approach to sustainability-conscious decision-making will be developed for the early building project phases that are crucial for value and performance of the completed building (pre-design/ concept phase), and for the choice of design scheme (preliminary design). The work consists of identification of key indicators of value and performance (emphasising sustainability), methodology to cope with life-cycle performance criteria (incl safety, security, user-comfort), benchmarking and validation of methods, and software both for investigative work and dissemination of results.



## R&D STARTED PROJECTS

### > INSYSME- Innovative Systems for Earthquake Resistant Masonry Enclosures in RC Buildings

**ISISE Principal Researcher:** Paulo Lourenço

**Budget:** Global: 2.697.131,61€/ISISE-UM: 54.609,82€

**ID:** 606229

**Funding Entity:** EC (BSG-SME-AG -Research for SME associations/groupings)

**Principal Contractor:** Università degli Studi di Padova

**Participating Institutions:** Tiles and Bricks Europe AISBL (BE), ANDIL Associazione nazionale degli industriali dei laterizi (IT), Arbeitsgemeinschaft Mauerziegel (DE), Associação Portuguesa da Industria de Cerâmica (PT), Tugla Ve Kremi Sanayicileri Derneği (TR), Universidade do Minho, Università Degli Studi di Pavia (IT), National Technical University of Athens (EL), Universitaet Kassel (DE), CTCV - Centro Tecnológico da Cerâmica e do Vidro (PT), Middle East Technical University (TR), Ruredil Spa (IT), SDA-engineering GmbH (DE), Vavouliotis-Gounaris-Mitakis Abee Eidon Keramopoiias (EL), H.I. Struct S.R.L. (RO)

### > ENDURE: European Network for Durable Reinforcement and Rehabilitation Solutions

**ISISE Principal Researcher:** Joaquim Barros

**Budget:** Global: 3.870.520,94€/ISISE-UM: 257.078,25€

**ID:** 607851

**Funding Entity:** EC (FP7-PEOPLE-2013-ITN-Support for training and career development of researchers - Marie Curie)

**Principal Contractor:** The University of Sheffield (UK)

**Participating Institutions:** Universiteit Gent (BE), University of Patras (GRC), University of Bath (UK), Lulea Tekniska Universitet (SWE), Budapest University of Technology and Economics (HU), Universitat de Girona (SP), Università degli studi di Padova (IT), Politecnico di Milano (IT), Technische Universitaet Kaiserslautern (DE), Eidgenoessische Materialpruefungs (CH), Universidade do Minho (PT), Latvijas Universitates Polimeru Mehanikas Instituts (LV), Netcomposites Limited (UK)



> **EQUALJOINTS – European pre-QUALified Steel JOINTS**

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

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

**ID:** RFSR-CT-2013-00021

**Funding Entity:** EU – RFCS: Research Fund for Coal and Steel

**Principal Contractor:** University of Naples

**Participating Institutions:** Universidade de Coimbra, Imperial College, University of Liège, Arcelormittal, Cordioli&C, Politechnical University of Timisoara

> **SAFEBRITILE – Standardization of Safety Assesment Procedures across Brittle do Ductile Failure Modes**

**ISISE Principal Researchers:** Luís Simões da Silva and Liliana Marques

**Budget:** Global: 1.099.131,00€/ / ISISE-UC: 252.139,00€

**ID:** RFS-PR-12103

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

**Principal Contractor:** Universidade de Coimbra

**Participating Institutions:** University of Coimbra, Arcelor Mittal, Technical University of Eindhoven, European Convention for Constructional Steelwork - ECCS, University of Stuttgart

> **TAPERSTEEL – Design of Non-Uniform Element Fire Resistance**

**ISISE Principal Researcher:** Luis Simões da Silva

**Budget:** Global: 118.952,00€/ / ISISE-UC: 75.772,00€

**ID:** PTDC/ECM-EST/1970/2012

**Funding Entity:** FCT

**Principal Contractor:** University of Aveiro (UA)

**Participating Institutions:** University of Aveiro, University of Coimbra

> **LVS<sub>3</sub> - Large Valorisation on Sustainability of Steel Structures**

**ISISE Principal Researchers:** Luís Simões da Silva and Helena Gervásio.

**Budget:** Global: 1.189.443,00€/ / ISISE-UC: 89.521,00€

**ID:** RFS-P2-12026

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

**Principal Contractor:** Arcelor Mittal

**Participating Institutions:** Arcelor Mittal, CTICM, University of Liège, University of Coimbra; AC&CS srl, Czech Technical University in Prague, University of Naples Federico II, Swedish Institute of Steel Construction – SBI, University of Miskolc, “Politehnica” University of Timisoara – UPT, Vilnius Gediminas Technical University, National Technical University of Athens, University of Ljubljana, Bouwen met Staal – BmS, Bauforumstahl, Tecnalia, Tallinn Technical University – TUT, Building Research Institute (Polish name: Instytut Techniki Budowlanej – ITB, Asturian Club of Innovation – CAI





# COMPLETED PHD THESSES

## > Uncertainty Evaluation of Reinforced and Composite Structures Behaviour

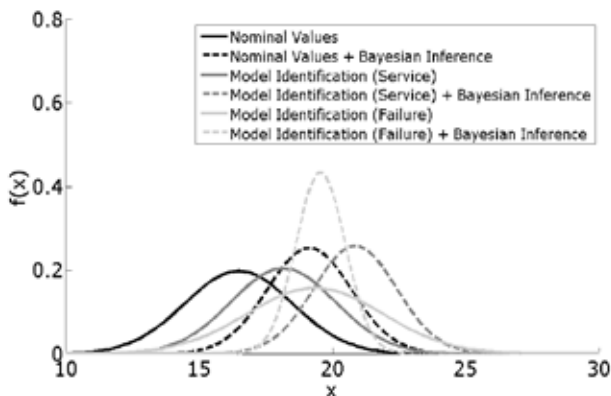
**Author:** José António Silva de Carvalho Campos e Matos

**Supervisors:** Paulo Cruz, Isabel Valente

**Date:** 12<sup>th</sup> July, 2013

**Summary:** The quantity of civil engineering infrastructures increased in a substantial manner within the last decades. As a result of this, countries become responsible for an enormous set of infrastructures to be maintained during its life. It is therefore necessary to develop advanced tools that, with the support of data from observation systems, allow to obtain an accurate representation of analyzed structure. This way, while some researchers introduced model identification techniques, others presented probabilistic assessment algorithms with Bayesian inference updating. Within this thesis an advanced probabilistic assessment algorithm that incorporates both techniques is developed. The final purpose is to obtain a reliability index that provides a structural performance measure. The developed algorithm is validated with two sets of laboratory tested structures loaded up to failure (reinforced concrete and composite beams). Finally, it is tested on a composite bridge submitted to a load test.

CV: Graduated in civil engineering (2002) and obtained a Master in structural engineering (2008), at Faculty of Engineering of Porto, and a PhD in civil engineering (2013), at School of Engineering of Minho. Develops his teaching activities at School of Engineering of Minho. His research areas comprise life-cycle costs, safety and risk assessment. Participates in several international committees.



## > Assessment of the performance of the buildings' surroundings towards the action of earthquake

**Author:** Manuel Fernando Paulo Pereira

**Supervisors:** José L. Barroso de Aguiar, Paulo Lourenço, Aires Camões

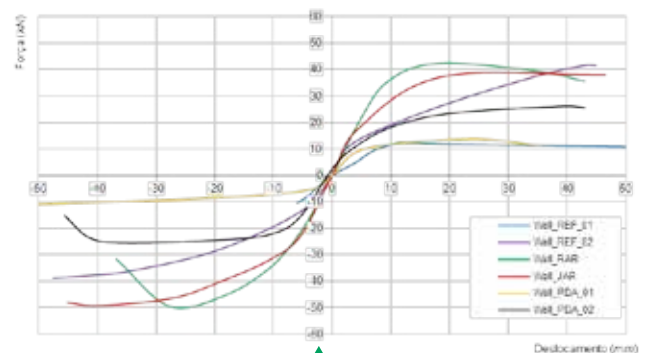
**Date:** 19<sup>th</sup> July, 2013

**Summary:** Recent earthquake codes in Europe require the safety assessment of non-structural elements (such as infills or parapets), when their collapse entails danger for people or for the main structure. Images of out-of-plane expulsions and severe in-plane damage of infill walls in recent seismic activities seem due to bad practice, wrong solutions or inadequate design.



Failure of infill masonry in out-of-plane direction (L'Aquila, Italy).

A large experimental campaign was carried out in order to determine: the masonry properties; the static out-of-plane panel behaviour subjected to previous in-plane damage; and the building behaviour subjected to dynamic tests (in a shaking table). Numerical parametric tests were also conducted, to establish analytical models able to reproduce in-plane and out-of-plane behaviour leading to an estimated load bearing capacity for each model.



Global results of out-of-plane tests



These studies made finally possible the development of a design method, for the in-plane and out-of-plane behaviour of masonry infills within reinforced concrete frames.

CV: **Manuel Pereira** obtained his degree in Civil Engineering at FEUP in 1985, MSc at UMinho in 2005 and PhD at UMinho in 2013. After five years of independent work, in 1990, he started PPSEC, a company of civil engineering projects with the main activities in technical consulting, structural design and construction management. Since 2010, he is Assistant Professor at Polytechnic Institute of Viana do Castelo.



Model 2 north and west elevation after shaking table test.

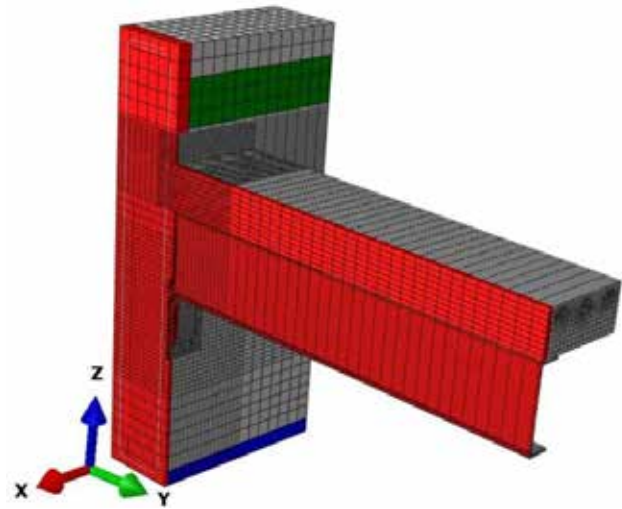
> **Behaviour of Joints: Simple and Efficient Steel-to-concrete Joints**

**Author:** José Alexandre Gouveia Henriques  
**Supervisors:** Prof. Luís Simões da Silva and Prof. Isabel B. Valente  
**Date:** 19<sup>th</sup> June, 2013

**Summary:** The behaviour of steel-to-concrete joints was investigated within the thesis. Its main objective was a transversal approach to structural steel-to-concrete joints using a configuration developed within the RFCS research project “InFaSo”. In its “complete” version, the joint configuration provides a semi-continuous/continuous solution to connect a composite beam to a reinforced concrete wall. Though, the adaptability of the configuration allows its modification to perform under different structural requirements, as pinned joint. A sequential approach was carried out, evolving from the simplest configuration to the “most complete”, with numerical and analytical characterization of the components, connections and joints.

The experimental validation was performed whenever possible with the contribution of the results available in the literature and produced in the experimental campaign of the referred project. Thus, analytical and numerical models were proposed for characterization of the behaviour of joints between composite beam and reinforced concrete wall independently of the structural idealization: pinned, semi-continuous and continuous.

CV: **José Henriques** *Education:* June 2003, graduation in Civil Engineering by the FCTUC. January 2008, Master degree in Civil Engineering by the FCTUC. June 2013, PhD degree in Steel and Composite Construction by the FCTUC. *Work Experience:* From October 2003 to September 2005, Civil Engineer at CMB, Lda. From October 2005 to November 2007, Research Engineer at the ULg, Belgium. From January 2008 to September 2012, Research Engineer at FCTUC. Since October 2012, R&D project manager at Cool Haven, SA.



> **Support System for Comparative Analysis of Life Cycle Costs of Different Solutions for Concrete Roadway Bridges**

**Author:** José Carlos Almeida  
**Supervisors:** Prof. Paulo Cruz (EE-Uminho) and Prof. Jorge de Brito (IST-UTL)  
**Date:** 18<sup>th</sup> October, 2013

**Summary:** The use of the structural systems combining members of different nature, such as reinforced concrete walls with steel/composite beams and columns, presents a competitive solution benefiting from the structural efficiency of each type of member. The aim of this work was to create an innovative method that quantifies the life cycle costs of concrete





decks of roadway bridges that supports the decision-making regarding the optimal selection between several construction / repair alternatives.

The main deterioration mechanisms of concrete decks were presented. Some of the most modern materials used on concrete bridges are also presented and characterized with special focus on their cost and service life.



Taking into account the vehicle operating costs, the cost of time and accident costs and user costs were computed. The model created was applied to an existing bridge,

where the determination and comparison of the costs of the application of different repair alternatives are analysed. In order to be able to make some recommendations of operation sensitivity analysis of the parameters that are considered most important is performed.



CV: **José Carlos Almeida** is graduated in civil engineering (structures area) by the Faculty of Engineering of the University of Porto, and has MSc and PhD degrees in Civil Engineering by University of Minho. Since the year 2000 he is a higher education professor. Since 2003, he is a collaborator in the Polytechnic Institute of Guarda. Currently he is the civil engineering Course Director and the President of the Pedagogical Council of the Technology and Management School.

## AWARDS & PRIZES

> Gláucia Dalfré and Joaquim Barros: Second place in the category "Outstanding technical and scientific paper on management and quality control of buildings", XII Latin-American Conference on the Construction Pathologies, and XIV Conference on the Construction quality control CONPAT-2013, Cartagena de Índicas, Colombia, October 2013.

> Hélder Sousa: Best Presentation Award - I Workshop of the PhD Students in Civil Engineering, University of Minho, 2013

> Patrícia Silva: Best Poster Award - I Workshop of the PhD Students in Civil Engineering, University of Minho, 2013

> Susana Moreira: Best Presentation Award - ISISE Day-Out and Workshop, Coimbra, Portugal, 2013

> José Sena-Cruz, Patrícia Silva, Pedro Fernandes, Miguel Azenha, Joaquim Barros, Christoph Sousa, Fernando Castro, Tiago Teixeira: Best Poster Award – FRPRCS-11 International Conference, Guimarães, Portugal, 2013

> The paper entitled "Experimental investigation on the repair of rammed earth by means of injection of mud grouts", by R.A. Silva, D.V. Oliveira, P.B. Lourenço, L. Schueremans and T. Miranda, was awarded as the best paper on the topic "Natural Hazards & Risk Mitigation" at the CIAV 2013 conference.

> Luís Simões da Silva: Award "Personality of the year in Engineering", Prémios Construir, 2013





> Luís Simões da Silva: ECCS Silver Medal, Milano, Italy, 2013

> The team entitled CAPSULUM composed by Patrícia Silva, Christoph Fernandes and Pedro Fernandes from University of Minho, under supervision of Miguel Azenha won the SC@UM Challenge promoted by FRPRCS-11 conference.



## EVENTS

### > The SC@UM Challenge

**Introduction:** Hosted by FRPRCS-11 last June 26-28 in Guimarães and supported by IIFC and S&P, the SC@UM Challenge has gathered researchers, practitioners and institutions in a reflection about CFRP strengthening applied to reinforced concrete (RC) structures. The motif was a T-shaped RC beam, which was pre-loaded to simulate the service conditions and then strengthened with longitudinal and transverse CFRP laminates. The SC@UM Challenge was mostly aimed for the PhD students working on the field and consisted on predicting accurately a group of parameters characterizing the load-deflection response and failure mechanism of the RC T-beam after strengthening.

ID	Institution	Country
IIUSESEU	Southeast University	China
MINSTR	University of Minho	Portugal
SUM	Simpson Strong Tie and University of Minho	USA and Portugal
ShinyDiamond	University of Minho	Portugal
CAPSULUM	University of Minho	Portugal
WCTW	University of Minho	Portugal
UME-TEAM	IUSS Pavia	Italy
SHEFFS	University of Sheffield	UK

Eight teams have reached the final stage of the competition, among a total number of 19 teams initially enrolled, representing, in addition to those countries listed above: Greece, Romania, Iran, Poland, Russia

and Saudi Arabia. Three teams have been awarded with the first, second and third place prizes: CAPSULUM from ISISE-University of Minho (Portugal), UME-TEAM from IUSS Pavia (Italy), and THE SHEFFS from the University of Sheffield (UK), respectively, have been awarded with a pecuniary prize of 1000,00€, 500,00€ and 250,00€. Considering the excellent quality of the reports delivered, the Jury members have also decided to attribute two honourable mentions, the Excellent Report Award, to the two best reports delivered by the teams SUM from the company Simpson Strong Tie (USA) and ISISE-University of Minho, and WCTW from ISISE-University of Minho.



Group photo of the SC@M Challenge awarded teams at the closing session of FRPRCS-11.

The challenge created a unique atmosphere to stimulate the emergence of alternative approaches and creative solutions to the FRP strengthening practice and technology. The contribution of young researchers to the development of the current state of the art should be encouraged in the future, through other events and periodic initiatives of this kind.



**> 11<sup>th</sup> International Symposium on Fiber Reinforced Polymers RC Structures (FRPRCS-11)**

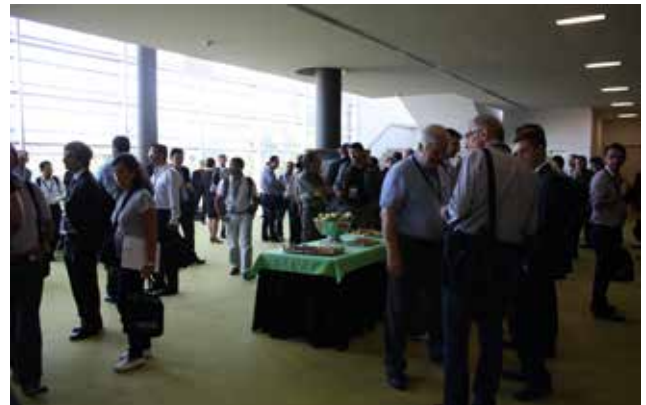
**Venue:** Centro Cultural Vila Flor, Guimarães, Portugal

**Date:** 26-28 June, 2013

**Website:** [www.frprcs11.uminho.pt](http://www.frprcs11.uminho.pt)

**Summary:** The 11<sup>th</sup> International Symposium on Fiber Reinforced Polymer for Reinforced Concrete Structures (FRPRCS-11), an event Co-sponsored by IIFC, was held last 26 to 28 of June in the Vila Flor Cultural Centre of Guimarães City, in Portugal. After a peer review process, 148 extended abstracts and full papers were accepted and published in the proceedings. Participants from 38 countries in representation of 137 institutions attended FRPRCS11, resulting in a total number of about 170 attendants. Prof. Brahim Benmokrane and Prof. Stijn Matthys presented two brilliant keynote lectures that were an extraordinary contribution to the motivation and enthusiasm of the attendants, and to the scientific

quality of the FRPRCS11. The closing ceremony ended with the announcement of the chairman of next FRPRCS11 organization, Prof. Zhishen Wu, who in 2015 will host the event in Nanjing, China, the FRP community interested in presenting the most recent advances in the use of these extraordinary composite materials for the reinforcement and strengthening of concrete structures



**Venue:** Universidade do Minho, Guimarães, Portugal

**Date:** 13-15 May, 2013

**Website:** [www.iomac.dk](http://www.iomac.dk)

**Summary:** The 5<sup>th</sup> IOMAC 2013 Conference was jointly organised by University of Minho and University of Porto, with the institutional sponsorship of Brüel & Kjaer and Structural Vibration Solutions.

The Conference covered all major aspects of Operational Modal Analysis, with focus on the following topics: identification techniques, measurement techniques, signal processing, noise control, comparison with traditional modal analysis, model validation, model updating, damage detection, load estimation, structural modification, response simulation, fatigue and vibration level.

Beyond a good number of interesting papers on these topics, presented by researchers, technical specialists and students, the Conference had a Keynote Lecture by Dr. Bart Peeters and a Lecture of Honour by Dr. Reto Cantieni, two prestigious members of the OMA community.





➤ **ASCP-2013, 3<sup>rd</sup> National Conference on Bridge Safety Preservation**

**Venue:** Faculdade de Engenharia da Universidade do Porto, Porto, Portugal

**Date:** 26-28 June, 2013

**Summary:** The 3<sup>rd</sup> National Conference on Bridge Safety and Maintenance – ASCP'2013 – occurred at University of Porto, from 26 to 28 June of the present year.



The principal objective of ASCP'2013 was the diffusion of the best achievements in the bridge safety and preservation area, creating a discussion forum of the principal topics related to this area, where we can highlight the following ones: life

cycle analysis, safety evaluation, dynamic behaviour, damage detection, durability, fatigue, inspection, monitoring, reinforcement or rehabilitation and bridge management systems.



➤ **II DiSTEEL workshop on Recent Developments and Contributions for the Seismic Design Approaches of MRF Steel Structures**

**Venue:** Exponor – Centro de Congressos (Matosinhos)

**Date:** 25<sup>th</sup> October, 2013

**Organizers:** Carlos Rebelo, Hugo Augusto

**Summary:** The workshop was held in Exponor as part of the IX CMM Conference, and aimed to present and discuss important research findings from the DiSTEEL project.

The workshop was moderated by prof. Carlos Rebelo and as speakers: The project coordinator prof. Timothy Sullivan from the EUCENTRE, introducing the project and the objectives. From the University of Napoli "Federico II", Prof. Gaetano Della Corte, presented the developments in the characterization of the bolted steel joints, using simple design tools. Professor José Miguel Castro from the University of Porto presented a comparison between force-based and displacement-based methods in the seismic design. And from the University of Coimbra, Eng. Hugo Augusto presented the

the work done in the characterization of partial-strength steel joints using an FE model. The workshop included a publication with the slides used during the presentations.





› **International Workshop on Modular Steel Intensive Building Research and Market Opportunities**

**Venue:** Porto

**Date:** 25<sup>th</sup> October, 2013

**Organizers:** Carlos Rebelo, Rui Simões and Guiomar Vicente

**Summary:** The workshop was developed as part of the European research project FRAMEUP in order to gather stakeholders from the industry and to promote the main ideas of the project by sharing the main ongoing results. The project aims to develop a concept and make feasibility tests of a new type of execution technique for a skeletal system (top-down construction) and to establish structural performances of joints developed for this application.

The workshop was integrated in the “IX Conference on Steel and Composite Construction”. The objectives of the project, as well as the relevant results of the ongoing work were exposed in four presentations as listed below:

- Global overview and the main innovation of the FRAMEUP project;
- The pilot building – erection process and lifting-up technology of modules;
- Innovation on the conception of tubular joints;
- Robustness of pilot building: Construction and service phases.

› **II Luso-African Conference on Sustainable Steel Construction**

**Venue:** Maputo, Mozambique

**Date:** 19<sup>th</sup> July 2013

**Summary:** The II Luso-African Conference on Sustainable Steel Construction took place on July 19<sup>th</sup> at the University Eduardo Mondlane in Maputo, and was sponsored by CMM - Associação Portuguesa de Construção Metálica e Mista. It had the institutional support of the University of Coimbra, Universidade Eduardo Mondlane, Portos e Caminho-de-ferro de Moçambique, ANE - Administração de Estradas de Moçambique and the Engineers of Mozambique. With the firm intention of disseminating the latest innovations in this type of construction and publicize the guidelines of research in this field, the II Luso-African Conference on Sustainable Steel Construction, has not forgotten the importance and potential of partnerships between Portugal and African countries in the field of steel building sustainable use of the opportunities and technical know-how that our country has in this sector. Evaristo Mussupai, ANE; e Utilização de Estruturas Metálicas- Exemplos Práticos, Eng. Tiago Mendonça, Betar Lda.





> **IX Conference on Steel and Composite Construction and I Luso-Brazilian Conference on Sustainable Steel Construction**

**Venue:** Exponor, Porto

**Date:** 24 -25 October, 2013

**Summary:** The biennial congress of CMM - Portuguese Steelwork Association, held on 24<sup>th</sup> and 25<sup>th</sup> October 2013, at Centro de Congressos da Exponor, Porto.

The "IX Conference on Steel and Composite Construction" was held for the first time simultaneously with the "I Luso-Brazilian Conference on Sustainable Steel Construction", corresponding to the requirements of the industry that verifies a quite relevant potential of exportation.

Throughout the various sessions specific topics were addressed in the areas of Architecture and steel, steel and composite bridges, energy efficiency and sustainability of steel buildings, industrial solutions for the construction of buildings.

Major projects, structural safety and performance of new materials and products, implementation and management of quality steel construction, steel construction in the oil industry, mining and renewable energy production.



## UPCOMING EVENTS

> ImpactFire Workshop - Steel connections subject to impact loads

**Venue:** University of Coimbra, Coimbra, Portugal

**Date:** 3<sup>rd</sup> January, 2014

**ISISE Organizers:** Aldina Santiago

> Frameup Workshop

**Venue:** Dusseldorf

**Date:** 28-29 April 2014

**ISISE Organizers:** Rui Simões and Carlos Rebelo

> 9<sup>th</sup> International Masonry Conference

**Venue:** Universidade do Minho, Guimarães, Portugal

**Date:** 7-9 July, 2014

**Website:** [www.iomac.dk](http://www.iomac.dk)

> 4jorninc - The 4<sup>th</sup> Journeys on Urban Fire Safety

**Venue:** Instituto Politécnico de Bragança

**Date:** 6 - 7 November 2014

**ISISE Organizers:** João Paulo Rodrigues

> IFireSS\_2015-International Fire Safety Symposium

**Venue:** University of Coimbra, Coimbra, Portugal

**Date:** 20-23 April, 2015

**Website:** [www.albrasci.com/ifires\\_2015](http://www.albrasci.com/ifires_2015)





# ISISE TECHNOLOGIES

## FRICION FORCES BETWEEN CABLES AND CLAMPS

### ARENA FONTE NOVA, SALVADOR - BRASIL

The structural system of the roof of Arena Fonte Nova, in Salvador, Brasil is composed by a set of high strength steel cables supported by clamps. The clamps are composed by a base plate and a cover plate tightened against the cable placed inside, in order to assure a specified minimum value of friction force. During the erection of the supporting clamps in order to eliminate some dimensional defects found in some clamps and also to assure a more uniform contact, there was placed a thin plate in zinc with 1 mm thickness between clamp pieces and cables. In view of this amendment, the question that arises relates to the need to demonstrate that the introduction of the zinc plate of 1 mm thickness does not imply a decrease in the friction force developed between the steel cables and the clamp pieces.



The technical report performed by some members of SMCT group of ISISE aimed to justify without resource to testing, that the change of the solution originally predicted for the execution of the clamps to support high-strength steel cables in Arena Fonte Nova, Salvador - Brazil does not imply a modification of the most relevant design parameters, which are the clamping force and the slip factor.

