

INDEX

01

ISISE HIGHLIGHTS

02

R&D COMPLETED
PROJECTS

04

R&D STARTED
PROJECTS

05

COMPLETED PhD
THESES

10

AWARDS & PRIZES

10

EVENTS

14

UPCOMING EVENTS

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GROUPS
**Historical and Masonry
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**Steel and Mixed Construction
Technologies**
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Structural Concrete
Joaquim Barros

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ISISE HIGHLIGHTS

The sixth issue of the ISISE Newsletter covers the main activities developed from December 2013 to April 2014. In this period 2 new national R&D projects were initiated, 3 R&D projects were concluded and 9 PhD theses were also concluded. ISISE has been involved in the organization of 7 events and a new award was attributed to ISISE members.



Graduation ceremony - SUSCOS

The University of Minho and ISISE participated in the Commitment on Raw Materials RMC, "ROSE - Recycling of secondary raw materials for a sustainable optimization of construction processes in civil engineering works" (<https://ec.europa.eu/eip/raw-materials/en/commitment-detail/344>) approved by the High Level Steering Group of the European Innovation Partnerships (EIPs). This is a consortia of Academic and Research Partners from 7 countries (Italy - Leader, Belgium, France, Poland, Portugal (FEUP, LNEC, UM), United Kingdom and Sweden) in cooperation with the following non-academic partners:

- > 7 large companies (KGHPOLSKA MIEDZ S.A., ENEL, Greenbet Polska S.A., Mota Engil, Katowicki holding, Teixeira Duarte, Keltbray);
- > 6 SME (AGS, RC Vedelago, Technital, I.P.S, FORMIT, LOTUS);
- > 6 stakeholders (Campania Region, Veneto Region, Legambiente, CCDR-N, APA, Katowicki holding).

The main innovation outcomes of this Commitment to be implemented from March 2014 to December 2020 are: new products to the market, new processes, new technologies, new ideas to the market.



Railway
2014-S06



R&D COMPLETED PROJECTS

> **DURCOST - Innovation in reinforcing systems for sustainable pre-fabricated structures of higher durability and enhanced structural performance**

ISISE Principal Investigator: Joaquim Barros

Budget: Global: 199.234,00€/ISISE-UM: 199.234,00€

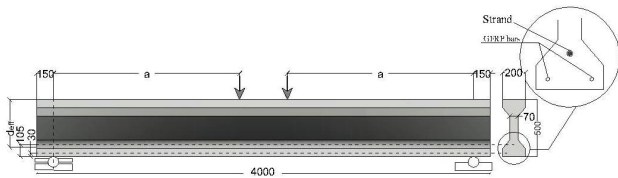
ID: PTDC/ECM/105700/2008

Funding Entity: FCT

Principal Contractor: University of Minho

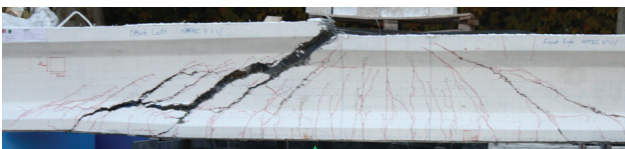
Duration: From June 2010 to December 2013

Summary: A highly effective reinforcing system was developed for the pre-fabrication of concrete structures of larger life cycle, combining glass fibre reinforced polymer and steel bars, with a reinforcing ratio and a pre-stress level that assure the required load capacity and ductility, also considering fire conditions. The GFRP bars are positioned as close as possible to the tensile surface of the beam, and the steel bars have a thickness cover that avoids corrosion.



Geometry of the beam

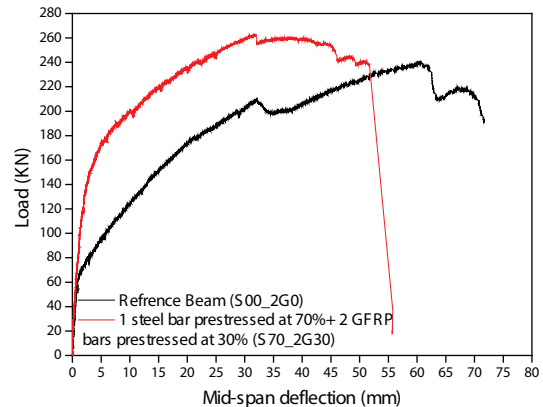
The shear resistance is assured by high performance fibre reinforced concrete in order to eliminate steel stirrups.



Crack pattern of S70-2G30

Experimental and analytical research with pre-fabricated hybrid reinforced pre-stressed beams was executed to develop a guideline for the design

and construction of this type of structures. A constitutive model was implemented in FEMIX computer program, capable of simulating the behaviour of these elements from their very early age up to their working conditions.



Load versus mid-span deflection of S00_2G0 and S70_2G30 beams

> **SelCo - Service life behaviour of concrete structures: a multi-physics**

ISISE Principal Investigator: Joaquim Barros

Budget: Global: 159.213,00€/ISISE-UM: 66.554,00€

ID: PTDC/ECM/099259/2008

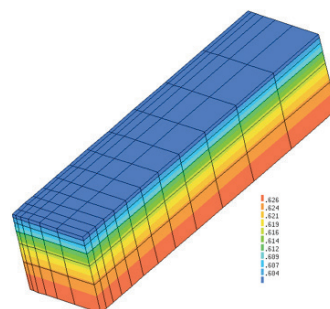
Funding Entity: FCT

Principal Contractor: FEUP

Participating Institutions: University of Minho

Duration: From June 2010 to November 2013

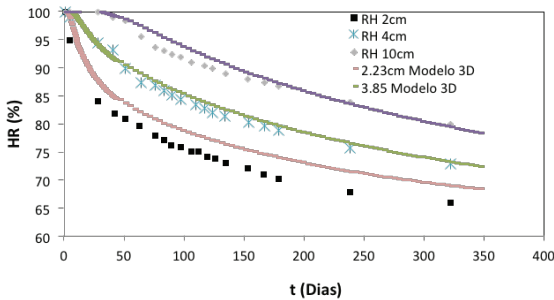
Summary: The present project, developed in cooperation with the Faculty of Engineering of the University of Porto, aimed to contribute to overcome knowledge insufficiencies in regard to the service life behaviour of concrete structures, by deploying a multi-physics approach.



Typical computation of humidity within the multi-physics framework (also allowed sustained prediction of shrinkage stresses)

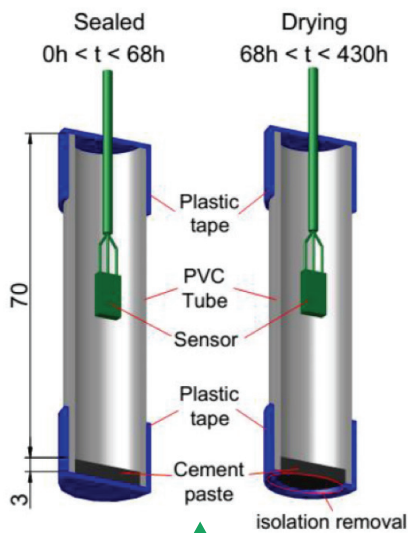


The project involved an extensive experimental research focused on the evolution of moisture distribution inside concrete, and its relation with shrinkage deformations (Tasks 1, 2 and 3). Besides, a variable axial restraint testing device (Task 4) was used to characterize the tensile behaviour of concrete induced by shrinkage (Task 5).



Humidity profile in concrete (measured vs calculated)

After this experimental program, a numerical framework was implemented (Task 6), by developing a thermo-hygro-mechanical numerical framework, an essential outcome of the present project. Finally, the last Task 7 was focused on applications, appropriately monitored, to provide an in-depth validation of the developed numerical tools.



Scheme of embedded humidity sensor in concrete

> **ECOFACHADA - Eco-Efficient Concrete Facade Panels with a Geopolymer Base Integrating Industrial Waste**

ISISE Principal Investigator: Paulo Santos

Budget: Global: 314.018,00€/ISISE-UC: 78.504,00 €

ID: 13285

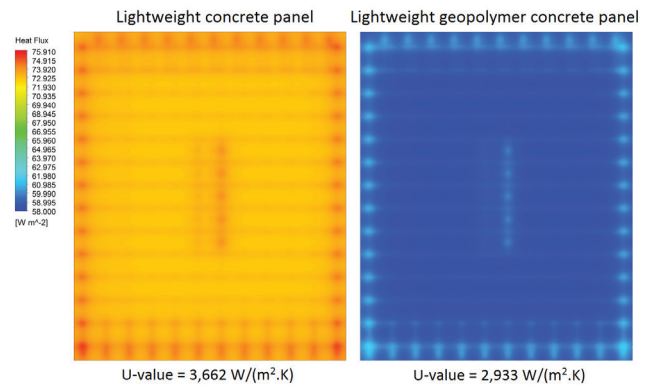
Funding Entity: ADI

Principal Contractor: PREGAIA

Participating Institutions: Prégaia-Préfabricados, Lda (Promoting Institution); UC, Portugal (Scientific sub-contractor)

Duration: From October 2010 to October 2013

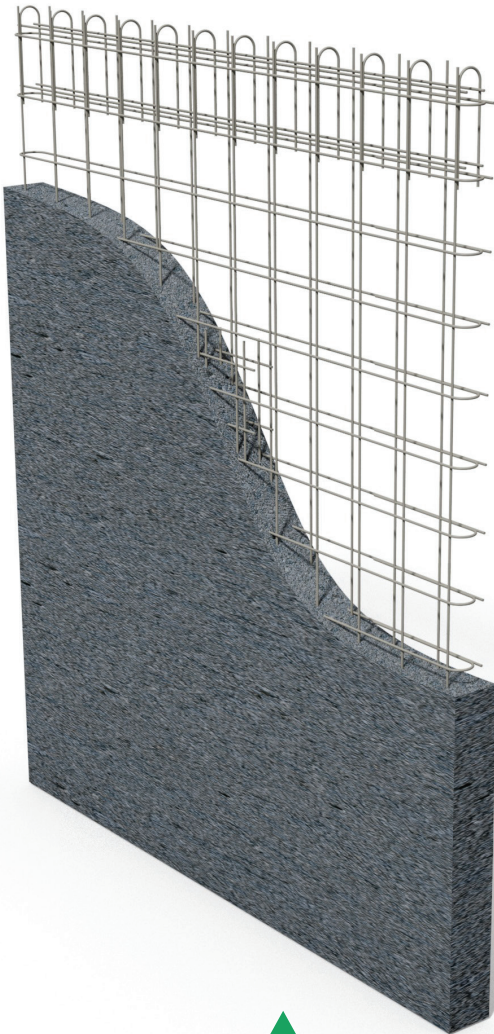
Summary: Nowadays, sustainability should be a major R&D priority in the construction sector. Within this research topic, the main goal of this project is the development of a new product: precast facade panels with geopolymer concrete integrating industrial waste.



Heat flux and thermal transmittance values

Indeed, the use of these facade panels improves the thermal behaviour of buildings and the replacement of cement by an eco-efficient material such as metakaolin, reduces the CO₂ emissions per m³ of produced concrete.





Model of the new panel prototype

Additionally, when the cement is replaced by industrial waste with pozzolanic properties, such as those resulting from coal-fired power-plants, besides the reduction of pollution inherent to the production of raw materials, it also promotes the recycling of industrial waste. In this project the performance of the new developed panels was characterized, including the thermal behaviour, mechanical resistance and durability.

R&D STARTED PROJECTS

> **VisCoDyn – Innovative method for continuous monitoring of concrete viscoelastic properties since early ages**

ISISE Principal Investigator: Miguel Azenha

Budget: Global: 49.943,00€/ISISE-UM: 49.943,00€

ID: EXPL/ECM-EST/1323/2013

Funding Entity: FCT

Principal Contractor: University of Minho

> **ClickHouse - Development of a prototype of emergency housing in composite materials**

ISISE Principal Investigator: José Sena Cruz

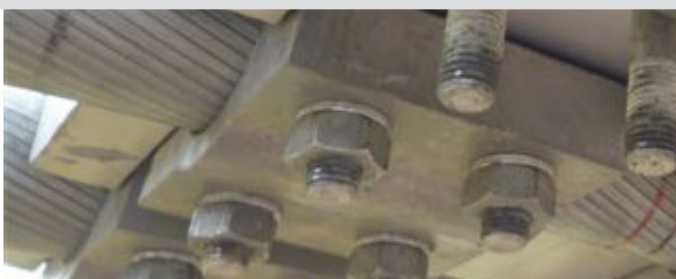
Budget: Global: 952.375,30€/ISISE-UM: 166.106,00€

ID: 38967

Funding Entity: ADI

Principal Contractor: Alto Perfis Pultrudidos, Lda.

Participating Institutions: Instituto Superior Técnico, University of Minho





COMPLETED PHD THESES

> **Experimental and Numerical Analysis of the Behaviour of Cold Formed Steel Elements in Fire – Proposal of Simplified Calculation Methods**

Author: Luís Miguel dos Santos Laím

Supervisors: João Paulo Correia Rodrigues

Date: December 2, 2013

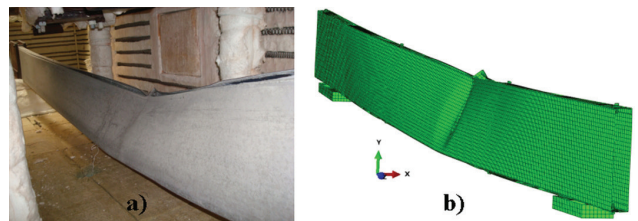
Summary: This research work was mainly aimed at the structural performance of cold-formed steel beams under fire conditions, based on the results of experimental tests and numerical simulations. The main objective of this research was to assess the failure modes and the critical temperature of the studied beams. Other goals of this work were also to investigate the influence of different cross-sections, of the axial restraint to the thermal elongation of the beam and of the rotational restraint at beam supports.



The main conclusions of this investigation were that the critical temperature of this kind of beams may drop significantly with the axial restraint (in contrast to the rotational restraint), and beyond a certain level of axial or rotational stiffness of the surrounding structure, there is no longer any change in the fire resistance of the beam. But, it is important to emphasize that its effect strongly depends on the

shape of the beam cross-sections and slightly on the beam slenderness.

CV: **Luís Laím** is a Civil Engineer and holds a Ph.D. in Fire Safety Engineering in the Department of Civil Engineering of the University of Coimbra. His principal research interests lie in the areas of structural testing, numerical modelling and the development of simplified calculation methods. He is author of 4 ISI papers and has published more than 20 papers in conference proceedings.



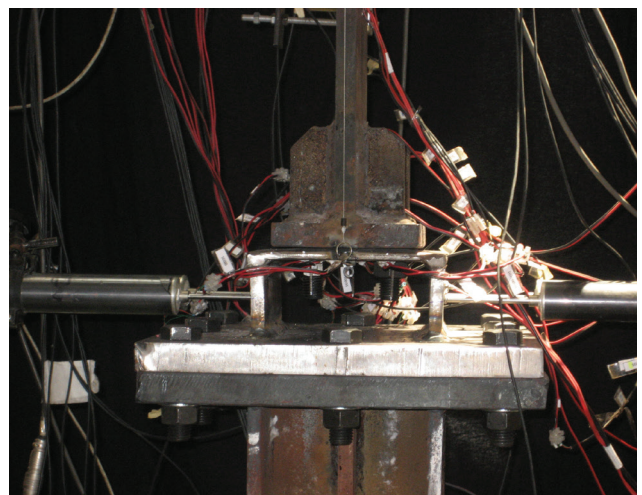
> **Remaining resistance of semi-rigid connections influenced by a fire load**

Author: Tim Heistermann

Supervisors: Milan Veljkovic, Luís Simões da Silva, Efthymios Koltsakis

Date: December 2, 2013

Summary: In a fire situation high rotational capacity of the connection region is required to ensure robustness as steel beams lose their bending stiffness and exhibit large deflections. The reverse channel has been proposed as a practical alternative to assemble beams to tubular columns. Thicknesses and depths of the reverse channel determine the level of rotational restraint.





The reverse channel has the ability to undergo catenary deformation in the tensile zone and similarly it is relatively ductile in the compression zone. Overall, the reverse channel connection response is rather ductile in terms of its ability to undergo large rotational deformation as long as bolt failure is avoided through proper design. Various tests and Finite Element simulations have been conducted to study the behaviour of reverse channel sections. Those results have been used to validate analytical models that describe the behaviour of this type of connection at both room and elevated temperature.



CV: **Tim Heistermann**, Education: Dipl.- Ing. - Civil Engineering (Mar 2007, RWTH Aachen), PhD in Steel Structures/Steel and Composite Construction (Dec 2013, double degree between Luleå University of Technology and University of Coimbra). Work experience: Student research assistant (2004-2006, RWTH Aachen), Consultant for HOCHTIEF (Apr 2007-Aug 2008, Frankfurt am Main), Associate Senior Lecturer (since Dec 2013, Luleå).

> Methodology for safety evaluation of existing timber elements

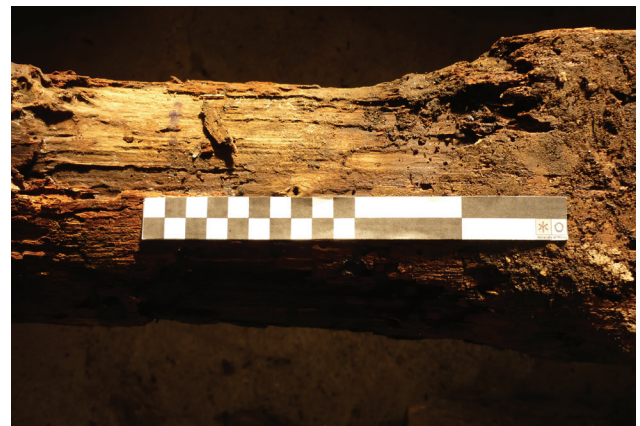
Author: Hélder Manuel da Silva e Sousa

Supervisors: Paulo B. Lourenço, Jorge Branco

Date: December 11, 2013

Summary: In today's society, besides the design of new construction with innovative wood based products, an increasing awareness for the preservation of existing timber structures is visible. Therefore, this PhD thesis was proposed regarding the assessment of existing timber elements with the purpose of establishing a methodology for structural safety evaluation. To reach that objective, initially a multi-scale experimental campaign was made regarding timber elements taken from an existing construction, and the resultant database allowed the correlation between mechanical

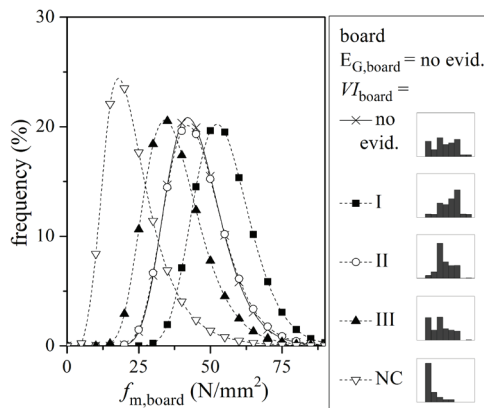
properties of timber between and within elements and in different size scales.



Visual inspection of an existing timber element with decay



The main outcomes of the present work are related to the prediction and inference of reference properties of timber, using a Bayesian hierarchical model that combines information from visual grading and non-destructive testing with local mechanic testing information, attending to possible onsite conditions and available data.



Inference results on bending strength of timber elements by use of a Bayesian Probabilistic Network with information on visual grading.

CV: **Hélder S. Sousa** obtained his 5-year Civil Engineering degree in 2009, MSc in 2010 and PhD in 2013 at the University of Minho. His main research topics are related with safety assessment of timber structures by use of non-destructive testing and probabilistic based methods. Presently, he develops research in the field of timber structure design with innovative wood products.

> Durability analysis of bond between composite materials and masonry substrates

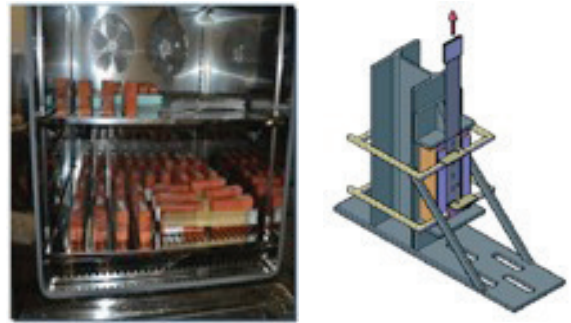
Author: Bahman Ghiassi

Supervisors: Paulo B. Lourenço, Giancarlo Marcarì

Date: December 16, 2013

Summary: The main purpose of this thesis was to create a basis for durability analysis of FRP-strengthened masonry components. Through systematic testing and numerical analysis, fundamental knowledge was developed on the changes in the physical and mechanical properties of the basic materials and bond behaviour under environmental degradation and their effect on the structural response. Accelerated ageing tests were performed to investigate the degradation of bond in FRP-strengthened

brick specimens under hygrothermal conditions. Predictive models were proposed based on the experimental results for simulating the degradation in FRP-masonry systems in different environments.



CV: **Bahman Ghiassi** obtained his B.Sc. in Civil Engineering in 2006, M.Sc. in 2008 and finished his PhD research in 2013 at the University of Minho. He is currently a FCT postdoctoral grant holder and continuing his research at University of Minho. His main research interests are durability of materials, service life prediction, strengthening solutions for masonry and seismic assessment.

> Repair of Earth Constructions by Means of Grout Injection

Author: Rui André Martins da Silva

Supervisors: Daniel Oliveira, Koen Van Balen (KU Leuven)

Date: December 18, 2013

Summary: An important part of earthen built stock is affected by cracking, whose repair is fundamental for its conservation. The successful cracking repair of earthen walls requires employing adequate intervention techniques. With this respect, the injection of mud grouts is being put forward in the recent years and has been showing good results in the few reported cases.



This thesis aims at contributing to the development of the limited knowledge on the injection technique



applied to earth constructions, as well as contributing for the characterization of the rammed earth construction from southern Portugal and for the numerical simulation of its behaviour. For this purpose, an experimental program was carried out, which allowed comprehending the effluence of the mud grouts composition on relevant properties for injection and on the effectiveness of the repair in reamed earth. The shear behaviour of tested rammed earth specimens was also modelled by means of the FEM, obtaining good agreement.

CV: **Rui Silva** obtained his M.Sc. in Civil Engineering at University of Minho in 2008, with the thesis entitled "Experimental Characterization of ancient masonry: strengthening and long-term effects". In 2013, he obtained his dual-Ph.D. degree in Civil Engineering by the University of Minho and KULeuven with the thesis entitled "Repair of Earth Constructions by Means of Grout Injection".

> **Characterization of the seismic behavior of traditional timber frame walls**

Author: Elisa Poletti

Supervisors: Graça Vasconcelos

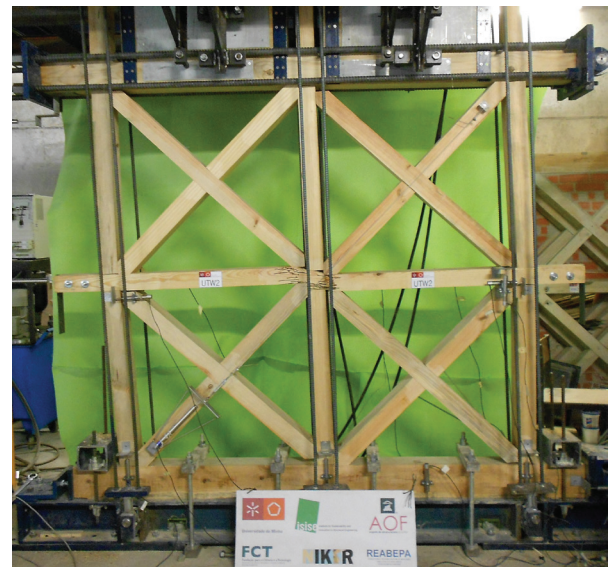
Date: December 20, 2013

Summary: Timber frame structures constitute an important cultural heritage of many countries, representing a typical anti-seismic construction adopted worldwide. Aiming at better understanding their behaviour under seismic loads, an extensive experimental campaign has been carried out, performing in-plane cyclic tests on real scale half-timbered and timber frame walls. Moreover, the walls were retrofitted (using bolts, steel plates and near surface mounted

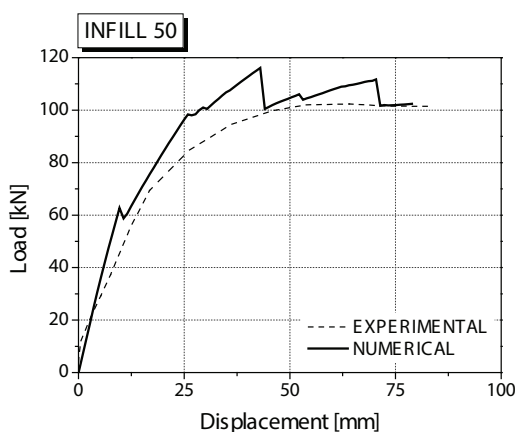
steel flat bars) and re-tested to compare the efficiency of the retrofitting solutions in terms of different seismic parameters. The behaviour of a single connection of the wall was also studied.

From the experimental results, an analytical hysteretic model was derived, which can be used in simplified numerical models to represent the hysteretic response of the walls.

Finally, numerical analyses were performed on timber frame walls and calibrated on the experimental results. Parametric analyses were performed considering different variables.



CV: **Elisa Poletti** obtained her Bachelor's degree in Civil Engineering with Honours in 2006 and her Master's Degree in 2009 with Honours both from University of Parma (Italy). She obtained her PhD in 2013 from University of Minho. Elisa is now a Postdoctoral Associate at The University of Nottingham (UK). Her research interests include seismic performance and retrofitting and constitutive modelling.



> **Fire Behaviour of Concrete Filled Steel Hollow Columns**

Author: Tiago Ancelmo de Carvalho Pires de Oliveira

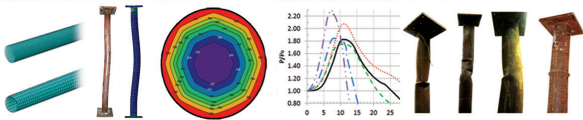
Supervisors: João Paulo Correia Rodrigues

Date: January 10, 2014

Summary: This thesis presents the results of a series of forty fire resistance tests on Concrete Filled Circular Hollow (CFCH) columns with axial and rotational restraining to thermal elongation. Parameters such as the slenderness of the column, its load level, the stiffness of the surrounding structure and the



degree of concrete filling inside the column, were tested. A three-dimensional nonlinear finite element model developed in ABAQUS to predict the behaviour in fire of these columns is also presented. Based on this study, simple equations to evaluate the critical time of the CFCH columns are proposed. Finally, a comparison between the research results and the simple methods proposed by EN1994-1-2 is presented. The thesis shows critical times smaller than the fire resistance suggested in literature. The stiffness of the surrounding structure does not lead to major changes in the critical times. The tabulated data method may be unsafe and the simple calculation model is conservative.



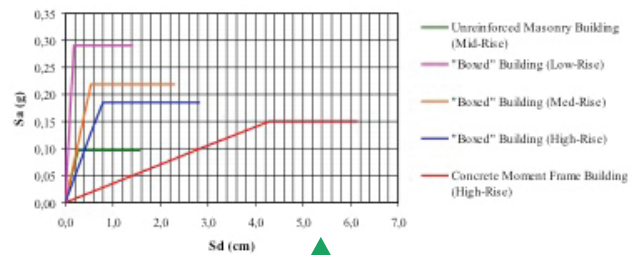
CV: **Tiago Oliveira**, PhD in steel and composite construction with an emphasis on structures subjected to fire at the University of Coimbra, FCTUC - Portugal (2014). Professor at the UFPE and Mauricio de Nassau University. Researcher at the Institute for Sustainability and Innovation in Structural Engineering (ISISE) and Research Group on Fire and Reliability (RISCTEC), respectively situated in FCTUC and UFPE.

> **Seismic strengthening of residential buildings. Economic feasibility of risk mitigation**

Author: Paula Raquel Pires da Cunha Lamego
Supervisors: Paulo B. Lourenço, Luísa Sousa (LNEC)
Date: February 24, 2014

Summary: Part of the existing buildings in mainland Portugal has characteristics of great seismic vulnerability and they require structural and non-structural intervention due to the presented age. This work is a contribution to the question about the feasibility of

the structural intervention to reduce the stock building seismic vulnerability by demonstrating the necessity of this kind of intervention in the three studied building typologies: unreinforced masonry buildings, "boxed" buildings with masonry walls and concrete floors and reinforced concrete buildings. The seismic risk is evaluated in the case of "Bairro de Alvalade", in Lisbon, through the generalization of the individual results to the building typologies. The feasibility of the strengthening solutions in terms of building performance and cost is quantified namely to support the involved technicians in the decision-making process. It is also useful to justify the choice of a particular solution.



Capacity curves of building typologies

CV: **Paula Lamego**, Academic: Bachelor (2000) and Graduation (2004) by ISEL (structures area); MSc (2007) in Construction by IST; PhD (2014) in Civil Engineering by University of Minho. Professional: Quantity surveyor (1993-1995) at CME and (1995-1998) at CENFIC; Laboratory Technician (2001-2006) at Computational Mechanics Laboratory and Structures Laboratory at ISEL; Equip. Assistant (2006 until now) at ADEC/ISEL.

> **Assessment of the material and structural behaviour of constructions in schist**

Author: Ricardo Freitas Lima da Silva Barros
Supervisors: Daniel Oliveira, Humberto Varum (University of Aveiro)
Date: March 12, 2014

Summary: There are many buildings in schist masonry spread all over Portugal, varying the buildings typology, the constructive techniques and even the type of schist. This study presents and analyses different typologies and construction methodologies. The main damage types observed in the traditional schist masonry constructions are also presented. Tests have been carried out to characterize the mecha-



nical behaviour and the durability of schist from five distinct areas of Portugal. Prisms and walls made of schist were prepared in the laboratory to assess the compressive strength and the diagonal compressive strength, respectively, considering also the presence of strengthening. The most common schist masonry typology was reproduced using traditional building techniques. The results achieved allowed to determine the mechanical properties of the schist masonry, to interpret its structural behaviour and to assess the efficiency of the adopted strengthening systems.

Compression test



Schist wall



AWARDS & PRIZES

> Best Paper Award: Vasconcelos, G., Fernandes, F.M., Alves, C., Ramos, L.F. (2014). "Assessment of the stability conditions of an ancient stone masonry tower." Em REHAB 2014 – International Conference on Preservation, Maintenance and Rehabilitation of Historic Buildings and Structures (REHAB 2014), 19th – 21th March, Tomar, Portugal. doi 10.14575glrehab2014104.

EVENTS

> **Workshop - Impact on Steel Connections**

Venue: Department of Civil Engineering, University of Coimbra

Date: January 3, 2014

Website: isise.net/smct

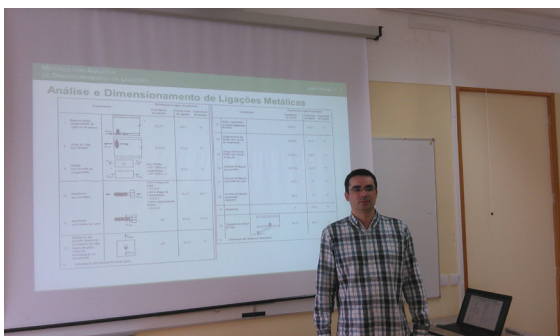
ISISE member: Aldina Santiago

Summary: The workshop was held in the Department of Civil Engineering at the University of Coimbra. It was developed as part of the National research project IMPACTFIRE in order to promote the main ideas of the project by sharing the main ongoing results. The project aims to study the response of bolted steel joints under accidental loadings (impact and fire) and to develop a joint design methodology that accounts for this type of loadings. The objectives of the project, as well as the relevant results of the ongoing work were exposed in four presentations as listed below: Aldina Santiago: "Exceptional measures, regulations, material behaviour, design",

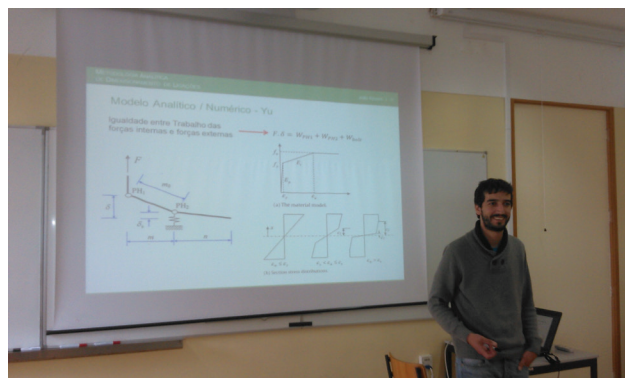




Pedro Barata: "Experimental assessment of the impact in connections";



Constança Rigueiro: "Nonlinear dynamic analysis of connections".



João Ribeiro: "Analytical methodology of design of connections". The workshop included a publication with the slides used during the presentations.

➤ Graduation ceremony for master students of the SUSCOS program

Venue: Czech Technical University of Prague, Czech Republic

Date: February 24, 2014

Website: isise.net/smct

Summary: The first generation of SUSCOS students has received their multiple degree from partner universities. They have started 1.5 year education in the Master "Sustainable constructions under natural hazards and catastrophic events" in the 1st semester of 2012-13 at Coimbra University and they continued the education at Czech Technical University in Prague in the 2nd semester. The students have done their Master Theses at all six partner Universities in the 1st semester of 2013-2014.



Coordinator of the program Prof. Frantisek Wald opened the graduation ceremony accompanied by the Rector of the University and the Dean of the Faculty of Civil Engineering. The coordinator of the program welcomed the professors from the partner universities: Prof. Jean-Pierre Jaspart from the University of Liege, Prof. Dan Dubina from the University of Timisoara, Prof. Luís Simões da Silva from the University of Coimbra, Prof. Milan Veljkovic from the University of Luleå, and Prof. Raffaele Landolfo from the University of Naples. The graduates were welcomed and they were asked, one by one, to receive the diploma from the Rector, swearing their Engineer's Hippocratic Oath. At the end, the audience paid contributes to the new masters with applause. The ceremony was followed by a celebration dinner, gathering the new graduates, professors and families.





› **WORKSHOP INFASO + “Valorization of Knowledge for Innovative Fastening Solution between Steel and Concrete”**

Venue: Department of Civil Engineering, University of Coimbra

Date: March 14, 2014

Website: isise.net/smct

ISISE member: Luís Simões da Silva

Summary: The Seminar was held on Friday, March 14 with the presence of about 50 practitioners. During this seminar new possibilities and calculation methods of steel-to-concrete joints were presented. Also contents developed in the research project INFASO “New Market Chances for Steel Structures by Innovative Fastening Solutions between Steel and Concrete” were summarized. Dissemination material was distributed. Within the RFCS-CT-2007-00051 research project INFASO design models for innovative steel-to-concrete joints on the basis of the component method have been developed as well as advantageous concrete components were included in these joints. INFASO+ is dealing with the valorisation, the dissemination, and the standardization of these

results to reach a wider audience including steel and concrete engineers.



In this workshop the presentation of results of the INFASO research work, also on the basis of worked examples, gave a deeper insight in more concrete terms for application in practice.

› **Railway 2014-So6, Special Session: Geotechnical Aspects in Rail-Track Performance**

Venue: Ajaccio, Corsica, France

Date: April 8-11, 2014

Website: civil-comp.com/conf/railways2014-s06.htm

ISISE member: A. Gomes Correia

Summary: The workshop was held in Ajaccio, Corsica, France. It was developed as part of the 2nd International Conference on Railway Technology: Research, Development and Maintenance. The special session on Geotechnical Aspects in Rail-Track Performance was organized by Prof. A. Gomes Correia (UM/ISISE), Dr. S. Costa d’Aguiar (SNCF, France) and Dr. Y. Momoya (Railway Technical Research Institute, Japan) aiming to bring together researchers, practitioners and experts from railway engineering and geotechnical engineering reporting on the current state of rail-track and substructure research and development. It includes new rail-track design and renewal of old rail-track addressing mainly the works strategy for

highest speed operations. Twenty papers were peer review and selected for presentation. These papers were published in: Civil-Comp Press 2014 (J. Pombo ed.), 408 pages, 330 summaries, ISBN 978-1-905088-59-1. Furthermore a special lecture was delivered by Prof. A. Gomes Correia on “Construction and quality control of railway embankments and compacted layers” to be published in the International Journal of Railway Technology.





› Meeting ECCS TC10, CONNECTIONS

Venue: Department of Civil Engineering, University of Coimbra

Date: April 11-12, 2014

Website: isise.net/smct

ISISE member: Luís Simões da Silva & Aldina Santiago

Summary: The meeting was held in the Department of Civil Engineering at the University of Coimbra, and brought to Portugal very relevant figures from the steel connections area. The following subjects were addressed: i) Joints: a database on steel connections was presented by L. Simões da Silva and K. Weynand presented a design approach for bolted and welded hollow section joints; ii) Welded Connections: H. Holopainen proposed a classification for welds and U. Kuhlmann presented the development of fillet welding of HSS; iii) Bolted connections: J.P. Jaspart presented the developments on an innovative bolted beam-to-column joint in moment resistant building frames.

The INFASO project was reported by F. Wald, while D. Dubina spoke about the Equaljoints Project; iv) Amendments and improvements in the next version of EN 1993-1-8: U. Kuhlmann and T. Ummenhofer reported the last developments on the TC250 SC3. During the meeting, the participants also attended a live test of impact in a T-stub.



› Course - Building Information Modelling

Venue: Ordem dos Engenheiros (2 editions: Lisbon and Porto)

Date: February to April, 2014

Website: www.cursobim.com

ISISE member: Miguel Azenha & José Carlos Lino

Summary: The members of ISISE Miguel Azenha and José Carlos Lino have coordinated the National Course on Building Information modelling (BIM), in a joint organization of 'Ordem dos Engenheiros' and the Universities of Minho, Lisbon and Porto. The course began in February 2014 and recently ended in April 2014, with simultaneous editions in Lisbon and Porto. The course was targeted to companies/professionals and students interested in the implementation of BIM collaborative methodologies in the productive processes of the AEC industry (Architecture, Engineering and Construction). Both editions of the course were complete with the maximum allowable number of participants (25), and very positive outcomes have been observed in the

practical assignments developed by the alumni. Further editions of the course are now being planned by the coordination team.





> **Calls for applications to SAHC masters course**

Venue: University of Minho

Date: May, 2014

Website: www.msc-sahc.org

Summary: Applications for the Advanced Masters in Structural Analysis of Monuments and Historical Constructions (SAHC), supported by Erasmus Mundus Programme, are open until May 20, 2014. A significant number of scholarships are available for students of any nationality. Within the 1st call, more than 500 students from 79 countries applied for a scholarship to enrol the 8th edition of the course. A 3rd call will be opened during July. Current SAHC students had a five-day integration week in Barcelona in October 2013. The primary purpose of this annual event is to bring together all the new SAHC students to discuss and share points of view, visit relevant case studies and explore soft skills. You can join us on facebook, where we have more than 7000 friends. Like our page to receive our news. For further details, please visit www.msc-sahc.org or email us at secretariat@msc-sahc.org.



UPCOMING EVENTS

> 9th International Masonry Conference

Venue: University of Minho, Guimarães, Portugal

Date: 7-9 July, 2014

Website: www.gimc.civil.uminho.pt

> 4th Conference on Urban Fire Safety

Venue: Instituto Politécnico de Bragança, Portugal

Date: 6-7 November 2014

Website: www.albrasci.com/4jorninc/

> Intervene in existing wooden buildings

Venue: University of Minho, Guimarães, Portugal

Date: 5 June, 2014

Website: www.civil.uminho.pt/madeiras

> Seminar Portugal Steel

Venue: Tectónica FIL, Lisbon, Portugal

Date: 6 May 2014

Website: www.portugalsteel.com

> Seminar Portugal Steel

Venue: IPCB, Castelo Branco, Portugal

Date: 13 May 2014

Website: www.portugalsteel.com

> Seminar Portugal Steel

Venue: University of Aveiro, Aveiro, Portugal

Date: 21 May 2014

Website: www.portugalsteel.com





> Seminar INFASO + North-East Germany

Venue: Stahl-Zentrum-Düsseldorf, Sohnstr. 65,
40237 Düsseldorf

Date: 16 May 2014

> Seminar INFASO + Finland

Venue: Finland

Date: 5 June 2014

> GeoHubei International Conference on Sustainable
Civil Infrastructures: Innovative Technologies and
Materials

Venue: Hubei, China

Date: 20-22 July, 2014

Website: geohubei2014.geoconf.org/

> 3rd Luso-African Conference on Sustainable Steel
Construction

Venue: Universidade Metodista de Angola, Luanda,
Angola

Date: 20-21 November, 2014

Website: www.cmm.pt/cla3

