



INDEX

01

ISISE HIGHLIGHTS

02

R&D COMPLETED
PROJECTS

14

R&D STARTED
PROJECTS
COMPLETED PhD
THESES

18

ISISE TECHNOLOGIES

19

AWARDS & PRIZES
EVENTS

24

UPCOMING EVENTS

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GROUPS
**Historical and Masonry
Structures**
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**Steel and Mixed Construction
Technologies**
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ISISE HIGHLIGHTS



STREMUM STRUCTURAL
ENGINEERING
M A S T E R

The new Structural Engineering Master programme at the University of Minho, STREMUM, was just launched. STREMUM will

provide world class training to prospective students in search for a challenging international graduate programme. The first call is now open and accepting applications until January 15, 2016. Students with excellent track record will be eligible for grants. STREMUM combines a solid common core of fundamental and general courses in the field of Structural Engineering, with applied courses and research related to five specialization tracks:

- > Eco-Efficient Structures
- > Advanced Structural Analysis and Design
- > Smart Structures
- > Risk Management and Extreme Events
- > Geotechnics

In addition, hands-on courses throughout the entire programme will provide training on case studies, design projects, or in some cases field studies, for an effective consolidation of the acquired knowledge. STREMUM meets the current challenges of modern societies by offering a world class training programme with specializations in different Structural Engineering domains which are nowadays of critical importance, both for the industry and for the society. For more information visit us at www.stremum.uminho.pt.



The Building Rehabilitation Master programme has started in October 2015, at the University of Coimbra with 25 students selected from a large the number of applications. This master will provide scientific and technological knowledge on both structural and non-structural rehabilitation. It includes a strong component in engineering fields, architecture, economy, laws, environment and sustainable development. The master programme will be held during three semesters, being the last one dedicated to development of the thesis. During the first two semesters a large range of subjects will be provided. Students will be able to choose to attend subjects, according to their preferences and

having as reference an integrated and comprehensive overview of the principles of sustainable construction, according to the different specific topics: structural rehabilitation; non-structural rehabilitation; a transversal approach to pathology and rehabilitation of recent buildings or old buildings; architectural and heritage perspective. For more information visit the website: <http://www.uc.pt/fctuc/dec/ensino/mestrados/mre>

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

> **WoodenQuark – Residential modules in wood**

ISISE Principal Investigator: Jorge Branco

Budget: Global: 229.155,00€/ISISE-UM: 107.517,59€

ID: 21635

Funding Entity: ANI

Principal Contractor: Portilame Engenharia e Madeira, Lda.

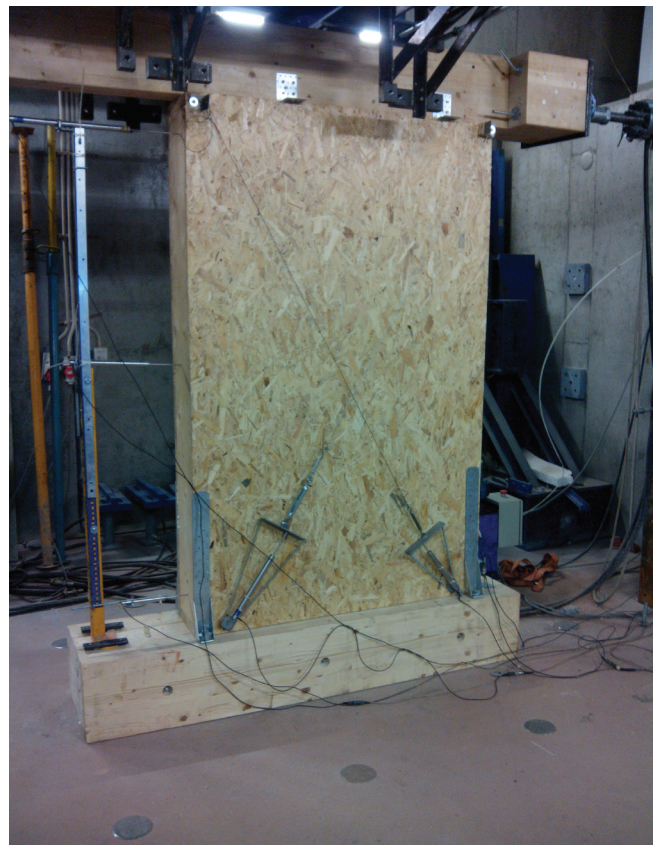
Participating Institutions: University of Minho

Duration: From 1st January 2012 to 30th June 2015

Summary: Adopting the concepts of prefabrication, modularity and easy transportability, coupled with a quick mounting work and a guarantee of quality, it is intended to help modernize the construction market of wooden houses, offering a more competitive solution within the existing systems in the European market.

WoodenQuark rather than a research project, materializes a concept based on a scalable and adaptable model that uses wood as a structural material, achieving a constructive solution sustainable and low cost. This project aimed to present an innovative wood-based solution for lightweight panels for single-house construction. The solution proposed is based on the modularity of the house and the standard measures of the wood-based materials in order to achieve a solution with less waste. The panel provides all infrastructures needed to a single house behaviour and

high level of thermal performance ensure excellent energy efficiency. The technical novelty of the wood-based panel (named Quark) has been protected by a national patent.



> **CH-SECURE – Reducing the vulnerability of cultural heritage buildings to blast loading**

ISISE Principal Investigators: Paulo Lourenço

Budget: Global: 157.188,00€/ISISE-UM: 100.568,00€

ID: PTDC/ECM/120118/2010

Funding Entity: FCT

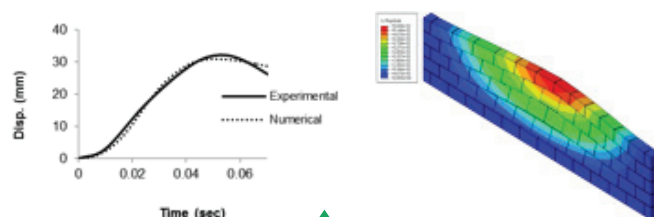
Principal contractor: University of Minho

Participating Institutions: Laboratório de Energética e Detónica, Associação de Apoio (LEDAP)

Duration: From 1st March 2012 to 31st August 2015

Summary: This research project focused on cultural heritage masonry buildings under blast loading. Cultural heritage buildings are relevant targets, not only because of their impact on public opinion,

because they are a part of the identity of a society and because they are often used for official acts with the highest authorities, but also because of religious reasons (e.g. churches, monasteries).

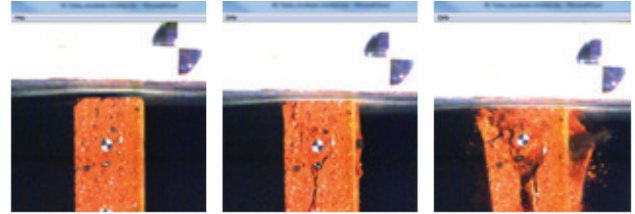


Masonry wall panel under impact using interface strain rate dependent constitutive model



The work developed during this project ranged from risk assessment to elaboration of design rules, through experimental testing, numerical analysis and applications. This work made significant contributions respecting: (a) application of risk assessment methodologies to public transportation networks; (b) experimental characterization of materials (both traditional and modern) under high strain rates; (c) experimental characterization of masonry walls under out-of-plane loading; (d) implementation of strain rate dependent constitutive models in commercial software; (e) design criteria and design rules for masonry

infill walls in the form of P-I diagrams; and (f) advanced non-linear explicit modelling of real explosion and real structures.



Typical high-speed test sequence for clay brick under compression

> Retroinf – Developing Innovative Solutions for Seismic Retrofitting of Masonry Infill Walls

ISISE Principal Investigator: Graça Vasconcelos

Budget: Global: 142.679,00€ / ISISE-UM: 100.155,00€

ID: PTDC/ECM/122347/2010

Funding Entity: FCT

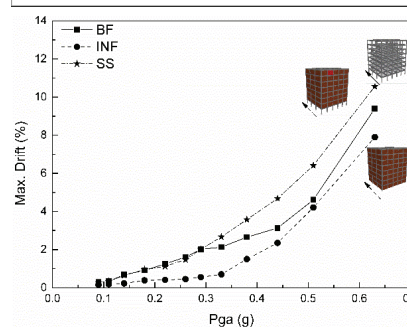
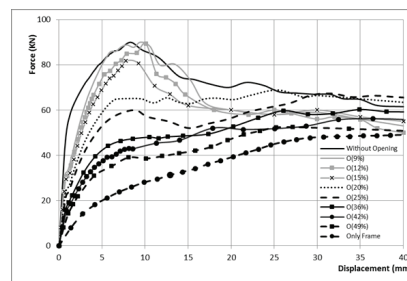
Principal Contractor: University of Minho

Participating Institutions: Faculdade de Engenharia da Universidade do Porto

Duration: From 1st April 2012 to 30th June 2015

Summary: The main aim of the proposed research program was the development of innovative materials for retrofitting masonry infill walls. The achievement of this purpose encompassed: (1) better understanding of the interaction between in-plane and out-of-plane performance of the existing typical masonry infills, namely at the level of the assessment of in-plane damage levels on the out-of-plane resistance; (2) better insight on the interaction between reinforced concrete frames and existing masonry infills; (3) development of innovative fibre textile based retrofitting materials to apply in the textile reinforced mortar technique for improvement of the in-plane and out-of-plane performance of infill walls, avoiding detachment and out-of-plane collapse for ultimate conditions. The improvement of masonry infill behavior intends

also to contribute simultaneously for the reduction of vulnerability of reinforced concrete infilled frames and a whole system, by minimizing the negative effects that masonry infill can have on the global structural behavior; (4) extensive numerical modeling aiming at clarifying main parameters influencing on the seismic behavior of RC masonry infilled frames.



Results of numerical modelling: (a) analysis of the influence of percentage of openings in the response of rc masonry infilled frames under in-plane loading; (b) global analysis and influence of the masonry infills in the global seismic behaviour of rc buildings





> **SlabSys-HFRC – Flat slabs for multi-storey buildings using hybrid reinforced self-compacting concrete: an innovative structural system**

ISISE Principal Investigators: Vitor Cunha

Budget: 100.568,00€

ID: PTDC/ECM/120394/2010

Funding Entity: FCT

Principal contractor: University of Minho

Duration: From 1st April 2012 to 30th September 2015

Summary: This project aimed to contribute to the development of a new generation of flat slabs, for multi-storey buildings, made of hybrid fibre reinforced concrete, by substituting most of the conventional reinforcement of the slab with hybrid discrete fibres. The proposed structural system has an enhanced cracking behaviour and flexural stiffness for serviceability limit states, while maintaining a flexural ductile failure mode for ultimate limit states. The following objectives were attained: (i) Development fibre reinforced concrete self-compacting mixtures with high residual strength. Mechanical and structural behaviour characterization; (ii) Assessment of the fibres' micromechanical behaviour under both monotonic and long-term conditions; (iii) Estimation of the mechanical properties variation within the structural system due to

the anisometric fibre distribution; (iv) Experimental characterization of the punching shear behaviour of the developed structural system. Development of analytical and numerical tools for predicting the ultimate loading capacity and deformational response; (v) Construction of a 1/4 scale prototype to demonstrate the developed structural system.



> **S-Glass – Structural Performance and Design Rules of Glass Beams Externally Reinforced**

ISISE Principal Investigators: Sandra Jordão (Paulo Cruz PI Former ISISE)

Budget: Global: 76.738,00€/ISISE-UM: 76.047,00€/ISISE-UC

ID: PTDC/ECM/116609/2010

Funding Entity: FCT

Principal contractor: University of Minho

Duration: From 1st April 2012 to 30th June 2015

Summary: The main goal of Project S-Glass is the characterization of the behavior of laminated glass beams reinforced externally, subjected to monotonic, cyclic and temperature load. Experimental tests and numerical simulations were performed. The layout corresponds to full scale beam models on a four point bending standing arrangement. The pre-stress system corresponds to a twin set of steel cables secured at the beam ends. A hybrid configuration with steel flanges was also considered, as well as re-habilitation assessment for fractured beams. Main conclusions indicate that the pre-stress system and

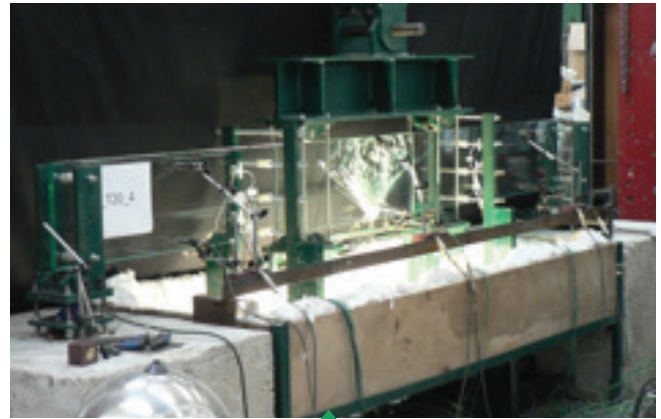
the hybrid configuration used (steel flanges | polyurethane adhesive) featured very good behavior leading to extra load bearing capacity well above the force inducing the first crack and a safer fracture mode. The pre-stress system also proved very effective for rehabilitation of damaged glass beams. A temperature conditioning chamber was built for the tests subjected to temperature load.



Test with temperature load: Fracture pattern



The results showed the downgrading of the inter-layer for higher temperatures. Since the beam is on an upright position the main costs are a modification in the out-of-plane deformation and a reduction of the differential effects between panes, namely the transfer of cracks. For the cyclic tests a new loading protocol was proposed. It was tailored for glass structures and iteratively optimized based on test results. Two different methods, traditionally used for ductile material, were used for assessment of accumulated damage. Its results were compared and its applicability to glass was assessed. The results showed accumulated damage in both pre and post fracture regime.



S-Glass full scale tests layout

> **3DJOINTS – Three-dimensional behaviour of steel joints**

ISISE Principal Investigator: *Luís Simões da Silva*
Budget: *Global: 138.420,00€/ISISE-UC: 138.420,00€*
ID: *PTDC/ECM/116904/2010*
Funding Entity: *FCT*

Principal Contractor: *University of Coimbra*
Duration: *From 1st May 2012 to 30th April 2015*

Summary: The project aimed at the development of a consistent design approach for the prediction of the three-dimensional behavior of steel joints under arbitrary loading. Subsequently, the incorporation of the real joint behavior in the 3D structural model was intended.

In this project the following objectives were achieved:

- On the basis of a theoretical and experimental analysis, the behavior of some new components was studied. In particular the characterization of T-stubs with four bolts per row and of reverse channel was provided.
- A finite element model capable of representing the behaviour of extended end-plate joints classified

as partial-strength according to Eurocode 3 was defined.

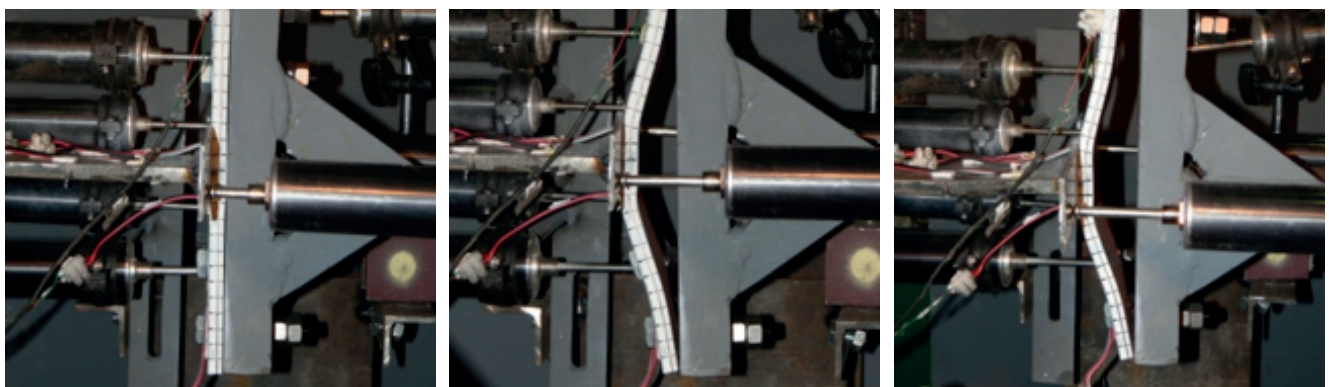


- The program FESTJoint was developed. This tool can be used to study following parameters:

- i) mechanical behaviour of joints' components up to failure;
- ii) hysteretic behaviour of column web panel in shear;
- iii) moment-rotation response of the steel joints under

monotonic or cyclic loading.

- 2d and 3d macro-elements that may be applied as nodal elements to the structural model were proposed, validated and used in frame analysis.





> **FRISCC – Fire Resistance of Innovative and Slender Concrete Filled Tubular Composite Columns**

ISISE Principal Investigators: João Paulo Correia Rodrigues

Budget: Global: 1.717.688€/ISISE-UC: 375.615€

ID: RFSR-CT-2012-00025

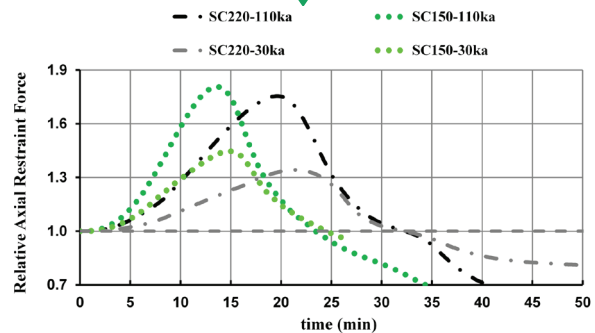
Funding Entity: Research Fund for Coal and Steel

Duration: From 1st July 2012 to 30th June 2015

Summary: Most of the previous studies on concrete-filled steel hollow section columns at high temperatures addressed the effect of the depth-to-thickness ratio, the initial applied load level and the load eccentricity on the fire resistance of these columns. This is why, the study on the influence of the axial and rotational restraint on the compressive behavior of these types of columns subjected to fire was important and required. So, the primary test parameters took into account in this research project were the type of section geometry, the axial and rotational restraint level imposed by a surrounding steel frame to the columns and the column slenderness. The specimens were uniformly exposed to a fire curve and the critical

time (fire resistance), the failure temperature distribution and the respective failure modes were assessed. Results of this research project showed that the fire resistance of identical columns may be not significantly affected by the stiffness of the surrounding structure, most likely due to the beneficial effect of the rotational restraint at their ends but, on the contrary, their structural behavior in the post-buckling range it may be affected.

Influence of the stiffness of the surrounded structure on the square columns



> **HILONG – High Strength Long Span Structures**

ISISE Principal Investigators: Luís Simões da Silva

Budget: Global: 1.618.212,00€/ISISE UC 271.240,00€

ID: RFSR CT 2012-00028

Funding Entity: Research Fund for Coal and Steel

Principal contractor: The Steel Construction Institute

Duration: From 1st July 2012 to 30th June 2015

Summary: The use of high strength steel (HSS) can lead to a significant reduction in the weight of a steel structure. A lighter structure requires smaller foundations, shorter transportation and construction times, and leads to lower CO2 emissions and energy use (both directly in less materials used and also indirectly due to lower transportation costs). Although HSS have found application in machinery and automotives, they are not widely used in construction because the benefit of reduced weight struggles to outweigh the disadvantages of higher price/tonne, reduced availability and different weld procedures. The purpose of the proposed work is to investigate innovative structural arrangements, design methods and cross-sections which enable the benefit of high strength to be maximised by suppressing buckling and reducing deflection. The study will

have a particular focus on long span applications such as stadia, auditoria, exhibition halls etc.



Experimental test layout

The proposed programme of testing, numerical analysis and development of design guidance will be informed by close consultation with designers of long span structures throughout the project. The grades of HSS to be studied are S460 and S690.



> **SustIMS – Sustainable Infrastructure management Systems**

ISISE Principal Investigators: José Matos

Budget: Global: 986.540,99€ / ISISE-UM: 90.682,21€

ID: 23113

Funding Entity: ANI

Principal contractor: Ascendi IGI, Inovação e Gestão de Infraestruturas, S.A.

Participating Institutions: University of Minho, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa

Duration: From 1st September 2012 to 30th June 2015

Summary: The aim of SustIMS was the development of a sustainable roadway infrastructure management system, to be further integrated into a geographic information system. The developed platform will manage, within a coherent and sustainable way, all main elements of a roadway concession, including bridges, pavements, telematics, embankments and walls. With this system it is possible to improve the quality of available data in each moment about the infrastructure, ameliorate the future

performance forecasts, and take better decisions regarding the preservation and rehabilitation of each infrastructure element. The project was developed in three great lines: (a) Development of a management system, which includes forecasting models and a multi-objective optimization algorithm, to obtain a set of maintenance strategies; (b) Development of a monitoring system, that allow to collect, in real time, important data for the efficient infrastructure management, namely, incident detection on roadway, due to landslides or vehicles flow; (c) Development of a mobile platform for infrastructure management. More information about this project can be seen in the following video: <http://youtu.be/Hfp37x4KAKg>.



> **InoTec – Inovative material with ultra-high ductility for the rehabilitation of the built heritage**

ISISE Principal Investigators: Joaquim Barros

Budget: ISISE-UC: 672.519,76€ / ISISE-UM: 457.589,68€

ID: 23024

Funding Entity: ANI

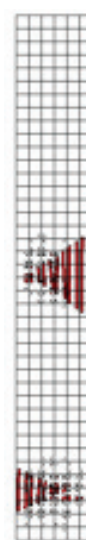
Principal contractor: Civitest – Pesquisa de novos materiais para a engenharia civil

Participating Institutions: University of Minho

Duration: From 1st October 2012 to 30th June 2015

Summary: A cement based material reinforced with a relatively high percentage of synthetic fibres (FRCC) was tailored for presenting high post-cracking tensile resistance and being applied to different substrates (natural stones, concrete, clay and mortar bricks) by shotcrete technology. This FRCC was developed for the rehabilitation of structures made by these type of brittle materials, such is the case of masonry-based structures of reduced strength to seismic events. A new strengthening technique was developed, consisting on applying by shotcrete two outer thin FRCC layers connected with polymer fibre reinforced polymer (FRP) connectors, able of increasing significantly the in-plane and out-of-plane load carrying capacity and energy dissipation capacity

of structures vulnerable to seismic events. Extensive experimental programs were carried out at material level, for the characterization of the interfaces and almost real scale that demonstrate the high strengthening effectiveness of this technique. Advanced numerical simulations were carried out for deep interpretation of the results obtained experimentally and for assisting on the development of design guidelines.



Schist wall prototype: testing experimentally / FEM-Modeling



> **FRPreDur – Short and long-term structural behavior of concrete elements flexurally strengthened with prestressed CFRP laminates**

ISISE Principal Investigators: José Sena Cruz

Budget: 169.406,00€

ID: PTDC/ECM-EST/2424/2012

Funding Entity: FCT

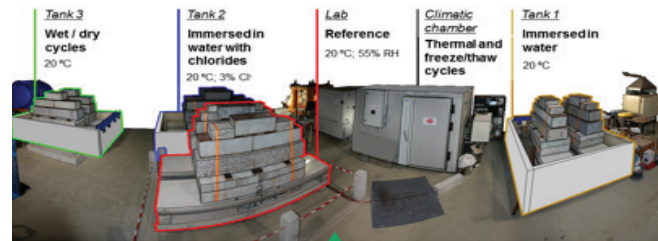
Principal contractor: University of Minho

Duration: From 1st July 2013 to 30th September 2015

Summary: The main objective of the research project was to contribute to the knowledge on short and long-term structural behaviour of RC elements strengthened in flexural with pre-stressed CFRP laminates under various specific application environments, load conditions and chemical degradation. The project involved the three following components: (i) an experimental program, (ii) numerical simulations and (iii) design recommendations.

The experimental program was supported in reinforced concrete slabs strengthened in flexural with prestressed CFRP laminates. The influence of the prestressed system, prestressed level and the existing damage on the

immediate and time-dependent losses under the effect of chlorides, sustained stress (creep), freeze-thaw, wet/dry and thermal cycles, were the main variables to be studied. The test results obtained from the experimental programs were used for predicting the service life behaviour of prestressed slabs, as well as the ultimate strength supported in some numerical models. The project had also the collaboration of researchers from other institutions, mainly EMPA/Switzerland, University of Madeira and Polytechnic Institute of Viseu.



Specimens submitted to environmental actions

> **UrbanCrete – Fibre reinforced concrete of enhanced properties of durability for urban furniture and infra-structures**

ISISE Principal Investigators: Joaquim Barros

Budget: Global: 595.929,00€ / ISISE-UM: 278.710,00€

ID: 30367

Funding Entity: ANI

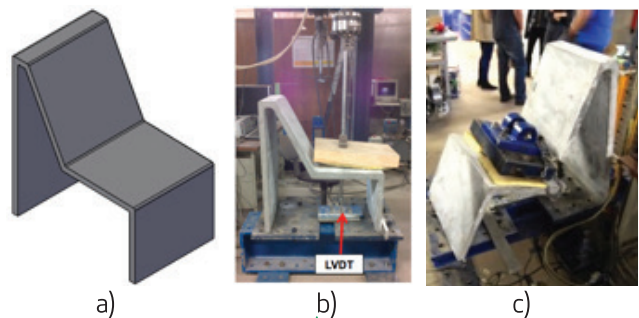
Principal contractor: Francisco Pereira Marinho & Irmãos, S.A

Duration: From 20th April 2013 to 30th June 2015

Summary: A high performance cement based material reinforced with non-metallic fibers (HPFRCC), of self-compacting character, high post-cracking tensile deformability, resistance, and impact and fatigue resistance, was developed for the fabrication of a new generation of urban furniture do not presenting durability concerns. Chair prototypes were fabricated and tested in monotonic, fatigue and impact loading conditions in order to demonstrate the high effectiveness of the developed material for urban furniture.

Another type of fiber reinforced cement composite was developed, of high strength and toughness, which was combined with a FRP grid for the production of manhole covers with load and stiffness capacity for

the most exigent load conditions, and immune to corrosion since conventional metallic reinforcements are not used. These developments were supported on an extensive experimental program on the mechanical and durability performance of these materials, as well as on FEM-based advanced numerical simulations to assist on the interpretation of the experimental results and to explore new applications of these materials in urban furniture and infrastructures.



Developed chair in HPFRCC:
a) geometry; b) monotonic test; c) impact test



> **SCLog – Investigation of timber log sonic crystals applied to noise traffic barriers**

ISISE Principal Investigators: *Luís Godinho*

Budget: *Global: 93 729,00€/ISISE-UC:67 429,00€*

ID: *PTDC/ECM-COM/1438/2012*

Funding Entity: *FCT*

Principal contractor: *University of Coimbra*

Duration: *From 1st June 2013 to 30th October 2015*

Summary: The motivation of the project SCLog relied in contributing for the definition of innovative technical solutions for traffic noise mitigation, making use of recent physical concepts and incorporating sustainable materials. The main conceptual idea behind these innovative solutions was of using “sonic crystals” as noise barriers, a recent trend in international research with promising results. The choice, in the present case, was the use of timber logs to produce the scatterers of the noise barrier, since it is an abundant and renewable material. Maritime pine roundwood timber was identified as a very interesting and promising solution. This is one of the most sustainable resources available for structural applications, due to the environmental

characteristics of the wooden material and very low processing required to obtain the circular section elements. Furthermore, these trees need to be removed in order to increase the forest health and decrease the fire risk. The proposal was to conduct research making use of both a theoretical/numerical approach and an experimental evaluation.



Image of the timber log assembled structure.

> **LVS³ – Large Valorisation on Sustainability of Steel Structures**

ISISE Principal Investigators: *Helena Gervásio*

Budget: *Global: 1.489.443,00€/ISISE-UC: 89.521,00€*

ID: *RFS2-CT-2013-00016*

Funding Entity: *RFCS*

Principal contractor: *Arcelor Mittal*

Duration: *From 1st July 2013 to 30th June 2015*

Summary: The technical objective of this project was to disseminate the knowledge acquired in the recent years about the environmental impact assessment of steel and composite buildings. During the last decade, a lot of research projects have been funded to develop methodologies, systems and products aiming at improving the thermal efficiency as well as the global environmental footprint of steel buildings. The new standard EN15804 intended for environmental calculation of buildings takes now into account the fact that steel is a recyclable material (Module D). So the objective of this project was to summarise all this acquired knowledge into different documents (Background, Design guide, leaflet, User-friendly Software), to translate all these training and teaching support into the different

European languages and finally to disseminate amongst Europe by the organisation of workshops in different countries. This project has 17 partners and each partner was responsible for the organisation of the seminar in his country. This was organised on a University campus or in a conference centre. The audience consisted of designers, architects, developers, future steel users such as students and professors, decision makers and authorities. During the seminar, printed documents as well as USB Keys that contain all data were distributed.





> SEISMIC-V – Vernacular Seismic Culture in Portugal

ISISE Principal Investigators: Graça Vasconcelos

Budget: Global: 116.376,00€ / ISISE-UM: 47.088,00€

ID: PTDC/ATP-AQI/3934/2012

Funding Entity: FCT

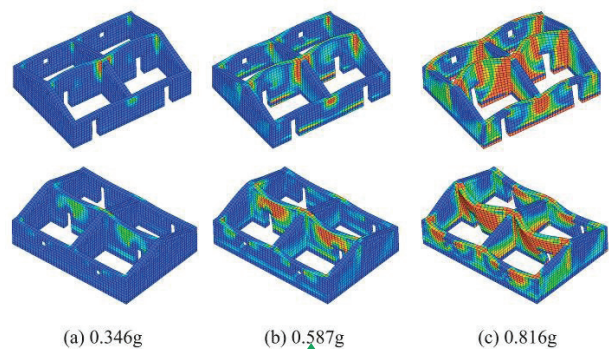
Principal contractor: FCO-Fundação Convento da Orada

Participating Institutions: University of Minho, University of Aveiro

Duration: From 1st July 2013 to 30th September 2015

Summary: The main goal of the project was to contribute to the awareness and protection of the vernacular heritage, as a need to protect it from natural hazards, particularly earthquakes. For that purpose and aiming at a better understanding of the seismic behavior of Portuguese vernacular constructions, it was possible to: (1) individualize specific case studies in seismic prone Portuguese regions such Alentejo, Algarve and Azores; (2) identify the materials and construction techniques and analyze the existence or absence of local seismic culture evidences as the reaction of the local communities to past seismic events; (3) carry out a numerical nonlinear

analysis of different typologies of vernacular buildings (isolated buildings, aggregates and buildings inserted in urban blocks) under seismic loads aiming at assessing the global seismic behavior and characterize the main parameters influencing their seismic response (geometry configuration, morphology of masonry walls and type of roofs). Additionally, identification of common errors and proposal of straightforward strengthening solutions that reduce the seismic vulnerability were also pointed out.



Evolution of maximum principal strains depicted on deformed mesh for the pushover analysis in +Y direction.

> TaperSteel – Stability design of non-uniform steel members

ISISE Principal Investigator: Luís Simões da Silva

Budget: Global: 75.772 € (SMCT-ISISE) | 118.952 € (Total)

ID: PTDC/ECM-EST/1970/2012

Funding Entity: FCT

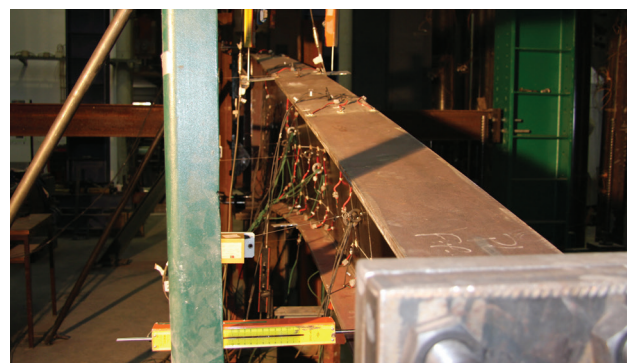
Principal Contractor: University of Aveiro

Duration: From 1st July 2013 to 30th September 2015

Summary: Non-uniform steel members are commonly used over prismatic members because of their structural efficiency. However, for such members, with tapered cross-section, irregular distribution of restraints, non-linear axis, castellated, etc., several difficulties are noted when applying EC3 verification rules: either there are yet no guidelines, or application of rules is mechanically inconsistent. As a result, safety verification does not account for the advantages non-uniform members provide. TaperSteel dealt with the stability design of non-uniform members and structural systems, where the buckling phenomena are properly accounted for by mechanically consistent generalized imperfections to account for the member non-uniformity. Through fur-

ther implementation of results in EC3, a more economic design is achieved. Accomplishments of the project were:

- Safety assessment procedure to the General Method in EC3-1-1;
- Development of a mechanical generalized slenderness model for non-uniform isolated members;
- Safety assessment of the developed rules;
- Contribution towards the revision of EC3-1-1, by achieving transparent, simple and straight-forward unified stability check procedures.





> **CUTINOV – Innovative carbon fiber laminates for the strengthening of RC structures in flexure, shear and punching**

ISISE Principal Investigators: Joaquim Barros

Budget: Global: 431.779,42€ / ISISE-UM: 228.243,61€

ID: 38780

Funding Entity: ANI

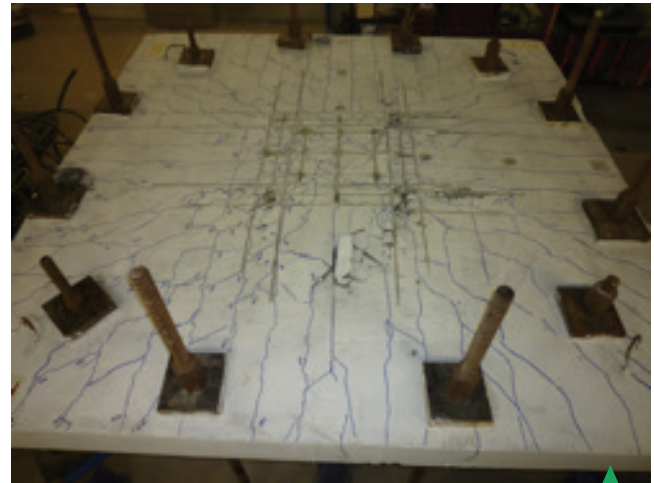
Principal contractor: Clever Reinforcement Iberica-Materiais de Construção, Lda.

Participating Institutions: University of Minho

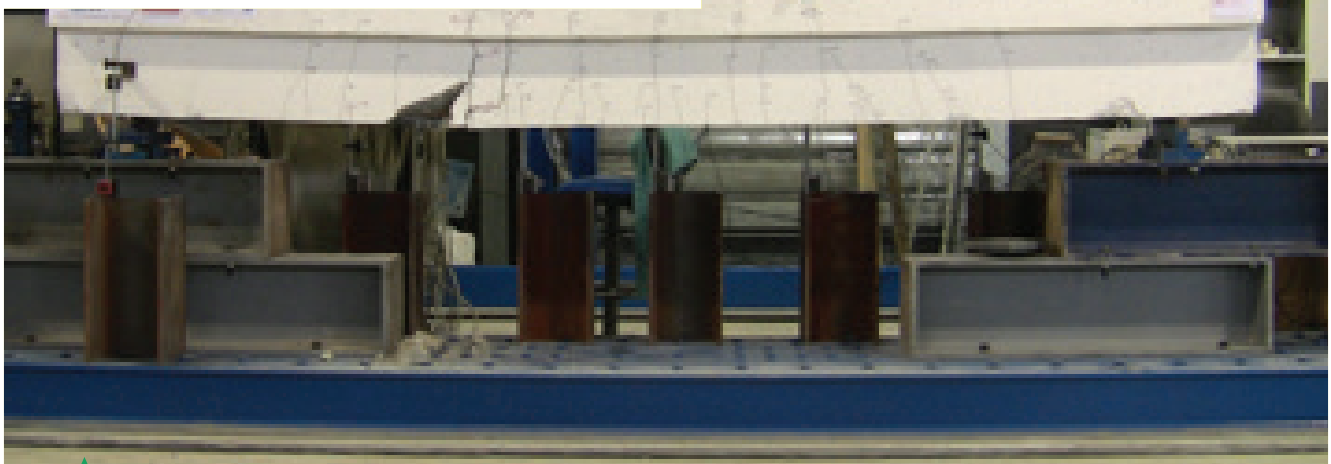
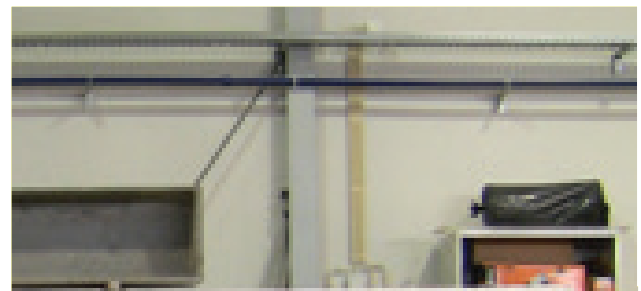
Duration: From 1st January 2014 to 30th June 2015

Summary: In the present project an innovative carbon fiber reinforced polymer (CFRP) laminate is proposed with the capability of providing, simultaneously, flexural and shear strengthening for reinforced concrete (RC) beams, and flexural and punching strengthening for RC slabs. This laminate is applied combining the procedures of the Near Surface Mounted (NSM) and Embedded Through Section (ETS) techniques. This laminate has a U configuration where the central part is used for the flexural strengthening, applied according to the NSM technique, and the extremities are used as shear/punching reinforcement applied according to the ETS technique. To provide a U shape for the laminate, a mechanism was developed to assure the transition zones with the required properties. Series of four point bending tests with real scale RC beams and with RC slabs of almost real scale have demonstrated the high effectiveness of the developed CFRP laminates and strengthening technique for these types of applications. Advanced numerical

FEM-based simulations were performed for exploring the strengthening potentialities and for executing parametric studies for assisting on the development of design guidelines.



RC slab strengthened to flexural and punching according to the new technique and CFRP laminates



RC beam strengthened in flexure and shear according to the new technique and CFRP laminates



> **ClickHouse – Development of a prefabricated house prototype for disaster zones using advanced composite materials**

ISISE Principal Investigator: José Sena Cruz

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

ID: 38967

Funding Entity: ANI

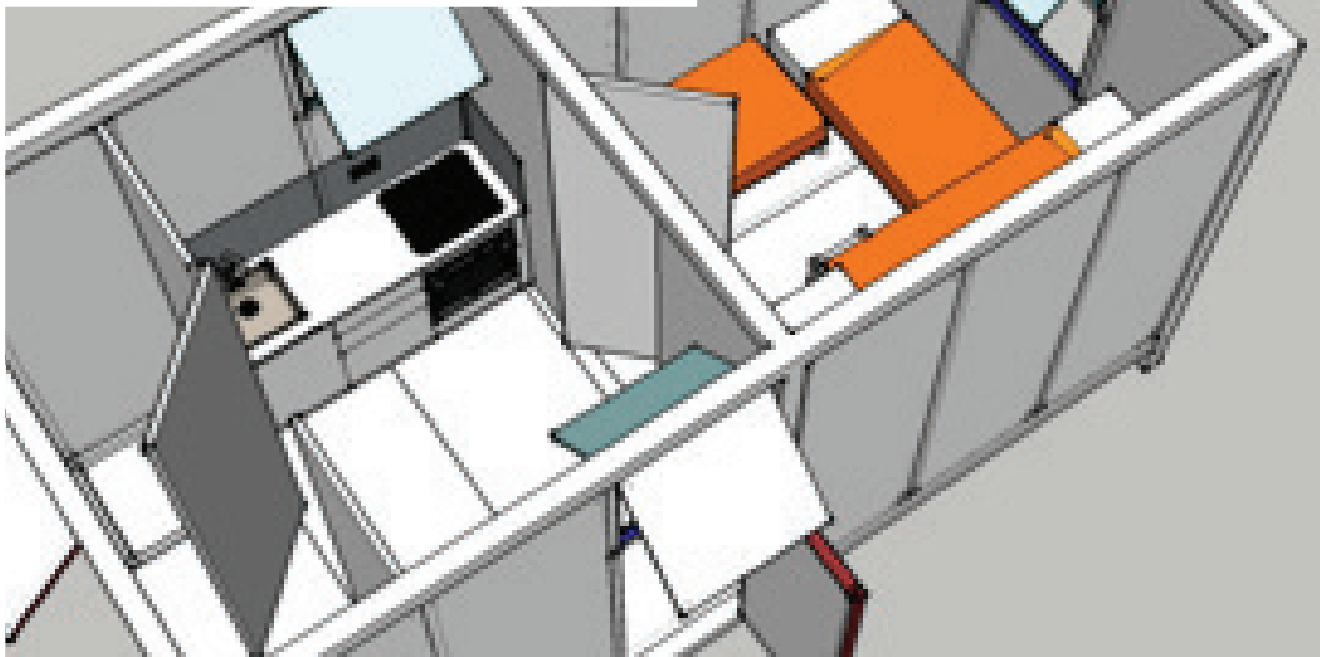
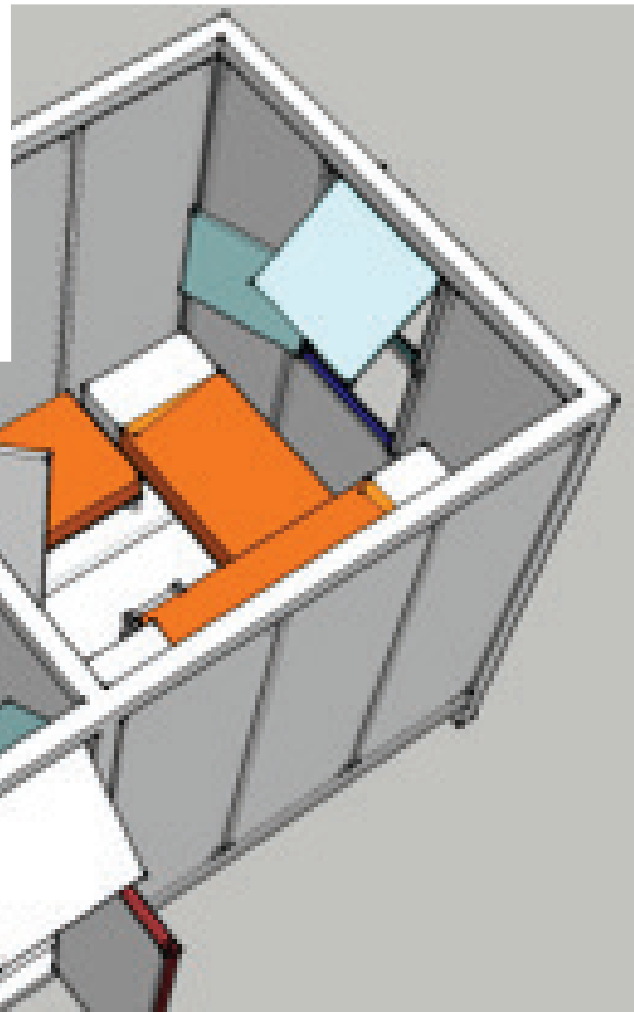
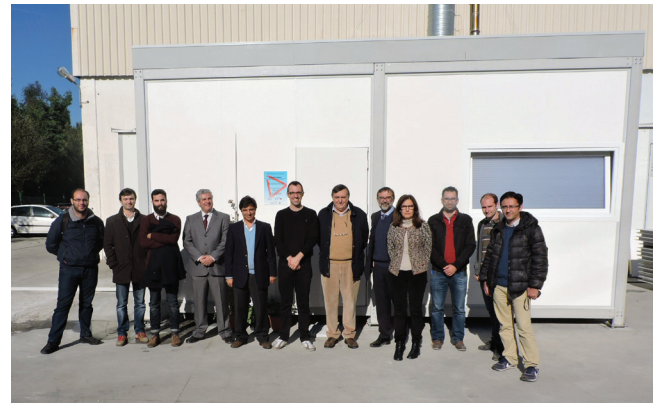
Principal Contractor: Alto Perfis Pultrudidos, Lda.

Participating Institutions: Instituto Superior Técnico, University of Minho

Duration: From 1st March 2014 to 30th June 2015

Summary: The main aim of ClickHouse was the development of a prefabricated house prototype for disaster zones, situations of emergency housing, construction sites and/or temporary shelters, using advanced composite materials. When comparing to the classic solutions in the market, the constructive system had to guarantee, at a competitive cost, a better performance regarding: (i) lightness; (ii) ease of transportation; (iii) quickness and facility of assembling and disassembling; (iv) possibility/flexibility of reutilization; (v) fulfilment of structural safety and thermal performance regulation requirements and recent international recommendations for this type of housing; (vi) self-sufficiency regarding energy and water supply; and (vii) durability. The housing structure was composed of GFRP pultruded profiles, whereas the façade and the roof was made of sandwich panels with

outer skins of GFRP and a core of an insulating material, comprising windows, doors and piping networks. The connections between the panels and the profiles was assured by splicing. The housing incorporates water, sewage, electricity networks and sanitation facilities.





> **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

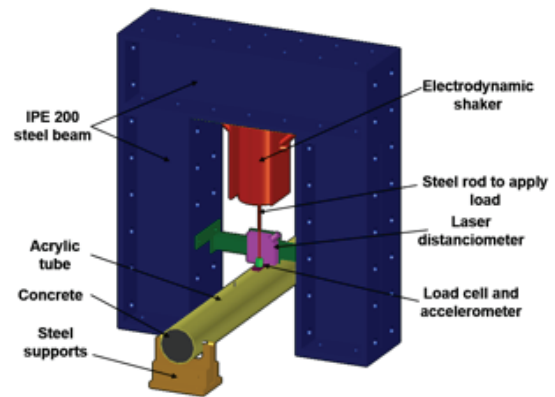
Principal Contractor: University of Minho

Duration: From 1st March 2014 to 30th July 2015

Summary: The main objective of the Project was to explore the possibility of using dynamic test approaches to continuously assess viscoelastic properties of concrete, with the proposal of a new methodology termed VisCoDyn. Such innovative implementation was intended to be achieved through the submission of a concrete specimen (e.g. a beam) to a known dynamic excitation. According to the theory of viscoelasticity, the deflection response of the beam to the known excitation allows the identification of viscoelastic parameters. The intents of the project involved setting up the necessary assembly to preliminarily test the VisCoDyn experiment, the conduction of parallel classical creep testing and the establishment of analytical frameworks for analysis of the obtained results. The main global achievements of this project were:

- The VisCoDyn testing framework has been success-

- fully conceived, assembled, tested and used;
- The necessary software and methodologies have been developed to evaluate test data;
- The wide experimental programs envisaged in the application were fully respected;
- The necessary theoretical developments have been applied to evaluate the loss modulus, the storage modulus and the phase angle;
- A new approach for obtaining Kelvin chain parameters has been proposed, particularly focusing on overcoming limitations related to existing approaches at very early ages;
- The dissemination of results has been fully achieved.



> **BEhaviour characterization and rehabilitation of EARTHEN construction**

ISISE Principal Investigator: Daniel Oliveira

Budget: Global: 116.376,00€ / ISISE-UM: 46.248,00€

ID: PTDC/ECM-EST/2396/2012

Funding Entity: FCT

Principal Contractor: University of Aveiro

Participating Institutions: Instituto Superior Técnico, University of Minho

Duration: From 1st June to 30th September 2015

Summary: The BE+EARTH project was organized into three main groups of activities. The first activity was related with the structural behaviour characterization of earth-based walls. The second activity was associated with the development and characterization of techniques aiming at the structural performance improvement of earth-based walls, while the last activity was connected with the numerical simulation of the response of earthen constructions. The project allowed to achieve the following main results: (a) geometrical and mechani-

cal characterization of adobe and rammed constructions, including dominant damage patterns; (b) development and validation of effective retrofitting solutions for earthen constructions; (c) development and calibration of robust numerical models able to reproduce the observed experimental behaviour.





R&D STARTED PROJECTS

> **SHOWTIME – Steel Hybrid Onshore Wind Towers Installed with Minimal Effort**

ISISE Principal Investigator: Carlos Rebelo, Luís Simões da Silva

Budget: 1 850 329,00€/ISISE-UC: 333 250,00€

ID: RFSR-CT-2015-00021

Funding Entity: EU – Research Fund for Coal and Steel

Principal Contractor: University of Coimbra

> **PROLIFE – Optimal use of High Strength Steel grades within bridges**

ISISE Principal Investigator: Luis Simões da Silva

Budget: Global: 1.690.102,00 €/ISISE-UC: 221.730,00€

ID: RFSR-CT-2015-00025

Funding Entity: EU – Research Fund for Coal and Steel

Principal Contractor: Lulea University of Technology



> **FREEDAM – Free from Damage Connections**

ISISE Principal Investigator: Luis Simões da Silva, Aldina Santiago

Budget: Global: 1.449.860 €,00€/ISISE-UC: 251.812 €,00€

ID: RFSR-CT-2015-00022

Funding Entity: EU – Research Fund for Coal and Steel

Principal Contractor: UNISA - Università degli studi di Salerno

COMPLETED PHD THESES

> **Load Distribution on Timber-Concrete Composite Floors**

Author: Sandra Raquel de Sousa Monteiro

Supervisors: Prof. Dr. Alfredo Manuel Pereira Geraledes Dias and Prof. Dr. Sérgio Manuel Rodrigues Lopes

Date: 28th October 2015

Summary: This research focused on study the load distribution in the transverse direction on timber-concrete composite (TCC) floors when subjected to point and line loads. Theoretical and experimental approaches were used.



The first one comprised, among other tasks, developing and validating a numerical model able to predict the phenomena under consideration.

Five real scale floor specimens were built and tested applying a point or line load one at a time at different

locations: mid or quarter span or aligned with longitudinal axis of each beam, respectively. Numerical results showed to be close to the experimental ones. The model was also used to carry a sensitivity analysis aiming at improving the knowledge on the parameters that most affect the TCC floor behaviour together with some design considerations. The span length showed to be one of those parameters, together with the beam and load location, among others. A simple rule to predict the percentage associated with each beam was developed.

CV: **Sandra Monteiro** PhD degree in Civil Engineering - Structures (October/2015); Lecturer at DEC-FCTUC since October/2005. Research expertise: modelling and experimental testing of timber concrete notched connections and floors. Participation on research 2 projects in the same area. Scientific papers since 2009: 5 on international conferences, 4 on international journals with scientific refereeing.



> **High strain rate constitutive modeling for historical structures subjected to blast loading**

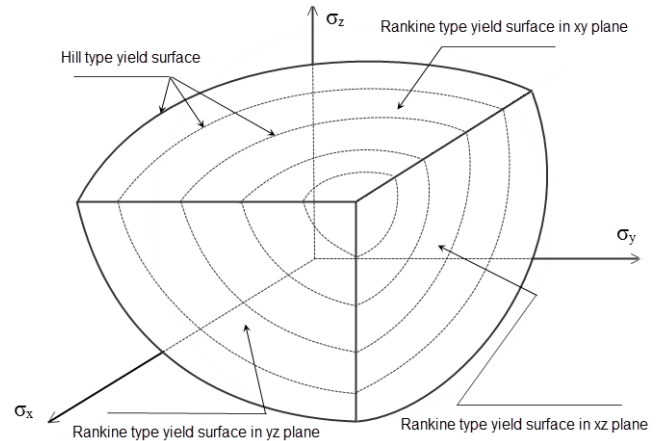
Author: Seyedehbrahim Hashemi Rafsanjani

Supervisor: Paulo Lourenço

Date: 7th May 2015

Summary: The PhD thesis has been accomplished at the Department of Civil Engineering of University of Minho. This work involves detailed numerical studies intended to better understand the blast response of masonry structures. The present study proposes a dynamic 3D interface model that includes non-associated flow rule and high strain rate effects. Furthermore, a new strain rate dependent anisotropic constitutive material continuum model is developed for impact and blast applications in masonry, with validation using the high strain rate response of masonry walls. Iso-damage curves are addressed for typical masonry infill walls in Portugal under blast with different loading conditions, which can be adopted for practical use in the case of enclosures. Finally, the new continuum plasticity model is taken into engineering applications to solve real problems. The full-scale numerical simulation of the blast response of Al-Askari holy shrine is considered to

practice and validate the model capability.



CV: **Seyedehbrahim Hashemi Rafsanjani** completed his PhD at ISISE, Department of Civil Engineering of University of Minho. His research aimed at developing two rate dependent constitutive material models for masonry. He has started his academic career as Assistant professor at University of Qazvin, Qazvin, Iran since September, 2015. He has published several papers in international conferences and Journals.

> **Creep Behaviour of Cracked Steel Fibre Reinforced Self-Compacting Concrete Laminar Structures**

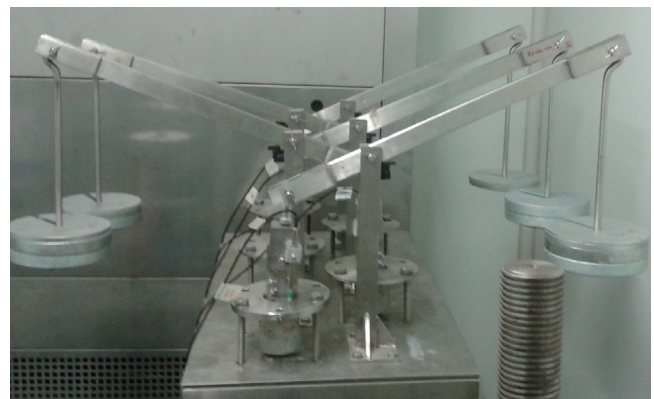
Author: Amin Abrishambaf

Supervisors: Joaquim Barros, Vitor Cunha

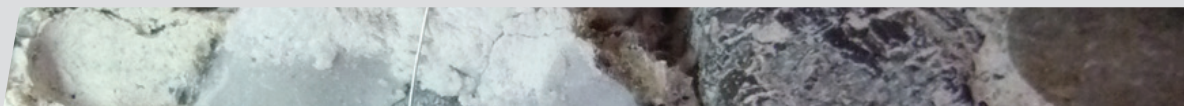
Date: 20th September 2015

Summary: This PhD work aims to increase the knowledge within the field of mechanical behaviour of steel fibre reinforced self-compacting concrete (SFRSCC). The main purpose was to achieve as much as possible a consistent comprehension of this material's behaviour under monotonic and long-term (in the cracked stage) loading conditions. Therefore, in the first phase, an experimental campaign was executed in order to understand how fibres were distributed and oriented in SFRSCC laminar structures, and, furthermore, how these parameters influence the overall composite behaviour at a macro-level. Then, the micro-mechanical aspects of fibre reinforcement were analysed by performing a series of monotonic and long-term fibre pull-out tests. Finally, based on the fibre's micro-mechanical properties, a numerical integral approach was used to predict the flexural behaviour of SFRSCC

laminar structures under monotonic and long-term loading conditions.



CV: **Amin Abrishambaf**, graduated in Master of Science in Civil Engineering at Eastern Mediterranean University, Cyprus, in 2009. He is a researcher at ISISE and finished his PhD in September 2015 at University of Minho. His research interests are: concrete structures, mechanical characterization of cementitious materials, fibre reinforced concrete, durability and long-term performance.



> **Seismic retrofit of masonry-to-timber connections in historical constructions**

Author: Susana Moreira
Supervisors: Luis Ramos, Daniel Oliveira
Date: 15th July 2015
Summary: Proper structural connections play an important role in ensuring seismic loads distribution and developing global damage mechanisms of structures. In unreinforced masonry buildings, effective connections between masonry walls and timber floors or walls, through the use of anchors, can prevent the occurrence of out-of-plane mechanisms and promote “box-like” behavior.



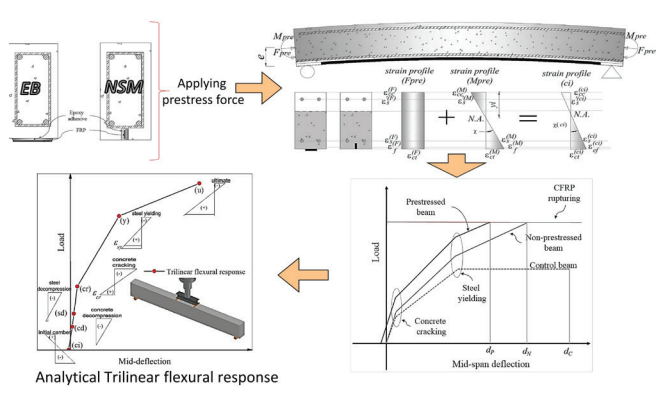
This thesis aimed at studying and developing seismic retrofit solutions for connections between masonry walls and timber structural elements (floors and framed walls), in historical unreinforced masonry buildings. Quasi-static monotonic and cyclic tests were carried out on pairs of injection anchors, and on wall-to-floor connections retrofitted with steel tie rod with anchor plate sets. From the experimental results, strength prediction formulae were studied and adapted to better fit the results obtained and idealized curves were developed based on force-displacement backbone curves. Retrofit design methodologies and performance criteria were proposed.

CV: **Susana Moreira** Graduated in Civil Engineering, at the Faculty of Engineering of University of Porto, in 2008, later joining the R&D depart. of Mota-Engil, SA. In 2009/2010, carried out the SAHC master’s program in Universities of Minho and Padova. In 2015, concluded the PhD thesis concerning seismic retrofit of masonry-to-timber connections at University of Minho, where currently develops research on retrofit design.

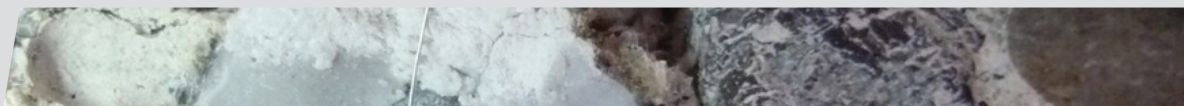
> **Innovative Methodologies for the Enhancement of the Flexural Strengthening Performance of NSM CFRP Technique for RC Beams**

Author: Mohammad Ali Rezazadeh
Supervisor: Joaquim Barros
Date: 25th June 2015
Summary: This thesis aimed to experimentally and numerically evaluate the efficiency of prestressing and hybrid strengthening techniques using near-surface-mounted (NSM) carbon-fiber-reinforced-polymer (CFRP) laminates for the enhancement not only the load carrying capacity at concrete cracking and steel yielding initiations, serviceability limit state, and ultimate condition, but also the ultimate deflection capacity when compared to the use of non-prestressed NSM CFRP technique. Besides, simplified analytical approaches, with a design framework, are developed to predict the flexural behavior of RC beams flexurally strengthened with prestressed CFRP reinforcement applied according to either externally-bonded (EB) or NSM techniques. Moreover, this study offers an analytical formulation based on a closed form solution for the prediction of dis-

tribution of CFRP tensile strain and bond shear stress and, additionally, the prestress transfer length immediately after the release of prestress force.



CV: **Mohammadali Rezazadeh**, graduated in Civil Engineering by IAU/Iran in 2006, Master of Science in Civil Engineering by TMU/Iran in 2009, and finished his PhD in June 2015 at UM. Researcher at ISISE in UM. His research interests include numerical and analytical structural analysis, fiber-reinforced composites, Strengthening methodologies.



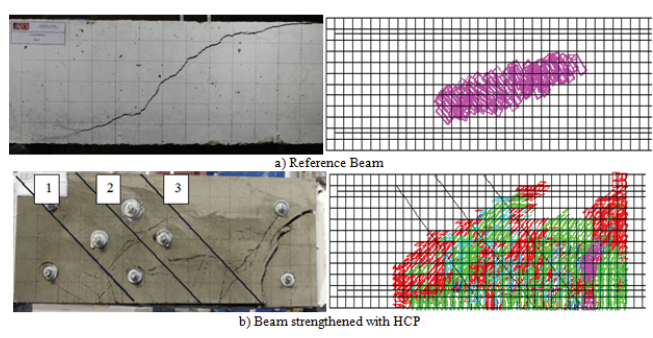
> Shear Strengthening of Reinforced Concrete Beams with SHCC-FRP Panels

Author: Hadi Baghi

Supervisor: Joaquim Barros

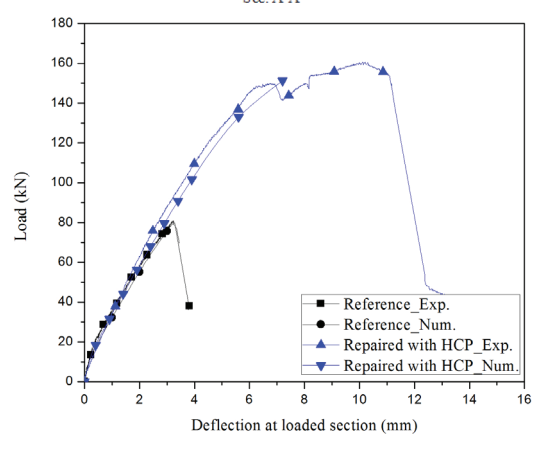
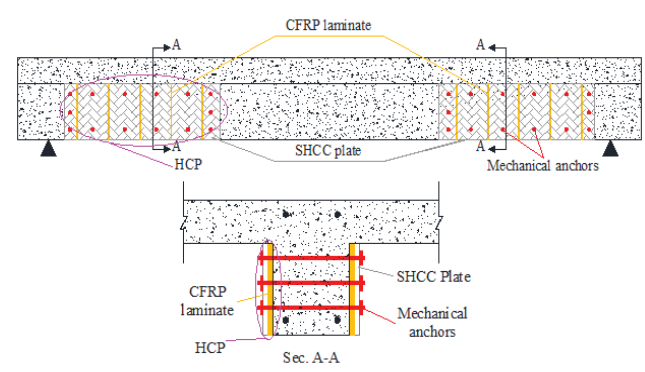
Date: 23th June 2015

Summary: The potentialities of Hybrid Composite Plates (HCP) for the shear strengthening of reinforced concrete beams were explored. HCP is a thin plate of Strain Hardening Cementitious Composite reinforced with Carbon Fibre Reinforced Polymer laminates applied according to the Near Surface Mounted technique. Due to the excellent bond conditions between SHCC and CFRP laminates, these reinforcements provide the necessary tensile strength capacity to the HCP, moreover the high post-cracking tensile deformability and resistance of SHCC avoids the occurrence of premature fracture failure of this cement composite in the stress transfer process between these two materials when the HCP is crossed by a shear crack.

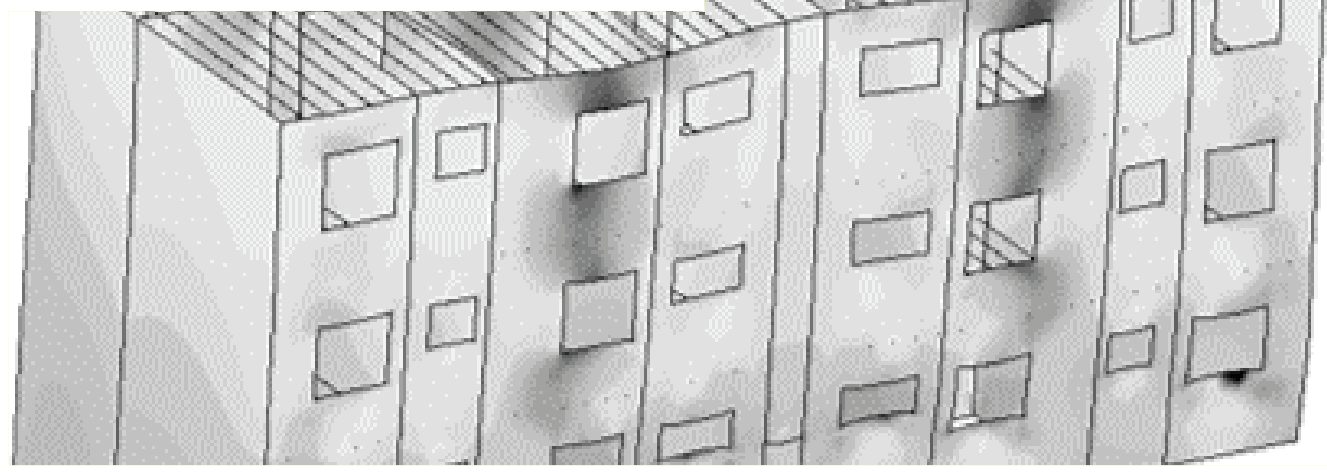


To further explore the potentialities of HCPs for the shear strengthening of RC beams, advanced numerical simulations are performed by using a FEM-based com-

puter program, whose adequate predictive performance is demonstrated by simulating the experimental tests carried out.



CV: Hadi Baghi got a PhD degree in June 2015 in the Department of Civil Engineering of Minho University. His research interests involve the use of strain hardening cement composites and fibre reinforced polymer systems, advanced numerical modelling and design guidelines for the structural rehabilitation.

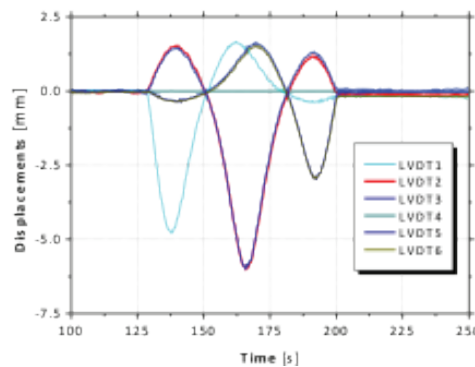




ISISE TECHNOLOGIES

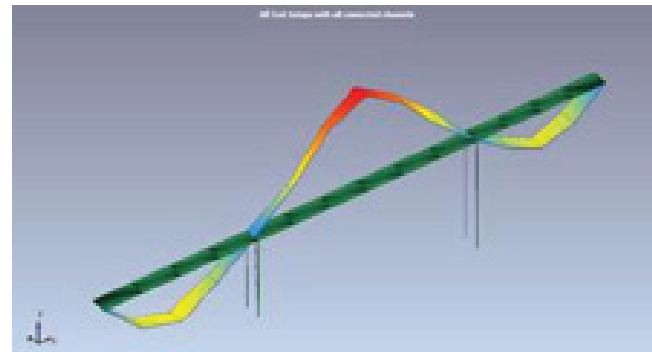
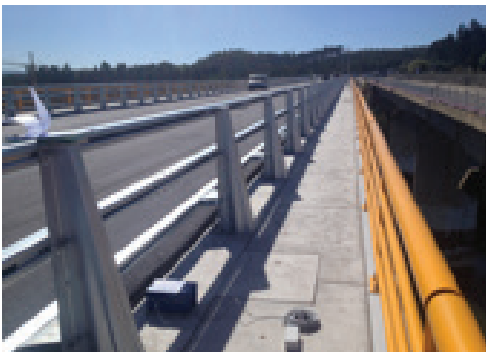
> Load test on the new bridge over Dão River near Coimbra

The new bridge over Dão River near Coimbra, Portugal, was submitted to load tests. This bridge was designed by Armando Rito Engenharia, Lda. Company and built by Casais, S.A. company. It consists of a three-span prestress concrete box girder, with span lengths equal to 120 m, 170 m and 100 m, a cross-section height varying from 4 m to 10 m, and a deck of 15 m of width. Piles are formed by two parallel U-shape shells made of prestress concrete, with a height of around 11 m monolithically connected to the bridge deck and to a footing located at the water level, which transmits all forces to the ground placed under water by nine pilots of 2 m of diameter. Three types of load tests were carried out: (i) static tests; (ii) moving loads; and (iii) dynamic tests.



Moving load test

Dynamic ambient test



A special system (under patent pending) was developed for measuring the vertical displacements along the three spans by using displacement transducers. Distinct sensors were used for measuring different responses, mainly, LVDT's, tiltmeters, accelerometers and seismometers. As expected the bridge behave linearly for the applied load levels. The natural frequencies were well spaced, the modes were mainly bending modes and the damping values were in the range of the expected values for these type of concrete structures.

Sena-Cruz, J.M.; Ramos, L.; Escusa, G. (2015) "Load tests on the new bridge over Dão River", Report no. 15-DEC/E-33, Department of Civil Engineering, University of Minho, Guimarães, 82 pp.



New bridge
over Dão
River



AWARDS & PRIZES

> **Professor António Gomes Correia** will deliver the 33th Manuel Rocha Lecture in October 2016, at the Calouste Gulbenkian Foundation, in Lisbon, entitled: "Development and Innovation in Transportation Geotechnics".



Manuel Rocha Memorial Lectures are given annually, by academics and researchers judged to be the leaders in their chosen field. This lecture series are organised each year, since 1984, by the Portuguese Geotechnical Society and the Geotechnical Association of Alumni of the New University of Lisbonized. This lecture series commemorates the distinguished professional career of Manuel Rocha, firstly by its own contributions as a scholar and as consultant engineer, and secondly through the impact of the National Laboratory of Civil Engineer, which he created. He was one of the founders of the International Society for Rock Mechanics (ISMR), its second president (1966-1970) and the chairman of the first congress of the ISRM

(Lisbon, 1966).

> **Japanese Concrete Institute Award of 2015** attributed to the paper: J. Granja, M. Azenha, C. Sousa, R. Faria, J. Barros (2014) "Hygrometric Assessment of Internal Relative Humidity in Concrete: Practical Application Issues". Journal of Advanced Concrete Technology, vol. 12 (8), pp. 250-265 <http://dx.doi.org/10.3151/jact.12.250>.

EVENTS

> **HISTWIN+ Workshop: Dissemination of results from HISTWIN+ project and introduction in Design according to Eurocodes**

Venue: Fenerbahce, Istanbul, Turkey

Date: 17-18 September 2015

Website: www.histwin.eu

Summary: The HISTWIN+ project is an EU-funded project involving six European institutions: ECCS, Belgium; FOSTA, Germany; LTU, Sweden; RWTH, Germany; UC, Portugal; UoB, United Kingdom.

The workshop promoted dissemination of results obtained during the research project and consisted of two events. On the 1st day, basic information about the relevant Eurocodes was explained and at the 2nd day results from the HISWIN project were in the focus.





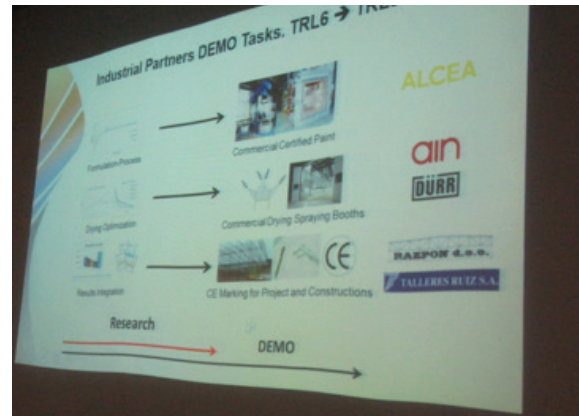
> **WorkShop: Steelprost DEMO project**

Venue: Istanbul, Turkey

Date: 17 September, 2015

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

Summary: Steelprost project has successfully developed a completed technical solution to protect steel structures from fire using a new high performance nanoenhanced intumescent polymeric coating (IC) and a new spraying/drying system. Now, Steelprost DEMO intends to continue with the route to market by achieving the IC certifications, to industrially validate the spraying/drying system and with the dissemination of the results.



> **Joint TMB/PMB & Networking Meeting**

Venue: Istanbul, Turkey

Date: 16 September, 2015

Website: www.steelconstruct.com

Summary: During the Joint TMB/PMB & Networking Meeting, Aldina Santiago presented the APPS developed by the technical committees of ECCS:

- ECCSEC3 STEEL MEMBER CALCULATOR - Calculation of the resistance of columns, beams and beam-columns (EC3-1-8).
- ECCS BUILDINGS LCA CALCULATOR - Calculation of the environmental performance of buildings (EN 15804) and components (EN 15978).
- ECCS EC3 STEEL CONNECTIONS CALCULATOR -

Calculation of the resistance of steel connectors (EC3-1-8).



> **8th International Conference on Advances in Steel Structures**

Venue: IST - Lisbon

Date: 21-24 July 2015

Website: <http://icass2015.ist.utl.pt/index.html>

Summary: The international conference series on Advances in Steel Structures was initiated in 1996 under the auspices of the Hong Kong Polytechnic University. The 8th ICASS'2015 was the first to take place outside of Asia. ISISE-SMCT had six representatives disseminating their recent research work. Prof. Simões da Silva, gave a keynote lecture "On the safety of stability design rules for steel members".





> Paredes de Alvenaria: Reabilitação e Inovação

Venue: Edifício da Reitoria da Universidade Nova de Lisboa (Campus de Campolide, Lisboa)

Date: 18 June 2015

Website: <http://www.civil.uminho.pt/paredes2015/>

Summary: The 4th edition of the national Seminar Paredes de Alvenaria (Masonry walls) took place in June 18 in Lisbon as a joint organization of University of Minho and New University of Lisbon. This edition was dedicated to innovation and rehabilitation of masonry walls, from masonry infill walls to ancient stone masonry walls. The seminar had more than 200 attendees from universities, construction companies and public institutions.



> III Workshop of the PhD Students in Civil

Venue: University of Minho, Azurém

Date: 22-23 October 2015

Website: <http://www.pdec.civil.uminho.pt/site/>

Summary: The workshop was held in the School of Engineering of the University of Minho. The primary purpose of this annual event is to bring together all the PhD students to present their work orally or by poster in order to discuss and share points of views. This is an opportunity to the PhD students to develop skills of more effective communicators and to facilitate the monitoring of student research progress by the steering committee. Furthermore, keynote speakers are also invited to show to the students their expertise in the related areas of the workshop.

This year the workshop program was composed by 5 Keynote Lectures, 5 Technical sessions, 28 Oral Presentations and 42 Posters. The workshop ending with a lunch where were announced the best oral and poster awards. The winners were Fatemeh Soltanzadeh and Christoph Sousa.



> 3º Seminário sobre o Projeto de Reforço de Estruturas de Betão com FRP's (SPREB-FRP 2015)

Venue: University of Minho, Azurém

Date: 18 September 2015

Website: <http://civil.uminho.pt/spreb-frp2015/>

Summary: The SPREB-FRP 2015 - 3rd Seminar on design strengthening of concrete structures with FRP materials (<http://civil.uminho.pt/spreb-frp2015/>), held at the University of Minho, Guimarães, on last 18th September, 2015. The seminar was attended by 50 participants and included 4 keynote lectures from Professors Joaquim Barros and José Sena Cruz (University of Minho), Dr. Julien Michels (Empa) and Eng. Filipe Dourado (CEO of S&P Clever Reinforcement Ibérica Lda.).

In the afternoon several presentations about the FRPreDur project were made by Professors José Sena Cruz and Paulo Costeira and the PhD students Luís Correia, Patrícia Silva, Pedro Fernandes and Mário Coelho.





> **3rd Edition of the Building Information Modeling Course**

Venue: Ordem dos Engenheiros (Lisbon and Porto)

Date: September to December 2015

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

Summary: Based on the success of the first and second edition of the National Course on Building Information modelling (BIM), the coordinators, Miguel Azenha and José Carlos Lino (ISISE members) have promoted a second edition to take place between September and December 2015 (simultaneously in Lisbon and Porto). The course continues to be a joint organization of 'Ordem dos Engenheiros' and the Universities of Minho, Lisbon and Porto. This third edition of the course had a high demand and rapidly became fully booked.



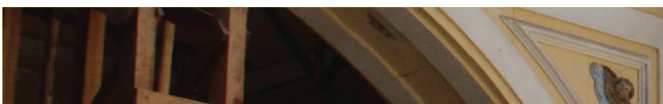
> **Safeguarding earthen cultural heritage in Peru**

Venue: Cusco, Lima and Ica

Date: June and July 2015

Summary: ISISE is involved in non-destructive testing and seismic assessment of earthen construction in Peru, in collaboration with Getty Conservation Institute and Pontificia Universidad Católica del Perú. Sonic testing, dynamic testing, photogrammetry survey with drones and visual inspection were recently carried out on site. Advanced non-linear analyses are currently being performed for several case studies, in current condition and after strengthening.

Two International Seminars with the title "New Trends in the registry, Diagnosis and Heritage Conservation", were held in Lima and in Cusco, on July 3rd and 6th, respectively, organized by PUCP Engineering & Heritage Group and UNESCO Representation in Peru. The seminars were part of series of activities carried out under the project "Support for the management of Heritage Cities Network", implemented by the UNESCO Representative in Peru. ISISE was also invited to participate on the seminars with a talk about advanced inspection and diagnosis techniques for heritage constructions.





> **Guimarães Noc Noc: Casa Guimarães + Verde**

Venue: Casa Guimarães + Verde, Rua Egas Moniz, Guimarães

Date: 3-4 October 2015

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

Summary: The Institute of Science and Innovation for Bio-sustainability (IB-S) was present at Guimarães Noc Noc event with the exposition “Development of ecologic blocks”. The exposition was exhibited in the house “Casa + Verde”, which also aimed at supporting the application of Guimarães to European Green Capital. During the two days of the event, the house was visited by about 1000 visitors.



> **1st Workshop of COST Action TU 1406**

Venue: CIGG, Geneva, Switzerland

Date: 21-22/9/2015

Website: www.tu1406.eu

Summary: The 1st Workshop of COST Action TU1406 was organized in CIGG, Geneva, Switzerland, in September 21-22, 2015. The focus of this event was the WG1 – Performance Indicators. The Action is chaired by Prof Jose Matos, who actively participated in the organization of this event. The main outcomes of this Workshop can be seen at www.tu1406.eu.



> **Engineered skins 2015 – Recent developments in Glass and Façade Engineering research at the University of Cambridge - Annual Symposium hosted by the Glass and Façade Technology Research Group at Cambridge University**

Venue: Cambridge University| Dep of Engineering |Cambridge | UK

Date: 3rd September 2015

Website: <http://www.gft.eng.cam.ac.uk/news/great-attendance-to-the-gft-symposium-engineered-skins-2015>

Summary: Annual Symposium featuring presentations and discussions about research findings, future trends in the façade sector and prospects for future collaboration between industry and academia. (80 participants from industry and other research centres). Prof Burgoyne (Univ Cambridge) | G. Coult -Eckersley O’Callaghan , S. Marinitsch - Seele (keynote speakers) | gFT researchers (presentations) | Dr Overend (recent

achievements of the gFT group and plans for 2015-16).





> **Workshop on Traffic noise: measurements, simulation and mitigation**

Venue: Coimbra, Portugal

Date: 28th October, 2015

Website: <http://www.itecons.uc.pt/index.php?module=events&id=20>.

Summary: This workshop discussed issues related to traffic noise, such as legislation, simulation and mitigation solution and promoted also dissemination of results of the SClog research project.



> **COST TU1403 Adaptive Façade Network**

Venue: Delft School of Architecture

Date: 16th-17th September 2015

Website: http://www.cost.eu/COST_Actions/tud/TU1403

Summary: Work Group 2 meeting



UPCOMING EVENTS

> *HISTWIN+ Workshop: Steel Wind Tower Design, Manufacturing and Maintenance*

Venue: Coimbra & Oliveira de Frades, Portugal

Date: 27 November & 4 December 2015

Website: www.histwin.eu

ISISE member: Carlos Rebelo

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

Venue: University of Minho, Azurém

Date: 13-24 June 2016

Website: sc.civil.uminho.pt/strengtheningtechniques/

ISISE member: Joaquim Barros

> *Advanced Masters in Structural Analysis of Monuments and Historical Constructions - Applications for the academic year 2016/2017 are now open*

Website: <http://www.msc-sahc.org/>

> *European Erasmus Mundus Master Course Sustainable Constructions under natural hazards and catastrophic events - Applications for the academic year 2016/2017 are now open*

Website: <http://steel.fsv.cvut.cz/suscos/grants.htm>

