



INDEX

01

ISISE HIGHLIGHTS

03

R&D COMPLETED
PROJECTS

06

R&D STARTED
PROJECTS

07

COMPLETED PhD
THESES

09

EVENTS

12

UPCOMING EVENTS

13

MASTER COURSES
PHD COURSES

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GROUPS

**Historical and Masonry
Structures**

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**Steel and Mixed Construction
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Functional Performance

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ISISE HIGHLIGHTS

ISISE Day-Out



The 2019 ISISE Day-Out and PhD Workshop had its 9th edition held on the 24th October at the Institute of Science and Innovation for Bio-Sustainability (IB-S) facility in Campus of Gualtar, Braga, of the University of Minho with about 110 participants.

This event started with the talk of Prof. Paulo Lourenço about his personal experience as evaluator and grantee of an ERC grant.

Then, the group also had the opportunity to hear the invited lecturer Dr. André Ribeiro who is working at the Centre for Waste Valorisation (CVR), which is a non-profit institution that offers research, scientific analysis and actual application services

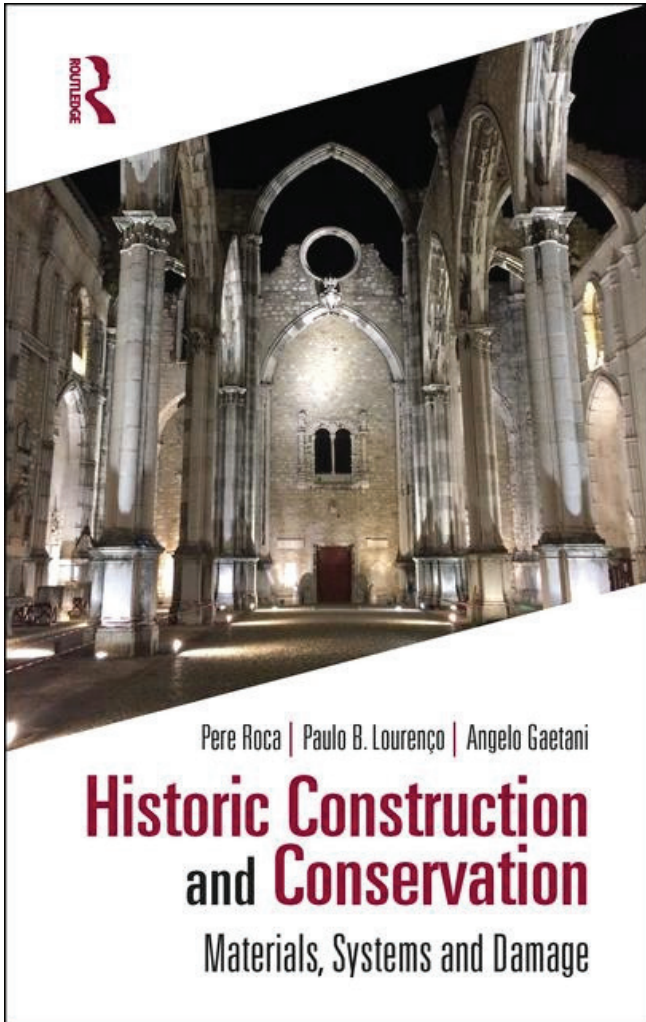
in the waste valorisation area. The presentation was about "Circular Economy on the waste sector: CVR perspective".

During the day, 10 PhD students presented their current work during the PhD Workshop and the "Best Presentation Prize" was awarded to Miguel Pereira, with the presentation entitled "Development of a new reinforcing system for steel-concrete composite slabs". The event ended with an icebreaking experience consisting in walking up the Stairway of 'Bom Jesus' which tested the endurance, stamina and perseverance of the participants coming from both Universities on different interaction games.

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



A New Book: Historic Construction and Conservation Materials, Systems and Damage, by Pere Roca, Paulo B. Lourenço, Angelo Gaetani



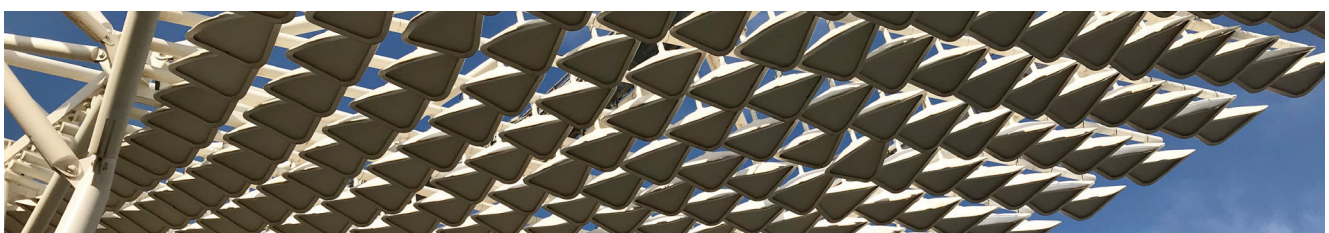
heritage” in the framework of the European Year of Cultural Heritage (2018). The program received a EU Prize for Cultural Heritage / Europa Nostra award in 2017, which is the most prestigious cultural heritage award in Europe. Aside from its evident significance on an international level, SAHC is impressive in its global reach. Alumni are now working across the world, creating a unique network of knowledge and friendship.

This book takes a modern approach to the meaning of a heritage structure and its conservation. The historical evolution of conservation is briefly addressed, considering prominent individuals and cases; along with the history of construction, focusing on materials and related structural elements, with insight on the sizing rules adopted by masons. This explains structural decisions made during the construction process and allows comparison of scientific theories from the 18th century to modern understanding of limit analysis. Damage and collapse mechanisms for masonry construction, as the most widespread structural form for historical buildings, is described. Excess permanent loading and settlement is differentiated from environmental and anthropogenic actions such as earthquake or incorrect intervention.

This book is inspired by the MSc in Structural Analysis of Monuments and Historical Constructions, SAHC (www.msc-sahc.org), initiated in 2007, graduating since then 400 students from 70 countries across the world.

The European Commission selected SAHC as an “inspirational example of what can be achieved when education, training and youth work meet cultural

The book addresses the history of conservation by exploring materials and structures and the history of construction and damage, so it is of value to students and professionals in civil engineering and architecture, as well as archaeologists and art historians.





R&D COMPLETED PROJECTS

> EQUALJOINTS PLUS – Valorisation of knowledge for European preQUALIFIED steel JOINTS

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

Budget: Global: 1.218.711,00€ / **ISISE-UC:** 112.043,00€

ID: EQUALJOINTS-PLUS – RFCS-2016/RFCS-2016/754048

Funding Entity: EU

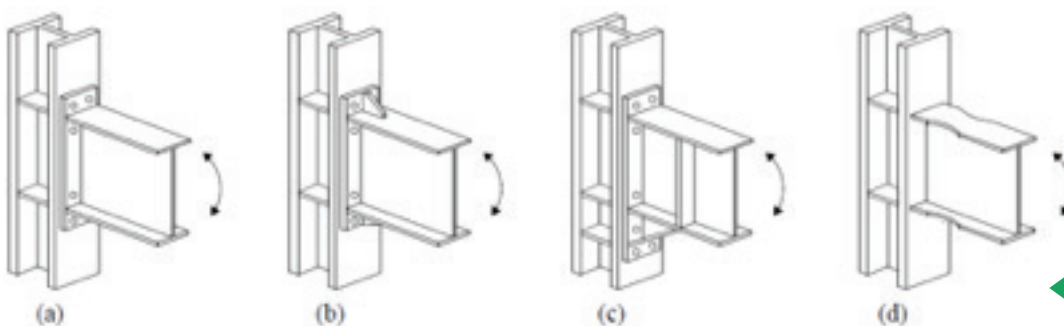
Principal Contractor: *Università degli Studi di Napoli Federico II (UNINA)*

Duration: From 01/07/2017 to 30/06/2019

Summary: This proposal focused the valorization and the dissemination of the results achieved within the project EQUALJOINTS, where seismic prequalification of steel joints has been developed. In order to fully exploit the potential of the European prequalification charts, design-oriented documents (guidelines, handbook, tools and design examples) have been produced in 12 different languages, and distributed among the partners of steel construction sectors, including all academic institutions, engineers and construction companies.

A software and an app for mobile to predict the inelastic response of joints was developed.

The Matlab software implemented analytical predictions of cyclic and monotonic response of connections based on the extension of the component method. A user-friendly mobile app for quick and reliable calculation and verification was developed for iOS and Android and made accessible for public usage. Moreover, workshops and seminars were organized all over Europe and in USA for presenting material and sharing knowledge in 12 languages.



Prequalified bolted joint types





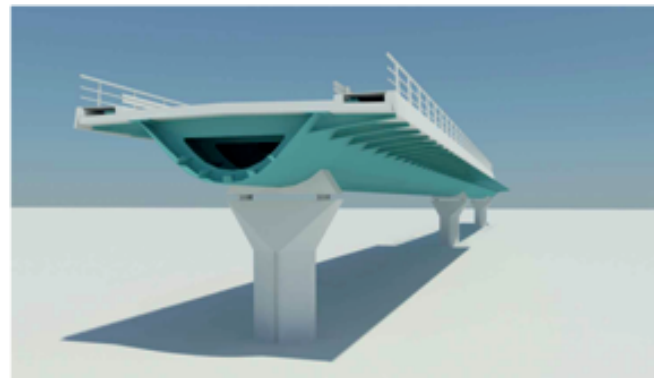
> **OUTBURST - Optimization of Steel Plated Bridges in Shape and Strength**

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

Summary: The objective of this research project was to develop solid knowledge on the structural behaviour of curved steel panels (stiffened and unstiffened transversely and longitudinally curved panels), transversally curved girders and girders with nonrectangular plates for optimized applications in steel and composite bridges, allowing extending the design rules in Eurocode and enlarging the use of steel in bold and appealing architectural designs. Specifically, the followings targets were completed within the scope of the research:

- > Extension of the EN 1993-1-5 design methodology for compression, bending, shear, torsion and possible combinations of these stresses by explicitly introducing curvature;

- > Characterization of relevant interactions (dual flange/web role of curved cross-sections);
- > Development of design rules for transverse stiffeners taking account of a possible dual flange/web role in curved panels;
- > Extension of plate buckling rules to plates with variable width, which are not yet covered in regular plate buckling design according to EN 1993-1-5. Such panels are used as webs of plate or box girders with a lower flange curved in the longitudinal direction.



> **FREEDAM – FREE from DAMAge Steel Connections**

ISISE Principal Investigator: *Luís Simões da Silva*
Budget: *Global: 142.372,00€*
ID: *PTDC/ECM-EST/3711/2014*
Funding Entity: *FCT - Fundação para a Ciência e a Tecnologia*
Principal Contractor: *Universidade de Coimbra (UC)*
Duration: *From 01/01/16 to 01/07/19*

Summary: In line with FCT policy of complementing European funding, this project applied for 40% of a RFCS project (founded in 60%); it is focused on the tasks of the Portuguese partners. The project addressed the development of a new design strategy to design steel connections able to withstand, without damage, the rotation demands due to extreme seismic events. Such connections are equipped with friction dampers located at the bottom flange level of the connected beam to dissipate the earthquake input energy. As output of the work, an analytical model describing the connection' behaviour was developed. This model

takes into account the effects of the dynamic loading in the resistance and ductility of the connection and can be easily implemented in frame model to study the robustness of frames. Robustness studies in a frame subjected to a vehicle collision were carried out, which highlighted that the slip mechanism of the FREEDAM connections, effectively protect the yielding of non-dissipative parts of the structure, since the input energy from the extreme event is mainly dissipated by the friction dampers. More information: ISISE youtube channel, FREEDAM youtube channel, expresso.pt, 90segundosdeciencia.pt and sicnoticias.pt





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

ISISE Principal Investigator: Miguel Azenha

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

ID: PTDC/ECM-EST/1056/2014 (POCI-01-0145-FEDER-016841)

Funding Entity: FCT

Principal Contractor: Universidade do Minho

Duration: From 01/07/2016 to 31/08/2019

Summary: The project aims to conduct a comprehensive program that incorporates extensive experimental characterization, real-scale testing with monitoring of relevant data and their corresponding simulation with multiscale and multi-physics approaches. The innovative aspect of this research project is the pioneering capacity of the team to integrate knowledge and research experience in both the experimental

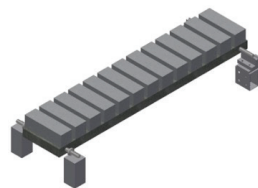
and numerical simulation fields, paving the way to an unprecedented set of integrative innovations ranging from the microstructural characterization and modelling to the real-scale testing, modelling and validation. The abovementioned program allowed to improve the prediction of cracking and service life behaviour and the consequent set of recommendations for designers are bound to cause significant impact on new structures and processes of reinforcement of cement-based materials. This will improve cracking performance and thus increase maintenance free lifespan of new structures. The project has been able to reach the full extent of its goals in all the 7 tasks. More information about the project can be found in www.civil.uminho.pt/integracrete



Restrained shrinkage
+ applied loads



Restrained shrinkage
+ self-weight



Free shrinkage
+ applied loads

Long-term experimental campaign

> **HeritageCare - Monitoring and preventive conservation of the historical and cultural heritage**

ISISE Principal Investigator: Daniel Oliveira

Budget: Global: 1.686.282,80€/ISISE-UM: 327.961,53€

ID: HeritageCare - SOE1/P5/P0258

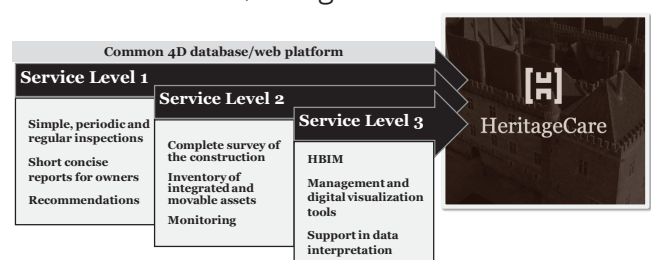
Funding Entity: Agência para o Desenvolvimento e Coesão (INTERREG V-B SUDOE)

Principal Contractor: Universidade do Minho

Duration: From 01/09/2016 to 31/08/2019

Summary: The implementation of a preventive conservation approach for cultural heritage buildings involves several challenges. The HeritageCare project explores the leading role that digitization is assuming in the context of heritage conservation, allowing information to be stored, manipulated, shared and transferred. The project has developed a digital-based integrated methodology to provide enhanced tools and services to properly document cultural heritage buildings and engage directly owners in the conservation process of their legacy. Dedicated web-based and mobile applications

combining flexibility and easy access have been designed in accordance with the protocol of inspection. Besides, advanced geomatic techniques have been leveraged to generate high-resolution virtual replicas of the inspected historic buildings. Lastly, 3D models of the inspected buildings have been created in Heritage Building Information Modelling (HBIM) environment, allowing to easily share, visualize and update all meaningful information about their conservation. This digital-based integrated methodology has been applied in the Ducal Palace of Guimarães, Portugal.





> **INVISIBLE WOODS - A dendrochronological survey of the structural woods of historic city centers of Portugal**

ISISE Principal Investigator: Jorge Branco

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

ID: PTDC/EPH-PAT/2401/2014 (POCI-01-0145-FEDER-016843)

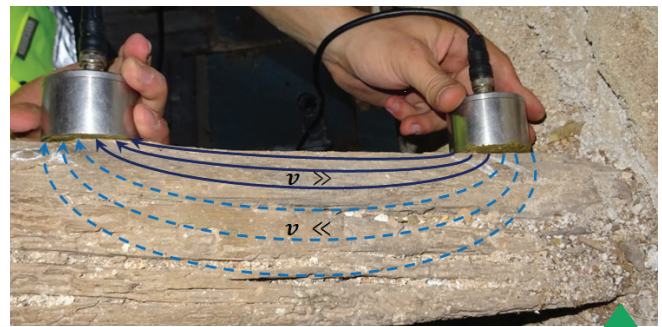
Funding Entity: FCT

Principal Contractor: UC

Duration: From 01/07/2016 to 31/10/2019

Summary: The research project INVISIBLE WOODS, more focused on the architectural and engineering part, aims at assessing the stability and the health of existing timber structures that were badly preserved over time, from the historic buildings selected for concomitant dendrochronology surveys in Portugal. In that context, three timber roof structures have been chosen as case study from the Convent of Christ in Tomar. The objectives have been achieved through applying an adequate methodology of inspection and diagnosis into four main tasks: (i) Visual inspection for the structural geometry and detection of any biological wood-deteriorations; (ii) Non-destructive wood diagnosis (i.e. Ultrasonic Pulse Velocity

Tests, Drilling Resistance and Impact Penetration Tests) to assess the damage extent in the members cross-section and to infer their wood mechanical properties; (iii) Safety evaluation of timber structures through modelling on a commercial software; (iv) Proposition of preventions and/or interventions means. As scientific communications, five scientific reports, three conference papers and two journal papers were produced successfully.



Non-Destructive Wood Diagnosis – Ultrasonic Pulse Velocity Tests. Wave's propagation in respect to Indirect Method parallel to the grain. Convent of Christ, Tomar.

R&D STARTED PROJECTS

> **Sticker – Innovative technique for Structural strengthening based on the use of CFRP laminates of multifunctional requirements and applied with advanced cementitious-based adhesive**

ISISE Principal Investigator: Joaquim Barros

Budget: Global: 640.053,63€/ISISE-UM: 380.957,95€

ID: POCI-01-0247-FEDER-039755

Funding Entity: ANI

Principal Contractor: Clever Reinforcement Iberica - Materiais de Construção Lda

Duration: From 12/08/2018 to 08/02/2022

Partners: UM

> **InfraCrit – Development of a managing system for critical infrastructures**

ISISE Principal Investigator: José Matos

Budget: Global: 724.956,00€/ISISE-UM: 239.414,47€

ID: POCI-01-0247-FEDER-039555

Funding Entity: ANI

Principal Contractor: PH-informática e Microsistemas, S.A.

Duration: From 01/10/2019 to 30/09/2022

Partners: UM, UC

> **RENEw - Residues in the construction for the circular economy**

ISISE Principal Investigator: Eduardo Pereira

Budget: Global: 1.573.259,57€/ISISE-UM: 451.290,92€

ID: POCI-01-0247-FEDER-033834

Funding Entity: ANI

Principal Contractor: Domingos da Silva Teixeira, S.A.

Duration: From 24/11/2019 to 23/11/2022

Partners: UM, UTAD, CVR



COMPLETED PHD THESES

> Dynamic analysis of out-of-plane loaded masonry walls using homogenization

Author: Luís Carlos Martins da Silva

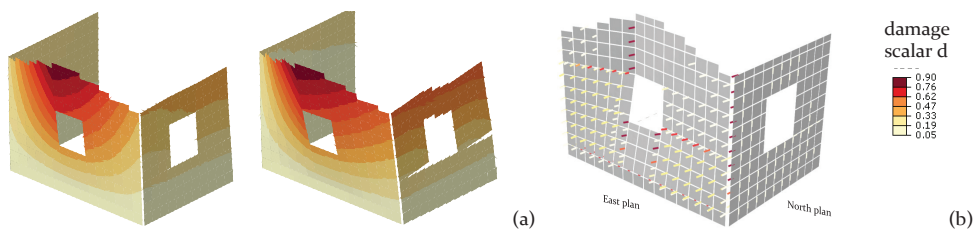
Supervisors: Paulo B. Lourenço; Gabriele Milani

Date: 11/06/2019

Summary: This thesis addresses the analysis of URM structures using a two-scale FE2 strategy based on homogenization principles. The main scope is the study of the quasi-static and dynamic mechanical behaviour and failure of Unreinforced masonry (URM) structures. A two-step numerical strategy using homogenization has been proposed for the nonlinear analysis of URM structures for both static and dynamic regimes. It comprises two-scales of analysis, i.e. the meso and the macro. It is suitable to account with the structural system uncertainties' by making use of a Latin Hypercube Sampling method aiming the

development of a seismic fragility assessment study. The application of the numerical framework covered a representative repertoire of case studies. These demonstrated that the approach can reproduce with good accuracy the out-of-plane static and dynamic behaviour of masonry structures. It proved to be robust, computationally attractive when compared with traditional FE strategies, and suitable to be used in seismic fragility studies of URM structures.

CV: **Luís C. Silva** is master's in civil engineering at University of Minho and concluded his PhD in Civil Engineering in 2019. He published 20 papers (journal and national/international conferences) in the field of masonry structures and numerical methods applied in Engineering. Currently, he is a Post-doc researcher at University of Minho.



Proposed numerical approach application to the LNEC brick house mock-up: (a) obtained deformed shape; (b) obtained failure pattern

> Use of NSM FRP for torsional strengthening on thin walled tubular RC structures

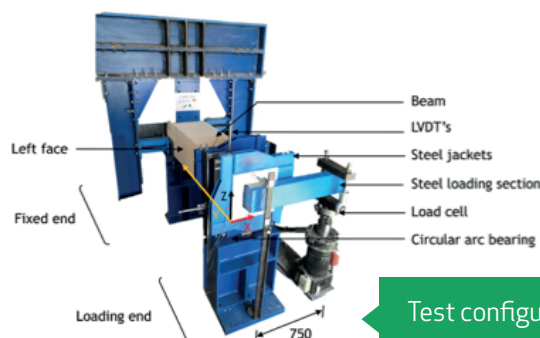
Author: Chandan Chinnagiri Gowda

Supervisors: Joaquim Barros; Maurizio Guadagnini

Date: 05/07/2019

Summary: The main objective of the current thesis was to develop different strengthening strategies for torsional deficient elements using near surface mounted (NSM) straight and L-shaped carbon fibre reinforced polymer (CFRP) laminates. The research includes extensive experimental programme followed by the development of an analytical model, complemented by numerical study. Non-linear finite element (FE) analyses were performed to finalise different strengthening configurations and prepare the experimental testing-rig. Experimental tests were then carried out on 12 beams in LEST laboratory. Based on the outcome, analytical model was developed in line with space truss analogy considering modified compression field theory (MCFT). All strengthening

configurations improved the torsional moment capacity (18-46%), ductility performance (20-76%) and arrest in crack growth (16-56%). The analytical model predicts the experimental results well with 7% error.



Test configuration

CV: **Chandan Gowda** is a Civil Engineering graduate from India, with a SAHC master's degree from University of Minho and UPC, Barcelona. Currently, he is working as a researcher at ISISE, University of Minho.



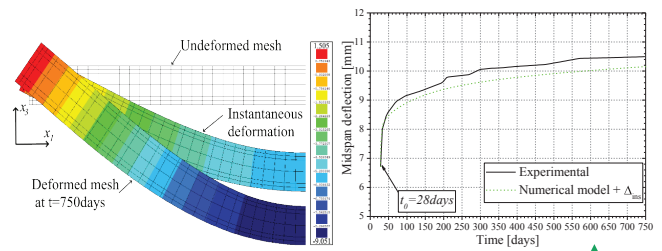
> **Advanced tools for design and analysis of fiber reinforced concrete structures**

Author: Tiago Daniel dos Santos Valente

Supervisors: Joaquim Barros; Lúcio Lourenço

Date: 05/07/2019

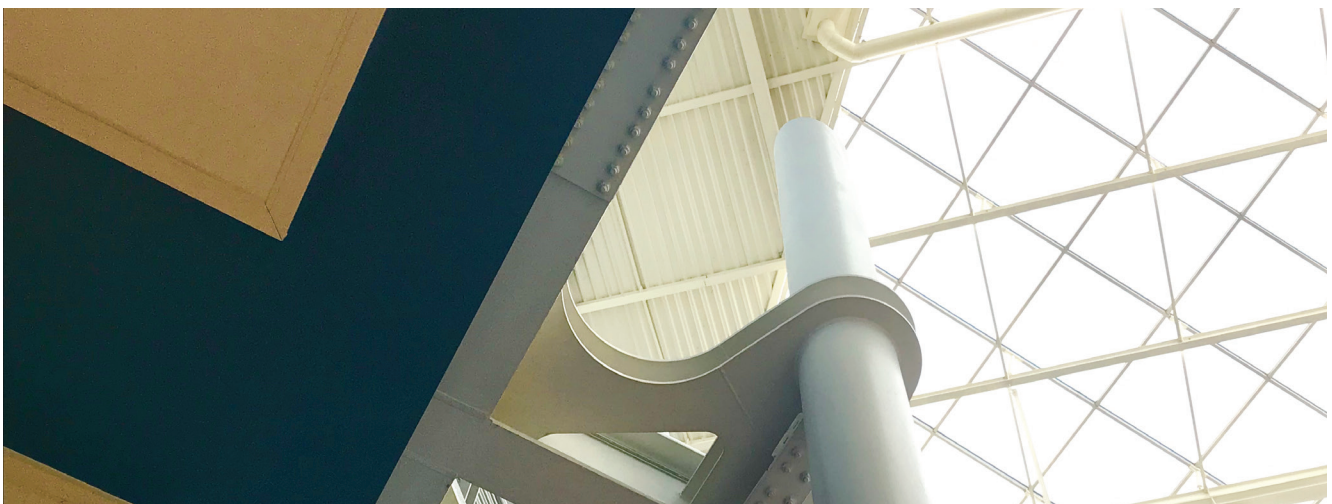
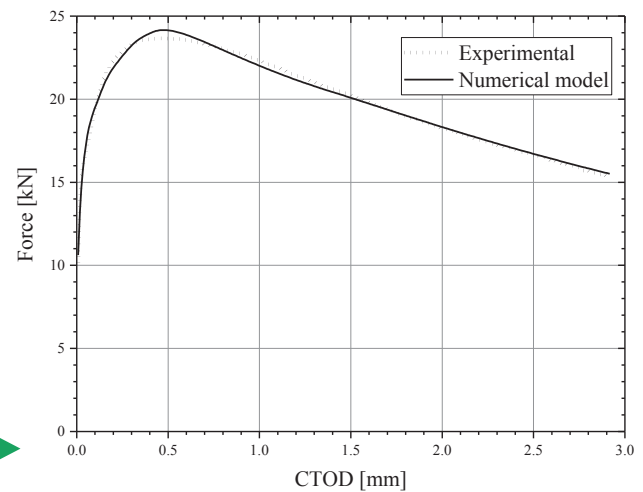
Summary: The work is devoted to the development of numerical tools for the analysis and design of fiber reinforced concrete (FRC) structural elements. It was developed an innovative numerical tool for the analysis of FRC structures that couples the effects of fiber orientation and segregation in the FRC members, and fiber pullout resistance. The predictive performance of the of shear resistance models for FRC members proposed in the fib Model Code 2010 (MC2010) was assessed, considering the results of shear tests collected in a database. The work also focused on the development of a model to predict, since early ages, the aging creep response of cement-based materials, and a constitutive model especially aimed to simulate the interface between FRC slabs supported on ground and the granular layers of the slab's foundation. In addition, it was developed a software to perform the ultimate and serviceability limit state safety verifications of FRC cross-sections according to MC2010 design guidelines.



Numerical simulation of concrete beam submitted to bending up to a period of 2 years.

CV: Tiago Valente obtained his Graduation (2007), MSc (2013) and PhD (2019) in Civil Engineering at the University of Minho. He has published 16 papers in scientific events and participated in several national and international conferences. He was also involved in the design of more than 100 civil engineer projects, in public and private construction works.

Comparison of force vs. CTOD relationship obtained experimentally and numerically considering the numerical tool that couples fiber orientation and segregation in the FRC members, and fiber pullout resistance.





> **Development of sustainable solutions for urban rehabilitation**

Author: Jocelyn Erandi Reyes Nieto

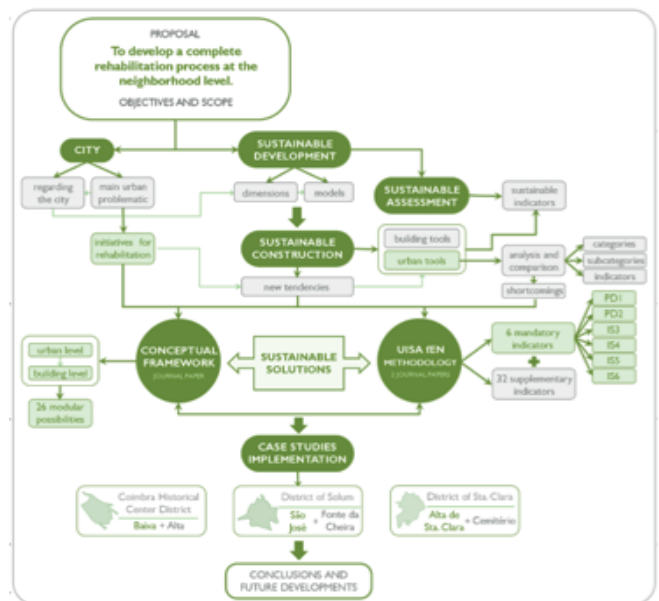
Supervisors: Luís Alberto Proença Simões da Silva, Vítor Manuel Baira da Murtinho and Maria Constança Simões Rigueiro

Date: 08/07/2019

Summary: This doctoral dissertation introduces a complete sustainable rehabilitation action plan that requalify and re-densify existing neighborhoods. The methodology used involved: the analysis of issues concerning the city and Sustainable Development, the development of two sustainable solutions for urban rehabilitation, and the implementation of them in six case studies. The sustainable solutions are:

- > A new urban sustainability assessment methodology (UISA FEN), which assists in the identification of current problems and constitutes a new circular approach that uses an evaluation process based on indexes.
- > A new urban-architectural model of decentralized management (CF), which comprises two levels of intervention: the urban level – involves restructuring the neighborhood by subdividing it in subsectors and the building level – consists in the construction of a multipurpose building within each subsector that provides an array of facilities and infrastructure that meet the needs of residents.

CV: **Jocelyn Erandi Reyes Nieto** is a research member of the ISISE and CONACYT institutions. In July 2019 she completed her PhD on Steel and Composite Construction at the University of Coimbra, obtaining the final grade of approved with praise and distinction. Author of 16 published works (distributed by scientific ISI journals and international conference papers) in the field of sustainable urbanism.



Research process flow chart

EVENTS

> **CMN 2019 - Congress on Numerical Methods in Engineering, Guimarães**

Venue: Guimarães

Date: July 1-3, 2019

Website: <http://www.cmn2019.pt>

Summary: The Congress on Numerical Methods in Engineering (CMN 2019) was held at University of Minho (Guimarães) on July 01-03 and had about 250 participants. CMN 2019 was jointly organized by the Portuguese (APMTAC) and the Spanish (SEMNI) Associations. The scientific program comprised plenary lectures from leading researchers and thematic sessions in different research fields computational mechanics.





> **International Workshop on preventive conservation of cultural heritage**

Venue: Avila, Spain

Date: July 11, 2019

Organization: University of Minho/ISISE

Summary: This Workshop was dedicated to present the HeritageCare approach, offering a live platform where theoretical aspects and practical applications were combined. The main topics of the workshop were: HeritageCare protocol for onsite inspection, advanced 3D recording strategies, cultural heritage virtualization, information integration and management, historical building information modelling.



> **Seminário SafEarth: A Proteção Sísmica do Património Construído em Terra**

Venue: Porto, FEUP

Date: September 18, 2019

Organization: University of Minho, FEUP, University of Aveiro, LNEC

Summary: The SafEarth project closing seminar presented the main findings of the project to the community through a session of nine communications followed by a debate. It counted with the participation of prof. Julio Vargas from Pontifical Catholic University of Peru, who is a well-known researcher on the seismic behaviour of adobe constructions and consultant of the project.



> **ISOC 2019 – International Sustainable Ocean Conference**

Venue: Figueira da Foz

Date: September 25-27, 2019

Website: <https://isoc2019.com/>

Organization: University of Coimbra/ISISE, MARE, CISUC

Summary: Climate change is the major challenge of our planet of the 21st century, with inherent negative impacts and risks, but also opportunities. In this first edition, ISOC 2019 conference hosted plenary sessions and workshops divided into three main topics: Marine Ecosystems, Sustainable Buildings Construction and Environmental Quality.





> **SHATIS International Conference on Structural Health Assessment of Timber Structures**

Venue: Guimarães

Date: September 25-27, 2019

Website: <http://shatis19.pt/>

Organization: University of Minho/ISISE

Summary: The SHATIS'19 was held at the University of Minho, Guimarães, on September 25-27, addressing both historic and new timber structures with topics from design, assessment, repair and strengthening. It counted with more than 110 contributions in 21 parallel sessions, with 5 Special Sessions, 5 Keynote lectures and was attended by more than 150 participants from 28 different countries.



> **3rd International Conference on Information Technology in Geo-Engineering**

Venue: Guimarães

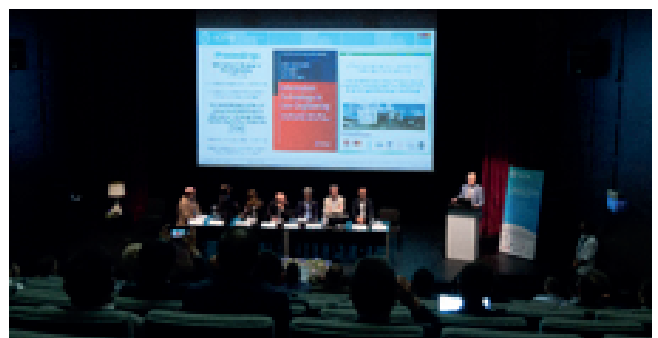
Date: September 29 – October 2, 2019

Website: <http://www.3rd-icigt2019.civil.uminho.pt/>

Organization: University of Minho/ISISE

Summary: The 3rd International Conference on Information Technologies in Geo-Engineering (3rd ICITG 2019) was held between 29 September and 2 October 2019, having been organized by the Geotechnical Portuguese Society (SPG) and the University of Minho and in the framework of the activities of the Joint Technical Committee 2 (JTC2) on representation of Geo-Engineering Data of the Federation of International Geo-Engineering Societies (FedIGS). The 3rd ICITG 2019 took place at the Vila Flor Cultural Centre, in Guimarães and included the inaugural lecture by Prof. Hehua Zhu, five keynote lectures and 21 technical sessions comprising 66 presentations. Together with the mini-symposium on Machine Learning in Geotechnics, a total of 162 participants have attended this international event. The conference Proceedings, available for purchasing at

the Springerlink: <https://link.springer.com/book/10.1007%2F978-3-030-32029-4>, contain 77 peer-reviewed papers. There is also available for free download an eBook with 20 Extended Abstract at: <http://doi.org/10.24849/spg.conf.2019.01> The organizers would also like to express their gratitude for the financial support offered by Keller and the Municipality of Guimarães, as well as to the co-sponsors (non-financial) TRB and DFI.





> **Seminário Engenharia e Conservação do Património Arquitectónico - Porto, Casa das Artes**

Venue: Porto, Casa das Artes

Date: October 4, 2019

Organization: University of Minho

Summary: The need to preserve the architectural heritage to perpetuate identity is a society demand, as we are also what we build.

Portugal has a unique heritage and, in recent decades, it has been possible to develop leading international research and to implement a highly qualified practice of intervention. The Seminar targeted at disseminate the most relevant ongoing research initiatives at UMinho.



UPCOMING EVENTS

> **XII Conference on Steel and Composite Construction**

Venue: Convento de São Francisco, Coimbra, Portugal

Date: November, 21-22, 2019

Website: www.cmm.pt/congresso12

> **IX Workshop on Connections in Steel Structures**

Venue: Coimbra, Portugal

Date: June 2-4, 2020

Website: <https://connectionsix.dec.uc.pt>

> **3rd RILEM Spring Convention 2020 – Ambitioning a sustainable future for built environment: comprehensive strategies for unprecedented challenges**

Venue: Palácio Vila Flor, Guimarães, Portugal

Date: March 10-14, 2020

Website: <https://www.rsc2020.civil.uminho.pt/>

> **Conference IPW 2020**

Venue: Guimarães, Portugal

Date: September 23-25, 2020

Website: www.ipw2020.com

> **ISCHP 2021 – International Scientific Conference on Hardwood Processing**

Venue: University of Coimbra

Date: Summer of 2021





MASTER COURSES

> **Erasmus Mundus Joint Master Degree: WAVES (Waves, Acoustics, Vibrations, Engineering and Sound)**

Venue: Dept. of Civil Engineering, University of Coimbra

Website: <https://master-waves.eu/>

Application dates:

> 2nd December 2019 until 16th February 2020

> **Advanced Masters in Structural Analysis of Monuments and Historical Constructions (SAHC)**

Venue: Dept. of Civil Engineering University of Minho

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

Application dates:

> 1st call: 20th January 2020

> **European Master in Building Information Modelling (BIM A+)**

Venue: Dept. of Civil Engineering University of Minho

Website: <https://bimaplus.org/>

Application dates:

> 1st call: 31st January 2020

> **Master Course on Acoustic and Energy Efficiency for a Sustainable Construction**

Venue: Department of Civil Engineering, University of Coimbra

Website: <https://apps.uc.pt/courses/en/course/6182>

Application dates:

> 1st call: 10th February until 31st March 2020

> **Master Course in Building Rehabilitation**

Venue: Dept. of Civil Engineering, University of Coimbra

Website: <https://apps.uc.pt/courses/EN/course/6201/2018-2019>

Application dates:

> 1st call: 10th February until 31st March 2020

Master in Structural Engineering (STREMUM)

Venue: Dept. of Civil Engineering University of Minho

Website: <http://www.stremum.uminho.pt/>

Application dates:

> 1st call: March 2020

PHD COURSES

> **Doctoral Program in Civil Engineering**

Venue: Dept. of Civil Engineering University of Minho

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

Application dates:

> 3rd call: 2nd January until 10th January 2020

> **Doctoral Program Steel and Composite Construction**

Venue: Dept. of Civil Engineering, University of Coimbra

Website: <https://apps.uc.pt/courses/EN/course/8181>

Application dates:

> 1st call: 10th February until 31st March 2020

> **Doctoral Program in Civil Engineering**

Venue: Dept. of Civil Engineering, University of Coimbra

Website: <https://apps.uc.pt/courses/EN/course/661>

Application dates:

> 1st call: 10th February until 31st March 2020

