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Science communication

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Career development

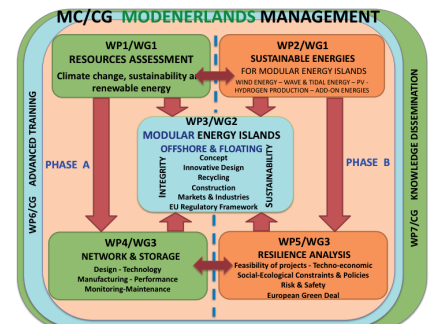
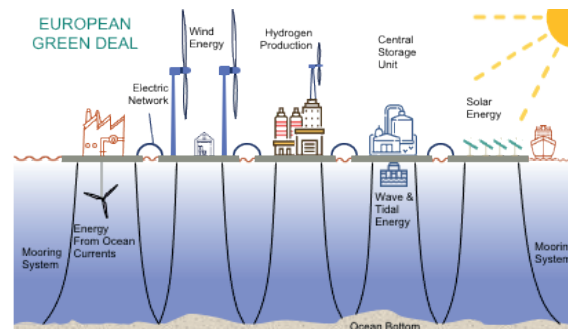
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ISISE HIGHLIGHTS

The MODENERLANDS COST Action aims to merge and systematise the efforts of the European Research and Development (R&D) groups working on Sustainable Energy and the related technologies, in particular wind and wave energy sources, by proposing pathways for incorporation and by promoting the relevant synergies in Research, Education and Training to enhance Sustainability in the built environment. MODENERLANDS revisits safe, smart, modular, cost-effective, and socially valuable high performance sustainable Energy Islands for consideration in the plans, design, and development of the future sustainable energy infrastructure. Looking forward to future development, MODENERLANDS will work with Modularised Construction of Offshore Floating Platforms aiming at easily extending their size and capacity according to future energy needs.



PhD Scholarships and research contracts

We are very happy to announce that a total number of 29 Phd scholarships (Portuguese Science Foundation) have been awarded to ISISE members, corresponding to 45% of all scholarships awarded in the scientific domain of Civil Engineering in Portugal.

It is also excellent news that ISISE received one further long term postdoctoral position from the Portuguese Science Foundation, as a result of a national-wide competition with a success rate of only 8%. The awardee distinguished researcher is Hélder David Craveiro. The above scholarships/contract, can represent more than 2 M€ direct funding to ISISE activities in the next years.

FCT Fundação
para a Ciência
e a Tecnologia

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



IMPACT STORIES

"The possibility of working and cooperating with colleagues and partners from different countries, backgrounds and cultures lead to a personal and professional growth from my side."

Rui Matos, Research Engineer,
ArcelorMittal Global R&D



> In which circumstances did you join ISISE?

My joining to ISISE group happened in January 2009 after the end of my integrated master in Structural Mechanics of the Civil Engineering course. The desire of pursuing a research oriented career and the development of a PhD study defined my next steps and direction. The opportunity raised within the group looked the most relevant and adequate. This aspects along with the opportunity of participating in a European research project with renown partners within the field of the renewable energies (HISTWIN project), appeared as a challenging and fruitful opportunity.

> How would you describe your experience in ISISE?

As expected, my experience in ISISE proved to be very international. The possibility of working and cooperating with colleagues and partners from different countries, backgrounds and cultures lead to a personal and professional growth from my side. The participation in the HISTWIN project, with all the European partners (references in their fields of expertise) and the possibility of cooperating with different international

colleagues within ISISE, highly enlarged my list of contacts as well as my scientific and technical growth. The contact with different cultures and realities proved to be an important asset to open my mind and to be more tolerant.

> What was the impact of your time in ISISE on your career? And friends?

The impact of the time spent on ISISE both on my personal life as well as in my career was undoubtedly significant. The possibility of working with different partners/references in their field of expertise, increased significantly my scientific knowledge and opened several doors for different cooperation. My current position as research engineer in ArcelorMittal is partly due to the long lasting cooperation between the company and ISISE. The scientific knowledge acquired during my time in the group allow me to tackle properly different problems raised in my current position. From a personal point of view, the high number of friendships raised in this period was significant and the certainty of keeping them during the rest of my life will surely indirectly link ISISE with my future.

R&D COMPLETED PROJECTS

> SROBE – Stronger steels in the built environment

ISISE Principal Investigator: *Luís Simões da Silva*

Budget: Global: 1519 693,00€ / ISISE-UC: 240 577,00€

ID: RFSR-CT-2016-743504

Funding Entity: RFGS – Research Fund for Coal and Steel

Principal Contractor: Steel Construction Institute, UK

Duration: 42 months

Summary: The case for the greater use of high strength steels (HSS) in structures is compelling. However, the uptake has been surprisingly slow; steels with a higher yield strength than 355 MPa make up less than 5% of the total tonnage of structural steels worldwide. The primary aim of the STROBE project was to grow the market for HSS in structures



by conducting research leading to the development of more cost-effective design rules for HSS and to clearly demonstrate the potential advantages of their appropriate use to designers.

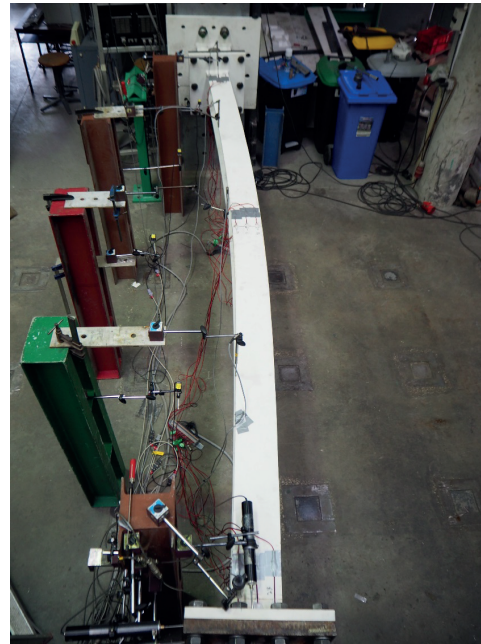
STROBE studied the performance of HSS structural members at both the ultimate and serviceability limit states for use in building-type structures. Homogenous and hybrid steel sections were studied, made from steels up to grade S700 ($f_y = 700$ MPa).

The principal objectives of the project were to develop:

- New ductility and toughness requirements, grounded on scientific principles, which do not unduly penalise HSS
- Rules for the plastic design of HSS and hybrid beams and frames
- Rules for ensuring the stability of HSS and hybrid members
- A floor vibration analysis tool to enable the dynamic performance of HSS floors to be assessed easily
- Comparative designs (HSS versus S355) which

quantify the weight, carbon and cost savings resulting from the application of the research in this project

- Proposed amendments to Eurocode 3 with comprehensive background information.



> PreSlabTec – Innovative constructive system for lightweight pre-fabricated slab

ISISE Principal Investigator: Maria Isabel Valente

Budget: Global: 502950,51€/ISISE-UM: 136395,08€

ID: NORTE-01-0247-FEDER-033690

Funding Entity: NORTE2020/ANI

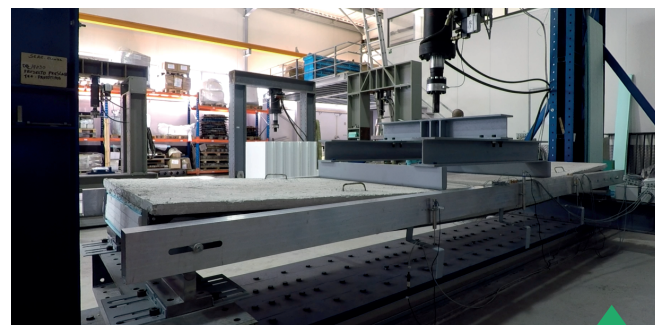
Principal Contractor: Civitest

Duration: From 01/10/2018 to 31/03/2021

Summary: The PreSlabTec project was developed by a consortium that integrated Civitest – Research of New Materials for Civil Engineering, Ltd., Serralharia Cunha, Lda. and the University of Minho, which teamed up to develop an innovative constructive system of fully pre-fabricated lightweight slab (see Figure 1). The project was supported by ANI and co-financed by the FEDER, through the NORTE 2020 program.

The main objective of the PreSlabTec project was to develop an innovative type of slab, which effectively mobilizes the potential and properties of its constituents, namely fiber reinforced concrete, honeycomb steel profiles, and lightweight materials, as well as thermal, acoustic and insulation materials. These materials are applied according to

a new industrialized construction process, ensuring durability, lightness, geometric flexibility and structural and functional behavior superior to any other existing prefabricated solution (see Figure 2). The solution has a level of total prefabrication, which allows for easier and faster construction of floors in any type of building, including rehabilitation interventions. As part of the project, prototypes were tested on a full scale and a pilot installation was built (Figure 3).



Evaluation of the structural behaviour of PreSlabTec slabs



R&D STARTED PROJECTS

> Aeros Constellation

ISISE Principal Investigator: Eduardo Pereira
Budget: Global: 278 6748,78€ / ISISE-UM: 94 579,02€
ID: POCI-01-0247-FEDER-045911
Funding Entity: ANI
Principal Contractor: Edisoft – Empresa de Serviços e Desenvolvimento de Software, S.A.
Duration: From 30/06/2020 to 30/06/2023

> K2D – Knowledge and Data from the Deep to Space

ISISE Principal Investigator: Eduardo Nuno Borges Pereira
Budget: Global: 1 417 332,88€ / ISISE-UM: 769 685,90€
ID: POCI-01-0247-FEDER-045941
Funding Entity: ANI
Principal Contractor: DSTELECOM, S.A
Duration: From 01/07/2020 to 01/07/2023

> ASTRIS – Atlantic Sustainability Through Remote and Integrated In-situ Solutions

ISISE Principal Investigator: Eduardo Pereira
Budget: Global: 6 050 633,88€ / ISISE-UM: 357 499,57€
ID: POCI-01-0247-FEDER-046092
Funding Entity: ANI
Principal Contractor: Tekever Space – Sistemas Espaciais, Lda
Duration: From 01/07/2020 to 30/06/2023

> GOA Bridge Management System – Bridge Intelligence

ISISE Principal Investigator: José Matos
Budget: Global: 114 447,73€ / ISISE-UM: 297 646,89€
ID: POCI-01-0247-FEDER-069642
Funding Entity: ANI
Principal Contractor: Betar – Consultores, Lda
Duration: From 01/01/2021 to 30/06/2023

> IN2TRACK3 – Research into optimized and future railway infrastructure

ISISE Principal Investigator: António Correia, Joaquim Barros and José Matos
Budget: Global: 12 929 511,2€ / ISISE-UM: 237 105,99€
ID: IN2TRACK3 — 101012456
Funding Entity: European Commission (H2020-S2RJU-CFM-2020)
Principal Contractor: Trafikverket
Duration: From 01/01/2021 to 31/12/2023

> Multi-risk Interactions Towards Resilient and Sustainable Cities

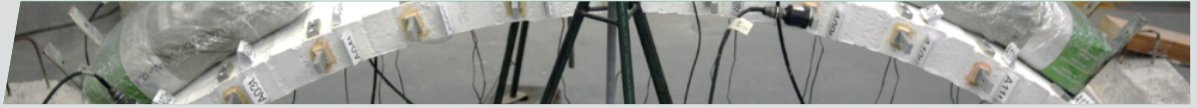
ISISE Principal Investigator: Tiago Ferreira
Budget: Global: 47 825,08€ / ISISE-UM: 34 060,45€
ID: MIT-EXPL/CS/0018/2019
Funding Entity: FCT
Principal Contractor: University of Minho
Duration: From 15/03/2021 to 14/03/2022

> NanoAir – Nanomaterials Applied on Innovative Road Pavements for Air-Cleaning

ISISE Principal Investigator: Elisabete Freitas
Budget: 253 418,49 €
ID: PTDC/FIS-MAC/6606/2020
Funding Entity: FCT
Principal Contractor: University of Minho
Duration: From 29/03/2021 to 28/03/2024

> HybridNET – Hybrid Simulation Integrated Facility for Real-Time, Multi-Hazard and Geographically-Distributed Testing

ISISE Principal Investigator: Nuno Adriano Leite Mendes
Budget: Global: 249 969,19€ / ISISE-UM: 61 986,47€
ID: HybridNET - PTDC/ECI-EST/6534/2020
Funding Entity: FCT
Principal Contractor: LNEC
Duration: From 29/03/2021 to 28/03/2024



› **DURABLE-FRP – Durabilidade de Estruturas de Engenharia Civil em Compósitos FRP**

ISISE Principal Investigator: José Sena Cruz

Budget: Global: 249 935,00€ / ISISE-UM: 74 268,75€

ID: PTDC/ECI-EGC/4609/2020

Funding Entity: FCT

Principal Contractor: Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)

Duration: From 29/03/2021 to 28/03/2024

Partners: IST-ID, UM, LNEC

› **FemWebAI – Integrated approach for reliable and advanced analysis and design of sustainable constructions systems in fibre reinforced concrete**

ISISE Principal Investigator: Joaquim Barros

Budget: Global: 249 979,58€ / ISISE-UM: 249 979,58€

ID: PTDC/ECI-EST/6300/2020

Funding Entity: FCT

Principal Contractor: University of Minho

Duration: From 29/03/2021 to 28/03/2024

› **ZeroSkin+ – Development of a 3D printed modular panel for holistic renovation of residential buildings, based on recycled plastic and natural materials**

ISISE Principal Investigator: Manuela Almeida

Budget: Global: 587 261,12€ / ISISE-UM: 587 261,12€

ID: NORTE-01-0145-FEDER-000058

Funding Entity: CCDR-N

Principal Contractor: University of Minho

Duration: From 01/07/2021 to 30/06/2023

› **DREAMERS – Design REsearch, implementation And Monitoring of Emerging technologies for a new generation of Resilient Steel buildings**

ISISE Principal Investigator: Luís Simões da Silva

Budget: Global: 1 893 510,00€ / ISISE-UC: 113 190,00€

ID: RFCS-PDP - 101034015

Funding Entity: Research Fund for Coal and Steel

Principal Contractor: University of Salerno, Italy

Duration: From 01/07/2021 to 31/12/2024

› **InCSEB – Innovative ultra-low Carbon building Steel Envelop systems with Bio-based insulation**

ISISE Principal Investigator: Helena Gervásio

Budget: Global 2 493 437,00€ / ISISE-UC: 386 850,00€

ID: RFCS-RPJ- 101033984

Funding Entity: RFCS – Research Fund for Coal and Steel

Principal Contractor: L'ENVELOPPE METALLIQUE DU BATIMENT, France

Duration: From 01/07/2021 to 30/06/2025

› **MODENERLANDS – Modular Energy Islands for Sustainability and Resilience**

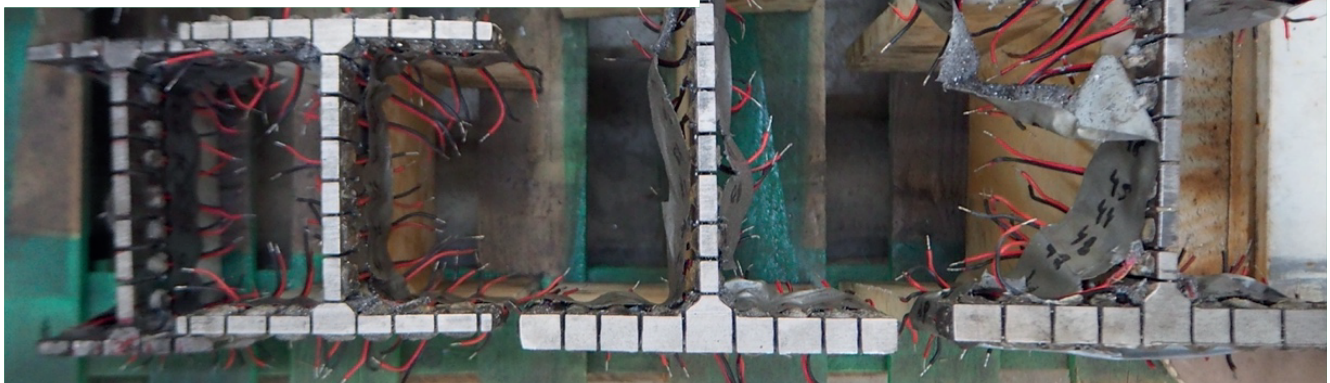
ISISE Principal Investigator: Carlos Rebelo

Budget: n/d

ID: COST Action CA20109

Funding Entity: COST Association

Principal Contractor: ISISE-UC





COMPLETED PHD THESES

> Numerical simulation of elastic wave propagation in discontinuous media – applications in ultrasonic and vibration control

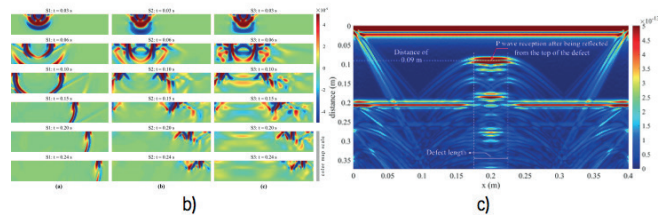
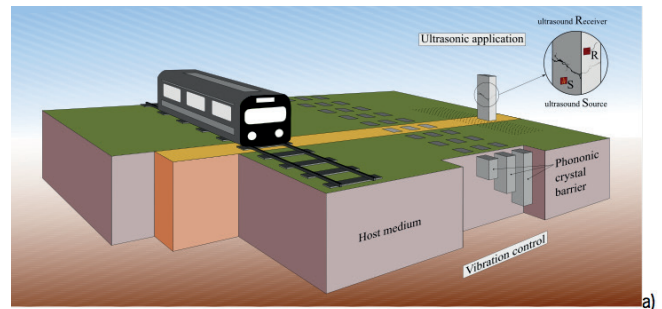
Author: Carlos Alberto Pessoa Albino

Supervisors: Luís Godinho and Daniel Dias da Costa

Date: 13/05/2021

Summary: This thesis addresses the propagation of waves in solid media, with application to transportation induced vibration control and to non-destructive testing using ultrasonic waves. For the first, an advanced strategy is presented, using simple individual elements in crystalline geometric arrangements, properly positioned between the source and the receiver, in order to mitigate the effect of these vibrations. For the case of NDT, the area of damage detection in concrete structures is addressed, trying to simulate the propagation of ultrasonic waves in concrete with cracks or inclusions. Two numerical simulation tools were developed, the first one using the method of fundamental solutions, and the other using a time domain finite element simulation.

The strategy used for vibration mitigation allowed to conclude that the phononic crystals have a significant effect on vibration levels reduction. Regarding damage detection, the results are promising and confirm the feasibility of the use of ultrasonic equipment based on primary and secondary waves for in situ applications.



Illustrative image of the wave propagation scenarios (a), and numerical results concerning wave propagation in a soil (a) and in a concrete specimen (c).

CV: **Carlos Albino** completed his Integrated Master's degree in 2012 and presented his doctoral thesis on Steel and Composite Construction in May 2021, both at the Dept. Civil Engineering of the University of Coimbra. He has 4 publications in international journals and 9 publications in conference proceedings. Since 2012, he has been involved in 8 projects, both at UC and at IST.

> Risk-based railway infrastructure management systems

Author: João Nuno Duarte Fernandes

Supervisors: José C. Matos; Daniel V. Oliveira; A. Abel Henriques

Date: 20/05/2021

Summary: The main goal of this research is to contribute to an evolution of the current practice of infrastructure monitoring in Portugal by proposing a management methodology based on the risk and on the resilience. Main Conclusions:

- The time-dependent risk analysis is an important metric to analyze along with the qualitative

structural indicators since the condition state provides a very general understanding about the condition of the bridge;

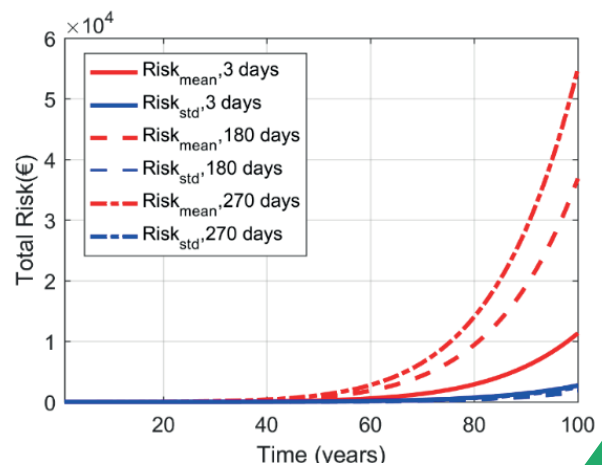
- The risk metric is very important to have always present on the assessment of the bridge since it can give very interesting insights into the decision-making process when compared to other structural indicators;
- The risk and resilience-based management system revealed to be a promising tool in the bridge assessment since it provides a very complete



analysis of the risk levels of hazard events as well as the post-recovery.

Moreover, the risk-based benefit metric proposed in this thesis revealed to be very useful to evaluate the benefit obtained when considering the introduction of a mitigation action.

CV: Master's in civil engineering, field of structures, graduated in the University of Porto in 2014. PhD in civil engineering, field of asset management, graduated in the University of Minho in 2021. His interests cover structural analysis modelling, asset management, data analysis, prediction modelling, data science, machine and deep learning, decision-making process, risk analysis, optimization.



Time – dependent Risk degradation as a function of time recovery for 3,180 and 270 days

› Bio-inspired algorithms for Structural Health Monitoring of Civil Engineering Systems'

Author: Alberto Barontini

Supervisors: José Luís Ferreira da Silva Ramos; Paulo Jorge Rodrigues Amado Mendes; Maria Giovanna Masciotta

Date: 04/06/2021

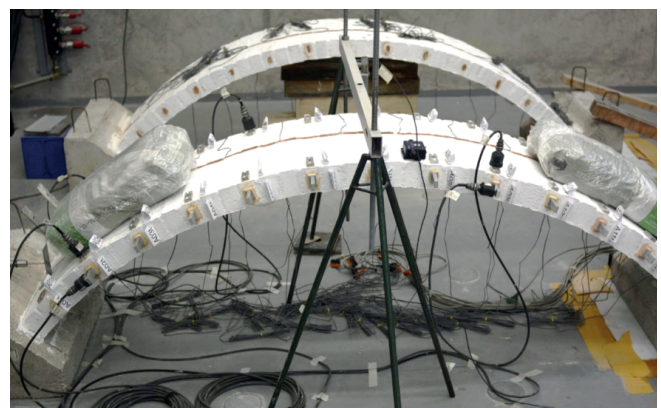
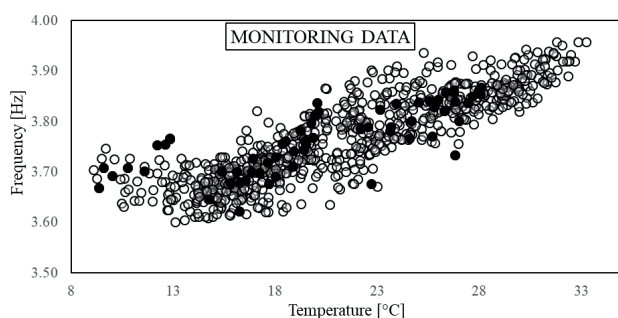
Summary: Nowadays, the management of complex existing structures and infrastructures, either close or beyond the end of their service life, is a relevant challenge which requires effective and robust automated strategies based on data acquisition and processing.

In this thesis a data-driven damage detection methodology based on an innovative version of Negative Selection Algorithm is developed.

The methodology is composed of several numerical features validated on both numerical and field-testing instances, considering multiple damage scenarios and varying environmental and

operational conditions. These features require a careful algorithm parameter setting, thus, suitable setting designs and recommended values or ranges are presented. The proposed methodology is deemed effective for early-stage damage detection, adaptable to different structures and damage-sensitive features, and robust against sources of uncertainties. The promising results foster more research and further applications.

CV: **Alberto Barontini**, graduated in Civil Engineering from the University of Florence, holds a PhD for a project developed at the University of Minho in collaboration with the University of Coimbra. He performed short term scientific missions at the Technical University of Madrid and the ETH of Zurich. He is currently working on Structural Health Monitoring related topics at the University of Minho.





➤ **A multi scale approach to the study of lime-cement mortars in masonry**

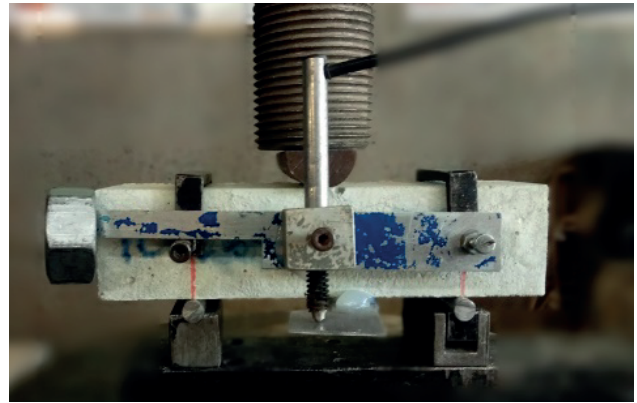
Author: Meera Ramesh

Supervisors: Miguel Azenha, Paulo B. Lourenço

Date: 14/06/2021

Summary: This doctoral research was funded by the European Lime Association and supported by FCT. It was aimed at investigating the quantitative benefits of substituting cement with lime in masonry mortars. Performance indicators were determined from a structured experimental campaign of lime-cement mortars, characterizing mechanical properties for different mixes: workability, mechanical strength, stiffness, drying shrinkage, and open porosity, among others, with selected tests performed up to 365 days. At the masonry level, the behavior of lime-cement mixes was compared with a reference cement mortar. Mechanical properties of masonry that were tested, included compressive strength, E-modulus, flexural strength (parallel & perpendicular), shear bond strength, and response to in-plane shear cyclic loads. It was found that a lime-cement mix, compared to a cement mix, with similar strength at the mortar level,

does not lead to a significant difference in mechanical behavior at the masonry level.



CV: Meera Ramesh works as a Restoration Engineer with Ryan Biggs Clark Davis, New York. She is a member of the RILEM TC – 277 LHS for lime-based repair mortars, and has recently joined the ASTM committee C12 on mortars and grouts, and the academics and research committee at APTI. She has co-authored over 10 articles in the field of mortars and masonry, for international journals and conferences.

➤ **Assessment of the Long Term Dynamic Behaviour of Innovative Railway Track Solutions**

Author: Ana Luísa Gonçalves Ramos

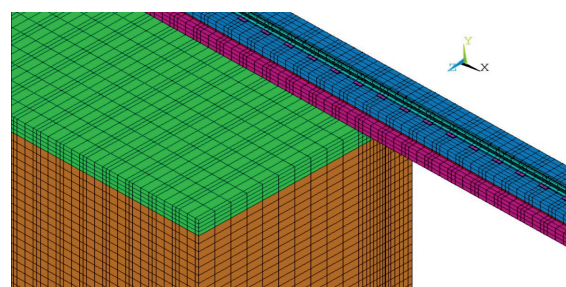
Supervisors: António Gomes Correia (UMinho/ISISE); Rui Calçada (FEUP)

Date: 19/07/2021

Summary: The investigation presented in this work aims at providing insight into the understanding of the short and long term dynamic behaviour of the ballasted and ballastless tracks introducing new concepts and methodologies. The behaviour of these railway structures was evaluated through the stress amplification and permanent deformation amplification factors using the numerical approach 2.5D FEM-PML. Furthermore, laboratory-scale experimental tests were performed to analyse the performance of the railway structures when submitted to more than 3 million load cycles. Considering these experimental results, a new methodology was introduced to analyse the short and long-term performances through the calibration of the materials' properties based on the 3D models and the materials constants of an empirical

permanent deformation model. This numerical tool was, posteriorly, implemented in the long-term modeling of a transition zone (embankment-tunnel in a ballastless track system).

CV: Ana Ramos completed the MSc (2013) at the Faculty of Engineering of the University of Porto and concluded the PhD degree in 2021 at the University of Minho. She developed new methods to study the short and long-term performance of railway tracks, including the transition zones. Currently, she is collaborating on an ongoing European research project: Shift2Rail – In2track3.





› **Cylindrically Curved Steel Panels in Bridge Design**

Author: Filip Ljubinković

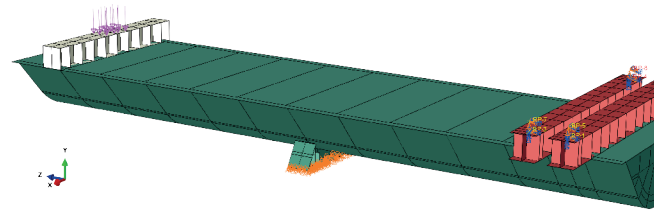
Supervisors: João Pedro Martins, Helena Gervásio

Date: 28/07/2021

Summary: The goal of the PhD was to develop mechanically consistent design rules for curved panels subjected to the most fundamental loading cases and for the box-girder bridge cross-section integrating a curved steel panel in the bottom flange. The work is divided into five main tasks, where experimental, numerical, and analytical methods were implemented. The findings in the thesis reveal the advantages of curved panels, allowing for considerable savings. Moreover, based on the assessment of the currently available design methods for stiffened curved panels under compression, the one developed in the scope of the Outburst project was found to be the most appropriate. This work explores the buckling and post-buckling behaviour of individual curved panels under to shear.

New expressions for critical and ultimate shear load of unstiffened curved panels were developed.

Finally, new shear resistance models were developed for box-girder bridge cross-sections integrating curved panels in the bottom flange.



CV: Filip Ljubinković, PhD in Steel and Composite Structures at the University of Coimbra, with the title Cylindrically curved steel panel in bridge design. Author of 6 peer-reviewed scientific articles and 2 more as the co-author. Participant in two completed research projects – ULTIMATEPANEL and OUTBURST, and an on-going Swith2Steel. Lecturer in the Master course in 2019-20.

AWARDS & PRIZES

› **Award to:** Erica Llovana Arango Patiño

Event: 18th International Probabilistic Workshop

Date: May 12-14, 2021



EVENTS

› **CRC2021, International RILEM Conference on early age and long-term crack width analysis in RC structures**

Venue: Hybrid: Online and ENS Paris Saclay, France

Date: 9 April 2021

Website: <https://crc2021.org/>

Summary: The conference aimed to bring together experts to share the state-of-the-art developments on the scope of cracking within RILEM TC 287 CCS. The conference consisted of lectures by researchers and other professionals from a variety of scientific disciplines, with most of the 210 attendants being online. CRC2021 was co-chaired by Miguel Azenha (ISISE member), Fragkoulis Kanavaris (ARUP) and Farid Benboudjema (ENS Paris Saclay).





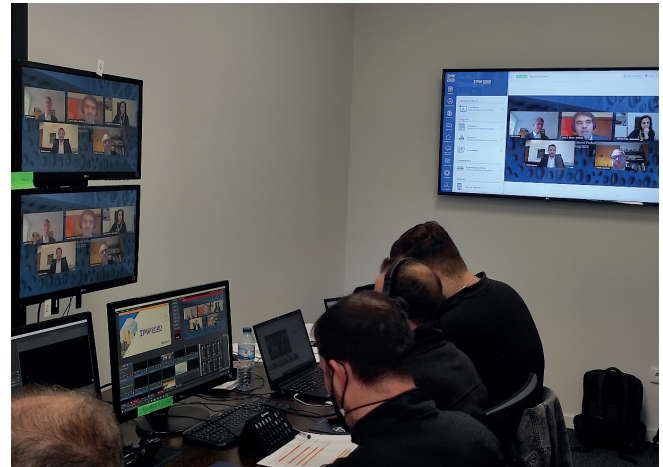
› **IPW2020 – 18th International Probabilistic Workshop**

Venue: Online, University of Minho, Guimarães

Date: 12-14 May 2021

Website: <https://ipw2020.com/>

Summary: The 18th International Probabilistic Workshop (IPW2020) took place online streamed from the University of Minho. This workshop aimed at providing an international forum for the debate on resilience, robustness and redundancy of infrastructure systems, risk assessment and management, climate change and loading uncertainties, as well as novel probabilistic based decision-making frameworks.



› **ECCS-AISC IX Connections Workshop**

Venue: Online

Date: 22/07/2021

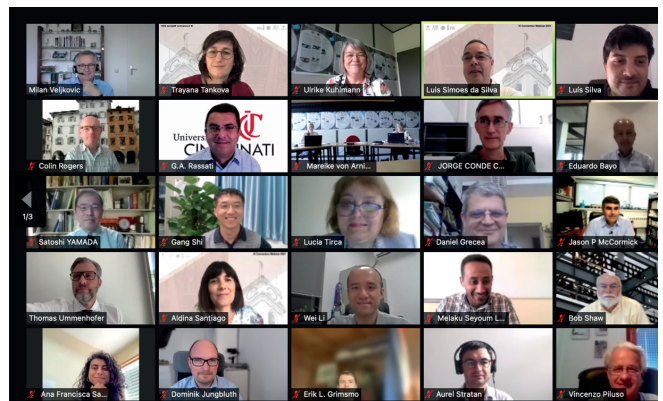
Website: <https://connectionsix.dec.uc.pt>

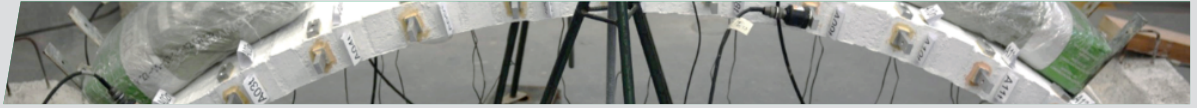
Summary: On July 22, 2021, the University of Coimbra at Portugal and the Czech Technical University in Praha at Czech Republic organised one of the most important events dedicated to structural Connections in Steel Structures: Webinar

Connections IX. More than 70 participants all around the world taken part in this online event.

This event was co-sponsored by the European Convention for Constructional Steelwork (ECCS) and the American Institute of Steel Construction (AISC).

The next event will be in the city of Coimbra on June 06-08, 2022 (<https://connectionsix.dec.uc.pt>).





UPCOMING EVENTS

> 4th Portuguese Congress of Building Information Modelling

Venue: Braga, Portugal

Date: from May 4 to 6, 2022

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

> IX ECCS-AISC Workshop on Connections in Steel Structures

Venue: Coimbra, Portugal

Date: 6-8 June 2022

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

> ISIC International Conference – Trends on Construction in the Post-Digital Era

Venue: Guimarães, Portugal

Date: from September 6 to 9, 2022

Website: <https://icisic2022.com/>

> Synercrete'23 – The International RILEM Conference on Synergising expertise towards sustainability and robustness of cement based materials and concrete structures

Venue: Milos, Greece,

Date: June 15-16, 2023

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

> IPW2024 – International Probabilistic Workshop

Venue: Guimarães, Portugal

Date: from May 8 to 10, 2024

> fib ICCS2024 – fib International Conference on Concrete Sustainability

Venue: Guimarães, Portugal

Date: from September 11 to 13, 2024

COURSES

> Doctoral Program Steel and Composite Construction

Venue: Department of Civil Engineering, University of Coimbra

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

Application dates:

> 3rd phase: 18 October 2021 – 19 October 2021

> Doctoral Program in Civil Engineering

Venue: Department of Civil Engineering, University of Minho

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

Application dates:

> 3rd phase: 21 September 2021 – 27 September 2021

> iDiSBE – International Doctorate in Sustainable Built Environment

Venue: Department of Civil Engineering, University of Minho

Website: <https://civil.uminho.pt/idisbe/>

Application dates:

> 3rd phase: 21 September 2021 – 27 September 2021

