ISISE NEWS LETTER
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ISISE HIGHLIGHTS

> RRP projects (Recovery and Resilience Plan)

We are very happy to announce that funding of 14M € has been awarded to ISISE through the RRP projects (Recovery and Resilience Plan) NEXUS, R2U TECHNOLOGIES, NGS.

PRR Plano de Recuperação e Resiliência

› NEXUS – Transição Verde e Digital para Transportes, Logística e Mobilidade

The NExus Agenda will create an ecosystem of 28 products and services for the Green and Digital Transition of the transportation and multimodal sectors. In the center of this ecosystem, is the NEXUS OPEN DATA COLLABORATION PLATFORM, that incorporates a set of apps and services (NEXUS FEDERATED APPLICATIONS AND SERVICES), and the component NEXUS HARWARE ASSETS of innovative hardware products which explore the principles of IoT and promote important synergies between the open data platform and the remaining apps and services. Each of them will have its digital representation (digital twin), aiming at sharing and receiving data with the purpose of improving the performance of the operations. The consortium is composed of 39 partners including ISISE UC. The project got total funding of 59.1M € (ISISE UC - 6.2 M €).

› R2U TECHNOLOGIES | Modular system

The Innovation pack "R2U Technologies | modular system" results from the merger of the Expressions of Interest "R2U Technologies" and "Glass Net" and has as its strategic objective a profound change in the modular construction sector. It aims to empower the industry, the academy and the HR with the means, knowledge and key competencies to create a National cluster for modular construction, thus envisioning the launch of 18 PPS with a tradable and internationalised profile at the end of the project. The consortium is composed of 30 companies and 18 ENESII, including both ISISE institutions (UC/UM). The project got total funding of 215M € (ISISE UC - 3.3 Million €, ISISE-UM: 3.8 Million €).

› NGS – New Generation Storage

The New Generation Storage (NGS) Innovation Pact is fully aligned with the European Union's energy transition strategy by 2040, and the challenge for complete electrification of mobility by 2035. Aims at creating a new tech ecosystem in the field of batteries that will make the National industry to stand out from the national market. The intention is to structurally transform the national productive fabric, creating the necessary conditions - in terms of technology and human resources - for an industrial ecosystem capable of mass production of innovative technologies, and a complete value chain that allows end-to-end management world-class benchmark. The consortium counts 54 entities (30 companies and 24 ENESII), including ISISE UM. The project got total funding of 111M € (ISISE-UM: 3.0 Million €).

› New Space Portugal

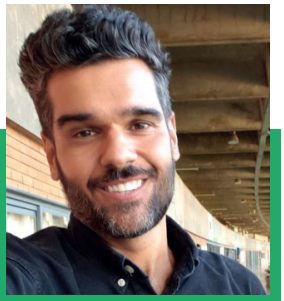
The Agenda aims to transform the Portuguese Space sector, with innovative, exportable products and services of greater technological complexity. The Agenda is based on 5 projects led by companies, which intend to promote R&D+I activity and industrial development in space and earth observation systems. In addition, 6 transversal projects dedicated to management, promotion, qualification, training and service demonstration initiatives will also be developed. Recently, Spain saw the approval of its strategic plan for Aerospace Economic Recovery and Transformation, which mentions the Iberian Alliance through the Atlantic Constellation. It is thus evident the alignment between Portugal and Spain to take concerted actions in the exploration of Space, contributing to European sovereignty in this matter. The consortium includes 40 co-promoters - 22 companies (13 SMEs and 9 non-SMEs) and 18 ENESII, including ISISE UM. The project got total funding of 137M € (ISISE-UM: 349,6 m €).

› World's Top 2% Scientists 2022

Five ISISE Researchers are listed in the World's Top 2% Scientists 2022, by the University of Stanford (USA) and the Elsevier publishing group, 2022.

Link: https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/5

IMPACT STORIES



"... I found in ISISE a very favourable environment to do my PhD and for my development. It was very good to have found such an internationalized research group... "

Rodrigo de Melo Lameiras,
University of Brasilia – UnB, Brazil

› In which circumstances did you join ISISE?

Since I started as a researcher, in scientific initiation projects still during my bachelor's degree in civil engineering at the Federal University of Alagoas - UFAL, in Maceió, northeastern Brazil, I dreamed of pursuing an academic career. Soon after graduating I went to the Federal University of Rio Grande do Sul - UFRGS to do a master's degree in Civil Engineering. After my master's I decided to try other experiences and work outside the academic area. After three years working in Rio Grande do Sul, in the extreme south of Brazil, and also in Pará, in

the Amazon region, north of Brazil, I became aware that I wanted to pursue scientific research and academia. As I had conducted research on fiber-reinforced cementitious materials during my master's degree, and had a special interest in the topic, I wanted to continue my research in this line of research. While searching for research groups that were publishing on the subject in the main journals of the area, I came across the works of the Structural Concrete Research Group. I contacted Prof. Joaquim Barros on June 29, 2009, by email, to demonstrate my interest in doing a PhD at the University of Minho. By coincidence, Prof. Barros had just approved three large research projects, among them was the LEGOUSE project, to which he suggested I apply for one of the project's PhD scholarships. At Prof. Barros' request, I also prepared an application for the FCT PhD grants, which we submitted at the end of August 2009. At the beginning of October, I was already in Guimarães, at the University of Minho. On October 9 of 2009, I met a professor newly arrived at UM, who would become my co-supervisor, Prof. Miguel Azenha. At the end of October 2009, I received the news that my application to FCT had been approved and I became an FCT grant holder starting in January 2010, but I continued linked to the theme of the LEGOUSE project.

› How would you describe your experience in ISISE?

Very enriching, from a personal and professional point of view. I found in ISISE a very favourable environment to do my PhD and for my development. It was very good to have found such an internationalized research group, with so many colleagues of different nationalities and bringing different experiences to enrich the group. I shared my lunches and exchanged ideas about our daily research problems with Iranian, Colombian, Mexican, Indian, Italian, Turkish, Brazilian and Portuguese colleagues. This daily conviviality with people from different countries would not be possible if I had not left Brazil. In ISISE I found this environment so rich for my formation. I believe that this environment also helped me to overcome one of my greatest limitations, which was the fear of speaking English in public. Factors such as being in a medium-sized city, like Guimarães, with a relatively low cost of living, having a support infrastructure that works adequately, i.e.; quality and accessible university restaurant and gymnasium within the campus, finding a well-managed group, with qualified and engaged support staff, are also factors that I believe have also contributed to my experience at ISISE having been so fruitful.

It was also great to have found such active faculty members, who participate in the most current discussions in their fields, such as in technical committees of RILEM, fib, ACI, etc. I also found the laboratory infrastructure and technical support that I needed to perform the tests. At ISISE I was challenged to overcome my limitations and be more productive. I accepted to participate in specialized technical services that required a lot of dedication but were very enriching. I found an environment that rekindled my dream of pursuing an academic career.

› Is there any anecdotal situation that you experienced in ISISIE, that is worthy of sharing?

There are countless curious memories from my time at ISISE. I will relate here one that was a welcome one and that I always tell to the friends I made at ISISE when we meet again.

Before I arrived in Guimarães, Prof. Barros put me in contact with the only Brazilian working with him at Structural Concrete at the time: the doctoral student Gláucia Dalfré. As always, Gláucia was very helpful and was available to pick me up at the train station as soon as I arrived in town. She picked me up in her old green twingo, affectionately nicknamed "frog". When we were passing the traffic circle at the República do Brasil square, in the central part and postcard of Guimarães, the "frog" breaks down and I had to push it for some meters. It was a beautiful reception. Perhaps this event made Gláucia become my great friend in Guimarães, and after a few trips to the mechanic, the "frog" served us well on the weekend outings throughout my doctorate.

I could also relate here the weekend trip to Madrid organized by the staff of the structural lab, where we stayed in a very bizarre hostel in a non-touristy and peripheral area of the city and ended with everyone running so as not to miss the flight at Barajas airport. It was also during the time of ISISE that I attended, along with other colleagues, the best

congress I have attended to date, the CICE 2012 in Rome. After the congress, me and the doctoral students Gláucia Dalfré, Pedro Fernandes and Bahman Ghiassi, who decided to join us at the last minute, had an unforgettable escapade through Venice.

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

Life changing. Before joining ISISE I had written a dozen or so conference papers, but I had never written papers in English, nor made a presentation at an international conference. At ISISE, I was encouraged and trained to do high level academic work, to attend several international events, to write many articles for journals, to participate in a RILEM technical committee, and to start making reviewes of articles for scientific events and journals. After the 4 years of my PhD, I published 4 articles in high impact journals in the field. And my experience in ISISE gave me until today 8 articles in journals with data from the time of my doctorate. This production, added to the fact that I had the experience in a research group that is already recognized in Brazil as a group of international excellence and worked with professors who are known and respected in their fields, opened the doors to reach the position in which I currently work. Between 2014 and 2017 I was a professor at the Federal University of Latin American Integration - UNILA, located in Foz do Iguaçu, southern Brazil. This is a young university with strong ties to the infrastructure sector, as it is located within the area of operation of the Itaipu Hydroelectric Power Plant, the second largest hydroelectric power plant in the world. There I helped implement the Master's in Civil Engineering and advised two master's students. Since 2017 I am a professor at the University of Brasilia – UnB, appointed by The Higher Education – THE as the 11th best Brazilian university and the 15th best university in Latin America. UnB is inserted in one of the world's great engineering projects, which is the planned city of Brasília, and the campus in which I work is an open-air museum, with several works signed by renowned Brazilian modernist architects, such as Oscar Niemeyer and João Filgueiras Lima (Lelé), recognized worldwide for exploring very well the plasticity of reinforced and prestressed concrete structures. In 2018 I became a lecturer at the Postgraduate Program in Structures and Civil Construction - PECC, also at UnB, where I have already oriented 6 master's students and currently orient 8 doctoral students and another 6 master's students. Until today I make a point of maintaining partnerships with ISISE's researchers. Currently, I supervise, in a co-tutorship regime, two doctoral students who are at the University of Minho and two other doctoral students who have ISISE's co-supervisors.

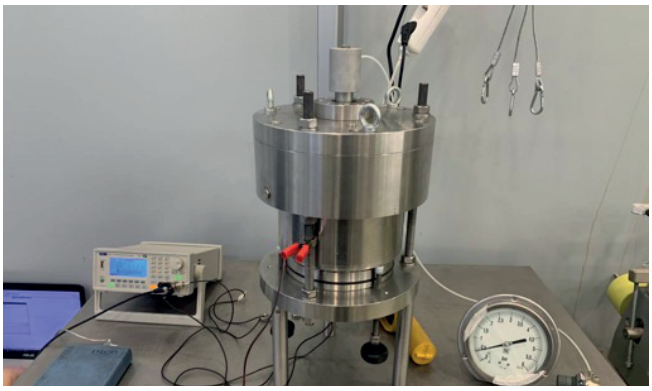
I am very fortunate to have been able to work and become friends with my supervisor Prof. Barros, my co-supervisor Prof. Azenha, and my "second co-supervisor" Prof. Isabel Valente. I keep the contact with many of my colleagues from the ISISE days until today, including constant partnerships with my great friend Gláucia Dalfré, currently a professor at the Federal University of São Carlos - UFSCar, located in southeastern Brazil.

R&D COMPLETED PROJECTS

> CEN-DynaGeo – Coupled Experimental and Numerical Approaches Toward Reliable Dynamic Characterization of Multi-phase Geomaterials

ISISE Principal Investigator: *António Gomes Correia / Miguel Azenha*
Budget: *Global: 233 723,06 €/ISISE-UM: 87 650,00 €*
ID: *PTDC/EAM-GTC/29923/2017*
Funding Entity: *FCT*
Principal Contractor: *IST-ID – Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento*
Duration: *From 01/10/2018 to 30/09/2022*
Summary: The project was grounded in 2 complementary lines of action: a numerical line, comprising Tasks 3, 5, and 6 and partially Tasks 4 and 7; and an experimental line, encompassing Tasks 1 and 2, and partially, 4 and 7. The objectives of the numerical tasks were fully achieved and largely

exceeded. The experimental tasks were affected by COVID-related restrictions and delays, and by the untimely exit of a researcher. Still, by the end of the project (which was delayed for 12 months), the objectives of the experimental tasks were also achieved, but the publication of some outcomes is still underway. 35 publications stemming from the project were produced, including 2 book chapters and 2 participations in national conferences which were not initially planned. One MSc thesis was completed, and 2 PhD theses were initiated, one expected to be defended in 2023. Six computational applications were produced, of which the GeoHyTE software is a marketable product, along with one prototype. Three conferences were organized to increase the visibility of the project, before and after the COVID restrictions. According to preliminary FCT data, the financial execution of the project stands at 91.36%.



> RESIST 2020 – Seismic Rehabilitation of Old Masonry-Concrete Buildings

ISISE Principal Investigator: *Paulo Lourenço*
Budget: *Global: 239 590,25€/ISISE-UM: 98 267,50€*
ID: *PTDC/ECI-EGC/30567/2017*
Funding Entity: *Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)*
Duration: *From 01/10/2018 to 30/09/2022*
Summary: The present work aims at providing an insight into the out-of-plane response of clay brick masonry walls, especially focusing on a traditional Portuguese building typology, namely the 'placa', towards a correct interpretation and assessment of their seismic behaviour. A thorough experimental campaign in a laboratory environment was conducted, including material characterisation through destructive and non-destructive techniques and the quasi-static test with an airbag on a U-shaped clay brick masonry specimen. The main experimental results are discussed with specific attention to the analysis of the masonry wall cyclic response, the damage pattern, the seismic performance, and the evolution of the modal parameters at distinct stages of the test. The material's characterisation demonstrated the low mechanical properties of the masonry associated with such buildings. Results show that, even though the specimen presents a stiff and almost linear behaviour until the peak, the specimen has a low capacity to dissipate energy since post-peak softening is immediately observed. The damage pattern evidences a failure governed by an out-of-plane rotation combined with shear sliding.

(a) (b) (c)

U-shaped specimen: (a) axonometric view; (b) final construction stage; (c) test setup configuration, added load on transverse walls and frame to support the airbag.

> SIRMA - Strengthening Infrastructure Risk Management in the Atlantic Area

ISISE Principal Investigator: *José Campos e Matos*
Budget: *Global: 2 023 994,52€/ISISE-UM: 311 438,64€*
ID: *EAPA_826/2018 – SIRMA*
Funding Entity: *CCRN/ Programa Interreg Espaço Atlântico*
Principal Contractor: *Universidade do Minho*
Duration: *From 01/04/2019 to 30/09/2022*
Summary: Most of the transportation of people and goods in the Atlantic Area is made by rail and road. The performance of this infrastructure is directly affected by extreme natural events and by the strong corrosion processes that result from proximity to the Atlantic Ocean.

SIRMA aimed to develop, validate and implement a robust framework for the efficient management and mitigation of natural hazards in terrestrial transportation modes in the Atlantic Area, which consider both road and railway infrastructure networks (multi-modal).

The SIRMA concept is at the cutting edge of the adoption of predictive maintenance, thus demonstrating the synergic integration of new cost-effective big data monitoring approaches (multiplatform remote sensing and crowdsourcing).

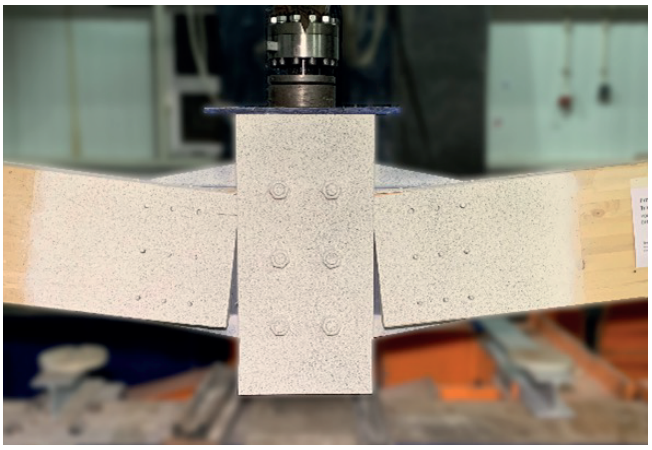
This project addressed the transportation infrastructures by developing a systematic methodology for risk-based prevention and management; developing a real-time process to monitor the condition of transportation infrastructure; and enhancing the interoperability of information systems in the Atlantic Area, by taking into account the data normalization and specificity of each country.

> InfraCrit – Desenvolvimento de um Sistema de Gestão para Infraestruturas Críticas

ISISE Principal Investigator: *José Campos e Matos*
Budget: *Global: 734 764,82€ / ISISE-UM: 240 715,48€*
ID: *POCI-01-0247-FEDER-039555*
Funding Entity: *FEDER/ANI*
Principal Contractor: *PH Informática*
Duration: *From 01/10/2019 to 15/03/2023*
Summary: Aware of the need to create a platform for processing information related to CI, PH Informática, UMinho and UCoimbra, with the consortium called InfraCrit, developed an intelligent technological solution for the protection and management of critical infrastructures, called SIGPIC, which enables: i) the management of the CI registry, allowing each operator, according to their level of permissions, to permissions, to insert, edit and consult its CIs; ii) obtaining criticality maps, assuming the vulnerability of different infrastructures subject to different events, such as fires, earthquakes, floods or terrorist attacks; iii) monitoring the evolution of the criticality level of infrastructures thus allowing the identification, in the short and long term, of which CI and their vulnerability to different risks vulnerability to different risks; iv) from the results generated by the simulation of an event, to which are associated vulnerability maps. In this way, the authorities responsible for the management of critical infrastructures have a tool that correlates the lack of operability of an operationality of infrastructure and the resulting consequences. A promotional video can be watched through the website: https://www.infracrit.pt/

> TimQuake – Structural performance of timber joints and structures under earthquakes

ISISE Principal Investigator: *Jorge Branco*
Budget: *Global: 225 826,45€/ISISE-UM: 163 601,45€*
ID: *POCI-01-0145-FEDER-032031*
Funding Entity: *FEDER/FCT*
Principal Contractor: *Universidade do Minho*
Duration: From 20/10/2018 to 17-10-2022
Summary: This research aimed to supply crucial data on the cyclic behaviour of timber joints for the revised edition of Eurocode 8 (EC8). Based on the experimental data collected, the sensitivity of the synthetic laws to few parameters, like stress level, grain direction, etc., was discussed. The aim was to define simplified physical models that could be used to predict those synthetic laws, thereby reducing the necessity of experimental data. To assess the effectiveness of the models, FE modelling, assuming the models defined for the joints, has to be performed. Not only has the numerical response of the joint to be analysed but also the predicted overall behaviour of the structure has to be monitored and compared with data from tests. A built example was analyzed under seismic loads. It was assumed as fundamental to guarantee that stakeholders (construction companies, owners, insurance companies, fire fighters) become familiar with the results of this project, and to enhance the use of a more sustainable construction solution, and therefore, a National Seminar was organized to transfer knowledge from the project activities.



> SEVen – Development of Sustainable Ceramic Brick Masonry Veneer Walls for Building Envelops

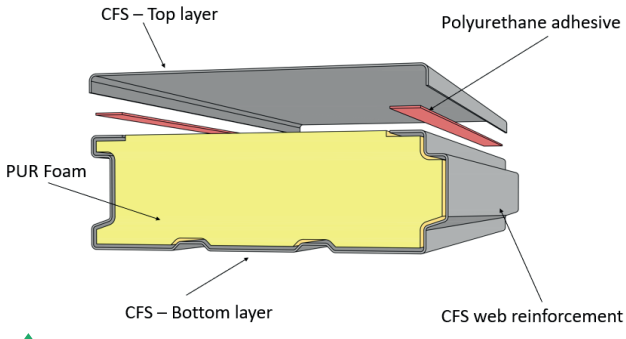
ISISE Principal Investigator: *Graça Vasconcelos*
Budget: *Global: 233 902,28€/ISISE-UM: 140 089,83€*
ID: *POCI-01-0145-FEDER-030876*
Funding Entity: *FEDER/FCT*
Principal Contractor: *Universidade do Minho*
Duration: *From 01-10-2018 to 30-09-2022*
Summary: The major objectives of the SEVen project were: (1) the development of innovative ceramic brick units for veneer walls; (2) validation of the mechanical behaviour based on static and dynamic experimental tests; (3) assessment of the thermal performance of the brick veneer system; (4) definition of numerical modelling strategies for veneer walls and providing constructive and design guidelines.
The most important outputs of the project were: (1) The design and production of the brick unit prototypes with enhanced thermal behaviour; (2) experimental characterization and obtainment of the main mechanical properties of brick veneer walls; (3) characterization of the cyclic tension-compression of tie-brick assemblages; (4) in-plane and out-of-plane behaviour of brick veneer walls and assessment of the important influencing parameters; (5) thermal efficiency assessment of the brick veneer walls; (6) design and construction of an experimental model for the dynamic analysis of the new solution of brick masonry walls; (7) numerical model approach for the analysis of tie-brick assemblages and implementation of a simplified numerical model; (8) review of the main design recommendation for brick masonry according to international standards.

> PROTIND – Protecting our industrial heritage: preservation and new uses for traditional warehouses

ISISE Principal Investigator: *Elisa Poletti*
Budget: *Global: 11 155,70€ / ISISE-UM: 5 683,70€*
ID: *PROTIND – EEA grants – FBR_OC1_130*
Funding Entity: *EEA Grants Portugal*
Principal Contractor: *Universidade do Minho*
Duration: *From 01/04/2022 to 31/10/2022*
Summary: NTNU and the University of Minho collaborated in performing an in-situ inspection and intervention proposal on original warehouses in Trondheim (Norway). The objective of this bilateral initiative was for the two institutions to jointly work on industrial buildings, taking into account a change in the use of the structures and new risks linked to climate change. This project allowed for the execution of a risk and vulnerability assessment of natural hazards with the creation of damage models and the development of a preventive maintenance plan to protect heritage buildings. The project organized a final international seminar in Guimarães, Portugal, focusing on the maintenance, preservation and rehabilitation of industrial heritage buildings. The results of the inspections carried out in Norway were presented and lectures were given by both NO and PT experts. A site visit was organized in Guimarães to the old textile factories, which have been restored and are now part of the campus. A site visit to traditional wine warehouses in Gaia was organized, showing similarities and differences in interventions, damages and change in use for these traditional warehouses.

> LightSlab – Development of innovative slab solutions using sandwich panels

ISISE Principal Investigator: *Paulo Lourenço*
Budget: *Global: 569 114,65€/ISISE-UM: 300 242,33€*
ID: *POCI-01-0247-FEDER-033865*
Funding Entity: *FEDER/ANI*
Principal Contractor: *Ferpainel*
Duration: *From 01/09/2018 to 30/11/2022*
Summary: Lightslab aimed at developing a new structural system for slabs, based on sandwich panels for applications in building rehabilitation and modular construction, and involved the University of Minho and Ferpainel S.A., as the consortium.
The work involved: (i) conception and optimization of the structural system; (ii) experimental characterization of different materials; (iii) conception, development and characterization of different adhesive and mechanical connections; (iv) construction and characterization of prototypes; (v) development of design tools.
This floor system is lighter, more economical and less polluting than any currently available solution. The panel's architecture includes a low-density core material reinforced with cold-formed steel sheets. The design of the panel was optimized by means of genetic algorithms to minimize mass, cost and environmental impacts. A comprehensive experimental campaign was carried out on the individual materials, prototypes and large-scale specimens. Based on experimental results, numerical analyses were developed to perform parametric studies. Design tools were developed for different geometries and load configurations to help practitioners.



Panel's architecture

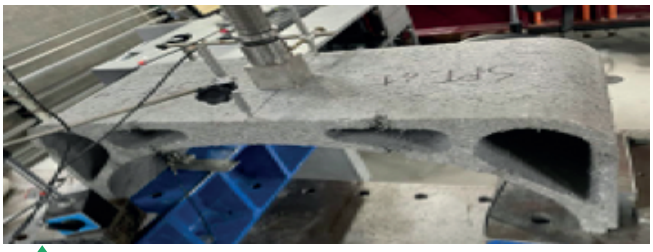
> EcOffShorBE – Eco Offshore Built Environment

ISISE Principal Investigator: *José Sena Cruz*
Budget: *Global: 427 893,42€/ISISE-UM: 214 601,76€*
ID: *NORTE-01-0247-FEDER-037417*
Funding Entity: *FEDER/ANI*
Principal Contractor: *Civitest*
Duration: *From 23/11/2018 to 22/11/2022*
Summary: The EcOffshoreBE project aimed to create an R&D Centre in co-promotion between Civitest (the leading entity) and the University of Minho (represented by the Departments of Biology, Industrial Electronics, Polymer Engineering and Civil Engineering). This collaborative structure has as its main motivation the strength of the internal competencies of CiviTest and UMinho in the area of R&D with a view to the development of high-performance cement matrix materials for engineering and offshore construction associated with the production of the wing energy. The main achievements of this project were:

- Reinforce the R&D capacity of the teams composing the Nucleus;
- Enhance the sharing of resources and infrastructure and the mobility and/or exchange of qualified human resources between promoters;
- Increase the knowledge and consolidate the experience of the teams composing the Nucleus on offshore construction, mainly associated with energy production;
- Promote and facilitate the transfer and endogenization of new knowledge and technologies by the teams composing the R&D Nucleus;
- Promote study and collaborative research;
- Identify and explore new opportunities for action, by listening to the challenges and needs of the market;
- Cooperate in carrying out medium and long-term technological foresight actions and technological feasibility studies.

> SlabImp – Prefabricated lightweight and multifunctional large span slabs

ISISE Principal Investigator: *Joaquim Barros*
Budget: *Global: 654 927,64€/ISISE-UM: 262 424,02€*
ID: *POCI-01-0247-FEDER-033883*
Funding Entity: *FEDER/ANI*
Principal Contractor: *Pavimentos Pré-Esforçados Império Braga Lda*
Duration: *From 31-08-2018 to 30-11-2022*
Summary: The present project proposed the development of a new slab system, SlabImp, with a capacity to overcome spans of up to 12 meters, composed of: (i) an innovative prefabricated prestressed beam in terms of geometry and contemplating a new hybrid concrete formulation, (ii) An innovative block with a structural character, through a new geometric configuration and formulation of sustainable concrete. The proposed slab system aims, when compared to other prefabricated existing alternatives, to constitute a sustainable solution of smaller deadweight, with higher performance in terms of structural behaviour and fire resistance, and including innovative functionalities in terms of serviceability, for applications for higher spans, to the new construction and urban rehabilitation segments. In this sense, the project contemplates important aspects of research in the level of the advanced materials of reinforcement of the concrete; Structural design; Development of advanced models of applied calculation; Manufacturing technologies and technical validation and functionality of the developed solution.



Testing an FRC block, a component of the developed lightweight slab

> SECClasS – Sustainability Enhanced Construction Classification System

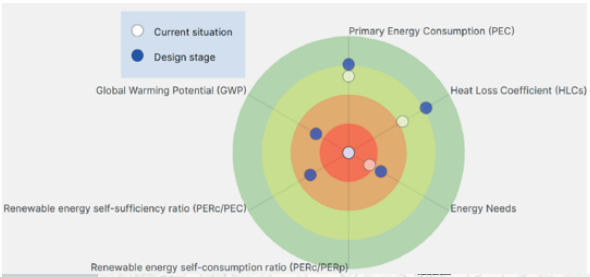
ISISE Principal Investigator: *Miguel Azenha*
Budget: *Global: 303 915,71€ / ISISE-UM: 49 940,16€*
ID: *19/Call #2_SECClasS*
Funding Entity: *Secretaria Geral do Ambiente (EEA Grants)*
Principal Contractor: *ISCTE – Instituto Universitário de Lisboa*
Duration: *From 01/10/2020 to 31-12-2022*
Summary: SECClasS project aimed to promote Circular Economy in the Construction industry by introducing an Information Classification System optimized for Sustainability. This system was oriented towards the BIM methodology and also served process management, quantification, compatibility of specialities, and work planning. It allowed the unification of terminology, facilitating communication between agents and supporting material and component selection and accurate assessment of the building's impacts over the life cycle. Its goal was to improve buildings' performance and reduce waste using digital tools that provide informed management and selection of construction materials and elements. Its main outcomes were:

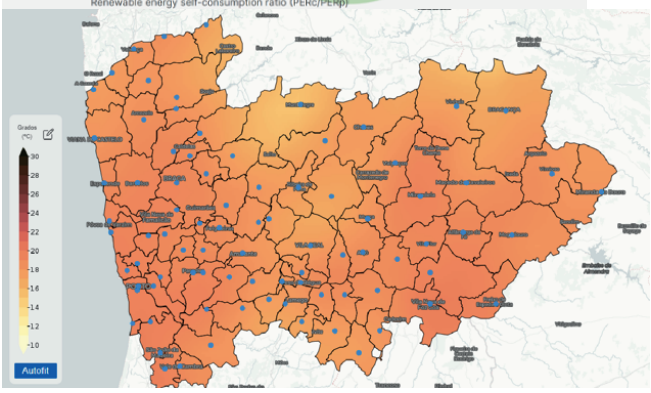
- SECClasS for the Portuguese reality, available to the public as complete tables, BIM software library files and searchable database.
- BIM object modelling guideline and demonstration with a set of example objects.
- Online platform with a search engine for the classification of building components
- The University of Minho contributed to the 2nd outcome with:
- The document "Rules for the Modelling of BIM Objects"
- Product Data Templates platform
- Examples of BIM objects

> ARCAS – Desenvolvimento de método de qualidade global para o desenho e avaliação de edificios residenciais multifamiliares com qualidade social, sustentáveis e energeticamente eficientes no território SUDOE

ISISE Principal Investigator: *Manuela Almeida*
Budget: *Global: 1 338 545,00€/ISISE-UM: 227 772,22€*
ID: *ARCAS - SOE3/P3/E0922*
Funding Entity: *Agência para o Desenvolvimento e Coesão (INTERREG SUDOE)*
Principal Contractor: *La Fundación Estudios Calidad Edificación Asturias (FECEA)*
Duration: *From 01/10/2019 to 31-03-2023*

Summary: The ARCAS project aimed to develop a multicriteria method to evaluate the quality and effectiveness of the renovation of buildings of social interest in the SUDOE territory. The developed method promotes a sustainable renovation of these buildings, addressing energy poverty, energy efficiency and indoor air quality issues, leading to healthier and more energy-efficient environments. The ARCAS method assumes a transversal approach defining different indicators on the three mentioned axes, most of which are based on in situ measurements. The methodology was tested in six selected demonstrator buildings in the SUDOE territory spread across the participating countries, i.e. Spain, France and Portugal. The ARCAS method proved to be useful in the design and post-renovation phases, allowing the evaluation of the effectiveness of the renovation proposals. The ARCAS Tool and the Climate Map Viewer were also delivered within this project. The first is an online tool that generates easy-to-read graphical results for the several indicators. The second is an online tool that presents several climatic and air quality parameters by municipality, also providing estimated data for climate projections.





> NORISK – International Masters on Risk Assessment and Management of Civil Infrastructures

ISISE Principal Investigator: *José Campos e Matos*
Budget: *Global: 55 000,00€/ISISE-UM: 55 000,00€*
ID: *NORISK – 101050410*
Funding Entity: *EC – European Commission (ERASMUS+)*
Principal Contractor: *Universidade do Minho*
Duration: *From 01/01/2022 to 01-03-2023*
Summary: Erasmus Mundus Design Measures support the design of high-level and integrated study programmes, at the master level. Joint programmes are designed and delivered by an international partnership of higher education institutions. The NORISK project was conceived within that perspective and it focuses on the topic of risk analysis and infrastructure management and has the main objective of preparing a new generation of technicians with solid basic training in an integrative and multidisciplinary context that allows them to operate in the risk analysis and infrastructure management market. The different phases of the risk management cycle will be scrutinized accounting for the fields of research and specialization of each partner. It is completely in line with the main lines of the European Union, as well as with the needs of many of the stakeholders involved. The NORISK consortium is composed of 4 high education institutions: Universidade do Minho (Portugal), Universitat Politecnica de Catalunya (Spain), La Rochelle Université (France) and Università degli Studi di Padova (Italy), with complementary expertise.

R&D STARTED PROJECTS

> MSSHBioCem – Mortar Surface Self-Healing via High-Performance Biocement

ISISE Principal Investigator: *Fernando G. Branco*
Budget: *Global: €249 086,21€ / ISISE-UC: €249 086,21€*
ID: *2022.03631.PTDC*
Funding Entity: *FCT*

> D_INNOCFSCONC Demonstration of an innovative hybrid structural solution combining cold-formed steel and lightweight concrete and/or CLT

ISISE Principal Investigator: *Hélder Craveiro*
Budget: *Global: 6 000 €*
ID: *UI-Transfer, Project 181315, POCI-01-0246-FEDER-181315*
Funding Entity: *Autoridade de Gestão do COMPETE2020*
Principal Contractor: *University of Coimbra*

> CONNECT – Innovative connecting devices for steel-CLT composite floor systems towards a sustainable construction sector

ISISE Principal Investigator: *Hélder Craveiro*
Budget: *Global: 5 000 €*
ID: *KICKSTART@ISISE*
Funding Entity: *ISISE*
Principal Contractor: *University of Coimbra*

> Modelling fire spread from forest to the built environment at the Wildland-Urban Interface (WUI) using Fire Dynamics Simulator

ISISE Principal Investigator: *Hélder Craveiro*
Budget: *Global: 1 219 € (96000 CPU core.hours; 1000 HB hard drive; LCAUC_Navigator)*
ID: *Call Advanced Computing Projects (3rd ed): A1 Preparatory or Develop. Access – 2022.15641.CPCA.A1*
Funding Entity: *FCT*
Principal Contractor: *University of Coimbra*

› R2UTechnologies – modular systems

ISISE Principal Investigator: *Luís Simões da Silva (ISISE UC) / Eduardo Pereira (ISISE UM)*
Budget: *Global 94,9 M € / ISISE-UC: 3,3 M € / ISISE-UM: 3,8M€*
ID: *C644876810-00000019*
Funding Entity: *IAPMEI, Plano de Recuperação e Resiliência (PRR)*
Principal Contractor: *DST*
Duration: *From 01/01/2022 to 31/12/202*

› TimberTech – Produtos estruturais de madeira com desempenho inovador ao nível da ductilidade

ISISE Principal Investigator: *Carlos Martins*
Budget: *Global: 49 926,99€ / ISISE-UC: 49 926,99€*
ID: *2022.06937.PTDC*
Funding Entity: *FCT – Fundação para a Ciência e Tecnologia*
Principal Contractor: *University of Coimbra*
Duration: *From 01/03/2023 to 01/08/2024*

› S&E4M – Towards a sustainable integrated seismic and energy retrofit of masonry buildings

ISISE Principal Investigator: *Daniel Oliveira*
Budget: *Global: 49 849,40€ / ISISE-UM: 49 849,40€*
ID: *2022.01429.PTDC*
Funding Entity: *FCT*
Principal Contractor: *Universidade do Minho*
Duration: *From 01/03/2023 to 31/08/2024*

› RESISTANCE – Prediction of the out-of-plane dynamic behaviour of masonry structures using machine learning: towards new simple standards for in-field structural assessment

ISISE Principal Investigator: *Paulo Lourenço*
Budget: *Global: 49 949,15€ / ISISE-UM: 49 949,15€*
ID: *2022.05425.PTDC*
Funding Entity: *FCT*
Principal Contractor: *Universidade do Minho*
Duration: *From 01/03/2023 to 31/08/2024*

› TuRUpAI – Multiscale modelling for tunnel's retrofitting optimization with fibre reinforced shotcrete designed by artificial intelligent algorithms

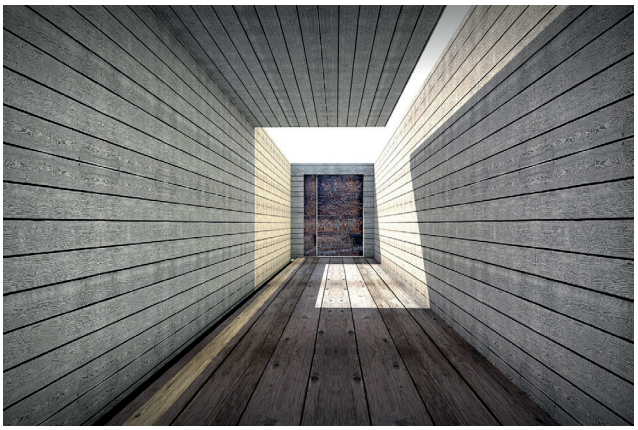
ISISE Principal Investigator: *Joaquim Barros*
Budget: *Global: 24 9960,12€ / ISISE-UM: 249 960,12€*
ID: *2022.06602.PTDC*
Funding Entity: *FCT*
Principal Contractor: *Universidade do Minho*
Duration: *From 01/03/2023 to 28/02/2026*

› IMPACT – IMproving Pedestrians' sAfety PerCepTion of shared streets: Auditory, visual and geometry-based strategies

ISISE Principal Investigator: *Elisabete Freitas*
Budget: *Global: 248 164,24 € / ISISE-UM: 183 656,66 €*
ID: *2022.06271.PTDC*
Funding Entity: *FCT*
Principal Contractor: *Universidade do Minho*
Duration: *From 05/03/2023 to 04/03/2026*

› ENABLE – Continuous health monitoring of pavement infrastructures using bender elements

ISISE Principal Investigator: *Miguel Azenha/ A. Gomes Correia*
Budget: *Global: 249 865,58 € / ISISE-UM: 66 240,22 €*
ID: *2022.06879.PTDC*
Funding Entity: *FCT*
Principal Contractor: *COFAC*
Duration: *From 05/03/2023 to 04/03/2026*



› NGS – New Generation Storage

*I**SISE Principal Investigator:** Eduardo Pereira*
***Budget:** Global: 111 M € / ISISE-UM: 3,0M€*
***ID:** C644936001-00000045*
***Funding Entity:** IAPMEI, Plano de Recuperação e Resiliência (PRR)*
Principal Contractor: DST Solar
Duration: From 01/01/2022 to 31/12/2025

› New Space Portugal

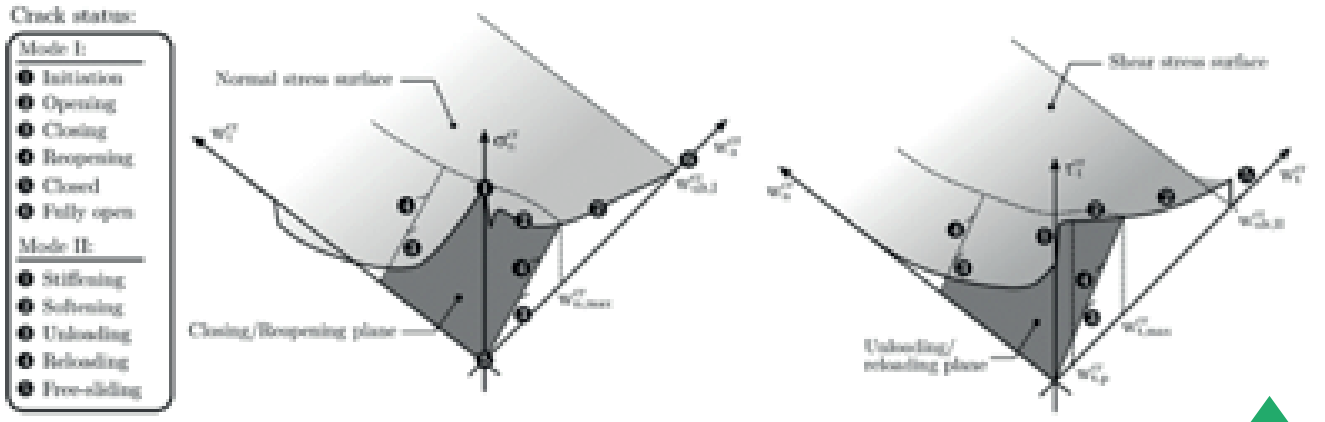
***ISISE Principal Investigator:** Eduardo Pereira*
***Budget:** Global: 137,4 M € / ISISE-UM: 349.581,36 €*
***ID:** C644936537-00000045*
***Funding Entity:** IAPMEI, Plano de Recuperação e Resiliência (PRR)*
***Principal Contractor:** GEO SAT, LDA*
***Duration:** From 01/01/2022 to 31/12/2025*

COMPLETED PHD THESES

› Integrated Mixed-Mode Fracture Model for the Design of 2D Steel Fibre Reinforced Concrete Structures

Author: Luís Miguel Pinto de Matos
Supervisors: Joaquim António Oliveira de Barros; Rui Artur Bártolo Calçada; António Ventura Gouveia
Date: 06/12/2022
Summary: This thesis presents research on the numerical simulation and analysis of fibre reinforced concrete (FRC) structures by implementing new tools on FEMIX software. The multi-fixed smeared crack model (SCM) approach is used to conduct numerical case studies of FRC elements failing in bending and shear, and the influence of fracture mode I/II parameters on constitutive models is analysed. A general crack bandwidth formulation is developed for plane stress, shell, and solid finite elements, allowing mesh-independent results. An efficient inverse analysis approach is developed to derive fracture mode I parameters of FRC from experimental results. A 2D mixed-mode fracture SCM is developed and appraised through numerical case studies, and modifications to the original formulations of fibre pullout models are proposed to enhance their predictive performance. The developed tools are applied to the simulation of several FRC structures and their suitable predictive performance is demonstrated.

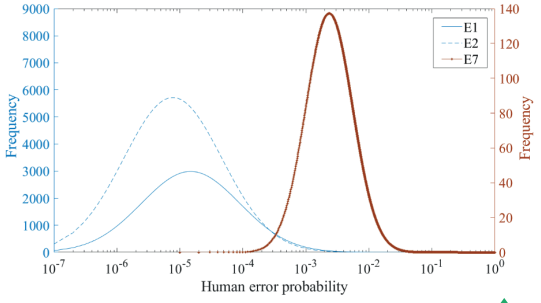
CV: **Luís Matos** holds a MSc. and PhD degree from the University of Porto and Minho, respectively. His research topic is related to the field of fibre reinforced concrete (FRC), more precisely, the development of numerical methodologies and constitutive models for the analysis of FRC structures. His interests include finite element analysis (FEA) of FRC structures, development and implementation of constitutive models for FRC and determination of fracture parameters by inverse analysis.



Mixed fracture I and II surfaces for modelling FRC structures

› The impact of human error in the short- and long-term behaviour of railway bridges

Author: Neryvaldo de Jesus Galvão Pereira
Supervisors: José António Campos e Matos; Luís Ferreira; Rade Hajdin
Date: 07/02/2023
Summary: Within this thesis, human errors are identified in their numerous forms, i.e., design errors and construction errors, according to expert opinions and real-world bridge collapse events. The actual impact of human errors on structural safety is investigated through structural reliability analysis. Such investigation is performed on two fronts, one where design and construction errors are introduced under scenarios where they are understood to be present, and another where the possibility of occurrence of construction errors is investigated considering probabilistic models to describe human error probabilities and error magnitudes. Single and multiple occurrences of errors are also discussed. Finally, the service life prediction of bridges considering carbonation-induced corrosion and the service life reduction of bridges due to construction errors are carefully addressed.

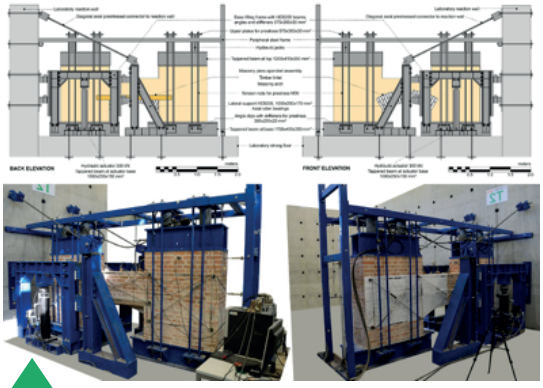


Human error probability

CV: **Neryvaldo Galvão** is a technology enthusiast concerned with sustainability and inspired by Elon's dream to reach Mars. Moreover, he is eager to take on new challenges and always looking for meaningful and fulfilling ways to contribute to a better tomorrow. In the meantime, the scope of his work is Human Errors, Reliability of Bridges, Risk Analysis, Non-linear Analysis and Machine learning.

› Experimental methods for investigating the effects of soil settlements and vibrations in cultural heritage buildings, induced by underground structures'

Author: Georgios Karanikoloudis
Supervisors: Paulo José Brandão Barbosa Lourenço; João Paulo Bilé Serra
Date: 28/02/2023
Summary: Structural assessment for cultural heritage structures, in the proximity of operating underground railways, is twofold, by induced soil movements, from tunneling construction, and fatigue, through railway induced groundborne vibrations. Hence, the current thesis is focused on obtaining reliable experimental data, for both hazards. First, fatigue tests in diagonal compression in wallets, under medium to high amplitudes of vibrations and high static loads, have resulted in cracking, at low number of cycles. Second, in-plane tests on differential uplift were conducted in piers and spandrel masonry specimens. Repair and strengthening applications were also assessed, namely grouting injections and a Fiber Reinforced Cementitious Matrix (FRCM) system. A sequential in-plane failure is identified through flexural, shear and sliding, while the repair and strengthening schemes are both tested effective, providing sufficient shear capacity and ductility.



Elevation views, of the experimental setup arrangement for piers and spandrel masonry assemblies, tested under differential vertical displacements

CV: **Georgios Karanikoloudis** is a structural engineer and researcher, specialized in advanced numerical modelling, field and laboratory testing of masonry historic structures. He obtained his PhD in February 2023, from the Civil Engineering Dept. of the University of Minho, studying the effect of soil settlements and vibrations on cultural heritage buildings, induced by underground structures.

AWARDS & PRIZES

> **Award to:** João Pedro Martins, Filip Ljubinković, Luís Simões da Silva

Prize: ICE Publishing Awards 2022; John Henry Garrood King Medal, for the paper "New design rules for plate girders curved in plan", journal Bridge Engineering
Date: 2022
Link: https://www.icevirtuallibrary.com/page/awards/john-henry-garrood-king-medal

> **Award to:** Ali Dalalbashi

Prize: 2022 Outstanding PhD Dissertation award from the Masonry Society, USA, to the PhD Thesis "Multi-scale investigation of the durability performance of TRM-strengthened masonry"
Date: 2022
Link: https://masonrysociety.org/2022-outstanding-student-thesis-awards/

> **Award to:** Iran Rocha Segundo

Prize: ANPET Scientific Production Award for the work "Diagnosis of air pollutant emissions in asphalt mixtures production" (in Portuguese language) at 36º Congresso de Pesquisa e Ensino em Transportes (ANPET), Fortaleza, Brazil (08-12/11/2022);
Date: November 2022
Link: https://proceedings.science/anpet-2022/trabalhos/diagnostico-de-emissoes-de-poluentes-atmosfericos-na-producao-de-misturas-asfalt?lang=pt-br

> **Award to:** Y. Jahani, M. Baena, J. Sena-Cruz, M. Aghabagloo, C. Barris, L. Torres

Prize: SMAR2022 congress, the SMAR 2022 MIRKO ROŠ SILVER MEDAL AWARD with the work entitled "Experimental fatigue b of NSM CFRP-strengthened RC beams under high service temperature", in the category "Rehabilitation of civil structure", Shanghai,
Date: September 6-8, 2022

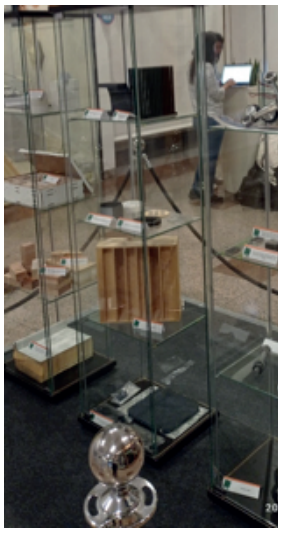
> **Award to:** Strauss, A., Ivanković , A.M., Benko, V., Matos, J.C., Marchand, P., Wan-Wendner, R., Galvão,N., Orcesi, A., Dobrý, J., El Hajj Diab, M., Ninčević, K., Hauser, M., Srbić, M., Skokandić, D

Prize: Outstanding Paper Award 2022 IABSE – Scientific Paper Category 2021:., with the work entitled "Round-Robin Modelling of the Load-bearing Capacity of Slender Columns by Using Classical and Advanced Non-linear Numerical and Analytical Prediction Tools", Structural Engineering International(SEI), 31:1, 118135, DOI: 10.1080/10168664.2020.1740069 (17.11.2022).
Link: https://iabse.org/Outstanding-Paper-Award

EVENTS

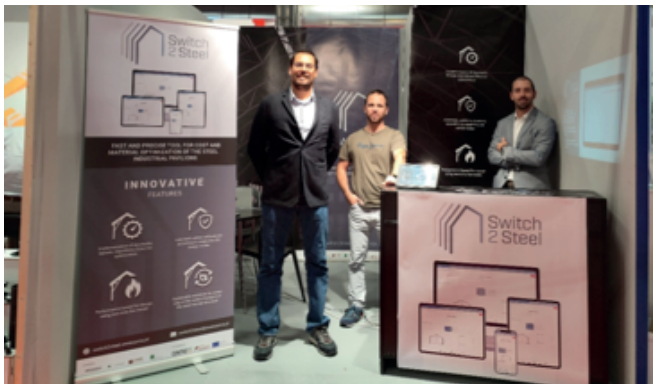
› Exposição "O que se investiga na UC?"

Venue: CoimbraShopping, Coimbra
Date: 15-29 September 2022
Website: https://www.infracrit.pt/
ISISE Member: Francisca Santos
Summary: ISISE participated, between September 15-29th 2022, in the exhibitions within the scope of the cycle- What is being investigated at UC?, promoted by the Interdisciplinary Research Institute of the University of Coimbra aiming at presenting the projects of the UC Research and Development Units to the community. In this exhibition, ISISE exposed their most outstanding current projects with greater relevance to society.



› BATIMAT

Venue: Expo Porte de Versailles, Paris, França
Date: 3-6 October 2022
ISISE member: Filip Ljubinkovic
Summary: ISISE was present at Batimat, one of the most renowned construction fairs in Europe, between October 3-6 2022, in Paris. The Researcher Dr. Filip Ljubinkovic (UC), Eng. Nuno Cândido and Eng. Luís Cordeiro (OneSource), presented the new app Switch2Steel, a platform for designing and optimizing the costs of industrial steel buildings. The app was developed within the scope of the National project Swithch2Steel, coordinated by ONESOURCE in partnership with the University of Coimbra (UC) and the Portuguese Steelwork Association (CMM).



› CONCRETA

Venue: Exponor – Feira Internacional do Porto, Porto
Date: 13-16 October 2022
ISISE member: Aldina Santiago/Luis Laim
Summary: ISISE was present at CONCRETA "Feira Internacional de Construção de Obras Públicas", from October 13 to 16, 2022. Prof. Aldina Santiago and the Researcher Dr. Luís Laím (UC), presented the Switch2Steel Project (platform for designing and optimizing costs and materials for industrial steel buildings), coordinated by ONESOURCE in partnership with University of Coimbra (UC) and the Portuguese Steelwork Association (CMM).

› 1st Management Committee Meeting of COST Action CA21103 – CircularB – Implementation of Circular Economy in the Built Environment

Venue: Brussels
Date: 27 October 2022
Website: https://www.cost.eu/actions/CA21103/
ISISE member: Luis Bragança
Summary: The main aim is to define the methodology to develop a common circularity framework for inclusive application and assessment in new and existing buildings to support decision-making for all value chain stakeholders and appraise the implementation level of the European Circular Economy Action Plan. Specific objectives are detailed in the MoU (https://www.cost.eu/actions/CA21103/).

› ICSCE 2022 (The 4th International Conference on Sustainability in Civil Engineering)

Venue: Hanoi, Vietnam
Date: from November 25 to 27, 2022
Website: https://icsce2022.utc.edu.vn/
ISISE member: José Campos e Matos
Summary: Professor Matos has joined the ICSCE as a Keynote Speaker with the presentation: "The use of new tools and technologies for the management of existing infrastructures. Worldwide perspectives". The International Conference on Sustainability in Civil Engineering (ICSCE) is very significant to the development of new ideas and the promotion of research into advanced in Sustainability in Civil Engineering field. The 4th ICSCE 2022 was held at University of Transport and Communications, Hanoi, Vietnam on 25-27th November 2022. The theme of ICSE2022 was "Green Techology" and brought together the key players in the sector from around the globe.

› Construção em madeira. Desafios e oportunidades

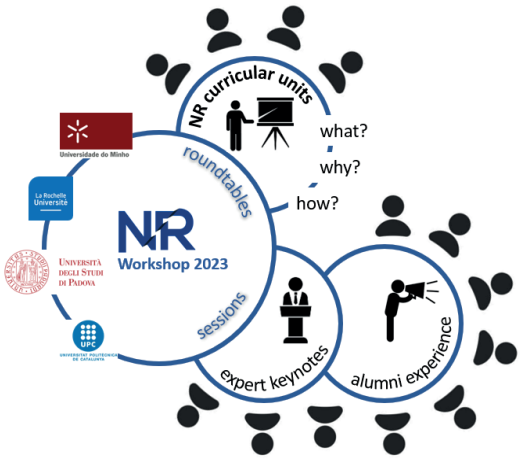
Venue: Coimbra, Departamento de Engenharia Civil
Date: 27 & 28 of March 2023
Website: https://ucpages.uc.pt/events/eguralt/
ISISE member: Carlos Martins, Sofia Knapic, Carlos Albino, Alfredo Dias, Sandra Monteiro
Summary: The Workshop "Construção em madeira. Desafios e oportunidades" aimed to gather the entire construction sector, namely companies, service providers, as well as decision-makers and the academic community. The workshop followed the scope of EGURALT project, financed by an INTERREG SUDOE, where SerQ – Forest Innovation and Competences Centre is the national partner of the consortium. About 200 people attended the event from different parts of Portugal and Spain for two days of intensive and extraordinary presentations from national and international specialists within the field of Timber Construction.

› Tech4INNOV – o Presente e o Futuro da Inovação

Venue: EUROPARQUE, Santa Maria da Feira.
Date: 29 March 2023
Website: Techo4Innov
ISISE member: Filip Ljubinkovic
Summary: ISISE was present at "Tech4INNOV – o Presente e o Futuro da Inovação", on March 29th 2023, at EUROPARQUE, in Santa Maria da Feira. The Doctoral Researcher Dr. Filip Ljubinkovic (UC), and Eng. Nuno Cândido and Eng. Luís Cordeiro (OneSource), presented the new app Switch2Steel, a platform for designing and optimizing the costs of industrial steel buildings. The app was developed within the scope of the National project Swithch2Steel, coordinated by ONESOURCE in partnership with the University of Coimbra (UC) and the Portuguese Steelwork Association Construction (CMM).

› NORISK Eramus+ Workshop

Venue: Guimarães
Date: from March 29 to 30, 2023
ISISE member: José Campos e Matos, Elisabete Teixeira e Hélder Sousa
Summary: The NORISK Consortium organized for the first time the NORISK Workshop completely open to the public. This Workshop presented the NORISK initiative, considering the results obtained in the NORISK EMDM, namely the curricular unit contents, objectives, and teaching methodologies. For each unit a roundtable was considered, joining experts on the field of risk assessment and infrastructure management.



UPCOMING EVENTS

› Energy Islands – Technical Challenges and Industrial Opportunities

Venue: *University of Luxembourg in Belval, Luxembourg*
Date: *15-16 May 2023*
Website: *https://modenerlands.eu/activities/events/strategic-workshop-2023/*

› Seminário Construir com Madeira

Venue: *Guimarães*
Date: *07 june 2023*
Website: *https://forms.gle/B7j3TZhw4dHe1MQD7*

› SynerCrete'23 The International RILEM Conference on Synergising expertise towards sustainability and robustness of cement-based materials and concrete structures

Venue: *Milos, Greece*
Date: *15-16 June 2023*
Website: *https://synercrete.com*

› 4TH International Congress on Luso-Brazilian Construction History

Venue: *Guimarães*
Date: *04-07 September 2023*
Website: *https://4cihclb.pt/en/homepage/i*

› fib ICCS – International Conference on Concrete Sustainability – 2024

Venue: *Guimarães*
Date: *11-13 September 2024*
Website: *https://www.fibiccs.org/*

› Summer Course – Resilience of Modular Sustainable Energy Islands in Face of Climate Change Challenges

Venue: *Laboratorio Nacional de Engenharia e Geologia*
Date: *25-28 September 2023*
Website: *https://modenerlands.eu/activities/events/training-school-2023/*

› International Probabilistic Workshop IPW 2024

Venue: *Guimarães*
Date: *08-10 May 2024*
Website: *Under development*

COURSES

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

Venue: Department of Civil Engineering, University of Minho, Portugal
Website: www.msc-sahc.org

> **Erasmus Mundus Master Waves**

Venue: Department of Civil Engineering University of Coimbra
Website: https://www.master-waves.eu

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

Venue: Dept. of Civil Engineering, University of Minho
Website: www.bimaplus.org

> **European Master Course in Advanced Structural Analysis and Design using Composite Materials – FRP++**

Venue: Dept. of Civil Engineering, University of Minho
Website: https://msc-frp.org/

> **International Master on Sustainable Built Environment iMiSBE**

Venue: Dept. ofCivil Engineering, University of Minho
Website: https://civil.uminho.pt/imisbe/

> **Master in Construction Management**

Venue: Dept. of Civil Engineering University of Coimbra
Website: https://www.uc.pt/fctuc/dec/ensino/novoscursos2021/mec/gestao

> **Master in Steel and Composite Construction**

Venue: Dept. of Civil Engineering University of Coimbra
Website: https://apps.uc.pt/courses/PT/course/333

> **Master in Structural Mechanics**

Venue: Dept. of Civil Engineering University of Coimbra
Website: https://www.uc.pt/fctuc/dec/ensino/novoscursos2021/mec/mecest

> **Master in Sustainable Construction and Rehabilitation (taught only in Portuguese)**

Venue: Department of Civil Engineering, University of Minho
Website: http://civil.uminho.pt/mcrs/

> **Doctoral Programme in Civil Engineering**

Venue: Department of Civil Engineering, University of Minho
Website: https://pdec.civil.uminho.pt/

> **Doctoral Program Steel and Composite Construction**

Venue: Dept. of Civil Engineering, University of Coimbra
Website: https://apps.uc.pt/courses/EN/course/8181

> **International Doctoral Programme in Sustainable Built Environment**

Venue: Dept. of Civil Engineering, University of Minho
Website: http://civil.uminho.pt/idisbe/