PROJECTS of the UNIVERSITY OF ZAGREB Faculty of Civil Engineering 2020–2024



University of Zagreb Faculty of Civil Engineering



IMPRESSUM

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FOREWORD

Welcome to the second edition of the University of Zagreb Faculty of Civil Engineering brochure featuring Faculty projects. This edition provides an overview of projects carried out between 2020 and 2024. The first edition, available <u>here</u>, covers Faculty projects carried out between 2018 and 2022. Both brochures include projects coordinated by the Faculty, those in which the Faculty participated as a partner, and COST Actions involving individual Faculty researchers.

The increasing number of competitive projects funded through national and international calls reflects the growing success and activity of the Faculty's researchers. In 2018, the Faculty participated as a coordinator or a partner in 26 competitive projects – 14 funded through international calls and 12 funded through national calls. Additionally, 13 projects were funded by the University of Zagreb's scientific and artistic activities programme, and Faculty researchers participated in 13 COST Actions.

For comparison, in 2023 the Faculty participated as a coordinator or a partner in 47 competitive scientific projects, 12 funded through international calls and 35 funded through national calls. 24 projects were carried out in 2023 within the University of Zagreb's funding of scientific and artistic activities programme, and Faculty researchers participated in 8 COST Actions.

Over the course of the nearly five-year period covered by this brochure, the Faculty was a partner in or coordinated projects in the most competitive European programmes, including HORIZON 2020 and HORIZON EUROPE (9 projects), the LIFE 2021-2027 programme (2 projects), the Union Civil Protection Mechanism 2014-2020 (4 projects), EEA and Norway Grants (3 projects), the European Climate Initiative – EUKI/BMWK grant (1 project), ERASMUS+ 2014-2020 and ERASMUS+ 2021-2027 (5 projects), EIT Manufacturing (1 project), and other European projects (2 projects). Faculty researchers participated in 15 COST actions.

The previous edition of the brochure presented a total of 20 EU-funded or internationally funded projects carried out between 2018 and 2022. For the period from 2020 to 2024, this number has increased to 27 projects, with further growth anticipated.

In terms of nationally funded project activity, the Faculty has coordinated or participated as a partner in projects funded by the Croatian Science Foundation (16 projects), the European Regional Development Fund 2014-2020 (16 projects), the European Social Fund 2014-2020 (3 projects), the National Recovery and Resilience Plan 2021-2026 (3 projects), and the Ministry of Science, Education, and Youth (3 projects). Additionally, there has been a steady increase in projects funded by the University of Zagreb's scientific and artistic activities programme, growing from 17 projects in 2018 to 25 projects in 2024.

The integration of young researchers into project application and implementation has proven to be a highly effective strategy, leading to an increase in both the number of applications and the proportion of young researchers at the Faculty. In 2018, four doctoral students were involved in Faculty projects, with their compensation funded by project resources; by 2023, this number had increased to more than twenty.

The Faculty's collaboration with over 250 organizations across 34 countries worldwide facilitates connections with stakeholders from the public sector, business, related higher education institutions, research organizations, non-governmental organizations, and various guild associations from Croatia, Europe, and beyond. Partner organizations are almost equally distributed across the four main representative sectors: public, private, nonprofit, and higher education.

The Faculty's projects in the areas of research, development, collaboration, innovation, education, curriculum modernization, policy reform, strategic partnerships, capacity building, open science infrastructure and research infrastructure presented in this brochure undoubtedly contribute to the Faculty's visibility at national and international level.

For additional details about Faculty projects, please reach out to the individual researchers or contact the Faculty's Centre for Projects, Innovation, and Technology Transfer at <u>cepitt@grad.unizg.hr</u>.

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HORIZON 2020

SAFE-10-T Safety of Transport Infrastructure on the TEN-T Network

Duration	01.05.2017-30.04.2020
Overall budget	2,997,000.00 €
Funding scheme	Research and Innovation Actions
Coordinator	Gavin and Doherty Geosolutions
Partners	University of Zagreb Faculty of Civil Engineering; Istituto di Sociologia Internazionale
	di Gorizia; Virtus It; Roughan & O'Donovan; Infrastructure Management
	Consultants; Ministry of Infrastructure And Water Management; Network Rail
	Infrastructure; Berlin University of Technology; German Research Center for
	Artificial Intelligence; Forum of European National Highway Research Laboratories
	Fehrl; Infra Plan Konzalting; Delft University of Technology; Croatian Railways
	Infrastructure
Leader at the Faculty	Prof. Meho Saša Kovačević









The SAFE-10-T project aims to develop a safety framework to ensure high safety performance, with extended life cycle, of critical infrastructure on roads, railways and inland waterways. Moving from considering critical infrastructure such as bridges, tunnels and earthworks as inert structures to intelligent (self-learning) objects, the project will minimize sudden exceedance of load-bearing capacity limits. The Faculty's research activities are focused on (a) analysis of long-term deformations around the tunnel to increase safety using neural networks and genetic algorithm, and (b) implementation of a continuous monitoring system at one of the 'case study' locations – Brajdica railway tunnel near the city of Rijeka.

- The safety framework includes remote sensing data stored in the BIM model, which is entered into the decision support framework (DST), and which allows automatic decision-making on maintenance priority for assets that are close to exceeding one of the limit states.
- Development of algorithm at the level of the asset and at the level of the transport network with the application of machine learning to enable continuous development of decision-making systems, using available data from asset monitoring activities.
- Demonstration and validation of the tools developed at critical hubs of the TEN-T transport network.

Net-UBIEP

Network for Using BIM to Increase the Energy Performance

Duration	03.07.2017-04.03.2020
Overall budget	995,022.50 €
Funding scheme	Coordination and Support Actions
Coordinator	Italian National Agency for New Technologies, Energy and Sustainable Economic
	Development
Partners	University Of Zagreb Faculty Of Civil Engineering; Agenzia Nazionale Per Le Nuove
	Tecnologie; L'energia E Lo Sviluppo Economico Sostenibile; Corporate Service Center
	Scarl; Viaeuropa Competence Centre Sro; Fundacion Laboral De La Construccion;
	Public Institution Digital Construction; Vilnius Gediminas Technical University;
	Stichting Isso; Tallinn University Of Technology; Itc International; State Agency For
	Higher Council Of Scientific Research; Balance & Result Organisatie Adviseurs Bv;
	Mittetulundusuhing Eesti Timmitud Ehituse Tugiruhm
ader at the Faculty	Assoc. Prof. Bojan Milovanović

Leo

и. Биј





An integrated approach to the Net-UBIEP project, based on information modelling of buildings, integrated with energy efficiency requirements, will be key to solving all problems in a more efficient way. The project proposes BIM qualification models integrated with energy competencies, in order to spread a better understanding of energy issues along the entire value chain of the construction industry so that the existing and new buildings will have better energy performance. Public administration, professionals (engineers / architects), technicians (installers / maintainers) and tenants are therefore involved in Net-UBIEP activities.

- Identification of specific energy BIM competencies required for the implementation of BIM models throughout the life cycle of the building
- "Integrated" BIM qualification models will be validated by stakeholders by providing various training activities (seminars / classroom courses / e-courses) addressed to at least six BIM professional profiles: BIM Manager, BIM Evaluator, BIM Coordinator, BIM Expert, BIM Facility Manager, BIM User
- Standardization of approved schemes for wider acceptance at the European and international levels through regulatory organizations (CEN / ISO)

DuRSAAM

PhD Training Network on Durable, Reliable and Sustainable Structures with Alkali-Activated Materials

Duration	01.11.2018–31.10.2022
Overall budget	3,997,847.76 €
Funding scheme	Marie Skłodowska-Curie Innovative Training Networks
Coordinator	Universiteit Gent
	University of Zagreb Faculty of Civil Engineering; Delft University of Technology;
Partners	Karlsruhe Institute of Technologyinstitut Fuer Technologie; University of Sheffield
	Panepistimio Patron; Eth Zurich
Leader at the Faculty	Assoc. Prof. Marijana Serdar



Web page:

https://www.grad.hr/latom/index.php/hr/umrezavanje-doktorskih-studija-o-trajnim-pouzdanim-i-odrzivimkonstrukcijama-s-alkalno-aktiviranim-materijalima-dursaam/



The aim of the project is to develop a new generation of cement-free alkali-activated binders, as an alternative to traditional cement-based concrete, in order to enable their application in sustainable green construction. Concrete is the most common construction material, and the omission of cement from concrete production significantly reduces CO₂ emissions as one of the most significant factors among the harmful effects on the environment. The interdisciplinary research is focused on the examination of alkali-activated materials from various aspects - composition design, microstructure, structural application, durability, and assessment of service life and sustainability of materials.

PROJECT OUTCOMES

The project activities will contribute to better understanding of the properties of alkali-activated materials, to more accurate prediction of their durability, and to expansion of the scientific database in order to enable reliable application of alkali-activated materials in construction. The project will contribute to the training of scientific staff for further research and development of environmentally efficient construction by creating a connection and collaboration between thirteen doctoral students from different fields.

The **nZEB** Roadshow

Duration 01.06.2020-31.05.2023 **Overall budget** 1,094,810.00€ Funding scheme Coordinator Partners

Leader at the Faculty

Coordination and Support Actions Fondatsiya Tsentar Za Energiyna Efektivnost University of Zagreb Faculty of Civil Engineering; Hellenic Passive House Institute; Zero Energy and Passivhaus Institute for Research; Association Cluster for Promoting Nearly Zero Energy Buildings Pro Nzeb; Bulgarian Construction Chamber Assoc. Prof. Bojan Milovanović

Web page: https://cordis.europa.eu/project/id/892378





Based on EU environmental requirements, starting from 2021 (or from 2019 for public buildings) all new buildings must be nearly-zero-energy buildings (nZEBs), which means buildings with a very high energy performance. The EU-funded nZEB Roadshow project will perform the national-level marketing and communication promotions in five EU countries, organising nZEB weeks in selected cities in each of the participating countries. The action consists of a wide range of events including construction products, real estate exhibitions, practical demonstration and real-time construction activities, training for both designers and workers, career orientation and job centres focusing on the local SME construction sector. Prefabricated modular mobile buildings will be used as information centres to raise awareness of the benefits of nZEBs.

- Marketing and communication campaigns at national level in five European countries, focusing on nZEB weeks organized in three to five selected cities in each country involved.
- Design and construction of mobile demonstration pavilions for the promotion of nZEB through small exhibitions and lectures, built according to nZEB standards.
- Construction of the MUZA mobile pavilion (Mobile, Efficient, Healthy, Architecture) which is an example of construction according to NZEB standards. In this pavilion, visitors can get information about the almost zero energy buildings (nZEB), and will also experience nZEB at first hand.
- nZEB Roadshow contributes to ongoing efforts to promote nZEB's two very important but unfortunately still
 missing components: professional marketing and sales services and a strong media partnership.

BUS-GoCircular Stimulate demand for sustainable energy skills

with circularity as a driver and multifunctional green use of roofs, façades and interior elements as focus

Duration	01.09.2021-29.02.2024
Overall budget	999,893.75 €
Funding scheme	Coordination and Support Actions
Coordinator	STICHTING ISSO
Partners	Stichting Circle Economy; Building Changes Support Bv; Fondatsiya Tsentar za
	Energiyna Efektivnost; University Of Architecture, Civil Engineering, And Geodesy;
	Czech Technical University in Prague; Institute of Circular Economy Zu; Valencia
	Institute of Building; Valencian Federation of Construction Companies; University
	of Zagreb Faculty of Civil Engineering; Emi Construction Quality Control Innovation
	Nonprofit; Technological University of the Shannon; Conseil des Architectes
	D'europe; Iclei European Secretariat
ader at the Faculty	Assoc. Prof. Bojan Milovanović

Leader at the Faculty



Web page: https://cordis.europa.eu/project/id/101033740



The overall goal of the BUS-GoCircular project is to address and overcome the challenges in the stimulation of demand for green energy skilled labour, and in building practical capacity to increase the number of skilled labour throughout the value chain. BUS-GoCircular will achieve this goal by developing and implementing a qualification framework of circular construction skills with an emphasis on multifunctional green roofs, facades and interior elements. This overall goal is translated into the following specific objectives:

- Stimulating market demand for circular skills.
- Improving the reputation of the construction sector and attracting women and young people to circular skills.
- Expanding the BUS-GoCircular project at the national and EU levels by developing and implementing a communication and replication strategy.

- Apply successful instructor-training methods and techniques in the included value chain.
- Stimulate demand for sustainable energy skills.
- Stimulate demand complemented with hands-on and practical upskilling of local and regional training capacity and workforce.
- Ensure broad involvement of small and medium enterprises.

HORIZON Europe

AshCycle

Integration of Underutilized Ashes into Material Cycles by Industry-Urban Symbiosis

Duration
Overall budget
Funding scheme
Coordinator
Partners

01.06.2022–31.05.2026 10,311,013.25 € Research and Innovation Actions University of Oulu University of Zagreb Faculty of Civil Engineering; Delft University of Technology; Universiteit Gent; Slovenian National Building and Civil Engineering Institute; Technical University of Denmark; Bioso4 Oy; Oulun Energia Oy; Kiertokaari Oy; Ai4value Oy; Beton Lučko; Gtf-Initiative for Sustainable Growth; Indeloop; Kleener Power Solutions Oy; Resourcefull, Seco Belgium; Orbix Solutions; University of Johannesburg; Veolia Nv-Sa; Cware Aps; Nexe D.d.; Lynnerup Thomas; A/S Ikast Betonvarefabrik; Mineralz Bv; Haitsma Beton Bv; Danske Tegl; Arc I/S Amager Ressource Center; Dok-Ing

Leader at the Faculty

ulty Prof. Nina Štirmer



Web page: https://www.ashcycle.eu/en/



The incineration of biomass, municipal solid waste and sewage sludge produces significant quantities of ashes in the EU: approximately 25 million tons annually. These residues currently have no use or they are utilized only in low-value applications. Significant problems with the use of incineration residues in construction, water treatment, and other industries are insufficient public awareness of the safety and environmental acceptability of the final products, the lack of uniform regulations, and the readiness of the market to accept incineration residues as supplementary material. The project AshCycle will demonstrate and implement industry-urban symbioses revolving around the underutilized ashes to reach a circular and climate-neutral economy in Europe. Pilots and replication demonstrations will be carried out in Denmark, Finland, Belgium, The Netherlands, Croatia, Slovenia, Switzerland, and South Africa. The symbioses will include all major actors from the value chains, namely ash providers, ash beneficiation handlers, concrete and adsorbent product providers, as well as the engagement of the general public. AshCycle answers unmet socio-economic demands, facilitates emerging ash-based circular products for market entry and unlocks benefits for society by accepting new circular concepts.

- To develop a software for ash producers (Ash Modelling Application, AMA) to evaluate the utilization potential
 of different ashes based on their composition and properties, and to predict the ash quality based on online
 measurements of power plants
- To decrease waste generation from incineration processes by avoiding the landfilling of ashes and to decrease
 ~20 Mt/year of CO₂ emissions by developing construction materials from the mineral residue of ashes
- To validate and demonstrate AshCycle technologies and products
- To identify and address the sustainability performance of innovative products and technologies, taking into account their safety and functionality
- To engage and improve knowledge exchange between all relevant stakeholders in the value chain to develop synergies, partnerships, and new business opportunities.

CIRCUIT

Holistic approach to foster CIRCUlar and resilient transport InfrasTructures and support the deployment of Green and Innovation Public Procurement and innovative engineering practices

Duration	01.05.2023-30.04.2027
Overall budget	5,666,556.25 €
Funding scheme	Innovation Actions
Coordinator	Forum of European National Highway Research Laboratories Fehrl
Partners	University of Zagreb Faculty of Civil Engineering; Infra Plan Konzalting; Ingeo Bv;
	Anas Spa; Slovenian National Building and Civil Engineering Institute; European
	Union Road Federation Aisbl; Acciona Construccion Sa; Spanish Institute of Cement
	and its Applications; Beton Lučko; Municipality of Črna Na Koroškem; University
	of Cantabria; Digitaltwin Technology; Ministry of Transport, Mobility, and Urban
	Agenda; Ingevity Holdings; Algorab; Croatian Motorways; Waterschap Hollandse
	Delta; Right-Click
Leader at the Faculty	Prof. Meho Saša Kovačević

Web page: <u>https://www.circuitproject.eu/</u>





The overall objective of CIRCUIT is to develop a holistic approach supported by digital solutions and guidelines to foster the introduction of innovative engineering practices in the whole construction supply/value chain enabling circular, sustainable resilient and smart transport infrastructure and a wider deployment of Green Public and Innovation Procurement. New elements and technologies for Circular, Smart, Resilient and Sustainable transport will be included in the design process to facilitate infrastructures upgrading and a quick adaptation to smart mobility and operations. CIRCUIT will also provide knowledge and technical solutions by exploiting the potential of four strategic pillars: Digitalisation, Recycle, Reuse and Energy. Different technologies will be validated in each of the pillars to deliver a holistic approach suitable for different transport modes, the urban and interurban environment, and the different stages of the life cycle of infrastructures. The Faculty of Civil Engineering of the University of Zagreb will mostly contribute to the Recycle pillar through the sustainable soil improvement technologies.

- Developing and deploying an innovative open-source digital platform (with advanced Circularity analytics and Supply/value chain matchmaking tools) interoperable with traditional engineering/design (BIM, Digital Twin, LCC, LCA) and traffic simulation tools
- Introducing modular solutions, ecodesign and reusing concepts as alternative to traditional designs
- Maximizing the use of biobased, Secondary Raw Materials (SRM) and Secondary Construction Elements (SCE) as alternative to traditional ones
- Including in the decision-making process of transport infrastructures design and route planning, information from updated traffic simulation tools to reduce incidents, accidents, congestion and future scenarios with autonomous vehicles).

ASCCENT Active storage of captured CO2 in net zero construction products

Duration	01.06.2024-31.05.2027
Overall budget	1,252,850.00 €
Funding scheme	Coordination and support action (CSA)
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Katholieke Universiteit Leuven; Aalborg Universitet; Rise Research Institutes of
	Sweden Ab; Holcim Innovation Center Sas
ader at the Faculty	Assoc. Prof. Marijana Serdar

Leader at the Faculty





Carbon capture, utilisation and storage (CCUS) will play a pivotal role in attaining the EU's goals for carbon neutrality by 2050 and mitigating climate change. The construction sector, a major global emitter of carbon, stands to benefit tremendously from CCUS. The EU-funded ASCCENT project aims to support the Faculty of Civil Engineering at the University of Zagreb in enhancing its ability to tackle carbon neutrality for the construction sector. Through twinning with EU leaders Ku Leuven (Belgium), Aalborg University (Denmark), RISE (Sweden) and Holcim Innovation Centre (France) in the field of CCUS in construction products, the University will advance its competence in research and innovation, sustainability assessment of technologies, and funding and partnership building.

PROJECT OUTCOMES

Dedicated activities in three pillars (excellent science, objective validation and innovation investment) will lead to raising research profile and attractiveness of UNIZG-FCE as a partner in key enabling net-zero technologies. With Croatia being one of the countries on the forefront of investment in CO2 capture in the ESEE region, the ASCCENT project will set the scene for utilisation of captured CO2, leading at the same time to savings in underground storage capacity of captured CO2, more sustainable waste management and creation of net zero construction products. Due to the UNIZG FCEs' regional network these results will have a spillover effect on other important stakeholders in the East-Southeast European region.

iNNO SED iNNOvative SEDiment management in the Danube **River** Basin

Overall budget Funding scheme Coordinator

Duration 01.09.2024-31.08.2026 8,765,402.50 € Innovation Actions Budapest University of Technology and Economics Partners University of Natural Resources and Life Sciences Vienna; Global Water Partnership Central and Eastern Europe; University College Cork; Hrvatski Geološki Institut; Geological Survey of Slovenia; University of Zagreb Faculty of Civil Engineering; Orszagos Vizugyi Foigazgatosag; Wwf Hungary; National Research Council Italy; Water Research Institute; Jaroslav Cerni Institute Development of Water Resources; National Research-Development Institute for Marine Geology and Geoecology - Geoecomar; Ferenc Rakoczi li Transcarpathian Hungarian College of Higher Education; Geologicheski Institut Pri Ban St.dimitrov; Lew Wasserkraft; Technical University of Munich; Cesky Hydrometeorologicky Ustav; Galati Lower Danube River Administration; Aqua-Terra Lab Chemical Trading, Manufacturing and Service; State University of Moldova; Viadonau; Center for Social Innovation Leader at the Faculty Assoc. Prof. Gordon Gilja

The Danube River Basin faces significant challenges associated with river sediments. In the 2021 update of the Danube River Basin Management Plan, sediment balance alteration emerged as a new sub-topic within the existing Significant Water Management Issue titled "Hydromorphological alterations". Additionally, sectors like industry, urban sewage, and agriculture call for sediment quality evaluations throughout the Danube River Basin. However, the absence of standard sediment monitoring limits our understanding of risks. iNNO SED will represent a pioneering approach to sediment management in large international river basins, utilising an approach that sets an example for other major global river systems like the Amazon, Mekong, or Niger. In doing so, it aligns with the Mission's objective of intensifying the European Union's competitiveness.

- Introduce a set of innovative methods for monitoring and modelling sediment quantity and quality, thereby deepening our knowledge of sediment processes.
- Provide innovative sediment management practices to improve sediment continuity and quality in DRB sections facing with sediment-related issues.
- Showcase co-created innovative measures through demonstration activities, while also evaluating their socio-economic and environmental aspects.
- Empower the public with innovative knowledge transfer methodologies.
- Collaborate with five Associated Regions, transferring the iNNO SED solutions to other river basins.

LIFE programme 2021–2027

CRO skills RELOAD CRO skills – rebooting the National Platform and Roadmap

Duration	01.11.2022-30.04.2024
Overall budget	370,027.40 €
Funding scheme	LIFE-PJG
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Croatian Green Building Council; Regional Energy Agency North; Association of
	Construction Schools of The Republic of Croatia; Croatian Chamber of Trades and Crafts
Leader at the Faculty	Prof. Ivana Banjad Pečur



Web page: <u>https://croskills-reload.grad.hr/</u>



The analysis of the renovation process carried out in Croatia in recent years shows that the level of energy renovation of the entire building stock needs to be increased, as only 0.7% of the total building stock was renovated annually in the period from 2014 to 2020.

A higher intensity of energy renovation of the building stock would significantly reduce energy consumption and CO2 emissions in the building sector and thus make a positive contribution to Croatia's and the EU's energy and climate targets by 2030.

To achieve these ambitious goals, Croatia needs a workforce trained in new technologies, innovative renovation/ construction methods, building standards (nZEB), the application of new materials and digitalization in construction, as well as other factors influencing the fulfilment and achievement of decarbonization goals in the building sector. The project builds on and extends the outcomes of previous BuildUP skills initiatives and projects to support the development of new skills.

PROJECT OUTCOMES

Outcomes of the CRO skills RELOAD project include the re-launch of the "National Qualification Platform" as well as the development of Status Quo Analyses and a National Roadmap to achieve the national energy and climate targets.

LIFE23-CET-DiVIRTUE

Development of Training Schemes with Application of Virtual Reality towards Implementation of Decarbonized New and Existing Buildings

Duration	01.08.2024-31.07.2027
Overall budget	1,186,604.16 €
Funding scheme	LIFE-PJG
Coordinator	Fondatsiya Tsentar za Energiyna Efektivnost - Eneffect
Partners	Energy Efficiency Center Z.u.; University of Zagreb Faculty of Civil Engineering;
	Association Cluster for Promoting Nearly Zero Energy Buildings Pro Nzeb; Hellenic
	Passive House Institute; Probuzhdenie Eood; Vocational High School of Construction
	And Architecture - Pazardzhik; Czech Technical University in Prague; Ion Mincu
	University of Architecture and Urbanism; National Technical University of Athens
Leader at the Faculty	Assoc. Prof. Bojan Milovanović



Decarbonization of EU economy requires strengthening of the whole value chain performing energy savings and full roll out of renewable energy sources. Low construction capacities can be considered as the weakest point in fast achievement of decarbonization of the building stock. The project aims at creating new construction capacities in 6 countries via digitalization of training schemes for students and construction professionals. This will be achieved via construction skills' trainings developed with application of virtual and augmented reality tools. these training schemes will be created in 7 languages for 15 selected topics based on the training needs dedicated to specific professions (e.g. airtightness or heat pump installations). The trainings will be developed to improve skills of newcomers but also current students and construction professionals. On the top of that, we will provide trainings for the future training developers and teachers to simulate future capacities in VR upskilling.

- Identified gaps and deficiencies in the training programmes used in the partner countries
- Assessed level of deployment of digital learning tools in the training and educational practice and identify potential synergies
- Catalogue of learning outcomes related to ZEB specifics suitable for VR interpretation for EQF levels 3-4 and 5-7
- At least 8 VR lessons covering the key ULOs developed
- Demonstrated to employers, including SMEs and micro-enterprises, public authorities and other key relevant stakeholders the capacity and potential of the training in developing skills and knowledge of students and construction professionals
- Ensured sustainable uptake and roll-out of the VR training materials to educational and training institutions.
Union Civil Protection Mechanism

oVERFLOw

Vulnerability assessment of embankments and bridges exposed to flooding hazards

Duration	01.12.2019–31.07.2022
Overall budget	586,192.01€
Funding scheme	Prevention and preparedness in civil protection and marine pollution
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Infra Plan Konzalting; GEKOM - Geophysical and Ecological Modeling; Safety Region
	South-Holland South; Ingeo Bv; Slovenian National Building and Civil Engineering
	Institute; Uprava RS za Zaščito In Rešavanje, Ministarstvo za Obrambo
Leader at the Faculty	Prof. Meho Saša Kovačević

Web page:

https://civil-protection-humanitarian-aid.ec.europa.eu/funding-evaluations/ financing-civil-protection/prevention-and-preparedness-projects-civil-protection/ overview-past-track-i-and-track-ii-projects/vulnerability-assessmentembankments-and-bridges-exposed-flooding-hazards-overflow_en





An improved method for assessing the vulnerability of embankments and bridges to floods is developed in the scope of the oVERFLOw project. This will be achieved by reducing known uncertainties in the VNK2 approach using techniques and procedures developed by consortium members in recent H2O2O projects (DestinationRAIL, GOSafe, SAFE 10-T), including the application of (i) non-destructive geophysical testing, advanced sensors and drones equipped with multiple cameras, and (ii) calibration of advanced numerical models based on test results, with the development of the so-called 'fragility curves' for embankments and bridges. The project also includes two pilot sites in Croatia and the Netherlands, the aim being to validate new technologies and increase the level of technological readiness of project results (TRL), and to enable validation and exploitation of results by key stakeholders (civil protection agencies, infrastructure managers).

PROJECT OUTCOMES

- Development of advanced technologies for assessing the condition of embankments and bridges based on non-destructive methods (geophysical methods, vibration response) and remote sensing methods (unmanned aerial vehicles).
- Methodology for assessing the vulnerability of embankments and bridges, along with risk forecasting tools, tailored to the needs of key stakeholders and decision-making processes related to the planning and design of measures to improve the safety and resilience of flood protection systems and bridges.
- Increasing the resilience of flood protection and bridge infrastructure to the effects of climate change with the proposal of structural measures to mitigate these impacts.

L2BR Learn to be Resilient

Duration Overall budget Funding scheme Coordinator Partners 15.01.2021–15.06.2022
229,919.46 €
Union Civil Protection Knowledge Network: Network Partnership
Network of National Associations of Local Authorities of South-East Europe
University of Zagreb Faculty of Civil Engineering; Ministry of the Internal Affairs
Republic of Croatia; City Hall of The Municipality of Tirana; Ss. Cyril and Methodius
University in Skopje; Health Facilities Institute for Public Health Podgorica
Assoc. Prof. Josip Atalić

Leader at the Faculty

Web page: <u>https://www.facebook.com/ResilientL2BR/</u>





The overall objective of the project is to strengthen the role of the Union Civil Protection Knowledge Network as an inclusive platform of shared knowledge and expertise, good practices and networking in order to establish common understanding and shared culture of the prevention, preparedness and response in civil protection and disaster risk management activities in the EU and the wider region. The specific objective is to support the civil protection and disaster risk management actors that promote and facilitate the development, dissemination and exchange of knowledge, good practices and expertise with relevant stakeholders. The project will take into account the lessons learned from the recent earthquakes in Albania, and from the Zagreb earthquake crisis management during the COVID-19 pandemics, and will also provide an overview of the new technologies and innovative approaches in the preparedness and response to earthquakes.

PROJECT OUTCOMES

In scope of the project, five documents and tools aimed at improving the prevention, preparedness and response to earthquakes will be created and distributed to all relevant national and international stakeholders in four partner countries. The aim is to improve the exchange of knowledge, good practices, and expertise. Moreover, the project will promote inter-sectorial cooperation through the real time HQ exercise and organization of national and international conferences. The long-term impact of the project results will be achieved through signature of the Memorandum of Understanding containing specific tools and measures to strengthen long-term cooperation and partnership between local, national, and regional entities. A new joint project proposal is also planned, thus supporting new partnerships, and strengthening the basis for future collaboration in the disaster risk management.

CROSScade

Cross-border cascading risk management for critical infrastructure in Sava river Basin

Duration	01.03.2022–29.02.2024
Overall budget	585,905.25 €
Funding scheme	Prevention and Preparedness Projects on Civil Protection and Marine Pollution
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Infra Plan Konzalting; Slovenian National Building and Civil Engineering Institute;
	Hrvatske Vode; University of Ljubljana Faculty of Civil and Geodetic Engineering
Leader at the Faculty	Prof. Meho Saša Kovačević



Web page: <u>https://www.crosscade.eu</u>



CROSScade project focuses on the analysis of cross-border risks between Slovenia and Croatia caused by earthquakes and floods, as well as their possible cascading sequence of events along the Sava River. The two neighbouring countries in the CROSScade are particularly vulnerable to earthquakes and river flooding due to their position in the seismically active area and near the end of major European river systems. The project delivers a cross-border risk assessment methodology and action plans that will increase the structural resilience of critical infrastructure and enhance transboundary communication between critical infrastructure managers and civil protection agencies. The methodology was developed, implemented and validated in the cross-border area of Slovenia and Croatia, stretching from HPP Brežice (Slovenia) to Jankomir bridge (Croatia). Coordinated efficiency of the emergency response services equipped with relevant data, using the new compendium of tools, impacting general population affected by the flood and seismic hazard event is achieved, along with the reduction of risk for rescue teams caused by misjudgement of complex situation causing cascading effects.

PROJECT OUTCOMES

- Developed series of cross-border seismic and flooding hazard scenarios and their possible cascading occurrence
- Developed and implemented BBN-based risk assessment methodology which has basis in the quantified vulnerabilities of critical infrastructure (bridges, levees) to the identified hazards
- Developed two actions plans, one for Critical Infrastructure and one for enhancing the transboundary communication between Critical Infrastructure Managers and Civil Protection Agencies, in order to reduce the cascade event crisis scale up.

CRISAFE

Critical infrastructure early warning system and population awareness for multi hazard cascading events

Duration	01.03.2024–28.02.2026
Overall budget	924,424.36€
Funding scheme	Knowledge for Action in Prevention and Preparedness
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Infra Plan Konzalting; Gdi; City of Zagreb; Hrvatske Vode; Ingeo Bv; Waterschap
	Hollandse Delta; Istituto di Sociologia Internazionale di Gorizia
Leader at the Faculty	Prof. Meho Saša Kovačević



Web page: https://www.crisafe.eu



The CRISAFE project works towards development of a harmonized and quantified risk assessment methodology to assess the vulnerability of urban infrastructure and population to cascading multi-hazard scenarios, which are common for participating. Risk assessment will be based on calculated vulnerability of flash & river flood protection infrastructure in order to detect the weakest link in the flood protection system to multiple hazards (heavy rainfall, flooding, earthquake and liquefaction). This will enable visualization of the scenarios and their implementation in the IT platforms of critical infrastructure managers (CIM) and first responders. By combining these with the sensor network that provides near real-time information on the identified alerts, a cascading multi-hazard Early Warning System, EWS (CHEWS) will be developed. Two case studies are covered, one in the Netherlands (city of Rotterdam) and the other in Croatia (city of Zagreb), where the outputs will be implemented in the IT platforms of relevant CIMs and first responders.

PROJECT OUTCOMES

- Development of a harmonized and quantified risk assessment methodology adapted to urban areas, which takes into account quantified vulnerabilities of flood protection infrastructure to flash floods and earthquakes
- A cascading multi-hazard Early Warning System for flash flood and earthquake hazards will be developed and implemented within the existing asset management systems
- Raising the risk awareness among the population and developing strategies for improving public access to cascading risk information.

The EEA Financial Mechanism and the Norwegian Financial Mechanism

nZEB

Establishment of the national training centre for nearly Zero Energy Buildings (nZEB)

Duration Overall budget Programme Coordinator Partners Leader at the Faculty

01.05.2021–01.05.2024 1,600,000.00 € Energy and Climate Change Energy Institute Hrvoje Požar University of Zagreb Faculty of Civil Engineering Assoc. Prof. Mislav Stepinac



The overall objective of the project is to increase, at the national level, the capacity to implement the newly adopted, yet not utilized, nearly Zero Energy Building standard (nZEB). Addressing poor energy performance of public buildings is at the core of Croatian energy strategies and action plans. Although the newly implemented building standard – nearly zero energy building (nZEB) – has been adopted, the real implementation is still lagging behind. One of the increasingly topical issues in Croatia today is how to efficiently transfer relevant regulations and recently developed methodologies regarding nZEB standards to all key stakeholders. This project will therefore support the key stakeholders in the realisation of all benefits of the nZEB standard. The project will prove that the nZEB approach, although innovative, is an optimum and cost-effective solution for the renovation of public buildings. Project also aims to capitalize on the results of key Norwegian initiatives, developed by the well-known research institution SINTEF, regarding nZEB and zero emission neighbourhoods.

PROJECT OUTCOMES

- Development of the entire documentation needed for achieving nZEB standard while retrofitting the existing public building.
- Deep retrofit of the existing public building based on state-of-the-art technologies, which will be thoroughly documented and monitored by the group of nZEB experts.
- Design of the training programme and project development assistance for nZEB projects at the level of local communities, with the action plan on how to achieve a zero-emission neighbourhood.
- Cooperation with Norwegian scientific institutions and other nZEB initiatives.

CBR

Ecosystem-based strategies for remediation of brownfield sites in coastal area

 Duration
 20.03.2023–20.03.2024

 Overall budget
 99,280.00 €

 Programme
 Bilateral Cooperation

 Coordinator
 University of Zagreb Faculty of Civil Engineering

 Partners
 University of South-Eastern Norway; Municipality of Dugi Rat; Sunce; University of Zagreb Faculty of Science

 Leader at the Faculty
 Prof. Dalibor Carević

Web page: https://cbr.grad.hr/hr/





The project is a collaboration by the University of Zagreb Faculty of Civil Engineering and the University of South-Eastern Norway. The main objective of this project is to strengthen cooperation between Croatian and Norwegian experts in the field of brownfield site remediation in the coastal area. The project aims to develop and share best practices in brownfield remediation with a particular focus on ecosystem solutions. This approach allows for the preservation of marine areas and the potential for green and sustainable tourism in revitalized areas. By involving local self-government in Croatia, the project aims to strengthen local authorities and improve their capacity to collaborate with professionals in order to reduce environmental, economic and social disparities in Europe.

PROJECT OUTCOMES

The main goals of the project were achieved through the activities of joint meetings, technical visits, capacity building workshops and short-term training, translation of national background documents, broadcasting of discussions between leading Croatian and Norwegian experts in the priority area of brownfield remediation and spreading public and local authority awareness through promotional tools and materials. Activities accomplished through the project are: 1) Analysis and summarizing national legislation, recommendations and practices, 2) Technical visit to the former industrial site in the city Nottoden (Norway), 3) Technical visit to the former ferroalloy factory in Dugi Rat (Croatia), 4) Technical visit to the company for processing of contaminated soil NOAH (Norway), 5) Service-learning workshop for brownfield site remediation (Dugi Rat) and 6) Final report – Brownfield Remediation Roadmap.

BLOOM Empowering SMEs in the construction sector for circular economy

Duration04.08.2023-15.04.2024Overall budget68,621.00 €ProgrammeInnovation, Research, Education and CompetitivenessCoordinatorUniversity of Zagreb Faculty of Civil EngineeringPartnersInternational Development NorwayLeader at the FacultyAssoc. Prof. Maja-Marija Nahod

Web page: <u>https://www.linkedin.com/groups/9569030/</u>





The BLOOM project focused on the business growth and resilience of small and medium-sized enterprises (SMEs) in Croatia, particularly in the aftermath of the damage caused by the earthquakes in December 2020. The project aimed to educate entrepreneurs in the construction sector in the affected areas about key aspects of the circular economy, with a special emphasis on agility and sustainability.

BLOOM provided technical and business education, helping entrepreneurs develop business models, strategies for material reuse, and waste management. The project also involved collaboration with Norwegian partners to facilitate the exchange of knowledge and experience. Key activities included training for green enterprises, the development of educational materials, and the creation of a feasibility study on the circular economy and its value for green SMEs. The project successfully strengthened collaboration between Croatian and Norwegian entities and encouraged innovation in sustainable business practices, contributing to a better future for the construction sector in Croatia.

PROJECT OUTCOMES

The project successfully enhanced the capabilities of green SMEs and large enterprises in the construction sector through comprehensive training and the promotion of sustainable practices. Forty-five green SMEs and five large enterprises participated in executive training modules, receiving extensive hours of training, coaching, and mentoring to improve their staff's skills. These sessions were conducted in a hybrid format with the involvement of the construction chamber of commerce. The project also supported knowledge transfer by training Croatian trainers on circular economy and agile approaches, which they then taught to 100 professional experts. This effort introduced best practices from Norway, fostering innovation and sustainability.

To showcase the project's outcomes, a public event was held, and multiple media publications were released. Additionally, information about Green Industry Innovations and the benefits of sustainability for construction SMEs was distributed to stakeholders, further promoting sustainable development and innovation in the sector.

ERASMUS+ 2014-2020

BIMzeED Education for zero energy Buildings using Building

Information Modelling

Duration	01.11.2018-30.04.2022
Overall budget	955,633.00 €
Key action	KA2: Cooperation for innovation and the exchange of good practices
Coordinator	Technological University of the Shannon
Partners	University of Zagreb Faculty of Civil Engineering; Centre Cim Fundacio Privada;
	Conseil des Architectes d'Europe; Emi Construction Quality Control Innovation
	Nonprofit; Catalonia Institute of Construction Technology; Obuda University; North-
	West Croatia Regional Energy Agency; Tipperary Energy Agency Limited
Leader at the Faculty	Assoc. Prof. Bojan Milovanović



Web page: https://bimzeed.eu/



The BIMzeED project is aimed at defining the training that the construction industry currently needs, as well as the training that needs to be encouraged In the future: 1) better employment opportunities, 2) low-carbon development, 3) green skills and near-zero energy building (nZEB) skills, 4) increasing youth employment. The challenge of the BIMzeED project is to overcome skills mismatches and improve employment opportunities in the current European construction market by improving the existing skills of trainers, SMEs, construction site managers, craftsmen and other construction workers.

PROJECT OUTCOMES

Twelve to sixteen learning units will be established and developed as part of the BIMzeED project in order to increase the understanding of BIM tools and nZEB within the existing curricula in the construction sector. BIMzeED will train 120 trainers at European universities and vocational schools through a series of trainings sessions using innovative and new educational materials. BIMzeED plans to educate 400 to 500 students, construction site managers, craftsmen and other participants in construction projects to improve their employment opportunities.

CSETIR Construction Safety with Education and Training using Immersive Reality

Duration	01.09.2019–31.08.2022
Overall budget	368,245.00 €
Key action	KA2: Cooperation for innovation and the exchange of good practices
Coordinator	Technical University of Košice
Partners	University of Zagreb Faculty of Civil Engineering; University of Porto; Aristotle
	University of Thessaloniki; Kamgrad
Leader at the Faculty	Prof. Ivica Završki



Construction Safety with Education and Training using Immersive Reality

Web page: <u>https://csetir.civil.auth.gr</u>



The aim of the project is to create a European network for adult learning that will train isolated groups of people about safety on construction sites. Such education will increase employment opportunities and reduce potential accidents at work in construction industry. The objective is to develop a learning system based on knowledge acquired through work and test a modern way of organized learning so that adults can develop their skills. Furthermore, upon completion of the project, construction companies will be able to use the developed platform to train their newly hired employees, with the aim of helping them adapt to the new work environment. The results of the project will enable students and young professionals of related professions to receive proper training for working on construction sites.

PROJECT OUTCOMES

- review of existing knowledge in the field of education, virtual reality, and work safety.
- BIM models of buildings at different phases of construction serving as basis for forming a virtual reality platform for education in the field of occupational safety.
- an innovative virtual reality platform for adult education in the field of occupational safety, which is available and feasible on all platforms (mobile phones, personal computers, virtual reality systems, etc.).
- methodology and a manual for non-formal education of adults in construction or related professions, enabling them to work safely on construction sites.
- online platform through which all project outcomes will be available upon completion of the project (YouTube channel, social platforms, 3D models, virtual reality education platform, and an accompanying education manual).

CALOHEE Phase 2

Measuring and Comparing Achievements of Learning Outcomes in Higher Education

Duration	01.01.2020-31.12.2021
Overall budget	500,000.00 €
Key action	KA3: Support for policy reform
Coordinator	University of Groningen – International Tuning Academy
Partners	(Civil Engineering) University of Zagreb Faculty of Civil Engineering; University of
	Porto; South East Technological University, Ireland; Middle East Technical University,
	Turkey; Universite De Montpellier; Aristotle University of Thessaloniki; University of
	Salerno
Leader at the Faculty	Prof. Ivica Završki



Web page: <u>https://www.calohee.eu</u>



Transnational Comparative Assessments in European Higher Education

CIVIL ENGINEERING

Measuring and Comparing Achievements of Learning Outcomes in Higher Education in Europe 2023

PROJECT DESCRIPTION

The Measuring and Comparing Achievements of Learning Outcomes in Higher Education In Europe (CALOHEE) II project is a follow-up of the CALOHEE project (2016-2018). That project resulted in highly innovative outcomes; that is European Qualifications Reference Frameworks and Assessment Reference Frameworks for five key subject areas, representing as many HE sectors. These Frameworks offer a serious contribution to rethink the internal and external quality assurance policies at European level. CALOHEE offers detailed reference to allow for defining what a relevant and high quality degree programme should entail. Based on a merger of the EQF for LLL and the QF for the EHEA it gives clear indicators for three succeeding levels of learning for both the first and the second cycle. It is therefore unique in its kind and highly innovative. The frameworks have been endorsed by all main stakeholders.

PROJECT OUTCOMES

The main outcomes of this project will be:

- Matching of representative degree programmes against the CALOHEE frameworks, resulting in an inventory of strength and weaknesses, which will offer evidence to fill gaps in learning and teaching to meet the needs of society in local, national and European settings;
- Matching of present quality assurance procedures and the CALOHEE frameworks, which offer way forward to strengthen the reliability of internal and external quality instruments at local, national and international level.

Building on the CALOHEE frameworks, a sophisticated and innovative bank of selected test items will offer insight and detail of the learning graduates are expected to have obtained to operate successfully in society, both in the workplace and as active citizen.

SkilledFireExpert Skilled to be a Fire Expert

Duration	01.10.2020–31.10.2022
Overall budget	171,135.00 €
Key action	KA2: Cooperation for innovation and the exchange of good practices
Coordinator	University of Ljubljana
Partners	University of Zagreb Faculty of Civil Engineering; Slovenian Fire Protection
	Association; VSB – Technical University of Ostrava; Majaczech, Z.S.; Inspekting
Leader at the Faculty	Assoc. Prof. Marija Jelčić Rukavina



Web page: https://www.skilledfe.eu/



The analysis of major fires (e.g., Grenfell Tower, Notre Dame Cathedral fire, etc.) that have caused human casualties and enormous economic, environmental, and cultural damage shows that regulators and industry are ill prepared to respond to new threats. There is insufficient sharing of knowledge about the impact of new products and services on building safety in a fire event. Experts involved in fire safety include architects, civil, mechanical, electrical, and other engineers taking part in building design, construction and maintenance, working in fire departments, etc. The access to information indispensable to this large community of experts is enabled by lecturers at universities, fire protection associations and other stakeholders involved in the transfer of knowledge about fire protection.

PROJECT OUTCOMES

An online platform for trainers in the field of building safety in the event of fire (Online Learning Platform for Fire Expert Trainers), based on the latest knowledge in this field, will be developed in the scope of this project.

ERASMUS+ 2021-2027

GREENCO Education for GREEN transformation of COnstruction sector

Duration	01.09.2023-31.08.2026
Overall budget	1,040,020.00 €
Key action	KA2: Partnerships for cooperation and exchanges of practices
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Center for Erhvervsrettede Uddannelser Lolland Falster; Construction Technical
	School; Holcim Innovation Center Sas; Odraz-Odrzivi Razvoj Zajednice; Technical
	University of Denmark; Ove Arup & Partners International Limited; Spegra; Institute
	for Materials Testing; Arup International Projects Limited
Leader at the Faculty	Assoc. Prof. Marijana Serdar

Web page: <u>https://www.greenco.grad.hr</u>





The main goal of the project is to implement a comprehensive set of cross-sectoral activities and tackle the mismatch between the current education curricula and market demand regarding digital and green skills in the construction sector in order to speed up its green transformation. Project is based on the following activities: 1) for the sensibilization of vocational level students about the importance of green building and sustainable development of construction sector, handbooks will be made as well as workshops on environmental reporting, training critical number of teaching professionals in vocational schools; 2) for the in-depth education of master level students a new curricula "Green building" will be implemented, in addition to dedicated workshops and training in software use to perform quantitative environmental calculation; 3) to enhance the innovation management skills and to increase the possibility for future green business creation in the sector for the PhD level students will be organized workshops, bootcamps and summer schools; 4) to simulate the decision making within a company, a learning construction ecosystem will be created, with short-term industrial missions of students to hosting industrial partners and with two major service-learning event will be held with all three educational levels participating and jointly working under industrial mentoring on a sustainable solution for a local challenge present in their immediate environment.

PROJECT OUTCOMES

Through tailor-made activities planned within GREENCO project, each targeted occupational/education level group will be trained for their active role as co-creators in green transformation of the construction sector, securely paving the way towards industrial climate neutrality by 2050, but also serving as a blueprint for possible future educational – entrepreneurial partnership, designed for answering societal and environmental challenges.

EIT Manufacturing

CIRCLEAR Sustainable and circular manufacturing of a new generation of barrier for air and noise pollution mitigation

Duration	01.06.2024-31.05.2025
Overall budget	857,915.00 €
Programme	Innovation
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Aalto University; Is Clean Air Italia; Beton-Lučko; Innorec
Leader at the Faculty	Assoc. Prof. Ivo Haladin

Web page: https://www.circlear.grad.hr/



The main goal of CIRCLEAR project is to develop a unique sustainable and circular economy-oriented product that embeds noise and air pollution reduction properties, that is easier to deploy and that at the end of its life can be reused for at least 90% of the components.

Objectives:

- Integrate industrialised product RUCONBAR Noise Barrier and Air Pollution Abatement technology APA (simultaneously are capable of reducing air pollution and noise)
- Redesign the manufacturing process of RUCONBAR barriers to achieve more sustainable manufacturing. This will involve changing the format of the panels accelerating the production process and reducing energy consumption
- Enhance production line, to enable integration of the two abatement solutions, keeping sustainable and circular economy compliance
- Optimize production process of integrated solution to reduce carbon intense material use (increasing percentage of recycled rubber and reducing amount of steel)
- Testing activities to provide the necessary information and documentation for the certification requirements.

PROJECT OUTCOMES

Results of CIRCLEAR project include:

- A unique market-ready solution for noise and air pollution abatement with tested and demonstrated capabilities
- Enhanced production capacity in 2 RIS countries by optimizing production process and thus minimizing energy consumption and materials use.

The air purification and noise abatement solutions planned for delivery in CIRCLEAR will revolutionise the way sensitive outdoor environments, such as heavy traffic roads, industrial sites and polluting construction sites, can mitigate the main environmental impacts they face (air and noise pollution) using a single, efficient, and sustainable solution.

Other projects

UIC Harmotrack project (Harmonisation of track quality description and assessment)

Duration
Source of funding
Project coordinator
Partners

ion 01.01.2020–28.03.2024
ing European Regional Development Fund
ttor UIC – International Union for Railways
ers Austrian Federal Railways – ÖBB (Austria), Bane NOR (Norway), Camrail (Cameroon), Department of Transportation – DOTr (Republic of Philippines), Ethiopian Railway
Corporation – ERC (Ethiopia), Hungarian State Railways (MÁV Magyar Államvasutak Zrt. – MÁV Zrt.) (Hungary), Research Design and Standards Organisation – RDSO (India), Sydney Trains (Australia), Infraestruturas de Portugal (Portugal), SNCF (France), African Railway Centre of Excellence (Ethiopia), Bern University of Applied Sciences (Switzerland), Central Queensland University (Australia), University College Dublin (Ireland), University of Birmingham (United Kingdom), University of Novi Sad (Serbia), University of Pretoria (South Africa), University of Zagreb (Croatia)
ulty Assoc. Prof. Ivo Haladin

Leader at the Faculty

Web page:

uic.org/com/enews/nr/698/article/uic-harmotrack-project-a-worldwide-project-bringing-togethercompanies-across?page=modal_enews



Railway track condition management is mainly based on the analysis of track geometry parameters. Track condition data are often collected by dedicated inspection vehicles, and track maintenance procedures are based on meeting certain limit values of required parameters based on historical experience. In recent years, measuring the acceleration of track elements has proven to be a useful tool for obtaining interesting information about the condition of the track. The use of accelerometers offers undeniable advantages, such as the reduced cost and easier portability of measuring devices, but their implementation in maintenance processes is not trivial. The measured accelerations depend on various factors that must be controlled to define the limit values on which maintenance is based. The Harmotrack project brings together global international experts to tackle current and future challenges with regard to dynamic measurements. The main objectives of the project are the adoption of international measures for implementation of the state-of-the-art measurement techniques for determining dynamic responses of the track (acceleration and force) to monitor its quality; determination of specifications for optical measuring devices; definition of reliable track quality indicators based on acceleration for improved network maintenance; contribution to better safety and cost reduction on all networks due to corrections of track geometry, with an emphasis on those parts with the most dangerous impact on vehicle dynamics; recommendation of limit values for accelerations in future international standards.

PROJECT OUTCOMES

- Machine learning models for evaluation of track geometry based on accelerations.
- Guidelines for implementation of the state-of-the-art measurement techniques for determination of dynamic responses of the track.
- Application of low-cost (mobile) devices for the interpretation of dynamic track properties.

CONGREGATE

Consumer Engagement in building renovation and renewable energy cooperatives for grassroot climate action

Duration	01.11.2020–31.03.2023
Overall budget	974,106.00 €
Programme	European Climate Initiative
Coordinator	Fondatsiya Tsentar za Energiyna Efektivnost
Partners	University of Zagreb Faculty of Civil Engineering; Association Cluster for Promoting
	Nearly Zero Energy Buildings Pro Nzeb; Center for The Study of Democracy; Inzeb;
	Seven – The Energy Efficiency Center Z.Ú.
Leader at the Faculty	Assoc. Prof. Bojan Milovanović

Web page: https://www.euki.de/en/euki-projects/congregate/





The CONGREGATE project is funded by the European Climate Initiative ("EUKI") 2020, and by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). In Croatia, the project involves monitoring and analysis of the way in which current energy renovation programs affect the energy and financial savings of tenants, as well as their behaviour and attitudes. The results of this study will be used in future national campaigns for civic engagement in building energy renovation programs.

PROJECT OUTCOMES

- The CONGREGATE project includes monitoring thee energy consumption of apartment buildings in the energyrenovated and non-renovated buildings for a period of one year.
- In addition to monitoring the energy consumption in each building on the example of one apartment, thermal comfort as well as air quality will be monitored.
- Upon completion of the project, the results of the research will be available to all interested representatives of co-owners as well as building managers
i-LINK Robotics and automation for NDT inspection of heritage structures

Duration Overall budget Programme Coordinator Partners Leader at the Faculty

01.09.2022–01.09.2024 18,759.12 € CSIC i-LINK 2024 Spanish National Research Council University of Zagreb Faculty of Civil Engineering Assoc. Prof. Mislav Stepinac



The project aims to reflect on the role that robotics and automation can assume in the context of heritage assessment and conservation. The success of any retrofit or repair intervention ultimately depends on having a proper understanding of the structure. The project proposes three specific objectives:

(i) to promote exchanges and collaboration among researchers of different disciplines and countries from leading research institutions from their regions;

(ii) to identify different solutions that, by integrating information technologies (IT) and robotics (namely automation, robotic, digitization and AI), can improve our current capabilities to carry out structural inspection and diagnosis of heritage buildings; and

(iii) based on the solutions identified, to develop one prototype that is able to show the potential of using automation and robotics for the inspection of heritage structures and to apply such system on one case study.

MeDeAH

Application of Mechatronics and Deep learning for Acoustic Tomography of the Architectural Heritage to improve structural diagnosis

Duration Overall budget Programme Coordinator Partners Leader at the Faculty 01.10.2023–01.01.2025 121,250.00 € AEI Proyectos Generación de Conocimiento 2022 Spanish National Research Council University of Zagreb Faculty of Civil Engineering Assoc. Prof. Mislav Stepinac





The application of mechatronics and Deep Learning (DL) to enhance the inspection capabilities of tomographic imaging for the structural diagnosis of architectural heritage requires the adoption of a collaborative multidisciplinary approach, which means the inclusion of specialists in disciplines such as architecture, heritage preservation, construction, topography, physics, non-destructive evaluation, electronics, automation, robotics, civil engineering, telecommunications engineering, signal and image processing, AI, etc. The overall objective of the project is to establish a methodology based on the use of DL algorithms to process tomographic images obtained from robotic inspections in order to optimize the interpretation of the data and extract valuable information from the interior of the walls of architectural heritage. This information should serve to improve the structural diagnosis of these heritage elements.

Croatian Science Foundation

VETROLIGNUM

Prototype of multipurpose timber – structural glass composite panel

Duration C Overall budget 9 Programme R Coordinator L Leader at the Faculty P

01.03.2017 – 29.02.2020 98,983.00 € Research Projects University of Zagreb Faculty of Civil Engineering Prof. Vlatka Rajčić



Web page: <u>https://www.grad.unizg.hr/vetrolignum</u>



The load-bearing glass in combination with a wooden frame is a composite system that exhibits good behaviour during earthquakes, is at the same time energy-efficient and cost-effective, aesthetically acceptable, and has good load-bearing characteristics. Several studies of wood - glass composite systems have recently been conducted in monotonous and cyclic tests, which are necessary for composites to be applicable in seismically active zones. The project examined not only the load-bearing properties of the panel but also the energy efficiency of the entire system.

PROJECT OUTCOMES

- Development and new knowledge about the joints of CLT structures with glued bars
- Development of a wood-load-bearing hybrid panel in terms of energy efficiency
- Development of a wood-load-bearing hybrid panel in terms of seismic resistance
- Development of details and joints in wooden structures
- Construction of a demonstration facility

TAREC²

Transformation of Wood Biomass Ash into Resilient Construction Composites

Duration Overall budget Programme Coordinator Leader at the Faculty 01.03.2017 – 28.02.2021 125,141.00 € Research Projects University of Zagreb Faculty of Civil Engineering Prof. Nina Štirmer







Morphology of bottom ash particles

Project workshop

Solid and gaseous biomass fuelled power plants are the biggest source of renewable energy in the EU. Burning of one tonne of forest biomass and wood waste typically generates 5 MWh of energy as well as 20 – 50 kg/t of the bottom ash and fly ash. Currently, 70% of the wood biomass ash (WBA) is landfilled, 20% tends to be used as a soil supplement in agriculture, and 10% is used in miscellaneous applications. The project assessed the quantities and properties of WBA available in the Republic of Croatia and, based on experimental research, identified the possibilities of using WBA in the concrete industry.

PROJECT OUTCOMES

- Detailed characterization of available WBA; considering the combustion technology, types and hydrodynamics of the furnace and tree species.
- Development of novel supplementary cementitious materials.
- Development of a novel mineral admixture.
- Development of novel construction composites by combining WBA, cement or other SCMs.
- Realisation of a mini-demonstration project using the developed composites.

ACT Advanced low CO2 cementitious materials

Duration Overall budget Programme Coordinator Partners Leader at the Faculty

01.04.2019–31.03.2023 352,391.27 € Croatian-Swiss Research Programme 2017-2023 University of Zagreb Faculty of Civil Engineering École Polytechnique Fédérale de Lausanne Assoc. Prof. Marijana Serdar



Web page: https://www.grad.hr/latom/index.php/hr/napredni-cementni-materijali-s-niskim-udjelom-co2-act/



The aim of the project is to optimize the composition of cement and concrete based on partial replacement of cement clinker with locally available waste materials and industrial by-products. This creates a double benefit, i.e., CO₂ emissions from the production of ordinary cement clinker are reduced, and the use is made of material that would otherwise be disposed of in landfills. The project focuses on two different aspects of sustainable concrete development researched by two PhD students. On the one hand, it is studied how to achieve minimal impact on the environment in the production of concrete of wide application (strength in the range of 20 to 40 MPa) without special durability requirements. On the other hand, the subject of the analysis is the high-performance concrete for use in buildings exposed to aggressive environments, such as maritime conditions.

PROJECT OUTCOMES

International cooperation will lead to the development of two doctorates, and the project and joint mentoring will strengthen the cooperation between the Faculty of Civil Engineering and EPFL. Joint mentoring is based on the transfer of knowledge between the two institutions implementing the project: on the one hand, basic knowledge of hydration and microstructure of cement materials provided by EPFL and, on the other, knowledge of designing the composition and durability of concrete elements provided by the Faculty of Civil Engineering. Through the dissemination activities envisaged in the scope of the project, the knowledge gathered from Switzerland will be transferred to the entire region, multiplying the benefits of the project.

BEACHEX

Sustainable construction of nourished beaches — Construction of new ones and increasing the capacity of existing ones

Duration	01.11.2019–04.03.2020
Overall budget	273,125.40 €
Programme	International cooperation
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Lancaster University-Lancaster Environment Centre; Zagreb University of Applied
	Sciences; University of Rijeka Faculty of Civil Engineering; University of Zagreb
	Faculty of Science; Natural History Museum Rijeka; Development Agency of
	Primorje-Gorski Kotar County
ader at the Faculty	Prof. Dalibor Carević

Lea

Web page: https://grad.hr/beachex/





Croatian beaches are under pressure to expand capacity for tourists while being at risk for erosion due to an increase in storm intensity caused by climate change. Croatia's beach management strategy aims to efficiently manage coastal resources but only with basic measures, which is why additional technical support is needed. That is the aim of the Beachex Project – to provide technical support for the long-term natural and artificial beach management while minimizing ecological risks.

PROJECT OUTCOMES

There are multiple project results: a database containing information on the beaches that were nourished or expanded. Extensive fieldwork will provide insight into morphological processes on nourished beaches in the Adriatic wave climate while also developing a tool for technical calculations (SHINGLE model). The environmental impact will also be assessed through five distinct diving missions aimed at assessing the state of biotic community near regularly nourished beaches. Following implementation of numerical models, technical measures will be provided for the reduction of material loss in beach nourishment while minimizing the impacts of climate change.

BRAVOBRICK

Use of treated oily wastewater and sewage sludge in brick industry – production of innovative brick products in the scope of circular economy

Duration	01.12.2019–15.02.2024
Overall budget	195,786.05 €
Programme	Research Projects
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Ruđer Bošković Institute; Imperial College London; University North; Indeloop
Leader at the Faculty	Prof. Dražen Vouk



The possibility of bringing the electrochemical technology of oily wastewater treatment to the level of quality that will enable efficient application in brick production will be analysed. New brick products with integrated treated water will have the same characteristics as conventional brick products. In addition, optimum conditions for thermal treatment of sewage sludge will be examined in order to obtain dried sludge best suited for brick production. In addition to obtaining sludge/ash with favourable characteristics, it will be possible to integrate significant amounts of sludge/ash as a substitute for clay and / or sand in brick production. New brick products with integrated sludge/ash will have the same characteristics as conventional brick products.

PROJECT OUTCOMES

- Determining the possibility of reusing the treated oily wastewater and sewage sludge in the production
 of innovative construction products in brick industry, which would significantly reduce environmental
 pressures, and contribute to the development of circular economy, while also increasing the competitiveness
 of brick products in the market.
- Determining optimum conditions for thermal treatment of sewage sludge as related to the quality of the obtained dried sludge and ash suitable for use in brick production.
- Increasing the level of sustainable waste management in Croatia.
- Increasing the level of sustainable sludge management in Croatia.
- Reducing total costs of sludge management.

REAL-fit Reliable design methods for aluminium structures fit for the future requirements

Duration	18.12.2023–17.12.2027
Overall budget	155,683.85 €
Programme	Research Projects
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	University of Zagreb Faculty of Mechanical Engineering And Naval Architecture
	University of Josip Juraj Strossmayer in Osijek Faculty of Civil Engineering and
	Architecture Osijek
Leader at the Faculty	Prof. Davor Skejić



Web page: <u>https://real-fit.grad.hr/</u>

O1 Project management establishment of an interdisciplinary research group, procurement of materials, O6 Development and equipment and laboratory overall evaluation of a O2 Evaluation of welding specimens new generation of parameter effects and design procedures for development of an the optimal design of optimised fabrication aluminium frame process for welded structural systems aluminium structural members and joints **REAL**-f O3 Creation of a statistically evaluated **O5** Probabilistic database of aluminium evaluation and alloys structural characterisation of the properties with an structural behaviour O4 Probabilistic evaluation emphasis on the revision of beam-to-column and characterisation of the of reduction factors joints primarily structural behaviour of normative values due to exposed to bending longitudinally welded welding aluminium members primarily exposed to compressive force

PROJECT DESCRIPTION

Conservative reductions of aluminium mechanical properties have the effect of avoiding the use of welded aluminium members in load-bearing structures. The REAL-fit project proposes comprehensive interdisciplinary research on the possibility of applying innovative robotic production technologies and reliable design methods for aluminium welded members, joints, and structural systems. Besides experimental, numerical and probabilistic methods, the challenges of the application of aluminium alloys in construction will be solved with a holistic approach that integrates the advanced Direct Design Method of structural design with the methods of life-cycle assessment and life-cycle cost analysis.

PROJECT OUTCOMES

- Development of an optimised fabrication process for welded aluminium structural members and joints.
- Creation of a statistically evaluated database of aluminium alloys structural properties for welded and nonwelded materials.
- Probabilistic evaluation of the structural behaviour of longitudinally welded aluminium members and welded beam-to-column joints.
- Development and overall evaluation of a new generation of design procedures for the optimal design of aluminium frame structural systems.

ECO-WOOD Structures Fully sustainable structural timber elements without adhesives and metal

Duration20.12Overall budget198,5ProgrammeResectCoordinatorUniveLeader at the FacultyProf. \

connectors

20.12.2023–19.12.2027 198,951.49 € Research projects University of Zagreb Faculty of Civil Engineering Prof. Vlatka Rajčić



Web page: https://www.linkedin.com/in/eco-wood-structures/

This research investigates the use of hardwood, densified, and welded wood dowels as sustainable alternatives to petroleum-based adhesives and metal fasteners in engineered wood products, specifically laminated elements. The study aims to enhance the mechanical properties, load-bearing capacity, serviceability, stability, and fire resistance of these materials. By addressing the environmental and economic challenges associated with traditional adhesives, this project contributes to the decarbonization of the construction sector, aligning with EU commitments to reduce greenhouse gas emissions. The findings will facilitate the production of recyclable, eco-friendly structural elements within the domestic wood industry, promoting sustainable building practices.

PROJECT OUTCOMES

This research will perform a life cycle analysis (LCA) to quantify the potential benefits of structural wood within a circular economy. It seeks to advance knowledge on the mechanical characteristics, load-bearing capacity, and fire resistance of wood elements connected by hardwood dowels, areas that have been insufficiently explored, particularly for linear and plate systems. The study will analyse the impact of dowel arrangement, botanical hardwood species, and dowel installation angles on these properties. Additionally, finite element models will be developed to validate experimental findings, enabling comprehensive parametric analyses. The research will also pioneer the use of densified hardwood species, such as acacia and chestnut, in structural applications, areas previously limited to furniture production. The project aims to generate at least five high-impact scientific publications and provide guidelines for practical applications, thereby supporting the wood industry's transition to sustainable, high-performance structural products.

LeeveLiq

Mapping the spatial variability of the liquefaction potential below levees and modeling of optimal mitigation techniques

Duration31.12.2023–30.12.2027Overall budget145,230.12 €ProgrammeResearch ProjectsCoordinatorUniversity of Zagreb Faculty of Civil EngineeringPartnersDelft University of Technology; Croatian Geological SurveyLeader at the FacultyAssoc. Prof. Mario Bačić



Web page: https://leveeliq.eu/



Liquefaction, as a phenomenon which turns a soil into a dense liquid during an earthquake, losing its strength and stiffness, is responsible for numerous damages to infrastructure. An illustrative example is the earthquake that struck the Sisak-Moslavina County in 2020, where excessive deformations and failures of series of levees occurred, causing a justified concern of infrastructure managers about the possible cascading floods. The LeveeLiq project develops an innovative methodology for reliable mapping of liquefaction potential spatial variability, which relies on in-situ data measured by multiple sensors. This data will be used to develop an algorithm for the evaluation of liquefaction spatial variability, which will be integrated into a digital interface. Furthermore, based on information on LP variability, mitigation measures will be optimized in the project through utilization of complex 3D numerical simulations calibrated on the results of physical laboratory models' monitoring. The methodology will be validated in the pilot area, along with the development of a handbook with guidelines for its implementation in the existing flood defence management framework.

PROJECT OUTCOMES

- Methodology that will enable rapid and reliable mapping of the spatial variability of the liquefaction potential under linear levees, which would overcome the uncertainties associated with the inherent variability of the foundation soil
- Calibration of advanced numerical models based on the results of laboratory physical models
- Optimization of mitigation measures in response to liquefaction hazard, which are based on the identified spatial distribution of liquefaction potential
- Guidelines for infrastructure managers on mapping the liquefaction hazard along the levee network.

ABC

Alternative binders for concrete: understanding microstructure to predict durability

Duration Overall budget Programme Coordinator Leader at the Faculty 01.04.2019–04.03.2020 358,027.74 € Installation Research Projects University of Zagreb Faculty of Civil Engineering Assoc. Prof. Marijana Serdar

Web page:

https://www.grad.hr/latom/index.php/hr/alternativna-veza-zabeton-razumijevanje-mikrostrukture-za-predvidanje-trajnosti/





Alternative concrete binders are a new generation of construction materials based on industrial waste that are a sustainable and economical alternative to traditional Portland cement. In order to achieve an almost full replacement of cement, it is of the utmost importance to use more thorough approaches to the research of alternative binders, enabling the understanding of materials at multiple levels (nano-micro-macro). The objectives of the project are to establish a research group as a centre of excellence for the research, understanding and correlation of the microstructure and durability of alternative binders for concrete, to realise training in an independent use of advanced analytical instrumental methods provided by a regional network of instrumentation, and to realise training via international centres of knowledge and excellence in a specific research area.

PROJECT OUTCOMES

The ABC project will result in the formation of a research team that will have, thanks to the knowledge gained from education and research on research infrastructure, a broad understanding of alternative concrete binders made from waste materials and by-products found in the region. Also, the resulting alternative binders will be exposed to various exposure classes to enable full understanding of microstructural changes that occur in aggressive environments. Finally, the service life, cost, and environmental footprint of Portland cement and alternative binders will be compared, and the knowledge gained will be used for testing new materials through other sources of funding.

R3PEAT Real-time remote monitoring of riprap erosion on major rivers

Duration13.12.2019–12.12.2024Overall budget260,358.35 €ProgrammeInstallation Research ProjectsCoordinatorUniversity of Zagreb Faculty of Civil Engineering
PartnersPartnersUniversity of Zagreb Faculty of GeodesyLeader at the FacultyAssoc. Prof. Gordon Gilja

RBPEAT

Web page: https://www.grad.hr/r3peat/



The R3PEAT project (Remote Real-time Riprap Protection Erosion Assessment on large rivers) aims to bridge the gap between scour monitoring next to the riprap scour countermeasures installed around the bridge pier through development of the remote monitoring system ScourBuoy, enabling scour development monitoring in real-time. The research is conducted through field campaigns and a hybrid modelling approach – combination of experiments using a scaled model (phase 1) and numerical simulations (phase II). Research group consists of 7 members: four researchers from the Faculty of Civil Engineering, one researcher from the Faculty of Geodesy, PhD and Postdoc recruits, and external associates.

PROJECT OUTCOMES

Key results of the research are the development of innovative methods and technologies for scour monitoring, and the development of a scour estimation methodology based on the hydraulic environment data, thus enabling bridge hazard assessment for various flood scenarios.

ARES

Assessment of the condition and renovation of existing buildings – Development of modern methods for masonry and wooden structures

Duration Overall budget Programme Coordinator Leader at the Faculty 09.01.2020–08.01.2025 180,913.63 € Installation Research Projects University of Zagreb Faculty of Civil Engineering Assoc. Prof. Mislav Stepinac



Web page: https://www.grad.hr/ares/



The aim of this research project is to study the role of assessment in the reliability analysis of existing structures. The project focuses on the existing masonry and timber structures and aims to evaluate the benefits of assessment with regard to the economy and safety of structures. In addition to establishment of a strong research group and application to other sources of funding, the main objectives of the project proposal are: to develop concise databases of structures and assessment techniques, to get an insight into material and structural properties obtained by assessments and structural analyses, to produce probabilistic database of material properties for masonry and timber structures, to quantify material properties and time-dependent material behaviour for structural analysis of existing structures, to optimize models for the prediction of structural performance, and to evaluate proportionality and reliability for development of design guidelines.

PROJECT OUTCOMES

The project aims to deliver the basis for an advanced assessment and design of existing structures, allowing a more economical design and a more accurate analysis of the consequences of failure. Also, methods for updating the assessment and verification of structures will be developed, and due consideration will be given to the time-dependent behaviour and the influence of environmental conditions. Design guidelines for the advanced assessment and rehabilitation of existing structures and for the integration of updating methods in the process of verification of the reliability of existing structures, will be the main benefit of the project. This knowledge will assist in achieving long-term objectives of code-writers and designers in continuous improvement of design codes.

Web page: <u>https://www.grad.hr/ares/index.php/scientific-papers/</u>

LWT-FLOOR

Innovative lightweight coldformed steel-concrete composite floor system

 Duration
 11.01.2021−10.01.2026

 Overall budget
 222,217.80 €

 Programme
 Installation Research Projects

 Coordinator
 University of Zagreb Faculty of Civil Engineering

 Partners
 Politehnic University of Timisoara; Ivicom Consulting Llc; Zagreb University of Applied Sciences

 Leader at the Faculty
 Assoc. Prof. Ivan Lukačević

EVERT-FLOOR RESEARCH PROJECT

Web page: <u>https://www.grad.unizg.hr/lwtfloor</u>



The LWT-FLOOR project integrates state-of-the-art knowledge in new, fast and productive spot-welding technology and innovative cold-formed steel-concrete composite solutions, proposing a new construction method as a combination of built-up cold-formed steel members and cast-in-place concrete slab. This lightweight floor system offers vital benefits in terms of a high degree of prefabrication, reusability, and long spanning capability. The extensive experimental, numerical, and probabilistic research is planned within the project. Probabilistic analyses and life cycle performance evaluation of the proposed floor system solution will be crucial for establishing the first analytical proposal for design recommendations of this new system within the European standards.

PROJECT OUTCOMES

- Research group equipped with knowledge and instrumentation.
- Technical report with test results on materials, optimal solutions for welded and shear connections.
- Technical report with test results and optimal solution for steel built-up cold-formed elements with or without web openings.
- Technical report with results for the proposed floor system.
- Report with validation of FEM models for different floor system typologies and results of numerical, probabilistic, and life cycle studies of specimens with larger spans.
- Technical recommendations for design and fabrication will be proposed.
- Research group as a centre of expertise self-sustained through other national and international funding sources.

PRIMEUS

Purification of Microbiologically and Chemically Contaminated Drinking Water by Electrochemical and Ultrasonic Processes

Duration Overall budget Programme Coordinator Leader at the Faculty 11.01.2021–10.01.2026
250,451.79 €
Installation Research Projects
University of Zagreb Faculty of Civil Engineering
Assoc. Prof. Ivan Halkijević



Web page: https://primeus.grad.hr/



The purpose of the project is to determine the efficiency of electrocoagulation and ultrasound, as advanced oxidation methods for the removal of microbiological contamination and heavy metals in the water purification process. The goal is to develop a small continuous flow device for water purification which will, based on the research, define an optimum configuration of process parameters of electrocoagulation and ultrasound, and to develop the design of the device.

PROJECT OUTCOMES

The project will result in an innovative and cost-effective water purification process that will successfully remove chemical and microbiological contamination without development of cancerous chlorination by-products. The results will also provide guidelines for the design of water purification systems based on the use of electrochemical and ultrasonic processes. The research will define the competitiveness of these technologies, compared to the conventional water disinfection, through determination of operational costs. In addition, it is expected that the project will result in a successfully developed continuous flow reactor, with guidelines for creating a pilot device with the potential for practical application in public or individual water supply systems.

2BESAFE

New vulnerability models of typical buildings in urban areas: applications in seismic risk assessment and targeted strengthening methodology

Duration O Overall budget 1 Programme Ir Coordinator U Partners U Leader at the Faculty A

01.02.2021–31.01.2026 147,651.74 € Installation Research Projects University of Zagreb Faculty of Civil Engineering University of Zagreb Faculty of Science Assoc. Prof. Mario Uroš



Web page: https://2besafe.grad.hr/



Although seismic risk should be among key priorities in Southeastern Europe, the activities actually taken to reduce it are very limited. Recent earthquakes in the region have demonstrated that earthquake consequences can be disastrous. In the scope of the proposed project, new methods will be developed, and the existing ones enhanced, as necessary for complete definition and description of seismic structural performance. The project will focus on the building types potentially exhibiting high seismic vulnerability, which represent a significant part of the urban building stock in the region.

PROJECT OUTCOMES

The level of seismic hazard, depending on seismotectonic conditions, will be defined, and the database of ground acceleration records will be formed, during implementation of this project. Complex collapse mechanisms of the selected structures will be systematically described, new fragility and vulnerability models which do not exist in scientific literature will be developed and, finally, a new methodology for target (optimal) retrofitting of the most vulnerable building types will be developed.

ReWire Cement composites reinforced with waste fibers

Duration Overall budget Programme Coordinator Leader at the Faculty 08.02.2021–07.02.2026 174,003.85 € Installation Research Projects University of Zagreb Faculty of Civil Engineering Assoc. Prof. Ana Baričević



Web page: <u>https://rewire.grad.hr/</u>



Waste fibres from the production of high-performance textiles for construction industry: a) glass fibres – roving end, b) basalt fibres – scrap from production, c) carbon fibres – roving end, d) glass fibres – scrap from production.

Construction industry is the world's largest consumer of natural resources and is responsible for 25-40% of global carbon emissions. Therefore, collective action is needed to promote transition to a low-carbon economy that is climate neutral, resource efficient and circular. The ReWire project will contribute to the much-needed paradigm shift in engineering solutions. It will enable development of high-performance cementitious materials reinforced with locally available waste fibres and boost awareness of their long-term environmental impacts and life-cycle costs. The ReWire project will address the need to build an internationally recognised research group to keep Croatia competitive in this area of research. At the same time, the project will improve technologies for the use of high-quality waste fibres and develop the scientific background for their application in the construction sector.

PROJECT OUTCOMES

The project will analyse the application of carbon, glass and basalt waste fibres from the production of highperformance textiles and recycled tyre polymer fibres as materials for reinforcement of cementitious composites in construction sector. To this end, the quantities of waste fibres available in the region will be identified, and technologies for processing and integration will be developed. The waste fibres will thus become a valuable resource for construction industry and enable development of high-strength fibre-reinforced cementitious materials. In addition, the project will establish a research group dedicated to the research, understanding, and modelling of cementitious composites reinforced with waste fibres, linking scientific organisations by training members of the research group in international centres recognised in this field.

Seismic and energetic renovation of existing structures

Duration12.08.2020-30.10.2023Overall budget4,100.00 €ProgrammeSupport to researchers for applying to programs of the European Research Council
University of Zagreb Faculty of Civil EngineeringLeader at the FacultyAssoc. Prof. Mislav Stepinac


The need to maintain the built environment is supported by global policies, as is clear from, for example, the 1997 Kyoto Protocol and all world congresses related to climate change and its impact on the built environment and construction in general. Long-term global goals are related to sustainable development, which includes implementation of the renovation, maintenance and replacement of existing buildings. It is important to distinguish between two types of existing buildings, defined based on their value. The first type relates to newer existing buildings with higher economic or financial value, while the second type concerns cultural heritage buildings whose value is intangible or cultural in nature. This project will focus on buildings characterised by high financial and material value (residential and industrial buildings). The importance of this research is evident in the preservation and renovation of the existing built infrastructure, and in development of guidelines for simultaneous energy and seismic reinforcement of existing structures.

PROJECT OUTCOMES

The project elaborates ideas for assessing the condition and maintenance of the existing masonry structures, and conceptually discusses models related to the energy and seismic reinforcement of the existing masonry structures. The focus of the research is on seismic risk and the response of the masonry structures most affected by the Zagreb earthquake. The project has also encouraged collaboration with Professor Paulo Lourenco, one of the world's most cited scientists in the field of civil engineering. One of the results of the project is the following joint publication: Stepinac, M.; Lourenço, P.B.; Atalić, J.; Kišiček, T.; Uroš, M.; Baniček, M.; Šavor Novak, M.: Damage Classification of Residential Buildings in Historical Downtown after the ML5.5 Earthquake in Zagreb, Croatia in 2020. Int. J. Disaster Risk Reduct. 2021, 56, 102140.

Young Researchers' Career Development Project – Training New Doctoral Students

Acronym and title:	Net-UBIEP Network for Using BIM to Increase the Energy Performance
Duration:	0.10.2018–9.10.2022
Coordinator:	Assoc. Prof. Bojan Milovanović
PhD student:	Sanjin Gumbarević
Project code:	DOK-2018-01-8611
Acronym and title:	TAREC ² Transformation of ash from wood biomass into building composites with added value
Duration:	22.10.2018-15.1.2024
Coordinator:	Prof. Nina Štirmer
PhD student:	Jelena Šantek Bajto
Project code:	DOK-2018-01-3084
Acronym and title:	R3PEAT Real-time remote monitoring of riprap erosion on major rivers
Duration:	1.10.2020–30.9.2025
Coordinator:	Assoc. Prof. Kristina Potočki
PhD student:	Martina Lacko
Project code:	DOK-2020-01-5354
Acronym and title:	ProtectAS Development of system for control and protection of ports from introduction of alien species
Duration:	5.10.2020-4.4.2024
Coordinator:	Prof. Goran Lončar
PhD student:	Tin Kulić
Project code:	DOK-2020-01-6524

Acronym and title:	BRAVOBRICK Use of treated oily wastewater and sewage sludge in brick industry - production of innovative brick products in the scope of circular economy
Duration:	12.10.2020-11.10.2024
Coordinator:	Prof. Dražen Vouk
PhD student:	Anđelina Bubalo
Project code:	DOK-2020-01-4363
Acronym and title:	ARES Assessment and rehabilitation of existing structures – Development of contemporary methods for masonry and timber structures
Duration:	1.12.2020-1.12.2024
Coordinator:	Assoc. Prof. Mislav Stepinac
PhD student:	Karlo Ožić
Project code:	DOK-2020-01-9251
Acronym and title:	ReWire Cement composites reinforced with waste fibers
Duration:	1.10.2021–30.9.2025
Coordinator:	Assoc. Prof. Ana Baričević
PhD student:	Branka Mrduljaš
Project code:	DOK-2021-02-4884
Acronym and title:	BEACHEX Sustainable construction of filled beaches – Construction of new ones and increasing the capacity of existing ones
Duration:	7.10.2021–6.10.2025
Coordinator:	Prof. Dalibor Carević
PhD student:	Hana Miličević
Project code:	DOK-2021-02-9108
Acronym and title:	2BESAFE New vulnerability models of typical buildings in urban areas: applications to seismic risk assessment and target retrofitting methodology
Duration:	25.10.2021–24.10.2025
Coordinator:	Assoc. Prof. Mario Uroš
PhD student:	Romano Jevtić Rundek
Project code:	DOK-2021-02-2478

Acronym and title:	DIV Development of DIV elastic railway clamp
Duration:	1.11.2021–31.10.2025
Coordinator:	Prof. Stjepan Lakušić
PhD student:	Krešimir Burnać
Project code:	DOK-2021-02-9981
Acronym and title:	LWT-FLOOR Innovative lightweight cold-formed steel-concrete composite floor system
Duration:	17.11.2021–16.11.2025
Coordinator:	Asst. Prof. Ivan Ćurković
PhD student:	Vlaho Žuvelek
Project code:	DOK-2021-02-2373
Acronym and title:	ARES Assessment and rehabilitation of existing structures – Development of contemporary methods for masonry and timber structures
Duration:	1.12.2021–1.12.2025
Coordinator:	Assoc. Prof. Mislav Stepinac
PhD student:	Antonela Moretić
Project code:	DOK-2021-02-1906
Acronym and title:	ASAP Autonomous system for assessment and prediction of infrastructure integrity
Duration:	1.12.2021-30.11.2025
Coordinator:	Assoc. Prof. Ivan Duvnjak
PhD student:	Jurica Pajan
Project code:	DOK-2021-02-5362

Doctoral and Postdoctoral programme of the Croatian Science Foundation

Acronym and title:	ACT Advanced low CO2 cementitious materials
Duration:	1.4.2023–31.3.2024
Coordinator:	Assoc. Prof. Marijana Serdar
PhD student:	Matea Flegar
Project code:	-

European Regional Development Fund 2014–2020

DIV Development of DIV elastic railway clamp

Duration01.07.2018 - 01.07.2023Overall budget3,311,686 €Source of fundingEuropean Regional Development FundCoordinatorDIV Ltd.PartnersUniversity of Zagreb Faculty of Civil EngineeringLeader at the FacultyProf. Stjepan Lakušić

Web page:

www.divgroup.eu/en/research-and-development-projects/development-of-div-elastic-railway-clamp/



Elastic clamps are used to fasten rail tracks to sleepers. A key objective of the project is to develop an elastic railway clamp that could be easily and economically produced, while also being simple, quick, and reliable for assembling/disassembling – providing long-lasting and reliable connection between railway sleepers and rails throughout their entire service life. The research and development program aims to enable development of a functional and innovative product - DIV elastic railway clamp - and, consequently, its placement and commercialization on the world market of construction and maintenance of railways.

PROJECT OUTCOMES

- A new type of elastic fastening system for railways.
- Easy installation and easy tightening check of the fastening system.
- Noise and vibration reduction at the fastening level.
- Anti-vandal protection.
- Tested and certified product.
- Product protected by patent.

Development of innovative building composites using bioash

Duration	01.02.2019–04.03.2020
Overall budget	635,928.32 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	Beton Lučko Rbg
Partners	University of Zagreb Faculty of Civil Engineering
Leader at the Faculty	Prof. Nina Štirmer

https://www.betonlucko.hr/razvoj-inovativnih-gradjevnih-kompozita-primjenom-biopepela.html



The overall objective of the project is to contribute to the strengthening of the economy through application of research and innovation in construction industry by developing innovative environmental products, technologies, and business processes. Innovative products – construction composites with bio-ash – are a solution to the problem of the wood biomass ash disposal as well as to environmental greenhouse gas emission problems. Industrial research includes a review of the state-of-the-art in the field, characterization of wood biomass, characterization and assessment of bio-ash effects on the properties of construction composites, while experimental development includes an in-plant demonstration of selected technologies.

PROJECT OUTCOMES

- Development of innovative products from ecological construction composites as a result of research, development, and innovation activities.
- Improvement of technological processes in construction industry.
- Closer cooperation with scientific research institutions in applied research activities.

ASAP

Autonomous system for assessment and prediction of infrastructure integrity

Duration	20.12.2019–30.11.2023
Overall budget	949,179.75 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	University of Zagreb Faculty of Mechanical Engineering and Naval Architecture;
	University of Zagreb Faculty of Electrical Engineering and Computing
Leader at the Faculty	Assoc. Prof. Marijana Serdar

Web page: <u>https://www.asap-project.com</u>





Road and railway infrastructure buildings require more rational planning of maintenance activities in order to minimize the consequences of their inevitable degradation. Proper maintenance of this type of buildings can greatly increase user safety and reduce the risk of collapse. The project is focused on the development of an autonomous robotic system and unmanned aerial vehicle using detailed inspection methods. Combining the developed systems with numerical modelling of structures will enable assessment of their load-bearing capacity and service life, timely response, and ultimately lower maintenance costs.

PROJECT OUTCOMES

The project activities will lead to the achievement of main results which will be transferred in the form of knowledge transfer to teaching, scientific and professional activities. The most important result of the project is the creation of a new product – an autonomous measuring system for testing structures based on a climbing robot and an unmanned aerial vehicle. Next, a conceptual protocol will be created to link the data obtained by testing the structures and numerically predicting the load-bearing capacity and service life of the structure. Finally, the result of the project will be the creation of an ASAP training program to train potential project beneficiaries.

DeltaSal Advanced monitoring of soil salinization risk in the Neretva Delta agroecosystem

Duration	01.01.2020-01.01.2023
Overall budget	378,707.55 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	University of Zagreb Faculty of Agriculture
Partners	Ruđer Bošković Institute; Croatian Geological Institute; University of Zagreb Faculty
	of Electrical Engineering and Computing; University of Zagreb Faculty of Civil
	Engineering
Leader at the Faculty	Prof. Neven Kuspilić



Web page: www.deltasal.hr/



The aim of the project is to develop and implement an advanced system for the monitoring, forecasting and reporting the water and soil conditions in the Neretva Delta agroecosystem that is primarily used for agriculture. The selected pilot location is specific due to its biodiversity – water network within the delta consists of the surface irrigation and drainage canal network, karst aquifer dominated by the tidal regime while also replenished by freshwater from the upstream river flow, all of which is used for citrus fruits production while at the same time influencing the water regime of the adjacent protected salt marshes ecosystem. Salt water intrusion is present in the entire delta, which is reflecting on the irrigation water quality and, subsequently, on the agricultural production of citruses which are salt-sensitive horticultural crops.

PROJECT OUTCOMES

An extensive spatial and temporal monitoring of water quality data through multisensory monitoring stations will be used for development of guidelines for salt stress alleviation in citrus fruits. The monitoring is focused on the continuous real-time measurement of surface water levels and index water velocity, using radars, shallow and deep piezometers for monitoring ground water levels, rain gauges, and multiparameter water quality measurements (dissolved oxygen, water depth, electrical conductivity, total dissolved solids, salinity, pH, oxidation reduction potential, temperature, nitrate and chloride). The data are transmitted in real-time to the cloud-based interface for remote access. The integrated data management will be used in the upcoming project stages for analysing the impact of the salt water intrusion on the Neretva Delta agricultural production. The final outcome of the project are the Neretva Delta management guidelines with the future outlook in the climate change context, compliant with UNFCCC convention according to which this area is one of the most vulnerable areas in Croatia.

Development of concrete for sustainable construction in marine environment

Duration	17.02.2020-17.08.2023
Overall budget	1,967,630.57 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	TPA Održavanje kvaliteta i inovacija
Partners	University of Zagreb Faculty of Civil Engineering; Pomgrad Engineering
Leader at the Faculty	Assoc. Prof. Ivan Gabrijel

Web page:

www.tpaqi.com/databases/internet/_public/content30.nsf/web30?Openagent&id=DE-TPAQI.COM_EU_hr.html



The main problems tackled within this project are the insufficient research and development capacities of TPA and Pomgrad companies, which are the prerequisites for the development of innovative products and, at the same time, for broadening the cooperation between these companies and the scientific and research sector. In addition, the purpose of the project is to develop innovative concrete mixtures that enable sustainable construction in the marine environment. Striving for the recycling of industrial by-products while maintaining robustness in terms of durability requires optimization that will produce the most favourable environmental and economic effects.

PROJECT OUTCOMES

The aim of the project is to improve the innovation and competitiveness capacities of TPA and Pomgrad companies through research activities and development of innovative concrete mixtures. Three innovative concrete mixtures for sustainable construction in the marine environment will be developed in the scope of the project. The work includes two thematic priority areas S3, through strengthening research, development and innovation capacity of TPA and Pomgrad companies, and cooperation with the University of Zagreb Faculty of Civil Engineering.

Plastopor Development and research of PLASTOPOR compact EPS(F) board

Duration	05.03.2020–04.08.2023
Overall budget	1,913,793.31 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	Plastform
Partners	University of Zagreb Faculty of Civil Engineering
Leader at the Faculty	Prof. Ivana Banjad Pečur



The project involves development of a new construction product with optimized properties, intended for the construction and renovation of nearly zero energy buildings. The aim is to achieve an environmentally friendly technology for the production of boards, and to implement a production line modernisation project by purchasing new machinery for the production of modern thermal insulation PLASTOPOR compact EPS F boards with improved properties, compared to panels presently available on the market.

PROJECT OUTCOMES

The result of the project is the development and optimization of a new thermal insulation board PLASTOPOR compact EPS F with improved thermal insulation and fire-resistant properties.

ProtectAS

Development of system for control and protection of ports from introduction of alien species

Duration	01.06.2020-04.03.2020
Overall budget	425,191.12 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Ruđer Bošković Institute; University of Rijeka Faculty of Maritime Studies;
	University of Dubrovnik; Teaching Institute of Public Health of Primorje-Gorski Kota
	County
Leader at the Faculty	Prof. Dalibor Carević



Web page: https://protectas.com.hr/



The spreading of species and their settlement in new habitats has begun with the development of first living organisms on the Earth. However, the transfer of species to the areas where they did not exist before, and which they could not reach naturally, has accelerated as a result of human activity. The majority of the present-day transport of cargo takes place by sea, and the ships, in addition to cargo, transport various marine organisms found in ballast waters. As part of the ProtectAS project, five partner institutions will conduct interdisciplinary research in the busiest Croatian cargo ports, Ploče and Rijeka. In addition to the determination of abiotic factors, the composition of planktonic communities, and the presence of viruses and pathogens, the marine currents in these ports will be modelled on the basis of field measurements to determine the dynamics of the spreading of species in ports.

PROJECT OUTCOMES

The aim of the project is to collect data for an effective protection of port areas from the introduction of foreign and harmful species via ballast water carried by ships. The research conducted in two ports (Ploče and Rijeka) will provide the following information 1. an overview of marine circulation in the ports of Ploče and Rijeka based on numerical modelling, 2. a list of identified species of pathogens, phytoplankton and zooplankton in the ports of Ploče and Rijeka with categorization of harmful species (toxic / foreign / invasive alien species), 3. a review of the dynamics of the spread of planktonic species within the ports of Ploče and Rijeka and towards the open waters of the Adriatic, and 4. an overview the influence of abiotic factors and meteorological conditions on pathogens in the ports of Ploče and Rijeka. The main result of the ProtectAS project is the development of the document entitled "System of control and defence of ports from the introduction of alien species".

Centre for Research and Development of Safe and Sustainable Built Environment

Duration29.06.2020-01.09.2022Overall budget634,334.65 €ProgrammeOperational Programme Competitiveness and Cohesion 2014-2020CoordinatorUniversity of Zagreb Faculty of Civil EngineeringLeader at the FacultyProf. Stjepan Lakušić



The purpose of the project is to develop the project documentation that will enable establishment of a Centre for Research and Development of Safe and Sustainable Built Environment, which involves investing in research, development and innovation infrastructure, and implementing organizational reform of the Faculty of Civil Engineering, with the aim of accelerating the process of transforming the Faculty into an internationally competitive scientific institution that creates a new added value in terms of scientific, social, and economic development.

PROJECT OUTCOMES

- Contribution to smart development and improvement of the competitive performance of the Republic of Croatia by investing in a research system open to innovation, which meets the needs of the economy.
- Positive impact on strengthening the research capacities of the Faculty of Civil Engineering for the implementation of top scientific research
- Contribution to smart and sustainable development through concrete examples of the balance established between environmental, social and economic goals (positive impact on green public procurement, climate challenges, principles of green growth and resource efficiency)
- After establishment of the Centre, research will be conducted in all development segments of construction through the work of individual research units related to the organization of the faculty and its 9 institutes and 5 laboratories

ECO₂Flex Development of new innovative product ECO₂Flex

Duration01.08.2020-01.08.2023Overall budget3,684,947.49 €ProgrammeOperational Programme Competitiveness and Cohesion 2014-2020CoordinatorCalucemPartnersUniversity of Zagreb Faculty of Civil EngineeringLeader at the FacultyAssoc. Prof. Marijana Serdar

Web page: https://www.calucem.com/eu-project/





The ECO₂Flex project is based on the development of a new product and an innovative production process aimed at reducing CO₂ emissions. By combining Calucem Ltd.'s own patented calcium aluminate cement (CAC), with selected CO₂ -neutral cementitious materials, a new type of cementitious binder is being developed, a unique product on the world market. The new product, called ECO₂Flex, is an innovative technological solution in the cement industry enabling reduction of CO₂ and production energy. As a scientific partner, the Civil Engineering Faculty conducts activities related to the research of reactivity, durability, and microstructure of the developed binder.

PROJECT OUTCOMES

The goal of the project is the successful development of ECO_2Flex products and the related production process. The implementation of the project will intensify research and development activities by users and partners, and increase cooperation between private and scientific research organizations. In addition to the successful implementation of project management tasks and the efficient use of human, time and financial resources, the successful use of project results will be ensured, and the basis for implementation of ECO_2Flex products on the market will be established.

Sensor system for continuous monitoring of pavement performance under load

Duration	14.08.2020-14.8.2023
Overall budget	869,057.01€
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	Geoprojekt
Partners	University of Zagreb Faculty of Civil Engineering; Contech; Proizvodnja Alata i
	Uređaja "P.S.G"
Leader at the Faculty	Prof. Tatjana Rukavina

Web page:

https://geoprojekt.hr/hr/sustav-senzora-za-kontinuirano-pracenje-ponasanja-kolnicke-konstrukcije-podopterecenjem



Pavement deflection is measured as the vertical deflected distance from the surface, resulting from an applied load (either static or dynamic). When a pavement structure is properly designed and built, this deflection is relatively small and almost entirely reversible (elastic). In a weak and distressed pavement, deflection is much higher, and part of it remains after unloading (plastic). The magnitude of deflection is inversely proportional to the load-bearing capacity of the pavement, and it is generally accepted that pavement deflection can be used as an indicator of its structural condition. A sensor system for continuous monitoring of pavement behaviour under load will be developed in the scope of the project. The measuring hardware-sensor units will continuously provide real-time information to the investor and road manager about pavement condition. The sensor system will be able to register anomalies and alert road managers about irregularities. Using such system, responsible agencies could undertake pavement rehabilitation and reconstruction measures in due time. Therefore, pavement degradation and significantly higher costs of its rehabilitation will be avoided.

PROJECT OUTCOMES

- Development of sensor system for continuous monitoring of pavement behaviour under load.
- Development of methodology for the installation, measurement and analysis of measurement results obtained by sensor system.

Development of a modular house using innovative timber elements

Duration	01.10.2020-30.09.2022
Overall budget	959,925.10 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	Tersa
Partners	University of Zagreb Faculty of Civil Engineering
Leader at the Faculty	Prof. Vlatka Rajčić

https://www.tersa.hr/projekti/razvoj-modularne-kuce-primjenom-inovativnih-drvenih-elemenata/



Innovative glued-laminated wooden elements: a) elliptical hollows; b) circular perforations

The project is based on the implementation of collaborative research and development activities - necessary activities of industrial research and experimental development – for the purpose of developing a new higher added-value product. The project includes the phase of architectural design, structural and technological development, production and testing of prototypes and samples, and the implementation of test results in the final product. Due to the mutual transfer of knowledge and technology between the scientific research institution and the economic entity, and the development of an innovative new product through effective cooperation of Tersa Ltd. and the University of Zagreb Faculty of Civil Engineering, the final result will be realized: a modular house – a set of innovative wooden elements.

PROJECT OUTCOMES

- Development of innovative wooden elements.
- Innovative nature of wood elements that are a new generation of wood products that allow easier construction, assembly, material savings, and global environmental sustainability.
- Defining fire resistance of innovative elements.
- Development of details and joints in innovative wooden elements.
- Development of technology and business processes in order to develop an innovative modular house made of wood.
- Construction of a demonstration facility a set of innovative wooden elements.

Web page:

https://www.grad.unizg.hr/klik-panel

KLIK PANEL Composite Light Steel Framed Panel with an Integrated Load-bearing Structure

Duration	16.12.2020–16.12.2023
Overall budget	1,095,821.01 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Tehnoplast Profili; Palijan; Keira
Leader at the Faculty	Prof. Ivana Banjad Pečur, Assoc. Prof. Marija Jelčić Rukavina



Kompozitni lagani pane nosivom konstrukcijom





In construction, the goal is to achieve the lowest possible construction cost per unit area with the lowest possible consumption of materials and time, while meeting the increasingly stringent requirements relating to the characteristics of the building. It is well known that the price, quality and characteristics of a building depend on weather conditions at the construction site, on the labour force and the available machinery, which is characteristic of the traditional construction process. The aim of the project is to develop an innovative lightweight composite panel with integrated load-bearing structure to be used for the construction of prefabricated nearly zero energy buildings in an industrial way.

PROJECT OUTCOMES

Research and development activities in this project will develop panels with the following advantages:

- integrated steel structure made of open thin-walled C-profiles,
- good thermal and diffusion properties for use in nearly-zero energy buildings (NZEB)
- required fire resistance.

NORMENG

Development of an automated system for standardization of resources in energy efficient construction

Duration	16.12.2020–15.12.2023
Overall budget	826,114.34 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	Normag Expert J
Leader at the Faculty	Prof. Ivica Završki

Web page: <u>https://www.normeng.eu</u>





The construction sector is one of the pillars of economic development and has a significant impact on the environment. The construction process consumes large amounts of resources (materials, workers, and machinery). Unlike most developed countries, the Republic of Croatia does not have modern standards of resources according to which participants in construction can more effectively assess, contract, and perform construction work. In addition, the standards currently in use date back to 1986 and are not in line with energy-sustainable construction and related regulations. Therefore, the aim of this project is to develop an innovative technological solution for the standardization of construction resources. The solution will be applied to six basic professions for green building. The results will be reflected in the published standards.

PROJECT OUTCOMES

- A concise description of standard cost items.
- Definition of general technical conditions.
- Proof of applicability of new technologies in the standardization process (production methods).
- Creation of a database of standards (material, machine, work) in printed and digital form, which is compliant with the IFC BIM standard and the EU standards

Development of new technologies and services in the field of special construction works

Duration	01.03.2021–30.11.2023
Overall budget	1,511,429.31 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	SPEGRA
Partners	University of Zagreb Faculty of Civil Engineering
Leader at the Faculty	Assoc. Prof. Ana Baričević



Development of new technologies and services in the field of special construction works, focusing on the protection of cultural heritage, prevention of natural disasters, protection of the coastal area and reconstruction of infrastructure. The main challenge is to reduce the use of new resources, increase overall safety of the existing structures, enable preservation of cultural heritage and prevent uncontrolled urbanization of rural, green, coastal and protected areas.

PROJECT OUTCOMES

Expected research and development outcomes include: an innovative technology for coastal environmental rehabilitation using recycled materials (harbours, docks, piers, breakwaters, and other coastal infrastructure), development of high-performance products (repair mortars) and a service for infrastructure rehabilitation using the newly developed products. In addition, the goal of the project is to develop a digitized knowledge database. The database will contain information on innovative technological rehabilitation methods for various types of buildings.

Seismic vulnerability assessment of buildings – development of a system for automatic damage detection

Duration01.06.2021-1.12.2021Overall budget34,375.21 €ProgrammeOperational Programme Competitiveness and Cohesion 2014-2020CoordinatorAIR-RMLDPartnersUniversity of Zagreb Faculty of Civil EngineeringLeader at the FacultyAssoc. Prof. Mislav Stepinac



The aim of the project is to transfer expertise and technical knowledge in the use of highly sensitive cameras in the analysis of seismic damage, primarily in culturally protected urban cores, which is applicable in the rapid post-earthquake assessment of damaged buildings.

PROJECT OUTCOMES

A methodology for surveying cities from the air and providing assistance in the evaluation of buildings after the earthquake was developed within the project. Also, the same methodology can be used for pre-seismic situations and for the assessment of seismic damage and, finally, seismic risk. Very valuable data (better than expected) were collected, and will be used for further improvement of the assessment of seismic damage to buildings in order to develop an innovative automatic damage detection system. The cooperation between "drones" and "designers" has proven to be excellent, and we believe that development of this service is crucial for the development of a complex service. The expected result, which is a simple, fast and efficient method of data collection and identification of key indicators for seismic vulnerability of urban cores, has been fully achieved in the scope of the project.
In-situ acoustic properties determination of RUCONBAR noise barriers on a railway line

Duration	15.10.2021–13.01.2022
Overall budget	13,935.89 €
Programme	Operational Programme Competitiveness and Cohesion 2014-2020
Coordinator	Beton Lučko
Partners	University of Zagreb Faculty of Civil Engineering
Leader at the Faculty	Assoc. Prof. Ivo Haladin

Web page:

www.betonlucko.hr/in-situ-ispitivanja-akustickih-svojstava-barijera-za-zastitu-od-buke-tipa-ruconbar.html



RUCONBAR innovative barriers for noise protection were applied for the first time in 2014. The location where practical usability of this innovative product was proven was on a section of the state road, near toll stations for the Island of Krk. The product was also applied for railway noise protection on the railway line Oštarije-Knin-Split in Croatia. A total of 5 walls with a total surface area of absorbing panels of 1011 m2 were built at the Perušić-Gračac subsection. This project is important because it was the first application of noise barriers on a railway section in the Republic of Croatia. Significant future investments in railway infrastructure in the Republic of Croatia are the motivation for the implementation of project activities aimed at optimizing RUCONBAR barriers for use on railways, and for proving their effectiveness and better positioning in the very competitive market of noise barriers. The projects defined in the tender documentation are characterized by increasingly demanding requirements for the products for implementation of noise protection on railways. An increasingly common requirement is the proven in-situ acoustic performance of the product. The installation of RUCONBAR barriers along the section of the Oštarije-Knin-Split line enabled implementation of this type of testing on railway infrastructure and proved the in-situ acoustic performance of this type of concrete barriers for noise protection.

PROJECT OUTCOMES

The planned tests for proving acoustic performance and optimization of RUCONBAR products include: determination of sound reflection according to HRS CEN/TS 16272-5:2014, determination of insertion loss according to HRN EN ISO 10847 and measurement of environmental noise according to HRN ISO 1996-2.

Realisation of the tests on RUCONBAR noise protection walls provides: possibilities for additional optimization of the RUCONBAR noise barrier system, the possibility for participating in an increasing number of tenders for the installation of noise protection systems on railway infrastructure in the Republic of Croatia and other EU members and a competitive edge compared to products without confirmation of properties according to the above mentioned standards.

European Social Fund 2014–2020

CPD4GB

Development of professional competences for green construction

Duration	01.03.2018–29.02.2020
Overall budget	153,979.16 €
Programme	Operational Programme Efficient Human Resources 2014-2023
Coordinator	Croatian Engineering Association
Partners	Croatian Green Building Council; Croatian Association of Civil Engineers; University
	of Zagrebu Faculty of Architecture; University of Zagreb Faculty of Civil Engineering;
	University of Zagrebu Šumarski Fakultet; University of Zagreb Faculty of Agriculture
Leader at the Faculty	Prof. Ivana Banjad Pečur

Web page: https://www.cpd4gb.com.hr CPD4GB

RAZVOJ PROFESIONALNIH KOMPETENCIJA ZA ZELENU GRADNJU CONTINUOUS PROFESSIONAL DEVELOPMENT FOR GREEN BUILDING



The main objective of the project is to enable students to work in the field of green building, to establish a sustainable program of socially useful learning, and to strengthen professional and analytical capacities of partner associations.

The objectives of the project were: to train teachers, through acquisition of knowledge from globally recognized experts in the field of green building, so that they can transfer this knowledge to students; to establish cooperation on educational programs between professional associations and higher education institutions; and to involve volunteers / young experts in solving local community problems in specific areas of sustainability.

PROJECT OUTCOMES

40 students from different parts of the University of Zagreb were trained in the scope of the project. These students developed competencies in the planning, design, construction and management of buildings according to the principles of green building, and thus acquired the basic knowledge to meet the challenges of sustainability and environmental protection in construction. A program of socially useful learning for green building was developed in cooperation with all project partners (associations and higher education institutions).

GRASP Student Internship at the Faculty of Civil Engineering

Duration Overall budget Programme Coordinator Leader at the Faculty

09.03.2020–09.03.2023 500,610.52 € Operational Programme Efficient Human Resources 2014-2023 University of Zagreb Faculty of Civil Engineering Prof. Domagoj Damjanović

Web page: <u>https://www.grad.unizg.hr/ck/projektgrasp</u>





The main goal of the GRASP Project is to improve the study programme by developing a student internship model. The new model includes elective courses entitled Undergraduate Student Internship and Graduate Student Internship – both internships lasting twenty working days. The introduction of the new elective courses, the content of which will be defined in cooperation with employers taking into account the needs of the labour market, will provide the students with practical knowledge and facilitate their inclusion in the labour market. The cooperation of the Faculty of Civil Engineering with employers will result in joint innovative activities, and will enable employers to revise their knowledge through a mentoring programme.

PROJECT OUTCOMES

- Career counselling service established through the Career Centre.
- A digital platform developed for the student internship programme.
- Networking between students of the Faculty of Civil Engineering and potential employers/mentors through the GRADify job fair and student internship.
- Improved student programme and curriculum.
- Improved teaching and non-teaching staff's mentoring and training skills.
- Fully equipped training rooms for development of digital and professional skills.
- Increased employability of graduates, which will have a positive impact on all target groups of the project: undergraduate and graduate students, employers, and teaching and non-teaching staff of the Faculty of Civil Engineering.

raSTEMo Development of STEM in civil society organizations

Duration	12.05.2021–11.01.2023
Overall budget	317,913.31 €
Programme	Operational Programme Efficient Human Resources 2014-2023
Coordinator	GTF-Initiative for Sustainable Growth
Partners	University of Zagreb Faculty of Civil Engineering; The First Cluster of Women
	Entrepreneurs of The Croatia "Wheel - How To Strengthen the Local Environment"
Leader at the Faculty	Prof. Ivana Banjad Pečur





The STEM area has an important role in the application of new knowledge and technologies, especially for achieving the smart and sustainable growth based on knowledge and information. One way to popularize STEM is through civil society organizations. Therefore, the purpose of the project is to strengthen the capacity of civil society organizations in STEM area with an active involvement of children, youth and general population in the popularization program.

PROJECT OUTCOMES

The result of the project is the popularization of STEM in the area of construction and reuse of materials for target groups: children, young people, and women through workshops, summer camps, and festivals. The concept varies by target group: workshops and camps for children and young people are designed as outdoor schools where children and young people will learn about sustainable construction and sustainable materials. Innovation camps for women will emphasize the opportunities that STEM area provides in the application of sustainable construction and materials to start their own business.

National Recovery and Resilience Plan 2021–2026

URITMIS

Urban railway infrastructure predictive maintenance system based on monitoring of vibro-acoustic track properties

Duration Overall budget Programme Coordinator Leader at the Faculty 01.07.2023–30.06.2026 513,435.73 € Research Development Grants University of Zagreb Faculty of Civil Engineering Assoc. Prof. Ivo Haladin



Web page: https://uritmis.grad.hr

For a comfortable and secure operation, tram track infrastructure must be well maintained. However, the manual measurement methods used today can be slow, dangerous and disruptive. The URITMIS (Urban Railway Infrastructure Maintenance System) project involves the development of an innovative system for predictive maintenance of tram infrastructure based on the recording of vibroacoustic track properties and machine learning methods. Through three years of research, a highly specialized multidisciplinary team of young experts trained in the areas of acquisition and analysis of track vibro-acoustic properties, modelling of track structures and predictive maintenance systems based on machine learning methods will be formed.

PROJECT OUTCOMES

As a part of the project, a research team of young scientists gathered around the described topic will be formed. Through the project, the competencies and knowledge of the research team are strengthened through a series of activities with the aim of overcoming the challenges in the development of the innovative URITMIS system. Numerical models of the tram track with defined vibro-acoustic parameters (transfer functions of wheels, track, rail contact surface) will be created, as well using machine learning methods to create a predictive track maintenance model. On the basis of the developed URITMIS system, a significant saving of valuable resources will be possible for managers of tram infrastructure maintenance.

recEPS

Development of an innovative insulation board with a high proportion of recycled material for underfloor heating and cooling

Duration01.01.2024-30.06.2026Overall budget1,652,357.26 €ProgrammeTargeted Scientific ResearchCoordinatorUniversity of Zagreb Faculty of Civil Engineering
PlastformLeader at the FacultyAssoc. Prof. Bojan Milovanović

The recEPS project aims to advance the application of recycled EPS in the production of floor panels for heating and cooling, exploring different aspects of this material. Through two main phases of research, the project will result in innovations and patents. In addition, this project will result in long-term cooperation between the Faculty of Civil Engineering in Zagreb and a platform that will expand to future projects. Through joint capacities, new ideas will be researched and developed, which abound not only with great commercial potential, but also with the potential to improve the economy in a broader sense.

PROJECT OUTCOMES

- Creation of a prototype of low level of readiness in a laboratory environment
- Dissemination of the results of project activities
- Validation of the optimal amount of recyclates in the recEPS board
- Acquiring and depreciation of equipment necessary for the implementation of research activities.

MAGdis

Integrated node for magnetic wireless monitoring of spatial displacements of geotechnical structures

Duration	02.04.2024–01.04.2025
Overall budget	73,121.32 €
Programme	Proof of Concept
Coordinator	University of Zagreb Faculty of Civil Engineering
Partners	University of Zagreb Centre for Research, Development and Technology Transfer
Leader at the Faculty	Prof. Meho Saša Kovačević



Within the project, a new product is being developed for measuring 3D (spatial) ground displacements and geotechnical structures called INTEGRATED NODE FOR MAGNETIC WIRELESS MONITORING OF SPATIAL DISPLACEMENTS OF GEOTECHNICAL STRUCTURES (MAGdis). In an innovative way, MAGdis offers a number of comparative advantages compared to existing market solutions. The importance of monitoring displacement is evident in the in-situ verification of geotechnical design solutions, and the necessity of monitoring has been particularly pronounced recently in conditions of unpredictable loads such as earthquakes and climate change, where many EU strategies emphasize the key role of monitoring in the implementation of adaptation measures. The users of MAGdis are companies that deal with monitoring in geotechnics. Infrastructure managers will also benefit from the product, as they will receive information about the state of the infrastructure in a more efficient way, as well as the general public through increasing its safety.

PROJECT OUTCOMES

- Enhanced knowledge on the innovative methods for monitoring of geotechnical structures and their response to various loads
- Proof of technical feasibility of a node for magnetic wireless monitoring of spatial displacements of geotechnical structures
- Development of the MAGdis commercialization documents
- Incorporation of the developed product on the geotechnical monitoring market.

Croatian Ministry of Science, Education and Youth

CRICK Climate Resilient Concrete Paving Block

Duration01.01.2020-31.12.2022Overall budget6,980.00 €ProgrammeCroatian-Austrian Bilateral ProjectCoordinatorUniversity of Zagreb Faculty of Civil Engineering
PartnersVienna University of TechnologyLeader at the FacultyAssoc. Prof. Ana Baričević



Recycled tyre polymer fibres



Wood biomass power plant

The project builds on the results of the previous research projects "TAREC2 – Transformation of wood biomass ash into resilient construction composites", "Development of innovative building composites using biomass ash" and "ANAGENNISI – Innovative Reuse of All Tyre Components in Concrete". The main goal of the project is to improve cooperation between the Faculty of Civil Engineering of the University of Zagreb and the Vienna University of Technology. Within the project, the scientists will jointly investigate possible uses of wood biomass ash and recycled tyre polymer fibres in the development of climate-resistant concrete pavers.

PROJECT OUTCOMES

Project activities will help build a network of researchers in the field of sustainable cementitious composite development and ensure better understanding of the impact of wood biomass ash and recycled tyre polymer fibres on the durability of cementitious composites.

Application of linear recurrences in number theory and combinatorics

Duration01.11.2021-31.10.2023Overall budget6,400.00 €ProgrammeCroatian-Hungarian Bilateral ProjectCoordinatorUniversity of Zagreb Faculty of Civil Engineering
PartnersLeader at the FacultyProf. Alan Filipin

Web page:

https://projekti.grad.hr/projekt/application-of-linear-recurrences-in-number-theory-and-combinatorics-2/

Several problems concerning linear recurrences in Number Theory and Combinatorics are considered in this project by researchers from the University of Sopron and researchers from the University of Zagreb.

PROJECT OUTCOMES

The publishing of joint papers in international journals, presentations at international conferences, as well as facilitating the establishment of bilateral cooperation particularly of early-stage researchers involved in the project with their colleagues from Croatia/Hungary.

Sediment transport analysis of the Danube River

Duration01.01.2021-31.12.2023Overall budget6,500.00 €ProgrammeCroatian-Hungarian Bilateral ProjectCoordinatorUniversity of Zagreb Faculty of Civil Engineering
Budapest University of Technology and EconomicsLeader at the FacultyAssoc. Prof. Gordon Gilja



The aim of the research is to develop, test, and apply innovative, scientifically based methods of sediment regime monitoring that can provide crucial information on the sediment transport along the Danube river. The main idea of the project is to work in parallel on the development of innovative methods of data analysis on water and sediment regime in partner institutions. In the testing phase of the effectiveness of the developed methods, a joint field campaign will be carried out on the Danube River.

PROJECT OUTCOMES

The main outcomes of the project are the development of an innovative method for bedload sediment transport and its testing at pilot sites, and publication of joint scientific publications.

COST (European Cooperation in Science and Technology)

DENORMS Design for noise reducing materials and structures

Duration Action code Coordinator Participants from the Faculty

09.03.2016–08.03.2020 CA15125 National Center for Scientific Research Prof. Stjepan Lakušić; Assoc. Prof. Ivo Haladin; Tamara Džambas, PhD





The project is implemented to gather together scientists and industry partners dealing with meta materials, meta-surfaces, sonic crystals and conventional porous materials with a goal of developing innovative, light, slim and multifunctional noise reduction materials with enhanced mechanical and thermal properties, and to define objective and subjective methods and standards for the characterisation of performance and exploitation.

PROJECT OUTCOMES

The DENORMS Action is divided into 3 interacting Working Groups (WG), which complement each other. Each of them aims at specific breakthroughs: WG1. Modelling of sound interaction with noise reducing materials and structures, WG2. Experimental techniques, and WG3. Industrial applications. Numerous laboratory experiments have been performed for the determination of physical, acoustical and other noise reducing properties of materials. New applications of innovative materials have been proposed. Five training schools and eight workshops have been organized, and 46 short term academic visit grants have been awarded.

SARCOS Self-healing As preventive Repair of Concrete Structures

Duration Action code Coordinator Participants from the Faculty 30.09.2016–28.03.2021 CA15202 Universidad de Cordoba Prof. Tomislav Kišiček; Assoc. Prof. Mislav Stepinac

Web page: <u>https://www.cost.eu/actions/CA15202/</u>

The search for smart self-healing materials and preventive repair methods is justified by the increasing sustainability and safety requirements for structures. The appearance of small cracks in concrete is unavoidable, not necessarily causing a risk of collapse for the structure, but certainly accelerating its degradation and diminishing the service life and sustainability of structures. That loss of performance and functionality leads to an increasing investment in maintenance and/or to intensive repair/strengthening works. The critical nature of such requirements is recognised by their inclusion as priority challenges in the European Research Program.

PROJECT OUTCOMES

Development of external healing methods for the repair of new and existing reinforced concrete elements.

PESFOR-W Payments for Ecosystem Services (Forests fo Water)

Duration Action code Coordinator Participants from the Faculty 18.10.2016–17.10.2021 CA15206 Forestry Commission Forest Research Agency Assoc. Prof. Kristina Potočki



Web page:

https://www.forestresearch.gov.uk/research/payments-for-ecosystem-services-forest-for-water/

The objective of the PESFOR-W COST Action is to synthesize knowledge, provide guidance, and foster collaboration to improve the ability to use Payments for Ecosystem Services in Europe so as to achieve the objectives of the Water Framework Directive by incentivizing forest planting to reduce the delivery of diffuse pollutants from agriculture to water.

PROJECT OUTCOMES

Establish and publish a spatial repository of forest areas that serve as "water payments for ecosystem services schemes" (https://www.forestresearch.gov.uk/research/pesforw/casestudies/). Creation and publication of the PESFOR-W Handbook in several European languages (https://www.forestresearch.gov.uk/research/pesforw/user-manual/), leading the UK government to support the development of the Woodland Water Code as part of the England Tree Planting Action Plan 2021-2024, based on the participation of Action members from 40 countries.

RESTORE REthinking Sustainability TOwards a Regenerative Economy

Duration Action code Coordinator Participants from the Faculty 09.03.2017–30.04.2021 CA16114 Eurac Research Asst. Prof. Jelena Bleiziffer

Web page: <u>https://www.eurestore.eu/</u>





The aim/objective of the RESTORE COST Action was to effect a paradigm shift towards restorative sustainability for new and existing buildings and space design across Europe.

PROJECT OUTCOMES

Contribution to defining the correct terminology regarding sustainability in the built environment, harmonising this awareness through continuous knowledge transfer among the 100+ organisations (mostly universities and research centres) involved. From a capacity building perspective, collaboration among different types of actors, such as research centres, universities, education entities, companies, NGOs, was increased in the scope of the project. A new 'body of knowledge' was set up, including a number of publications, frameworks, and tools, to be used both by researchers and practitioners to advance the progress in addressing the climate emergency through the built environment. The Action addressed different stages throughout the life of a building as is systematically presented in a series of publications (and by organizing a training school for each of the stages, 5 of them in total), 30 Short Term Scientific Missions were carried out and a tool "Atlas of Solutions" was set up on the web. 8 books were published. In line with the RESTORE regenerative objectives, the Action managed to achieve carbon neutrality.

LAND4FLOOD Natural Flood Retention on Private Land

Duration Action code Coordinator Participants from the Faculty 14.09.2017–13.03.2022 CA16209 University of Jan Evangelista In Ústí Nad Labem Prof. Damir Bekić; Assoc. Prof. Kristina Potočki; Martina Lacko



The main objective of the Action is to establish a common knowledge base and collaboration among scientists, regulators, land owners and other stakeholders in field in implementing "Nature-based solutions" such as Natural Water Retention Measures. These measures are primarily applied on private lands. Thus, the mission of the LAND4FLOOD action is to coordinate flood risk management and land management from different perspectives: clarifying economic issues, property rights issues (e.g., how to allow temporary flood storage on private land), public participation issues (e.g., how to ensure involvement of private landowners), and public subsidy issues (e.g., how to integrate flood retention in agricultural subsidies).

PROJECT OUTCOMES

In the first four years, 34 different publications were published, including books, articles, and special issues of the journal; proposals and recommendations were prepared for decision-makers and citizens; 16 meetings and workshops were held; a research network was established to continue collaboration after completion of the project.

CONTEXT European network to connect research and innovation efforts on advanced Smart Textiles

Duration Action code Coordinator Participants from the Faculty 11.10.2018–11.10.2022 CA17107 Associació Agrupació D'Empreses Innovadores Tèxtils Prof. Vlatka Rajčić

Web page: https://www.cost.eu/actions/CA17107/





The aim of the action is to create a network of European researchers and major stakeholders in order to develop common ideas and initiatives that can be transformed into advanced smart textile products. A smart textile material is a "functional textile material that actively interacts with its environment, i.e., reacts to or adapts to changes in the environment." Textile products find application in all sectors, especially in the health and medicine, automotive and aeronautical sectors, personal protective equipment, sports and wearables, and the building and interior design sector. Although several R&D projects have in recent years been carried out in this area, most of the prototypes obtained did not reach the market for a number of reasons, such as the product reliability, cost-effectiveness, lack of proven use and / or value proposition. In this sense, CONTEXT aims to launch research and innovation projects (with a high expected TRL) by pooling, within the same network and through working groups, various experts with the right competencies and experience from the academia and industry.

PROJECT OUTCOMES

Providing a centre to combine existing knowledge and identify common problems to develop new smart textiles, production technologies, services, and business models. Promote development of a joint research plan in line with the Strategic Innovation and Research Program for the European textile and clothing industry and other related ETPs in order to increase the efficiency and effectiveness of the innovation process.
AGITHAR Accelerating Global science In Tsunami Hazard and Risk analysis

Duration Action code Coordinator Participants from the Faculty 18.03.2019–17.03.2023 CA18109 University of Hamburg Assoc. Prof. Mislav Stepinac; Assoc. Prof. Josip Atalić



Web page: <u>https://www.cost.eu/actions/CA18109/</u>



Large tsunamis are low-frequency but potentially very high-impact events that can cause extreme numbers of casualties as well as very large economic losses, as recently demonstrated by the Sumatra-Andaman Tsunami in December 2004 and the Japan Tsunami of March 2011. In both cases, the scale of actual disaster surpassed by far the anticipated magnitudes. One of the reasons for the underestimated risk potential can be identified as the lack of rigorous, robust and standardized hazard and risk analysis methods and associated uncertainties. While a large number of probabilistic as well as deterministic methods has been proposed and used in the past, a consolidation process is dearly overdue and will require to bring together the experts from diverse areas of science specialising in tsunami hazard and risk analysis.

PROJECT OUTCOMES

AGITHAR is a network for improving, standardizing, and promoting tsunami research. It uses specific COST tools – workshops, networking, exchange of experts – in order to:

- Assess current approaches in tsunami hazard and risk analysis, and evaluate them quantitatively by means
 of common metrics and benchmarks.
- Determine gaps in scientific knowledge, methodological approaches and tools in order to achieve robust tsunami hazard and risk analysis across a variety of tsunami sources, including earthquakes, landslides, volcanoes, and meteorological events.
- Derive and agree on best practices and standards for probabilistic tsunami hazard and risk analysis, through discussion by a large group of practitioners.
- Identify issues and challenges to properly orient future research.
- Disseminate the acquired knowledge among hazard and risk practitioners and end-users.

CERTBOND Reliable roadmap for certification on bonded primary structures

Duration04.04.2019–03.04.2023Action codeCA18120CoordinatorDelft University of TechnologyParticipants from
the FacultyProf. Vlatka Rajčić; Prof. Davor Skejić; Assoc. Prof. Mislav Stepinac;
the FacultyAsisst. Prof. Ivan Ćurković; Ivan Čudina; Anđelo Valčić; Nikola Perković, PhD

Web page: <u>https://certbond.eu/</u>







With an increasing pressure to meet unprecedented levels of eco-efficiency, the aircraft industry aims for superlight structures, and, towards this aim, composites are replacing conventional aluminium. The same trend is being followed by the civil, automotive, wind energy, naval and offshore industries, in which the combination of steel and composites, or replacement of steel with composites, can increase the strength-to-weight ratio. However, the joining design is not following this transition. Currently, composites are being assembled using fasteners. This leads to a reduction in load-bearing capacity and is a huge weight penalty for composites, since holes cut through the load carrying fibres and destroy the load path. Adhesive bonding is the most promising joining technology in terms of weight reduction and performance. However, its lack of acceptance is limiting its application to secondary structures, whose failure is not detrimental to structural safety. In primary (load-bearing) structures, fasteners are always included along bondlines, as "back-up" in case the bond fails. The main reasons for this lack of acceptance are the limited knowledge of their key manufacturing parameters, non-destructive inspection techniques, damage tolerance methodology, and reliable diagnosis and prognosis of their structural integrity.

PROJECT OUTCOMES

The goal of the Action is to provide a reliable background for the certification of bonded joints in primary (loadbearing) composite structures. Despite the motivation being aircraft structures, which are believed to have the most demanding certification, it will directly involve other application fields in which similar needs are present. This Action will tackle the scientific challenges at the different stages of the life cycle of bonded structures through the synergy of multidisciplinary fields and knowledge transfer.

ODIN Optimising Design for Inspection

Duration Action code Coordinator Participants from the Faculty 02.10.2019–01.10.2023 CA18203 Cardiff University Prof. Vlatka Rajčić

ODIN

Web page: <u>www.odin-cost.com</u>



Non-destructive assessment methods based on ultrasonic techniques, electro-mechanical device techniques, and wireless network sensors, have proven to be very effective in monitoring aircraft component damage in laboratory conditions (TRL 3). However, it is necessary to integrate this approach and techniques into the initial research and design. This COST action brings together top European experts from various related fields of research to support the development of an integrated framework for optimized self-sensing structures capable of analysing and projecting structure behaviour, and together with case studies and educational activities, including training programs, will ultimately seek toward a cleaner and safer sky.

PROJECT OUTCOMES

Optimization (sensor / structure), computational modelling, advanced signal processing, and advanced design approaches, will be integrated to produce a new access framework, design tools, and guidelines for the delivery of the first generation of self-sensing aircraft capable of delivering accurate structure behaviour projections. This will improve maintenance strategies, bridge the gap between the research and industry, enable increased use of advanced materials, reduce operating costs, and ultimately deliver safer and greener air transport solutions.

PROCLIAS Process-based models for climate impact attribution

across sectors

Duration Action code Coordinator Participants from the Faculty

27.10.2020–26.10.2024 CA19139 Potsdam Institute for Climate Impact Research Assoc. Prof. Kristina Potočki; Martina Lacko; Prof. Vlatka Rajčić

Web page: https://proclias.eu/





In Europe, there are many complex process-based models for predicting future climate impacts. Nevertheless, the current research community on climate impacts is fragmented and focused on a single system modelling. The integration of climate impacts across different natural and social sectors is gaining acceptance albeit at a very slow pace. Although climate change is already evident, the attribution of climate change to other causes has not been adequately explored, and more lawsuits are being filed over climate impacts, while policy debates over damages and losses are increasing. PROCLIAS aims to develop common protocols, harmonised datasets, and a shared understanding of how to conduct cross-sectoral studies of climate change impacts at regional and global scales, so as to enable attribution of recent climate change impacts and robust projections of future climate impacts.

PROJECT OUTCOMES

Build a scientific community of climate impact models that transcends disciplinary and sectoral boundaries and is to continue beyond the Action duration period. Support provision of harmonized datasets for global and regional climate impact simulations. Provide common protocols for cross-sector climate impact simulations. Assist in improving methods for conducting and analysing cross-sectoral simulations and attribution studies. Outreach to potential stakeholders through a variety of channels.

MODENERLANDS Modular energy islands for sustainability and resilience

Duration Action code Coordinator Participants from the Faculty

11.10.2021–10.10.2025 CA20109 University of Coimbra Assoc. Prof. Ivan Lukačević; Prof. Davor Skejić; Ivan Čudina; Anđelo Valčić



The MODENERLANDS 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, wind and wave energy sources in particular, by proposing pathways for incorporation, and by promoting relevant synergies in Research, Education and Training, in order to enhance Sustainability in the built environment. MODENERLANDS will work with Modularised Construction of Offshore Floating Platforms aiming at easily extending their size and capacity according to future energy needs. The Modular Energy Island concept will act as a platform to maximise collection and conversion of the renewable energy sources, and to efficiently transfer them to the network, exploring the cutting-edge Green Hydrogen related technologies for efficient energy storage and transportation.

PROJECT OUTCOMES

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. The Action will promote synergies that will offer breakthrough scientific developments leading to new concepts and R&D outcomes, thereby strengthening the European research and innovation capacities.

HELEN Holistic design of taller timber buildings

Duration Action code Coordinator Participants from the Faculty 12.10.2021–11.10.2025 CA20139 Aalto University Prof. Vlatka Rajčić, Assoc. Prof. Mislav Stepinac

Web page: https://www.cost.eu/actions/CA20139/



A shift towards sustainable and renewable construction techniques is necessary as the world construction sector is responsible for one third of carbon dioxide emissions, as well as for forty percent of the world energy use and waste production. Structural wood, the champion of sustainable building materials, has evolved to a stage that allows the construction of not only family housing but also taller buildings that are usually built of concrete or steel. While different designers of concrete and steel buildings (architects, construction engineers, fire engineers, acoustic engineers, etc.) can work almost independently, the design of taller wooden buildings needs to be done with an intensive cooperation of members of the design team. Therefore, it is crucial to solve the problem of multi-storey wooden buildings from a common and interdisciplinary perspective, taking into account the static, dynamic, fire and acoustic aspects, human health and other aspects simultaneously and not separately.

PROJECT OUTCOMES

Only through interdisciplinary analysis and interaction can a set of holistic design guidelines be developed that will enable safe construction of taller wooden buildings, as well as the respect of requirements for human wellbeing. This Action aims to achieve this through intensive interdisciplinary work and interaction between different approaches and bases, as well as between the academic and design experts.

OPENSENSE Opportunistic precipitation sensing network

Duration Action code Coordinator Participants from the Faculty 13.10.2021–12.10.2025 CA20136 Czech Technical University in Prague Assoc. Prof. Kristina Potočki; Martina Lacko

Web page: <u>https://opensenseaction.eu/</u>





Despite advances in remote sensing, precipitation observations remain one of the weakest links in the description of Earth's water cycle. This is especially critical in the face of climate change, human-induced hydrologic changes e.g. due to rapid urbanization, and consequent increase in frequency and magnitude of extreme events. OpenSense unites scientists, weather service experts, sensor network owners, and rainfall product users to create a global opportunistic sensing community. The project aims to enhance access to continental opportunistic sensing (OS) observations, establish OS as a reliable method for operational precipitation monitoring, and integrate OS into traditional networks.

PROJECT OUTCOMES

The challenges addressed by OpenSense include overcoming data exchange barriers, gaining acceptance as hydrometeorological observations, defining standards for large-scale OS precipitation product benchmarking, coordinating OS observations with traditional monitoring, and identifying new sources of precipitation data. These efforts will boost OS adoption and produce high-quality precipitation products with superior spatial and temporal resolution.

FOLIAGE European network for FOstering Large-scale ImplementAtion of energy GEostructure

Duration Action code Coordinator Participants from the Faculty 15.09.2022–14.09.2026 CA21156 Université de Lille Assoc. Prof. Mario Bačić

Web page: https://www.ca-foliage.eu/



Energy geostructures are a special type of ground heat exchanger installed within ground contact structures, such as retaining walls, piles, tunnels etc. They are a relatively mature technology whose physical behaviour has been studied. However, both technical and non-technical barriers still prevent actual implementation at a large scale. Some of the challenges may be related to: (1) Integration issues, including of shallow geothermal energy with other renewables, and of energy geostructures with other shallow geothermal sources; (2) Upscaling from the mastering of individual structures to the planning of geothermal district heating and the connection with the city scale; (3) Sustainability in the long term; (4) The absence of a database of knowledge regarding existing geostructures; (6) Non-technical issues related to legislation, financial incentives, social impact, lack of standardization etc. The aim of this COST Action is to gather all needed information to reduce these barriers and foster development by creating a multi-disciplinary network between the different stakeholders.

PROJECT OUTCOMES

- Development of a complete collaborative network of experts with a critical mass to enhance large-scale implementation of EGS
- Bringing together local authorities, communities, developers, designers, architects, academics, contractors to ensure the consistency of the framework developed and the dissemination of the outputs
- Development of a plan to fill up technical and non-technical knowledge gaps through future collaborations
- Utilization of multidisciplinary approaches to reduce barriers to knowledge exchange between diverse stakeholders
- Harmonisation and integration of research outputs to increase the visibility of existing experience of EGS.

CIRCULAR B

Implementation of Circular Economy in the Built Environment

Duration 27.10 Action code CA21 Coordinator Unive Participants from Prof. I the Faculty Asst.

27.10.2022–26.10.2026 CA21103 University of Minho Prof. Ivana Banjad Pečur, Prof. Vlatka Rajčić, Assoc. Prof. Ivan Lukačević, Asst. Prof. Ivan Ćurković, Andrea Rajić; Vlaho Žuvelek



Web page: https://circularb.eu/

Construction has been identified as a field of action by the European Commission's Circular Economy Action Plan (CEAP). However, the lack of a common understanding and open tools to classify buildings' circularity, at any stage in their lifecycle, is a barrier in the application of circular thinking.

Thus, this Action aims at defining the methodology to develop an international circularity framework for new and existing buildings to support decision making and assess the implementation level of CEAP. It will be based on Key Performance Indicators (KPIs), selected according to international best practices, current CE state-of-the-art, CEAP, and COST countries' construction practices.

The main aim of the Action 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 (ECEAP).

PROJECT OUTCOMES

The outcome of the CircularB project is the development of a KPIs framework with enough flexibility to be locally applied.

University of Zagreb

Funding of scientific and artistic activities for the ac. y. 2019/2020

Project code	Project leader	Title
2020-GF1	Prof. Tatjana Rukavina	Influence of dielectric constant on the reliability of GPR measurement results
2020-GF2	Prof. Mladen Vukomanović	Key success factors for integrating Building Information Modelling (BIM) with Enterprise Resource Planning (ERP) in contractor organizations
2020-GF3	Prof. Goran Lončar	Establishment of methodological standard for selecting appropriate degree of purification at SWTP for agglomerations of up to 10 000 PE
2020-GF4	Assoc. Prof. Mario Bačić	Non-destructive testing of rock bolt integrity
2020-GF5	Prof. Dalibor Carević	Hydromorphological changes of Croatian rivers
2020-GF6	Assoc. Prof. Saša Ahac	Quantification and classification of urban public transport stop dwell time influential factors
2020-GF7	Prof. Ana Mandić Ivanković	Key Performance Indicators of existing bridges
2020-GF8	Prof. Anita Cerić	The role and importance of communication risk in construction projects
2020-GF9	Prof. Vlatka Rajčić	Reliability index of rehabilitated and reinforced structures
2020-GF10	Assoc. Prof. Ana Baričević	Prediction of long-term properties of repair materials
2020-GF11	Assoc. Prof. Mario Uroš	Seismic performance assessment of typical buildings in the City of Zagreb
2020-GF12	Assoc. Prof. Bojan Milovanović	Modelling hygrothermal conditions in NZEB buildings
2020-GF13	Prof. Stjepan Lakušić	Noise and vibration protection on urban transport infrastructure

2020-GF14	Assoc. Prof. Mislav Stepinac	FEM analyses of glued-in rods
2020-GF15	Prof. Ivica Završki	Identification, systematization, and evaluation of innovative construction technologies
2020-GF16	Assoc. Prof. Marijana Serdar	Influence of pore microstructure on the behaviour of building materials
2020-GF17	Prof. Domagoj Damjanović	Contemporary methods for dynamic monitoring of civil engineering structures
2020-GF18	Prof. Damir Lazarević	Efficiency assessment of iterative procedures for the design of spatial truss systems
2020-GF19	Prof. Tomislav Došlić	Structural and enumerative aspects of maximal matchings
2020-GF20	Prof. Alan Filipin	Generalized problem of Diophantine m-tuples
2020-GF21	Assoc. Prof. Dario Jukić	Non-integral statistics and applications of inequalities

Funding of scientific and artistic activities for the ac. y. 2020/2021

Project code	Project leader	Title
2021-GF1	Prof. Anita Cerić	Communication protocols and trust building risk minimisation strategies for risk caused by poor communication among project participants in construction projects
2021-GF2	Prof. Goran Lončar	Establishment of methodological standard for selecting appropriate degree of purification at SWTP for agglomerations of up to 10 000 PE
2021-GF3	Prof. Tatjana Rukavina	Quantification of moisture and fine grain content in pavement unbound granular layer by GPR
2021-GF4	Assoc. Prof. Saša Ahac	Quantification and classification of urban public transport stop dwell time influential factors
2021-GF5	Prof. Mladen Vukomanović	Key Success Factors for Integrating Building Information Modelling (BIM) with Enterprise Resource Planning (ERP) in Contractor Organizations
2021-GF6	Prof. Ana Mandić Ivanković	Key Performance Indicators of existing bridges
2021-GF7	Assoc. Prof. Gordon Gilja	Improvement of local scour monitoring methods
2021-GF8	Prof. Tomislav Kišiček	Ductility of hybrid reinforced concrete beams
2021-GF9	Prof. Dalibor Carević	Interaction of coastal structures and environment
2021-GF10	Assoc. Prof. Mario Bačić	Determination of the liquefaction potential of soil below flood protection embankments
2021-GF11	Prof. Davor Skejić	Reliability assessment of innovative aluminium joints
2021-GF12	Prof. Vesna Dragčević	Noise and vibration protection of urban road and rail infrastructure

2021-GF13	Assoc. Prof. Bojan Milovanović	Environmental impact assessment during energy renovation of buildings
2021-GF14	Prof. Nina Štirmer	Life cycle assessment of innovative precast concrete products
2021-GF15	Assoc. Prof. Marijana Serdar	Calculation of ecological footprint of alternative binders for concrete
2021-GF16	Assoc. Prof. Mario Uroš	Seismic performance assessment of typical buildings in the City of Zagreb
2021-GF17	Prof. Damir Lazarević	Application of tension-compression analogy for assessing condition of cultural heritage buildings
2021-GF18	Prof. Ivica Završki	Identification, systematization, and evaluation of innovative construction technologies
2021-GF19	Assoc. Prof. Ana Baričević	Economic and ecological efficiency of cementitious composites reinforced with waste fibres
2021-GF20	Prof. Domagoj Damjanović	Contemporary methods for dynamic monitoring of civil engineering structures
2021-GF21	Prof. Tomislav Došlić	Maximal matchings and Diophantine m-tuples
2021-GF22	Assoc. Prof. Dario Jukić	Non-integral statistics and applications of inequalities

Funding of scientific and artistic activities for the ac. y. 2021/2022

Project code	Project leader	Title
2022-GF1	Assoc. Prof. Gordon Gilja	Improving monitoring methods of local scouring around bridges
2022-GF2	Assoc. Prof. Bojan Milovanović	Environmental impact assessment during the energy- efficient refurbishment of buildings
2022-GF3	Prof. Nina Štirmer	Analysis of the properties of repair mortars containing wood biomass ash
2022-GF4	Prof. Davor Skejić	Reliability assessment of bonded aluminium joints
2022-GF5	Assoc. Prof. Mario Uroš	Analysis of the seismic resilience of characteristic buildings in the City of Zagreb
2022-GF6	Assoc. Prof. Mario Bačić	Optimization of foundations of offshore wind farms
2022-GF7	Prof. Ivica Završki	Identification, systematization and evaluation of innovative construction technologies
2022-GF8	Prof. Tatjana Rukavina	Quantification of moisture and fine dust in mechanically compacted base layers of road pavements using GPR
2022-GF9	Prof. Vesna Dragčević	Roadworthiness of road vehicles and effects of the introduction of autonomous vehicles on road planning
2022-GF10	Prof. Goran Lončar	Definition of methodological standards for the selection of the appropriate treatment stage in wastewater treatment plants in urban areas up to 10,000 PE
2022-GF11	Assoc. Prof. Saša Ahac	Quantification and classification of parameters that influence the dwell time of public transport vehicles at stops

2022-GF12	Prof. Anita Cerić	Application of blockchain technology to improve BIM security
2022-GF13	Prof. Dalibor Carević	Interaction of maritime structures and the environment
2022-GF14	Assoc. Prof. Ana Baričević	Influence of waste fibres on the internal curing of mortar
2022-GF15	Prof. Dražen Vouk	Treatment of different types of wastewater with hybrid electrochemical processes
2022-GF16	Prof. Mladen Vukomanović	Integration of Building Information Modelling (BIM) with environmental, social and Governance (ESG) principles in construction project management
2022-GF17	Prof. Tomislav Kišiček	Ductility of hybrid reinforced concrete beams
2022-GF18	Prof. Damir Lazarević	Application of the compression-tension analogy in the assessment of the condition of cultural heritage structures
2022-GF19	Prof. Vlatka Rajčić	Assessment of the reliability index of repaired and reinforced structures
2022-GF20	Assoc. Prof. Marijana Serdar	Evaluation of the durability properties of low-carbon concrete in different exposure classes
2022-GF21	Prof. Ana Mandić Ivanković	Key Performance Indicators for existing bridges
2022-GF22	Assoc. Prof. Josip Atalić	Analysis of the behaviour of buildings in block construction under seismic action
2022-GF23	Prof. Stjepan Lakušić	Noise and vibration protection of urban roads
2022-GF24	Prof. Domagoj Damjanović	Modern methods for dynamic monitoring of structures
2022-GF25	Prof. Tomislav Došlić	Maximum adjustments and diophantine m-tuples
2022-GF26	Assoc. Prof. Dario Jukić	Topological phases and applications of inequalities

Funding of scientific and artistic activities for the ac. y. 2022/2023

Project code	Project leader	Title
2023-GF1	Assoc. Prof. Mario Bačić	Optimization of foundations of offshore wind farms
2023-GF2	Assoc. Prof. Ana Baričević	Microstructure of fibre-reinforced cement composites
2023-GF3	Prof. Domagoj Damjanović	Modern methods of dynamic monitoring of structures
2023-GF4	Assoc. Prof. Bojan Milovanović	Environmental impact assessment of the energy- efficient refurbishment of buildings
2023-GF5	Assoc. Prof. Marijana Serdar	Evaluation of durability properties of concrete with low environmental footprint in different exposure classes
2023-GF6	Prof. Davor Skejić	Reliability assessment of longitudinally welded aluminium columns
2023-GF7	Assoc. Prof. Mario Uroš	Analysis of seismic resilience of characteristic buildings in the City of Zagreb
2023-GF8	Prof. Anita Cerić	Application of blockchain technology to improve BIM security
2023-GF9	Assoc. Prof. Marija Jelčić Rukavina	Optimization of materials for use in lightweight steel composite panels under fire exposure
2023-GF10	Prof. Tomislav Kišiček	Ductility of hybrid reinforced concrete beams
2023-GF11	Prof. Ana Mandić Ivanković	Key Performance Indicators for existing bridges
2023-GF12	Assoc. Prof. Gordon Gilja	Improved methods for monitoring local scouring around bridges
2023-GF13	Prof. Dražen Vouk	Treatment of different wastewaters with hybrid electrochemical processes

2023-GF14	Prof. Dalibor Carević	Interaction of maritime structures and the environment
2023-GF15	Prof. Goran Lončar	Establishment of methodological standards for choosing the appropriate level of treatment in wastewater treatment plants in municipalities with up to 10,000 PE
2023-GF16	Prof. Vlatka Rajčić	Evaluation of the reliability index of repaired and reinforced structures
2023-GF17	Prof. Tatjana Rukavina	Quantification of moisture and fine particles in mechanically compacted base layers of road pavements using GPR
2023-GF18	Prof. Damir Lazarević	Application of discrete models in the analysis of traditional masonry structures
2023-GF19	Prof. Mladen Vukomanović	Integration of Building Information Modelling (BIM) with Environmental, Social and Governance (ESG) principles in construction project management
2023-GF20	Prof. Vesna Dragčević	Impact of noise and vibration from road and rail vehicles on environmental conditions in urban areas
2023-GF21	Assoc. Prof. Maja Ahac	Quantification and classification of parameters that influence the dwell time of public transport vehicles at stops
2023-GF22	Assoc. Prof. Matej Mihić	Increasing occupational safety by applying innovative technologies
2023-GF23	Prof. Alan Filipin	Diophantine sets and maximum correspondences
2023-GF24	Assoc. Prof. Dario Jukić	Topological phases and applications of inequalities

Funding of scientific and artistic activities for the ac. y. 2023/2024

Project code	Project leader	Title
2024-GF1	Assoc. Prof. Bojan Milovanović	Environmental impact assessment during the energy- efficient refurbishment of buildings
2024-GF2	Assoc. Prof. Ivan Duvnjak	Modern methods of dynamic monitoring of buildings
2024-GF3	Assoc. Prof. Marijana Serdar	Calculation of the environmental impact of materials designed for different environmental classes
2024-GF4	Assoc. Prof. Mario Uroš	Analysis of seismic resilience of characteristic buildings in the City of Zagreb
2024-GF5	Assoc. Prof. Mario Bačić	Optimization of foundations of offshore wind farms
2024-GF6	Prof. Anita Cerić	Application of blockchain technology to improve BIM security
2024-GF7	Prof. Ana Mandić Ivanković	Comprehensive approach for the assessment of existing bridges
2024-GF8	Prof. Dražen Vouk	Treatment of various wastewaters with hybrid electrochemical processes
2024-GF9	Prof. Tomislav Kišiček	Ductility of hybrid reinforced concrete beams
2024-GF10	Assoc. Prof. Gordon Gilja	Improved methods for monitoring local scouring around bridges
2024-GF11	Assoc. Prof. Ana Baričević	Microstructure of fibre-reinforced cement composites
2024-GF12	Assoc. Prof. Marija Jelčić Rukavina	Research on geopolymers for tunnel linings
2024-GF13	Prof. Mladen Vukomanović	Integration of Building Information Modelling (BIM) with Environmental, Social and Governance (ESG) principles in construction project management

2024-GF14	Prof. Davor Skejić	The influence of welding on the mechanical properties of structural aluminium alloys
2024-GF15	Assoc. Prof. Ivan Lukačević	Development of an innovative shear wall system made of double-layered, corrugated and concrete- filled cold-formed steel sheets
2024-GF16	Prof. Vlatka Rajčić	Evaluation of the reliability index of repaired and reinforced structures
2024-GF17	Assoc. Prof. Kristina Potočki	Interaction of hydraulic structures and the environment under the conditions of climate change
2024-GF18	Prof. Vesna Dragčević	Impact of noise and vibration from road and rail vehicles on environmental conditions in urban areas
2024-GF19	Assoc. Prof. Maja Ahac	Quantification and classification of parameters influencing the dwell time of public transport vehicles at stops
2024-GF20	Prof. Tatjana Rukavina	Quantification of moisture and fine particles in mechanically compacted base layers of road pavements using GPR
2024-GF21	Prof. Damir Lazarević	Application of the push-pull analogy in the assessment of the condition of cultural heritage buildings
2024-GF22	Prof. Goran Lončar	Definition of methodological standards for selecting the appropriate treatment stage for wastewater treat- ment plants in municipalities with up to 10,000 PE
2024-GF23	Assoc. Prof. Zvonko Sigmund	Digitalization as a driver of circular construction
2024-GF24	Prof. Alan Filipin	Diophantine quantities and maximum matches
2024-GF25	Assoc. Prof. Dario Jukić	Topological phases and applications of inequalities

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