# European Council of Civil Engineers

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## ECCE Joins the New European Bauhaus as official partner


**The European Council of Civil Engineers has joined the New European Bauhaus movement promoted by the European Commission, a network of thinkers, planners, architects, designers, businesspeople, students and citizens who, through a process of collective creation, will work to carry out innovative initiatives and solutions that encourage inclusive, accessible, sustainable and pleasant environments in which to cohabit after the pandemic.**

**The New European Bauhaus**

*"We will set up a new European Bauhaus – a co-creation space where architects, artists, students, engineers, designers work together," European Comission President Ursula von der Leyen stated, "I want NextGenerationEU to kickstart a European renovation wave and make our Union a leader in the economy,"*

A creative and interdisciplinary initiative that will give us the opportunity to design future ways of living and cohabiting wherever art, culture, social inclusion, science and technology are found. The New European Bauhaus is a think-do tank that wants to build a sustainable future through creativity, innovation and imagination.

The New European Bauhaus will develop over three stages. Co-design, to give shape to proposals through participative co-creation. Results, to develop a framework in which to test them through pilot programmes. And Dissemination, to present the results and endow them with funding. In this last one, the systematic exchange of knowledge between participants and professionals will be very important: establishing the best methods, solutions and prototypes to make them available to cities, localities, architects and designers.

The New European Bauhaus is a project designed to transform the built environment (housing, infrastructure, architecture) into one fit for the future, with fewer emissions, and long-term social value.

The idea behind the New European Bauhaus movement is that the climate emergency can be faced from a multidisciplinary perspective and with the ultimate goal of reaching a circular economy bringing together the construction and the culture sector, thus considering beauty and humanity values together with a greener architecture. So, it opens the door to a more ***holistic approach*** to our built environment.

**The European Council of Civil Engineers would like to bring forward and highlight the *importance of structural safety* of the buildings which unfortunately has not been considered at least to the necessary extent.**

**New European Bauhaus official partners list**

# ECCE Statement on the New European Bauhaus: "A Resilient New Bauhaus: the need for safe, sound and sustainable buildings"

The European Council of Civil Engineers has submitted its statement on the New European Bauhaus initiative highlighting that we need a **Resilient New European Bauhaus with safe, sound and sustainable buildings.**

As the President of the European Commission Ursula von der Leyen stated in her inaugural speech "The New European Bauhaus movement is intended to be a bridge between the world of science and technology and the world of art and culture... it is about a new European Green Deal aesthetic combining good design with sustainability." The New European Bauhaus is an initiative designed to transform the built environment (housing, infrastructure, architecture) into one that is fit for the future, with fewer emissions, greater resilience, and generating long-term social value. At the heart of the New Bauhaus is the belief that the climate emergency can be faced from a multidisciplinary perspective and with the ultimate goal of reaching a circular economy. It will bring together the construction and the culture sectors, thus considering the values of beauty and humanity together with a greener architecture. So, *it opens the door to a more holistic approach to our built environment*.

A sustainable built environment must be resilient, and, in that context, ECCE would like to bring forward and highlight the importance of structural safety of buildings which we believe has not been adequately taken into account to date:

**Aging building stock: a challenge for energy efficiency and structural/seismic safety**

The majority of the existing building stock in most European countries built in the 80s, 70s or earlier does not meet modern design standards including the requirements for seismic safety and energy efficiency. For this "aging" group of existing buildings, key challenges lie ahead regarding their structural safety, sustainability and energy performance. Society and its engineers have the responsibility to address this multidimensional challenge and to maintain this "aging" building stock in an operational, reliable and resilient state, in order to ensure firstly the safety and comfort of the users and secondly the enhancement of its architectural character and energy efficiency.

**Structural/Seismic safety: a basic requirement for buildings**

For buildings, structural/seismic safety is one of the essential requirements of EU policy and legislation for construction works, which demands that technical specifications shall be based on these seven requirements:

- Structural resistance and stability
- Safety in case of fire
- Hygiene, health and the environment
- Safety and accessibility in use
- Protection against noise
- Energy economy and heat retention
- Sustainable use of natural resources

**Sustainable Structural Design (SSD): a holistic approach to building renovation**

Currently, from a sustainability perspective, emphasis is placed on developing an integrated holistic design methodology for new buildings that should be preferred over individual actions to ensure a Sustainable Structural Design (SSD). Such approaches like the SSD methodology will ensure that new buildings satisfy aesthetic aspects, structural safety, energy efficiency and that meet the needs of the owner and user while minimizing the environmental impact and conserving resources where possible.

For existing buildings SSD means that a conceptually similar approach is required to provide a holistic upgrading solution. Therefore, when renovation projects of a certain scale are undertaken, structural upgrading should be considered and funded jointly with functional, aesthetic and energy efficiency upgrading.

**Recent Developments: a pilot project for integrating seismic strengthening and energy efficiency**

Only the last few years it has been acknowledged that independent retrofit actions should be integrated to enhance the overall performance of buildings. It started with an effort to relate seismic efficiency with environmental benefits where works were being carried out to mitigate damage and/or demolition caused by earthquakes. This was succeeded by a multidisciplinary approach to improve building performance taking both seismic and energy efficiency into consideration. In this light, the European Commission's Joint Research Center (JRC) is carrying out the Pilot Project "Integrated techniques for the seismic strengthening and energy efficiency of existing buildings". This Pilot Project puts forward a holistic approach to improve simultaneously the seismic safety and energy efficiency of the

European building stock. This sustainable approach will combine renovation efforts that reduce building vulnerability to protect lives and will update the energy efficiency of ageing structures to significantly reduce CO2 emissions and tackle energy poverty. The Pilot Project directly supports several European Commission priorities including the Green Deal's call for renovating in an energy and resource efficient way. It provides the technical background in support of the Renovation Wave initiative and an EU Action Plan to modernise the European building stock.

**A Resilient New Bauhaus: the need for safe, sound and sustainable buildings**

The New European Bauhaus is a transformational crossroads project which leads the way to a holistic approach to our built environment, proposing new dimensions and considerations that are the main drivers for quality planning processes and quality projects. It constitutes a source of inspiration and innovation as well as critical thinking and problem solving. In that context, investing in siloed energy efficiency renovation schemes while overlooking building safety is unwise, particularly in regions with seismic hazard, where the first seismic episode after renovation may lead to the damage or collapse of energy-efficient renovated buildings that are unsafe. Last year ECCE launched a campaign declaring 2020 as the Year of the 3S approach which stands for Safe, Sound and Sustainable buildings. We strongly believe that the European New Bauhaus initiative should take into account the need to integrate the structural/seismic upgrade of existing buildings with energy efficiency and aesthetic improvements. Building safety is a critical factor which needs to be part of a holistic approach to our common efforts to ensure a safe, beautiful and sustainable built environment.

The European Council of Civil Engineers: ready to support the New Bauhaus initiative
ECCE is ready to support the development of the New Bauhaus initiative, notably by:

- acting as an information platform and facilitating dissemination and dialogue through the broad ECCE network (we are able to reach a large audience via our 23 national member organisations);
- enabling contact with renowned professionals and experts, who would be able to give greater visibility to the initiative;
- offering a knowledge and expertise hub, to help the European Commission to further design the initiative and ensure that its process delivers the desired outcomes;
- obtaining inputs from public authorities and decision-makers;
- acting as a partner for co-organising consultations, co-creation initiatives, and awareness-raising events targeting professionals;
- offering The European Engineers' Day – a regular European Engineering event co-organized with other European Engineering Organisations – as a platform to discuss and disseminate the projects and results of the New European Bauhaus.

ECCE is committed and offers its help and support towards optimizing the planning and organization of this initiative and we will follow up with some further suggestions. We are very much looking forward to collaborating with the European Commission and its stakeholders to make this initiative a success.

**Download the ECCE statement on the New European Bauhaus**

# ECCE´s Intervention on the Consultation on the revision of the Energy Performance of Buildings Directive 2010/31/EU

## Introduction

As announced in the European Green Deal, the Commission adopted on 14 October 2020 a strategic Communication "Renovation Wave for Europe - greening our buildings, creating jobs, improving lives". It contains an action plan with specific regulatory, financing and enabling measures for the years to come and pursues the aim to at least double the annual energy renovation rate of buildings by 2030 and to foster deep renovations. It is expected that mobilising forces at all levels towards these goals will result in 35 million building units renovated by 2030.

The Renovation Wave confirms that the existing legislative measures on buildings will neither suffice to achieve the increased EU 2030 climate target of at least 55% emission reduction target and the planned increase in the ambition for energy efficiency, nor the 2050 climate neutrality objective. Therefore, the Renovation Wave communication announces a revision of the Energy Performance of Buildings Directive 2010/31/EU (EPBD) together with a number of areas of legislative and non-legislative reinforcement in relation to building renovation and decarbonisation of buildings. The EPBD is the cornerstone of European legislation in the area of energy performance of buildings. It aims at accelerating the transformation of the EU building stock into a highly energy efficient and decarbonised building stock by 2050.

The Renovation Wave already indicated some specific aspects which will be addressed in the revision of the EPBD, namely: the phased introduction of mandatory minimum energy performance standards for all types of buildings (public and private), an update of the framework for Energy Performance Certificates, the introduction of Building Renovation Passports and the introduction of a 'deep renovation' standard in the context of financing and building decarbonisation objectives. The requirements for new buildings and measures fostering sustainable mobility are also considered to be updated in line with the enhanced climate ambition of the European Green Deal and the Climate Target Plan 2030. This includes addressing resource efficiency and circularity principles in order to reduce whole lifecycle emissions, digitalisation in design, construction and operation of buildings, climate resilience and health and environmental requirements, as well as accessibility for persons with disabilities, and energy poverty, requires consideration. More information is provided in the Inception Impact Assessment.

The consultation that was launched was part of a larger stakeholder consultation which will feed into the Commission's work on the revision of the EPBD. It builds upon the results from the very extensive and in-depth public consultation for the Renovation Wave that took place between January and September 2020, whose results have been assessed in a dedicated report.

The European Council of Civil Engineers contributed to the public consultation on the revision of the Energy Performance of Buildings Directive 2010/31/EU. ECCE´s contribution can be accessed here. In addition to this, ECCE addressed an intervention that is presented below.

**European Council of Civil Engineers' intervention regarding the Revision of the Energy Performance of Buildings Directive 2010/31/EU via Directive (EU) 2018/844**

The European Council of Civil Engineers (ECCE) since 1985 is the active voice of Civil Engineers across Europe. It represents the Civil Engineering professional associations from 23 countries. Civil engineers fully support and welcome the call for promoting the enhancement of energy efficiency of the EU building stock with a perspective of achieving the 2030/2050 climate targets and the revision of the Energy Performance of Buildings Directive (EPBD) so that it is coherent with the Renovation Wave strategy objectives.

However, while with the introduction of Article 2α.7 in the revised EPBD, the significance the structural integrity of buildings located within the seismic regions of EU has on their lifetime and on energy renovations is recognized, we strongly believe that more specific references and requirements should be incorporated in the revised EPBD, shall (a) the assessment of the seismic efficiency of structures undergoing major energy renovations be ensured and (b) the simultaneous upgrading of the buildings seismic/structural capacity and energy efficiency in seismic regions of the EU is encouraged. In particular, we note the following:

1. The majority of the existing building stock in most of the southern European countries prone to earthquakes has been erected during time periods where no or less strict seismic codes were implemented in design and materials of poorer mechanical properties were used in construction. The lack of proper maintenance for a considerable number of aging buildings in the seismic regions of the EU has also contributed to their vulnerability to seismic events.
2. The structural integrity and seismic resistance of structures is often the main parameter dictating their lifetime and thus the lack in seismic resistance capacity of buildings may pose a significant obstacle to energy renovations. It is thus evident that structural integrity and sustainability are interrelated. This has been recognised by the ECCE which has declared 2020 as the year of the 3S Approach (Safe, Sound and Sustainable) in its recent manifesto and has also been acknowledged in the revised EPBD, as mentioned above.
3. On the basis of the above, we consider that a holistic approach should be taken for the upgrading of the energy efficiency of the aging existing building stock of European countries prone to earthquakes, one that incorporates the assessment and upgrading of their structural/seismic resistance.
4. EPBD revision: We therefore recommend that the revised EPBD places emphasis on the need for assessment of the structural capacity and seismic resistance of older buildings within the earthquake prone areas of the EU undergoing major energy renovations – especially those designed with no consideration for their seismic resistance - so that potential needs for seismic resistance upgrading are identified and addressed. Particularly, we recommend that the assessment of the seismic resistance/structural stability of structures prior to the execution of energy renovation works is set as a requirement for buildings undergoing major energy renovations, that have been designed with no consideration for their seismic resistance (i.e. without the implementation of a seismic code). Such a requirement would contribute in ensuring the safety of the building's users and the public, placing the necessary emphasis on resilience. It would also ensure that the proposed upgrading of the energy efficiency of a building is analogous to its estimated remaining lifetime. Additionally, it would create incentive for the execution of structural renovation works – where this is deemed as necessary - which could prolong the remaining life of a significant number of buildings, thus creating further opportunity for long-term investments in energy renovations.

   Also, we recommend that specific requirements are included in the revised EPBD, promoting a holistic and integrated approach for the upgrading of a building's performance which takes into consideration the state of its structural integrity and encourages the simultaneous upgrading of the energy efficiency and structural/seismic capacity of buildings in these areas. On this basis, we recommend that the revised EPBD includes requirements for the simultaneous upgrading of the seismic and energy efficiency of buildings for which the assessment of their seismic capacity has shown that structural upgrades are deemed as necessary for the safety of the structure and/or that their estimated remaining lifetime is significantly disproportionate to the pro-

posed energy renovations for the building.

On the basis of the above, we recommend that the below reference is added in Article 2α.7 of the revised EPBD:

"Each Member State may use its long-term renovation strategy to address fire safety and risks related to intense seismic activity affecting energy efficiency renovations and the lifetime of buildings. *For buildings located within regions of high seismicity that have been designed without the implementation of a seismic code and shall undergo major energy renovations, the seismic capacity of the building should be assessed by a competent engineer. In the case that structural upgrades are deemed as necessary for the safety of the building following the assessment of its seismic capacity, the structural/seismic upgrading of the building should take place simultaneously or prior to the energy renovation works.".*

5. Funding instruments: Furthermore, we recommend and consider that it is of outmost importance that financial resources made available by the Eurovision Commission via the Renovation Wave strategy include funds to encourage the assessment of the structural capacity of older buildings in the seismic regions of the EU which may lack in seismic capacity, so that, if deemed necessary, issues of structural performance are addressed, ensuring the safety of the occupants and the public but also creating opportunity for long-term investments for the upgrading of the energy efficiency of the buildings.

   Also, we recommend that part of the funding is also utilised to encourage the simultaneous upgrading of the structural/seismic capacity and energy efficiency of the older building stock of European countries prone to earthquakes, via the use of an integrated methodology, or otherwise.

   The incorporation of such incentives could contribute significantly in creating a culture for a common and integrated approach for the upgrading of the structural/seismic capacity and energy efficiency of buildings in these regions.

**Download ECCE´s intervention on the EPBD revision**

# Construction 2050 Alliance Press Release: The construction ecosystem as an opportunity for new talent? YES!

01.07.2021

**In the context of the event "The European Construction Sector – Opportunities for new talent" held on 1st July, the Construction 2050 Alliance issued the following press release, entitled "The construction ecosystem as an opportunity for new talent? YES!":**

Sustainability, robot dogs, new technologies for training and education are rapidly changing the image of the construction sector, which is sometimes still perceived as physically challenging, dirty, or dangerous.

The second public event organised by the Construction 2050 Alliance, which gathered 200 participants, showed that construction is a sector that can offer many opportunities to new talent. The discussions proved that in light of the EU Green Deal and of the Recovery and Resilience plans, construction can contribute positively to restore and create better and safer jobs for European citizens.

Significant efforts are already being deployed by the actors of the sector for investing in lifelong learning, in better working conditions and social protection, in a healthier and safer working environment and in better promotion of career opportunities.

However, in order to strengthen and accelerate the process, the Construction 2050 Alliance asks the policymakers to:

1. Ensure that the **"Reskill and upskill" flagship** is respected in the National Recovery Plans that the Member States will need to implement.
2. Ensure that **public money** that will be made available in the context of the Renovation Wave and the Recovery packages should go towards the creation of quality jobs.
3. Provide tailored **financial and technical support** to boost green and digital skills and deliver the objectives of the EU Green Deal and Renovation Wave (e.g. use of Digital Innovation Hubs also for skills).
4. Carry out outreach targeted initiatives for the construction ecosystem to promote its **attractiveness among youngsters, women, migrants and professionals coming from other sectors** with relevant skills for new construction activities.

The construction ecosystem will play a key role in the achievement of the ambitious goals of the EU Green Deal and of the National Recovery and Resilience plans. **Let's make it happen.**

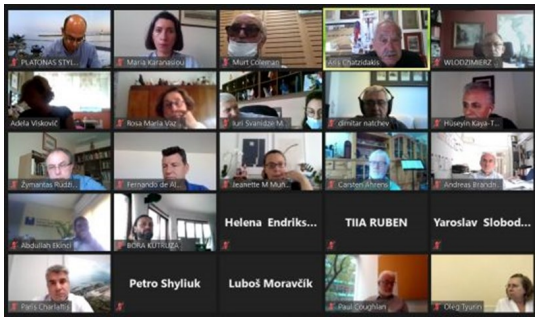
For more information on the Construction 2050 Alliance, visit the **website** or follow **#EUConstruction2050** on LinkedIn and Twitter.

**Download the Press Release**

# 72nd ECCE General Meeting

The 72nd ECCE General Meeting was held on Friday 11 June 2021, 11:00 - 16:15 EEST in a virtual environment via Zoom. The 72nd ECCE General Meeting gathered 41 delegates from the ECCE Full and Associate Members as well as invited guests from its partner organizations.

## 72nd ECCE General Meeting materials:




- Agenda for the 72nd ECCE General Meeting
- ECCE brief activity report October 2020 - June 2021
- ECCE book "Notes on the history of civil engineering Vol. II" presentation
- ECCE Strategic Plan survey presentation
- Construction News presentation
- New European Bauhaus presentation
- 2021 ECCE ExBo Elections Instructions
- 73rd ECCE GM and Building Engineering Forum presentation

# ECCE Position Paper Proposal on "European infrastructure maintenance & upgrade"

The Executive Board of the European Council of Civil Engineers during the 72nd ECCE General Meeting introduced a new proposal for the creation of a Position Paper on the "European Infrastructure maintenance & upgrade". The ECCE ExBo is currently formulating the working group that will work on the new Position Paper. ECCE members who are interested in participating in the working group are kindly requested to contact the ECCE General Secretary Maria Karanasiou at ecce_sps@otenet.gr.

## Background Information

### *Current infrastructure condition in Europe*

The decade-long policy of austerity imposed across Europe has in general been accompanied by a generalized **cut in public investment in infrastructure** and, above all, in the budget allocated to **maintenance and upgrading of the existing infrastructure**.

These economic circumstances unfortunately coincide with the completion of 40-60 years since the creation of Europe's basic infrastructure in the 60s and 80s. This means that **basic infrastructure, mainly transport and hydraulic, is starting to deplete their technically expected life span**.

Therefore, the phenomena of failures and accidents that are happening more and more frequently are technically expected and obviously a **broad maintenance program and upgrade of our infrastructure is required**.

### *European infrastructure challenges*

It is not just the **issue of aging** that needs to be addressed. There are also serious developments in our scientific knowledge that needs to be incorporated into them, and, above all, the **increase in design traffic loads and speeds** with which they have been calculated in relation to the current ones. In countries with high seismicity like Greece, the relevant knowledge and security levels of today's constructions have nothing to do with those of the time when designing and constructing these infrastructures.

### *Examples of infrastructure problems in Europe*

Of course the **problem exists across Europe**. In France, the Minister of Transport estimates that one-third of the country's 12,000 bridges are in need of maintenance. In 7% of the cases, the situation is considered to be risky for collapse so there is a need to immediately address the problem, and it has been proposed that the loads are reduced on them.

In Germany, while only 12.5% of bridges are considered to be in poor condition, only 12.5% are considered to meet modern requirements. The rest is clear that they were not designed for today's loads.

In Italy they estimate that some 300 bridges are at risk of failure and there is a sense of depletion of the basic infrastructure life cycle in the technical world.

**These infrastructures are vital for Europe's economic, social and regional development and to this end they have been identified as Trans-European Networks.** The extensive Trans-European Network includes 136,706 km of motorways and 138,072 km of railway lines, so the magnitude of the problem is enormous.

### *A European problem in need of a European solution*

**So, there is a European dimension problem and a European dimension policy is needed.** Currently, there are thoughts and processes at Committees level, but we strongly believe that this matter should be among the priorities of the next programming period.

In Greece a considerable amount of work has been carried out at the technical preparations level. The Technical Chamber of Greece (TCG) has organized a number of workshops on these issues. Since 2002 the Earthquake Planning and Protection Organization (EPPO) has issued Instructions for the Inspection and Evaluation of Bridges. The Ministry of Infrastructure, Transport and Networks issued also in 2009 detailed Manuals for Bridge Autopsy and Assessment. EGNATIA SA has an updated monitoring and maintenance program and accumulated know-how. ERGOSE also proceeds to the instrumental monitoring of its network bridges. Also, maintenance has been carried out on several existing bridges and there are studies ready for implementation.

Obviously, the scale of needs requires a much more organized approach and the Minister's announcement to establish a country's infrastructure register will help to record and know of the existing capacity so that we do not need to search to find out who has the responsibility and ownership of an infrastructure every single time. In addition to the necessary organizational and managerial effort, the unified administrative structure, the modernization of monitoring methods and the assessment of infrastructures, it is clear that significant resources will have to be mobilized either from Community resources or from national or other mixed funding methods.

### *Proposal for an ECCE Position Paper*

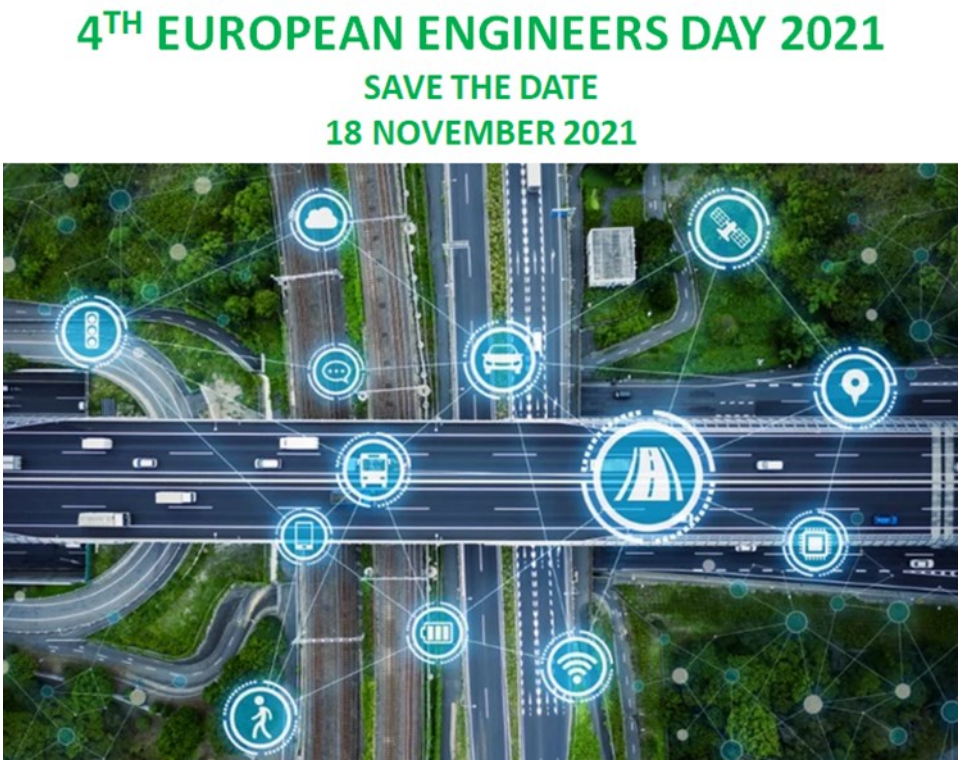
The European Council of Civil Engineers recognizes the broad extent of the problem of the aging and undermaintained infrastructure in Europe, as well as the consequences that stem from this inadequacy on the health, safety and financial prosperity of the society. Therefore, we propose the elaboration of a Position Paper that will raise awareness on the importance of safe and resilient infrastructure and will propose solutions for the enhancement of the current situation.

## 73rd ECCE General Meeting
## SAVE THE DATE!


The 73rd ECCE General Meeting will be held on 22 and 23 October 2021, in Sofia, Bulgaria, hosted by the Union of Civil Engineers in Bulgaria (UCEB). It will be an in-person event should the pandemic circumstances allow it.

More information will be released soon on the ECCE website.

# 4th European Engineers Day
# SAVE THE DATE!




The European Council of Civil Engineers (**ECCE**), the European Council of Engineers Chambers (**ECEC**), and the Federation of European Engineering Associations (**FEANI**) have been carrying out the so called "European Engineers Day" every 3 years. Unfortunately, due to the COVID-19 crisis the last Engineers Day in 2020 had to be postponed.

The three organizers met and have come up with a new date for the 4th European Engineers Day which is currently scheduled for 18 November 2021, in Brussels.

The main theme of the 4th European Engineers Day will be:

## The new Bauhaus: the vital role of engineering intelligence

More information will be released soon on the ECCE website.

# ECCE participates in the dialogue with the European Commission on Professional liability insurance for cross-border services

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR INTERNAL MARKET, INDUSTRY, ENTREPRENEURSHIP AND SMES
Services in the Single Market and Digitalisation
**Services Directive and Policy**

ECCE was invited by Mr. Henning Ehrenstein, Deputy Head of Unit for Energy Intensive Industries & Raw Materials, to participate in the dialogue on the professional liability insurance for cross-border services.

The 2020 European Commission's Single Markets Barriers Report identified a range of obstacles in the European Union's single market from the perspective of businesses and professionals that seek to provide their services in other EU Member States. One of these obstacles pertains to professional indemnity insurance and the access to adequate insurance coverage for their business activities in other Member States.

The European Commission has been assessing the availability of professional liability insurance for service providers in the context of their cross-border activities in the European Union.

The EC is aware that professional liability rules and corresponding insurance products vary widely between Member States. As a result, service providers might find it difficult to obtain reasonable insurance coverage for their activities in other Member States.

In that regard, they would like to find out whether civil engineers from our member organisations experience difficulties in obtaining insurance coverage and should this be the case, they would be interested in exploring together different potential options of addressing such difficulties.

ECCE President had a conference call with Mr. Ehrenstein and Mrs. Brigita Sabaliauskaite, Legal Officer of the Unit. During this call the EC officers further explained the topic and a first round of discussions was held where Mr. Chatzidakis expressed his views and experience on the topic.

After deliberations within the ECCE Executive Board, some of our members and some additional input from an expert on the field of Professional Liability Insurance, a letter was sent to Mr. Henning Ehrenstein expressing our views on the topic.

ECCE's input in the dialogue can be found here.

# ECCE's partnership with ICE in COP26

UN CLIMATE CHANGE CONFERENCE UK 2021
IN PARTNERSHIP WITH ITALY

ice Institution of Civil Engineers

The Institution of Civil Engineers (ICE) has invited ECCE to be partner in their COP26 Expression of Interest submission.

COP stands for "Conference of the Parties". COP refers to the decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC).

In November 2021, the UK will be hosting the 26th annual session of the Conference of the Parties to the Convention, or "COP26", in Glasgow. At the summit, delegates including heads of state, climate experts and negotiators will come together to agree coordinated action to tackle climate change.

As well as the negotiations, there will also be space for countries, international organisations and other delegates to showcase climate action, highlight diverse climate change issues and share knowledge.

Particularly, **ICE's focus for COP26 will be to showcase the work the infrastructure sector is doing to support achieving the UN Framework Convention on Climate Change and Paris Climate Agreement**.

ICE has three key areas they wish to cover:

- Showcasing what the profession can and is doing to drive progress toward the Paris Climate Agreement/SDG 13.3 outcomes
- Supporting the infrastructure sector in the attempt to create a sector decarbonisation pathway as a contribution to national NDCs to achieve SDG 9.4
- Providing insight and guidance on how to integrate climate change measures into sub-national infrastructure policies, strategies and planning in support of 13.2

The European Council of Civil Engineers will be a partner in the proposals No.1 and No.2 that have already been submitted by ICE.

More information about COP26 can be found here.

# ECCE becomes an affiliated society for the 9th World Sustainability Forum


## The 9th World Sustainability Forum - WSF2021
## 13-15 September 2021, Online

September 2021 marks the sesquianniversary of much of the world entering into various forms of lockdown or pandemic management as well as the 6th anniversary of the 2030 Agenda for Sustainable Development and the UN Sustainable Development Goals. The pandemic has challenged our expectations for the future and has prompted a re-evaluation of the relationships between society, politics and the commercial world. In the 9th World Sustainability Forum, we will consider all aspects of these new and evolving relationships and their impact on sustainability. Although all topics are welcome, we will have major sessions on the topics of Business and Finance, Climate, Health and Medicine, Water and Education.

The health crisis and its consequences will not guarantee a more sustainable future but it certainly provides a narrow window of opportunity to rethink outdated economic, social, and environmental arrangements. It is encouraging to note the widespread calls for a sustainable “new normal”.

We hope that this forum will contribute to the global debate as the world contemplates returning to a new normal and will contribute to establishing platforms and networks among stakeholders including lawmakers, commerce, the general public and academic disciplines. The aim is to bring structure to the vision of a sustainable world which deals fairly and transparently with the multifold issues of sovereignty, governance and society that have arisen in the pandemic.

Following the initiative in WSF 2020 of making an event on sustainability more sustainable, the 9th World Sustainability Forum will be an online global event.

Abstract Submission is open until 13 July 2021. For further details on how to submit, please click here. Please note that the abstract submission and conference registration are two separate processes. If you wish to simply participate as an attendee, you can register here.

The World Sustainability Award and the Emerging Sustainability Leader Award, funded by the MDPI Sustainability Foundation and the Sustainability journal respectively, will be conferred during the conference. Both the World Sustainability Award and the Emerging Sustainability Leader Award are endowed with a sum of USD 100'000 and USD 20’000 respectively.

The 9th World Sustainability Forum will take place from 13 - 15 September 2021.

We, the chair and the organization team, are very much looking forward to welcoming you to the 9th World Sustainability Forum. Let us grab this opportunity to advance the sustainability agenda!

Conference Chair

**Prof. Dr. Ed Constable**
Department of Chemistry and former Vice-Rector for Research,

University of Basel, Switzerland - Website

# ECCE participates in the 15th WCCE General Assembly

ECCE was invited to the 15th WCCE General Assembly and was officially represented by the ExBo member Helena Endriksone who acts as ECCE's liaison to WCCE and is also a member of the WCCE ExCo since ECCE is an international member of WCCE. ECCE President Aris Chatzidakis and General Secretary Maria Karanasiou also attended the meeting.

The Assembly was welcome by OEPT's President Carlos Mineiro. Attendance at WCCE activities by WCCE delegates was enriched by the attendance of WFEO Vice President, Mustapha Shehu. 15 organizations from 14 countries attended this 15th General Assembly in difficult circumstances such as these.

The General Assembly showcased the activity of WCCE's Standing Committees within the pandemic period and how it has overcome the isolation through new initiatives and member's collaboration.

# ECCE participates in the Jury of the 2021 European Steel Design Awards

Steel is recognized for its high potential in terms of strength, durability, design flexibility, adaptability, recyclability and reusability. Today's steel structures allow the best adaptation to modern life and renovation of historical elements of our built environment, being in cities or countryside. Steel is also the perfect material for reaching a circular economy while leaving the necessary room for creativity in design.

The European Steel Design Awards are given by the European Convention for Constructional Steelwork (ECCS) every two years to encourage the creative and outstanding use of steel in architecture. The awards are dedicated to the owners, the architects, the engineers, the general contractors and the steelwork contractors.

ECCS is the European Association of Steelwork Contractors, the unique platform gathering steel producers, contractors, researchers and academics. ECCS is a federation of 18 national associations of steelwork contractors.

The Professional and International Jury meeting was held online on 3rd June 2021 and counted with:

- **Bernhard HAUKE**, Germany, Chairman of Promotional Management Board of ECCS and Chairman of the Jury
- **Annamarie HAGOORT**, The Netherlands, Chairwoman of AC4 Architectural Awards Committee
- **Christine LENOUY**, France, Secretary General of Le Syndicat de la Construction Métallique de France
- **Jacques FERRIER**, France, Architect, Ferrier Marchetti Studio, Paris
- **Mitsu EDWARDS**, France, Engineer, Eckersley O'Callaghan design office, Paris
- **Aris CHATZIDAKIS**, Greece, President of the European Council for Civil Engineers
- **Véronique DEHAN**, Belgium, Secretary General of ECCS

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# Scientific Papers

## Earthquake Risk Assessment for Cyprus
## (presented at the 2nd International Conference on Natural Hazards and Infrastructure, 2019, Greece)

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### Introduction

Cyprus is located at the boundary between the Eurasian, Arabian and African plates within a complex tectonic setting. Studies (e.g. Papazachos & Papaioannou, 1999) have demonstrated that the Anatolian subplate, to which Cyprus belongs, is forced to move westward by the collision of the African plate, which moves north north-eastward relative to the Eurasian one, and the Arabian plate, which moves northwards in a faster rate. The North Anatolian Fault and the East Anatolian fault (Figure 1), the two major strike-slip faults, enable this western movement of the Anatolian Subplate.

The Cyprus Arc, being the boundary accommodating the movement between the African and Anatolian subplate, is relatively less active than the neighbouring Hellenic Arc, Dead Sea and East Anatolian faults, being though the

origin of several shallow earthquakes. According to historical records (*e.g. Ambraseys, 1965; Kalogeras et al., 1999*), Cyprus has suffered from at least 16 destructive earthquakes the past 2000 years and numerous smaller earthquakes. It is worth-noticed that modern instrumentation began in the island only after 1997 and thus, the seismic catalogue until then is composed by empirical relationships and various international sources. The largest earthquakes mostly occurred at the southern part of the island, causing damage in Paphos, Limassol, and Famagusta (e.g. the earthquakes of 342 with estimated Mw= 7.4, 1222 with Mw=6.8, 1577 with Mw=6.7, 1785 with Mw=7.1, 1940 with Mw=6.7 (*Cagnan & Tanircan, 2010*).

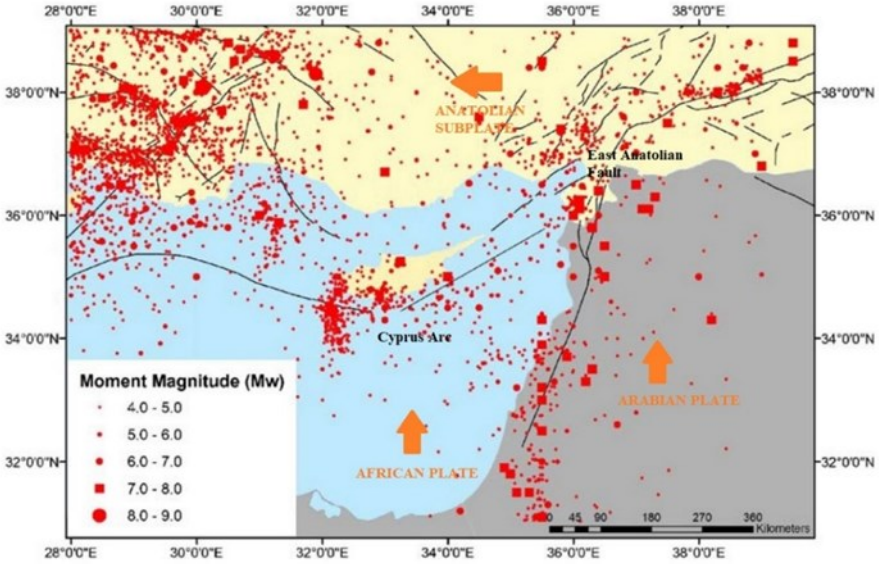



**Figure 1.** Distribution of shallow earthquake epicenters in the northeastern mediterranean region from 2150 B.C. to 2006 A.D. The solid lines are mapped and inferred faults. Vectors indicate plates movements/ Modified after *Cagnan and Tanircan (2009)*, *CGSD (1995)*, *Barka et al. (1997)* and *USGS (1999)*.

Hence, the first large event in the region for which seismic data from a digital network were available, was in 1996, of Mw=6.8 and shallow depth. Its epicentre was located offshore, to the southwest of the island, but a violent shock was widely felt.. Although building damage was limited, 20 people were slightly injured and 2 were the reported fatalities from indirect causes. Similarly, in 1999 an earthquake of Mw=5.6 with epicentre close to Limassol tremored the island with as many as 40 injuries mainly due to panic (*Cyprus mail, 2015*). In 2015, an Mw=5.8 earthquake violently shocked the districts of Paphos up to Limassol mainly with contents damage. Finally, the latest deadliest earthquake that hit the island was in 1953 (Mw=6.1) and caused 40 fatalities, 100 injuries and extensive damage to 158 villages and the city of Paphos (*Ambraseys, 1992*).

The need for thorough and continuously up-to-date study of the seismic hazard and risk of the island of Cyprus is, thus, made evident. Several projects on probabilistic hazard assessment have included Cyprus and provided refined results (GSHAP Program, *Giardini et al., 1999*; SESAME Project, *Jimenez et al, 2001*; EMME Project, *Erdik et al, 2012*; SHARE Project, *Giardini et al, 2013*). However, limited work has been done, regarding risk assessment at urban or national level for Cyprus (*Gountromichou et al., 2017a* within PACES Project; *Chrysostomou et al., 2014* within EMME Project, *Erdik et al., 2012*), although the outcome of the seismic risk assessment is more comprehensive and exploitable by the stakeholders and community than the hazard itself.

For the performance of seismic hazard and risk analysis, the OpenQuake platform (*Silva et al., 2013*) developed within the Global Earthquake Model Foundation (2018), has been applied. The engine is open-source, open-code and has the possibility to perform both probabilistic hazard and risk assessment and scenario damage and risk computation. Tailor-made hazard, exposure and vulnerability models have been uploaded together with customized logic trees to account for epistemic uncertainties.

## Seismic Hazard Assessment

For the implementation of Probabilistic Seismic Hazard analysis, the classical integration procedure as proposed by *Cornell (1968)* and formulated by *Field et al. (2003)* has been incorporated into OpenQuake software and performed in the study herein for investigation time of 50 years. The input files are: the three Seismic source models (ESHM13) developed for SHARE project (*Giardini et al., 2013*) in the OpenQuake format (*Pagani et al., 2014*), a collection of seismic sources describing the seismic activity (geometry and activity rate of each source) in the region of interest, with the associated tailored logic tree, which describes the epistemic uncertainties associated with each seismic source model; the Ground motion model, that associates Ground Motion Prediction Equations (GMPEs) and distribution weights to each tectonic region, given the occurrence of an earthquake rupture and the respective GMPE logic tree of SHARE project. For the definition of the site conditions, the simplified model based on the Shear wave velocity (Vs30) map of USGS (2018) has been used.

The information extracted from the probabilistic seismic hazard analysis is summarized in the seismic hazard curve which combines the rate (or probability) of exceedance of a range of intensity levels for different ground motion parameters at a given site. This curve is composed by consideration of exceedance of ground motion parameter levels by all possible earthquake ruptures included in the seismic source model within a given investigation time. Peak Ground Acceleration (PGA) curves for different probabilities of exceedance in 50 years have been generated for the main cities of Cyprus, for which PGA varies between 0.3 and 0.5g (with 10% probability of exceedance). It was concluded that the level of seismic hazard is the highest in Paphos and Limassol, both being in the vicinity of the shallow seismic subduction zones of the Cyprus and the Hellenic Arc.

The seismic hazard maps below express the distribution of the ground motion parameters under study for the given recurrence period (T). Figure 2 (left and right) illustrate the distribution of the Peak Ground Acceleration (PGA) for 10% probability of exceedance in 50 years or T=475 and for 2% probability of exceedance in 50 years or T=2500 years, respectively. It varies from 0.2 to 0.55g (Figure 2, left) and from 0.40 to 0.90g (Figure 2, right). It is evident that the highest seismic hazard is concentrated in the southwestern part of Cyprus. More precisely, along the southwestern shore of the island, where Limassol and Paphos are located, PGA exceeds 0.45g (for T=475years) and 0.80g (for T=2500 years). Interesting is the comparison with the current seismic design map (*CEN, 2004*) which anticipates max design PGA, in the same regions, yet equal to 0.25g (for T=475 years).

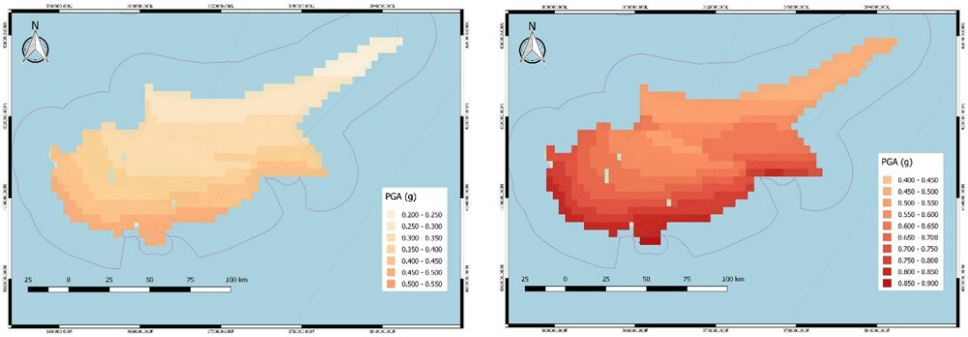



**Figure 2.** Mean seismic Hazard map in PGA for probability of exceedance 10% in 50 years (T=475 years) (left) and probability of exceedance 2% in 50 years (T=2500 years) (right)

## Exposure Model and Structural Vulnerability

### Exposure Model

The exposure model for Cyprus refers to the building stock and the permanent population. Main source of both databases is the 2011 Population Census of Cyprus and the GIS based building database of the Department of Lands and Surveys. All data were collected by to the local representatives of EMME project (*Erdik et al., 2012*), as reported in *Chrysostomou et al. (2014)* and was kindly provided by the authors of the latter work for the purposes of the current study. Within EMME project, a 1x1km$^2$ grid was generated for the entire island and a number of buildings, per building typology, and population is given per grid. The classification of buildings per typology has taken place following the European Building Taxonomy Classification, as defined by the RiskUE project (*Milutinovic & Trendafiloski, 2003*).

Hence the following typologies are available, according to *Chrysostomou et al. (2014)*: bearing masonry (mainly built before 1975), reinforced concrete (RC) frames for low- to mid-rise and high-rise buildings and further distinction of RC structures for low ductility (or with no Earthquake Design Code-ERD) and moderate ductility (with ERD). The low-to-mid-rise buildings have been grouped together, based on the availability of fragility curves. As explained by *Kyriakides et al. (2015)*, fragility curves for low-rise buildings (for average height of 2 stories) have been generated due to their multitude, as well as fragility curves for high-rise buildings (for average height of 7 stories) due to their observed vulnerability. Mid-rise building of 3-5 stories height have not been thoroughly examined due to low damage recording from previous earthquakes and limited resources. Design with seismic codes was enforced in 1992 in the majority of the island. From the processing of data obtained it is evident that low to mid-rise RC buildings with no seismic design codes (ERD) is the predominant typology (57% of the building stock) with its counterpart with ERD being the following one in multitude (27%). 17% of the registered building stock is made of bearing masonry, mainly encountered in the Northern part of the island, if not accounting for the major cities. High-rise buildings correspond to around the 3% of the island's building stock. From the spatial distribution of buildings throughout the island, highest concentration (>3,000 buildings per cell) is observed in the big cities (Nicosia, Paphos, Limassol, Larnaca), as expected, while it is interesting to comment upon the fact that buildings designed with ERD codes, hence erected after 1992, are smoothly distributed out of the big cities, what is less evident for older structures. The replacement value considered per structural typology is part of the exposure module of a risk study. Based on empirical data and for simplification reasons, the average area per floor has been decided for all typologies between 80 and 100m$^2$. The replacement cost accounts only for structural works and ranges between 600 and 800 euro/m$^2$ for structural elements. The total structural replacement value of the exposed assets is estimated around 32 billion euro. No differentiation of the buildings per occupancy has been assumed.

### Structural Vulnerability Model

For the reinforced concrete buildings, which represent the 83% of the Cypriot building stock, fragility curves analytically derived after the study of *Kyriakides et al. (2015)* for Limassol buildings, have been employed. These have been developed for low-rise (average height of 2 stories) and high-rise (average height of 7 stories) buildings, with ERD (Eurocodes) and no seismic design. The Fragility curves for four (4) Damage States were derived by fitting the mean and standard deviation values of PGA to the lognormal distribution. As far as bearing masonry buildings are concerned, in the absence of local studies, it has been decided to make use of curves referenced in literature for the same region, for which engineering expertise demonstrates the existence of similar typology as in Cyprus. Hence, from the GEM/OpenQuake Physical risk Dataset, the analytical fragility curves developed by *Ahmad et al. (2010)* for the Euro-mediterranean masonry low to mid-rise masonry buildings have been selected.

For the final derivation of vulnerability curves, the adoption of a consequence (or damage ratio) model is necessary. This is usually constructed based on damage information claimed by householders in financial terms following a damaging earthquake when requesting financial aid. This data was not easily available at this phase for Cyprus and thus published models by *Kappos et al. (2006)*, based on the Greek reality, have been adopted considering no major discrepancies due to their similarities with the structural typologies.

## Seismic Risk Assessment

Following the probabilistic hazard analysis that allow us to obtain the seismic hazard outputs, OpenQuake platform gives us the opportunity to perform a variation of probabilistic analysis, the so-called Stochastic event-based analysis. During this, seismicity of a region is simulated according to the source models by generating stochastic event sets (or synthetic catalogue) for a given time span. Simulations are generated with the Monte Carlo (i.e. random) sampling procedure and a stochastic event set comprises a sample of the full population of ruptures. From the stochastic event sets and the associated ground motion fields ("objects describing geographic distribution around a rupture of a ground motion intensity measure"), probabilistic seismic risk analysis takes place and leads to the calculation of loss distribution for individual assets, as well as aggregated loss distribution for all the assets of the exposure model, within a specified time period. For each ground motion field, the intensity measure level at a given site is combined with the predefined vulnerability functions per structural typology, randomly sampling loss ratios for the exposure model. Hence, monetary loss for the structural damage is estimated at asset level (which contains a number of buildings of specific structural typology) and for the entire portfolio for realizations with given probabilities of exceedance. The final loss estimate is deduced after multiplication of the loss ratio with the asset's replacement value.

### Aggregated loss

The aggregated loss for the entire portfolio is, thus, given by means of the loss exceedance curves which represent a list of losses and respective probabilities of exceedance, or the equivalent return periods. The loss exceedance curve is a comprehensive outcome of a probabilistic risk assessment and widely used, as it may provide a loss estimate for any probability of interest. In order to obtain a realistic approach for loss estimates within 10,000 years, it was deemed necessary to perform stochastic event -based risk analysis for 50,000 years or investigation time of 50 years for 1,000 stochastic event sets per logic tree path. In Figure 3 the loss exceedance curve with mean values of aggregated loss is given for the various return periods of interest.

It is, therefore, noted that for the design earthquake with T=475 years (or 10% probability of exceedance), the expected aggregated mean loss is 3.46 billion euro what corresponds to the 14.5% of Cyprus island GDP (Gross Domestic Product). For T=2500 years (or 2% probability of exceedance) the expected aggregated mean loss is 6.3 billion euro, what corresponds to 26.6% of Cyprus island GDP. The mean loss ratio, calculated with normalization of the aggregated loss over the total replacement value of the entire building portfolio (~32 billion euro), is also computed as a more representative figure of the impact. Hence, for T=475 years the mean loss ratio is equal to 11% and for T=2500 years equal to 20%. For lower return periods, and thus higher probabilities of exceedance, exponentially lower expected loss is estimated.

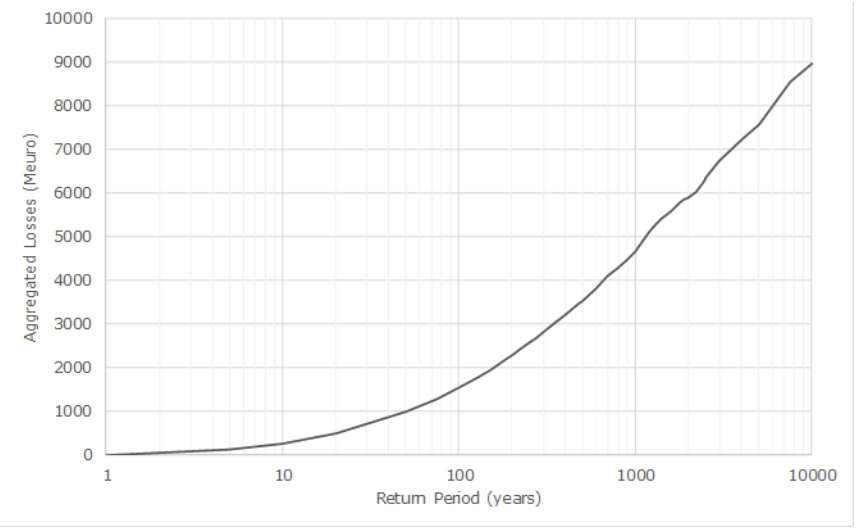



**Figure 3.** Loss exceedance curve

### Average annual loss

By integration of the loss exceedance curves over the risk investigation time (t=50 years), estimation of the average annual loss takes place. This yields equal to 116 million euro, what corresponds to the 0.50% of the island's GDP for a total of 1.022 million population.

Moreover, the average annual loss ratio (AALR) is computed as the quotient between the abovementioned total loss and total replacement value for the entire portfolio and is estimated equal to 0.36%. The aggregated average annual loss for Nicosia, Paphos, Larnaca and Limassol (the assumption of two grid cells for all cities was adopted for compatibility) varies between 6.6 and 12.3million in ascending order, with Limassol presenting the highest expected annual loss due to both its increased seismic hazard and exposed buildings value. It is, also, interesting that Nicosia's affected population is almost as high as Limassol's for significantly lower average annual loss, what is explained by the high population density of Cyprus capital.

### Loss maps (Distributed loss)

The probabilistic loss maps contain the aggregated average losses per grid that have a specific probability of exceedance within a 50 years time-span throughout the region of interest. It is, thus, evident that the spatial loss distribution does not significantly change for the two return periods and the highest loss is concentrated at the big cities, although the hazard distribution differs (Figure 3). Moreover, it is noted that Limassol presents the highest expected absolute loss while the affected area of Nicosia is more expanded, as opposed to Paphos and Larnaca.

The graph of Figure 4 demonstrates the disaggregation of total average loss ratio per structural typology for the two

return periods. It is evident that masonry and no ERD low to mid-rise buildings contribute the most to the total average loss being the most vulnerable typologies. The latter typology corresponds also to the largest building population what places it on top of the overall loss contribution ranking. No observation of spatial correlation of specific typologies with increased seismic hazard can be made at this phase. It is characteristic that for both return periods the loss ratio for masonry buildings exceeds 50%, what, in simplified terms, means that for the potential seismic event with 10% probability of occurrence in 50 years, the expected damage to the masonry building stock could lead to the loss of more than 50% of its total structural value.

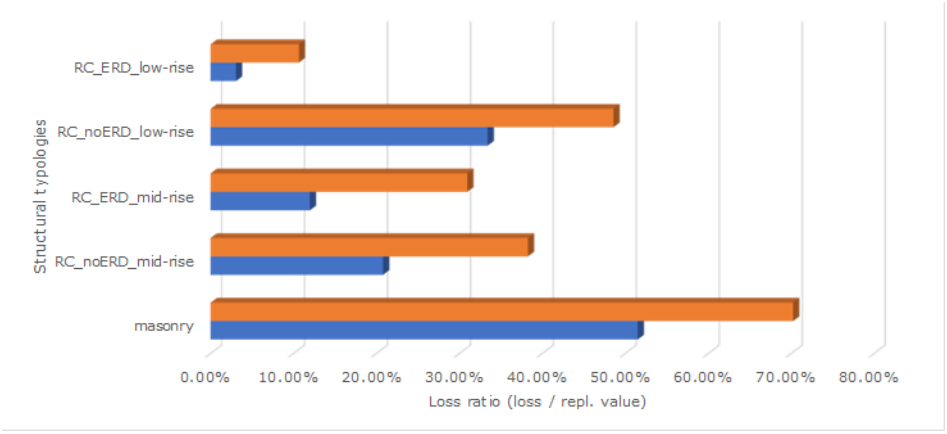



**Figure 4.** Loss ratio per structural typology for T=475 and 2500 years

## Scenario-based Risk Analysis

Two seismic scenarios have been analyzed. The first has probability of occurrence 10% in 50 years (T=475 years), leading to aggregated loss with 10% probability of exceedance. The second one has 2% probability of occurrence (T=2500 years) with loss with respective probability of exceedance. The selection of the earthquake ruptures has been randomly made among all the different realizations (15) of the stochastic catalogue. The GMPE of *Akkar and Bommer (2010)* was decided to be implemented, following the recommendation of *Cagnan and Tanircan (2010)*. Each scenario was performed for a number of 1000 ground motion fields (for different ruptures within the fault). In Figure 5, the geometry of the simulated faults and the hypocenter of the rupture, with the given probability of occurrence, are projected on the earth's surface on the island of Cyprus. The fault geometry and characteristics and the rupture magnitude of the selected events are also marked.

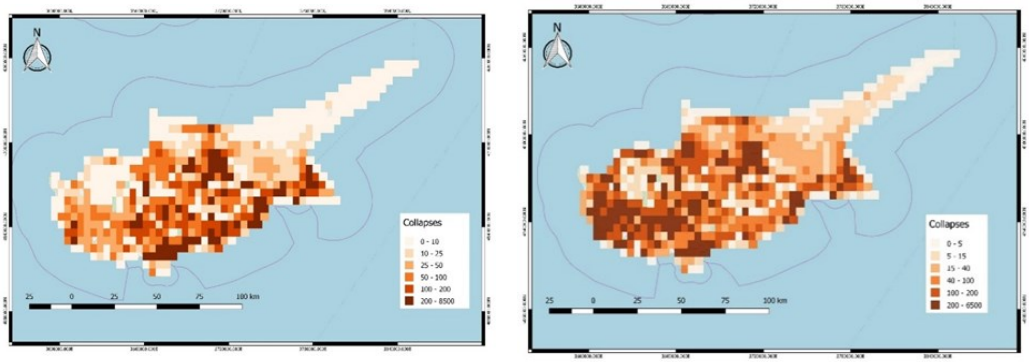

**Figure 5.** Projected geometry of faults of seismic scenarios on the island of Cyprus (green line depicts top edge of the fault plane, red line bottom edge)

### Monetary loss outcome

The total average aggregated loss for the T=475 years scenario is 7.71 billion euro and for the T=2500 years scenario is 9.37 billion euro. Considering the vicinity of the two faults to Limassol (Figure 5) and the high exposure value, Limassol and its surroundings is the most heavily affected area for both cases. In overall the monetary loss is mainly concentrated in the big cities, while heavily damaged building ("Collapsed") are encountered throughout the southwestern Cypriot territory as well as in the surroundings of Nicosia. From the generated collapse maps (Figure 6), it may be noticed that for the T=2500 years scenario, the affected areas are shifted to the western part of the island, compatible to the faults trace location. It should be highlighted, also, that although the maximum absolute number of collapsed buildings is lower in the "big" scenario, they are encountered in much wider zones than in the T=475 years scenario, especially towards the West, where Paphos is located.

From the damage distribution, it is interesting to notice that the 25.6% and the 32.4% of the total building stock for the T=475 and the T=2500 years scenario, is expected to reach the "Collapse" damage state, respectively. Moreover, the 40.1% and 32.2% is expected to present no damage. From the disaggregation of the damage outcome per structural typology, it is observed that the majority of "collapsed" buildings are encountered in the masonry and no

ERD low-to-mid-rise typology, and especially to the latter one which has the highest building population. Hence, for both scenarios for the masonry and the no ERD low-to-mid-rise typologies, more than 30% of their stock is expected to present damage at the level of collapse. Moreover, a significant ratio of more than 20% of no ERD high-rise buildings presents extensive damage at the 2500 years scenario. Finally, is interesting, that around 20% of ERD low-to-mid-rise buildings and 10% of ERD high-rise buildings are estimated to suffer from moderate and extensive damage according per the 475 and 2500 years scenario, respectively. This variation may be attributed to




the spatial distribution of the building typologies since the main impact zone of the two seismic events varies.

**Figure 6.** Collapse map (in number of buildings) as a result of damage assessment for a seismic scenario with (left) T=475 years and (right) T=2500 years.

### Human loss outcome

For the seismic scenarios, risk in terms of human loss has been also estimated in order to obtain a number of affected population to be elaborated as order of magnitude for disaster management purposes. This estimate is valuable for preparedness of the Civil Defence and municipalities for healthcare capacities, short and long-term accommodation, emergency response and relevant budget allocation.

For the human casualty modelling (fatalities) the model of *Coburn and Spence (2002)* has been adopted with the values for the parameters as proposed by Spence for the Thessaloniki case study (Greece) within LESSLOS project (*Spence, 2007*). The casualties (fatalities) have been separately estimated for day and night time, considering 80% of residential buildings and 20% of non-residential. An equivalent casualty model has been computed from which, in combination with fragility curves corresponding to the “Complete” damage level, new fatality-related vulnerability curves were derived for each typology and uploaded to OpenQuake software.

The model proposed by *HAZUS (1999)* for indoor casualties has been applied, trimmed for estimation of Severity 2 injuries to which all the branching probabilities (all four fragility curves) contribute. The scope of this module is to provide an estimation of non-fatal casualties, or injuries in need of a greater degree of medical care and in need of transition to healthcare facilities. The availability of health-care structures in case of a strong seismic event can be, thus, examined.

The estimation of the affected number of population in potential need of displacement provides useful figures (order of magnitude) to stakeholders for anticipation of post-disaster provisions and/or evacuation planning. The households in need of housing are distinguished in those seeking for short-term public shelter at the immediate post-disaster phase and the long-term displaced ones, due to loss of habitability of their homes (red and yellow-tagged buildings). In the current study, the shelter model of *HAZUS (1999)* has been applied with proper engineering judgment and omission of American-based coefficients only for the long-term displaced population. The estimated amount of people expected to remain displaced “long-term”, due to severe damage or collapse of their residences, is computed from the probabilities of reaching damage states Extensive and Collapse. The population of the exposure model refers to the permanent population per the 2011 Census, irrespectively of the occupancy, occupancy rate and time of the day.

Based on past experience registered in *Gountromichou et al. (2017b)* as part of PACES Project, the estimated ratio of the affected population that would seek for long-term public accommodation strongly depends on the economic, age and cultural background of the homeowners. Moreover, alternative accommodating structures are often offered (hotels, ships or trains). Finally, the final number will reduce throughout the time, in function to the seasonal weather, age and culture of affected population, geographical location and economic background. Considering the above-mentioned, the Cypriot mentality and family bonds, the possibility of ships to be used as floating emergency sheltering option and the large amount of touristic lodges, the 50% of the estimated displaced population is expected to be in need of public sheltering in tents or other portable structures.

Hence, the human loss assessment provides the following results for the entire island, varying for the day and night scenario: Fatalities: between 210-310 for the T=475 years scenario and 380-540 for the T=2500 years; Injuries: 730-1500 for the T=475 years scenario and 870-1780 for the T=2500 years scenario; Displaced: 93,000-110,000 for the T=475 and 2500 years scenario, respectively. The affected population and losses per city is also identified.

## Conclusions

The seismic risk at national level has been calculated by implementation of probabilistic hazard and risk analysis in the OpenQuake risk platform of Global Earthquake Model (GEM) Foundation. The input seismic hazard model is the available European one, developed within SHARE (*Giardini et al., 2013*) project. From probabilistic hazard analysis, maps with Peak Ground Acceleration (PGA) distributions with 10% and 2% probability of exceedance have been generated. Moreover, hazard curves, demonstrating the probability of exceedance for a range of intensity levels in terms of PGA, have been incised for the four major cities.

The stochastic event-based risk analysis yielded aggregated loss estimates for several return periods, from which

the loss exceedance curve for the island has been constructed for numerous return periods, up to 10,000 years. The average annual loss and loss ratio were also estimated for the island, equal to 116M euro and 0.36% respectively, and for the four major cities, together with the respective exposed population. Limassol presents the highest impact in monetary terms due to its increased hazard and building stock. Disaggregation of the average annual loss and the average total loss per structural typology, allowed for extracting observations with respect to the seismic vulnerability of the different typologies. It is, thus, concluded that the masonry buildings and the low-to-mid-rise RC buildings with no ERD contribute the most to the total economic loss, due to their inherent vulnerability and multitude. The distribution of loss for 10% and 2% probability of exceedance has been also mapped on the input exposure grid.

Two seismic scenarios have been selected, based on the outcome of the probabilistic risk analysis. The first scenario is one among those of the stochastic catalogue that have probability of occurrence 10% in 50 years and the second one with probability of occurrence 2% in 50 years. Loss in monetary terms, casualties and injuries as well as long-term displaced population has been assessed in order to provide realistic figures of a future scenario for preparedness purposes.

Concluding, it is widely recognised that seismic risk management needs to be supported by scientific estimates of the impact of seismic hazard in terms. Probabilistic approach for both hazard and vulnerability leads to mean estimates of absolute and relative figures, to be treated recognizing the associated uncertainties and probabilities of occurrence, as well as risk maps, comprehensive and illustrative tools to be used for disaster management. Moreover, following a probabilistic analysis, or independently, there is the possibility to simulate specific future, past, probable or credible seismic scenarios, that are generally necessary for the prevention and preparedness phases of the disaster management cycle. Hence, budget allocation, insurance premiums and institutional resources can be anticipated from probabilistic risk outcomes, while the study of scenarios is applicable for the designation of evacuation routes or locations of shelters and/or coordination centers. Finally, reference should be made to the importance of inclusion of social vulnerability into an integrated risk assessment working towards a holistic interpretation and management of seismic risk.

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# Effect of Duration of the Cyclic Loads on Offshore Wind Turbine Foundation

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## Abstract

Since the late 1990s, focus on wind energy programs has been started in European countries. One of the main objectives of the creation of Offshore Wind Farms (OWF) is to reduce Green House Gas (GHG). Wind energy both onshore and offshore is a secure type of energy and environmentally friendly. Because of the huge amount of coastal areas in the world and the high speed of the offshore wind, the offshore wind is much more interested nowadays. Offshore wind turbines (OWT) are the main parts of an offshore wind farm harnessing wind's power to produce electricity. Mostly these turbines are installed in shallow waters and supported on large diameter monopile foundations. Offshore wind turbines and their foundations are subjected to different types of environmental cyclic loads such as wave and wind actions during their lifetime. It is obvious that the performance of these structures both functionally and economically is of great importance. For these giant structures with 25 years as the design life, the cost of the foundation is one of the important parts of the whole system. These lateral cyclic loads can influence the response of the loaded structural system because of accumulated permanent displacement of soil and excess pore water pressure, which can change pile-soil stiffness and their interaction. However, the behavior of OWT and its foundations is mostly studied under short-term cyclic loading, and the effects of duration of the cyclic loading on pile-soil interaction and performance of the monopile foundation are not well understood and documented. Therefore, there is a lack of guidance in codes for the duration effects of cyclic loads on structural and geotechnical performance of offshore wind turbines. In this regard, the current study considers the effects of duration of the cyclic loading on serviceability and performance of the OWT system by considering soil-foundation-structure interaction using a 2-D finite element analysis method. The performance is evaluated based on the monopile displacement profile, shear strain, and excess pore water pressure ratio in the vicinity of the pile. In addition, computed data is used to determine liquefaction susceptibility around the monopile foundation and its effects on pile performance in the sandy soil layer. The presented results are useful to determine the effect of the duration of cyclic lateral environmental loads on offshore wind turbine performance and its serviceability. Finally, the results can be used to determine the need for considering the duration of cyclic lateral loads for the design of OWT structures.

**Keywords:** offshore wind turbine, monopile, cyclic load duration, soil-foundation-structure interaction, liquefaction.

## Introduction

Wind energy both onshore and offshore is a secure type of energy and environmentally friendly. Offshore wind will be more demandable than the onshore one in the future because of high energy density, lower turbulence, environment-friendly, and lower wind shear (Oh et al., 2018). By 2030, the capacity of the offshore wind projects will be 150 GW globally and the performance of these structures both functionally and economically is of great importance (Haiderali and Madabhushi, 2012).

For these giant structures with 25 years as the design life, the cost of the foundation is one of the important parts of the whole system. Monopiles are the typical foundations for the Offshore Wind Turbines (OWTs) in shallow coastal waters. Current design procedures for monopile foundations rely on the simplified analysis method, known as the 'p -y' method in which the foundation is modeled by definition of the p-y curves based on the pile lateral load and displacement. The main issue about this method is its use and definition for the slender, relatively flexible piles, especially the ones in the oil and gas sector (DNV-RP-C205, 2010). Different studies are being done recently related to this issue to check its validity for the offshore wind turbine foundations (Haiderali and Madabhushi, 2013, Corciulo et al., 2017, Massah Fard et al., 2018 and 2019, Burd et al., 2019). Many researchers mentioned that the current p-y curve method is not suitable for the design of OWT under repeated lateral loading (Haiderali and Madabhushi, 2013, Arshad and O'Kelly, 2017). The main reason is that the strain accumulation in the soil surrounding the monopile can not be predicted and for the OWTs, soil-pile interaction is a factor that should be considered. To investigate the performance of these systems during environmental loading, both geotechnical and structural aspects are needed to be considered in terms of parametric studies. The parametric studies related to the monopile foundation, surrounding soil, sea-water, loading types, and structural properties are the ones that have been studied by different researchers (Corciulo et al. 2017, Massah Fard et al., 2019).

The lifetime of the OWTs is 20 to 30 years. The number of loading cycles that an offshore wind turbine structure must withstand is dependent on the situation. 1000-5000 cycles are caused by storms approximately and $10^7$ cycles are determined for the Fatigue Limit State (FLS). Some researchers proposed different equations related to the effect of the number of cycles on the foundation stiffness and the accumulation of rotation (Leblanc et al., 2010, Cox et al., 2014). The degradation of soil shear modulus by the cyclic loads is so effective on the performance of offshore wind turbines as by decreasing the shear modulus of soil, there is a reduction in the structure's bearing capacity (Oh et al., 2018). Because of the long-time needed for analysis of the system by considering soil-pile-structure interaction, a short duration loading situation with a limited number of cycles is mostly common among researchers. According to the recent popularity of OWTs in seismic prone areas and sea-wave cyclic loading applied to the foundation, liquefaction susceptibility is a case that is needed to be investigated in the surrounding soil for better estimation of their performance. In this regard, because of the large diameter of the monopile foundations for the offshore wind turbines and to investigate the liquefaction possibility in the surrounding soil, soil-pile-structure interaction modeling of the system is considered in the current study by using the finite element method. Effect of duration of the sea-wave cyclic loads on the surrounding soil and the monopile foundation is studied and results are presented in the specified graphs and discussed.

## Model Overview

Up to now, there have been few numerical studies focusing on the foundation part of the OWT during cyclic loading. In this regard, we decided to investigate this phenomenon in more detail in the current study. 2-D dynamic fully coupled u-p analysis is conducted for the soil-monopile-structure system to consider the pore water pressure (PWP) generation. In this study, the prototype wind turbine was located at a water depth of 20 m and it was supported with a monopile foundation as shown in Figure 1 is modeled through the FE program, OpenSees (Mazzoni et al., 2010). Free Field Analysis (FFA) is performed in the first stage of the analysis. After the gravity analysis, the monopile foundation and the offshore wind turbine are defined as beam elements and added to the model. The viscous boundary condition is assumed for the system by using Lysmer-Kuhlemeyer (1969) dashpots through zero-length elements (Mazzoni et al., 2010). Modified soil elements are used for simulating soil-pile interaction effects. 5-m diameter foundation is assumed for the analyses according to the previous studies by the authors and the thickness equal to 4% the monopile diameter with a degraded friction and phase transformation angles is considered for soil-pile interface elements (Corciulo et al., 2017, Massah Fard et al., 2019). To select the appropriate parameters for the mentioned constitutive model (Yang, 2000) and generate realistic soil response, the calibrated values specified by previous researchers by verification of the model parameters with the undrained cyclic simple shear test, are considered for the sandy soil layer (Karimi and Dashti, 2016, Massah Fard et al., 2019).

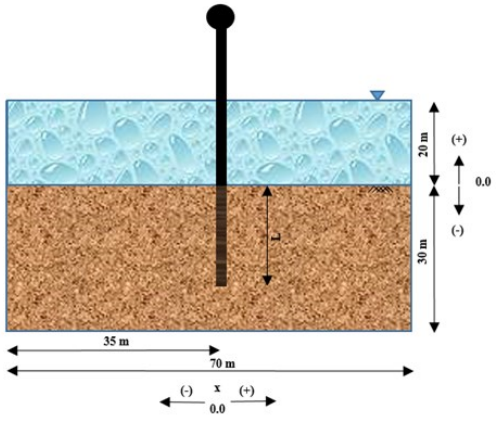



Figure 1. Schematic view of the numerical modeling of the problem

Soil properties at the location of the wind turbine assumed for this study are presented in Table 1.

Table 1. Soil properties for Nevada sand (Karimi and Dashti, 2016)

| Soil Unit Weight ($kN/m^3$) | Friction Angle (°) | Phase Transformation Angle (°) | Shear Modulus (kPa) | Relative Density (%) |
|---|---|---|---|---|
| 20 | 34.5 | 26.5 | 72500 | 63 |

The properties for the offshore wind turbine, foundation and seawater are presented in Table 2.

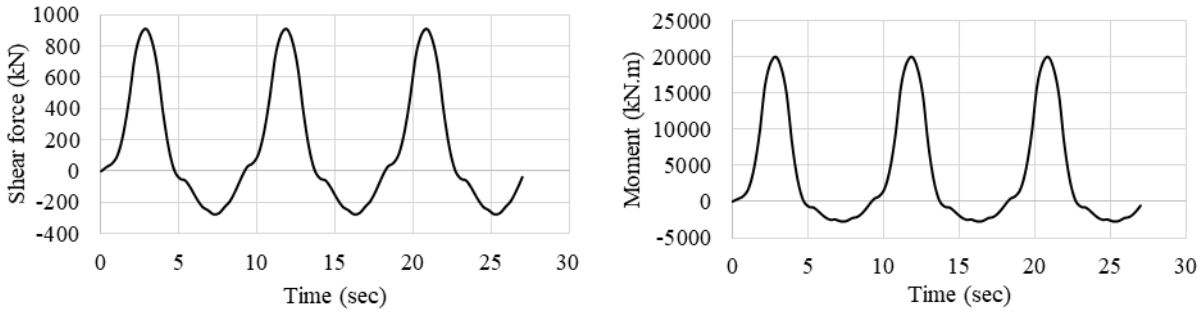
Table 2. Offshore wind turbine parameters (Corciulo et al., 2017)

| h (m) | d (m) | L (m) | D (m) | $\rho_s$ (ton/ $m^3$) | $E_s$ (GPa) | $A_{sec}$ ($m^2$) | $I_{sec}$ ( $m^4$) | M (ton) |
|---|---|---|---|---|---|---|---|---|
| 90 | 20 | 20 | 5 | 7.85 | 200 | 0.777 | 2.38 | 350 |

## Cyclic Load Characteristics

According to the nature of the offshore wind turbines, the sea-wave loads are more critical than the wind during the lifetime of these structures. Investigation of the behavior of the surrounding soil and foundation of the OWT during application of the cyclic loads (sea-wave) gives a better estimation of the system performance also in seismic prone areas. Most of the research items related to the modeling of the OWTs with the full finite element modeling of the surrounding soil have been done for short duration loading conditions (low number of cycles) (Corciulo et al., 2017). In this regard and along with the previous studies by the authors (Massah Fard et al., 2019), as evaluation of the liquefaction susceptibility of the surrounding soil is of great interest, the effect of duration of the cyclic loads applied to these structures is investigated in the current study.

For consideration of the lateral hydrodynamic loads on the structure, three cases for wave loading with a 9-sec wave period which is typical for the North Sea (Nikitas et al., 2017) are applied for the liquefaction analysis of the monopile-soil system. The corresponding total shear load and bending moment applied to the OWT foundation for 27-sec duration (3-cycles loading) is given in Figure 2.




a) b)

Figure 2. Loads on seafloor level for monopile foundation (20-m pile embedment and water depths and 9-sec sea-wave period): a) Shear load and b) Moment

## Duration of the Cyclic Loads

Offshore wind turbines are the structures experience about 10,000,000 load cycles during their lifespan. There is currently a lack of guidance in codes for the long-term effect of the cyclic loads on wind turbines (Ma et al., 2017). In the present study, first, the OWT system under 27-sec sea-wave load condition was analyzed and the results for the foundation and the surrounding soil in terms of deformation, inertial forces and shear strain and pore water pressure generation were investigated, respectively. The results for the soil response show an increasing trend which makes it needed to analyze the system for a longer duration cyclic loading situation. In this regard, three cyclic loading conditions (27-sec, 90-sec and, 180-sec) for a 9-sec period sea-wave load situation are considered for the present study. The time history responses for the surrounding soil for these three cases in different depth values are presented in Figures 3 and 4. According to the figures, by getting closer to the sea-bed surface, the soil response (both excess pore water pressure ratio and lateral displacement) increases. It can be seen from the figures, that after about 100-sec sea-wave loading application, the soil response values reach a constant amount and a stable situation takes place. The results are similar for both sides of the monopile foundation location (x=-5 m and x=+5 m).

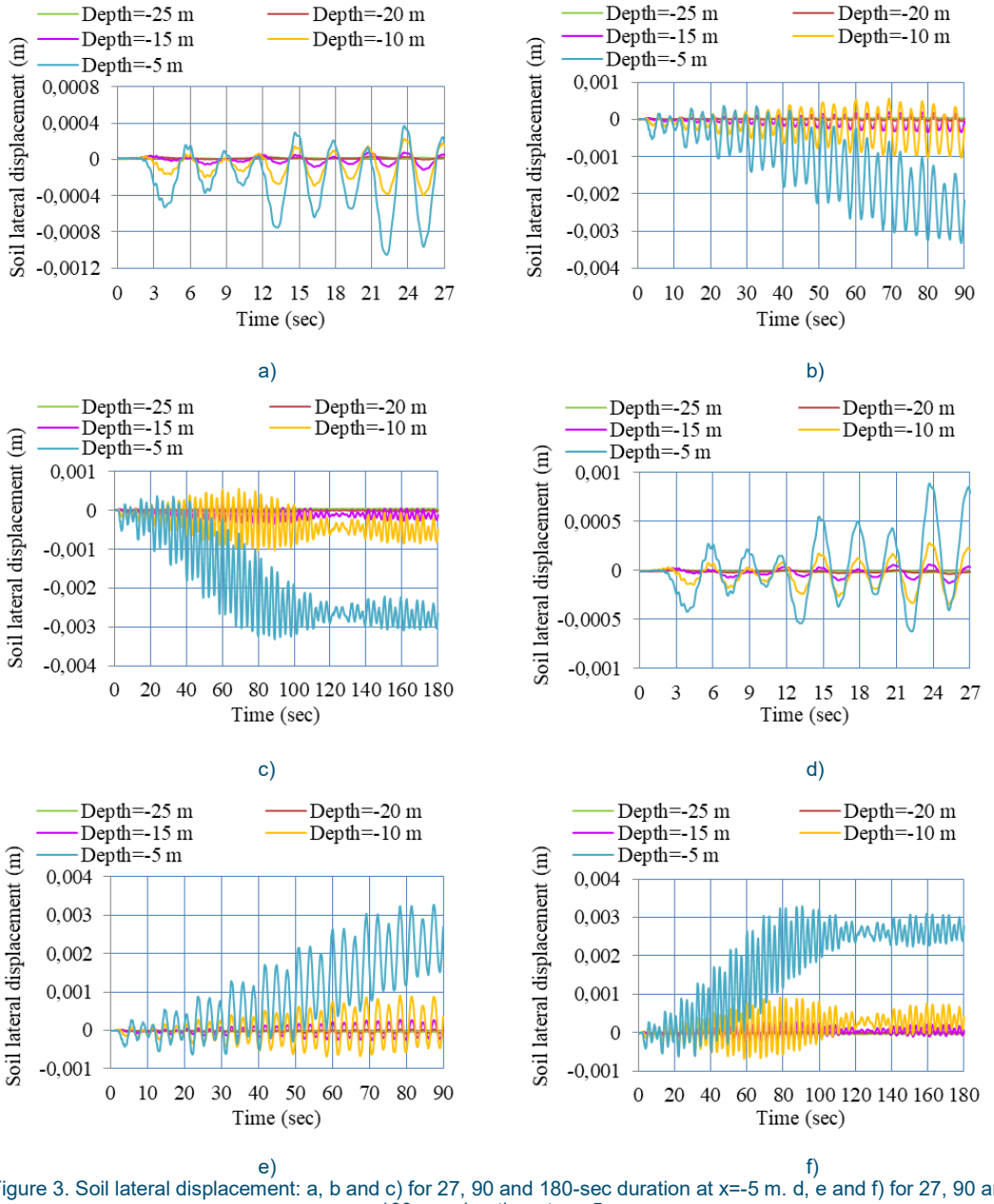
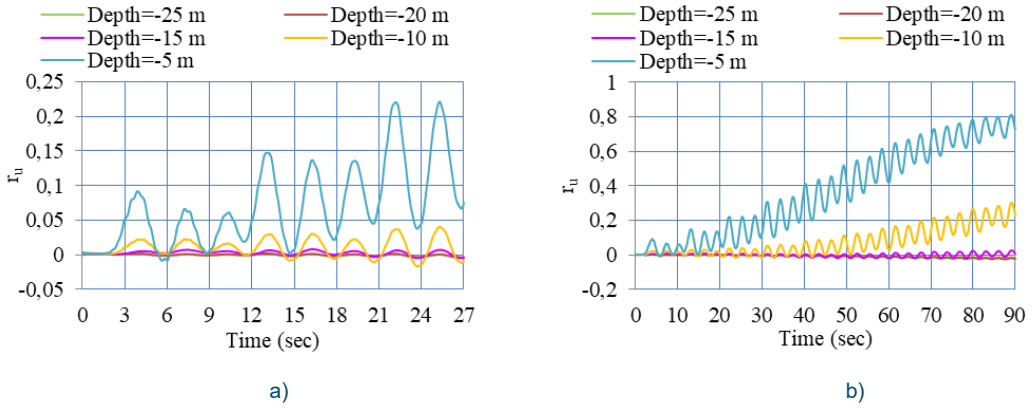



Figure 3. Soil lateral displacement: a, b and c) for 27, 90 and 180-sec duration at x=-5 m. d, e and f) for 27, 90 and 180-sec duration at x=+5 m



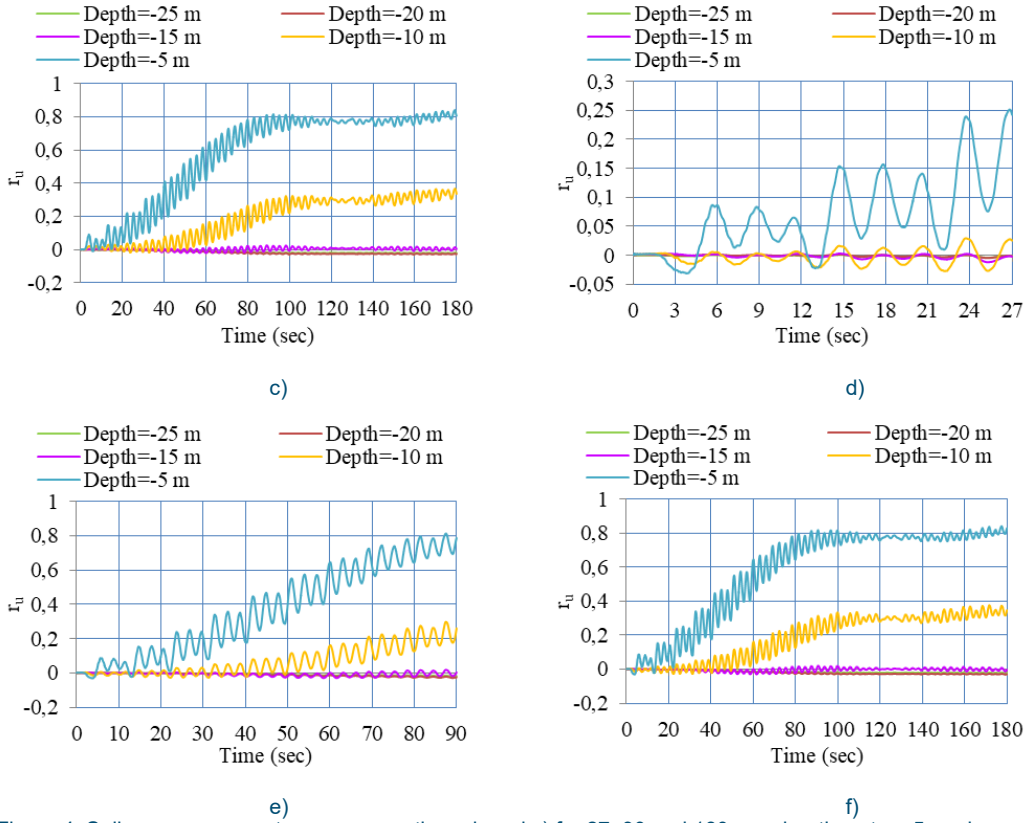



Figure 4. Soil excess pore water pressure ratio: a, b and c) for 27, 90 and 180-sec duration at x=-5 m. d, e and f) for 27, 90 and 180-sec duration at x=+5 m

Based on the time that the maximum soil lateral displacement happens for both sides of the foundation location, the response of the monopile and the surrounding soil is evaluated and demonstrated in Figures 5 and 6.

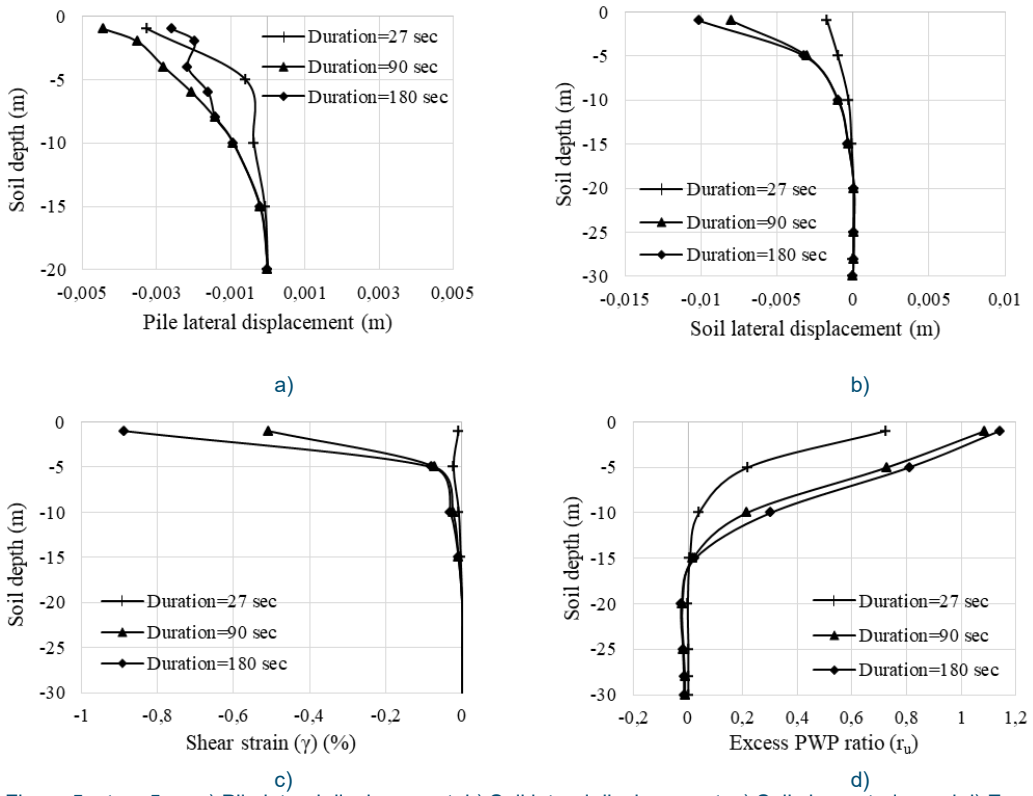



Figure 5. at x=-5 m: a) Pile lateral displacement, b) Soil lateral displacement, c) Soil shear strain, and d) Excess PWP ratio in soil

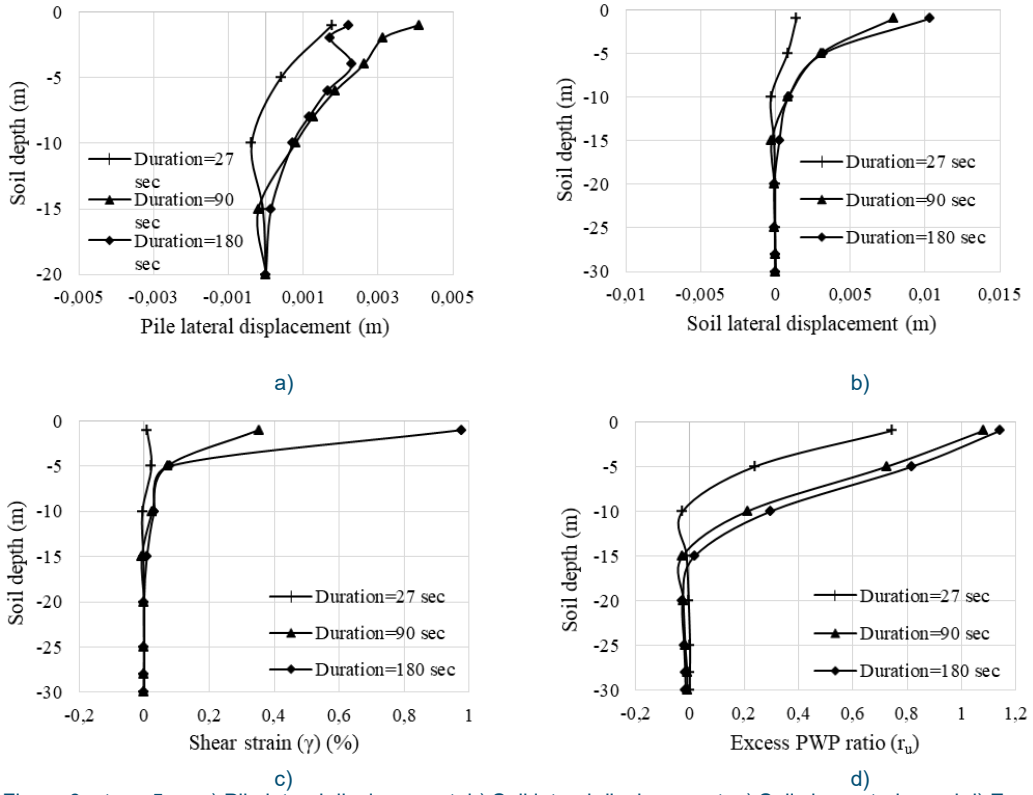



Figure 6. at x=+5 m: a) Pile lateral displacement, b) Soil lateral displacement, c) Soil shear strain, and d) Excess PWP ratio in soil

As it is presented in Figures 5 and 6, increasing the duration of the cyclic load makes a significant change in the results, especially for the surrounding soil. The values for both the monopile foundation and the surrounding soil response increase in depth by getting closer to the sea-bed surface. The soil and the foundation move together which makes excess pore water pressure generation in the surrounding soil medium. The shear strain values are much higher for the longer duration loading which makes liquefaction happens for 90-sec and 180-sec duration load application close to the sea-bed surface.

## Conclusion

In the present study, a 2D FE model is developed for the dynamic analysis of an offshore monopile foundation in the sandy soil layer by considering soil-monopile-structure interaction. The effect of cyclic loading duration for the 5 -m diameter monopile foundation on the surrounding soil and the foundation response is investigated through the OpenSees FE program. The soil behavior (lateral displacement, shear strain, and excess pore water pressure ratio) and the foundation response (lateral displacement) are in the increasing trend during short (27-sec) duration sea-wave load. In order to reach a stable situation and a better assessment of the system characteristics, investigation of the results by increasing the duration of the cyclic loads was carried out. The results indicated that increasing the duration of the cyclic load makes a significant change in the response quantities, especially for the surrounding soil. Results demonstrated that increasing the duration, affects the shear strain values around the monopile foundation close to the sea-bed surface, which makes a rise in the excess PWP ratio and liquefaction happening possible. This procedure makes it significant to investigate the soil response under long duration cyclic loads which can be effective on the performance of the whole system.

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# Impacts of Climate Change on Coastal Structures and Planning of Coastal Cities

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## Abstract

Climate changes such as sea level rise and change in sea surface temperature have caused significant impacts on the Turkish coastlines and these changes have put an additional pressure on the coastal areas in many different aspects. This study explores and indicates the impacts of climate change on the design and design parameters of coastal structures and planning of coastal cities along the Turkish coastline with two different case scenarios.

## 1. Introduction

Coastal areas are important economic zones where settlements, industry, tourism, agriculture and transportation sectors thrive. Enriched by the existence of 'water' and the natural resources coastal areas are the spaces where the socio-economic developments are the most rapid (Timmerman and White ,1997). Therefore, when the matter of concern is the coastal areas and the coastal towns a multi-discipline approach must be involved in the development strategies, ranging from social and physical sciences, economy to cultural and political processes covering national, regional and the urban scales.

In the midst of all these approaches ‘Coastal Engineers’ take a role in planning stage and have the responsibility of design, implementation, monitoring of all the coastal projects (large to small scale) such as ports, marinas, coastal protection structures, sea outfalls, land reclamation, dredging and filling operations at the coastal areas.
Recently additional pressure put on coastal areas by climate change which has gained great significance. Rise in sea level rise, sea surface temperatures are two climate change driven parameters that have most significant impacts on coastal areas. Recently, sea level rise is included in the design of coastal structures and also has to be considered in the planning of infrastructures of the coastal-towns together with the regional adaptation measures for impacts of climate changes in future.

## 2. Impacts of Climate Change on Coastal Areas and planning of Coastal Cities

With an 8333km of coastline, Turkey is a country surrounded by Black Sea, Marmara, Aegean and Mediterranean Sea. Population density of coastal areas are twice as high as the inlands (out of 81 cities 26 is the located at the coastal areas) and these coastal locations are important economic zones yet threatened by continuing immigration, urbanization, degradation of ecosystems, erosion and flooding which are the main pressures on the important resources provided by these coastal areas of Turkey. The dynamic and complex physical characteristics of coastal areas, the crosscutting of many economic activities and the need for different spatial and time scales require a holistic approach which must utilize multi-criteria and interdisciplinary methodologies.

Recently additional pressure put on coastal areas by climate change which has gained great significance. Observed as having increasing trends, sea surface temperatures and sea levels are two climate change driven parameters that have impacts on coastal areas. Impacts of sea level rise on coastal areas can be grouped into three: coastal erosion, flooding due to increased levels of storm surges, land loss due to inundation and saltwater intrusion to aquifers and rivers. While saltwater intrusion will exert more pressure on freshwater resources; flooding and inundation will exacerbate the already present pressure on agriculture, tourism, ecosystem and most notably infrastructure, and settlements.

When compared to other climate change driven parameters such as temperature and precipitation, change in sea level is observed slowly and it is assumed that there is time for adaptation. The diversity of characteristics of Turkish coastlines also stresses the necessity of both regional and national assessments of coastal areas in relation to sea level rises.

'Impacts of Climate Change on Coastal Areas and Adaptation Measures', 'regarding the sea level rise' are summarized in Table (1).

**Table 1.** Impacts of Climate Change on Coastal Areas and Adaptation Measure
(Ergin, A., Türkiye'de İklim Değişikliği Etkileri,Etkilenebilirlik ve Uyum .Kıyı Alanları,2011 ,'UNDP 2nd National Communication to the UN Framework Convention on ClimateChange; Impact, Vulnarability and Adaptation; Coastal Areas',December, 2011)

| Vulnerability | Adaptation Measures |
|---|---|
| Land loss and coastal erosion | Adaptation measures against the impacts given in first column should not only focus on physical options but also include socio-economic aspects. Integration of these measures with national action plans is mandatory, providing sufficient funding and encouraging rapid implementations. However uncertainties existing within the body of physical processes, gaps in data at national and regional level, low efficiency of existing coastal protection structures as well as complex nature of<br><br>institutional and legal framework of coastal zone management are the major problems in adaptation policies against the impact of climate change on coastal areas |
| Changes in frequency of storms | |
| Salt water intrusion to rivers and increase in soil salinity near rivers | |
| Inundation of coastal agricultural areas | |
| Salt water intrusion to coastal aquifers | |
| Adverse impacts on tourism | |
| Impacts on coastal settlements due to oceanographic pressures | |

In summary, the numerous studies show that increased coastal erosion, land loss due to inundation and salt water intrusion to groundwater resources are the main impacts expected to be observed along Turkish coastlines and it is a highly challenging process to develop and implement adaptation policies for coastal areas. Continued monitoring of sea level at varying locations in addition to data collection along coastal areas within a national framework would ensure reliable and detailed assessments of impact and vulnerability in the long run.

## 3. Design of Coastal Structures

Human impact, by utilization of the coastal areas through constructing ports, marinas, coastal defense structures (sea walls, revetments, groins), breakwaters, artificial reefs, jetties, extraction of natural resources, land reclamation, dredging, sea outfalls, flood gates, river mouth management facilities can be manipulative of coastal processes causing problems of land loss due to severe erosion. In coastal engineering, since coastal structures are generally characterized by large failure consequences and substantial capital expenditures therefore there is a need for improved safety by including all the possible risk factors in planning stage depending on the highly variable random design parameters such as wind and wave climate extreme storms, storm surge and level rise due to global warming. The consequences of failure of coastal structures range from low to very significant economic losses.

In planning of infrastructure of coastal cities there is a need to include the river basin characteristics affecting the settlement area (from the land side) together with the design parameters of the coastal structures (from the sea side), since a coastal city is at the interface of land and sea. Planning the land use patterns, housing and design of all the infrastructure such as sewage disposal systems, rainfall catchment collectors and sea outfalls, fresh water systems, river reclamation, land reclamation, dredging, coastal highways has to be considered in a holistic approach at the planning stages. Otherwise, frequent structural failures, random flooding, loss of lives and property will be unavoidable.

To put special emphases on impact of climate change, after a brief review of the steps in the design of coastal structures the discussions will be confined to sea level rise components with an example case and related discussions.

Number of studies prior to the design of a coastal project is mainly; geomorphology and topography, bathymetry, foundation soil conditions, nearby rivers, seismic activity, wind and wave climate, tsunami, local currents, accretion and sedimentation patterns together with the assessment of environmental impact and socio-economic factors. In the design of coastal structures, wind and wave climate studies are the basic studies where the selection of design parameters (design wave characteristics at the depth of construction) depends on accurate knowledge of the frequency distribution of strong surface wind and generated wind waves.

Wind waves are the most important phenomenon to be considered among the environmental conditions affecting

the coastal structures. Randomness of the wind waves is the fundamental property and incorporates in the design process. Design wave is selected using short-term, long term wave statistics and extreme value wave statistics which are the major studies for the description of wind waves. For these studies, as more accurate and longer the datasets uncertainty in the statistical description of the wind waves and the return period calculations will be minimized. Danger of underestimating the intensity and the frequency of design waves results in underestimating the wave forces during the economic life-time of the coastal structures leading to a partial or full damage of the structures which causes a major economic loss not only for the coastal town but also for the country. Therefore, accurate assessment of the magnitude and frequency of extreme wind speeds and the generated wind waves are the major relevance of insurance of the related damage risks of the coastal structures.

Climate change has promoted a wide study of the sea level rise and potential impacts of enhanced effect on the frequency, duration and the intensity of wind storms in future compared to today. Recent studies which focus on the relationship between the frequency and the intensity of extreme winds, cyclones expect an increase in both the intensity and the frequency of high wind causing storms over Europe in future yet; there is still no systematic long-term trend in the statistics of wind Della- Marta at all.2007.

Waves arriving from deep water to the project site will undergo transformations of refraction, diffraction, shoaling, breaking etc.If the water depth (d) is less than half of the deep water wave length ($L_0$), this depth is defined as intermediate depth ($d/L_0<0.5$). The refraction and shoaling of waves start when they reach this intermediate depth. In the wave transformation studies, the shoaling coefficients (Ks) are obtained from GWT (Gravity Wave Table) (Skovgaard et al., 1974). In order to calculate the refraction coefficients (Kr) values, Ocean Engineering Research Center Middle East Technical University, Department of Civil Engineering, has developed a numerical model **(REFRA)** The basic inputs of the model are bathymetry of the near shore area, wave direction and the deep water wave characteristics obtained from long term and extreme wave statistics. During wave transformation studies, the sea level rise (storm surge) resulting from the storm conditions are assumed to occur at respective increased sea levels (high water level; HWL). Physical events that are used to determine high water levels in addition to wind set-up and the respective wave-set-up, are tidal and seasonal variations, sea level rise due to global warming, barometric changes and changes in the sea level due to Coriolis effects.

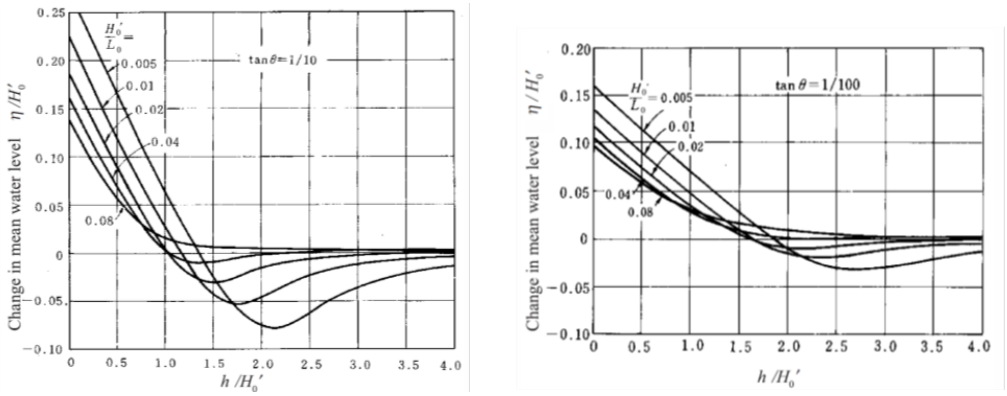
In any coastal project, the first step in the computations is the determination of possible extreme water levels (High Water Level) at selected locations within the project area, by running scenarios of extreme storm events with different return periods (such as 100, 1000 and 10000 years) and long term storm events from the effective fetch directions.

## 4. Deep Water Wave Characteristics and High Water Level Computations for the Selected Scenarios of Storm Events for the Project Area

All design storm events has to be taken as to occur in the respective high water levels (HWL; defined as the storm surge) which is sum of wind set-up and the respective wave set-up, astronomical tidal and seasonal variation amplitudes, sea level rise due to climate change (global warming) and possible Coriolis effects. At nearshore, wave and wind set-up in general constitutes (80-90)% of the storm surge as stated by Walton & Dean (2009). Effects of Barometric changes and Coriolis forces on the sea level can be taken as 10 % of the total of wind set-up, seasonal and tidal variations and sea level rise due to global warming. Seasonal variations and tidal ranges are site specific and must be determined based on existing site measurements. The sea level rise(due to global warming) which ranges between 3mm/year to 10mm/year, however in practice it is taken as 10mm/year if no data is available for the project region. (Rock Manual 2007)

### 4.1 Wave set-up:

The total rise in the mean water level at the shoreline due to random wave breaking (total wave set-up) is the sum of static (mean wave set-), and dynamic (surf beat, $\zeta_{rms}$ ) components of wave set-up. The static component of wave set-up values ( $\eta$ ) at relative water depths ($h/H_0'$) for different sea bottom slopes (tanθ) are obtained from Figure 1 a-b. (OCDI, 2002).




(a) (b)

In wave transformation studies, the sea level rise possible to occur in the coming century due to global warming as 1.0 m.

Figure 1: Change in Mean Water Level (a: Bottom Slope 1/100, b: Bottom Slope 1/10; OCDI, 2002)

The dynamic (oscillating) component of wave set-up, surf beat amplitudes ( $\zeta_{rms}$ ) at shorelines are computed from Equation (1) (OCDI, 2002) where h is the intermediate water depth, $K_r$ is the refraction coefficient at respective depth and $L_0$ is the deep water wave length. In the computation of static and dynamic components of the wave set-up at shoreline at selected locations, the nearshore wave heights and average bottom slopes at 10 m water depth are used and the slope is assumed to be constant up to shoreline. Therefore, the computed wave set-up values are approximate and should be re-evaluated in detail considering land topography and the structural features at the nearshore project area.

$$\zeta_{rms} = \frac{0.01H_0^{'}}{\sqrt{\frac{H_0^{'}}{L_0}(1+\frac{h}{H_0^{'}})}} \qquad H_0^{'} = H_0 K_r \quad \text{.....(1)}$$

### 4.2 Wind set-up

The wind set-up $\eta_0$ (cm) along an effective fetch distance F (km) from a specific direction formed by the average wind speed $U_{ave,10}$ (m/sec) and the average water depth $h_{mean}$ (m) in the same direction was calculated using the Equation 2 (OCDI, 2002):

$$\eta_0 = 4.8 \cdot 10^{-2} \frac{F}{h_{mean}} U_{ave,10}^2 \quad \text{.....(2)}$$

The above given equation is an approximate solution of the wind set-up (Rock Manual, 2007).

In the following part preliminary design computations carried out for a hypothetical coastal project is given.

## 5. Example Case Study:

Design computations are given in steps.

### 5.1. Bottom topography:

A hypothetical coastal project area is selected at a region where the coastline is aligned from East to West with a uniform sea bed slope taken as 1/33. Within this project area a rubble mound breakwater is planned to be constructed at a depth of 10 m, as shown in Figure 2. Depth of construction 10m is the reference mean Mean Water Level (MWL) taken from sea bed topography. In practice for any coastal project, near shore seabed topography (bathymetry) of the project area can be obtained from the navigation maps of (SHODB) Navigation, Hydrography, and Oceanography Department of Turkish Naval Forces and the nearshore bathymetric measurements held around project area.

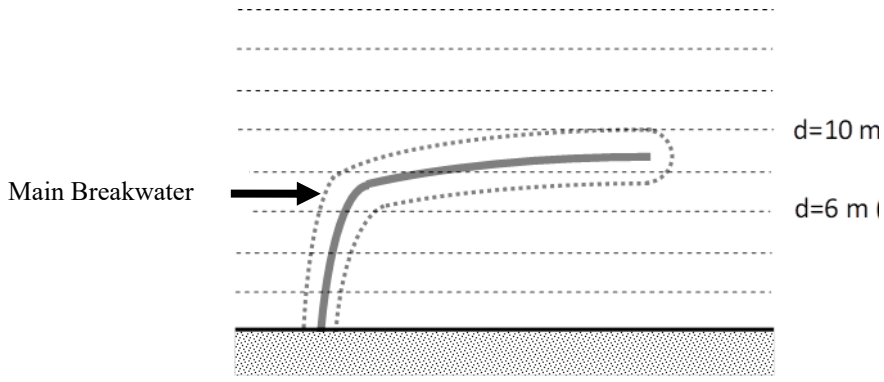



Figure 2. Project area and the layout of the main breakwater

### 5.2. Wind Statistics

For this example, European Centre for Medium-Range Weather Forecasts (ECMWF) wind data (18 years) is used for the long term wind statistics analysis as a data source. Plotting the cumulative number of occurrences of each wind class for each direction on to a semi-log graphical paper gives the cumulative exceedance probability of wind speeds, $U_{ave,10}$, is given as;

$$Q(>U_{ave,10}) = \exp[(U_{ave,10}-B)/A] \quad \text{..... .....(3)}$$

where $Q(>U_{ave,10})$ is the cumulative exceedance probability of a hourly average wind speed at 10 meter above still water level ($U_{ave,10}$)

## 5.3. Wave Statistics and Hindcasting

### 5.3.1. Effective Fetch Study

The effective fetch lengths for the wave hindcasting are normally determined from the navigation maps of SHODB (Navigation, Hydrography, and Oceanography Department of Turkish Navy). In the computation of effective fetch lengths, for each direction, the effective area is considered as a sector from -22.5º to +22.5º totally covering an area of 45º with 7.5º intervals.

For the example the computations are carried out for dominant wave direction selected as North where the effective fetch is computed as 400km. Along the effective fetch direction the average water depth taken as 1500 m.

### 5.3.2. Wave Steepness

Using effective fetch lengths and the wind data of ECMWF (18 years), deep water wave parameters

($H_{s0}$: deep water significant wave height, $T_s$: significant wave period) are obtained from the storms by using the numerical **Model W61** developed by Middle East Technical University, Department of Civil Engineering, Ocean Engineering Research Center. Using these deep water wave characteristics, wave steepness ($H_{s0}$: / $L_0$ ) of the region is determined as the first step for the long term and extreme wave studies.

For the example study wave steepness ($H_{s0}$: / $L_0$ ) is obtained as 0.0395

### 5.3.3 Long Term Wave Statistics

Long term wave statistics studies are carried out in two stages:

**5.3.3.1 Extreme wave height probability distribution**:

This statistical study is carried out valuable for the decision on the design wave height to be used for a coastal structure which is susceptible for destruction during one storm event. In order to obtain the extreme wave statistics of the region, extreme wave data for the project area (Table 2) is analyzed using different extreme wave height probability distributions (FT-1, FT-2, Weibull, Log Normal) with different distribution coefficients. Gumbel distribution (FT-1, Equation 4) which gave the best fitting results is used to show the relation between the extreme wave heights and the cumulative non-exceedance probability of these extreme wave heights.

$$P(<H_{s0}) = \exp[-\exp(-(H_{s0}-B)/A)] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

where $H_{s0}$ is the extreme significant wave height (deep water) within the reference time length, $P(<H_{s0})$ is the cumulative probability that $H_{s0}$ value is not exceeded within the reference duration.A and B are the distribution parameters.

**Table 2.** Highest Annual Deep Water Significant Wave Heights and Significant Wave Periods

| Year | $H_{s0}$ (m) | $T_s$ (s) | Fech Direc. |
|---|---|---|---|
| 1991 | 4.87 | 8.68 | NNW |
| 1992 | 4.89 | 8.52 | NW |
| 1993 | 6.19 | 9.82 | N |
| 1994 | 5.51 | 9.30 | NW |
| 1995 | 5.85 | 9.17 | NNW |
| 1996 | 5.12 | 8.93 | N |
| 1997 | 4.00 | 7.78 | N |
| 1998 | 6.46 | 9.62 | N |
| 1999 | 4.32 | 8.12 | NNE |
| 2000 | 4.68 | 8.37 | NNW |
| 2001 | 5.67 | 9.05 | N |
| 2002 | 4.56 | 7.98 | NE |
| 2003 | 5.42 | 9.16 | NNW |
| 2004 | 5.57 | 9.03 | N |
| 2005 | 5.22 | 9.09 | NNE |
| 2006 | 5.95 | 9.18 | N |
| 2007 | 6.21 | 9.42 | N |
| 2008 | 5.98 | 9.24 | N |

The return period $R_P$, (defined as the average period of occurrence of a certain event), which is related to non-exceedance probability value by the following relationship:

$R_p = 1/(1-P(<H_{s0}))$. ..... (5)

The results of extreme wave statistics for eight different return periods within 90% confidence interval limits and for different wave steepness values are given in Table 3

**Table 3.** Results of Extreme Wave Statistics (Deep Water)

| Return Period (Years) | Deep Water Significant Wave Height, $H_{s0}$ (m) |
|---|---|
| 5 | 6.00 ± 0.45 |
| 10 | 6.48 ± 0.61 |
| 20 | 6.95 ± 0.77 |
| 50 | 7.55 ± 0.98 |
| 100 | 8.01 ± 1.14 |

**5.3.3.2 Normal-Log distribution:**
Using deep water wave parameters $H_{s0}$: (deep water significant wave height), plotted the cumulative number of occurrences are plotted on to a semi-log graphical paper. The cumulative exceedance probability of deep wave height, $H_{s0}$, is given as;

$Q(>U_{ave,10}) = \exp[(H_{s0}-B)/A]$ .....(6)

where $Q(>H_{s0})$ is the cumulative exceedence probability of deep water wave height ($H_{s0}$). From this statistical distribution annual exceedence probability of the selected design wave height can be obtained.

## 6. Deep Water Wave Characteristics and High Water Level Computations for the Selected Design Storm

Within the scope of wave transformation, refraction and shoaling analyses are carried out by considering the high water level occurrences within the project site. In the computations sea level rise possible to occur in the coming century due to global warming is taken as 0.6 m. The tidal variation and the seasonal variation are both assumed as 0.30 m Water level variations due to atmospheric pressure changes and Coriolis effects were taken as 1/10 of the total sea level rise resulting from the wind setup, tidal and seasonal variations and sea level rise due to global warming (Walton and Dean, 2009).

### 6.1.Scenario 1

As an example scenario storm event with hundred year return period from North direction is selected.

In the wave transformation computations, a simple approach given by Van Deer Meer (1990) for uniform sea slopes Figure 3 with zero degree approach angle is used. Deep water wave characteristics and computed high water levels (HWL) are at 10 m construction depth (MWL)is given in Table 4 ,together with the significant wave heights at (MWL) and (HWL)

**Table 4.** Deep Water Wave Characteristics and High Water Level Computations for the Selected Scenario of Storm Event for the Project Area

| **Scenario** | |
|---|---|
| Return Period (year) | 100 |
| Direction | N |
| Deep Water Significant Wave Height, $H_{s0}$ (m) | 8.0 |
| Deep Water Significant Wave Period, $T_s$ (s) | 11.4 |
| Deep Water Peak Wave Period, $T_p$ (s) | 12.3 |
| Deep Water Significant Wave Steepness, $s_{os}$ | 0.0395 |
| Deep Water Peak Wave Steepness, $s_{op}$ | 0.034 |
| **High Water Level (HWL) Calculations** | |
| Wind Speed, $U_{ave,10}$ (m/s) | 27.0 |
| Fetch Length, F (km) | 400 |
| Average Depth $h_{mean}$ (m) | 1500 |
| Surf beat, $\zeta_{rms}$ (m) | 0.29 |

| | |
|---|---|
| Wind Setup, $\eta_0$ (m) (Eqn.2) | 0.09 |
| Seasonal Variations sv (+m from MWL) | 0.15 |
| Tidal Variations, tv (+m from MWL) | 0.15 |
| Sea Level Rise, slr (+m from MWL) | 0.60 |
| Barometric and Coriolis Effects (+m from MWL) | 0.10 |
| High Water Level, Δh (+m from MWL) | 1.40 |
| **Wave Transformation Calculations, Near-shore Wave Characteristics** | |
| $h_{MWL}/L_{op}$ (10/1.56/12.3$^2$) | 0.042 |
| $h_{HWL}/L_{op}$ (11.4/1.56/12.3$^2$) | 0.048 |
| Significant Wave Height $H_{s,d=10.0m,MWL}$ (m) | 6.30 |
| Significant Wave Height, $H_{s,d=11.4m,HWL}$ (m) | 7.10 |

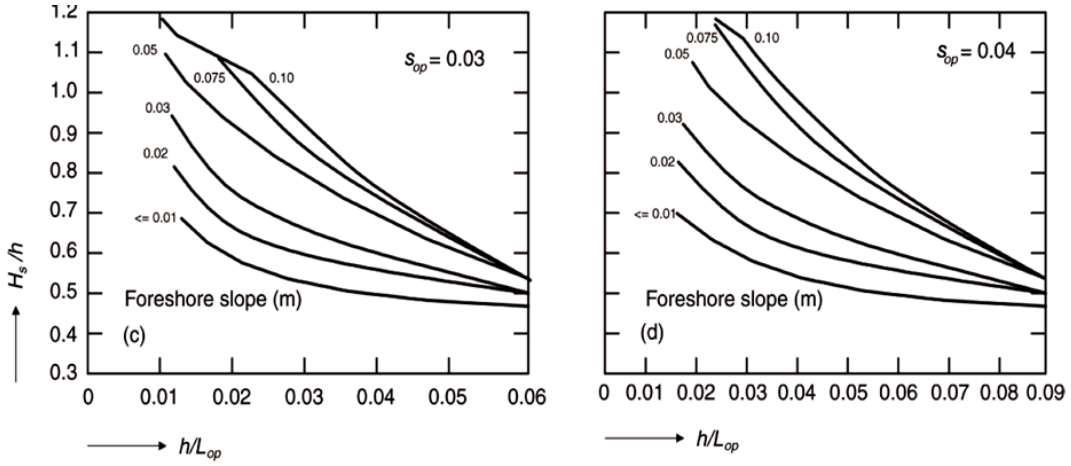



**Figure 3.** Nearshore Significant Wave Height Transformation for uniform sea bed slopes (CIRIA; CUR; CETMEF,2007)

Significant wave heights at (MWL) and at (HWL) are computed as 6.3m and 7.1m. Increase in wave height wave height will cause an increase in wave forces. In case of rubble mound breakwaters such an increase in design wave height will results in stone sizes almost 1.5 times larger. Not only the stone size but also the height of the breakwater has to be increased with respect to HWL. This result clearly proves the importance of the high water level considerations to minimize the risk the structural damage and failure of coastal structures.

This example problem can be extended to include the wave set-up and run-up computations at shallower depths where the sea level rise plays an important role in the design of the infrastructures of coastal cities such as sewage disposal systems, rainfall catchment collectors and sea outfalls, fresh water systems, river basin reclamation, land reclamation, dredging, coastal highways and coastal defence structures. For the above given example storm scenario

For the above given scenario without considering the sea level rise due to global warming(at present time) at near-shore depths around 2 m rise of sea level will be around 70 cm. At the shore the same storm will cause run-up values (EurOtop(2007) around 2.00m. These results explain flooding of the low lying urban areas and river basin settlements.

## 6.2. Scenario 2

Another example problem on high water level computations is prepared for Izmir bay for a project site near Alsancak at the shore (figure.4) to point out the importance of the design wave characteristics that have to be computed considering the high water level. The computations are again given in the steps.

-The effected fetch for the site is computed as 35 km over the sea areas where the mean water depth 20m over the fetch is taken as with sea bend slope approximately 1/100.

As an example a probably worst scenario case with wind velocity maximum $U_{ave,10}$ is selected from coastal metrological station (Göztepe) wind data of ECMWF over a 45 years period. Accordingly, $U_{ave,10}$ =12.5 m/s is selected as the design wind velocity. Wave characteristic are generated by $U_{ave,10}$ =12.5 are predicted as deep water significant wave height $H_{s0}$ 1.5 m ,deep water significant wave period, $T_s$=5.2 seconds with deep water peak wave period, $T_p$= 5.6 seconds. Hasselmann (Coastal Engineering Manual 2008).


**Figure 4**: Fetch Distance for the example case project area in Izmir Bay near Alsancak

Deep water wave characteristics and high water level computations for the selected scenario of storm event for the project Area at Izmir Bay near Alsancak are all given in table5. (at present)

**Table 5.** Deep Water Wave Characteristics and High Water Level Computations for the Selected Scenario of Storm Event for the Project Area at Izmir Bay near Alsancak (at present)

| **Scenario** | |
|---|---|
| Direction | W |
| Deep Water Significant Wave Height, $H_{s0}$ (m) | 1.50 |
| Deep Water Significant Wave Period, $T_s$ (s) | 5.20 |
| Deep Water Peak Wave Period, $T_p$ (s) | 5.60 |
| Deep Water Significant Wave Steepness, $s_{os}$ | 0.04 |
| Deep Water Peak Wave Steepness, $s_{op}$ | 0.03 |
| **High Water Level (HWL) Calculations at depth h=0.5m near shoreline** | |
| Wind Speed, $U_{ave,10}$ (m/s) | 12.50 |
| Fetch Length, F (km) | 35.00 |
| Average Depth $h_{mean}$ (m) | 20.00 |
| Surf beat, $\zeta_{rms}$ (m) | 0.07 |
| Wave Setup (static) $\eta$ (m) | 0.12 |
| Wind Setup, $\eta_0$ (m) (Eqn.2) | 0.13 |
| Seasonal Variations sv (+m from MWL) | 0.15 |
| Tidal Variations, tv (+m from MWL) | 0.30 |
| Sea Level Rise, slr (+m from MWL) | 0.00 |
| Barometric and Coriolis Effects (+m from MWL) | 0.06 |
| High Water Level, Δh (+m from MWL) | 0.83 |

Design stages for the high water level computations are carried out for the selected scenario with Deep Water Significant Wave Height $Hs_0$=1.5 meters, deep water significant wave period, $T_s$ (s)=5.2 , deep water peak wave period, $T_p$=5.6 (s)

Wave Set-up eta ,$\eta$ =0.007m ….figure 1b

Wind Setup is calculated from equation 2. (h is taken as 20 m.)

Seasonal variations and tidal variations from mean water level (MWL) are taken as 15 and 30 centimetres respectively are taken from Menteş Mariograph Stations.

Barometric and Coriolis effects are taken as %10 percent of the total sea level rise resulting from the wind setup tidal and seasonal variations.

As seen from table 5. (at present) not considering the sea water level rise due global warming the high water level (wave and wind setups, seasonal and tidal variations, barometric and Coriolis effects) is 0.83 m above the mean water level. Such an increase in sea level affects not only coastal cities by causing flooding and the damage of coastal structures as well. In case of Izmir bay example, for the given design scenario Therefore in planning stage for future developments along the coastal area high water level has to be taken into consideration with design storms of different return periods (different scenarios) together with the global sea level rise. In case of Izmir Bay example for the given design scenario if sea level rise is selected with a range 0.6-1.0 meter as recommended in practice. High water level will be obtained with a range of 1.43 - 1.83 meters that has to be considered in the design of coastal structures, coastal defence structures and, infrastructures outlets.

For present case remedial measures against flooding is of primary importance for coastal cities which can be over-come by some innovative measures such as by designing recharge system of the flooding water to pump back to into the sea.

## 7. Conclusions

Rise in sea level rise, sea surface temperatures are two climate change driven parameters that have most signifi-cant impacts on coastal areas. Recently, sea level rise is included in the design of coastal structures and also has to be considered in the planning of infrastructures of the coastal-cities together with the regional adaptation measures for impacts of climate changes in future.

In summary, the numerous studies show that increased coastal erosion, land loss due to inundation and salt water intrusion to groundwater resources are the main impacts expected to be observed along Turkish coastlines and it is a highly challenging process to develop and implement adaptation policies for coastal areas. Climate change has promoted a wide study of the sea level rise and potential impacts of enhanced effect on the frequency, duration and the intensity of wind storms in future compared to today. Therefore ,all design storm events has to be taken as to occur in the respective high water levels (HWL; defined as the storm surge) which is sum of wind set-up and the respective wave set-up, astronomical tidal and seasonal variation amplitudes, sea level rise due to climate change (global warming) and possible Coriolis effects. Continued monitoring of sea level at varying locations in addition to data collection along coastal areas within a national framework would ensure reliable and detailed assessments of impact and vulnerability in the long run.

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# News from ECCE Members

## Austria

### Digitalization Strategy of the Federal Chamber of Architects and Chartered Engineers (BKZT)

This so called "zt:archive" is an archive used for highly secure long-term storage as well as the digital creation, sealing and signing of certificates, plans, reports and documents. It is part of the Austrian eGovernment architecture and allows the secure entry and retrieval of data as well as the secure exchange of documents with courts and authorities. The authenticity of the documents is protected, among other things, by the qualified digital signature. State-of-the-art measures guarantee the best possible level of security. The "zt:archive" contains all public documents drawn up by Architects and Chartered Engineers.
The aim is to carry out technology-related administrative procedures (e.g. digital building submission) via the "zt:archive", that is managed by the BKZT. Federalism is a major challenge for this aim, since e-government is implemented on a federal state basis in Austria. Since technology-related administrative procedures have to be carried out at the municipal, federal and - in some cases - federal state level, legal and technical coordination must take place on all of these authority levels. To make matters worse, it is not uncommon for the procedural provisions to hinder the purely digital processing of procedures, which is why a large number of legal provisions will have to be changed. A first major success could be achieved in Carinthia, one of the nine Austrian Federal States, with a pilot project on the forest division process.
The archive is a so-called external e-government project. The judicial organization law is the essential legal basis. The archive enables Architects and Chartered Engineers, in their capacity of issuing public documents, to create electronic documents and to archive them securely and legibly in an internationally standardized long-term archive format.
The electronic documents from the "zt:archive" are considered originals and thus increase legal security - both for the Architects and Chartered Engineers and the processing authorities. Access to the "zt:archive" is specially secured. For this purpose, the Architects and Chartered Engineers have special qualified certification and professional signatures at their disposal, which ensure a secure signature.
The fact that the "zt:archive" can be offered and established step-by-step as a solution approach for the provision of data in the direction of e-government within the framework of technology-oriented procedures counteracts the threat of a wild rush of inconsistent solutions. In this sense, the "zt:archive" is also an instrument of digital interest representation by the BKZT.

### YesWePlan!

The Erasmus + project YesWePlan! connects project partners from Germany, France, Austria, Slovenia and Spain: The common goal is to use new approaches to reduce the gender gap among architects and civil engineers.
The project, which started in November 2019, aims to develop recommendations for action for professional representatives, training organizations and political actors in order to specifically reduce gender-specific disadvantages in the areas of

YesWePlan!
Co-funded by the Erasmus+ Programme of the European Union

Architecture and Civil Engineering. In addition to the Austrian Federal Chamber of Architects and Chartered Engineers, which initiated the project through the Committee of Female Architects and Engineers and acts as lead partner, the German Federal Chamber of Architects, the Slovenian Chamber for Architecture and Spatial Planning, the Polytechnic University of Valencia and the French Association for Urban and Housing Research are on board.
In order to make comparisons of the gender equality situation easier, analyses were carried out in all project partner countries that highlight and question the legal and practical framework conditions and gender-specific differences with regard to vocational training and professional practice. These country reports are available on the project website.
In order to be able to learn from one another, a collection of best practice examples is created, which can also be transferred to other countries. One example is the well-known French women's architecture award, which is to be established in a similar form in Austria by 2022.
The core of the project is a career tracking system, with which concrete measures are to be derived on the basis of from a large number of personal interviews and a large Europe-wide online survey, which was open until the end of May 2021 and gathered around 1000 inputs.
Further important aspects of the project are learning and networking meetings at which female Architects and Chartered Engineers from all partner countries can jointly complete professional training, visit best practice examples and exchange ideas with local experts.
Due to the delays caused by travel restrictions in the corona pandemic, the project will be extended beyond the originally planned project duration: In spring 2022, the project results will be presented to the public at a large project closing event in Vienna.

# Bulgaria

## Be part of Building Engineering Forum and join the engineers from European Countries


**Building Engineering Forum**
**International Conference on Earthquake Engineering**
**20 – 21 October 2021, Sofia, Bulgaria**

***under the auspices***
*of Ministry of Regional Development and Public Works of Bulgaria*

***The motto is:***
*Turning seismic hazard awareness into risk mitigation.*
*Seismic risk reduction through integrated design*

The event is organized by the Union of Civil Engineers in Bulgaria and the Chamber of Engineers in the Investment design, region Sofia (KIIP, regional branch Sofia-city). European Council of Civil Engineers (ECCE) and European Council of Engineers Chambers (ECEC) are partners of the Conference. The members of these organizations will be invited to take part in the event and their national members will be part of the audience. Joint Research Centre (JRC)` of the European Commission, Municipality of Sofia and University of Architecture, Civil Engineering and Geodesy (UACEG) – National Center for Seismic Engineering (NCSE) are also partners of the Conference.




Bulgaria is a country of high seismic risk. The earthquake danger and the higher seismic activity on the Balkans predetermines the common problems, faced by the civil and earthquake engineers in the region and the need of exchange of experience, knowledge, ideas, results of research and practical experience, related to the seismic construction and seismic risk reduction.

This has been the major reason that made the Chamber of Engineers in the Investment Design, regional branch Sofia-city, the Bulgarian Academy of Sciences and the University of Architecture, Civil Engineering and Geodesy, to organize time ago such professional forums on the Balkans.
Greek Bulgarian Seminar on Earthquake engineering, Sofia -2007 and two Balkan Seminars on Earthquake Engineering in Sofia -2009 and 2011 have been organized by KIIP, regional branch Sofia-city, jubilee Conference on Sustainable Construction, organized by Bulgarian Chamber of engineers in the investment design 2014, Balkan Engineering Forum, 2018, organized by Ministry of Regional Development and Public Works and ECCE, and held under the auspices of the Bulgarian Presidency of the EU Council.

The responsibility of civil engineers to reduce seismic risk is enormous. We must make joint efforts, with the support of the state and with political will, to be able to reduce the seismic risk, the damage from earthquakes and to ensure the funds needed for reconstruction work. Reducing seismic risk requires the exchange of knowledge, ideas, practical experience.
In the panel dedicated to the holistic approach to the renovation of buildings, JRC will present the results of the led by them, awarded by EU pilot project „Integrated techniques for the seismic strengthening and energy efficiency of existing buildings"
.
It is expected to be presented the insights on the novel technologies and solutions for combined improvement of energy and seismic performance of existing buildings, this will be a valuable contribution to the goals of the Conference.

The results of the pilot project will be the basis for taking a decision by the European Commission for planning the use of European funds for disaster prevention and risk reduction by applying a new holistic approach to both seismic reinforcement and energy efficiency of existing buildings.

An important aspect is the protection of immovable cultural heritage. In this context, activities to strengthen, restore and identify immovable cultural heritage are particularly important for sustainable development and improving the quality of life. The role of the construction industry is extremely important.

During the Forum will be held a Panel Discussion with Bulgarian participants.

## International Advisory Board


Aris Chatzidakis, *ECCE President European Council of Civil Engineers (ECCE)*

Klaus Thürriedl, *ECEC President European Council of Engineering Chambers (ECEC)*

Artur Pinto, *Head of the JRC Unit 'Safety and security of buildings' Joint Research Centre (JRC), European Commission*

Silvia Dimova, *Deputy Head of the JRC Unit 'Safety and security of buildings' Joint Research Centre (JRC), European Commission*

Ivan Markov, *Rektor of UACEG University of Architecture, Civil Engineering and Geodesy (UACEG)*

Todor Chobanov, *Deputy mayor of the Municipality of Sofia Municipality of Sofia*

## Venue and type of the event

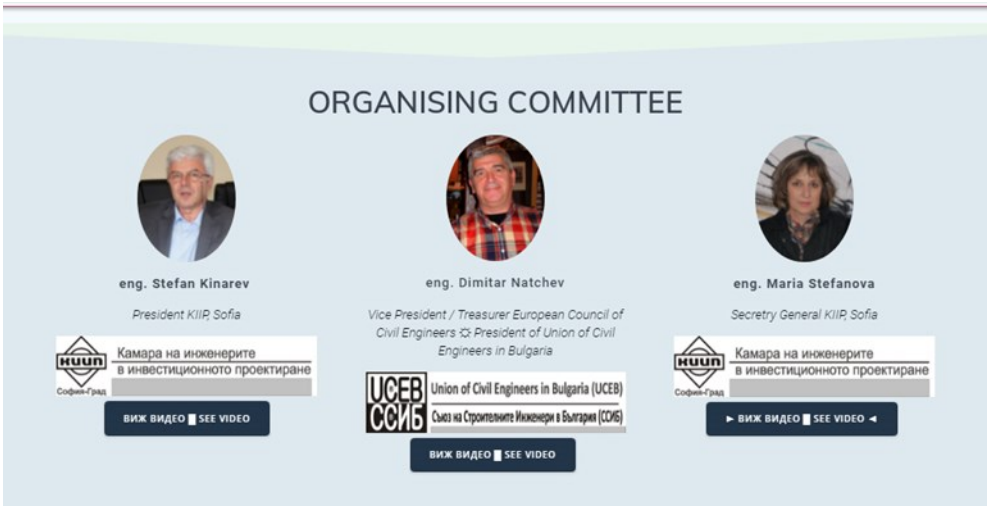
Depending on the epidemiological situation in the country, the conference will be held in person in Sofia or in the format of a virtual hybrid conference.
The lectures will be broadcast directly through an online platform to Bulgarian engineers and engineers from European countries. It will be possible to ask questions online.
The Panel Discussion will be only for Bulgarian engineers.
The lectures will be given in Bulgarian and English with two-way simultaneous translation.

## Conference Panels

**Chairman:** prof. dr. Atanas Georgiev, UACEG
***Panel 1:*** *Seismic risk reduction through proper design with Eurocode 8. Expected regulatory changes.*
**Chairman:** Aris Chatzidakis, ECCE President
***Panel 2:*** *Integrated techniques for the seismic strengthening and energy efficiency of existing buildings*
**Chairman:**
***Panel 3:*** *Anti-seismic design in strengthening, reconstruction and renovation of buildings declared as cultural built heritage / immovable cultural values*

**Panel Discussion**
*Legislative frameworks for application of integrated techniques in reconstruction and renovation of the building stock and of the buildings declared as cultural built heritage / immovable cultural values*
***Moderator:*** *CEng. Dimitar NATCHEV, ECCE Vice President*

**Organizing Committee**
The organizers and participants in the forum work on a voluntary basis or are in employment relations with institutions. No registration fee is due for participation in the forum.




Visit: **www.bef2021.uceb.eu**

**Save the dates 20-23 October 2021**
**Come to Sofia and experience good moments.**
**If you can't, get involved virtually**
**and you will be impressed.**

Interreg
Greece-Bulgaria
European Regional Development Fund

EUROPEAN UNION

## Interreg Greece - Bulgaria

Greece and Bulgaria, two neighboring countries with a rich past, since the end of the 1990s have entered an era of closer co-operation, due to the INTERREG Programme “Greece-Bulgaria”.

The main idea behind “INTERREG” is that countries have issues which can be better solved if they work together with their neighbors than if each one remains confined within its borders. So for this reason, in our Programme we promote activities that bring our people closer.

**TECHNICAL CHAMBER OF GREECE** / SECTION OF CENTRAL MACEDONIA/ and **UNION OF CIVIL ENGINEERS IN BULGARIA** in cooperation with FEDERATION OF INDUSTRIES OF GREECE and CHAMBER OF COMMERCE & INDUSTRY – Gotse Delchev BG

**started the implementation of a joint Project:**
**Creating "Circular" Business by young ENGINEers at the cross-border area of Greece-Bulgaria.**

*"Promoting entrepreneurship, in particular by facilitating the economic exploitation of new ideas and fostering the creation of new firms, including through business incubators".*

For the first time in Greece and Bulgaria, two technical/professional organizations and two chambers of entrepreneurship join their forces to bring together mainly engineers and the market by training, coaching and networking them in the most effective way for the success of their entrepreneurship venture.
The project will help young engineers create their own business in the area of circular economy.

The project will strengthen the friendly relations and partnership between Bulgarian and Greek engineers.

https://www.uceb.eu/

Cyprus

## Cyprus Association of Civil Engineers (CYACE)

### Introduction of CYACE

**The reasons why the Cyprus Association of Civil Engineers was established**

A brief historical reference to the formation of our Association, and to the reasons for its establishment, were provided alongside the invitation to the first General Assembly of the Cyprus Association of Civil Engineers (CYACE) held on 11 December 1993.
The Founding Assembly of the CYACE was held on 12 December 1992, with official registration of the 48 founding member Association taking place on 23 September 1993. The CYACE's establishment was deemed necessary due to the continuous downgrading and marginalisation of the profession in both the private and the public sector.
The establishment of the Technical Chamber of Cyprus (ETEK) gave rise to the foundation of an independent organisation, which would exclusively represent Civil Engineers.

**Main Objectives**
The Association's main objectives are:

- To inform the public about the role of a Civil Engineer through press conferences, press releases and participation in public debates on industry-related matters.
- To protect all acquired rights covered by Legislation.
- To set up a working team of Civil Engineers, from all branches of the industry, who will identify and analyse problems faced by fellow Engineers with a view to resolving them through the Cyprus Technical Chamber or other responsible body.
- To train fellow Engineers by means of organised seminars, educational trips etc.
- To be represented in or to participate in any committees, relating to the Civil Engineering profession.
- To develop a database, outlining qualifications, speciality and experience of Civil Engineers, purely for professional purposes.
- To organise social events in order for engineers to meet other engineers and to improve relationships within the profession.
- To obtain Civil Engineering studies for government projects directly from Cypriot engineers.
- To offer guidance and assistance to newly-qualified Civil Engineers, enabling them to settle more easily into the profession.
- To support employees of Civil Engineering firms where the role of a Civil Engineer is disgraced or degraded by the employer or others in the firm.

The aims and objectives of the CYACE are set out in more detail in the Association's Articles of Association.

**Education**
Cyprus Association of Civil Engineers (CYACE), one of the parties that constitute the Cyprus Council of Civil Engineers (CCCE), following the Cyprus Republic's guidelines for reducing the spread of Covid-19 virus, has continued to provide seminars and educational programmes online using the Zoom platform.

**Free Webinars**
Cyprus Association of Civil Engineers organizes free Webinars to present topics related to civil engineering. The primary purpose of these Webinars is to educate the New and Old Engineers and to deliver relevant, timely information to the audience. Each participant takes a certificate at the end of the Webinar.

The table below presents the free Webinars organized by Cyprus Association of Civil Engineers:

Table 1: Free Webinars organizes by Cyprus Association of Civil Engineers

| A/A | Date | Title | Speaker |
|---|---|---|---|
| 1st | 7th November 2020 | Introduction to LinkedIn | Mr. Petros Kkolas |
| 2nd | 17th February 2021 | Introduction to Safety and Health in construction works - The role of the Engineer | Ms. Evangelitsa Tsoulofta |
| 3rd | 9th April 2021 | Introduction to Construction and Technical Works Contracts | Mr. Varnavas Lambrou |
| 4th | 28th June 2021 | Seismic Hazard in the Cyprus Area and Reinforcement Methods | Dr. Nicolas Kyriakides |

## Educational and Research Centre of CYACE - Seminars

The Educational and Research Centre of CYACE, organized with great success and full participation the following seminars, which were authorized by Human Resource Development Authority of Cyprus.

**Evaluation of Existing Buildings**
**Title:** Evaluation of Existing Buildings
**Dates:** 9th and 10th of July 2020
**Location:** Online, via Zoom platform
**Trainers:** Dr. Demetris Vamvatsikos and Dr. Nicholas Kyriakides

The aim of the program was to acquire the participants with the necessary knowledge for the independent treatment of valuation and upgrade of existing constructions, with emphasis on reinforced concrete buildings, using the latest developments. Moreover, the participants would gain an understanding in regards to the seismic behavior of such constructions, based on engineering principles and the provisions of the Applied Regulations and in particular, of the Eurocode 8.

Picture 1: Evaluation of Existing Buildings via Zoom platform

**Building Contract Management (Roles - Responsibilities - Studies & Legal Background)**
**Title:** Building Contract Management (Roles - Responsibilities - Studies & Legal Background)
**Dates: 10th and 11th of September 2020**
**Location: Ajax Hotel, Limassol**
**Trainers: Mr. George Ioannou**

The seminar aimed to provide the participants with an understanding of the structure and contractual relationships in building contracts and the basic principles and responsibilities of each contracting party in construction contracts. Moreover, by following this seminar the participants gained knowledge in regards to the terms included in the construction contracts as well as their correct application and interpretation through the existing Case Law.

Picture 2: Building Contract Management

**Recent Developments in the Design of Metal Structures**
**Title:** Recent Developments in the Design of Metal Structures
**Dates:** 5th & 7th, 12th & 14th of October 2020
**Location:** Online, via Zoom platform
**Trainer:** Dr. Charis Gantes

The aim of the training was for the participants to acquire the necessary knowledge that would allow them to independentantly treat steel structures/buildings, utilizing the latest developments in the field, in order to understand the behavior of such constructions, both theoretically and practically. Moreover the participants would gain the necessary forming and dimensioning of their members and joints in accordance with the principles of engineering and the provisions of its new versions Eurocode 3 and Eurocode 8.

Picture 3:Recent Developments in the Design of Metal Structures

**Effective Correspondence in Construction Contracts of the Private Sector**
**Title:** Effective Correspondence in Construction Contracts of the Private Sector
**Dates:** 19th & 26th of February 2021 and 05th & 19th of March 2021
**Location:** Online, via Zoom platform
**Trainer:** Dr. Andis Sfykas

The training program's aim is to equip the participants with the necessary skills in order to be able to indicate the cases, circumstances, events and facts for which letters, notices, warnings and requests should be prepared. By completing this training, the participants will be able to identify the relevant information and data that must be included in each letter / notice / warning / request in order to be considered complete, to serve its purpose and to meet the provisions of the Cyprus Joint Construction Contracts Tribunal (CyJCCT) Contracts E1 (A), E2 (A) and E3 (A). Moreover, this program will familiarize the participants with the provisions of CyJCCT Contracts as below:

- E1 (A) - Form of Main Contract for Building Projects (With Quantities)
- E2 (A) - Form of Main Contract for Building Projects (Without Quantities)
- E3 (A) – Form of Contract Form for Small Building Projects

Picture 4: Effective Correspondence in Construction Contracts of the Private Sector

**Assessment of Existing Condition and Upgrading of Structures by Masonry Buildings**
**Title:** Assessment of Existing Condition and Upgrading of Structures by Masonry Buildings
**Dates:** 7th and 8th of July 2021
**Location:** Cyprus Scientific and Technical Chamber (ETEK)
**Trainer:** Dr. Constantinos Spyrakos

The aim of the Educational Program is to provide the participants with the necessary knowledge for the elaboration of studies concerning the assessment of the existing situation and the selection of the appropriate intervention methods for the repair and possible reinforcement of the structures. This will take place in accordance with the principles of engineering, the current Eurocode 8, the regulation under development for assessment and structural interventions in masonry, as well as the plan for the new revised Eurocode 8.

Through examples of practice, both traditional practices and modern-new methodologies will be established, while emphasis will be placed on the treatment of constructions that are characterized as monuments.


Picture 5: Book of Dr. Constantinos Spyrakos - Assessment of Existing Condition and Upgrading of Structures by Masonry Buildings

## Announcements

**CYACE'S 28th Online General Assembly, 16th December 2020**

The 28th Online General Assembly of the Cyprus Association of Civil Engineers (CYACE) was held on the 16th of December 2020, via the Zoom platform.

The Assembly consisted of particularly interesting lectures. Specifically Dr. Charis Gantes, Professor at the National Technical University of Athens, gave a lecture on ''The Design of Metal Structures Against Fire''.

Picture 6: CYACE'S 28th Online General Assembly, 16th December 2020

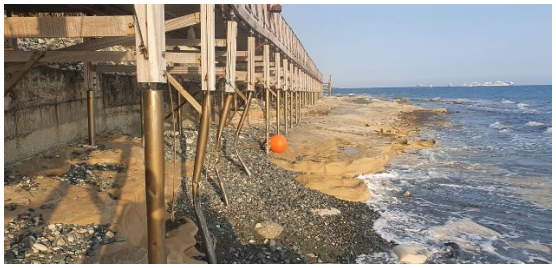
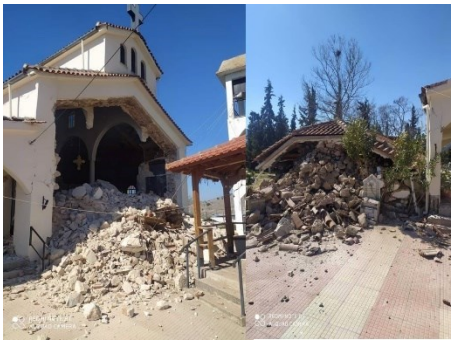
**Elections of the Cyprus Scientific and Technical Chamber**

The elections of Cyprus Scientific and Technical Chamber (ETEK) took place on the 24th of October 2020. Mr. Andreas Theodotou (President of CYACE), was elected as a Vice President in the board, Mr.Platonas Stylianou, (former president of CYACE) as a General Secretary and Mr. Varnavas Lambrou (General Secretary of CYACE) as a Member.

Picture 7: Mr. Varnavas Lambrou (left), Mr. Platonas Stylianou (center), Mr. Andreas Theodotou (right)

**Press releases**

In an effort to contribute to the society and on matters that are of high importance for Civil Engineers, the Cyprus Association of Civil Engineers has published the following press releases:

| Date | Title | Pictures |
|---|---|---|
| **14th January 2021** | The Cyprus Association of Civil Engineers welcomes the reestablishment of the area around the Kourris dam as a protection zone |  |
| **18th January 2021** | The Cyprus Association of Civil Engineers calls on the Government to proceed with the creation of unified authorities for licensing and control of development | |
| **1st February 2021** | Announcement of the Cyprus Association of Civil Engineers regarding the illegal demolition of preservable buildings in the old town of Nicosia, |  |
| **2nd March 2021** | Dangerous Condition of Coastal Walkway in the area of Agios Tychonas in Limassol, |  |
| **4th March 2021** | Will the old buildings in Cyprus resist an earthquake of the size of that in Elassona Area in Greece? |  |

| Date | Title | Pictures |
|---|---|---|
| 5th March 2021 | CYACE expresses its sadness in regards to the damage caused due to fire at the castle of Agios Hilarion in occupied Cyprus |  |
| 29th March 2021 | Relocation of the Faculty of Architecture of the University of Cyprus |  |
| 21st April 2021 | Proposed construction of a cathedral inside the Paphos Public garden - CYACE invites everyone to cooperate for the good of the city | |
| 28th April 2021 | Announcement of the Cyprus Association of Civil Engineers regarding the World Day for Safety and Health at work (28th April 2021) "Anticipate, Prepare and Respond to crises – Invest Now in Resilient OSH SYSTEMS" |   |

**7th International Construction Safety and Health Conference and Exhibition of Equipment and Services**


The Cyprus Association of Civil Engineers (CYACE) is organizing on the 5th and 6th of November 2021, in Hotel Hilton Nicosia, the 7th International Construction Safety and Health Conference and Exhibition of Equipment and Services on Vision Zero, titled: **Evolution or Revolution – The future is now!** Motto of the Conference is **Mission Possible**!
Co-Organizers are the International Social Security Association for the Construction Sector (ISSA-C) and the Ger-

man Social Accident Insurance Institution for the Building Trade (BG BAU). The Conference will be held under the auspices of the Minister of Labour, Welfare and Social Insurance of Cyprus and will be supported by the Scientific and Technical Chamber of Cyprus and the Department of Labour Inspection.
The intention of the organizers is for the Conference to take place with physical presence and to include participation of speakers through the web. Details regarding the participation and attendance of the Conference will be announced by June 2021, depending on the situation with the Covid-19 Pandemic.
The Conference will be held under Vision Zero Campaign, following up on the 6th International Conference held on May 2019 under Vision Zero Campaign.
The panel of the speakers of the Conference includes distinguished professors and other experts on occupational safety and health from Europe and other countries worldwide, including the CEO of BG BAU, the President of ISSA-C and other officials of these organizations.
The aim of the Conference is to present innovative practical solutions to achieve the vision of "Zero Accidents and Diseases", with particular emphasis on the presentation of new technologies, practices and tools for the transformation of the construction sector during the modern digital age. While the construction industry faces unique challenges from the global pandemic, the introduction of digitalisation is an important milestone for safety and health, as it will offer modernisation and smarter solutions for safer working conditions, savings, better quality and less impact on the environment, with the ultimate aim of zero accidents.
The Conference will be a unique opportunity for professionals in the construction sector and in related activities to gather and exchange information, as well as for the occupational health and safety experts and consultants. The participants will be informed through practical examples regarding the most important construction innovations transforming the construction industry. Finally, the participants will have the opportunity to participate actively in the Conference's Workshops.
More information is available on Conference's website (www.cosh2021cy.com).


Video - 7th International Conference 1 - https://www.youtube.com/watch?v=sgQkaVjfL1M

## Contact Information

Website: https://www.spolmik.org/

Facebook: https://www.facebook.com/cyace

LinkedIn: https://www.linkedin.com/in/cyace/

7th International Conference on Construction Safety & Health: https://www.cosh2021cy.com/

Email: info@spolmik.org

Latvia

## Unique Acoustics on an Open-Air Stage

**Antra Ērgle**
**editor in chief of magazine *Buvinzenieris* (Civil Engineer), Latvian Association of Civil Engineers**
**Photo – magazine *Buvinzenieris***

**The newly built Mežaparks Great Bandstand with supportive infrastructure was opened Riga, the capital of Latvia, in June 2021.**

The Latvian Song festival takes place at the Mežaparks Bandstand once every five years and sees tens of thousands of choir singers, musicians and spectators join sing together in celebration of national freedom. The main feature of the Mežaparks Bandstand is unique in Europe, with acoustics purposefully developed for open-air conditions.

*The new look of the of Mežaparks Great Bandstand and the spectator area. The forest around the bandstand and the amphitheater symbolises the surrounding natural environment as well as helps to boost the volume of the choir.*

### Several phases

Since its construction in 1955, the open-air stage has undergone several reconstructions. Most recently, this national treasure was totally recreated into a modern bandstand for concerts, providing a convenient area for spectators, premises for cultural events and supportive infrastructure.

The reconstruction of the Mežaparks Great Bandstand started on 11 March 2016, when Riga City Council and the National Culture Centre of the Ministry of Culture signed an agreement with the Juris Poga and Austris Mailītis architectural firms for the development of a construction design. Phase A of the reconstruction of the Mežaparks Great Bandstand – the construction of the spectator's area and a pergola – was completed by 7 June 2018. Phase B – the construction of a new bandstand – was completed by 18 June 2020. Part 2 of phase B is now also complete. The last phase is due for completion in 2023, when the Song and Dance Festival will commemorate the site's 150th anniversary.

During the construction, very intense and productive architectural supervision was maintained to clarify and detail specific solutions.

The cupola is made of a metal structure with acoustic timber plates and a fibreglass membrane.

### Buildings and site

The newly built central building, service building and warehouses of the Mežaparks Great Bandstand have been put into service – construction works under phase B2 started in October 2020. The central building of the bandstand has four surfaces and two subterranean floors with a total area of 10,185 square metres. The boiler house has been reconstructed, the site has been arranged and utility infrastructure has been installed during construction works.

12,874 choir singers can perform on the bandstand – twice as many as previously. Following the reconstruction, the bandstand will be more conveniently structured, more accessible and safer for festival participants. The cupola of the bandstand is covered by a textile membrane that covers an area of 5,324 square metres. The fire-resistant material of the membrane consists of fibre manufactured by AS *Valmieras stikla šķiedra*, which is woven into a textile at the *Valmiera Glass UK* plant in the UK. The new roof covering of the bandstand will protect performers from sunlight, wind and rain, as well as provide outstanding acoustics. The bandstand now offers much greater possibilities in terms of scenography and the organisation of the flow of people.

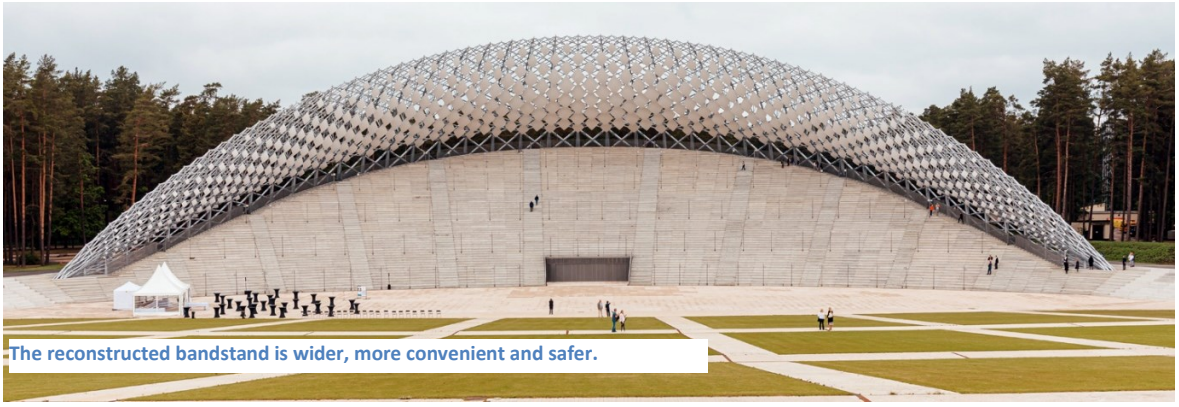
### Timber acoustic screens

The area for performers and the cupola of the new bandstand were completed in May of last year along with the infrastructure – security, engineering and technical systems, roads – and part of the site was also landscaped. The Mezaparks Great Bandstand has taken on the appearance of a *'Silver Grove* on a mountain of song', as its architects intended. The branches of the tree-like pattern are supported by a heavy metal structure weighing 1766.4 t and consisting of columns and trusses that measure 35.8 m in height. 510 acoustic screens are suspended from the metal trusses, thus creating a unique acoustic solution. The screens are manufactured from curved plywood made in Latvia.

The steps of the new bandstand are made of reinforced concrete, and 4788 metres of removable timber benches covered

with a protective coating are used for seating. An adiabatic system is installed in the bandstand to cool the air around the performers with a cold mist in hot weather.
Valdis Koks, the project director of the general contractor *LNK, RERE,* explains that unique large-scale structures have been developed for the stage – it is the strongest metal structure ever built in the Baltic countries. The construction started with the demolition of the old building. The new bandstand is supported by 1,144 piles with a length of 10-12 m. The total volume of concrete used during the construction of the bandstand was 9558.73 cubic metres.

**Most complex – the roof**
The dome of the roof is made of metal structures of an impressive scale. All solutions used during this project are unique, as the building is one of a kind and irregular. The metal structures of the dome are the most complex elements. The dome is supported by 44 columns, of which the shortest one stands at 2.18 m, while the tallest measures 26.35 m. The total weight of all metal structures built on the site exceeds 1930.9 tons. 510 acoustic panels are attached to the metal cupola.
Each structure is unique in the Mežaparks Great Bandstand. Every column has its individual size, every reinforced concrete step is shaped according to the dimensions intended for its location. Valdis Koks, the project manager, compares it to a huge jigsaw puzzle which has to be put together with extreme precision. The shape of the acoustic screens is also unique, as they are made of bilaterally curved timber plywood boards attached to adjustable supporting structures made of metal. The project is something new for Latvian engineers; the constructors created them to bring the architects' vision to life in the form of the intended "Silver Grove on a Mountain of Song".
At the same time, very complex visual and technical solutions had to be made transportable. All of the metal structures were delivered from Hungary. The manufacturer had to separate the metal structures into transportable parts and assemble them on-site. Similarly, columns, trusses and couplings had to be delivered in lots to assemble them on-site. Good communication and precisely calculated logistics allowed for work to continue in shifts, and all structures were assembled and installed in parallel to delivery.


The reconstructed bandstand is wider, more convenient and safer.

**Inspired by folklore**
Architect Austris Mailītis explains that the idea of the Silver Grove was inspired by Latvian folklore and similarities to nature. 'It is a metaphorical mountain of song covered by a silver grove. The singers' platform is a metaphorical mountain, above which the choir singers are protected by a silver grove. It is both a philosophical notion from our folk songs and reminds us of a forest that is of great importance to the Latvian way of life,' explains the architect.
There were several important tasks to be completed during the reconstruction works, aimed at providing the image of a new, wider bandstand and good acoustics. 'A choir as big as ours can be found only in Estonia; it does not exist anywhere else in the world. One of the tasks was to create the best possible acoustics. The width of the front row of the choir is 100 metres, also the depth of the choir is large, there are many rows for the choir on the platform, the area for spectators – wide and deep. When someone starts singing at one end of the first row, his or her neighbours hear the sound right away, but someone standing at the other end of the stage hears it only half a second later, which is a huge delay. To avoid that lag and ensure the quality of sound is consistent, we had to create a special geometry on the stage,' explains Mr. Mailītis.
The roof of the bandstand plays an important part; together with acoustic reflectors, it *catches* and diverts the sound, and reflects a part of the sound projected towards the sky back to the spectator area. In addition, the sound is diverted back towards the chorus. The roof encircles the acoustic space to help the chorus feel comfortable and confident, and make the acoustic performance more coherent and stronger. It was not easy to achieve this at such scale, as the architect admits.

**Inherited mentality**
Mr. Mailītis admits that the new construction maintains a historical appearance and mood: 'The bandstand has a sloping and peaceful mentality, it is like the horizon. A sloping hill with a silver grove — it is an environment for values and spirituality.' The constructive, acoustic and aesthetic parameters were taken into account during the designing of the bandstand roof and turned into mathematical algorithms. A person with a programmer's and architect's education was a part of the design team, and the use of appropriate software allowed them to accomplish something that has never been done before.
The structure is transparent, and the metal elements are attached to one another with screws of an impressive size. Juris Poga, the architect, explains that when designing such a structure, you need to bear in mind no standards exist for it, because large open-air bandstands and song festival traditions of this kind can only be found in Estonia and Latvia. When calculating the capacity of the bandstand, inspiration was taken from stadiums. When the bandstand is empty, the architecture and structure is clearly visible. When thousands of singers in colourful attire take their places within the structure, much like Latvian nature, it provides a peaceful backdrop. Mr. Poga says this principle was supported by the choice of materials, because everything had to be simple and durable. The building is characterised by fine vibrations, and the predominating materials are reinforced concrete and metal balanced by timber.

**Unique angles**
Mr. Mailītis compares the bandstand to a new musical instrument that needs to be tuned up. The architect sees parallels between the structure and acoustic solution of the roof and the acoustics of the forest: the construction is based on steel tubes that are visually reminiscent of tree trunks and split into many smaller branches. The *branches* support acoustic screens that remind us of tree foliage. The panels can be adjusted and each of them has a unique angle.
'Leaves and branches are reminiscent of a forest, and the acoustics are also similar to those you'd find in a forest. It is the best acoustic space for a choir – the final sound fades out smoothly over the right length of time,' says the architect.
The bandstand will receive not only a new appearance, but also several new entrances and exits for choir singers. It will make the movement of singers much faster when the choirs change places. In total, 10 sets of stairs have been built along the whole perimeter of the bandstand instead of the former four. Several passageways are constructed for the platform. The platform is accessible from all sides now.
To reduce the heat that singers experience during hot weather on the platform, the part between the top edge of the platform and the roof cornice is left open to channel out heat and avoid the space turning into a hot bowl. The other solution for cooling the space is the adiabatic cooling system that creates a fine mist.

**Solutions and process**
Valdis Čerpakovskis, the project manager of *LNK Industries,* explains that 16 types of panels shape the acoustic structure of the bandstand, beginning from the smaller panels at its sides to the largest at the centre. The curved plywood panels are manufactured by the Latvian company IKTK, which is also a research center for large-scale timber structures.
The acoustic elements are fixed to the raised horizontal structures of the bandstand trusses, as well as on the ground. The panels and metallic supports are attached to one another by a vacuum press at the manufacturing facility, screwed together and delivered as ready modules to the site. Every element has its own location in the general ensemble on drawings to achieve the desired acoustic properties. To fix the acoustic elements to the vertical supports of the bandstand, a very special engineering-technical solution and careful work on the part of the constructors were needed.
The acoustic elements are curved and very large. The membrane above the panels serves to provide the structure's acoustic properties. The Hungarian team of industrial alpinists together and local specialists worked together to install the panels. As elements like these had never been used before, daily solutions had to be found to achieve the intended result.

**Historical renaissance**
Andris Zabrauskis, a leading engineer in constructive acoustics and a professor at Riga Technical University, emphasises that the tradition of excellent acoustics at the Song Festival Bandstand started in 1930s, when a timber platform and spectators' amphitheater was build under the management of the experienced architect Aleksandrs Birzenieks. The end result is an impressive achievement that combines decades of knowledge and experience to create the unique open-air acoustics of the reconstructed Mežaparks Bandstand.
Concrete and bricks were used for the first building of the bandstand in 1954, when the spectators' amphitheater exceeded the size of the natural sound distribution area. Loudspeakers caused sound confusion. It was dismantled in the 1980s.
During a significant reconstruction in 1990, two side platforms were constructed at the head conductors' request, but the recommendations of designers and acoustics experts were ignored. The forward length of the choir area exceeded 170 m, the sound lag from the opposite end of the choir to the nearest sectors of the audience mostly ruined the listening experience. The sidewalls of the timber platform were cut so short that sound diverted from them no longer covered the entire spectators' area. To compensate this, two 6 m curved shields were installed

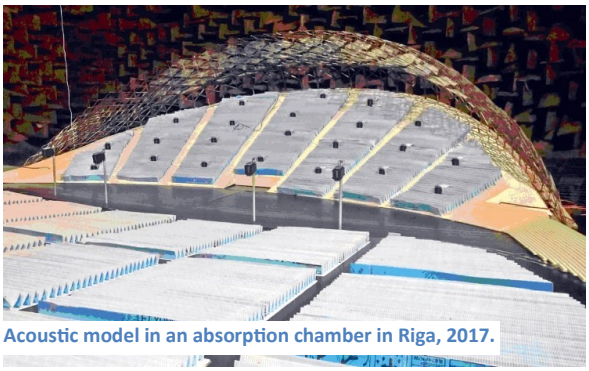
according to Mr. Zabrauskis's recommendation in order to re-establish the diversion of sound from the sides to the audience.


Mežaparks Great Bandstand in 1955.

**First in open air**

During reconstruction works carried out in 2007–2008, the construction company *PBLC* demolished the unsuccessful sides of the platform and re-established the designed geometry of the curved side shields by covering the damaged surface with a sound-diverting coating, as recommended by Mr. Zabrauskis. As the upper part of the platform sidewalls caused disturbing echoes, according to measurements, they were covered with so-called Schroeder diffusers. These were used for the first time in open-air conditions, so the sound was considerably improved at the upper part of the platform. The sound of the unified choir became much clearer and well-balanced, but still the bandstand lacked a qualitative sound distribution system. In 2008, everything possible was done to improve the acoustics, as far as the old timber structures would allow, beyond which further development was impossible.

As the centenary of Latvia approached, a contest was held to in search of designs for the reconstruction of the Great Bandstand in 2007, and the winning entry was a design developed by Juris Poga's office and Austris Mailītis. Their design involved the construction of a new platform and the reconstruction of the amphitheater for the audience. The impressive size of the spectators' area would need a qualitative, dissipated and fixed sound distribution system.


Acoustic model in an absorption chamber in Riga, 2017.


Song Festival in 2018.

**Essential parameters**

To accommodate the desired number of choir singers, the platform had to be expanded on either side. This precluded the use of sound-diverting sidewalls. The German designers recommended constructing *placebo walls*, i.e. visual, acoustically transparent external walls.

At the start of the present reconstruction, Mr. Zabrauskis set several demands in collaboration with the German from *Müller-BBM*:

1) the front of the choir area has to be 100 m at most;
2) detailed 3D acoustic computer modelling for the entire platform, audience amphitheater and the fringe of the forest;
3) digital auralization in all sectors for spectators, that is, it is possible to listen to the choir singing by the means of a computer model to assess its quality.

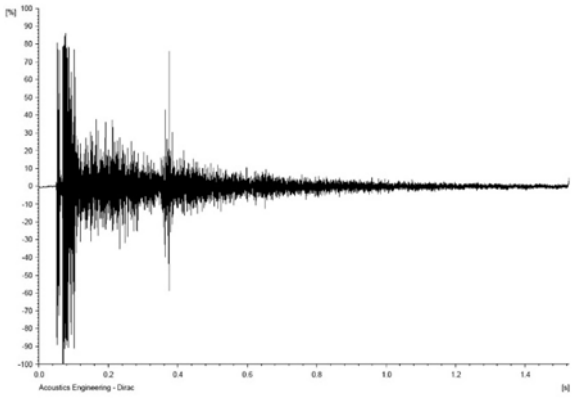
The task was complicated considerably by the lack of specific, objective acoustic parameters for open-air stages for choirs, because structures of such size can only be found in the Baltic countries. It was clear – when the side walls are demolished and additional places are added to the carrying timber constructions, some acoustic parameters changed objectively. The surround-sound coefficient LF decreased in the nearest spectator rows, but the sound clearness C80 increased. The verge of the wood has always been a factor influencing the later part of reverberation in the farthest places, but this effect are observed also nearer now.

**Diverted at several points**

The number of areas where sound is distributed naturally has decreased to about 30% in the new, much larger amphitheater, and qualitative sound distribution became a decisive factor. The loss of the sidewalls brought the acoustics closer to that of open-air sound, and the relief elements and trees that had been shielded up until now took on a much more important role, as the expert in acoustics explains.

The acoustic principle for the construction of the new platform is completely new – a double-curved internal surface consisting of several hundreds of separate reflectors of different sizes – a hyperbolic paraboloid with a curved external surface. The benefit is an opportunity for the sound to reach every listener from at least 5–7 nearest roof reflectors. A richer echogram with better surround-sound is obtained for the spectators' area, and the performers have better acoustic support.

During the design phase of the impressive building, ultrasound tests of the largest special model in Europe at the time were carried out in the sound absorption chamber of SIA *R&D Akustika*; it was the widest acoustic computer modelling with three programs. Additionally details and materials were tested.



**Unique test**

Several architectonic acoustic variants were considered during the design phase of the timber platform:

- uncovered metal structure without diverters;
- metal structure with a membrane roof only;
- diverters and metal structure without a roof;
- diverters and metal structure with a membrane roof;
- diverters, metal structure and modified membrane roof with a sieve at both ends.

The final solution included a modification of the membrane roof, using it compact over the central part of the platform, but sieve-type at the ends. Such solution prevented acoustically adverse diversion from the ends of the roof, as Mr. Zabrauskis explains.

A unique test was performed at the end of this huge project by 30 equally synchronised acoustic systems distributed regularly along the choir platform at exactly the same positions as during the acoustic modelling. The results of the measurements demonstrated enriched echograms, improved values for clear, surround-sound, as well as higher sound levels in the spectator area than in 2018, as the acoustic engineer explains, clearly satisfied with the Mežaparks bandstand following its resoundingly successful 21st century reconstruction.

**Facts**

**Reconstruction of Mezaparks Open-Air stage in Riga**

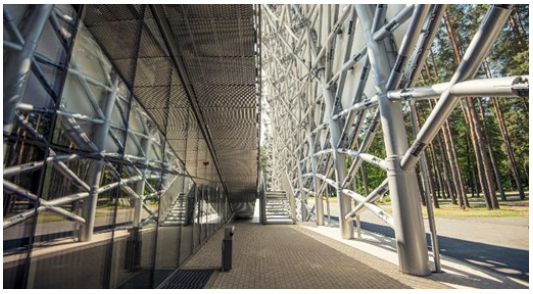
The customer: Riga City Council, Development Department in collaboration with the Ministry of Culture and the Government of Latvia
The general contractor: LNK, RERE
The architects: Austris Mailītis, Ivars Mailītis, Matīss Mailītis
The manager of the construction project: Juris Poga
Architectural supervision: SIA *Altcon* – Reinis Gaigalis
Site: *Firma L4* – Linda Šaķe, Jānis Langenfelds
Landscape architect: Gita Gagāne
Constructions: SIA *LVCT* – Andis Vecvērdiņš, Juris Kučiks; SIA *Būvinženieru konstruktoru birojs* – Aldis Grasmanis, Didzis Žīgurs
Membrane structure: *K.TA*
Acoustics model 1:30: *Ideju lidosta*
Acoustics: Andris Zabrauskis, *Müller-BBM* – Karlheinz Müller, Michael Wahl, Harald Frisch, Marcus Blome, Marc Walter; *R&D akustika* – Gundars Kozlovskis, Juris Tomsons
Wind tunnel test: *Wacker Ingenieure* – Jürgen Wacker
The total cost of all phases of the project – about 95 million euros.

**The bandstand:**

standing area for 12,874 choir singers;
30,511 seats for spectators;
standing area for 67,437 spectators;
the assembled metal structure weighs a total of 1,766 tons and stands at a height of 36 m;
510 acoustic shields;
total surface area of 10,800 m².

**Reconstruction timeline**

Design and construction: 2007–2022
Preliminary design: 2007–2008
Construction project phases A and B: 2016–2018
Construction phase A: 2017–2018
Construction phase B1: 2018–2020
Construction phase B2: 2020–2022
Construction phase C: 2021–2023



Portugal

**ANALYSIS**

## Climate Change
## The water resources management in Portugal

**Pedro Cunha Serra**
**Engineer**

In the past 45 years, there has been a profound change in the legal and institutional framework for the Environment, comparable only to the one that took place more than a century ago, when Decree no. 8, of December 1, 1892, which established the organization of Hydraulic Services was adopted. As with water then, the protection of the environment became part of our daily concerns and the legislation reform, especially in the 1990s, was accompanied by a profound change in the institutions competent for its application, in 1892 with the creation of the Hydraulics Department, nationwide, now with the creation of a Ministry of the Environment and specialized regulatory authorities for the various natural environmental components. About the climate change, both in 1892 and in 1974, not a word, which is understandable considering that the Law aims at regulating the emerging problems in the relations of citizens and economic agents with each other and with the State, and climate change was not yet a topic on the social agenda.

But in 2021 climate change is there and cannot be ignored. It conforms, directly or indirectly, the policies for the water, energy, transport, agriculture and territorial planning sectors, to mention only the most relevant ones. And, naturally, it has a severe impact on all other sectors of activity, as well as on international relations, in the European, Portuguese-Spanish and world context.

We can have an idea of the depth of the reform carried out by the extensive list of the legal acts that were approved, revoked or derogated during this period, especially after 1990. In this regard, and as an indication only, we can see the list of legal acts derogated by Decree-Law no. 46/94, of February 22, on the licensing regime for uses in the public water domain, article 91, with 26 entries, the first of which is precisely, and not by chance, Decree no. 8, of December 1, 1892, with which the reform of the previous century had begun.

As expected, this reform also had a constitutional expression. With the autonomy of the Environment operated by the 1976 Constitution, we have what Gomes Canotilho classifies as "*the transmutation of the Environment of mere socially relevant interest into a legal asset and its autonomy in relation to other legal assets worthy of protection, such as the people's lives, health or property*". This transmutation and autonomy would have to be expressed in the Law, with the creation of a regulatory authority for the Environmental Law. The revolutionary character of this new branch of law is well expressed by the words of Freitas do Amaral, according to whom it would be "*the first branch of law that was born, not to regulate the relations of men among themselves, but to try to discipline the relations of the Man with Nature*". Climate change further accentuated the need for this reform.

Climate change manifests itself through several descriptors, of which water is one of the most relevant: the change in the patterns of distribution of rainfall over the territory, the decrease in its quantity in a large part of the water basins, its greatest seasonal and interannual irregularity, with more frequent and more severe floods and droughts, seem to be here to stay. And they also have an impact on demand, since the increase in atmospheric temperature corresponds to an increase in the evapotranspiration of the crops and, therefore, in the water needs for irrigation, which are, in volume, the most important. The management of water resources must adjust to all these changes, so that it is possible to adapt to the new conditions thus generated.

It is tempting to think that, to the increasing scarcity and irregularity of water resources, we can respond by building more and more dams, increasing the volume of water stored in reservoirs. Designing and building dams is something we know how to do, we have been doing it for over 80 years, and it is a solution that, if well-conceived in a multi-purpose perspective, can also allow the production of clean, hydro-electric energy, and with that reduce the CO2 emissions that are the cause of climate change that we are concerned about. It is the real 2 in 1 and the dream of any dam engineer, a category in which I include myself, I must confess.

But this solution has a drawback: dams fragment *habitats*, they create conditions conducive to the degradation of the state of water bodies, create obstacles that are difficult to overcome for fish species and an environment favorable to the introduction of exotic species, retain the sediments that fail to arrive to the sea and thereby strip our beaches and our coastline and, acting only on supply, convey the false feeling of a solved issue

for a problem that is much deeper and that needs a truly holistic approach: less flooding downstream, more water available for different uses in the dry season and in periods of hydrological drought, certainly, but also protection of nature and biodiversity.
This holistic approach exists within the European Union framework and is well reflected in the Water Framework Directive, "Directive 2000/60/EC (WFD) establishing a framework for Community action in the field of water policy". And if there were any doubts about how to deal with drought and water scarcity, there is also the Communication from the Commission to the European Parliament and the Council, COM (2007) 414, of July 2007, "Addressing the challenge of water scarcity and droughts in the European Union".
The WFD, as it is known, sets the goal, in short, to prevent further deterioration and to protect and improve the state of aquatic and terrestrial ecosystems and wetlands directly dependent on them, to promote sustainable water use based on long-term protection of available water resources, enhanced protection and improvement of the aquatic environment, ensuring the progressive reduction of groundwater pollution and helping to mitigate the effects of floods and droughts. The WFD establishes the principle of recovering the costs of the so-called water services, which are practically all water uses (for human consumption, irrigation, hydro-electricity, etc.) and creates the figure of the Water Resources Management Plans (WRMP) that integrate programs of measures that aim for those goals to be fully achieved by the end of 2027.
COM (2007) 414, on the other hand, clearly aims to moderate the dam impetus of those States that do not care for the recovery of the costs of water and containment of demand (for which the price of water is an exceptionally effective tool) and only see the increase of the offer as a solution to the water deficits that are emerging here and there, as it happens among us. This Communication was an initiative of the Portuguese Government, which aimed precisely at obtaining coverage for more and more dams, without success.
Climate change has made all these provisions of the European Union law even more relevant, all of them already widely accepted in national law, but with little implementation among us.
Starting with the floods, which is perhaps the easiest part of this equation, Directive 2007/60/EC on the Assessment and Management of Flood Risks establishes the obligation for Member States to adopt flood risk management plans (FRMP), plans that should focus on prevention, protection and preparedness. With a view to giving rivers more space, they should consider, where possible, the maintenance and/or restoration of floodplains, as well as measures to prevent and reduce damage to human health, the environment, cultural heritage and economic activity associated with floods (from the directive).
In December 2019, we witnessed major flooding in the Mondego valley, with the rupture of the dike that protects the agricultural land on the right bank of the river and the consequent flooding of the marginal land, once the flood plain, with all the resulting destruction. What was the solution that some engineers immediately proposed? The construction of another dam in Mondego upstream of Aguieira dam! The watchword would then be to control and not to prevent, to order, to prepare!
But if for some, building more dams is the solution for floods, let alone droughts, which are also more frequent and more severe due to climate change. COM (2007) 414, without setting aside these solutions, places a set of prerequisites that States must adopt in order to face the growing scarcity of the water resource: pricing policy that encourages saving of the resource (with the recovery of scarcity costs, as required by the WFD), more efficient allocation of water and related financing, greater emphasis on sustainable agriculture, improved drought risk management with the development of drought risk management plans, promotion of a culture of water saving and technologies and practices with good water efficiency and, *in fine*, consideration of additional water supply infrastructures (read, more dams!).
Among these measures, the policy of recovering water services spending stands out, an important part of a culture of efficient water use, a policy that our legislation clearly enshrines, in theory, but not in practice.
In fact, our Local Finance Law has for a long time enshrined the need for municipalities to promote the recovery of expenses incurred in the provision of water supply and sanitation services through the tariffs they practice (without prejudice to social tariffs for deprived households).
But if we look through the annual reports of ERSAR, the sectoral regulator, and look at what is happening in many services that are the responsibility of local authorities, that does not happen and has consequences for water use efficiency. There are many dozens of municipalities that practice tariffs that only cover a small part of the expenses they incur and, also for this reason, they only incur in a small part of the expenses they should incur in order to offer quality and efficient services. The municipality of Macedo de Cavaleiros is an extreme case, which in 2018, the last year for which there are published data, did not declare the coverage of expenditures they practiced, but declared that they had a volume of water not invoiced (physical and financial losses) of approximately 80%, with about 460 L/connection/day of physical water losses (!). And this situation happens in a territory where water resources are scarce.
The Water Law establishes some provisions regarding the recovery of scarcity costs that could alleviate the situation in some regions of our country. I am referring to its article 72, paragraph 4, which provides that "*the Government, through a Decree-Law issued by the Ministry of the Environment (...), can institute for a certain Hydrographic Basin or part of it, the possibility of trading water use rights, regulating the respective market, (... )*". That has never happened.
The transaction of rights, together with the policy of recovering the costs of water services, acts on the demand side for water, promoting the reduction of consumption (reduction of per capita consumption, irrigation needs, promotion of more efficient irrigation techniques, etc.). This is a problem that already arises today in Algarve and Alentejo, where the demand for irrigation water hugely increased in recent years and where droughts are felt more and more frequently.
Also, in order to face the growing scarcity of water, the reuse of treated wastewater has been considered as a solution. This solution has several limitations (distance from the main sources, which are the metropolitan areas of the coast, to places of consumption, limitations on the storage of these waters produced throughout the year for use during irrigation season, etc.), but it can be considered in some regions where there is a severe shortage, such as in Algarve (a large floating population in summer, which is when irrigation water is needed, the existence of

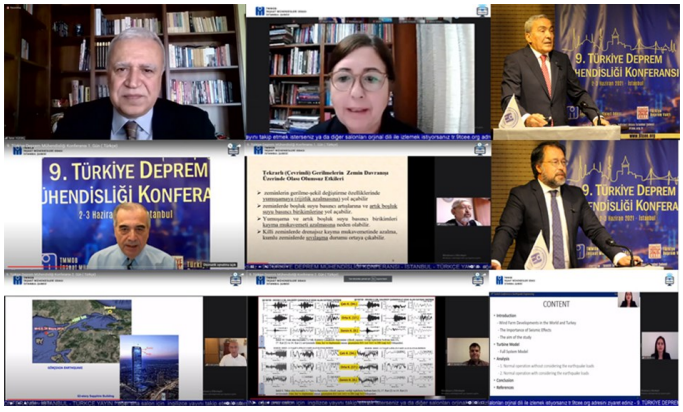
WWTPs with advanced treatment because of the need to protect the quality of bathing waters and, therefore, no need for new investments in treatment, short distance between production and consumption).
But for any of these solutions to advance, it will be necessary to overcome what is perhaps the biggest limitation in the management of national water resources: the lack of a robust hydraulic administration, with a clear mandate and equipped with the personnel and technical means necessary for the fulfillment of its mission. No, we are not returning to the controversy on the territorial organization of water management, if river basin water administration or centralized administration, which seems to be completely idle. The Portuguese Environmental Administration has very competent staff, but it lacks the means to be able to monitor and adequately inspect the rights of water resources use and to monitor the quality of the water bodies and the flows flowing in rivers and streams, without which the water management is impaired.
That being said, yes, there are perhaps some dams missing for better coverage of the territory and greater guarantee of our water independence from our Spanish neighbors, and others that should have their uses revisited. The Tagus river, which is the backbone of the water resources of the Iberian Peninsula, has not received due attention among us. The building the Alvito dam, on the Ocreza river, can be interesting, not as a hydropower project, but as a multi-purpose project, to guarantee ecological flows in the river, water for irrigation in Ribatejo and for the agricultural fields of the West. And the Cabril dam, whose concession to EDP (Electricity of Portugal) ends next year, should also be explored in a multi-purpose perspective. And the EFMA (Alqueva Multipurpose Enterprise) should merit our full attention, considering its contribution to irrigation and other water uses in Alentejo and to the stability of our balance of payments and to our food autonomy.
The EU Recovery Plan (the so called bazooka) is coming, and that, I can't hide it, makes me worried. Are we going to continue to invest in non-tradable assets as it happened in the first decade of this century, or are we going to bet on the development of our economy, on the digital transition, on fighting and adapting to climate change, on protecting biodiversity?
These are the challenges that climate change poses to us.

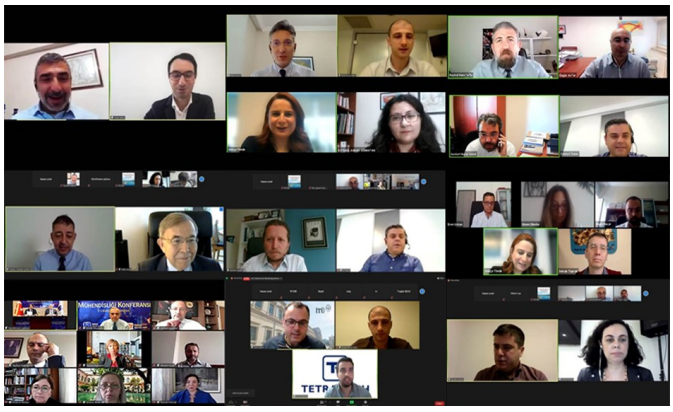
**in INGENIUM (Order of Engineers Magazine)**

## Turkey


### 9th International Turkey Earthquake Engineering Conference Completed

The 9th International Turkish Earthquake Engineering Conference, which was organized by Istanbul Branch Office of Turkish Chamber of Civil Engineers and the Turkish Earthquake Foundation-Earthquake Engineering Committee, was completed on 2-3 June 2021.
The conference, which lasted two days, started with the opening speeches of TCCE Istanbul Branch President - Conference Co-Chair Nusret Suna, Turkish Earthquake Foundation Earthquake Engineering Committee - Conference Co-Chair Alper İlki, Turkish Earthquake Foundation Chairman of the Board Mustafa Erdik and president of TCCE Taner Yüzgeç.
In the opening session chaired by Atilla Ansal, in the part of "Prof. Dr. Rıfat Yarar's Lecture", İ.Kutay Özaydın made a presentation on "Developments in Geotechnical Earthquake Engineering in Turkey".
The First Session of the Conference was chaired by Haluk Sucuoğlu. In this session, Invited Speaker Mustafa Erdik made a presentation on "Seismic Isolation in Turkey".
In the second session chaired by Sinan Akkar, Invited Speaker Vitor Silva made a presentation on "Current Practices and Future Trends in Probabilistic Seismic Risk Assessment".



# News from ECCE Partners

## American Society of Civil Engineers (ASCE)

### ASCE welcomes Briaud as new president at virtual convention

In a ceremony unlike any ASCE has seen before, Jean-Louis Briaud assumed the role of 2021 Society president, Thursday, Oct. 29.

Briaud accepted the presidential pin and gavel from ASCE's 2020 President K.N. Gunalan – in a trick of digital technology – during the annual membership meeting as part of the ASCE 2020 Convention, hosted virtually this year because of the COVID-19 pandemic.

"There's no doubt that I would have preferred to meet in person and get the gavel from Guna directly and give him a hug," said Briaud, Ph.D., P.E., D.GE, Dist.M.ASCE. "But it was not possible.

"That's what my mother was just telling me – 'This darn virus; I miss my hugs!'
"But you accept it and do the best you can with what you have, and hopefully we'll get back together in person soon."

Briaud attended the virtual event from his office at Texas A&M University, where he is a distinguished professor, addressing membership, "You've just handed me a 168-year-old jewel called ASCE."
Briaud likened his leadership approach to the way he plays his favorite sport.

"I play tennis, and one thing that helps me is learning that you can only play the next point," Briaud said. "If you try to think too many points ahead, you usually don't do well. You can only play one point at a time."
One of those points no doubt will be communicating with members.

Briaud emphasized communication during his campaign in 2019, and he helped bridge gaps during his year as president-elect, helping organize a summit between ASCE institutes and regions, as well as convening a student presidential group.

He will also launch a regular "town hall" event for members to ask the ASCE president questions about the Society – held every first business day of the month, beginning next week.

"The role of ASCE president is a fantastic honor and responsibility," Briaud said. "I'm really pumped up, no doubt. I look forward to working with everybody to build upon the good work that's been done before me."
Gunalan now assumes the role of past-president. Meanwhile, Dennis Truax, Ph.D., P.E., DEE, D.WRE, F.NSPE, F.ASCE, was installed as ASCE's 2021 president-elect at the annual meeting, along with five new directors:

- John C. Folts, P.E., M.ASCE (Region 1 director)
- Kevin D. Nielsen, Ph.D., P.E., M.ASCE (technical region director)
- Lawren Pratt IV, P.E., LEED AP, M.ASCE (Region 5 director)
- Kenneth H. Rosenfield, P.E., ENV SP, F.ASCE (Region 9 director)
- Elizabeth Ruedas, P.E., ENV SP, M.ASCE (at-large director)

**Convention goes 'virtual'**
The Convention was not in Anaheim, as originally planned, but instead presented as a virtual event, similar to the ASCE Virtual Technical Conference in September and other Society events throughout the year.
"I have been very impressed how intensive and engaging the virtual convention has been going," said Arthur Alzamora Jr., P.E., F.ASCE, a senior associate and vice president for Langan and vice chair of the ASCE Convention Technical Program Subcomittee.

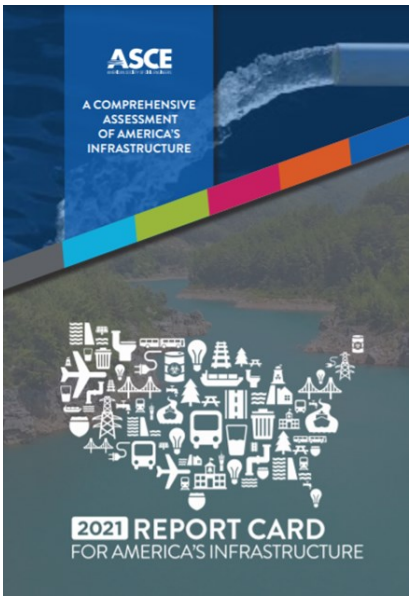
"This convention shows how great of an event a team can put together when faced with extraordinary measures during this difficult time."
Much of the regular Convention programming continued – just in a digital form.
Jacob Ward kicked off the Convention with an opening plenary talk about artificial intelligence and the disruptive technologies that will shape the 21st century.

Quincy Alexander, M.ASCE, Carol Martsolf, P.E., PMP, M.ASCE; Yvette Pearson, Ph.D., P.E., F.ASCE; Elizabeth Ruedas, P.E., ENV SP, M.ASCE; Stephanie Slocum, P.E., M.ASCE; and Leyah Valgardson had a plenary panel discussion about inclusion, "Become a Change Agent to Rise Together."
The Industry Leaders Forum provided attendees with an in-depth look at the new Future World Vision Mega City 2070.
And the annual Celebration of Leaders Lunch … OK, the Celebration of Leaders Lunch did not include lunch this year, but it did honor the 2020 class of Distinguished Members and Society award winners, complete with video acceptance speeches.

Attendees could interact with speakers in special Q&A rooms or by posting questions in the session forums. The usual networking moved to direct messaging and daily happy hour events.
“Of course there is always something missing when we can’t get together in person, but this has been the best platform I’ve used for a conference so far,” said Logan Johnson, P.E., M.ASCE, attending the Convention virtually from her home in New Hampshire. “Hats off to ASCE for pulling this all together.”

**Author**
**Ben Walpole**
**Aff.M.ASCE**

### 2021 Report Card for America’s Infrastructure




Infrastructure supports nearly every aspect of life. Our pipes deliver drinking water to homes and hospitals. Airports, railroads, and inland waterways transport goods from farms and manufacturing plants to store shelves. The roads that crisscross the country allow us to get to work and school safely, and the network of transmission and distribution lines keeps the lights on and our electronics charged. Dams enable consistent water supply in arid climates, and levees hold back floodwaters to protect rain-soaked communities.
Since ASCE began issuing the Report Card in 1998, the grades have struggled to get out of the D’s. However, more recently, decision-makers at all levels of government have recognized the critical role our infrastructure plays in supporting our quality of life and economy. Voters and lawmakers alike have championed smart infrastructure policy and increased investment in our multimodal freight system, drinking water networks, and more. This down payment on our infrastructure bill has contributed to modest but meaningful improvements.
The 2021 Report Card for America’s Infrastructure reveals we’ve made some incremental progress toward restoring our nation’s infrastructure. For the first time in 20 years, our infrastructure is out of the D range. The 2021 grades range from a B in rail to a D- in transit. Five category grades — aviation, drinking water, energy, inland waterways, and ports — went up, while just one category — bridges — went down. And stormwater infrastructure received its first grade: a disappointing D. Overall, eleven category grades were stuck in the D range, a clear signal that our overdue bill on infrastructure is a long way from being paid off.

Download the Executive Summary

Download the Full Report

# Japan Society of Civil Engineers (JSCE)

### JSCE President 2021-2022

**Hiroaki TANIGUCHI**
Term: June 2021 - May 2022

### Brief Profile

| | |
|---|---|
| 2019 to date | President, Construction Industry Engineering Center |
| 2017 | President, Japan Tunnelling Association |
| 2016-2018 | President, Japan Road Association |

| | |
|---|---|
| 2014-2020 | President, Japan Federation of Construction Managing Engineers Association |
| 2013-2019 | President, Japan Institute of Construction Engineering |
| 2011 | Professor, Management of Technology, Shibaura Institute of Technology<br>(From 2013, Visiting Professor, Shibaura Institute of Technology) |
| 2009-2010 | Administrative Vice Minister, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), (2010,Retired MLIT) |
| 2006 | Vice Minister for Engineering Affairs, MLIT |
| 2004 | Director-General, Road Bureau, MLIT |
| 2002 | Director, Kinki Regional Development Bureau, MLIT |
| 1999 | Director, Planning Division, Road Bureau, Ministry of Construction |
| 1995 | Director, Coordination Division, Planning and Coordination Bureau, National Land Agency |
| 1972 | Seconded Ibaraki Prefecture |
| 1972 | Entered Ministry of Construction, Japan |
| 1972 | Graduated from Department of Civil Engineering, Faculty of Enginneing, University of Tokyo |

**Activities in JSCE**

| | |
|---|---|
| FY 2020 | JSCE President-Elect |
| FY 2010-2011 | Member, JSCE Editorial Committee |
| FY 2009 | Chair, JSCE Coordinate Committee for Board selection |
| FY 2008 | Chief, Outstanding Civil Engineering Achievement Award, JSCE Award Committee |
| FY 2007-2008 | JSCE Vice President, JSCE Board of Director |
| FY 2008 | Chair, JSCE Environmental Award Committee |
| FY 2007 | Vice Chair, JSCE Environmental Award Committee |
| FY 1995 | JSCE Fellow |
| FY 1991-1993 | Member, JSCE Planning Committee |
| 1991 | JSCE Member |

You can access the latest JSCE International Activities Center Newsletter of July 2021 at the link here IAC News No.105, July 1 2021

# Korean Society of Civil Engineers (KSCE)

KOREAN SOCIETY OF CIVIL ENGINEERS

**Message from the 2021 KSCE President**

**Seung-Ho Lee, Ph.D.**
KSCE President

Dear members of the Korean Society of Civil Engineers!
The Korean Society of Civil Engineers (KSCE) is the largest society representing the construction sector in South Korea. Since its establishment in 1951, it has grown into a society with 28,000 members, consisting of 10 branches and 72 committees. Implementing this year's slogan, "70 Years of Civil Engineering! To the Next 30 Years!", we are conducting various activities for the development of construction technology and academics in civil engineering.
Last year, we have been through many difficulties due to the pandemic, and I hope we will overcome the crisis this year and days of normal life will return. In particular, the year 2021 marks the 70th anniversary of the foundation of the KSCE. For the past 70 years, the Korean construction industry has been a driving force for economic development and modernization based on excellent competitiveness and human resources. We believe that the KSCE has been a strong support behind its strong competitiveness. However, the changes in the domestic construction industry and the development of technology in the fourth industrial revolution era have great influences on construction industry and civil engineering technology, and our society is also facing the reality of pioneering this

change and innovation.
So this year, under the slogan “70 Years of Civil Engineering! To the Next 30 Years!”, as an academic society that acts as a mediation and assistance aid for enactment, amendment and supplementation of construction law and regulation, the KSCE will do our best for the revitalization of construction market and for the win-win growth of construction and engineering companies. In addition, we will play a key role in presenting various policies for the development of civil engineering departments in universities, and expand mutual exchanges with related academic societies and associations. Furthermore, for sustainable development, the KSCE will seek various projects for the future value of our profession through finding ways to enhance participation of young civil engineers and also of related experts, and improve communication among our members. Also, through expanding research, enlarging publication business, increasing journal publication income, and utilizing both the KSCE building and Songsan building, we will establish a basis for producing profit for the society, which will eventually return to the benefits of our members.
Lastly, we ask for your interest and advice so that our society can play a pivotal role in national development and that civil engineers can contribute with pride. We also hope that this website can be used as a platform for information exchange and active communication.

**Seung-Ho Lee, Ph.D.**
President
Korean Society of Civil Engineers

You can access the KSCE International Newsletter at the link here KSCE International Newsletter.

# World Federation of Engineering Organizations (WFEO)


Dear members, associates, supporters, friends and partners of WFEO,
In March, the World Engineering Day 2021 (WED2021) was celebrated across the globe with the theme “**Engineering for A Healthy Planet- Celebrating the UNESCO Engineering Report**” by over 115 WED celebrations held in every continent, reaching out to different engineering institutions, businesses, UN bodies and social groups.

Thanks to the concerted efforts from all sides, these activities proved to be a great success even in such a challenging time. An estimated 32 million people were engaged via social media and other platforms. The topic “I’m an Engineer” on TikTok in China alone attracted thousands of participants and more than 0.73 billion views. António Guterres, Secretary General of the United Nations joined WED2021 by tweeting with the topic “**World Engineering Day**”:“***As a trained engineer, I am passionate about the potential of engineering to help solve the most pressing challenges facing our world.***” UNESCO Director General Audrey Azoulay also delivered a special speech on March 4th main event celebration. Restrained by its length, this newsletter could not include all celebration activities, but try to give you a comprehensive picture by showing some snapshots of WED2021.

WFEO has been working tirelessly to advocate diversity, inclusion, and gender equality in engineering. It is proud to have hosted several webinars during WED celebrations that presented the insights of leading women engineers who have shared their leadership journeys, discussed how women face challenges and find resilience in STEM in time of the pandemic.

The WFEO GREE Women in Engineering Award 2020 was also hosted on April 8th to acknowledge those outstanding women engineers for their professional excellence and contribution to engineering. Other events were also hosted to address the pressing topics such as resilient societies, clean water and sanitation, engineering education, etc, to promote engineering for delivering the UN Sustainable Development Goals.

WED2021 highlighted a remarkable achievement - the launch of the second UNESCO Engineering Report, *Engineering for Sustainable Development: Delivering on the Sustainable Development Goals*. Ten years after the publication of the 1st UNESCO Engineering Report, it is a systemic report on engineering development firstly initiated by WFEO underlining the crucial role of engineering in achieving sustainable development and introducing approaches to enhance the engineering capacity for the delivery of the SDGs.

This Report is launched in the context of accelerating actions to deliver the Sustainable Development Goals, in the upsurge of Industry Revolution 4.0 and in the global response to COVID-19, with the support by WFEO and multiple organizations and experts. This new report will serve as a reference for governments, engineering organizations, educational institutions and industry, and chart the course for shaping future engineering.

Dear WFEO members and partners, with the productive outcomes of the 2nd World Engineering Day, let’s keep progressing and make persistent efforts to prepare for WED2022 and work to advance the 2030 Agenda for Sustainable Development.

**GONG Ke**
**President of WFEO**

You can access the WFEO Flash-Info #38, April 2021 at the link here **WFEO Flash-Info #38, April 2021**

# European Civil Engineering Education and Training Association (EUCEET)

### 2021 EUCCET Association Award for Excellence in Teaching in Civil Engineering

The EUCEET Association Award for Excellence in Teaching in Civil Engineering, instituted and awarded by the EUCEET Association, aims to encourage the excellence of the teaching function through the recognition of good teaching practice at Civil Engineering schools. The Prize goal is to award a teaching initiative that can come from individual lecturers or from teaching teams who have developed a successful teaching project in recent years.

The Contest terms and conditions can be found **here**.

### 2021 EUCEET Association Conference

The 5th International Conference of the EUCEET Association will be held on 12 November 2021 and will be hosted by Aristotle University of Thessaloniki (Greece). This Conference on Civil Engineering Education will be a joint EUCEET/AECEF event.
The Association of European Civil Engineering Faculties (AECEF) is a free association of Civil Engineering educational organisations and their staffs, research institutes, engineering companies, and other - public as well as private - organisations or individuals involved in civil engineering.
AECEF was founded on 14th September 1992 as a non-governmental, apolitical and non-profit making organisation.

# EU News

### Council approves conclusions on an EU renovation wave

**Infographic - Renovation wave: creating green buildings for the future**

See full infographic

The Council on 11 June 2021 approved conclusions on a renovation wave that repairs the economy now, and creates green buildings for the future. The renovation wave strategy aims to intensify renovation efforts throughout the EU, in order to make the necessary contribution by the buildings sector to the 2050 climate neutrality goal and to deliver a fair and just green transition.

Member states endorse the strategy's aim to double energy-related renovation rates in the EU by 2030, while tackling energy poverty, creating new jobs and promoting resource efficiency and circular economy. The conclusions also emphasise the importance of social inclusion and accessibility.

The strategy promotes in particular renovations that reduce energy use, curb greenhouse gas emissions, increase the environmental performance of buildings and generate cost savings. Member states underline that the starting point for renovations should be the cost-efficient reduction of energy demand and the replacement of carbon intensive or energy-inefficient heating and cooling technologies. This should go hand in hand with the integration of energy efficient solutions and the use of renewable energy and waste heat or cold.

The Council underlines the importance of eco-design, environmental and energy labelling measures in promoting green heating and cooling solutions and facilitating the phase-out of fossil-fuel-operated equipment in the most cost-efficient way.

The Council emphasises the pivotal role of buildings renovation in the process of economic recovery from the COVID-19 pandemic. The Council recalls the crucial opportunity offered by the Recovery and Resilience Facility to mobilise investments and prioritise building renovations. The EU has set a target of at least 30% for climate action in the Multiannual Financial Framework for 2021-2027, and of at least 37% under the Recovery and Resilience Facility.

The Council highlights that work must continue in order to extend and combine the available financing options for building renovations, such as green subsidies, tax and green loan incentives, green bonds, energy saving obligation schemes.

**Background and next steps**
The buildings sector is one of the largest energy consumers in Europe and is responsible for more than one third of the EU's greenhouse gas emissions. With millions of Europeans unable to afford keeping their home adequately heated, renovation is also an important response to energy poverty and quality of life of citizens.
The European Commission presented the renovation wave strategy on 14 October 2020 as part of the European Green Deal.

## Commission to invest €14.7 billion from Horizon Europe for a healthier, greener and more digital Europe

The Commission has adopted the **main work programme of Horizon Europe for the period 2021-2022**, which outlines the objectives and specific topic areas that will receive a total of €14.7 billion in funding. These investments will help accelerate the green and digital transitions and will contribute to sustainable recovery from the coronavirus pandemic and to EU resilience against future crises. They will support European researchers through fellowships, training and exchanges, build more connected and efficient European innovation ecosystems and create world-class research infrastructures. Moreover, they will encourage participation across Europe and from around the world, while at the same time strengthening the European Research Area.
Margrethe **Vestager**, Executive Vice-President for A Europe Fit for the Digital Age, said: "*This Horizon Europe work programme will support European researchers, deliver top quality, excellent research and innovation, for the benefit of us all. Covering the full research and innovation cycle, from the lab to the market, it will bring researchers and innovators from all over the world closer together, to address the issues we are facing.*"
Mariya **Gabriel**, Commissioner for Innovation, Research, Culture, Education and Youth, said: *"With 40% of its budget devoted to making Europe more sustainable, this Horizon Europe work programme will make Europe greener and fitter for the digital transformation. Horizon Europe is now fully open for business: I would like to encourage researchers and innovators from all over the EU to apply and find solutions to improve our daily lives."*

**Horizon Europe delivers on climate neutrality and digital leadership**
More than **four in ten euros** - around **€5.8 billion in total** - will be invested in research and innovation to support the **European Green Deal** and the Union's commitment to make the **EU the world's first climate-neutral continent by 2050**. The funds will support projects that advance the science of climate change, and that develop solutions to reduce greenhouse gas emissions and to adapt to the changing climate. For example, activities will accelerate the transition towards clean energy and mobility in a sustainable and fair way, help adapt food systems and support the circular and bio-economy, maintain and enhance natural carbon sinks in ecosystems, and foster adaptation to climate change.
Making this decade **Europe's Digital Decade** and laying the groundwork for new digital enterprises even further into the future are also core objectives of the programme, which will ensure a substantial increase of investment in this area. For instance, it will help maximise the full potential of digital tools and data-enabled research and innovation in healthcare, media, cultural heritage and creative economy, energy, mobility and food production, supporting the modernisation of industrial models and fostering European industrial leadership. The development of core digital technologies will be supported with around **€4 billion** over 2021-2022.
Finally, this work programme will direct investments of around **€1.9 billion** in total towards helping repair the immediate economic and social damage brought about by the coronavirus pandemic. In line with **NextGenerationEU**, the funding will contribute to building a post-coronavirus Europe that is not only greener and more digital but also more resilient for the current and forthcoming challenges. This includes topics that aim to modernise health systems and contribute to research capacities, in particular for vaccine development.

**International cooperation for bigger impact: strategic, open, and reciprocal**
International cooperation in research and innovation is essential for tackling global challenges and to enable Europe to access resources, know-how, scientific excellence, value chains and markets that are developing in other areas of the world. In May 2021, the Commission presented a Global Approach to Research and Innovation, Europe's strategy for international cooperation in a changing world. With this, the EU aims to deliver solutions and facilitate global responses to global challenges, based on multilateralism, openness and reciprocity.
The work programme of Horizon Europe for 2021-2022 includes dedicated actions to support and strengthen **cooperation through multilateral initiatives** in areas such as biodiversity and climate protection, environmental observations, ocean research or global health. It also includes targeted actions with key non-EU partners, including the first ever ambitious and comprehensive '**Africa Initiative**'.
Horizon Europe is by default **open to the world**. The association of non-EU countries to Horizon Europe will enlarge the geographical scope of the overall programme and will offer additional opportunities for researchers, scientists, companies, institutions or other interested establishments to participate, with generally the same conditions as those of the Member States. In order to safeguard the EU's strategic assets, interests, autonomy or security, and in line with Article 22.5 of the Horizon Europe Regulation, the programme will limit participation in a very small number of actions. Such limitation will be exceptional and duly justified, in agreement with the Member States and in full respect of the EU's commitments under bilateral agreements.

**Next Steps**
The first calls for proposals will open on the Commission's Funding and Tenders Portal on 22 June. The European Research and Innovation Days on 23 and 24 June mark the occasion to discuss Horizon Europe amongst policy-makers, researchers, innovators and citizens. Horizon Europe Information Days targeting potential applicants take place between 28 June and 9 July.

**Background**
Horizon Europe is the EU's **€95.5 billion** research and innovation programme for 2021-2027 and the successor of Horizon 2020. Today's Horizon Europe work programme is based on Horizon Europe's Strategic Plan, which was

adopted in March 2021 to set the EU's research and innovation priorities for 2021-2024. Most of the funding is allocated based on competitive calls for proposals, set out in work programmes. New funding opportunities have already opened up since early 2021: in February the Commission launched the first European Research Council calls under Horizon Europe and in March it launched the new European Innovation Council. Furthermore, in April, it quickly mobilised €123 million for research and innovation into coronavirus variants.

**For More Information**
Horizon Europe video
Horizon Europe factsheets
Horizon Europe
Horizon Europe's Strategic Plan (2021-2024)
Funding and Tenders portal
Funding and Tenders portal Work Programme

### Climate change: what the EU is doing
### Council adopts European climate law

The Council adopted its position at first reading on the European climate law, ending the adoption procedure and **setting into legislation the objective of a climate-neutral EU by 2050**. This follows a political agreement reached with the European Parliament on 21 April and the Parliament's adoption of its position at first reading on 24 June.

The European climate law sets a **binding EU climate target** of a reduction of net greenhouse gas emissions (emissions after deduction of removals) by **at least 55% by 2030** compared to 1990. The EU will also aim to achieve a higher volume of carbon net sink by 2030.
The regulation establishes a **European Scientific Advisory Board on Climate Change** which will provide independent scientific advice and reporting on EU climate measures. It foreseen an intermediate climate **target for 2040** to be established in the next years.

Council adopts European climate law (press release, 28 June 2021)

Read more here.

# Public Consultations of the European Commission

Please note that the European Communications regularly does Public Consultations many of which are very relevant for the engineering professions. We would therefore advise to regularly check the page and contribute to relevant topics: LINK

# Upcoming events

| Date | Event | Place |
|---|---|---|
| 1-4.09.2021 | 18th International Conference for Women Engineers and Scientists<br>ICWES18 18TH INTERNATIONAL CONFERENCE OF WOMEN ENGINEERS AND SCIENTISTS<br>https://warwick.ac.uk/fac/sci/eng/icwes18/ | Warwick,<br>UNITED KINGDOM |
| 13-15.09.2021 | 9th World Sustainability Forum<br>WSF 2021 The 9th World Sustainability Forum 13-15 SEPTEMBER 2021 \| ONLINE SUSTAINABLE DEVELOPMENT GOALS<br>https://wsf-9.sciforum.net/ | Virtual |

| Date | Event | Place |
|---|---|---|
| 6-8.10.2021 | ASCE 2021 Convention<br>  <br>https://convention.asce.org/ | Virtual |
| 20-21.10.2021 | Building Engineering Forum<br>  <br>www.bef2021.uceb.eu | Sofia, BULGARIA |
| 22-23.10.2021 | 73rd ECCE General Meeting<br>  <br>http://www.ecceengineers.eu/ | Sofia, BULGARIA |
| 5-6.11.2021 | 7th International Construction Safety and Health Conference and Exhibition of Equipment and Services<br>  <br>www.cosh2021cy.com | Nicosia, CYPRUS |
| 12.11.2021 | First Joint EUCEET and AECEF Conference<br>"The role of education for Civil Engineers in the implementation of the SDGs"<br>  <br>https://websites.auth.gr/euceetaecef2021/ | Thessaloniki, GREECE |

| Date | Event | Place |
|---|---|---|
| 18.11.2021 | 4th European Engineers Day<br>"The new Bauhaus: the vital role of engineering intelligence" | Brussels, BELGIUM |
| 19-24.06.2022 | 3rd European Conference on Earthquake Engineering and Seismology (3ECEES)<br>  <br>https://3ecees.ro/ | Bucharest,<br><br>ROMANIA |

**For many of our members and readers, the time has come to take a break over the summer period. We hope that you will have a chance to take a meaningful and safe holiday.**

**Stay safe and enjoy your summer!**

**All the best from the President, the Executive Board and Secretary of the European Council of Civil Engineers**

**Aris Chatzidakis**
**ECCE President**

**Maria Karanasiou**
**ECCE General Secretary**

European Council of Civil Engineers

## European Council of Civil Engineers

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**"Civil Engineers at the Heart of Society Building Life Quality and a Sustainable Environment"**

**The European Council of Civil Engineers (ECCE) was created in 1985 out of the common concern of the professional bodies for Civil Engineers in Europe that the Civil Engineers working together across Europe could offer much more to assist Europe advance its built Environment and protect the natural environment.**

**At the European Union level, ECCE aims to promote the highest technical and ethical standards, to provide a source of impartial advice, and promote co-operation with other pan-European organizations in the construction industry. ECCE also advises and influences individual governments and professional institutions, formulates standards and achieves a mutual compatibility of different regulations controlling the profession, and formulates standards for a European Code of Conduct of the Civil Engineering Profession and disciplinary procedures applicable throughout the Union.**