European Commission

JRC CONFERENCE AND WORKSHOP REPORT

The Eurocodes Balkan Summer School 2021: sharing knowledge to enhance seismic resilience

Support to the Eurocodes implementation in the Western Balkans

Athanasopoulou, A., Apostolska, R., Sousa, M.L., Dimova, S.

2022

Joint Research Centre

Contact information
Name: Safety and Security of Buildings Unit, Directorate E - Space Security and Migration, Joint Research Centre, Ispra, European Commission.
Address: Joint Research Centre, Via Enrico Fermi, 2749, 21027 Ispra, VA, Italy
Email: JRC-EUROCODES@ec.europa.eu

EU Science Hub
https://joint-research-centre.ec.europa.eu

JRC130961

Ispra: European Commission, 2022

How to cite this report: Athanasopoulou, A., Apostolska, R., Sousa, M.L., Dimova, S., *The Eurocodes Balkan Summer School 2021: sharing knowledge to enhance seismic resilience*, European Commission, Ispra, 2022, JRC130961.

Contents

Abstract

Due to the high seismicity of the Balkan region, most non-EU countries in the Balkan region are close to formally adopt or have already adopted the European standard EN 1998 “Eurocode 8: Design of structures for earthquake resistance”. This European standard provides the principles for the design of structures for earthquake resistance, being part of the Eurocodes suite (EN 1990- EN 1999). To enable technical support in the topic, the European Commission's Joint Research Centre (JRC) and its Safety and Security of Buildings Unit organized the first edition of the JRC Eurocodes Balkan Summer School on the seismic design of concrete buildings from 5 to 16 July 2021.

The main objective of the Eurocodes Balkan Summer School was to assist the training of practitioners (design engineers) in the use of the Eurocodes in their day-to-day design practice. The Summer School scientific programme consisted of ten half-day sessions of a highly engaging and interactive programme including keynote lectures and lectures with worked examples by the Eurocodes’ drafters, group work on assignments under expert supervision, and an interactive classroom “talk with the expert”. Interaction between younger and senior engineers of the region gave additional value to the Summer School. The high level of participants’ satisfaction is a strong indicator of the Summer School’s positive impact. It opens possibilities for similar events in the future and the transformation of the developed training materials into an e-Learning course.

Foreword

The construction ecosystem[1] is of strategic importance to the European Union (EU), as it delivers the buildings and infrastructures needed by the rest of the economy and society, having a direct impact on the safety of persons and the quality of citizens' life. Ensuring more sustainable and climate resilient buildings and infrastructures, i.e., adapting the construction ecosystem to the inevitable impacts of the changing climate is one of the central priorities of the European Green Deal (COM(2019) 640)[2]. Recognizing that the EU's ambitions towards a climate neutral, resilient and circular economy cannot be delivered without leveraging the European standardisation system, the European Commission presented a new Standardisation Strategy (COM(2022) 31 final)[3], to enable global leadership of EU standards in promoting values and a resilient, green and digital Single Market.

The EU has already put in place a number of policy and regulatory instruments for the construction sector, including related European Standards (EN). Within this framework, the Eurocodes are, presently, a series of 10 European Standards, EN 1990 to EN 1999, comprising 59 parts and providing common technical rules for the design of buildings and other civil engineering works. With the publication of the Eurocodes in 2007, their implementation in the European countries started in 2010 and now the process of their adoption internationally is continuously gaining momentum.

The Commission Recommendation of 11th December 2003[4] on the implementation and use of Eurocodes for construction works and structural construction products, stresses the importance of training in the use of the Eurocodes. In line with Commission Recommendation, the Joint Research Centre (JRC) of the European Commission provides scientific and technical support to the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) in the frame of Administrative Arrangements on the Eurocodes. The activities on the promotion of the construction sector outside the EU are part of JRC's effort to support the EU policies and standards for sustainable construction.

JRC activities comprise guidance and training to the countries showing commitment to adopt and implement the Eurocodes and the European policies and tools for sustainable construction. Among the countries that have shown commitment and progress in the adoption of the Eurocodes are the non-EU Balkan countries. The JRC activities related to the Eurocodes implementation in the Balkans are aligned with EU's commitment to support the Western Balkan partners in view of democratic, political, economic and societal improvements. The European Commission's Western Balkans Strategy (COM (2018) 65 final)[5] outlines, on the one hand, the reforms that are to be implemented by the Western Balkan region for accessing the EU and, on the other hand, the EU's increased commitment to support this process of change politically, technically and financially through six flagship initiatives[6].

One feature of the EU laws and standards, the so-called *acquis communautaires*, which have to be adopted or aligned to by candidate countries in order to join the EU, relate to the advanced common standardization environment of the Union. Thus, the past and future Eurocodes related training activities support the Western Balkan countries and other non-EU countries in the Balkan region so as to build the capacities to adapt their own national legislation in the field of construction to the EU legal framework.

The JRC has offered specialised workshops and provided scientific and technical support to non-EU Balkan region for the adoption and implementation of the Eurocodes since 2013. The first cycle of activities, under the umbrella of the former JRC Enlargement and Integration Action (E&IA) 2013 – 2016, focused on assessing the state and specific needs for the adoption of the Eurocodes in the Balkan region.

A second cycle addressing the roadmap for the Eurocodes implementation in the Balkan region was designed for the period 2018-2022 in the framework of JRC's E&IA. This second cycle aims to enhance building capacities

[1] Commission staff working document: Scenarios for a transition pathway for a resilient, greener and more digital construction ecosystem, https://ec.europa.eu/docsroom/documents/47996

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0031

[4] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32003H0887

[5] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Region: "A credible enlargement perspective for and enhance EU engagement with the Western Balkans" COM(2018) 65 final, 6.2.2018

[6] In the fields of the rule of law, socio-economic development, digital agenda, security and migration, transport connectivity, reconciliation and good neighbourly relations: https://ec.europa.eu/commission/sites/beta-political/files/six-flagship-initiatives-support-transformation-western-balkans_en.pdf

within the National Authorities and National Standards Bodies and facilitate the implementation of the Eurocodes in the region in the day-to-day practice. The first event in the second cycle was the Workshop 'The way forward for the Eurocodes implementation in the Balkans', which took place in Tirana in October 2018[7]. This training event was then followed by the first edition of the JRC Eurocodes Balkan Summer School on the seismic design of concrete buildings, held online in July 2021.

This report summarizes the contents and activities of the Eurocodes Balkan Summer School on the seismic design of concrete buildings, provides some flashes from the discussions during the Summer School and describes the future activities.

We would like to gratefully acknowledge the experts giving the lectures in the Summer School for their contribution and for sharing their experience and expert views.

The authors and editors have sought to present useful and consistent information in this report.

Related info about JRC Eurocodes Balkan Summer School on the seismic design of concrete buildings can be found on the "Eurocodes: Building the future" website (http://eurocodes.jrc.ec.europa.eu).

Adamantia Athanasopoulou & Silvia Dimova

European Commission, Joint Research Centre (JRC)

Directorate E - Space, Security and Migration, Safety and Security of Buildings

[7] More details on the workshop at https://eurocodes.jrc.ec.europa.eu/showpage.php?id=2018_10_WS_Balkan

Acknowledgments

This JRC report was prepared as a follow-up of the Eurocodes Balkan Summer School "*Seismic Design of Concrete Buildings*" held online on 5-16 July 2021. The training event was organized in the framework of the former JRC Enlargement and Integration Action.

The support of JRC's Science and Technology for Associated Countries Action (ex-Enlargement and Integration Action), CEN/Technical Committee 250 (CEN/TC 250), CEN/Technical Committee 250 Sub-Committee 8 (CEN/ TC 250/ SC8), the Institute for Standardization of Serbia (ISS) and the Faculty of Civil Engineering of the University of Belgrade, Serbia for the organisation of the Eurocodes Balkan Summer School is highly recognised.

The authors express their gratitude to all experts that have delivered the lectures and presentations for the Summer School, sharing their expertise and experience and preparing state-of-the art training material. The contribution of Dr Antonio Correia, CEN/TC 250/SC 8 Secretary, is particularly acknowledged as he was instrumental in the design and successful organization of the Summer School.

The participants at the Summer School have also contributed to its success with their enthusiastic participation and interesting discussions and the authors would like to thank then for the time dedicated in attending the Summer School.

Lastly, the authors would like to thank the JRC Unit E4 "Safety and Security of Buildings" colleagues who actively contributed to the organisation of the event and in particular Ms Maria Fabregat-Morillas for the excellent support to the organisation and running of the event.

Authors

Adamantia Athanasopoulou, Joint Research Centre, European Commission

Roberta Apostolska, University Ss Cyril and Methodius in Skopje, Institute of Earthquake Engineering and Engineering Seismology, IZIIS, Republic of North Macedonia

Maria Luisa Sousa, Joint Research Centre, European Commission

Silvia Dimova, Joint Research Centre, European Commission

1 Introduction

1.1 Policy context: the Western Balkans and the European Union

The European Commission's Western Balkans Strategy (COM (2018) 65 final)[8] outlines, on the one hand, the reforms that are to be implemented by the Western Balkan for accessing the EU and, on the other hand, the EU's increased commitment to support this process of change politically, technically and financially through six flagship initiatives[9]. The Strategy stresses that one of the key priorities for accession to the EU is for the Western Balkan partners to '*properly apply EU rules and standards not only in law but in practice*'. It also states that '*the Commission will enhance its technical assistance to the Western Balkans to help them align with EU legislation and ensure its effective implementation in practice*'.

Reaffirming their commitment to this '*European perspective for the Western Balkans*' at the EU-Western Balkans summit in Sofia on 17 May 2018, EU leaders outlined new measures for enhanced cooperation in key areas such as security, rule of law and migration through the Sofia Declaration[10] and the Sofia Priority Agenda[11]. In May 2019, the European Commission's Communication on EU Enlargement Policy[12] acknowledged the results yielded by the recent boost of EU's engagement in the region and called for more concrete and brisk action to optimize the momentum gained. As highlighted in the 2019 Communication, the EU remains by far the biggest trading partner of the Western Balkans for both imports (73.5%) and exports (80.6%). EU companies are the biggest investors in the region, providing 73% of foreign direct investment making them the main external driver of growth and jobs in the region.

Bringing the Western Balkans closer to the EU is one of the top geopolitical priorities of this Commission – *Commission Priorities 2019-2024: Priority 5: A Stronger Europe in the World*[13] - Western Balkans' European Future. In fact, the Commission champions for a coordinated approach to external action that secures a stronger and more united voice for Europe in the world. Making Europe an attractive place for business is key to strengthening the EU's role as a global leader while ensuring the highest standards of climate, environmental and labour protection. Such European leadership also means working shoulder-to-shoulder with neighbouring countries and partners, thus reaffirming the European perspective of the Western Balkans.

The Commission also plans to integrate the Western Balkans into its priority for a European Green Deal[14] – a growth strategy, transforming the Union into a modern, resource-efficient and competitive economy and making EU climate neutral by 2050. The Commission will prepare the "Green Agenda for the Western Balkans", guiding the region towards Green Deal targets while benefiting from the added value the Western Balkans could offer. Making the Western Balkans part of the Green Deal may increase the chances of success of the EU climate-neutral agenda right across the continent and ensure the region is given equal opportunities and weight.

On 25 March 2020, the General Affairs Council of the EU gave the green light to opening of EU accession negotiations with North Macedonia and Albania[15], generating a positive momentum across the region, where the accession negotiations with Montenegro started in June 2012, and Serbia opened accession negotiations in January 2014. This decision was welcomed by the European Commission[16] and in the words of the Commissioner for Neighbourhood and Enlargement, Olivér Várhelyi "*Opening of accession talks sends a loud and clear message […] to the Western Balkans as a whole. It reaffirms and delivers on the EU's commitment to the European perspective of the region: its present is with the EU and its future is in the EU".*

Following the final endorsement of the Council's decision by the European Council members on 26 March 2020, the Commission will submit proposals for negotiating frameworks with the two countries. These frameworks

[8] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Region: "A credible enlargement perspective for and enhance EU engagement with the Western Balkans" COM(2018) 65 final, 6.2.2018

[9] In the fields of the rule of law, socio-economic development, digital agenda, security and migration, transport connectivity, reconciliation and good neighbourly relations: https://ec.europa.eu/commission/sites/beta-political/files/six-flagship-initiatives-support-transformation-western-balkans_en.pdf

[10] https://www.consilium.europa.eu/en/press/press-releases/2018/05/17/sofia-declaration-of-the-eu-western-balkans-summit/

[11] https://www.consilium.europa.eu/media/34776/sofia-declaration_en.pdf

[12] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions: "2019 Communication on EU Enlargement Policy" COM (2019) 260 final, 29.5.2019

[13] https://ec.europa.eu/info/strategy/priorities-2019-2024/stronger-europe-world_en

[14] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[15] https://data.consilium.europa.eu/doc/document/ST-7002-2020-INIT/en/pdf ; Council conclusion 7002/20 of 25 March 2020

[16] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_519

establish the guidelines and principles governing the accession negotiations with each candidate country. The Commission is expected to begin the necessary preparatory work immediately and, during the negotiations, the countries will pave the way to implement EU laws and standards.

1.2 The European standards for structural design – the Eurocodes

The construction sector is of strategic importance to the European Union (EU), as it delivers the buildings and infrastructures needed by the rest of the economy and society, having a direct impact on the safety of persons and the quality of citizens' life. The sector contributes to about 11.5% of the EU's Gross Domestic Product (GDP), providing directly about 12 million jobs in 3.3 million of companies (Commission Staff Working Paper, 2021).

Ensuring more sustainable and climate resilient buildings and infrastructures, i.e., adapting the construction ecosystem to the inevitable impacts of the changing climate is one of the central priorities of the European Green Deal (COM(2019) 640)[17]. Recognizing that the EU's ambitions towards a climate neutral, resilient and circular economy cannot be delivered without leveraging the European standardisation system, the European Commission presented a new Standardisation Strategy (COM(2022) 31 final)[18], to enable global leadership of EU standards in promoting values and a resilient, green and digital Single Market.

The EU has already put in place a number of policy and regulatory instruments for the construction sector, including related European Standards (EN). Health and safety in construction and the free movement of engineering/construction services and products are important policy priorities. Concerning the construction activity itself, the focus is on the competitiveness of the sector, not least in the field of sustainable construction. European legislation defines the essential requirements that goods must meet when they are placed on the market and the European standards bodies have the task of drawing up the corresponding technical specifications.

The Eurocodes are a series of 10 European Standards, EN 1990 - EN 1999, providing a common approach for the design of buildings and other civil engineering works and construction products. They are adaptable to the local requirements of each country (i.e. geographical, geological or climatic conditions) and allow for the selection of the level of safety. The Eurocodes cover the basis of structural design, actions on structures and the design of concrete, steel, composite steel-concrete, timber, masonry and aluminium structures, together with geotechnical, seismic and structural fire design. With the publication of the Eurocodes in 2007, their implementation in the European countries started in 2010, facilitating the free movement of construction-related products and services. Following their publication, third countries have shown strong interest in their adoption and now such process is gaining international momentum (https://eurocodes.jrc.ec.europa.eu).

The European Commission has supported, from the very beginning in 1975, the development and elaboration of the Eurocodes, and contributed to the funding of their drafting. The publication of the Eurocodes by the European Committee for Standardization (CEN) in May 2007 marked a major milestone in the European standardisation for the construction sector, since the Eurocodes introduced common technical rules for calculating the mechanical and fire resistance, and the stability of constructions and construction products. The implementation of the Eurocodes in the EU and EFTA Member States enhances the functioning of the internal market for construction products and services by removing the obstacles arising from different national practices.

The European Commission's Mandate M/515[19] to CEN initiated a process of further evolution of the Eurocodes, incorporating improvements to the existing standards and extending their scope. The detailed work programme prepared by CEN Technical Committee (TC) 250 "Structural Eurocodes" as a reply to M/515 ensures that the so-called Second Generation of the Eurocodes continues to be the most comprehensive and advanced state-of-the-art codes for structural and geotechnical design in the world. The Second Generation of the Eurocodes is expected to be published after 2026.

1.3 Seismic design regulations in the non-EU Balkan countries

The Western Balkan region has suffered numerous and powerful earthquakes in the past decades, causing serious destruction and many casualties. In 1963, a Mw 6.1 (moment magnitude earthquake) in Skopje (Albania) killed over one thousand people, causing major damages in the city (Berg, 1964). On 26 - 27 October,

[17] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN
[18] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0031
[19] M/515 Mandate for amending existing Eurocodes and extending the scope of structural Eurocodes.

a series of quakes struck Banja Luka (Bosnia and Herzegovina) with two main shocks of Mw 6.1[20]. In 1979, a Mw 6.9 earthquake in Montenegro left 136 people dead, more than one thousand injured and over 100,000 people homeless (Console and Favali, 1981). Far smaller quakes have been a regular occurrence throughout the region for decades.

Following the Skopje 1963 earthquake, technical provisions for designing buildings in seismic areas were available for the first time in the area of the former Yugoslavia in 1964[21]. These provisions were necessary due to required fast reconstruction of the area around Skopje as issues related to the design, detailing and construction of buildings were regulated. An improved seismic design code was published in 1981[22], followed in 1985 by the code for the repair and strengthening of earthquake-damaged buildings[23]. These codes incorporated macro-seismic maps for several characteristic return periods (50, 100, 200, 500, 1000, 10000 years) that complied with the seismic-hazard level of the region[24]. The principal design philosophy of these provisions was the protection of human lives against earthquakes while having a partially controlled damage in the event of an earthquake. Following the break-up of former Yugoslavia in 1991, national design regulations were developed in the Western Balkan countries.

Recently, on 26 November 2019, a Mw 6.4 earthquake occurred a few kilometres north of the port city of Durres (Albania) killing 51 people and injuring 600 others. Several buildings collapsed in the cities of Durres and Thumane, and many were damaged as well as in Tirana, the capital city 30 km from the epicenter (Bossu et al., 2020). As noted in the published field observations made by the Earthquake Engineering Field Investigation Team (EEFIT) after the event, the earthquake demonstrated that there is a need for a critical review of the current Albanian seismic code[25] or for the accelerated adoption of the European standard EN 1998, which could help to reduce the seismic risk associated with the future constructions (Freddi et al., 2021). Engineers in the local media have reported that new structures in the area, which were designed implementing the Eurocodes principles, suffered only minor damages.

Four months later, on 22 March 2020, a Mw 5.3 earthquake struck a wide area north of Croatia's capital, Zagreb, the largest to affect the city in 140 years[26] (Markušić et al, 2020). At least 17 people were injured and widespread damage was reported, including Zagreb's iconic cathedral.

EN 1998 "Eurocode 8: Design of structures for earthquake resistance" is the European standard in the Eurocodes suite that provides the principles for the design of structures for earthquake resistance. It applies to the design and construction of buildings and other civil engineering works in seismic regions. Its purpose is to ensure that in the event of earthquakes the human lives are protected, the damage is limited and the structures important for civil protection remain operational.

Due to the high seismicity of the Balkan region (see the Global Seismic Hazard Map[27] in Figure 1 and the seismic hazard map of the Western Balkans in Figure 2), most non-EU countries in the Balkan region are close to, or are intending to, formally adopt EN 1998 "Eurocode 8: Design of structures for earthquake resistance". In this context and in continuation of JRC's support to the Eurocodes implementation in the Balkans, JRC provided technical assistance at the Eurocodes implementation level addressing the seismic design of concrete buildings through a Eurocodes Balkan Summer School.

[20] https://earthquake.usgs.gov/earthquakes/eventpage/iscgem803808/executive

[21] Temporary Technical Regulation for Construction in Seismic Regions (Official Gazette of SFRY No.39/64).

[22] Technical Regulations for Construction of Buildings in Seismic Regions, Official Gazette of SFRY No.31/81 & Amendments 49/82, 29/83, 21/88 and 52/90).

[23] Technical Regulations for Repair, Strengthening and Reconstruction of Buildings damaged by Earthquakes.

[24] Provisional Seismic Zoning Map of Yugoslavia, Official Gazette of SFRY no.49/82; Seismic Zoning Maps of SFRY for Return Period of 50, 100, 200, 500, 1000 and 10000 years, Official Gazette no. 52/90.

[25] KTP-N.2-89 (1989) Technical aseismic regulations. Publication of Academy of Sciences and Ministry of Constructions (in Albanian). Tirana, Albania. Note: KTP-N.2-89 is currently enforced in Albania, for more recent designs (i.e., after 2010).

[26] https://earthquake.usgs.gov/earthquakes/eventpage/us70008dx7/executive

[27] The Global Earthquake Model (GEM) Global Seismic Hazard Map (version 2018.1) depicts the geographic distribution of the Peak Ground Acceleration (PGA) with a 10% probability of being exceeded in 50 years, computed for reference rock conditions (shear wave velocity, VS30, of 760-800 m/s).

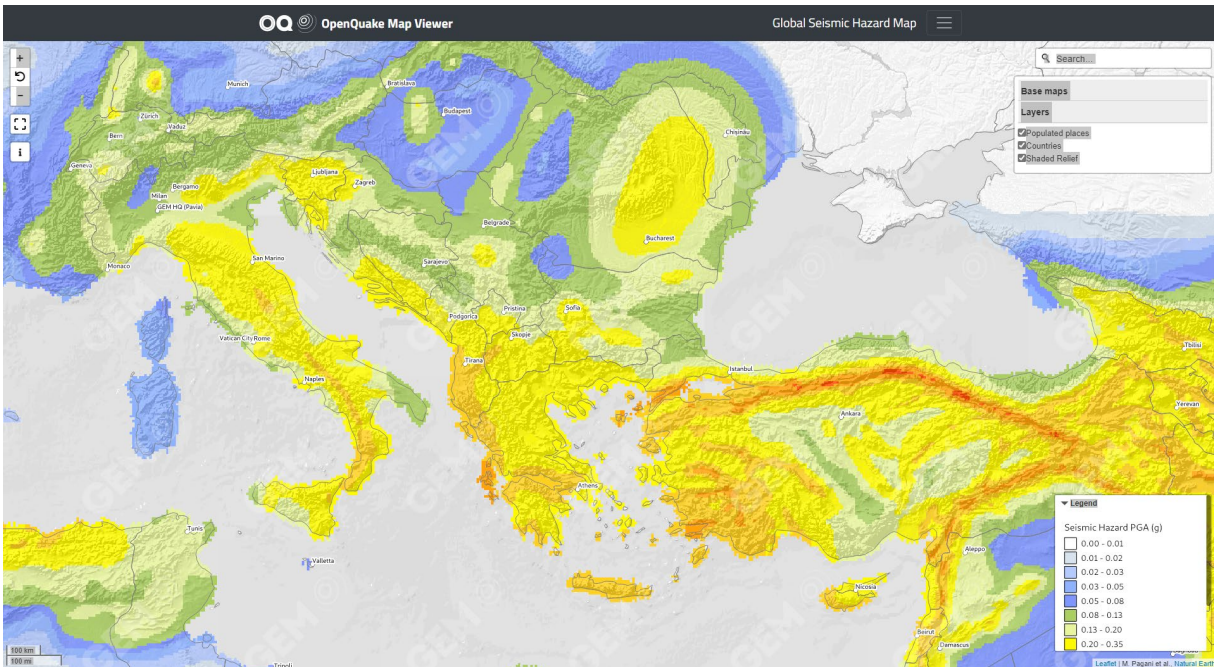

Figure 1. Global seismic hazard map (Pagani et al., 2018) [source https://maps.openquake.org/map/global seismic-hazard-map]

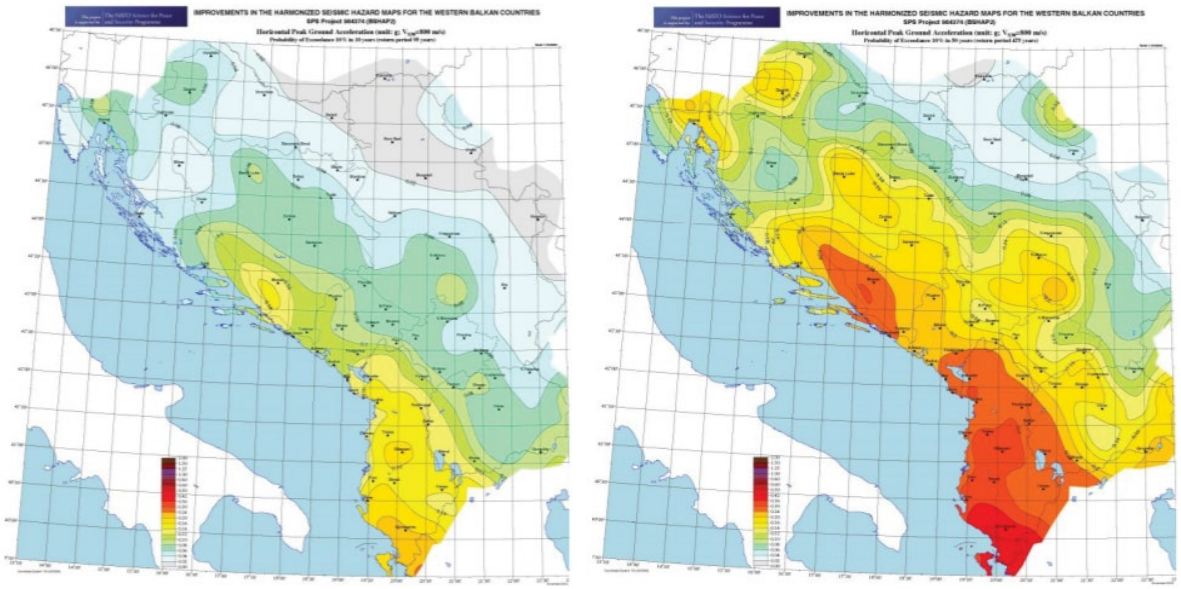

Figure 2. Left: Seismic hazard maps of Western Balkans, showing peak ground acceleration for 10-percent probability of exceedance in 10 years (Return Period 95 years); Right: Seismic hazard maps of Western Balkans, showing peak ground acceleration for 10-percent probability of exceedance in 50 years (Return Period 475 years) (Gülerce et al., 2017)

2 The Eurocodes implementation in the Balkan region

2.1 JRC activities in support of the Eurocodes in the Balkan region (2013-2016)

The construction sector is an important part of the economy of the non-EU Balkan countries. In 2020, the construction sector had a share to the national GDPs in the region in the range between 5.5% up to 10.6% (Eurostat, 2022)[28]. The activities of promotion of the construction sector outside the EU are part of the JRC efforts to support the EU policies and standards for sustainable construction. In line with the Commission Recommendation of 11th December 2003[29], the JRC activities comprise guidance and training to the countries showing commitment to adopt and implement the Eurocodes and the European policies and tools for sustainable construction.

One feature of the EU laws and standards, the so-called *acquis communautaire*, which have to be adopted or aligned to by candidate countries in order to join the EU relates to the advanced common standardization environment of the Union. In this context, JRC is engaged in a wide range of activities supporting the implementation, further development and promotion of European policies and standards for sustainable construction, including the Eurocodes.

Until 2021, JRC managed the Enlargement and Integration Action which supported countries to build the capacities to adapt their own national legislation to the EU legal framework (*acquis communautaire*) and facilitated scientific and technical exchange. As of January 2022 a new Action, called 'Science and technology for Associated Countries' (S&T for AC), replaced the former Enlargement and Integration Action (E&I), with continuity in objectives and eligible activities.

In the framework of its former Enlargement and Integration Action, JRC has offered, since 2013, specialised workshops and provided scientific and technical support to non-EU Balkan region for the adoption and implementation of the Eurocodes (see Figure 3).

Figure 3. The timeline of the Eurocodes dissemination and training events for the non-EU Balkan countries, organised by the JRC in the period 2013 to 2015

The first cycle of activities, in the period 2013 – 2016, focused on assessing the state and specific needs for the adoption of the Eurocodes in the Balkan region. Eurocodes related dissemination events and workshops included the following:

- Adoption of the Eurocodes in the Balkan region, Milan – JRC *(2013)*[30]
- Building capacities for elaboration of Nationally Determined Parameters and National Annexes in the Balkan region, Skopje (2014)[31]

[28] Eurostat, Basis figures on the Western Balkan and Turkey: FACTSHEETS 2022 editions, Luxembourg: Publication Office of the European Union, 2022

[29] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32003H0887

[30] http://eurocodes.jrc.ec.europa.eu/showpage.php?id=2013_12_WS_Balkan

[31] http://eurocodes.jrc.ec.europa.eu/showpage.php?id=2014_11_WS_Balkan

- Elaboration of maps for climatic and seismic actions for structural design in the Balkan region, Zagreb (2015)[32]
- Current status of the Eurocodes in the Balkan region, Skopje (2016)[33].

More than 250 stakeholders from the Balkan region have participated in the four workshops. The major conclusions from the workshop that showcased the positive developments and commitment of the countries in the Eurocodes adoption and implementation are summarised in Table 1.

Table 1. Conclusions from the JRC Eurocodes training events for the non-EU Balkan region (2013-2016) [Apostolska et al., 2022]

Event	**Focus**	**Conclusions**
Adoption of the Eurocodes in the Balkan region, Milan – JRC (2013)	Steps for the adoption and implementation of the Eurocodes	Intention to use the Eurocodes as primary design standards.
Building capacities for elaboration of Nationally Determined Parameters and National Annexes in the Balkan region, Skopje (2014)	Definition of the National Determined Parameter (NDPs) and National Annexes (NAs)	Significant progress in the definition of NDPs was observed. The average (%) of the acceptance of the Recommended Values - more than 80%.
Elaboration of maps for climatic and seismic actions for structural design in the Balkan region, Zagreb (2015)	Elaboration of maps for climatic and seismic actions for use with the Eurocodes	Elaboration of seismic hazard maps was in the advanced phase The elaboration of maps for climatic actions is lagging behind mainly due to insufficient data being available.
Current status of the Eurocodes in the Balkan region, Skopje (2016)	Explore opportunities to facilitate the process of adoption and implementation of the Eurocodes in the Balkan region.	Significant progress in the process of adoption of the Eurocode since the first in 2013. None of the countries have adopted and implemented the Eurocodes in the National regulatory framework.

All countries in the Balkan region reported significant progress in the adoption of the Eurocodes in the workshop held in 2016. It was further concluded that most of the **non-EU countries in the Balkan region intended to use the Eurocodes as primary standards.** Though most National Standardization Bodies (NSBs) reported having adopted the Eurocodes as standards, it was noted that they are being used in parallel with existing national codes as none of non-EU Balkan countries had implemented the Eurocodes in the national regulatory framework. The Balkan region partners stressed that they are aware of the needs for harmonization of their national legislation and standardization framework for construction with EU legislation. The main challenges reported related to the lack of institutional support for the implementation of the Eurocodes in the national legislative and standardization frameworks.

2.2 Roadmap for the Eurocodes implementation in the Balkan region

The first cycle of Eurocodes-related dissemination events in the Balkans made evident that further effort and technical assistance is necessary to support the introduction of the Eurocodes into the national regulatory environment and disseminate their use in practice. Particular importance was given to the **harmonization of seismic hazard, snow, wind and thermal maps** for use in the Eurocodes National Annexes.

A second cycle of Eurocodes activities in the Balkan region was designed for the period 2018-2022 in the framework of JRC's E&IA (Apostolska, 2018). It aims to enhance building capacities within the National

[32] http://eurocodes.jrc.ec.europa.eu/showpage.php?id=2015_10_WS_Balkan

[33] http://eurocodes.jrc.ec.europa.eu/showpage.php?id=2016_06_WS_Balkan

Authorities and facilitate the implementation of the Eurocodes in the region in day-to-day practice. The JRC offers technical assistance at three different levels:

- *National regulatory framework level* – facilitating the implementation of the Eurocodes in the national regulatory framework.
- *Implementation level* – assisting the training of practitioners (design engineers) to enable their understanding and use of the Eurocodes in day-to-day design practice.
- *Maintenance and upgrading level* – increasing awareness of the National Authorities and National Standardization Bodies of the need to maintain the existing Eurocodes and keep pace with the forthcoming second generation of the Eurocodes (expected by 2026).

The Workshop *"The way forward for the Eurocodes implementation in the Balkans"*[34] took place in Tirana (Albania) in October 2018 and it was the first event of the new series of the Eurocodes dissemination and training activities in the Balkan region. It focused on the process and challenges for the implementation of the Eurocodes in the national regulatory framework level.

In the workshop, significant progress was reported by all non-EU Balkan countries in the adoption of the Eurocodes since 2016. There was also evidence of strengthened collaboration and information sharing among the non-EU Balkan countries and support given to the countries by neighbouring EU Member States. Moreover, it was made clear that practitioners were acquainted with the Eurocodes system and their concepts and the Eurocodes were used in the design practice in the region, primarily for the design of high importance construction works (Athanasopoulou et al., 2019).

Summarizing the conclusions of the Workshop, a JRC Technical Report (Athanasopoulou, et al., 2018) describes the challenges non-EU Balkan region partners are encountering with the implementation of the Eurocodes in the national regulatory framework and provides **recommendations for facilitating the procedure** based on the EU Member State case studies.

Within the second line of the Roadmap for the Eurocodes implementation in the Balkan region, i.e., *assisting the training of practitioners (design engineers) to enable their understanding and use of the Eurocodes in day-to-day design practice,* the European Commission's Joint Research Centre (JRC) and its Safety and Security of Buildings Unit organized the first edition of the JRC Eurocodes Balkan Summer School on the seismic design of concrete buildings (5-16 July 2021). The details about the school are given in Chapter 3 and Chapter 4 that follow.

2.3 Recent developments in adoption and implementation of the Eurocodes in the non-EU Balkan countries

The state of the play on the adoption and implementation of the Eurocodes in non-EU Balkan countries is summarised below (Apostolska et al., 2020). In three of the Western Balkan countries, namely the Republic of North Macedonia, Montenegro and Serbia, the Eurocodes or parts of the Eurocodes are reported to have been incorporated in the National Regulatory Framework.

Albania

All 58 EN Eurocodes Parts are published by GDS as Albanian standards (SSH Standards); the development of the National Annexes to the Eurocodes is ongoing.

Bosnia and Herzegovina

All 58 EN Eurocodes Parts are published as Bosnian standards (BAS Standards) *(http://eurokodovi.ba/?page_id=57).* National Annexes to EN 1990, 1991, 1992, 1993, 1996 and 1998 are being elaborated *(http://eurokodovi.ba/?page_id=44*). EN 1992 and EN 1996 have been incorporated in the federal Rulebook on technical regulations.

[34] More details on the workshop at https://eurocodes.jrc.ec.europa.eu/showpage.php?id=2018_10_WS_Balkan

Kosovo*[35]

All 58 EN Eurocodes Parts are published by KSA as Kosovo standards (SK Standards) due to the cooperation with General Directorate of Standardization of Albania. The National Annexes have not been elaborated, and the Eurocodes are not yet incorporated in the National Regulatory Framework.

(*https://aks.rks-gov.net/standard/index.php?national_committee_id=25&item_from=0*).

Montenegro

The government of Montenegro brought a decision for the mandatory application of the Eurocodes for the design and construction of building through different Rulebooks. For each structural material, the design is regulated by a corresponding group of nationally adopted EN standards and related National Annexes. National regulations for design of structures were effective till August 1, 2020.

(*http://www.mrt.gov.me/rubrike/zakonska-regulativa/131438/Zakonska-regulativa-iz-oblasti-gradevinarstva.html*

Republic of North Macedonia

The Eurocodes were officially adopted on 02.09.2020 as national codes for the design of construction works with a three-year coexistence period with the current national regulations. [*Official Gazette of the Republic of North Macedonia no. 211 dated 02.09.2020*]

Serbia

The Eurocodes were officially adopted on 26.12.2019 as national codes for the design of construction works with a one-year coexistence period with the current national regulations.

(https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/ministarstva/pravilnik/2019/89/2/reg)

[35] * This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

3 The Eurocodes Balkan Summer School "Seismic Design of Concrete Buildings"

3.1 Objectives

As it was noted in earlier Chapter, most non-EU countries in the Balkan region are close to formally adopt or have already adopted EN 1998 "Eurocode 8: Design of structures for earthquake resistance". In the context of JRC's support to the Eurocodes implementation in the region, the Safety and Security of Buildings Unit of the JRC organized the first edition of the JRC Eurocodes Balkan Summer School on the seismic design of concrete buildings. The training event held from 5 to 16 July 2021 and took place online due to the restrictions posed by the COVID pandemic from 5 to 16 July 2021.

The objective of the School was to provide the participants with an overview on seismic design procedures for typical multi storey reinforced concrete buildings. At the end of the Eurocodes Balkan School, the participants achieved to:

- Have an overall understanding of the seismic design concepts, procedures and current practices using the Eurocodes, enabling them to plan and direct the construction activity appropriately.
- Understand the methodology of seismic design to be able to execute a proper design using EN 1998 and relevant Eurocodes.
- Have a better appreciation of various construction details with respect to seismic response when applying the Eurocodes.

The Summer School topics were focused on the practical use of EN 1998 for the seismic design of reinforced concrete buildings, along with the relevant parts from EN 1990 (Basis of Design), EN 1991 (Actions on structures), EN 1992 (Design of concrete structures) and EN 1997 (Geotechnical design aspects). Hands-on work on the simulation of seismic response of concrete buildings, explaining various analysis methods, design verifications and use of appropriate software was also presented. An overview of the evolution of the Eurocodes towards the publication of their second generation (expected after 2026) was provided to facilitate the participants to keep up with the latest developments related to the seismic design of reinforced concrete buildings were delivered.

The main topics addressed in the Summer School are given in the Table 2 and the detailed programme of the Summer School is available in Annex 1.

Table 2. The topics address in the Eurocodes Balkan Summer School

Topics on general concepts for the design of reinforced concrete buildings Focus on EN 1992 and related content of EN 1990, EN 1991 and EN 1997	Topics addressing seismic design concepts Focus on EN 1998 and EN 1997
Introduction to design of buildings with EN 1992 (to also cover relationship to other Eurocodes)	Detailing of structural elements
Basis of design, combinations of actions with design examples	Seismic hazard and earthquake actions
Preliminary (conceptual) design of RC buildings	Structural analysis
Materials, durability, structural analysis	Basic seismic design principles for buildings (capacity design)
Limit state design (ULS - SLS)	Seismic design of concrete buildings
Geotechnical aspects (foundation design)	Shallow and pile foundations
Detailing of structural elements	

The Eurocodes Balkan School aim was to assist the training of practitioners (design engineers) in the use of the Eurocodes in their day-to-day design practice. The Summer School's scientific programme consisted of ten half-day sessions of a highly engaging and interactive programme including keynote lectures and lectures with worked examples by the Eurocodes' drafters, group work on assignments under expert supervision, and an interactive classroom "talk with the expert". All sessions were delivered online and there was the possibility for asking questions through the chat in writing or live.

3.2 Participants

Civil/Structural Engineers with a strong interest in seismic design and assessment of reinforced concrete buildings from the Western Balkan region (Albania, Bosnia and Herzegovina, North Macedonia, Kosovo*[36], Montenegro and Serbia), Turkey (Candidate country for EU membership) and Moldova (Horizon Europe Associated country) were invited to attend the Eurocodes School. The participants were identified with the support of Engineering Chambers and/or other relevant professional engineering institutions of the countries.

According to their background in the field, participants were divided to two groups:

- Full participants: Young/junior engineers with some professional knowledge on the design of building structures for earthquakes resistance with access to all feature of the Summer School.
- Passive participants: Senior structural engineers, following the keynote lecturers and lecturers with worked examples only.

The registered participants in the Summer School were 77 from 7 countries, 36 of which were attending the school as "Full participants" and 41 as "Passive participants". The number of participants per country is provided in Figure 3. More than 20 experts attended some of the lectures as observers. Interaction between younger and senior engineers of the region gave additional value to the Summer School.

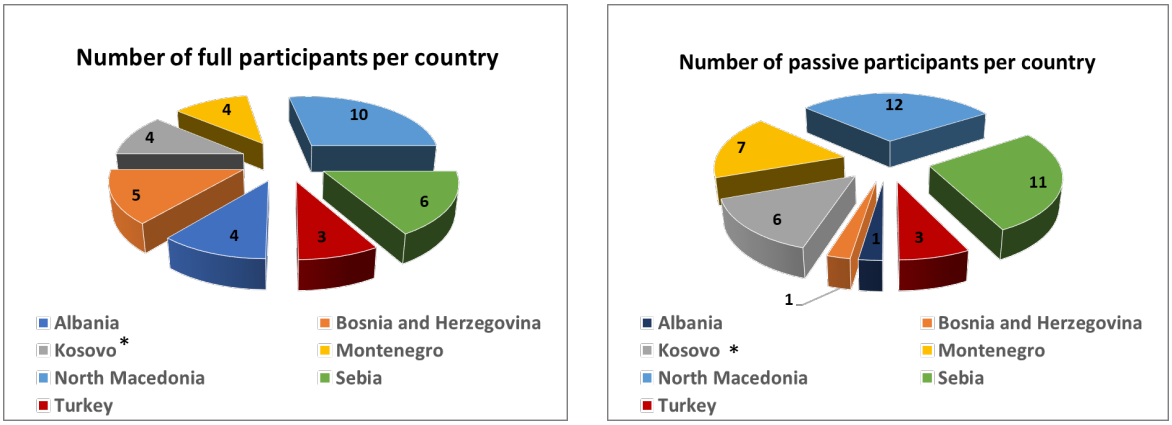

Figure 4. Number of participants per country (left: full participants, right: passive participants) [Note for Kosovo: *This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.]

[36] *This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

3.3 Brief description of the training lectures

A short summary of the content of the presentations and keynote lectures of the Summer School programme is given in the Table 3 below.

Table 3. Brief description of the Summer School presentations.

	Session title	Addressed topics
Day 1		
	Key opening remarks	Welcome addresses by Joint Research Centre (JRC) of the European Commission and the Institute for Standardization of Serbia (ISS)
	Presentation **ISS activities in support of the Eurocodes implementation**	• Status of the Eurocodes in Serbia • ISS activities • Drafts on public enquiry • Reading the draft standards on public enquiry
	Presentation **Integrated techniques for the seismic strengthening and energy efficiency of existing buildings**	• EU building stock • Policy goals • Integrating energy efficiency and structural strengthening • European Pilot Project - Integrated techniques for the seismic strengthening and energy efficiency of existing buildings (scope, objectives, timeline, pilot project actions, publications in preparation, synergies, the JRC pilot project team)
	Presentation **Eurocodes Balkan Summer School curriculum and activities**	• The past - JRC support for the Eurocodes in the Balkans • The present – The Eurocodes Balkan Summer School (What's on offer for you?; Summer School programme structure; Learning objectives; Participants & technical programme) • Support to standardization needs • What is next? • The future - JRC support for the Eurocodes in the Balkans
	Keynote Lecture **Introduction to the Eurocodes – present and future**	• Evolution of codes and standards in the field of Civil / Structural Engineering – A historical flash-back • Key features of the current EN Eurocodes (1st Generation) • Evolution of the EN Eurocodes towards a "2nd Generation" – Excerpts from N 1250 on national choices • Evolution of the EN Eurocodes towards a "2nd Generation" (including consideration of climate change) • Position paper of CEN/TC 250 on enhancing ease of use of the Structural Eurocodes • CEN/TC 250 Position paper on reducing the number of Nationally Determined Parameters (NDP) in the Structural Eurocodes • Evolution of CEN/TC 250 focus areas
	Keynote Lecture **Introduction to EN 1990 "Eurocode: Basis of structural design" for the design of RC buildings**	• Introduction to EN1990, with a «seismic perspective» (and some remarks on ongoing evolution in 2nd generation EN's) • Principles of limit states design and basic variables (actions) • Limit states and seismic action in EN1998-1 and EN1998-3 (with brief on PSHA and link to seismic action) • Basic variables (materials and product properties), Structural Analysis • Verifications by the partial factors method • Reliability background
	Keynote Lecture	• Scope and summary of EN 1991-1-1 • Scope and summary of EN 1991-1-2

	Introduction to EN 1991 for the design of RC Buildings	• Scope and summary of EN 1991-1-3 • Scope and summary of EN 1991-1-4 • Scope and summary of EN 1991-1-5 • Scope and summary of EN 1991-1-6 • Scope and summary of EN 1991-1-7 • EN 1991-Uploading and acceptance per part (05/05/2021)
Day 2		
	Keynote Lecture **Seismic design of reinforced concrete buildings. Part A – "Eurocode 2: Design of concrete structures"**	• Scope and summary of EN 1992-1-1 • Basis of design – partial factors • Materials • Durability and cover to reinforcement • Structural analysis • Ultimate limit state (ULS) • Serviceability limit state (SLS) • Detailing
	Keynote Lecture **Introduction to Eurocode 8**	• General presentation of EN 1998 • Fundamental requirements for new constructions • Cyclic behaviour of structures & design strategies • Capacity design & analysis
	Lecture with worked examples **Seismic action in Eurocode 8**	• Link between seismic design and seismic action • Basic representation of seismic action • Importance factor and return periods of seismic action • Importance classes for buildings • Soil classification • Alternative representation of seismic action • Competence of National Authorities
	Lecture with worked examples **Conceptual design and methods of analysis**	• Basic principles of conceptual design • Main causes of vulnerability in RC buildings • Structural regularity • Modelling and analysis
Day 3		
	Keynote Lecture **Seismic design of reinforced concrete buildings. Part B – "Eurocode 8: Design of structures for earthquake resistance"**	• Eurocode 8 Parts • Performance requirements in Eurocode 8 • The "seismic action" in Eurocode 8 • Analysis for the "seismic action" • Design and detailing of concrete buildings for ductility • Capacity design of RC members against pre-emptive shear failure • Summary of RC member detailing rules
	Lecture with worked examples **Design of RC buildings with EN 1992 (Eurocode 2) and EN 1998 (Eurocode 8): Worked examples -Part A: Design of a RC building frame structure**	• Introduction • Building structure • Vertical loads • Seismic action • Structure seismic response • Design and detailing
	Lecture with worked examples **Simulation of seismic response of buildings. Analysis methods, design verifications and software – Part I**	• Analysis Methods • Nonlinear Dynamic Analysis (NDA) • Nonlinear Static Analysis & comparison with NDA • Linear Dynamic Analysis

Day 4		
	Lecture with worked examples **Design of RC buildings with EN 1992 (Eurocode 2) and EN 1998 (Eurocode 8): Worked examples -Part B: Design of a RC building wall structure**	• Introduction • Building structure • Vertical loads • Seismic action • Structure seismic response • Design and detailing
	Lecture with worked examples **Simulation of seismic response of buildings. Analysis methods, design verifications and software – Part II**	• NDA - seismic input definition • Recorded accelerograms • Artificial accelerograms • Simulated accelerograms • Case-study applications
	Keynote Lecture **Geotechnical aspects in the seismic design of buildings**	• Object and salient features of EN 1998-5 • Relations with EN 1997 • Ground properties (strength, stiffness, material factors) • Requirements for construction site • Earth retaining structures • Foundation system: shallow and deep foundations • Soil structure interaction
Day 5		
	Lecture with worked examples **Geotechnical aspects in the seismic design of reinforced concrete buildings**	• Soil structure interaction • Foundations • Earth retaining structures
	Worked Examples – Part A **Team work on assignments under expert supervision**	• A full example for the design of a reinforced concrete wall building • The example covers alternative design and analysis methods of EN 1998-1 • Discussion of hand calculations vs computer approach
Day 6		
	Keynote Lecture **Seismic assessment of buildings**	• Performance requirements • Information for assessment • Assessment (Approaches, Modelling and Analysis) • Verifications - Ductile failure modes (chord rotation in beams, columns and walls) • Verifications - Brittle failure modes (shear in beams, columns, walls and joints) • Examples
	Lecture with worked examples **Seismic assessment of buildings**	
Day 7		

	Keynote Lecture
	Seismic retrofitting of reinforced concrete buildings
		• Content of EN1998-3(2005) relevant to Retrofitting → what is missing?
		• Brief overview of the structure of the forthcoming EN1998-3 (expected after 024)
		• Techniques for repair and strengthening of existing R/C members
		  • based on EN 1998-3 (2005), if item is covered
		  • based on Greek Code Structural Interventions (2017) if not in EN 1993-3

		• some key background works • Retrofitting of existing R/C buildings by addition of members
	Lecture with worked examples **Seismic retrofitting of reinforced concrete buildings**	• Modelling and analysis of different retrofitting solutions in a real case-study • Brief illustration of another two retrofitting applications
Day 8		
	Worked Examples – Part B **Team work on assignments under expert supervision**	• A full example for the design of a reinforced concrete wall building • The example covers alternative design and analysis methods of EN 1998-1 • Discussion of hand calculations vs computer approach
Day 9		
	Worked Examples **Team work on assignments under expert supervision**	• A full example for the design of a reinforced concrete wall building • The example covers alternative design and analysis methods of EN 1998-1 • Discussion of hand calculations vs computer approach
	Presentation **Interactive classroom "talk with the experts"**	Extensive discussion between participants and lecturers was developed during the entire duration of the School. 88 questions were asked by the participants addressed to different experts and various topics. Approximately 20% of these questions were discussed during dedicated "talk with the experts" sessions.
Day 10		
	Keynote Lecture **Base isolation**	• Main principles of base isolation • The isolating devices and their design • General arrangement & design criteria • Modelling and analysis
	Keynote Lecture **Second generation of Eurocode 8 highlights for the design of reinforced concrete buildings**	• Main changes in Eurocode 8 • Main changes in Part 1-1 • Main changes in Part 1-2 • Main changes in Reinforced Concrete chapter
	Presentation **Designing with the Eurocodes – sharing experience from Serbia**	• Design with the Eurocodes - Belgrade Waterfront Plot 17a, Beograd Serbia
	Presentation **Designing with the Eurocodes – sharing experience from Montenegro** **Jovan Furtula** – Civil Engineer, OPTIMUSPROJECT doo, Member of the Engineering Chamber of Montenegro, Chamber of Civil Engineers	• Buildings design according to the Eurocodes • How we do design • Main differences in design: Eurocodes vs old standards • Design with software: Towers vs Etabs • Wall design with Tower • Additional manual wall design according to Eurocode 8 • Performances of buildings • Main obstacles in design: Eurocode vs old standards
	Presentation **Education programmes and needs for supporting the practical implementation of the Eurocodes**	Details on the training and education offered by the academic institutions in Serbia

	Presentation **Eurocode 8 implementation status survey to the Balkan countries**	• Seismic design of buildings in the Balkan non-EU countries • Eurocode implementation status in the Balkan non-EU countries – focus on EC8 • Flashes from the JRC Eurocodes Balkan Summer School
	Closure	• Fact and figures related to the number of participants and hours of sharing knowledge • "Training kit" available as open-source material • Re-use of School in *e-learning* environment in order to increase the impact

Note:

Key for the different sessions

Presentation (open to all participants)	Lecture with worked examples (open to all participants)
Keynote Lecture (open to all participants)	Worked examples (group assignments) (restricted to full participants)

3.4 Training material and discussion

The Summer School programme offered keynote lectures, lectures with worked examples, interactive sessions with practical examples and the possibly for asking questions to the experts that have steered the preparation of the European standard for seismic design of buildings. More than 90 technical questions were addressed by the participants to the lecturers and were answered live during the Summer School. Follow-up questions or detailed queries were also addressed via written communication or through the chat. Moreover, during the interactive sessions presenting the practical worked example, the participants were asked to answer short quizzes that then were triggering the discussion on the challenges in designing with the Eurocodes.

The training material from the Summer School is under compilation as a full training kit and will be made freely available on the JRC Eurocodes website[37]. The event provided an opportunity to build upon the experience, initiatives, difficulties and solutions concerning the implementation of the European standards and policies for construction in the Balkan region. The training material may serve as a reference not only for practitioners in the Balkans but also worldwide as there are many third countries interested in the adoption of the Eurocodes and in particular, EN 1998.

[37] Eurocodes: Building the Future (https://eurocodes.jrc.ec.europa.eu/)

4 Flashes from the JRC Eurocodes Balkan Summer School

In order to assess the participant's level of knowledge in the topics of the School and better address their specific needs, as well as to overcome the challenges from the absence of face-to face sessions, six polls were launched during the School, addressing particular topics as:

- Design of RC building structures according to the national seismic design practice and the Eurocodes
- Nonlinearity, damping and capacity design
- Analysis methods and selection of ground motions
- Seismic assessment and retrofitting

These polls were answer by 50% to 60% of the participant attending the sessions. The results from the polls and discussion are presented further.

4.1 Design of RC building structures according to the national seismic design practice and the Eurocodes

The polls 1, 2 and 3 addressed the below questions, accordingly:

1) How would you rate your experience in seismic design of buildings with the Eurocodes?
2) Do you have experience in the design of reinforced concrete (RC) building structures according to the national seismic design practice (national codes, technical specifications, etc.)?
3) Do you have experience in the design of reinforced concrete (RC) building structures according to the provisions of Eurocode 2 and 8?

The obtained results are illustrated on Figure 5.

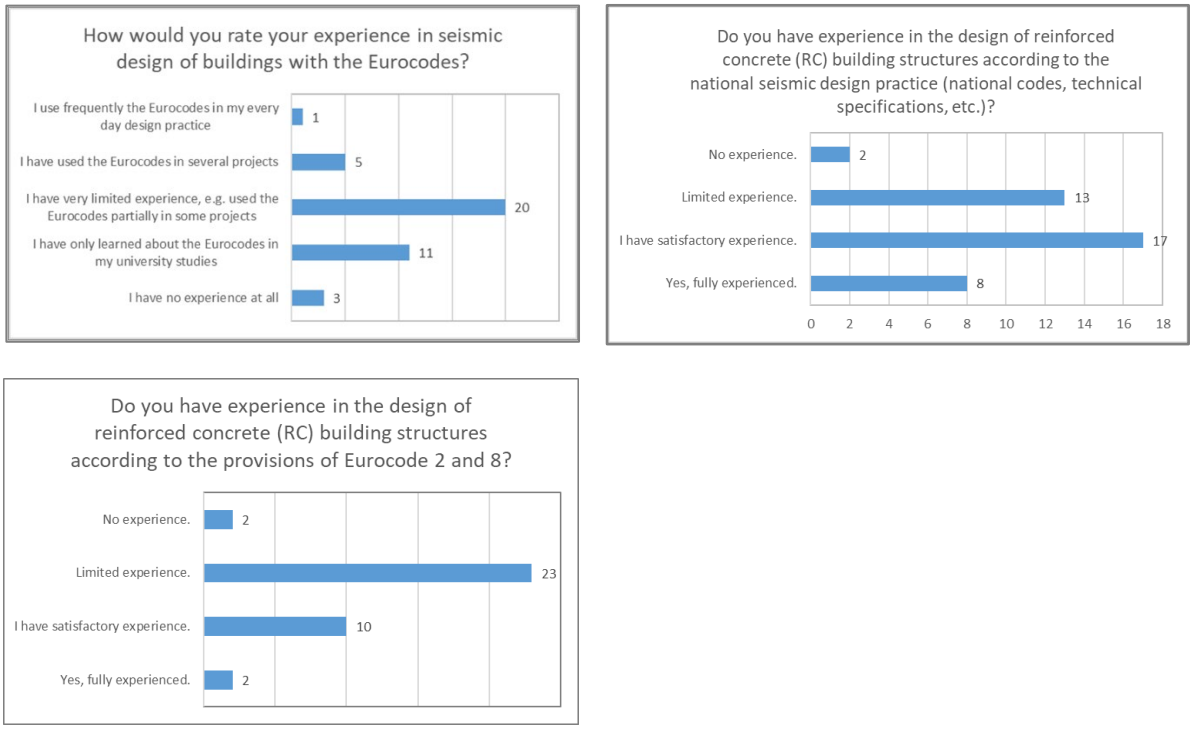

Figure 5. Results of the polls addressing issues on the design of RC building structures according to the national seismic design practice and the Eurocodes [Source: R. Apostolska – Eurocode 8 implementation status survey to the Balkan countries (presentation during the Summer School, 16/07/2021)]

It is evident that 50% of the participants answered that they have very limited experience in design of RC buildings according to the Eurocode 8 (EN 1998) and 62% that they have limited experience following provision of both

design standards, Eurocode 2 (EN 1992) and Eurocode 8. On the contrary, 43% of them have satisfactory experience in design according to the national seismic design practice. The above numbers indicate lack of knowledge and experience related to the seismic design with the Eurocodes but not an absence of awareness on the Eurocodes concepts and system.

4.2 Nonlinearity, damping and capacity design

The poll 4 addressed the below questions, accordingly:

1) Are you familiar with the term "ductility" in the behavior of structures?
2) Are you familiar with the term "damping" in structural dynamics?
3) What is your level of knowledge on the nonlinear analysis for reinforced concrete structures?
4) Are you familiar with the concept and provisions of capacity design?

From the collected results (Figure 6) it is evident that the almost half of the participant are fairly familiar with the concepts of “ductility”, “damping” and “capacity design” (38%, 45% and 40% consequently) and despite the fact that 48% of them are familiar with the concept of nonlinearity, it is only on theoretical level and without further implementation in daily practice.

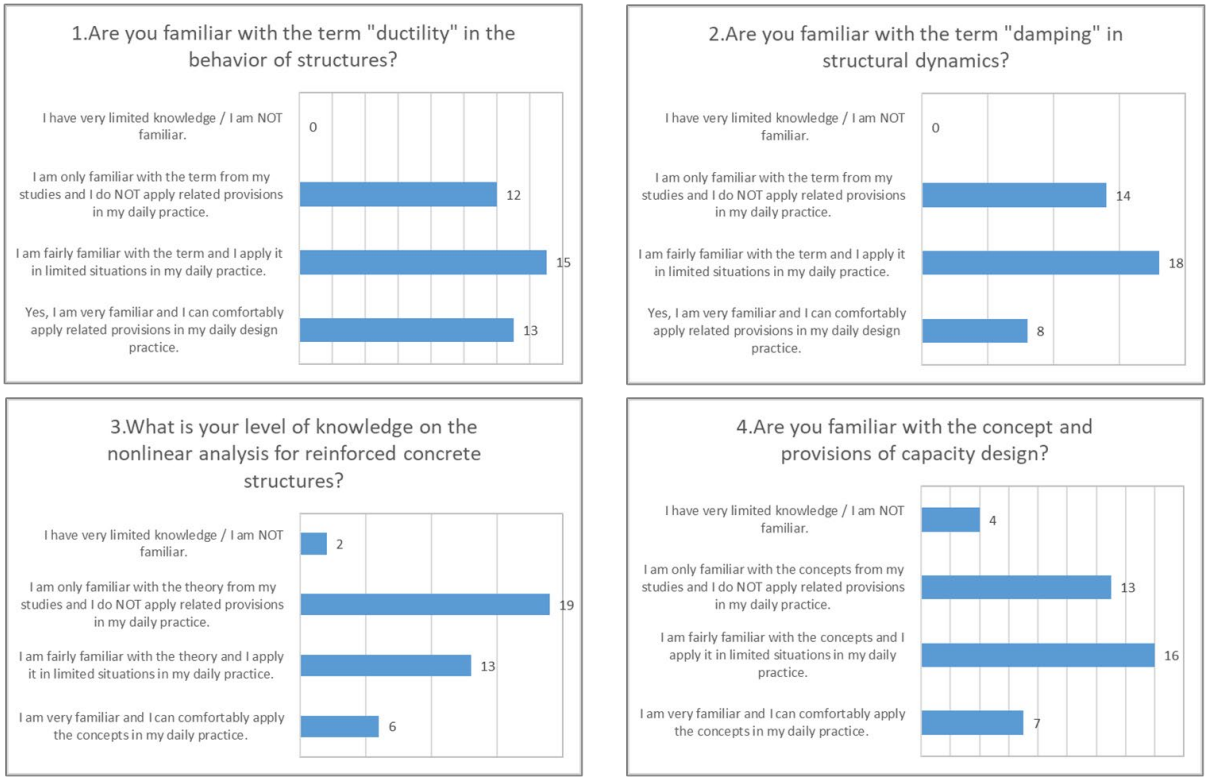

Figure 6. Results of the polls addressing issues on Nonlinearity, damping and capacity design [Source: R. Apostolska – Eurocode 8 implementation status survey to the Balkan countries (presentation during the Summer School, 16/07/2021)]

4.3 Analysis methods and selection of ground motions

The poll 5 addressed the below questions, consequently:

1) Are you familiar with the linear dynamic analysis method for RC structures?
2) Are you familiar with the non-linear dynamic analysis method for RC structures?
3) Are you familiar with the concept of pushover analysis?
4) How do you assess your knowledge on the selection of ground motions for structural analysis?
5) What is your level of knowledge on soil-structure interaction analysis?

Below, on Figure 7 are illustrated the collected results from this poll of questions.

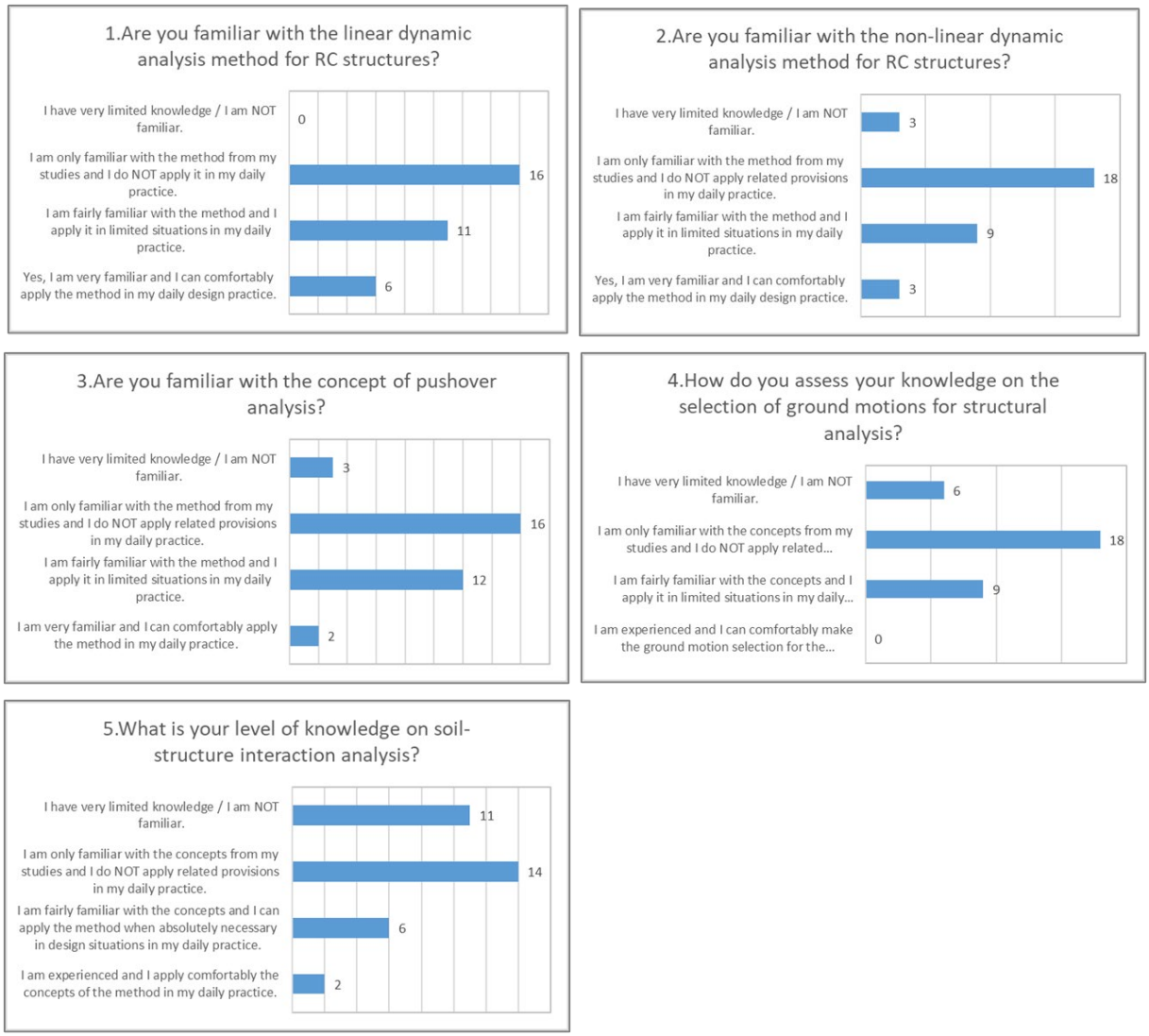

Figure 7. Results of the polls addressing issues on Analysis methods and selection of ground motions [Source: R. Apostolska – Eurocode 8 implementation status survey to the Balkan countries (presentation during the Summer School, 16/07/2021)]

The collected answers point out that almost half of the participants have only theoretical conceptual knowledge in the topics (in the range between 42% and 55%) and don't apply related provision in their daily engineering design practice.

4.4 Seismic assessment and retrofitting

Seismic assessment and retrofitting were addressed in the poll 6 through following questions:

1) Are you familiar with procedures/methodologies for the seismic assessment of buildings?
2) Do you have experience in carrying out design projects on the seismic assessment of buildings?
3) Do you have any previous knowledge on the basic concepts of EN 1998 Part 3 "Assessment and retrofitting of buildings"?
4) Are you familiar with the displacement based-assessment method?
5) Do you have any previous knowledge on the retrofitting of existing RC structures, e.g. different methods, techniques, design of the retrofit?

Approximately half of the participants (Figure 8) responded that they are only familiar with the procedures and concepts (43%, 41%, 57%, 46% and 54%, consequently) but and don't implement them in their daily engineering design practice.

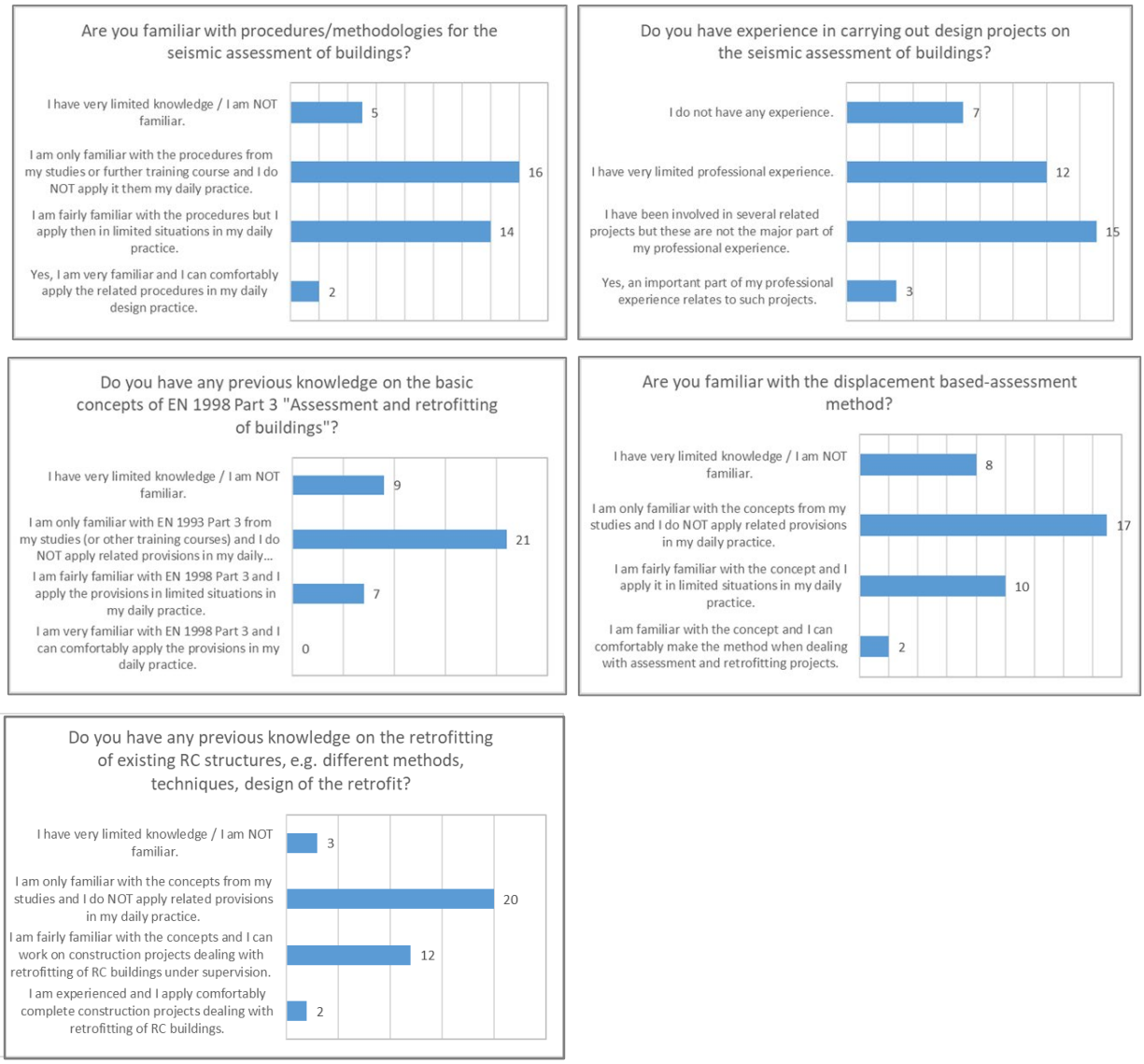

Figure 8. Results of the polls addressing issues on Seismic assessment and retrofitting [Source: R. Apostolska – Eurocode 8 implementation status survey to the Balkan countries (presentation during the Summer School, 16/07/2021)]

The overall conclusions from the compiled responses indicates that the certain gaps that participants have are adequately addressed by the selected topics of the Balkan Summer School.

5 Feedback, conclusions and the way forward

5.1 Feedback from the participants

Shortly after the Summer School, the participants were invited by the School organizing committee to provide their feedback on the training activity along with any reflections or recommendations. More than 50 attendees participated in the survey which included questions targeting the organisation aspects of the Summer School, the quality of the presentations and training material, the structure of the programme and technical details related to the online delivery of the event.

More than 80% of the responding participants have noted that they are very satisfied overall with the Summer School (organisation, communication, training material quality and support). The responding participants further assessed the Summer School with a high satisfaction rate compared to their expectations. The sessions with the highest satisfaction rate were the sessions with the worked examples, followed by the keynote lectures with integrated worked examples, confirming the great interest of the Eurocodes users in practical training.

More than 85% of the responding participants answered that the presentation style in the lectures was fully suitable while 70% of them considered that the sessions addressed most of the topics relevant to their work and need. Approximately 75% of the responding participants commented that the length of the Summer School was appropriate while 20% noted that it was rather long and it could be delivered in two separate blocks. In relation to the online delivery of the Sumer School, approximately 60% of the responding participants felt that the live chat and email communication supported overcoming the challenges from the absence of face-to-face sessions fully or to a great extent.

Many participants have requested further training events in the format and style of the Eurocodes Balkan Summer School covering other Eurocode parts and design topics. Half of the responding participants indicated that they are involved or will be involved in training programs on the Eurocodes in their countries. This aspect highlights the importance of such training events in supporting capacity building and developing a community of trainers for the designers interested in using the Eurocodes.

One of the most important takeaways as described by the participants was the possibility to ask questions directly to the lecturers, being also drafters of the Eurocodes as such opportunity strengthens their understanding of the Eurocodes concepts and background information.

The event provided an opportunity to build upon the experience, initiatives, difficulties and solutions concerning the implementation of the European standards and policies for construction in the Balkan region. The training material as well as a this JRC Report presenting the training event may serve as a reference not only for practitioners in the Balkans but also worldwide as there are many third countries have adopted or are considering to adopt the European standards for structural design.

5.2 Conclusions and the way forward

Significant and important progress has been achieved by all non-EU countries in the Balkan region in the adoption and implementation of the Eurocodes since 2013.

The JRC support during the past seven years was important and contributed in the facilitation of the Eurocodes implementation in the National Regulatory Framework in three non-EU Balkan countries. Extensive transfer of knowledge has been done through the first training cycle addressing topics such as the policy of the Eurocodes implementation, drafting of the National Annexes to the Eurocodes, co-existence with National Codes, and the Eurocodes system as a whole concept. With the Eurocodes Balkan Summer School, the first practical training event was delivered. The Summer School addressed the design issues related to one of the most important hazards in the region - namely seismic hazard.

The training event also provided further evidence of strengthened collaboration and information sharing among the non-EU Balkan countries and support given to the countries by neighbouring EU Member States; such activities are important good practices that need to continue and be further elaborated in the future. With this perspective, launching of a Community of Practice platform may facilitate implementation of the Eurocodes and keep pace their second generation.

Interest for attending the Summer School was particularly high and nominated participants by the Civil Engineering Chambers exceeded by far the targeted number of participants. The original planning was for 50

participants (extended in the end to 80 accepted participants) so as to accommodate in the best way the interactive and hands-on training philosophy of the School curriculum. The Summer School organizers have received questions on the planning for a second version of the School in the near future and the possibility to have the recordings of the training sessions and lectures.

Thus, following the Summer School, the concept for an e-Learning course on the seismic design of concrete buildings using European standards for construction started to be developed. The e-Learning course will be delivered through the EU Academy platform[38]. The e-Learning course resources will be based on the training material developed form the Summer School but adapted to resources suitable for an e-Learning course. Additional resources will be developed to enhance the engagement of the learners (as for example voice-over tutorials and quizzes).

Below are presented the most important observations and conclusions based on the ten half day sessions of highly engaging and interactive Eurocodes Balkan Summer School:

- The objective – to provide an overview on seismic design procedures for typical multi-storey reinforced concrete buildings and the learning objectives set in the programme were fully met.
- The overall level of satisfaction for the Summer School considering all aspects (organization, communication, training material quality, support) exceed 80% with the majority expressing full satisfaction for the Summer School technical programme which represents strong indicator of its positive impact.
- Organisation of 2nd edition of the Summer School, as well as Summer School focused on other Eurocodes or types of structures are of outmost interest for the non-EU Balkan countries, especially for the younger engineers who are at the begging of the professional careers as designers.
- Re-use of accumulated knowledge and supporting materials developed for the Summer School through development of e-learning course dedicated to the seismic design of RC buildings with the Eurocodes is anticipated.
- Considering high percentages of Balkan building stock which is old, vulnerable to earthquakes and energy inefficient, the transfer of knowledge from EU MS countries in seismic assessment and integrated techniques for seismic strengthening and energy efficiency is one of the top priorities.

[38] https://academy.europa.eu/

References

Apostolska R., Taucer F., Dimova S., “Adoption of the Eurocodes in the Balkan region”, JRC Science and Policy Report EUR 265458EN, Publications Office of the European Union, Luxembourg, 2014

Apostolska. R., The state of Eurocodes implementation in the non-EU Balkan countries –, Presentation at the workshop in Tirana 2018.

Apostolska R., Taucer F., Dimova S., “Building capacities for elaboration of NDPs and NAs of the Eurocodes in the Balkan region”, JRC Science and Policy Report, EUR 26949EN, Publications Office of the European Union, Luxembourg, 2014.

Athanasopoulou, A, Apostolska, R, Sousa, L, Dimova, S, Workshop: The way forward for the Eurocodes implementation in the Balkans, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-98582-9, doi:10.2760/789047, JRC114796.

Athanasopoulou, A., P. Formichi, P. Spehl, I. Dabizheva, V. Gacesa-Moric, J. Markova, J. A. Calgaro, N. Malakatas, M. Lurvink, P. Croce, R. Apostolska, D. Sumarac, M. L. Sousa, S. Dimova, *The implementation of the Eurocodes in the National Regulatory Framework*, EUR 29601 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-79-98657-4, doi:10.2760/033434, JRC115175.

Berg, G.V. “The Skopje, Yugoslavia Earthquake, July 26, 1963”, American Iron and Steel Institute, New York, 78 pp., 1964

Bossu R, Fallou L, Landès M, Roussel F, Julien-Laferrière S, Roch J and Steed R (2020) Rapid Public Information and Situational Awareness After the November 26, 2019, Albania Earthquake: Lessons Learned From the LastQuake System. Front. Earth Sci. 8:235. doi: 10.3389/feart.2020.00235

Commission Staff Working Paper, Scenarios for a transition pathway for a resilient, greener and more digital construction ecosystem, Brussels, 14.12.2021.

Console, R. and Favali, P., 1981. Study of the Montenegro earthquake sequence (March-July 1979), Bull. seism. Soc. Am., 71, 4, 1233-1248, DOI: 10.1785/BSSA0710041233

Eurostat, Basis figures on the Western Balkan and Turkey: FACTSHEETS 2022 editions, Luxembourg: Publication Office of the European Union, 2022

Formichi P., Danciu L., Akkar S., Kale O., Malakatas N., Croce P., Nikolov D., Gocheva A., Luechinger P., Fardis M., Yakut A., Apostolska R., Luisa M.L., Dimova S., Pinto A., (2016) “Elaboration of maps for climatic and seismic actions for structural design with the Eurocodes”, JRC Science and Policy Report, EUR 28217EN (2016), Editors: Rajcic V., Apostolska R., Luisa M.L., Dimova S., Pinto A.

Freddi, F., Novelli, V., Gentile, R. et al. Observations from the 26th November 2019 Albania earthquake: the earthquake engineering field investigation team (EEFIT) mission. Bull Earthquake Eng 19, 2013–2044 (2021). https://doi.org/10.1007/s10518-021-01062-8

Zeynep Gülerce, Radmila Šalić, Neki Kuka, Snježana Markušić, Jadranka Mihaljević, Vladan Kovačević, Abdullah Sandıkkaya, Zoran Milutinović, Llambro Duni, Davor Stanko, Nataša Kaludjerović, Svetlana Kovačević (2017). Seismic Hazard Maps for the Western Balkan, Environmental Engineering, Vol.4, No.1, pg. 7-17, ISSN 1849-4714, https://hrcak.srce.hr/186022.

Markušić, Snježana; Stanko, Davor; Korbar, Tvrtko; Belić, Nikola; Penava, Davorin; Kordić, Branko (2020). "The Zagreb (Croatia) M5.5 Earthquake on 22 March 2020". Geosciences. 10 (7): 252. Bibcode: 2020Geosc..10..252M. doi:10.3390/geosciences10070252

M. Pagani, J. Garcia-Pelaez, R. Gee, K. Johnson, V. Poggi, R. Styron, G. Weatherill, M. Simionato, D. Viganò, L. Danciu, D. Monelli (2018). Global Earthquake Model (GEM) Seismic Hazard Map (version 2018.1 - December 2018), DOI: 10.13117/GEM-GLOBAL-SEISMIC-HAZARD-MAP-2018.1

List of figures

List of tables

Annexes

Annex 1. Programme of the Eurocodes Balkan Summer School 2021 - Seismic design of concrete buildings

European Commission

Programme

Eurocodes Balkan Summer School 2021

Seismic design of concrete buildings

5-16 July 2021

EUROCODES

Joint Research Centre

Eurocodes Balkan Summer School | Seismic design of concrete buildings

JRC supports the non-EU Balkan region to build capacities for adapting national legislation in the field of construction to the EU legal framework. Starting in 2013, the JRC has organized specialized workshops and provided scientific and technical support to the non-EU Balkan region partners for the adoption and implementation of the European standards for structural design – the **Eurocodes (EN 1990 – EN 1991)**.

Now, it is time to join us for the first edition of the Eurocodes Balkan Summer School on the seismic design of concrete buildings, organised by the European Commission's Joint Research Centre (JRC) and its Safety and Security of Buildings Unit.

Due to the continuously evolving pandemic crisis, the Eurocodes Balkan Summer School will be held online.

Why this Summer School?

The Balkan region has suffered numerous and powerful earthquakes in the past decades. More recently, on 26 November 2019, a Mw 6.4 earthquake hit Albania, with epicentre 34 km northwest of its capital, Tirana, near the coastal city of Durres. 51 people were killed, hundreds were sent to hospitals and thousands were left homeless. However, it was reported that new structures in the area, which were designed implementing the Eurocodes principles, suffered only minor damages. Four months later, on 22 March 2020, a Mw 5.3 earthquake struck a wide area north of Croatia's capital, Zagreb, the largest to affect the city in 140 years. At least 17 people were injured and widespread damage was reported, including Zagreb's iconic cathedral.

Indeed, due to the high seismicity of the Balkan region, most non-EU countries in the Balkan region are close to, or are intending to, formally adopt EN 1998 "Eurocode 8: Design of structures for earthquake resistance", which provides the principles and requirements for the design of structures for earthquake resistance. JRC will provide technical and practical assistance for the Eurocodes implementation in the non-EU Balkan region, addressing the seismic design of concrete buildings through the Eurocodes Balkan Summer School.

The Summer School provides you with a unique opportunity to learn to use in practice the Eurocodes from experts directly involved in the Eurocodes development and drafting while sharing knowledge and experience with your peers in the group sessions.

What's on offer for you?

Ten half-day sessions of a highly engaging and interactive programme including keynote lectures and lectures with worked examples by the Eurocodes' drafters, group work on assignments under expert supervision, and an interactive classroom "*talk with the expert*" powered by you!

The Summer School scientific programme will focus on the practical use of EN 1998 for the seismic design of reinforced concrete buildings, along with the relevant parts from EN 1990 (Basis of Design), EN 1991 (Actions on structures), EN 1992 (Design of concrete structures) and EN 1997 (Geotechnical design aspects). We will also dedicate time to present and work hands-on the simulation of seismic response of concrete buildings, explaining various analysis methods, design verifications and use of appropriate software. To keep up with the latest developments, we will also give you an overview of the evolution of the Eurocodes towards the publication of their second generation, expected by 2026, with particular focus on aspects related to the seismic design of reinforced concrete buildings.

The aim of the Summer School is to provide an overview on seismic design procedures for typical multi-storey reinforced concrete buildings. At the end of the Summer School, you are expected to:

- Have an overall understanding of the seismic design concepts, procedures and current practices using the relevant Eurocode Parts, enabling you to plan and direct the construction activity appropriately.
- Understand the methodology of seismic design to be able to execute a proper design using Eurocode 8 and relevant Eurocode Parts.
- Have a better appreciation of various construction details with respect to seismic response when applying the Eurocodes.

Who can participate?

Civil/Structural Engineers with a strong interest in seismic design and assessment of reinforced concrete buildings from the Western Balkan region (Albania, Bosnia and Herzegovina, North Macedonia, Kosovo*, Montenegro and Serbia), Turkey (Candidate country for EU membership) and Moldova (Horizon Europe Associated country) may attend the Eurocodes School.

We are looking for participants with a Bachelor's degree in Civil/Structural Engineering (*essential*) and a Master's degree in Civil, Earthquake or Structural engineering (*preferred*). The curriculum of the Summer School is designed for designers having already professional knowledge on the design of building structures for earthquakes resistance. In particular, participants are expected to have minimum two years of collaboration or contribution to design projects following the completion of relevant studies (alternatively 240 credits of continuous professional development) (*compulsory*) but no more than five years of related professional experience following the completion of the latest relevant studies. Knowledge of EN 1990 and EN 1991 would be useful, but not essential.

We expect a continuous an active presence from all participants to take full benefit of the School. All lectures and discussions will be in English and no translation will be provided.

A certificate of attendance will be provided at the end of the Summer School by the Organizing Committee.

How to express your interest?

To express your interest, you can contact the Engineering Chamber in your region (or other relevant stakeholder as the Institution of Civil Engineers/Association of Earthquake Engineering), providing the following documents:

- A motivation letter (max. one page) explaining why you are interested in attending the Summer School and how it will benefit you in your career.
- A short CV of two pages maximum, stating clearly your education background and related professional experience.
- Contact details of at least two referees that can provide a reference for you, upon request.

The maximum number of participants will be 40 and the Organizing Committee seeks to achieve a balance between nationalities and gender of participants, where possible.

The closing date for applications is 20 May 2021. Decisions on acceptance will be announced by email from the Organizing Committee starting on 01 June 2021.

---

* *This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

Event details

Registration of the invited participants will be done online through a dedicated registration site. The Organizing Committee will announce the registration details to the invited participants. There will be no registration fee for the Summer School.

Relevant training material (presentations, worksheets etc.) will be distributed to the participants at the Eurocodes School. The material from the training event will be collected in an appropriate training kit package and will made available on the JRC Eurocodes website after the School (https://eurocodes.jrc.ec.europa.eu/). The training scheme and material is envisaged to be of interest to other countries worldwide that have expressed interest in the Eurocodes and in particular EN 1998.

Contacts

Please direct all enquiries to JRC-EUROCODES-ENLARGEMENT@ec.europa.eu.

Organizing Committee

- Artur Pinto, Silvia Dimova, Adamantia Athanasopoulou, Luísa Sousa, Maria Fabregat Morillas

European Commission, Joint Research Centre, Directorate for Safety, Security and Migration, Safety and Security of Buildings Unit

- Roberta Apostolska

University Ss Cyril and Methodius, Institute of Earthquake Engineering and Engineering Seismology, IZIIS, Skopje, Republic of North Macedonia

- Antonio Correia

Laboratório Nacional de Engenharia Civil (National Laboratory for Civil Engineering), LNEC, Lisbon, Portugal, CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8

With the support of

European Commission - JRC Enlargement and Integration Action

CEN/Technical Committee 250 "Structural Eurocodes"

CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8 "Eurocodes 8: Design of Structures for Earthquake Resistance"

Institute for Standardization of Serbia (ISS)

Faculty of Civil Engineering, University of Belgrade, Serbia

Summer School Programme

All time indications are in Central European Summer Time (CEST)

Legend

	Presentation (open to all participants)		**Lecture with worked examples** (open to all participants)
	Keynote Lecture (open to all participants)		**Worked examples (group assignments)** (restricted to full participants)

*Note: Senior engineers invited as "**passive participants**" will be able to attend the sessions noted as Presentation, Keynote Lecture and Lecture with worked examples. Participants invited to the **full programme** of the Summer School should attend all sessions, including the sessions noted as Worked examples that will take place as break-out sessions.*

Monday, 5 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 09:15	**Key opening remarks** **Artur Pinto -** *Head of Unit, Joint Research Centre of the European Commission* **Tatjana Bojanić -** *Director, Institute for Standardization of Serbia (ISS)*	
09:15 – 09:25	**Presentation** ISS activities in support of the Eurocodes implementation **Speaker:** Jelena Skoković *Institute for Standardization of Serbia (ISS)*	
09:25 – 09:40	**Presentation** Seismic safety and energy renovation **Speaker:** Silvia Dimova *Joint Research Centre of the European Commission*	
09:40 – 10:00	**Presentation** Eurocodes Balkan Summer School curriculum and activities **Speaker:** Adamantia Athanasopoulou *Joint Research Centre of the European Commission*	
10:00-11:00	**Keynote Lecture** Introduction to the Eurocodes – present and future **Lecturer:** Nikolaos Malakatas *CEN/TC250 "Structural Eurocodes" Sub-Committee 1 Chairman*	
11:00 – 11:30	Break	
11:30 – 12:30	**Keynote Lecture** Introduction to EN 1990 "Eurocode: Basis of structural design" for the design of reinforced concrete buildings **Lecturer**: Paolo Franchin *Sapienza University of Rome, Department of Structural and Geotechnical Engineering, Professor of Structural Design and Earthquake Engineering*	
12:30 – 13:30	**Keynote Lecture** Introduction to EN 1991 "Eurocode 1: Actions on structures" for the design of reinforced concrete buildings **Lecturer**: Nikolaos Malakatas *CEN/TC250 "Structural Eurocodes" Sub-Committee 1 Chairman*	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Tuesday, 6 July 2021		
08:30 –09:00	Preparation for session start (connection check-ups)	
09:00 – 10:00	**Keynote Lecture** Design of reinforced concrete buildings. Part A - EN 1992 "Eurocode 2: Design of concrete structures" **Lecturer:** Michael Fardis *CEN/TC250 "Structural Eurocodes" Vice-Chairman*	
10:00 – 11:00	**Keynote Lecture** Introduction to EN 1998 "Eurocode 8: Design of structures for earthquake resistance" **Lecturer:** Philippe Bisch *CEN/TC250 "Structural Eurocodes" Sub-Committee 8 Chairman*	
11:00 – 11:30	Break	
11:30 – 12:30	**Lecture with worked examples** Seismic actions in EN 1998 "Eurocode 8: Design of structures for earthquake resistance" **Lecturer:** Alain Pecker *AP Consultant, Professeur Ecole des Ponts Paris Tech, CEN/TC250 "Structural Eurocodes" Sub-Committee 8 PT4 Leader*	
12:30 – 13:30	**Lecture with worked examples** Conceptual design and methods of analysis **Lecturer:** Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee* 8	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Wednesday, 7 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 10:00	**Keynote Lecture** Seismic design of reinforced concrete buildings. Part B - EN 1998 "Eurocode 8: Design of structures for earthquake resistance" **Lecturer:** Michael Fardis *CEN/TC250 "Structural Eurocodes" Vice-Chairman*	
10:00 – 11:00	**Lecture with worked examples** Design of reinforced concrete buildings with EN 1992 (Eurocode 2) and EN 1998 (Eurocode 8) **Lecturer:** Humberto Varum University of Porto (FEUP), Portugal, Civil Engineering Department of the Faculty of Engineering, Professor	
11:00 – 11:30	Break	
11:30 – 13:30	**Lecture with worked examples** Simulation of seismic response of buildings. Analysis methods, design verifications and software **Lecturer:** Rui Pinho University of Pavia, Italy, Civil Engineering and Architecture Department, Professor	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Thursday, 8 July 2021		
08:30 –09:00	Preparation for session start (connection check-ups)	
09:00 – 11:00	**Lecture with worked examples** Seismic design of reinforced concrete buildings **Lecturer:** Humberto Varum University of Porto (FEUP), Portugal, Civil Engineering Department of the Faculty of Engineering, Professor	
11:00 – 11:30	Break	
11:30 – 12:30	**Lecture with worked examples** Simulation of seismic response of buildings. Analysis methods, design verifications and software **Lecturer:** Rui Pinho *University of Pavia, Italy, Civil Engineering and Architecture Department, Professor*	
12:30 – 13:30	**Keynote Lecture** Geotechnical aspects in the seismic design of buildings **Lecturer:** Alain Pecker *AP Consultant, Professeur Ecole des Ponts Paris Tech, CEN/TC250 "Structural Eurocodes" Sub-Committee 8 PT4 Leader*	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Friday, 9 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 11:00	**Lecture with worked examples** Geotechnical aspects in the seismic design of reinforced concrete buildings **Lecturer:** Alain Pecker *AP Consultant, Professeur Ecole des Ponts Paris Tech, CEN/TC250 "Structural Eurocodes" Sub-Committee 8 PT4 Leader*	
11:00 – 11:30	Break	
11:30 – 13:30	**Worked Examples** Team work on assignments under expert supervision **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* Joao Almeida *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Monday, 12 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 11:00	**Keynote lecture** Seismic assessment of buildings **Lecturer**: Paolo Franchin *Sapienza University of Rome, Department of Structural and Geotechnical Engineering, Professor of Structural Design and Earthquake Engineering*	
11:00 – 11:30	Break	
11:30 – 13:30	**Lecture with worked examples** Seismic assessment of buildings **Lecturer**: Paolo Franchin *Sapienza University of Rome, Department of Structural and Geotechnical Engineering, Professor of Structural Design and Earthquake Engineering*	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Tuesday, 13 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 11:00	**Keynote lecture** Seismic retrofitting of reinforced concrete buildings **Lecturer**: Andreas Kappos *Khalifa University of Science & Technology, United Arab Emirates, Department of Civil Infrastructure & Environmental Engineering, Professor*	
11:00 – 11:30	Break	
11:30 – 13:30	**Lecture with worked examples** Seismic retrofitting of reinforced concrete buildings **Lecturer**: Rui Pinho *University of Pavia, Italy, Civil Engineering and Architecture Department, Professor*	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Wednesday, 14 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 11:00	**Worked Examples** Team work on assignments under expert supervision **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* Joao Almeida *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
11:00 – 11:30	Break	
11:30 – 12:30	**Worked Examples** Small groups work on assignments under expert supervision (breakout sessions) **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* *Joao Almeida* *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
12:30 – 13:30	**Worked Examples** Small groups work on assignments under expert supervision (breakout sessions) **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* *Joao Almeida* *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Thursday, 15 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 10:00	**Worked Examples** Small groups work on assignments under expert supervision (breakout sessions) **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* *Joao Almeida* *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
10:00 – 11:00	**Worked Examples** Small groups work on assignments under expert supervision (breakout sessions) **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* *Joao Almeida* *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
11:00 – 11:30	Break	
11:30 – 12:30	**Worked Examples** Team work on assignments under expert supervision **Lecturers**: Antonio Correia *CEN/Technical Committee 250 "Structural Eurocodes" Sub-Committee 8* Joao Almeida *Université Catholique de Louvain (UCLouvain), Belgium, Assistant Professor*	
12:30 – 13:30	**Presentation** Interactive classroom "talk with the expert" **Lecturers**: TBC	
13:30 – 13:40	Wrap-up and preparation for next day activities	

Friday, 16 July 2021		
08:30 – 09:00	Preparation for session start (connection check-ups)	
09:00 – 10:00	**Keynote lecture** Base isolation **Lecturer**: Philippe Bisch *CEN/TC250 "Structural Eurocodes" Sub-Committee 8 Chairman*	
10:00 – 11:00	**Keynote lecture** EN 1998 evolutions – highlights for the design of reinforced concrete buildings with the Eurocodes 8 Second Generation **Lecturer**: Philippe Bisch *CEN/TC250 "Structural Eurocodes" Sub-Committee 8 Chairman*	
11:00 – 11:30	Break	
11:30 – 12:00	**Presentation** Designing with the Eurocodes – sharing experience from Serbia **Speakers**: Olga Djuric-Peric and Vesna Vicovac *asmec consultants d.o.o.*	
12:00 – 12:30	**Presentation** Designing with the Eurocodes – sharing experience from Montenegro **Speaker**: Jovan Furtula *Civil engineer at OPTIMUSPROJECT doo, member of Engineer Chamber of Montenegro, Chamber of Civil Engineer*	
12:30 – 13:00	**Presentation** Education programmes and needs supporting the practical implementation of the Eurocodes **Speakers**: Branko Milosavljević and Veljko Koković *Faculty of Civil Engineering, University of Belgrade, Serbia*	
13:00 – 13:30	**Presentation** Eurocode 8 implementation status survey to the Balkan countries **Speaker**: Roberta Apostolska *University Ss Cyril and Methodius, Institute of Earthquake Engineering and Engineering Seismology, IZIIS, Skopje, Republic of North Macedonia*	
13:30 – 14:00	**Closure** **Adamantia Athanasopoulou -** *Joint Research Centre of the European Commission*	

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online (european-union.europa.eu/contact-eu/meet-us_en).

On the phone or in writing

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

— by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

— at the following standard number: +32 22999696,

— via the following form: european-union.europa.eu/contact-eu/write-us_en.

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website (european-union.europa.eu).

EU publications

You can view or order EU publications at op.europa.eu/en/publications. Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre (european-union.europa.eu/contact-eu/meet-us_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex (eur-lex.europa.eu).

Open data from the EU

The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

The European Commission's science and knowledge service

Joint Research Centre

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
joint-research-centre.ec.europa.eu

@EU_ScienceHub

EU Science Hub - Joint Research Centre

EU Science, Research and Innovation

EU Science Hub

EU Science