



*Under the honorary patronage of His Excellency Mr. Borut Pahor, President of the Republic of Slovenia.*



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**UNESCO**



## 2019 Ljubljana Declaration on Buildings and Infrastructure Resilience

Contributing to the 2030 Agenda for Sustainable Development Goals

1. The World Construction Forum 2019 was convened and jointly organized in Ljubljana, Slovenia, from April 8 to 11, 2019 by the World Federation of Engineering Organizations (WFEO), Slovenian Chamber of Engineers (IZS) and the University of Ljubljana, Faculty of Civil and Geodetic Engineering (UL FGG), the latter two celebrating its 100<sup>th</sup> Anniversary in 2019. The event was co-organized by several international engineering organizations, as well as national engineering professional societies and associations in Slovenia. The Forum was under the Honorary Patronage of Mr. Borut Pahor, the President of the Republic of Slovenia, and under the Patronage of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The Forum was sponsored by several entities from construction industry. Over 600 participants - scientists, researchers, engineers, entrepreneurs, professors, students, policy makers, public officials as well as representatives from construction industry - took part from 50 countries and from 5 continents.
2. The participants take note that: i) the planet's over 7.5 Billion need homes, workplaces, clean water, sanitation, buildings and infrastructure which are safe and operational at any time; ii) feeding the world requires investing into irrigation and other support systems for agriculture; iii) climate change calls for measures of adaptation to warmer and more volatile climate as well as measures for the reduction of greenhouse gas emissions; iv) ageing populations particularly in the West have new requirements for residential and transportation infrastructure.
3. The participants are aware that the construction sector, including engineering, in which they are active stakeholders is the key element in solving these problems and are determined to shape its education, research and industrial strategies towards addressing these imminent challenges.
4. The participants point out that construction industry and related engineering disciplines especially civil engineering is an important economic driver in different economic environments and contributes to economic development by a direct contribution to Gross Domestic Product (GDP) and also indirectly by securing resilient buildings and infrastructure facilitating growth in all other sectors.
5. The participants pledge that the construction sector, including engineering, can and will contribute to international development agreements, especially to the 2030 Agenda for Sustainable Development, the 2018 Paris Agreement on Climate Change under the United Nations Framework Convention on Climate Change, and last but not least to the Sendai Framework for Disaster Risk Reduction 2015-2030.
6. Consistent with the strategic goals of the World Federation of Engineering Organizations to advance the UN Sustainable Development Goals through engineering, the participants pledge to contribute to the 2030 Agenda for Sustainable Development to tackle climate change (SDG #13 Climate Change). It can mitigate the effects of changing climate, for example by installation of passive and active climate control in buildings, by preventing floods, improving water supply etc. (SDG #6 Clear Water and Sanitation). It can furthermore

contribute to the reduction of CO2 emissions by construction of sustainable energy generation plants (SDG #7 Affordable and Clean Energy), by building sustainable transportation infrastructure (SDG #9 Industry, Innovation and Infrastructure) and by tightly bounding together the structural and energy retrofiting of buildings to support smart cities (SDG #11 Sustainable Cities and Communities). The participants recognize that strong cooperation among diverse stakeholders is needed to achieve these goals. (SDG #17 Partnerships for the Goals).

7. The participants unanimously agreed that the Sustainable Development Goals could be achieved in the long term by treating sustainability and the resilience objectives as a coupled challenge, which requires appropriate understanding, communication and management of natural disaster risks. The engineering sector with an emphasis on civil engineering sector, construction industry, code-writing and civil-protection units as well as policy makers have to cooperate in order to enhance community resilience against adverse natural events, especially for very rare events for which stakeholders cannot develop perception.
8. At WCF 2019, the participants highlighted topics that will influence development of construction sector, including the relevant engineering disciplines, in the decades to come. Fully aware of the vital importance of construction products and infrastructure for the life and work, the WCF 2019 topics focused on societal resilience, specifically on “Buildings and Infrastructure Resilience”. Accordingly, the following recommendations were made:

Recommendations on Energy: Electricity consumption in the world is and will be growing, so new renewable and greenhouse-gas neutral electricity production units are and will be needed to cover increasing electricity demand, new electrification, and assure stable electrical grid and energy system operation. We should increase world production of electricity from renewable and environmentally friendly sources, and reduce electricity production from fossil fuels. Questions related to wind, nuclear, water, geothermal, and solar energy, with special emphasis on technical and economic feasibility of energy issues are of great significance to society. The construction engineering needs to develop new design techniques and construction technologies to enhance resilience of all these products and services, i.e. smart power grids in urban areas and generally in the built environment.

Recommendations on Construction 4.0: Technologically the world is entering a new phase of digital revolution that will be characterized by internet of everything, robotics, artificial intelligence, cyber-physical systems, digital twins etc. Construction sector needs to embrace this revolution by combining the material and the digital world into one – with the goal of creating not only high quality, inexpensive and sustainable, but also smart, interconnected and customized construction products for the end user. Education, research, business strategies and public procurement should contribute to this development.

Recommendations on Cultural heritage: Digital solutions in the field of cultural heritage open the wide range of possibilities in holistic approach to development of policy and conservation strategies as well as economic development of countries having rich tangible and intangible cultural heritage. The Directive 2013/37/EU lays down the general principle that documents from libraries, museums and archives shall be re-usable for commercial and non-commercial purposes, and promotes availability in open, machine-readable format together with metadata and the use of open standards. This approach can serve as a good practice example for the rest of world because digitalization can turn world cultural resources into an important pillar of the digital economy. Sustainable preservation and increase the resilience of modern structures and infrastructure has to consider lessons learned from cultural heritage preservation.

Recommendations on Disaster Risk Management & Governance for Resilient Communities: Participants recommend new policies, an adaptation of education and extensive research and development around these specific goals: i) Increasing the community awareness about the risks due to natural and other hazards by introducing concepts of short-term and long-term risk tolerance; ii) Developing and implementing structural design codes and integrated tools for quantitative risk and resilience assessment for variety of natural and other hazards; iii) Developing policies for comprehensive retrofitting and upgrading of the world’s built environment with consideration of tolerable community resilience; iv) Providing new insights into the

behavior of buildings and infrastructures exposed to natural and other hazards in order to enhance the resilience of communities.

Recommendations on Engineering Capacity Building: Engineering capacity building in institutions and individuals through education, training, mentoring, orientation and mobilization of resources needs to support the SDG goals across the WCF 2019 themes so that engineers and technicians will be able to lead the development at different levels. The elements of reformed education are crucial: i) engineering education in primary and secondary schools (e.g. Science, Technology, Engineering, and Mathematics subjects) is vital for successful higher education in the field of engineering and technical sciences in general, and to boost creative and breakthrough thinking and innovation in young generation; ii) education must provide top-notch theoretical and practical knowledge on engineering subjects unique to construction; iii) education must provide a solid basis for life-long, continued education as this will be needed due to rapid progress and digitalization; iv) on all levels, awareness for social responsibility of engineering work and role in providing for well-being of humanity must be raised.

Recommendations on the Building Information Modelling (BIM) life-cycle, Facility Management (FM) and Asset Information Management: The back-bone of digitally engineered built environment is the information fusion with feedback loop within and between physical and digital worlds. The complexity of the life-cycle of infrastructure projects can be better managed if projects at different scales, phases and various domains are developed collaboratively as dependent socio-technical systems. Building Information Modelling that supports the evolution of active digital twins can develop and advance design, construction and operation. Integrated design technologies, facility management and asset management systems with real-time sensing and analysis of structural and environmental data can improve the capacity and resilience of buildings and infrastructure.

9. The participants call upon responsible governmental bodies to secure long-term stable financial and working environment for construction sector to avoid fluctuations in its activities and for supporting construction engineering sector to fulfil its inevitable contributions to sustainable development at different scales, from local over regional and national to international level.
10. The participants express gratitude to the World Federation of Engineering Organizations (WFEO) for their continuous support to engineering profession and its leading role in securing a framework for an international collaboration of different relevant stakeholders in the field of construction engineering.

Adopted in Ljubljana, on 10 April 2019.

Dr. Marlene Kanga AM  
President, World Federation of Engineering  
Organizations

Dr. Peggy Oti-Boateng  
Director, Division of Science Policy and Capacity  
Building, Natural Sciences Sector, UNESCO

Prof. dr. Matjaž Mikoš  
Dean, Faculty of Civil and Geodetic Engineering,  
University of Ljubljana

Mag. Črtomir Remec  
President, Slovenian Chamber of Engineers

