Consensus Statement

Uncertain Climate Futures – A New Reality for Structural Design and Integrity Management

Copenhagen, June 17, 2025

Preamble

The International Workshop on Uncertain Climate Futures – A New Reality for Structural Design and Integrity Management, was held in Copenhagen on June 16–17, 2025, under the auspices of the Danish Association of Consulting Engineers (FRI) and the Joint Committee on Structural Safety (JCSS).

The presenting participants at the workshop comprised selected stakeholders to structures and infrastructure systems, including professionals and experts from climate science, civil engineering, reliability and decision sciences, owner organizations, regulatory bodies and public authorities. In total more than 50 professionals, representing 14 nation states and 4 continents, attended the workshop.

The workshop was designed with the explicit objective to bring together the most relevant groups of stakeholders in the context of how deep uncertainties may or should affect adequate design and integrity management of structures and infrastructure systems.

The first day of the workshop was allocated to; i) establishing a common understanding of what we know and can know about future climate changes, ii) sharing perspectives of the participating stakeholders and iii) conveying knowledge on the methodical basis for designing and assessing structures that is used at present.

On the second day of the workshop, knowledge was shared on how the industry is presently dealing with the challenges – present best practices - and on recent developments from academia on how present best practices may be improved.

All workshop participants have agreed to the present Consensus Statement. The list of participants is enclosed in the end of this document.

Consensus among all workshop participants

Traditional approaches to structural and infrastructure design have till now relied on historical data, physical understanding, statistical modeling and extrapolation, to model environmental loads over their lifetimes. Under the assumption of stable climate conditions this approach has provided a reliable evidence base for development of design codes and standards – as for decision support in the context of specific major projects.

Climate change and deep uncertainties in climate projections—locally and globally—have severely called into question the validity of the presently applied approach. It is now evident that climate conditions are significantly changing over time – and that we know very little about how these changes will manifest themselves. Climate models are not only associated with very substantial

uncertainties due to the fact that we have only little knowledge concerning the ability and willingness of the global society to reduce the concentration of Green House Gas in the atmosphere – in due time. On top of this comes the effect of exceeding possible "tipping points" that may be associated with more abrupt and severe changes of weather patterns. Due to climate change and the associated knowledge uncertainties our present best practices for design and integrity management of structures and infrastructure systems are becoming insufficient.

As a result, the structures and infrastructure systems we design and construct now, will most likely not meet our requirements and societal expectations for safety, reliability, resilience, or sustainability when we approach the end of their service lives, i.e. in 50 to 150 years from now. It is to be expected that some of these structures and infrastructure systems may even become technically or economically obsolete before then – because of effects of climate change.

Stakeholders to structures and infrastructure systems present at the workshop agree that this situation is not acceptable and that actions must be taken now to ensure that structures and infrastructure systems are designed, maintained and adapted - now and in the future – according to (as far as feasible) the same performance standards we have applied in the past.

Approaches and methods on how to deal with the deep climate uncertainties are being developed and used, in the industry and in academia. Several of these were presented and discussed at the workshop. From these presentations and discussions it is evident that what is being done in practice at the present time is inadequately diverse and also to a certain degree incomplete. Similarly, whereas there are methods available from academia, these still have to be adapted, integrated and also benchmarked before they adequately may support establishing a better industry practice.

Furthermore, in moving forwards, the knowledge domains of climate science, engineering and decision analysis must be better coordinated and aligned for the particular context of structures and infrastructure systems.

In conclusion a new rationale for structural design, protection, and adaptation is urgently needed—one that explicitly addresses deep climate uncertainties, integrates multiple models, and allows for ongoing revision based on emerging data on climate changes as they evolve. This new rationale must afford for the optimization of decision options for structural concepts and design and integrity management for large infrastructure projects as well as for every day design tasks supported by design codes.

It is of crucial importance that this rationale is standardized at international level to ensure globally harmonized safety and reliability standards, and to support equitable, knowledge-based competition in structural and infrastructure engineering. This shall be leveraged by engagement of professional associations of national and international significance such as the American Society of Civil Engineers (ASCE), and others that already have engaged in the challenge or would be willing to contribute to the urgently needed developments.

Next Steps

To develop and implement the new rationale for design and integrity management of structures and infrastructure systems it was decided to establish a special task force. The special task force will

operate under the auspices of the Joint Committee on Structural Safety (JCSS) and is expected to have an operational lifetime of 4 years.

Members of the special task force will be selected predominantly among the participants of the workshop, based on interest and availability. However, due consideration will be given to ensure that the group is adequately geographically representative.

The mandate of the special task force is to ensure that the new rationale for design and integrity management of structures and infrastructure systems is established and implemented within a short time horizon – i.e. 4-5 years.

As a first step the special task force shall establish an action plan before the end of 2025. Further specific actions include but are not limited to:
- Completion of foundational JCSS documents on theory, methods, and approaches by Year 2.
- Development of a dedicated ISO standard (or addendum to ISO2394:2015) by Year 3
- Developments of Eurocode amendments and/or a recommendation on how to devise National Application Documents that account for the effects of uncertain climate futures, by end of Year 4.
- Dissemination of guidelines and examples for the use of consulting engineers, contractors and owner organizations by the end of Year 4.

It was finally agreed that the possibility of institutional support of the special task force from the side of the Joint Research Centre (JRC) at Ispra, Italy should be investigated in the months to come. Such a support would strongly facilitate that the intentions and potentials of the workshop, and the work of the special task force, achieve the intended impact.

Conclusion

This consensus statement affirms our commitment to confronting uncertain climate futures with collaboration, rigor, and foresight. We invite all relevant stakeholders - not least from the side of politicians - to appreciate and support the creation and mission of the special task force and to contribute to developing internationally recognized standards and practices that ensure – despite of deep climate uncertainties - the continued safety, resilience, and sustainability of infrastructure systems.

Workshop participants

Name	Organization
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Andelo Valcic	University of Zagreb, Faculty of Civil Engineering
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Andreas Rogge	Federal Institute for Materials Research and Testing (BAM), Germany
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Christina Lohfert Rolandsen	Sund & Bælt, Denmark
Christoffer Truelsen	NIRAS A/S, Denmark
Daniel Straub	Technical University of Munich, Germany

Name	Organization
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Dennis Zuk Grandt	Danish Authority of Social Services and Housing, Denmark
Diego Allaix	TNO, the Netherlands
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Eloi Figueiredo	University of Lusofona, Lisbon, Portugal
Fabio Biondini	Politecnico di Milano, Italy
Georgios Tsionis	European Commission, Joint Research Centre, Italy
Inger Birgitte Kroon	COWI A/S, Denmark
Jennifer Goupil, P.E.	American Society of Civil Engineers (ASCE), USA
Jens Sandager Jensen	COWI A/S, Denmark
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Lene Højris Jensen	The Danish Road Directorate, Denmark
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