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*Challenges for Existing and Oncoming Structures*

**REPORT**

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# IABSE Symposium Prague 2022

Challenges for Existing and Oncoming Structures



## Proceedings

ORGANISED BY  
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IN COOPERATION WITH  
CZECH TECHNICAL UNIVERSITY PRAGUE







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| <b>Author Index</b>                                                                                                                                      | <b>1950</b> |



# Preface



František Wald



Pavel Ryjáček

Welcome to the IABSE Symposium Prague 2022 Challenges for Existing and Oncoming Structures (CEOS). Thanks to the quality of the contributions offered, the Scientific Committee succeeded in preparing an interesting Proceedings to summarised the latest developments of structural engineering with respect to the advanced and new methods of design and analysis.

Scientists, experts, designers, contractors and all those who are interested in advances and problems in civil engineering structures and bridges, in numerical modelling and advanced methods of design, to contribute to the theme. All written papers presented in this Proceedings are peer-reviewed by the Scientific Committee.

The conference format has been chosen to facilitate debates and discussions. For this purpose, each session has been limited to five presentations with a time left to the Session Facilitators to encourage questions and interaction amongst speakers and attendees. The Organizers hope that this Symposium will help to share the experience of the world's structural engineering community with today megastructures and to present the vision of tomorrow's megastructures and more broadly their prospect of future outstanding structures.

During the event the large majority of the presentations are delivered orally in sessions, nevertheless Special Sessions are taking place as well. Task Groups of IABSE proposed these Special Sessions with a keen sense of innovation and currently achieved knowledge. Renowned Keynote Speakers are introducing relevant topics to the theme and give a state-of-the-art lecture.

This Symposium would not have been organized without the sustained effort of many persons. The authors, the committee members, and the reviewers are essential to the success of the Symposium. Especially, we would like to thank the members of the Scientific Committee for their efforts in handling of the papers and preparing the technical program, and the members of the Local Organizing Committee for concocting an amazing programme.

We hope that you will enjoy this Symposium, both for its scientific, technical and social aspects.

**František Wald**  
Scientific Committee Chair

**Pavel Ryjáček**  
Organising Committee Chair



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# Keynote Lectures

## **Extrapolation of test data in time, size and risk – a challenge for concrete design codes** [page 54](#)

Thursday, 26 May 2022, Forum Hall, at 09:45

**Zdeněk Bažant**, McCormick Institute, USA

Zdeněk P. Bažant is a full professor at the McCormick Institute, Northwestern University. His interests lie in new interdisciplinary problems of the mechanics of solids and structures, with applications in structural, mechanical and aeronautical engineering, materials science, geophysics and petroleum engineering. His research group works on nonlinear fracture mechanics, size effects and scaling of failure, stability of structures, micromechanics of damage in materials, inelastic constitutive laws, creep and hygrothermal effects in nanoporous materials, chemo-mechanics, failure of fiber composites, hydraulic fracturing of shale, geothermal energy, impact problems, probabilistic mechanics of quasibrittle structures, plasticity and finite strain, with related numerical methods. He is a Member of NAS, NAE, AAAS, Royal Society of London, National Academies of Austria, Czech Republic, Italy (dei Lincei), India, Spain and Lombardy; Academia Europaea, and Eur. Academy of Science and Art. He has 7 honorary doctorates and many other international awards.

## **UHPFRC is ready to revolutionize existing and new structures** [page 67](#)

Thursday, 26 May 2022, Forum Hall, at 09:00

**Eugen Brühwiler**, Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland

Eugen Brühwiler is a Professor of structural engineering and Director of the Laboratory of Maintenance and Safety of Existing Structures at EPFL – the Swiss Federal Institute of Technology in Lausanne, Switzerland, since 1995. His teaching and research activities include modern methods of examination in structural engineering including structural and fatigue safety, monitoring and reliability of bridges and buildings as well as the use of Ultra-High Performance Fiber Reinforced Cementitious Composites (UHPFRC) for the rehabilitation and strengthening of existing RC structures and the design and construction of new UHPFRC structures.

## **Carbon Concrete – Towards a climate neutral building industry**

Wednesday, 25 May 2022, Forum Hall, at 09:30

**Manfred Curbach**, Technische Universität Dresden, Germany

Graduated civil engineering at the University of Dortmund in 1982. He received his PhD. In 1987 at the Institute of Reinforced Concrete Structures and Building Materials at the University of Karlsruhe under Prof. Josef Eibl. Since 1994 he is university professor, holder of the chair for concrete structures at Technische Universität Dresden. He is a member of many organizations, such as ACI, ASCE, DAfStb, IngKammer, PCI, RILEM, VDI, VPI, member of the National Academy of Sciences Leopoldina and others.



## **The bridges in Italy: how to manage the infrastructural heritage guaranteeing safety and sustainability**

Friday, 27 May 2022, Forum Hall, at 09:00

**Marco Di Prisco, Politecnico di Milano, Italy**

Marco di Prisco is full professor at the Department of Civil and Environmental Engineering at Politecnico di Milano. His main research interests are constitutive modeling of advanced cement-based materials, reinforcement-concrete interaction mechanisms, sustainable design of R/C and P/C and FRC structures, prefabricated structures, structural response at exceptional loads. He is author of more than 350 papers, coordinator of many research projects financed by private Companies, Regional and National funds and European Community. Series Editor of Springer Tracts and Lecture Notes in Civil Engineering for Springer-Nature, honorary Editor of ISI Journal European Journal of Civil and Environmental Engineering, Presidium member of fib, member of several National and International Technical Committees, Coordinator of the Committee for Model Code 2020 chapters on FRC and of Rilem Commission TC 288 on Impact and Explosion. He is currently convener of the Commission TC250/SC2/Wg1/TG2 to introduce FRC in EC2 and is coordinating a National Research Project on existing bridges ("FIRMITAS: multi-hazard assessment, control and retrofit of bridges for enhanced Robustness using sMart IndusTriAlized Solutions"). Since 2018, he is Technical Director of the design company DSC-ERBA s.r.l.

## **Steel structure design assisted by finite element analysis**

Friday, 27 May 2022, Forum Hall, at 09:45

**László Dunai, Budapest University of Technology and Economics, Hungary**

Graduated Civil Engineering at the Technical University of Budapest in 1983 and Engineering Mathematics in 1986. PhD title was obtained in 1996 and in 2002 he acquired the habilitation. In 2008 he got the Doctor of Sciences degree, and in 2016 he was elected as the Corresponding Member of the Hungarian Academy of Sciences. He participated in postdoctoral study programmes in Lehigh University (USA) and in Osaka University (Japan). He is now professor at the Civil Engineering Faculty and head of the Structural Engineering Department, Budapest University of Technology and Economics. His key areas of research cover the following subjects: steel and steel-concrete composite structures; thin-walled structural systems; stability and fatigue of bridges; numerical modeling, finite element analysis and design of structures; on these fields he supervised 16 PhD thesis. He participates actively in editorial boards of international journals, in the development of the new generation of steel structural Eurocodes and in conference organising and scientific committees.

## **Multilevel FEA and BIM for the design of structural steel [page 46](#)**

Wednesday, 25 May 2022, Forum Hall, at 10:15

**Frantisek Wald, Czech Technical University in Prague, Czech Republic**

Works at Czech Technical University in Prague as Professor the Department steel and timber structures. In his professional life he concentrates to the connection, fire design of steel structures, and aluminium structures. In structural steel connection design he prepared the component model for column bases and the component based finite element model of joints and members (CBFEM). He supervised 19 PhD, 121 Master and 127 Bachelor theses, managed Erasmus Mundus Master Program Sustainable Constructions under Natural Hazards and Catastrophic events – SUSCOS\_M and established bachelor's program Fire Safety of Buildings, master's Integral Building Safety and doctoral Integral Safety. Coordinated of 19 research projects. Author of 9 books, 169 research-based publications. Prof received the award Ministry of the Interior 2008 Prize for Merit for Safety, CAOK 2017 Prize of Pavel Juchelka for Outstanding Contribution to the Field, ECCS 2018 Charles Massonnet Award, and Czech Head Prize for MERLION Project.



# Session Plan

Wednesday, 25 May 2022

## Plenary Session: Opening Ceremony

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08:30–09:30

FORUM HALL

08:30–08:35

**OC Chair Welcome and Opening of Symposium**

Pavel Ryjáček

08:35–08:45

**Welcome from IABSE President**

Yaojun Ge

08:45–08:50

**Welcome of the Dean of Faculty of Civil Engineering of CTU in Prague**

Jiří Máca

08:50–08:55

**Ředitelství silnic a dálnic ČR (Presentation of the Road and Motorway Directorate of the Czech Republic)**

Jiří Hlavatý

08:55–09:05

**Ředitelství vodních cest ČR (Presentation of the Waterway Directorate of the Czech Republic)**

Lubomír Fojtů

09:05–09:20

**Building Bridges to Better Lives**

Nicola Turrini

09:20–09:25

**Welcome of the Scientific Committee and Czech National Group IABSE + Organisational Info**

František Wald

## Keynote Session: Keynote Lectures I

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09:30–11:00

FORUM HALL

**Chairs: Pavel Ryjáček, Czech Republic,**

**Ysabel Guil Celada, Spain**

09:30

**Carbon Concrete – Towards a climate neutral building industry**

Manfred Curbach, Germany



- 10:15 **Multilevel FEA and BIM for the design of structural steel** [page 46](#)  
František Wald, *Czech Republic*

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## Coffee Break

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11:00–11:30 FOYER/EXHIBITION AREA

## Special Session: The Storstrøm Bridge in Denmark – Challenges in Design and Construction

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11:30–13:00 FORUM HALL

**Chairs:** Martin Svendsen, *Denmark*,  
Marco Raimondi, *Denmark*

- 11:30 **The New Storstrøm Bridge – From tender requirements to reality** [page 80](#)  
Barbara MacAulay, *Denmark*
- 11:43 **The New Storstrøm Bridge – Pier Design** [page 104](#)  
Michael Needham, *United Kingdom*
- 11:56 **The New Storstrøm Bridge – Prestressed Box Girder Design** [page 112](#)  
Luca Cargnino, *Denmark*
- 12:09 **The New Storstrøm Bridge – Pylon and Stay Cable Design** [page 120](#)  
James Wharton, *United Kingdom*
- 12:22 **The New Storstrøm Bridge – Construction tolerances and precast structures  
installation challenges** [page 96](#)  
Marco Raimondi, *Denmark*
- 12:35 **Independent check and validation activities for the New Storstrøm Bridge**  
[page 88](#)  
Ysabel Guil Celada, *Spain*
- 12:48 **Discussion**

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## Scientific Session: Advanced Bridge Solution

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11:30–13:00 NORTH HALL

**Chairs:** Pablo Tarín, *Spain*,  
Nagy Zsolt, *Romania*

- 11:30 **Weathering Steel Bridges – the New European ECCS Design Guide** [page 128](#)  
Peter Hatke, *Germany*



- 11:45      **Economical Steel Bridges** [page 136](#)  
Martin Van Leeuwen, *Belgium*
- 12:00      **Structural stress analyses of long-span railway extradosed cable-stayed bridge based on rational construction state** [page 141](#)  
Bruno Briseghella, *China*
- 12:15      **Methods and technologies for evaluating and minimising noise from road bridge expansion joints** [page 149](#)  
Simon Hoffmann, *Switzerland*
- 12:30      **Modular composite bridges with integral sheet piling abutments for a time efficient construction** [page 157](#)  
Mike Tibolt, *Luxembourg*
- 12:45      **Discussion**

## **Special Session: Structural Steel Connection Design – Challenges and Vision**

11:30–13:00

### **TERRACE 2 A**

Chair: Milan Veljkovic, *Netherlands*,  
Hitoshi Moriyama, *Japan*

- 11:30      **Experimental Database on Resistance of Hybrid Joints with High-strength Bolts and Epoxy Adhesive** [page 165](#)  
Hitoshi Moriyama, *Japan*
- 11:45      **Load transferring mechanism of long riveted joint partially replaced by high-strength bolts** [page 173](#)  
Yu Chen, *Japan*
- 12:00      **Numerical and experimental analysis of hanger-arch connections for tied arch bridges with rolled sections** [page 181](#)  
Riccardo Zanon, *Luxembourg*
- 12:15      **Experimental study on the cooperative slip/bearing limit state of high-strength bolted frictional girder connection** [page 189](#)  
Ryo Sakura, *Japan*
- 12:30      **Development of Ductile Cast Iron Components to Shorten On-site Assembly of Existing Steel Earth-Retaining Beams** [page 196](#)  
Yuma Sugimoto, *Japan*
- 12:45      **Discussion**



## Scientific Session: Wind, Vibrations and Fatigue

11:30–13:00

TERRACE 2 B

Chair: Alexandre Mathern, *Sweden*,  
Stanislav Pospíšil, *Czech Republic*

11:30

**Active moment connection system for mitigating wind-induced vibrations**  
[page 203](#)

Anurag Bura, *USA*

11:45

**Recent and future trends of onshore wind turbine foundations** [page 210](#)

Jesus Armesto Barros, *Sweden*

12:00

**Development of an accurate low-cost device for structural vibration acquisition** [page 218](#)

Syedmilad Komarizadehasl, *Spain*

12:15

**Improving of fatigue assessment method for stud shear connectors using experimental data from studs' test of existing road bridge** [page 224](#)

Nikolai Kozak, *Russian Federation*

12:30

**Collapse Fragility Development of Electrical Transmission Towers Subjected to Hurricanes** [page 235](#)

Jerome Hajjar, *USA*

12:45

**Discussion**

## Scientific Session: Experimental Design of Structures

11:30–13:00

SOUTH HALL 2 B

Chair: Abdelhamid Bouchair, *France*,  
Jakub Dolejš, *Czech Republic*

11:30

**Experimental study of the shallow wide-flange steel beam-column under cyclic Loading with constant compressive axial force** [page 243](#)

Atsushi Sato, *Japan*

11:45

**A state-of-the-art, flexible, easy-to-replace plug-type expansion joint for the Delaware Memorial Bridges** [page 250](#)

Gustav Gallai, *Austria*

12:00

**Structural characteristics and analysis simulation of new Core Truss structure**  
[page 258](#)

Shunichi Nakagawa, *Japan*



- 12:15      **Experimental Testing of Mechanical Splices for Titanium Alloy Bars** [page 266](#)  
Mustafa Mashal, *USA*
- 12:30      **Large-Scale Flexural Testing of Concrete Beams Reinforced with Conventional Steel and Titanium Alloy Bars** [page 272](#)  
Mustafa Mashal, *USA*
- 12:45      **Discussion**
- Lunch**
- 
- 13:00–14:00      FOYER/EXHIBITION AREA
- Special Session: Ultra-High-Performance Concrete is Ready to Revolutionize**
- 
- 14:00–15:30      FORUM HALL
- Chair: Eugen Brühwiler, *Switzerland*,  
Petr Tej, *Czech Republic*
- 14:00      **Short span UHPFRC railway bridge in Switzerland – from design to implementation** [page 277](#)  
Ngoc Thanh Trinh, *Switzerland*
- 14:15      **Design and construction of the “Chaumény” footbridge in posttensioned UHPFRC** [page 285](#)  
Eugen Brühwiler, *Switzerland*
- 14:30      **Development of timber–UHPC composite bridge system** [page 293](#)  
Milan Holý, *Czech Republic*
- 14:45      **Use of fibre reinforcement concrete for encased composite bridge sections – an opportunity?** [page 301](#)  
Riccardo Zanon, *Luxembourg*
- 15:00      **New UHPFRC footbridges in the Czech Republic** [page 309](#)  
Petr Tej, *Czech Republic*
- 15:15      **Discussion**



## Scientific Session: Structural Health Monitoring

14:00–15:30

### NORTH HALL

Chair: Robert Veit-Egerer, *Austria*,  
Miloš Drdáký, *Czech Republic*

14:00

**Structural Health Monitoring of the Canakkale Bridge in Turkey, the largest monitoring system for the longer bridge in the world** [page 314](#)

Stephane Joye, *France*

14:15

**Monitoring to secure the Ile-de-Ré Viaduct, France** [page 318](#)

Stephane Joye, *France*

14:30

**Periodic assessment of an old concrete road bridge based on operational dynamic bridge behaviour with regard to structural integrity and the remaining load bearing capacity** [page 322](#)

Robert Veit-Egerer, *Austria*

14:45

**A Framework for Automated Bridge Inspections and Assessments with Visual Sensing Technology** [page 330](#)

Jerome Hajjar, *USA*

15:00

**Monitoring and assessment of bridge cable stays consisting of bundles of fully locked coil ropes** [page 338](#)

Rudolf Aroch, *Slovakia*

15:15

**Discussion**

## Scientific Session: Coming up Standards

14:00–15:30

### TERRACE 2 A

Chair: Michael Schäfers, *Germany*,  
Dana Procházková, *Czech Republic*

14:00

**Risk-Based Design of Bridges** [page 346](#)

Dana Prochazkova, *Czech Republic*

14:15

**Shear design of composite columns with sheet metal sections** [page 354](#)

Michael Schäfers, *Germany*

14:30

**From ETAG to EADs – The ongoing development of the European regulatory system governing the design and manufacture of bridge expansion joints** [page 361](#)

Simon Hoffmann, *Switzerland*



14:45 **Beam-column behaviour of stainless steel I-section members** [page 369](#)

Michal Jandera, *Czech Republic*

15:00 **Safety level of longitudinally stiffened plates under biaxial loading considering different launching bearings and eccentricities** [page 377](#)

Nadine Maier, *Germany*

15:15 **Discussion**

## Scientific Session: Seismic and Dynamic Design

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14:00–15:30

TERRACE 2 B

Chairs: Dimitra Achillopoulou, *Greece*,  
Stanislav Pospíšil, *Czech Republic*

14:00 **Seismic Performance Evaluation of an Existing Low-Rise RC Building after Strengthening using the Nonlinear Static Procedure** [page 387](#)

Samard Buddee, *Thailand*

14:15 **Standardized Seismic Design of Modular High-rise Steel Structure Equipped with Viscous Dampers** [page 395](#)

Gang Wang, *China*

14:30 **Development of simplified Bridge-Weigh-In-Motion based on displacement evaluation using an accelerometer** [page 407](#)

Nanami Ashizawa, *Japan*

14:45 **Development of a 3D Finite-Element Modelling Technique Based on Data Processing Platform and Fatigue Analysis of Full-Scale Reinforced-Concrete Bridge Deck** [page 415](#)

Jie Fang, *China*

15:00 **Simulation of nonlinear and non-stationary buffeting response of long-span bridges using Volterra series-based wind force model** [page 423](#)

Aleena Saleem, *Japan*

15:15 **Discussion**



## Scientific Session: Diagnostics of Bridges

14:00–15:30

SOUTH HALL 2 B

Chairs: Vanessa Saback, *Sweden*,  
Kouichi Takeya, *Japan*

14:00

**Subsurface defect detection in concretes by active infrared thermography**  
[page 431](#)

Masoud Pedram, *United Kingdom*

14:15

**Crack monitoring by fibre optics and image correlation: a pilot study** [page 437](#)

Vanessa Saback, *Sweden*

14:30

**Physics-informed Gaussian process model for Euler-Bernoulli beam elements**  
[page 445](#)

Gledson Rodrigo Tondo, *Germany*

14:45

**Damage detection in concrete with coda wave interferometry using a 60 kHz ultrasonic signal** [page 453](#)

Stefan Grabke, *Germany*

15:00

**Design of energy harvesting from temperature difference in concrete bridges**  
[page 458](#)

Kouichi Takeya, *Japan*

15:15

**Discussion**

## Coffee Break

15:30–16:00

FOYER/EXHIBITION AREA

## Scientific Session: Railway Bridges

16:00–17:30

FORUM HALL

Chairs: Jakub Dolejš, *Czech Republic*,  
Jindřich Potůček, *Czech Republic*

16:00

**Replacing of a steel bridge by a rotation around the longitudinal axis** [page 467](#)

Jakub Dolejš, *Czech Republic*

16:15

**Structural analysis of a historical masonry arch railway bridge in Gata de Gorgos, using a commercial Finite Element Analysis software** [page 476](#)

Pablo Tarín, *Spain*



- 16:30      **The design of the anchoring of the steel double track railway integral bridge in Mechelen contrasting the historical Vierendeel bridges** [page 484](#)  
Bart De Pauw, *Belgium*
- 16:45      **System identification and finite element model updating of a multi-span railway bridge with uncertain boundary conditions** [page 491](#)  
Emrah Erduran, *Norway*
- 17:00      **Railway bridges – Monuments in the network** [page 499](#)  
Johanna Monka, *Germany*
- 17:15      **Discussion**

## Scientific Session: Fatigue I

16:00–17:30

### NORTH HALL

**Chairs:** Lisa-Marie Gölz, *Germany*,  
Philippe Van Bogaert, *Belgium*

- 16:00      **Fatigue behaviour of cracked concrete decks under cyclic shear loading**  
[page 507](#)  
Lena Stempniewski, *Germany*
- 16:15      **Fatigue analysis of existing railway bridges: strengthening through geometry improvement** [page 515](#)  
Hans Pétursson, *Sweden*
- 16:30      **Fatigue behaviour of tubular bracings in steel and composite bridges** [page 524](#)  
Lisa-Marie Gölz, *Germany*
- 16:45      **Experimental and numerical investigations on the fatigue behavior of high-strength concrete under combined shear-compression loading**  
[page 532](#)  
Henrik Becks, *Germany*
- 17:00      **The effect of undue transverse welding on the fatigue resistance of hanger connections for steel tied arch bridges** [page 541](#)  
Philippe Van Bogaert, *Belgium*
- 17:15      **Discussion**



## Scientific Session: Damage Repair and Retrofitting I

16:00–17:30

TERRACE 2 A

**Chairs:** Rob Vergoossen, *Netherlands*,  
Milan Veljkovic, *Netherlands*

16:00

**West Seattle bridge rehabilitation** [page 547](#)

Jan Žitný, *Czech Republic*

16:15

**Re-using existing prefabricated prestressed concrete girders in new bridges**  
[page 554](#)

Rob Vergoossen, *Netherlands*

16:30

**Structural Assessment of existing masonry arch bridges** [page 562](#)

Thomas Harrewijn, *Netherlands*

16:45

**Shear performance of replaced bolt shear connectors used in prefabricated steel-concrete composite beams** [page 569](#)

Milan Veljkovic, *Netherlands*

17:00

**D4R7. Prievoz Interchange refurbishment at Bratislava** [page 578](#)

Wojciech Wlodzimirski, *Poland*

17:15

**Discussion**

## Scientific Session: Steel Connections

16:00–17:30

TERRACE 2 B

**Chairs:** Johannes Veie, *Norway*,  
Riccardo Zandonini, *Italy*

16:00

**An experimental and numerical approach to investigate the load – deformation behavior of anchorages with headed fasteners in reinforced-concrete columns** [page 586](#)

Taygun Firat Yolacan, *Luxembourg*

16:15

**An experimental investigation on base-plate joints of steel storage pallet racks** [page 594](#)

Riccardo Zandonini, *Italy*

16:30

**Prototype of no-projected and Sandglass-shaped Bolt Having High Strength and Durability for Efficient Steel Structures Maintenance** [page 602](#)

Tatsuya Hashimoto, *Japan*



- 16:45 **Investigating strength and stiffness of out-of-plane bending by biaxial testing of a nailed glulam connection** [page 610](#)  
Oskar Ranefjärd, *Sweden*
- 17:00 **New possibilities with the use of automated laser- laser-hybrid welding methods for steel bridges** [page 618](#)  
Johannes Veie, *Norway*
- 17:15 **Discussion**

## Scientific Session: Seismic Design and Testing

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16:00–17:30

SOUTH HALL 2 B

**Chairs:** Taiki Giga, *Japan*,  
František Wald, *Czech Republic*

- 16:00 **Influence of design criteria on the seismic response of single-storey steel buildings** [page 624](#)  
Nicola Ceccolini, *Italy*
- 16:15 **Evaluation of Seismic Performance and Proposing the reinforcement methods for the Bridge with Rocking Piers Penetrating the Railway Platform** [page 637](#)  
Taiki Giga, *Japan*
- 16:30 **Experimental study of potential bearing uplift of long-span cable-stayed bridges under earthquakes** [page 645](#)  
Wei Guo, *China*
- 16:45 **Evaluation of bidirectional seismic input compatible with a maximum-direction target spectrum** [page 654](#)  
Alan Rivera-Figueroa, *Puerto Rico*
- 17:00 **Dynamic responses and failure pattern of suspended cable tray system through shaking table test** [page 662](#)  
Chen Wu, *China*
- 17:15 **Discussion**

## Social Programme: Welcome Reception

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17:30–19:30

FOYER/EXHIBITION AREA



## Thursday, 26 May 2022

### Keynote Session: Keynote Lectures II

09:00–10:30

FORUM HALL

Chair: Jan Vitek, *Czech Republic*,  
Martina Eliášová, *Czech Republic*

09:00

**UHPFRC is ready to revolutionize existing and new structures** [page 67](#)

Eugen Brühwiler, *Switzerland*

09:45

**Extrapolation of test data in time, size and risk – a challenge for concrete design codes** [page 54](#)

Zdeněk P. Bažant, *USA*

### Coffee Break

10:30–11:00

FOYER/EXHIBITION AREA

### Scientific Session: Landmark Bridges

11:00–12:30

FORUM HALL

Chair: Rasmus Rempling, *Sweden*,  
Jakub Dolejš, *Czech Republic*

11:00

**Pelješac Bridge – design and construction** [page 670](#)

Marjan Pipenbahr, *Slovenia*

11:15

**New Pumarejo bridge over Magdalena river** [page 678](#)

Miguel Ortega, *Spain*

11:30

**The Design of the new Storstrom Bridge: design philosophy, structural concepts, fundamental design and innovative Construction Methods** [page 686](#)

Mario de Miranda, *Italy*

11:45

**Process and methods for verification of performance requirements for transport infrastructure** [page 694](#)

Rasmus Rempling, *Sweden*

12:00

**The New Little Belt Bridge – the role of the physical model and its digital twin for the first suspension bridge in Denmark** [page 702](#)

Baris Wenzel, *Germany*

12:15

**Discussion**



## Special Session: Bridge Management System and Building Information Modelling: Challenges and vision 1

11:00–12:30

### NORTH HALL

**Chairs:** Vanja Samec, *Austria*,  
Rade Hajdin, *Switzerland*

11:00

**BIM and BMS: current status and challenges** [page 710](#)

Rade Hajdin, *Switzerland*

11:15

**From data to bridge information model** [page 716](#)

Eetu Partala, *Finland*

11:30

**Geometry as a common ground for BMS and BIM** [page 720](#)

Dušan Isailović, *Serbia*

11:45

**Creating digital twins of existing bridges through AI-based methods** [page 727](#)

M. Saeed Mafipour, *Germany*

12:00

**Bridge Condition Assessment Based on Image Data and Digital Twins** [page 735](#)

Marcel Helmrich, *Germany*

12:15

**Discussion**

## Scientific Session: Advanced Modelling I

11:00–12:30

### TERRACE 2 A

**Chair:** Wolfgang Bachofner, *Austria*,  
Jörg-Martin Hohberg, *Switzerland*

11:00

**Long-term concrete strain measurements of large-scale experiments exposed to environmental effects** [page 743](#)

Wolfgang Bachofner, *Austria*

11:15

**Strength assessment of prestressed concrete sections under the combined action of internal forces** [page 750](#)

Filip Svoboda, *Czech Republic*

11:30

**Analysis of Machine Learning for Detect Concrete Crack Depths Using Infrared Thermography Technique** [page 758](#)

Arum Jang, *Republic of Korea, Republic of Korea*

11:45

**Rehabilitation of Earth Retaining Wall for Slope Failure due to Strength Reduction and Seismic Accelleration, Considering Nonlinear Soil-Structure Interaction** [page 766](#)

Jörg-Martin Hohberg, *Switzerland*



12:00 **Modelling rebar-concrete interaction, (bond) with a mesh-objective equivalent transition layer scheme for FE analysis of RC structures** [page 774](#)  
Hongning Ye, *United Kingdom*

12:15 **Discussion**

## Scientific Session: Fatigue II

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11:00–12:30

TERRACE 2 B

Chair: Atte Mikkonen, *Finland*,  
Dana Procházková, *Czech Republic*

11:00 **Study on the Improvement of Fatigue Durability of Steel Box Girder Corner Plate by Peening at the Un-welded Area** [page 783](#)  
Takamitsu Nishishiba, *Japan*

11:15 **Cracking and Fatigue in Heavy Loaded Prestressed Concrete Bridge in Sweden** [page 792](#)  
Jaime Gonzalez-Libreros, *Sweden*

11:30 **Experimental investigations of welding induced temperature gradients and distortions in a segment of OSD** [page 800](#)  
Arvid Maarleveld, *Netherlands*

11:45 **Behavior of Othotropic Steel-UHPC Composite Bridge Deck under Cyclic Loading** [page 810](#)  
Zhanchong Shi, *China*

12:00 **Verification of fatigue load model for stay cables** [page 820](#)  
Atte Mikkonen, *Finland*

12:15 **Discussion**

## Scientific Session: Strengthening of Bridges I

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11:00–12:30

SOUTH HALL 2 B

Chairs: Paul Herrmann, *Austria*,  
Dimitra Achilopoulou, *Greece*

11:00 **Refurbishment, Strengthening and Retrofitting of Façades to increase Seismic Resistances** [page 829](#)  
Matthias Roik, *Germany*

11:15 **Strengthening of road composite bridge using Fe-SMA** [page 837](#)  
Jakub Vůjtěch, *Czech Republic*



- 11:30      **Refurbishment of Franzensbrücke in Vienna- retrofitting a historical steel arch bridge with composite plate in between limited time frame, restrictive urban environment and challenging structural requirements** [page 845](#)  
Paul Herrmann, *Austria*
- 11:45      **Efficiency of adhesive layers in strengthening schemes or concrete elements** [page 853](#)  
Dimitra Achilopoulou, *Greece*
- 12:00      **Influence of Material Stiffness on Bond Behaviour for CFRP and BFRP Strips Glued to Concrete Surface** [page 860](#)  
Szymon Grzesiak, *Germany*
- 12:15      **Discussion**
- Lunch**
- 
- 12:30–14:00      FOYER/EXHIBITION AREA
- Scientific Session: Assessment of Existing Bridges I**
- 
- 14:00–15:30      FORUM HALL  
Chair: Miguel Ortega, *Spain*,  
Ioannis Retzepis, *Germany*
- 14:00      **The assessment and condition survey of concrete prestressed bridges in the Czech railway network** [page 868](#)  
Pavel Ryjáček, *Czech Republic*
- 14:15      **Evaluation Methods for the Existing Infrastructure in Germany** [page 876](#)  
Ioannis Retzepis, *Germany*
- 14:30      **Condition assessment of the steel riveted roof structure of heritage value building in Sofia, Bulgaria** [page 884](#)  
Dimitar Dakov, *Bulgaria*
- 14:45      **Assessment and retrofitting of existing infrastructures in urban area** [page 889](#)  
Theodoros Tzaveas, *Qatar*
- 15:00      **Equilibrium verification of a steel bridge based on wind tunnel testing, traffic and wind speed probabilistic model** [page 897](#)  
Jan Žitný, *Czech Republic*
- 15:15      **Discussion**



## Special Session: Bridge Management System and Building Information Modelling: Challenges and Vision 2

14:00–15:30

### NORTH HALL

Chair: Vanja Samec, *Austria*,  
José Matos, *Portugal*

14:00

**Enhancement in Indian Bridge Management System (IBMS) using analytics within BIM data model** [page 903](#)

Sachidanand Joshi, *India*

14:15

**Information is for Life not just for BIM Models** [page 911](#)

Philip Jackson, *United Kingdom*

14:30

**BMS and BIM: the Portuguese scenario** [page 920](#)

José Matos, *Portugal*

14:45

**Transportation Infrastructure Mega Project in China Upgrading the 4<sup>th</sup> Ring Transportation Corridor in Zhengzhou, Henan, China** [page 928](#)

Gernot Komar, *USA*

15:00

**Correlation between early- and later-age performance indices of early frost-damaged concrete** [page 934](#)

Liu Dongyun, *Sweden*

15:15

**Discussion**

## Special Session: Membrane Structures – Recent Achievements in Practice and Standardization

14:00–15:30

### TERRACE 2 A

Chair: Jörg Uhlemann, *Germany*,  
Vipul Surana, *India*

14:00

**Design-driven Uniaxial and Biaxial Tensile Testing of Knitted Fabrics Applied to Construction** [page 942](#)

Alara Kutlu, *Italy*

14:15

**European harmonized design for membrane structures** [page 956](#)

Jörg Uhlemann, *Germany*

14:30

**Developing weathering induced ageing strength modification factors for PVC-coated polyethylene terephthalate fabrics** [page 963](#)

Hastia Asadi, *Germany*



- 14:45 **Comparison of Stainless Steel with HYSD Rebars** [page 970](#)  
Vipul Surana, *India*
- 15:00 **FC Cincinnati, TQL Stadium featuring an elegant, efficient roof over a complex seating arrangement and a structural façade supporting state-of-the-art dynamic lighting technology was built to a fast-track schedule** [page 976](#)  
Joe Darcy, *United Kingdom*
- 15:15 **Discussion**

## Scientific Session: New Bridge Solutions

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14:00–15:30

### TERRACE 2 B

Chair: Niklas Schweer, *Germany*,  
Riccardo Zanon, *Luxembourg*

- 14:00 **Design and construction of the Second Hinterrhein Bridge** [page 984](#)  
Andreas Galmarini, *Switzerland*
- 14:15 **Effects of Truck Platooning on Highway Bridges** [page 992](#)  
Marian Ralbovsky, *Austria*
- 14:30 **Design and structural behavior analysis of a balanced cantilever bridge with a below suspended bicycle and pedestrian bridge** [page 1000](#)  
Niklas Schweer, *Germany*
- 14:45 **Building bridges from thin-walled pre-cast elements** [page 1008](#)  
Franz Untermarzonner, *Austria*
- 15:00 **Integral VFT-RS composite bridges – Efficient standard highway overpasses** [page 1013](#)  
Riccardo Zanon, *Luxembourg*
- 15:15 **Discussion**

## Scientific Session: Footbridges

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14:00–15:30

### SOUTH HALL 2 B

Chair: Vojtěch Kolínský, *Czech Republic*,  
Pablo Tarín, *Spain*

- 14:00 **New Prague footbridge connecting the districts of Holešovice and Karlín** [page 1021](#)  
Petr Tej, *Czech Republic*



- 14:15 **Neby Bru: one footpath, three ways of sustainability** [page 1025](#)  
Pablo Tarín, *Spain*
- 14:30 **Analysis of the Florida University Pedestrian Bridge Collapse** [page 1033](#)  
Vojtěch Kolínský, *Czech Republic*
- 14:45 **Bru over Otra, a new footbridge in Kristiansand (Norway)** [page 1039](#)  
Birger Opgård, *Norway*
- 15:00 **Pedestrian bridge over the River Elbe in Hradec Králové** [page 1047](#)  
Jiří Keclík, *Czech Republic*
- 15:15 **Discussion**

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## Coffee Break

15:30–16:00 FOYER/EXHIBITION AREA

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## Scientific Session: Architecture and Structures

- 16:00–17:30 FORUM HALL
- Chair: Petr Tej, *Czech Republic*,  
Elif Ünalán, *Kuwait*
- 16:00 **Above Or Below – This Is The Question** [page 1053](#)  
Cezary Bednarski, *United Kingdom*
- 16:15 **1 Triton Square – Structural reuse for low-carbon architecture** [page 1063](#)  
Eric Sturel, *United Kingdom*
- 16:30 **Education City Stadium, Doha, Qatar** [page 1071](#)  
Johanna Isaksson, *United Kingdom*
- 16:45 **3D scanning applications in structural design** [page 1079](#)  
Zsolt Nagy, *Romania*
- 17:00 **Challenges of a Bridge Design in Tight Urban Areas** [page 1087](#)  
Elif Ünalán, *Kuwait*
- 17:15 **Discussion**



## Scientific Session: Assessment of Existing Bridges II

16:00–17:30

### NORTH HALL

Chair: Jaroslav Odrobiňák, *Slovakia*,  
Jaime Gonzalez-Libreros, *Sweden*

16:00

#### Stochastic degradation model analysis for prestressed concrete bridges

[page 1092](#)

José Matos, *Portugal*

16:15

#### Through constructions on arched bridges [page 1100](#)

Conrad Pelka, *Germany*

16:30

#### Torsion of a Norwegian bridge with partial box-action – a case study [page 1108](#)

Victor Vestman, *Sweden*

16:45

#### Evaluation of Riveted Railway Bridge Using Experimental-Numerical Analyses

[page 1115](#)

Jaroslav Odrobiňák, *Slovakia*

17:00

#### Assessment of available methodologies to evaluate residual prestressing forces in concrete bridges [page 1123](#)

Angélica María Agredo, *Sweden*

17:15

### Discussion

## Scientific Session: Bolts and Anchors

16:00–17:30

### TERRACE 2 A

Chair: František Wald, *Czech Republic*,  
Ulrike Kuhlmann, *Germany*

16:00

#### Quasi-static load bearing behaviour of hybrid grouted joints [page 1132](#)

Jakob Boretzki, *Germany*

16:15

#### Proposal of Ultrasonic Bolt Axial Force Evaluation Method Using Machine Learning and Signal Processing [page 1140](#)

Kensho Hirao, *Japan*

16:30

#### Advancement of Eddy Current Based Evaluation of Axial Force of High-Strength Bolts [page 1148](#)

Ayako Akutsu, *Japan*

16:45

#### Durability of Rock and Soil Anchor Kits Using Prestressing Steel Strands

[page 1156](#)

Xiaomeng Wang, *Switzerland*



17:00 **Improvement of high slip coefficient of the combined joint using adhesive and high strength frictional bolts** [page 1164](#)

Sae Fukutsuji, *Japan*

17:15 **Discussion**

## Scientific Session: Damage Repair and Retrofitting II

16:00–17:30

TERRACE 2 B

Chairs: Rudolf Aroch, *Slovakia*,  
Pavel Ryjáček, *Czech Republic*

16:00 **Rehabilitation and Strengthening of Bridges over Boa Vista River** [page 1172](#)

Marcelo Melo Filho, *Brazil*

16:15 **Potential of memory steel reinforcement for shear strengthening of concrete bridge girders with I-sections** [page 1180](#)

Muhammad Arslan Yaqub, *Belgium*

16:30 **Repair effect of externally bonded CFRP on propagation life of fatigue cracks initiated at in-plane welded gusset joints** [page 1188](#)

Atsushi Matano, *Japan*

16:45 **Temperatures during weld repair in orthotropic steel decks** [page 1196](#)

Rudolf Aroch, *Slovakia*

17:00 **Influence of anchor length and drilled hole on mechanical behaviour of masonry column structures strengthened with bonded anchor** [page 1204](#)

Daisuke Sasaki, *Japan*

17:15 **Discussion**

## Scientific Session: Innovative Materials and Solutions

16:00–17:30

SOUTH HALL 2 B

Chairs: Mario Rando Campos, *Norway*,  
Cosmin Chiorean, *Romania*

16:00 **Fly ash Based Banana Fiber-reinforced Geopolymer Mortar** [page 1212](#)

Vincent Pilien, *Philippines*

16:15 **Mechanical performance of Alkali Treated Kawayan Tinik Bamboo Fiber Textile** [page 1220](#)

Roneh Glenn Libre Jr., *Philippines*



- 16:30 **SporX – Design and construction of a ten-storey timber building in Drammen, Norway** [page 1226](#)  
Mario Rando Campos, *Norway*
- 16:45 **Control of fatigue in hydraulic steel structures** [page 1234](#)  
Ryszard Daniel, *Netherlands*
- 17:00 **Analysis and Design of Link Slab in Steel-Concrete Composite Bridge** [page 1242](#)  
Liang Xiao, *China*
- 17:15 **Discussion**

## Friday, 27 May 2022

### Keynote Session: Keynote Lectures III

09:00–10:30

#### FORUM HALL

**Chairs:** Birger Opgård, *Norway*,  
Michal Jandera, *Czech Republic*

09:00

#### **The bridges in Italy: how to manage the infrastructural heritage guaranteeing safety and sustainability**

Marco Di Prisco, *Italy*

09:45

#### **Steel structure design assisted by finite element analysis**

László Dunai, *Hungary*

### Coffee Break

10:30–11:00

#### FOYER/EXHIBITION AREA

### Scientific Session: Large Bridges

11:00–12:30

#### FORUM HALL

**Chair:** Bartłomiej Halaczek, *United Kingdom*,  
Jose Luis Sanchez Jimenez, *Spain*

11:00

#### **Braila Suspension Bridge: Construction Methodology of the Pylons** [page 1251](#)

Oguz Berber, *Romania*

11:15

#### **The new City Bridge in Drammen, Norway: Designing a new urban landmark for an extreme environment** [page 1257](#)

Bartłomiej Halaczek, *United Kingdom*



- 11:30      **Reconstruction of the Vilemov Viaduct on the railway line Rumburk-Sebnitz**  
[page 1265](#)  
Marek Rusňák, *Czech Republic*
- 11:45      **The new City Bridge of Drammen: An structural insight** [page 1270](#)  
Birger Opgård, *Norway*
- 12:00      **Quisi Bridge: a new route for the railway line in Alicante, Spain** [page 1278](#)  
Manuel Sánchez-Solís, *Spain*
- 12:15      **Discussion**

## **Special Session: New European Standardisation on Monitoring, Safety Assessment and Bridge Maintenance**

11:00–12:30

### **NORTH HALL**

**Chair: Diego Lorenzo Allaix, *Netherlands*,  
Maria Pina Limongelli, *Italy***

- 11:00      **Standardization of structural performance monitoring: existing documents and open questions** [page 1285](#)  
Maria Pina Limongelli, *Italy*
- 11:15      **Review of surveying and non-destructive techniques for the condition assessment of in-service bridges** [page 1292](#)  
Ana Sánchez Rodríguez, *Spain*
- 11:30      **Numerical model updating of an ageing bridge based on multidisciplinary experimental campaign** [page 1300](#)  
Brais Barros González, *Spain*
- 11:45      **Review of the current state of standardisation on monitoring, data-informed safety assessment and decision-making regarding maintenance of the transport infrastructure** [page 1309](#)  
Diego Lorenzo Allaix, *Netherlands*
- 12:00      **Future perspectives of standardisation for a safe European transport infrastructure** [page 1314](#)  
Diego Lorenzo Allaix, *Netherlands*
- 12:15      **Discussion**



## Scientific Session: Advanced Modelling II

11:00–12:30

TERRACE 2 A

**Chairs:** Richard Stroetmann, *Germany*,  
Martina Eliášová, *Czech Republic*

11:00

**Advanced modeling of concrete bridges** [page 1321](#)

Jiří Rymeš, *Czech Republic*

11:15

**New beam element for horizontally curved steel-concrete composite box girder bridges** [page 1329](#)

Iván Campo-Rumoso, *Spain*

11:30

**Toward crack-based assessment of shear-distressed reinforced concrete infrastructure** [page 1337](#)

Jarrod Zaborac, *USA*

11:45

**Design for Manufacturing and Assembly-Oriented Parametric Modelling of Prefabricated Bridges** [page 1345](#)

Cuong Nguyen, *Republic of Korea*

12:00

**Discussion**

## Scientific Session: Infrastructure Design

11:00–12:30

TERRACE 2 B

**Chair:** Michele W.T. Mak, *United Kingdom*,  
Michal Jandera, *Czech Republic*

11:00

**New reinforcement concept for radial joints of precast tunnel segments** [page 1352](#)

Clemens Proksch-Weilguni, *Austria*

11:15

**Influence of large-scale asperities on the stability of concrete dams** [page 1358](#)

Adrian Ulfberg, *Sweden*

11:30

**Assessment of scour risk in hydraulic infrastructures. A bridge case study** [page 1366](#)

Ana Margarida Bento, *Portugal*

11:45

**Shear design in concrete beams without transverse reinforcement – A comparative study** [page 1374](#)

Michele W.T. Mak, *United Kingdom*



12:00 **Fatigue-resistant design of modular bridge structures made of precast concrete elements** [page 1382](#)

David Schaarschmidt, *Germany*

12:15 **Discussion**

## **Special Session: Design Assisted by Finite Element Analysis**

11:00–12:30

**SOUTH HALL 2 B**

**Chair: László Dunai, *Hungary*,  
Mohammad Ashour, *Kuwait***

11:00 **Finite element analysis of wind turbine tower with a tapered cross-section using various finite element models** [page 1390](#)

Mohammad Ashour, *Kuwait*

11:15 **Application of ABAQUS secondary development in finite element analysis of rebar behavior in reinforced concrete member** [page 1396](#)

Wang Yang, *China*

11:30 **Evaluation of Prestressed Reinforced Concrete Slab Punching Shear Using Finite Element Method** [page 1404](#)

Zhi Zhang, *USA*

11:45 **Numerical Investigation of Slab-Column Connections with Various Reinforcement Ratios** [page 1410](#)

Hadi Panahi, *Canada*

12:00 **Nonlinear analysis of reinforced concrete structural elements** [page 1419](#)

Ananth Ramaswamy, *India*

12:15 **Discussion**



## Lunch

12:30–14:00

FOYER/EXHIBITION AREA

## Scientific Session: Dynamic Analysis of Bridges

14:00–15:30

FORUM HALL

**Chairs:** Martin Svendsen, *Denmark*,  
Antonia M. Kohl, *Germany*

14:00

**Advanced analysis of a pedestrian bridge and considerations on crowd-structure interaction** [page 1427](#)

Antonio De Luca, *USA*

14:15

**The New Storstrøm Bridge – Nonlinear Dynamic Ship Impacts** [page 1435](#)

Martin Svendsen, *Denmark*

14:30

**Vehicle-bridge interaction: Influence of the train type on the dynamic response of bridges due to a train crossing** [page 1444](#)

Antonia M. Kohl, *Germany*

14:45

**Effect of skew wind on curved long-span floating bridges** [page 1452](#)

Pål Grøthe Sandnes, *Norway*

15:00

**Approach for the mathematical calculation of the damping factor of railway bridges with ballasted track** [page 1460](#)

Andreas Stollwitzer, *Austria*

15:15

**Discussion**

## Scientific Session: Composite and Non-steel Materials – Structures and Bridges

14:00–15:30

NORTH HALL

**Chair:** Martina Eliášová, *Czech Republic*,  
Nora Susanne Bies, *Germany*

14:00

**Stability and Resistance of Hybrid Composite Glass Structures under Seismic and Temperature Loads** [page 1487](#)

Nikoleta Stamataki, *Greece*

14:15

**Kagraner Steg – new GFRP pedestrian bridge in Vienna** [page 1468](#)

Stoyan Ivanov, *Bulgaria*



- 14:30      **Tensile strength of the bent portion of GFRP rebars** [page 1476](#)  
Nora Susanne Bies, *Germany*
- 14:45      **Tests of glass banister panels with embedded laminated connections** [page 1482](#)  
Michaela Zdražilová, *Czech Republic*
- 15:00      **Adhesive two-part acrylate steel-glass and aluminium-glass connection – influence of temperature and thickness of adhesive layer** [page 1495](#)  
Markéta Zikmundová, *Czech Republic*
- 15:15      **Discussion**

## Scientific Session: Challenging Bridges

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14:00–15:30

### TERRACE 2 A

Chair: Miguel Ortega, *Spain*,  
Oguz Berber, *Romania*

- 14:00      **Balanced cantilever bridge, 125 m maximum span, in a high risk seismic area, at Wiwili, Nicaragua** [page 1503](#)  
Jose Luis Sanchez Jimenez, *Spain*
- 14:15      **Evaluation of a Non-Prismatic Open Cross-Section Arch for the Toronto Port Lands Bridges** [page 1511](#)  
Jonathan Werner, *Canada*
- 14:30      **Functionality, aesthetics and structural efficiency integrated into the design for an outstanding bridge on the access to the new T4 Terminal at Barajas Airport (Madrid)** [page 1519](#)  
Miguel Ortega, *Spain*
- 14:45      **D4R7. New Danube Crossing at Bratislava** [page 1527](#)  
Luis Martin-Tereso, *Spain*
- 15:00      **Addressing design and construction challenges for a complex elevated interchange over the sea** [page 1535](#)  
Michael Tapley, *Hong Kong*
- 15:15      **Discussion**



## Scientific Session: Seismic Design

14:00–15:30

TERRACE 2 B

**Chairs:** Peter Paul Hoogendoorn, *Spain*,  
Katrina Mae Montes, *Japan*

14:00

**Nonlinear soil–structure interaction analysis of retaining walls subjected to pulse-like earthquakes** [page 1543](#)

Andrea Cruz-Chamorro, *Puerto Rico*

14:15

**Nonlinear Behavior Identification of HDR Bearing using Neural Network for Seismic Structural Design** [page 1551](#)

Katrina Mae Montes, *Japan*

14:30

**Wind and seismic design of steel preheater towers in cement plants. Adjusting ductility capacity to ductility demand for non-seismic design** [page 1559](#)

Peter Paul Hoogendoorn, *Spain*

14:45

**A Hysteretic Model of Compressive and Tensile Behavior for Laminated Rubber Bearings** [page 1567](#)

Seita Komori, *Japan*

15:00

**A thermo-mechanical coupled model of hysteresis behavior of HDR bearings** [page 1574](#)

Yuqing Tan, *Japan*

15:15

**Discussion**

## Scientific Session: Dynamics of Structures

14:00–15:30

SOUTH HALL 2 B

**Chairs:** Lara Bettinelli, *Austria*,  
Marco Martino Rosso, *Italy*

14:00

**Alternative approach for additional damping in dynamic calculations of railway bridges under high-speed traffic** [page 1582](#)

Lara Bettinelli, *Austria*

14:15

**Dynamic Analysis and Innovative Design of a Kilometer Long Highway Bridge under Extreme Landslide Generated Wave Loadings** [page 1590](#)

Jianping Jiang, *Canada*

14:30

**Vibration response due to group movements on a footbridge** [page 1598](#)

Mehdi Setareh, *USA*



14:45      **Prediction of the floor vibration response due to walking excitation** [page 1604](#)  
Mehdi Setareh, *USA*

15:00      **Indirect estimate of concrete compression strength framework with FE model  
updating and operational modal analysis** [page 1611](#)  
Marco Martino Rosso, *Italy*

15:15      **Discussion**

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## Coffee Break

15:30–16:00      FOYER/EXHIBITION AREA

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## Scientific Session: Advanced Models of Structures and Bridges II

16:00–17:30      FORUM HALL

Chair: Richard Stroetmann, *Germany*,  
Michal Jandera, *Czech Republic*

16:00      **Development of an orthotropic composite slab system for road bridges**  
[page 1619](#)  
Richard Stroetmann, *Germany*

16:15      **Externally prestressed concrete: anchor block 3D yield design** [page 1627](#)  
Agnès Fliscounakis, *France*

16:30      **A kinematics-based model for complete behaviour of RC dapped-end  
connections governed by re-entrant corner cracks** [page 1635](#)  
Chathura Rajapakse, *Belgium*

16:45      **On the use of Volterra series for modelling of nonlinear self-excited forces**  
[page 1643](#)  
Henrik Skyvulstad, *Norway*

17:00      **Discussion**

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## Scientific Session: Design by FEA

16:00–17:30      NORTH HALL

Chair: Paweł Hawryszków, *Poland*,  
František Wald, *Czech Republic*

16:00      **Parametric Study of Existing Concrete Trough Bridges using non-linear Finite  
Element Analysis** [page 1652](#)  
Silvia J. Sarmiento, *Sweden*



- 16:15 **Relating stress concentrations in triangular steel bridge piers to simple beam models** [page 1660](#)  
Philippe Van Bogaert, *Belgium*
- 16:30 **Full-scale Fatigue Simulations for Reinforced Concrete Bridge Slabs with Multi-scale Multi-chemo Physics FEM system** [page 1668](#)  
Yuya Takahashi, *Japan*
- 16:45 **Computational sensitivity analysis for structural model assessment under consideration of the construction stage process** [page 1676](#)  
Martin Fusseder, *Germany*
- 17:00 **Improvements in chloride determination in reinforced concrete structures to find optimal time for remediation** [page 1942](#)  
Fritz Binder, *Austria*
- 17:15 **Discussion**

## Scientific Session: Bridge Details and Solutions

16:00–17:30

### TERRACE 2 A

Chair: Stephan Fasching, *Austria*,  
Vojtěch Stančík, *Czech Republic*

- 16:00 **Horizontal bracing in steel I-girder bridges with composite concrete decks** [page 1684](#)  
Victor Vestman, *Sweden*
- 16:15 **An engineering approach to analyze displacement rate in embedded rail system coupled with bridge** [page 1691](#)  
Vojtěch Stančík, *Czech Republic*
- 16:30 **The role of key structural components such as bearings, expansion joints, dampers and STUs in addressing the challenges faced by railway bridges** [page 1699](#)  
Filip Kostecký, *Czech Republic*
- 16:45 **Semi-precast segmental bridge construction method: Construction of a prototype and shear tests on cross-frames** [page 1707](#)  
Stephan Fasching, *Austria*
- 17:00 **Improvements in chloride determination in reinforced concrete structures to find optimal time for remediation** [page 1942](#)  
Fritz Binder, *Austria*
- 17:15 **Discussion**



## Scientific Session: Modern Methods of Design and Models

16:00–17:30

TERRACE 2 B

Chair: Cosmin Chiorean, *Romania*,  
Bidhan Chandra Roy, *India*

16:00

**Ultimate and Nominal Strength Capacity Evaluation of Composite Sections with Arbitrary Shapes at Elevated Temperatures** [page 1715](#)

Cosmin Chiorean, *Romania*

16:15

**Cost and process optimization of precast segmental bridges in Israel** [page 1723](#)

Jindrich Potucek, *Czech Republic*

16:30

**Historic Building Information Modeling for Conservation and Management: A case for using HBIM for Heritage Conservation as part of Urban Infrastructure** [page 1730](#)

Bidhan Chandra Roy, *India*

16:45

**Discussion**

## Scientific Session: Bridges and Bridge Modelling

16:00–17:30

SOUTH HALL 2 B

Chairs: Francesco Presta, *United Arab Emirates*,  
Xavier Gamme, *Belgium*

16:00

**Design of a flyover for the SAAR Interchange in Bahrain** [page 1738](#)

Francesco Presta, *United Arab Emirates*

16:15

**Load Sharing System Performance considering Each Member contribution for Plate Girder Bridges with Corrosion Damages** [page 1747](#)

Ryoga Oura, *Japan*

16:30

**Design and behavior analysis of a long free expansion length, multi-span, V-shaped pier supported bridge** [page 1755](#)

Xavier Gamme, *Belgium*

16:45

**Loss of cable – design criteria for cable stayed bridges** [page 1763](#)

Atte Mikkonen, *Finland*

17:00

**New developments in the design of Z-shaped steel sheet pile walls** [page 1772](#)

Alexander Enders, *Germany*

17:15

**Practical Guidance for Design of Steel Truss Footbridges** [page 1780](#)

Abhijith Raghuraj Nair, *India*



17:30

**Discussion**

## **Plenary Session: Closing Ceremony**

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17:45–18:15

FORUM HALL

17:45 – 17:55

**Summary and Outcome of Congress – lessons learnt**

František Wald

17:55 – 18:05

**Awards to Young Engineers Awards**

18:05 – 18:15

**Closing Remarks of the IABSE President and Invitation to Future Conferences**

Yaojun Ge

18:15 – 18:25

**Presentations of next two IABSE Conferences  
(Nanjing 2022, New Delhi 2022)**

18:25 – 18:30

**Closing Remarks of the OC Chair**

Pavel Ryjáček



# Scientific and Organising Committee

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