International Association for Bridge and Structural Engineering

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Program

# IABSE Workshop

# Safety, Robustness and Condition Assessments of Structures

**11-12 February 2015**

**Helsinki, Finland**

ril

Finnish Association of Civil Engineers

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# Organizers

**Finnish Group of IABSE**

**Finnish Association of Civil Engineers RIL**

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Imperial College London

**Mr. Predrag Popovic**
Wiss, Janney, Elstener Associates, Inc., USA

**Prof. Thomas Vogel**
ETH Zurich, Switzerland

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# Introduction and welcome

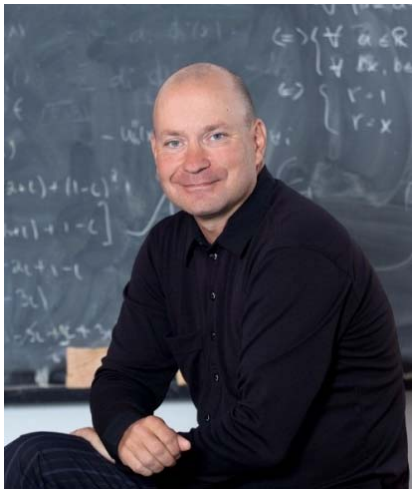
IABSE Workshop “Safety, Robustness and Condition Assessments of Structures” focuses to the recent developments of making structures safer for unexpected, unforeseen, accidental and extreme events.

Although the principles and definitions of robustness have recently become more recognized, and concerns of progressive collapse are heightened, design approaches have remained descriptive and largely unaltered since the 1970’s. These need to be developed further to give engineers and structure owners tools to put the principles in practice - in the extend most suitable for the particular project.

Recent emerging issue appears to be the lack of assessment codes for existing structures in most countries. Old structures are today widely assessed by applying design codes prepared for the new structures, e.g., using their load and resistance partial safety factors. This is despite that modern technologies allow precise measurements of the key structural assessment parameters; to reduce uncertainties, which are appropriate to assume for new structures. This links the condition assessment and structural monitoring into this context. Generally speaking - data is available from the structures, and more could be produced by measurements. How it could be used in assessments with proper code base, which all parties can commonly accept. And if it is used, the logical question is then what are the minimum requirements for it and how to deal with uncertainties of data itself?

The above remarks invoke from the discussions of the IABSE workshop “Safety, Failures and Robustness of Large Structures” Helsinki 2013 and the Nordic IABSE Summit Helsinki-Tallinn 2014. Organized by the same team and for the same format the present workshop is continuation of these discussions. At the days of the 2013 workshop, a roof collapse occurred in Finland with one fatality. This got wide news coverage implying also political pressure to study actions to improve safety. One of those was an obligatory periodic inspection certification of long-span structures. Soon, another collapse happened: in this case a mid-aged concrete water reservoir, whose pre-stress steel got stress-corrosion fracture. The structure could be well characterised as non-robust; and the visual inspection, conducted only weeks before, hadn’t any change to identify the risk. Individual experts claimed later on that this vulnerability of the used steel quality was known. Notably risks are involved in how information flows between people and organisations. Can safety-critical information any longer be detected from the vast information flow? A survey revealed dozens of alike susceptive structures in Finland. These are recent examples from Finland, and many could be probably found in other countries. Design for robustness of new structures and improvement of condition assessment routines of existing structures, together with assessment code development, are important branches for enhancing safety. The latter mentioned is also important to avoid unnecessary replacement of old structures, or at least, to give owner opt for replacement and retaining.

We are particularly happy to invite the old and new participants to the workshop in Helsinki!



Prof., Dr. Risto Kiviluoma
Chair of the Finnish Group of IABSE

Ms. Helena Soimakallio
Managing Director, Finnish Association of Civil Engineers

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# Purpose of the workshop

The workshop theme is **“Safety, Robustness and Condition Assessment Structures”**. Workshop focuses on structures that can cause notable safety concerns like buildings, bridges, viaducts, power plants, dams, harbour structures, stadiums, sport halls, public areas, malls and large urban developments, i.e., structures whose failure may cause the most significant consequences in the terms of fatalities, injuries and economic losses; and to whom condition assessment is routinely used. The Workshop also addresses the question of creating assessment codes for existing structures and the role of condition-assessment data in them. Most relevant topics for the workshop include

- assessment codes and guidelines for existing structures
- validation of probabilistic design methods
- newest developments in non-destructive testing and structural monitoring
- risk handling for hazards and extreme events
- fire
- progressive collapse, redundancy and alternate load paths
- human-made hazards
- forensic engineering of structures.

The purpose of the workshop is to provide a meeting point and discussion forum to any professional interested in the theme. The theme is the continuation of the IABSE Workshop “Safety, Failures and Robustness of Large Structures” Helsinki 2013; and its targets were formulated at the discussions of the Nordic IABSE Summit Helsinki-Tallinn 2014.

Keynote speakers are invited as multidisciplinary bases and aim to present the best skills and experience on their field. This gives the participants a possibility to learn new ideas and best practices. The workshop includes five open call-for-papers sessions, in which experts will publish their scientific contribution to the theme. The abstracts and papers have been revived by the International Scientific Committee of the Workshop. Accepted papers will be published in the proceedings.

The workshop includes general closing discussions where the stage-of-the art can be reviewed. If urged, the organizers on the behalf of workshop participants, can gather statements or recommendations towards IABSE or openly to national structural engineering associations. These may include recommendation for arranging future events or other modes of collaboration on specific topics.

# Scientific program

Scientific program consists on invited key-note lectures and an open call-for paper sessions. Intension is that the presentations serve as starting points of discussions, and all workshop participants are welcomed to bring their own contribution and observations to the topic. Moderators of each session will guide the discussions. At the end of the both workshop days, panel discussions are arranged and time is reserved for common discussions.

| | TUESDAY<br>February 10, 2015 | WEDNESDAY<br>February 11, 2015 | THURSDAY<br>February 12, 2015 | |
|---|---|---|---|---|
| 8.00 | | ***Breakfast served*** | | |
| 9.00 | | ***OPENING SESSION***<br>***Chair: Risto Kiviluoma***<br>***Opening words: Risto Kiviluoma and Helena Soimakallio*** | ***SESSION 4 "Safety"***<br>***Moderator: Eugen Brühwiler*** | |
| 9.15 | | ***Keynote 1*** *: History, Causes and Consequences of Bridge Collapses in USA.* Predrag Popovic, USA | ***Keynote 4*** *: Structural Robustness - Risk Management and Codes.*<br>Michael Havbro Faber, Denmark | |
| 9.30 | | | *Modelling The Spatial-temporal Progression Of Corrosion With Special Emphasis On Its Influence On Structural Reliability*<br>Hackl, J. Switzerland | |
| 9.45 | | ***Keynote 2*** *: Making Robustness an Integral Part of Structural Design.* David A. Nethercot, UK | *The Effects Of Damages On The Partial Safety Factor For Parallel Wire Cables.*<br>Baravalle, M., Norway | |
| 10.15 | | ***Coffee at 10.15-10.30*** | | |
| | | ***SESSION 1 "Robustness 1"***<br>***Moderator: Joan Casas*** | ***SESSION 5 A "Robustness 2"***<br>***Moderator: Michael Havbro Faber*** | ***SESSION 5 B "Condition Assessment 1"***<br>***Moderator: Ayaho Miyamoto*** |
| 10.30 | | *Detailing For Robustness Of Concrete Structures*<br>Kaiser, T., Norway | *Alternate Path Sensitivity Analysis Of Reinforced Concrete Frames Using First-Order Second-Moment Method*<br>Arshian, A.H. Germany | *Statistical Analysis And Long-Term Operational Monitoring Of Sutong Bridge.*<br>Khan, I.U., China |
| 10.45 | | *Robust Impact Design Of Steel And Composite Buildings*<br>Hoffmann, N., Germany | *Tensile Membrane Action In RC Slabs: A Parametric Study*<br>Botte, W., Belgium | *Health Monitoring Of Rubber Bearing By Using Acoustic Emission Test*<br>Kawasaki, Y. Japan |
| 11.00 | | *Robust Impact Design Of Steel And Composite Buildings: The Alternate Load Path Approach*<br>Zandonini, R., Italy | *Design of an LNG Tank for Accidental Loads In Finland*<br>Martínez, F. Spain | *Seismic Fragility Of Continuous Rigid Frame Bridge With Unequal Pier Height.*<br>Dong, J., China |
| 11.15 | | *Robust Impact Design Of Steel And Composite Buildings: Advances In The Residual Strength Method*<br>Korndörfer, J. Germany | *Increasing The Robustness Of Bayesian Analysis.*<br>Marsili, F. ,Italy | *Dangers Of Lot Line Retrofits And Construction.*<br>Valderruten L, USA |
| 11.30 | | *Analytical Procedure To Derive P-I Diagram Of A Beam Under Explosion*<br>Hamra, L., Belgium | *The Target Reliability Of The Eurocodes*<br>Poutanen, T., Finland | *Experimental Study On Impact Force Factor During Sudden Cable Loss In Cable-Stayed Bridges.*<br>Hoang, V., Japan |
| 11.45 | | *Energy-based Method For Sudden Column Failure Scenarios: Theoretical, Numerical And Experimental* Analysis.<br>Herraiz, B., Switzerland | *A Geometrical Approach To Evaluating Constitutive Elements Of Structural Robustness .*<br>Zastavni D., Belgium | *Evaluation Of Vehicular Induced Displacement By Using Wavelet Transformation From Wireless Acceleration Measurement*<br>Umekawa, Y., Japan |
| 12.00 | | ***Lunch at 12.00-13.00*** | | |
| | | ***SESSION 2 "Extreme events"***<br>***Moderator: Predrag Popovich*** | ***SESSION 6 "Condition Assessment 2"***<br>***Moderator: Risto Kiviluoma*** | |
| 13.00 | | *The Role Of Extreme Wind Events In The Structural Design Of Tall- And Super-tall Buildings*<br>Cammelli, S., UK | ***Keynote 5*** *: Bridge Condition and Safety Based on Measured Vibration Level.*<br>Joan Casas, Spain | |
| 13.15 | | *Offshore Platform Structural Damage Identification Versus Robustness*<br>Rizzo, M., Italy | | |
| 13.30 | | *Resiliency Of Long Span Bridges To Extreme Loads*<br>Astarlioglu, S., USA | *Development And Practical Application Of A Long Term Health Monitoring System For Short And Medium Span Bridges.*<br>Miyamoto, A. Japan. | |
| 13.45 | | *Numerical Analysis Of Charring Of Timber Structures In Natural Fires*<br>Salminen, M. Finland | *Ageing Management Platform For NPP Concrete Structures*<br>Al-Neshawy, F., Finland | |
| 14.00 | | *Study On The Progressive Collapse Of Large Span Truss-beam Structures Induced By Initial Member Break.*<br>Zhao, X, China | *Assessment And Full Scale Failure Test Of A Steel Truss Bridge*<br>Häggström, J. Sweden | |
| 14.15 | | ***Coffee 14.15-14.30*** | ***Coffee at 14.15-14.30*** | |
| 14.30 | | ***SESSION 3 "Codes for Existing Structures"***<br>***Moderator: David A. Nethercot*** | ***CLOSING SESSION*** | |
| | | ***Keynote 3*** *: Swiss Standards for Existing Structures – Four Years of Implementation.*<br>Eugen Brühwiler, Switzerland | ***Panel discussion 2***<br>***Moderator: Risto Kiviluoma***<br>*Panel Discussion of workshop themes, keynote speakers of the workshop and the audience* | |
| 15.00 | | *Short Term Solutions For The Assessment Of The Shear Capacity Of Existing Prestressed Concrete Bridges*<br>Adam, V., Germany | | |
| 15.15 | Check-in to the hotel starting at 14.00 | *Loading To Failure Of A 55 Year Old Prestressed Concrete Bridge*<br>Bagge, N., Sweden | **Bus transportation to the airport and Helsinki City centre at 15.15** | |
| 15.30 | | *Impact Of Material Deterioration On The Strength Of Reinforced Concrete Half-joint Structures*<br>Desnerck, P. UK | | |
| 15.45 | | *The Finnish Assessment Procedure For The Structural Safety Of Existing Buildings*<br>Åström, G., Finland | | |
| 16.00 | | ***Break*** | | |
| 16.15-16.45 | | ***Panel Discussion 1***<br>***Moderator: Risto Kiviluoma***<br>*Panel discussion of day's topics*<br>*Keynote speakers of the day and the audience* | | |
| 18.00 | **Get-together at Gustavelund at 18.00-20.00** | Guided walk to the dinner venue at 18.30 | | |
| 18.30 | | (about 10-15 min) | | |
| 19.00 | | **Dinner at Restaurant Krapihovi at 19.00-22.00** | | |

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# Invited keynote presentations

### *History, Causes and Consequences of Bridge Collapses in USA*

Mr. **Predrag Popovic**, USA

Vice president and Senior Principal Wiss, Janney, Elstener Associates, Inc., Chicago

Pete Popovic is Honorary Member and former President and of IABSE. His fields of expertise are the design, assessment and repairs of bridges and buildings. He has in particular expertise in assessment and repair of concrete structures and of fatigue damage in steel bridges, and exterior facades of high-rise buildings. During the first 10 years of practice, he participated in structural design of major steel bridges and rapid transit systems in Chicago, New York and Atlanta, USA. He was engaged in the design of post-tensioned box girder bridges in Kuwait. Over the last 30 years, he has evaluated and designed repairs for over 1500 structures. Major projects included assessment of steel bridges for fatigue damage, investigation of collapses of bridges and buildings, assessment and design of repairs for exterior facades of high-rise buildings up to 60-stories tall, and assessment and repair of over 100 parking structures. Pete act as vice president and senior principal Wiss, Janney, Elstener Associates, Inc., USA.

### *Making Robustness an Integral Part of Structural Design*

Prof., Dr. **David A. Nethercot**, UK
*President of IABSE*

OBE, FREng, FTSE, Emeritus Professor of Civil Engineering Imperial College London

After 12 years as Head of the Department of Civil and Environmental Engineering at Imperial College London, David Nethercot retired in September 2011. He remains active in technical and professional work as well as being involved with research in his specialist areas of steel and composite construction. He holds a D.Sc. degree, was elected to the Royal Academy of Engineering in 1993, and was awarded the Gold Medal of the Institution of Structural Engineers in 2009. A former president of IStructE, he is the current President of IABSE.

### *Swiss Standards for Existing Structures – Four Years of Implementation*

Prof., Dr. **Eugen Brühwiler**, Switzerland

Professor, Swiss Federal Institute of Technology (EPFL) Lausanne

Eugen Brühwiler's activities as a Professor of Structural Engineering at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland, are motivated by the following principle: "Methods for the examination of existing structures ("Examineering") must be developed with the ultimate goal to limit construction intervention to a strict minimum. If interventions are necessary, their objective is to improve the structure." His activities as researcher, teacher and consultant include existing civil structures, in particular bridges of high cultural value, the fatigue, dynamic and structural behaviour of bridges as well as Ultra-High Performance Fiber Reinforced cement-based Composites for the improvement of structures.

### *Structural Robustness - Risk Management and Codes*

Prof., Dr. **Michael Havbro Faber**

Technical University of Denmark – DTU, Lyngby

Michael Havbro Faber's research is directed on engineering decision making with focus on applied Bayesian decision theory, aspects of sustainability in engineering decision making, life safety, management of catastrophic risks, risk assessment, Bayesian uncertainty modelling, structural reliability and risk based assessment and maintenance. He has an extensive practical experience in the development and implementation of theories and methods of statistics and probabilistic structural analysis for the purpose of load analysis, structural design, disaster risk management, assessment of existing structures and risk based inspection and maintenance planning. A significant part of his practical experience originates in projects concerning bridges, cable structures, offshore installations, ships and aeronautical structures.

### *Bridge Condition and Safety Based on Measured Vibration Level*

Prof., Dr. **Joan Casas**, Spain

Professor, Technical University of Catalonia in Barcelona

Main fields of expertise of Joan Casas are bridge safety and reliability, maintenance and strengthening. Besides his participation in bridge design and construction, Professor Casas has participated in more than 100 consulting and advising works related to bridge safety, maintenance and management and in several European Projects related to safety and robustness of existing bridges and structures. He holds the Bill Curtin Medal 1998, awarded by the Institution of Civil Engineers of United Kingdom to the best paper presented to the Institution describing innovative design in civil engineering and the 2012 IABMAS Senior Prize in recognition of outstanding contributions to the application of advanced bridge inspection, assessment and monitoring techniques.

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# Publication

Accepted papers will be published in the printed workshop report and in digital format. The report will be available at the beginning of the workshop. The proceedings will be available later on for separate purchase through IABSE.

# Social program

Social program of the workshop includes a get-together reception at the venue (on Tuesday evening) and the workshop dinner (on Wednesday evening). The dinner takes place at restaurant Krapihovi, which will be reached by guided walk of about 10-15 min or by taxi.

# Participants

The workshop is intended to engineers, architects, researchers, actuarial mathematicians and officials working with structures. The workshop is also an excellent possibility for young engineers and postgraduate students to get familiar with the theme and the IABSE organisation.

# Registration and fees

Registration can be made via the website **www.ril.fi/iabse2015.**

The registration fee will include participation to the workshop days (incl. lunch and coffee), get-together reception, dinner and the workshop proceedings. There will be three different fee categories:

- regular participation fee
- IABSE and RIL member fee
- young-engineer fee for participants of 35 years or younger (born 1985 or later).

At the registration, it is possible to reserve and purchase extra dinner tickets for accompanying persons.

For any questions please contact the workshop secretariat: **ville.raasakka@ril.fi** or +358 50 366 8687.

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# Venue, accommodation and transportation

Workshop venue is **Gustavelund** (address: Kirkkotie 36, Tuusula), which is located 35 km from Helsinki city centre and close to the Helsinki-Vantaa airport.

The venue has own accommodation facilities with total 84 rooms reserved to the workshop participants. Accommodation needs to be booked separately. In Gustavelund, specially negotiated room rates to workshop participants are:

| | |
|---|---|
| Single room (standard) | 79 eur / night |
| Double room (standard) | 99 eur / night |

Room reservations directly from the hotel:

**Tel. + 358 9 273 751**
**E-mail: reception@gustavelund.fi**
**Booking code: IABSE**

Booking code is valid until January 12th unless sold out before.
Recommended transport from the airport is taxi, which takes about 15 min. Driving instructions and information of the public transport can be found at **www.gustavelund.fi**.

After the workshop, bus transportation will be arranged to the airport and to the Helsinki city centre. The bus is scheduled to leave on Thursday at 15.00. The estimated arrival to the airport is at 15.45 and Helsinki City centre at 16.30.

# Important dates

| | |
|---|---|
| February 8, 2015 | On-line registration ends |
| February 10, 2015 | Get-together at the venue |
| February 11-12, 2015 | the Workshop |

*View to the Helsinki Market Square and Cathedral.*

*Finland has about 188'000 lakes: example of the landscape on a short, cold and sunny winter day.*

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# General information

**Language**
The official language of the workshop is English. Oral presentation and discussion will be in English only.

**Winter weather in Helsinki region**
The month of February is considered winter also in the Southern Finland. If you plan to do outdoor activities, remember to bring a warm jacket, walking shoes, gloves and hat with you. Walking paths might be icy and slippery.

# Helsinki, Finland

The capital, Helsinki, and the neighbouring towns, Espoo and Vantaa, form the fast growing Helsinki metropolitan region, which is now home to almost a million Finns. Helsinki was founded by King Gustav Vasa of Sweden in 1550 and became the capital city of the independent Finland in 1917. Surrounded by the sea and its own exotic archipelago, Helsinki offers visitors an endless number of possibilities.

The workshop is held in Tuusula, about 30 km from Helsinki city centre and 15 min from Helsinki-Vantaa airport. Tuusula is a small town with the population of 36.000. Tuusula has a strong cultural heritage. The first Finnish museum road - Tuusula Rantatie – is located close to the workshop venue. This road hosts the homes of many Finnish artists, such as Pekka Halonen, Juhani Aho, Venny Soldan-Brofeldt, Aleksis Kivi, Eino Leino, Eero Järnefelt and Jean Sibelius.

Finland (Finnish name Suomi) is a republic which became a member of the European Union in 1995. Its population is 5.3 million. Finland is an advanced industrial economy: Metal, engineering and electronics industries account for about 60 % of export revenues and the forest products industry for about 20 %. Finland is situated in northern Europe between the 60th and 70th parallels of latitude. A quarter of its total area lies north of the Arctic Circle. Forest covers about 75 % of Finland, while bodies of water - mainly lakes - cover almost 10 %.

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# Local organizers

**The Finnish Group of IABSE** is more than sixty years old and one of the oldest national groups inside the IABSE organization. The Finnish Group together with RIL have organized several IABSE events, including:

2014 Nordic IABSE Summit ”Engineering and Beyond”, Helsinki-Tallinn

2013 Helsinki Workshop ”Safety Failures and Robustness of Large Structures”

2008 Helsinki Conference “Information and Communication Technology (ICT) for Buildings, Bridges and Construction Practice”

2001 Lahti Conference “Innovative Wooden Structures and Bridges”

1988 Helsinki Congress “Challenges to Structural Engineering”

**Finnish Association of Civil Engineers (RIL)** is an organization for civil engineers with Master of Science degrees and university students of civil engineering. RIL supports the development of building, urban planning and environmental technology and acts to preserve solid and durable building and maintenance traditions. RIL also supervises the benefits of its members and promotes their professional skills and welfare. Read more from: **www.ril.fi.**

# About IABSE

The International Association for Bridge and Structural Engineering (IABSE) was founded in 1929. The mission of IABSE is to promote the exchange of knowledge and to advance the practice of structural engineering worldwide in the service of the profession and society. To accomplish its mission, IABSE organizes conferences and publishes the quarterly journal Structural Engineering International (SEI), as well as reports and other monographs. IABSE also presents annual awards for outstanding achievements in research and practice that advance the profession of structural engineering.

More information about IABSE:

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