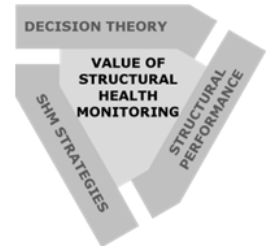




**TU1406**  
COST ACTION



**TU1402**  
COST ACTION



[www.tu1406.eu](http://www.tu1406.eu)

[www.iabse.org](http://www.iabse.org)

[www.cost-tu1402.eu](http://www.cost-tu1402.eu)

# JOINT COST TU1402 – COST TU1406 – IABSE WC1 WORKSHOP

## The Value of Structural Health Monitoring for the reliable Bridge Management

2<sup>nd</sup> – 3<sup>rd</sup> March, 2017



Sveučilište u Zagrebu  
Građevinski fakultet  
University of Zagreb  
Faculty of Civil Engineering

### WORKSHOP CONTACTS

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## 1. INTRODUCTION

### 1.1. ABOUT COST

[COST](#) is the longest-running European framework supporting trans-national cooperation among researchers, engineers and scholars across Europe. It is a unique means for them to jointly develop their own ideas and new initiatives across all fields in science and technology, through pan-European networking of nationally funded research activities.

[COST Action TU 1402](#) strives to enhance the benefit of Structural Health Monitoring (SHM) by novel utilization of applied decision analysis on how to assess the value of SHM – even before it is implemented.

[COST Action TU 1406](#) aims to bring together, for the first time, both research and practicing community in order to accelerate the establishment of a European guideline in the area of quality specifications for roadway bridges.

### 1.2. ABOUT IABSE

[IABSE](#) (International Association for Bridge and Structural Engineering) is a fellowship of structural engineers operating on a worldwide basis, with interests of all type of structures, in all materials. It acts to improve our knowledge and understanding of the performance of structures. Its members represent structural engineers of all ages, employed in design, academe, construction, regulation and renewal; many of its members occupy senior roles based on a history of personal achievement.

[IABSE Working Commission 1](#) provides a forum for discussion on problems related to structural performance and safety and life-cycle cost. The evaluation of Performance includes analytical and experimental approaches. WC 1 deals with structural performance under various actions, both man-made and environmental, the methodology of structural analysis, assessment of design loads, material properties, structural resistance, and problems related to structural safety and serviceability, for buildings, bridges and other civil engineering structures.

## 2. JOINT ZAGREB WORKSHOP DETAILS

### 2.1. OBJECTIVES

The focus of the COST Action TU 1406, so far, was on screening process of existing European documents, establishing a database for Performance Indicators and on defining the technical and non-technical bridge performance goals, followed by the establishment of Quality Control Plans for Bridges.

The focus of the COST Action TU 1402 was development on Fact Sheets on theoretical framework of decision analysis and value of information theory, SHM categorisation and information modelling platform and associated methods and tools involved in the value of information process.

IABSE WC1, as a commission dedicated to the problems related to structural performance, safety and life-cycle cost, has set up the Performance of existing structures as one of its focus areas within activity planning.

The long-term objective of this workshop is to contribute jointly to the improvement of the bridge management leading to satisfied users and bridge operators, and sustainable development of European road network.

More specific objective is to reveal the value of using sophisticated methods of collecting, updating and processing data and subsequently their inclusion in the probabilistic-based reliability analysis.

## 2.2. PROGRAMME OVERVIEW

| Thursday, March 2 <sup>nd</sup> , 2017                               |   |
|--|---|
| 08:00 – 08:30  | Registration for meetings & Joint workshop  |
| 08:30 – 09:00  | Opening of Meetings and Joint Workshop - Welcome speeches/presentation  |
| 09:00 – 12:20  | <b>Session 1: COST Action TU 1406 - Performance assessment of existing Bridges for their reliable management</b>                      |
| 09:00 – 09:30  | Keynote presentation 1  |
| 09:30 – 10:10  | Presentations 2*(15+5) min  |
| 10:10 – 10:30  | Coffee break  |
| 10:30 – 12:20  | Presentations 5*(15+5) min +10 min  |
| 12:30 – 13:30  | Lunch   |
| 13:30 – 16:50  | <b>Session 2: COST TU1402 Framework, Strategies and Tools towards the Quantification of the Value of Structural Health Monitoring</b> |
| 13:30 – 14:00  | Keynote presentation 2  |
| 14:00 – 15:00  | Presentations 3*(15+5) min  |
| 15:00 – 15:20  | Coffee break  |
| 15:20 – 16:50  | Presentations 4*(15+5) min +10 min  |
| 17:00 – 19:00  | Technical visit in Zagreb (Sava bridges)  |
| 19:30 – 22:00  | Networking Dinner   |
| Friday, March 3 <sup>rd</sup> , 2017                                 |   |
| 08:00 – 08:30  | Registration for meetings & Joint workshop  |
| 08:30 – 12:00  | <b>Session 3: IABSE WC1 - Management and Performance-assessment of Existing Structures</b>  |
| 08:30 – 09:00  | Keynote presentation 3  |
| 09:00 – 10:00  | Presentations 3*(15+5) min  |
| 10:00 – 10:20  | Coffee break  |
| 10:20 – 10:50  | Keynote presentation 4  |
| 10:50 – 12:00  | Presentations 3*(15+5) min +10 min  |
| 12:00– 12:20   | Coffee break  |
| 12:20 – 13:20  | <b>Closing session</b>  |
| 12:20 – 13:20  | Discussions, conclusions, further progress, next workshops  |
| 13:20 – 13:30  | Closing speech  |
| 13:30 – 14:30  | Lunch   |
| 14:30 – 15:30  | Steering committee meeting of TU 1402, TU 1406 and IABSE  |
| 15:30 – 16:45  | TU 1406 WG2+WG3 Meeting (75') / TU 1402 MC Meeting (60') / IABSE WC1 Meeting (75')  |
| 16:45 – 17:15  | Coffee break  |
| 17:15 – 18:30  | TU 1406 WG4+WG5 Meeting (75')   |
| 18:30 – 19:15  | TU 1406 MC Meeting (45'), only for MC members   |
| 19:30 – 22:00  | Social programme  |
| Saturday, March 4 <sup>th</sup>                                      |   |
| Technical visit outside Zagreb (if enough people will show interest) |   |

## 2.3. DETAILED PROGRAMME

| Thursday, March 2 <sup>nd</sup> , 2017 |   |
|--|---|
| 08:00 – 08:30                          | Registration for meetings & Joint workshop  |
| 08:30 – 09:00                          | Opening of Meetings and Joint Workshop - Welcome speeches/presentation (WORKSHOP HALL)<br><i>I. Završki, Vice Dean for International Cooperation; Jose Matos, Chair of the Cost Action TU 1406; A. Mandić Ivanković, Vice-Chair of the Cost Action TU 1402; A. Kindij, Institut IGH Inc.; D. Tenžera, Croatian Roads Ltd.</i> |
| 09:00 – 12:20                          | <b>Session 1: COST Action TU 1406 - Performance assessment of existing Bridges for their reliable management (WORKSHOP HALL)</b><br><i>Moderators: Rade Hajdin &amp; Irina Stipanović Oslaković</i>   |
| 09:00 – 09:25                          | <b>Keynote presentation: Risk-, Resilience- and Sustainability-Informed Decision Making for Bridges in a Life-Cycle Multi-Objective Optimization Context</b><br><i>D. M. Frangopol</i>  |
| 09:30 – 09:45                          | <b>Performance indicators for road bridges - overview of findings and future progress</b><br><i>A. Strauss, A. Mandić Ivanković, J. C. Matos, J. R. Casas</i>   |
| 09:50 – 10:05                          | <b>Multi-criteria decision making: AHP method applied for network bridge prioritization</b><br><i>Z.A. Bukhsh, I. Stipanovic Oslakovic, G. Klanker, N. P. Hoj, B. Imam, Y. Xenidis</i>  |
| 10:10 – 10:30                          | Coffee break  |
| 10:30 – 10:45                          | <b>Structural Health Monitoring and Design Code compliance for performance assessment of bridges under scour and seismic hazards</b><br><i>M. A. Zanini, F. Faleschini, N. Ademovic, L. J. Prendergast, K. Gavin, M. P. Limongelli</i>  |
| 10:50 – 11:05                          | <b>The impact of different maintenance policies on ownerscosts: Case Studies from Croatia and the Netherlands</b><br><i>G. Klanker, I. Stipanovic Oslakovic, S. Skaric Palic</i>  |
| 11:10 – 11:25                          | <b>Performance indicators for bridges exposed to a flooding hazard</b><br><i>N. Tanasic, R. Hajdin</i>  |
| 11:30 – 11:45                          | <b>Basis for the development of Quality Control Plans for Arch Bridges</b><br><i>J. Amado, R. Hajdin</i>  |
| 11:50 – 12:05                          | <b>Bridge inspection quality improvement using standard inspection methods</b><br><i>M. Kušar</i>   |
| 12:10 – 12:20                          | Discussions   |
| 12:30 – 13:30                          | Lunch   |
| 13:30 – 16:50                          | <b>Session 2: COST TU1402 Framework, Strategies and Tools towards the Quantification of the Value of Structural Health Monitoring (WORKSHOP HALL)</b><br><i>Moderators: Helmut Wenzel &amp; Geert Lombaert</i>  |
| 13:30 – 13:55                          | <b>Keynote presentation: Bayesian uncertainty quantification and sparse Bayesian learning for model updating in structural health monitoring</b><br><i>James L. Beck, Yong Huang</i>  |
| 14:00 – 14:15                          | <b>Observation-based Decision-making for Infrastructure</b><br><i>E. Chatzi, D. Straub, R. Hajdin</i>   |
| 14:20 – 14:35                          | <b>Monitoring during life cycle of bridges to establish performance indicators</b><br><i>P. Haardt, R. Holst</i>  |
| 14:40 – 14:55                          | <b>Application of DIC to monitor reinforced concrete structures</b><br><i>L. Saucedo-Mora, C. Andrade Perdrix, C. L. Hombrados, J. Barroso, A. Z. Bragado</i>   |
| 15:00 – 15:20                          | Coffee break  |
| 15:20 – 15:35                          | <b>System Reliability of Bridge Structure Subjected to Chloride Ingress</b><br><i>B. J. Leira, S. Thøns, M. H. Faber</i>  |
| 15:40 – 15:55                          | <b>Quantifying the value of SHM for emergency management of bridges at-risk from seismic damage based on their performance indicators</b><br><i>P. Omenzetter, M. P. Limongelli &amp; U. Yazgan, S. Soyoz</i>   |

|   |  |
|---|--|
| 16:00 – 16:15                             | <b>Application of Bridge Weigh-in-Motion measurements in assessment of existing road bridges</b><br><i>D. Skokandić, A. Žnidarič, A. Mandić Ivanković, M. Kreslin</i>                            |
| 16:20 – 16:35                             | <b>Optimal decisions based on monitoring – case study of steel roof</b><br><i>D. Lenzi, D. Diamantidis, M. Sykora</i>  |
| 16:40 – 16:50                             | <b>Discussions</b>   |
| 17:00 – 19:00                             | Technical visit in Zagreb (Sava bridges)   |
| 19:30 – 22:00                             | <i>Networking Dinner (VINODOL)</i>   |
| <b>Friday, March 3<sup>rd</sup>, 2017</b> |  |
| 08:00 – 08:30                             | <i>Registration for meetings &amp; Joint workshop</i>  |
| 08:30 – 12:00                             | <b>Session 3: IABSE WC1 - Management and Performance-assessment of Existing Structures</b><br><i>Moderators: Hitoshi Furuta &amp; Ana Mandić Ivanković (WORKSHOP HALL)</i>                       |
| 08:30 – 08:55                             | <b>Keynote presentation: What We Have Learned from Operational Monitoring and Serviceability Assessment of Long-Span Bridges</b><br><i>Ho-Kyung Kim</i>  |
| 09:00 – 09:15                             | <b>Indicators for the performance assessment of road bridges through monitoring</b><br><i>P. Tanner, M. Prieto</i>   |
| 09:20 – 09:35                             | <b>Bridge scour reliability under changing environmental conditions</b><br><i>B. Imam, A. Kallias</i>  |
| 09:40 – 09:55                             | <b>Bridge SMS: Intelligent bridge maintenance and management system</b><br><i>D. Bekic, I. Kerin, P. Michalis, E. McKeogh, P. Cahill, V. Pakrashi</i>  |
| 10:00 – 10:20                             | <i>Coffee break</i>  |
| 10:20 – 10:45                             | <b>Keynote presentation: New Technologies for Condition Assessment of Existing Structures</b><br><i>Hitoshi Furuta</i>   |
| 10:50 – 11:05                             | <b>Non Gaussian multi-parameter Bayesian estimation through the mechanical equivalent of logical inference</b><br><i>D. Bolognani, A. Verzobio, C. Cappello, D. Tonelli, B. Glisic, D. Zonta</i> |
| 11:10 – 11:25                             | <b>Integrated Structural Health Monitoring in steel arches bridges using continuous dynamic monitoring: two case studies in China</b><br><i>J. Gao, T. Liu, B. Briseghella, G. Carlo Marano</i>  |
| 11:30 – 11:45                             | <b>Optimal sensor placement for Spatial Variability Assessment of Structures</b><br><i>F. Schoefs, E. Bastidas-Arteaga</i>   |
| 11:50 – 12:00                             | <b>Discussions</b>   |
| 12:00 – 12:20                             | <i>Coffee break</i>  |
| 12:20 – 13:20                             | <b>Closing session (WORKSHOP HALL)</b><br><i>Moderators: Sebastian Thöns, Jose Matos, Niels Peter Hoj</i>  |
| 12:20 – 13:10                             | Discussions, conclusions, further progress   |
| 13:10 – 13:15                             | Presentation of the next COST TU 1406 Workshop in Riga <i>by Ainars Paeglitis</i>  |
| 13:15 – 13:20                             | Presentation of the next COST TU 1402 Workshop in München <i>by Sebastian Thöns</i>  |
| 13:20 – 13:30                             | Closing speech <i>by Thöns, Matos, Hoj, Mandić Ivanković</i>   |
| 13:30 – 14:30                             | <i>Lunch</i>   |
| 14:30 – 15:30                             | Steering committee meeting of TU 1402, TU 1406 and IABSE (WORKSHOP HALL)   |
| 15:30 – 16:45                             | TU 1406 WG2+WG3 Meeting (ROOM 58, 75')   |
|   | TU 1402 MC Meeting (WORKSHOP HALL, 60')  |
|   | IABSE WC1 Meeting (ROOM 129, 75')  |
| 16:45 – 17:15                             | <i>Coffee break</i>  |
| 17:15 – 18:30                             | TU 1406 WG4+WG5+Innovative Subgroup Meeting (ROOM 58, 75')   |
| 18:30 – 19:15                             | TU 1406 MC Meeting, only for MC members (ROOM 58, 45')   |
| 19:30 – 22:00                             | <i>Social programme (STARI FIJAKER)</i>  |

## 2.4. KEYNOTE SPEAKERS

| <i>Name</i>      | <i>Affiliation</i>   | <i>Lecture</i>  |
|------------------|--|---|
| Dan M. Frangopol | Department of Civil and Environmental Engineering, Lehigh University, USA            | Risk-, Resilience- and Sustainability-Informed Decision Making for Bridges in a Life-Cycle Multi-Objective Optimization Context |
| James L. Beck    | Dept. of Computing & Mathematical Sciences, California Institute of Technology, USA  | Bayesian uncertainty quantification and sparse Bayesian learning for model updating in structural health monitoring             |
| Ho-Kyung Kim     | Dept. of Civil and Environmental Engineering, Seoul National University, South Korea | What We Have Learned from Operational Monitoring and Serviceability Assessment of Long-Span Bridges                             |
| Hitoshi Furuta   | Faculty of Informatics, Kansai University, Japan                                     | New Technologies for Condition Assessment of Existing Structures  |

## 2.5. COMMITTEES

An executive scientific committee as well as an organizing committee were defined.

### 2.5.1. SCIENTIFIC COMMITTEE

| <i>Name</i>              | <i>Position</i>         | <i>E-mail</i>  |
|--------------------------|-------------------------|--|
| Marios Chryssanthopoulos | COST TU 1402 WG2 Leader | <a href="mailto:mkchry@surrey.ac.uk">mkchry@surrey.ac.uk</a> |
| Rade Hajdin              | COST TU 1406 WG3 Leader | <a href="mailto:wg3@tu1406.eu">wg3@tu1406.eu</a>             |
| Niels Peter Hoj          | IABSE WC1 Vice-chair    | <a href="mailto:tecsec@tu1406.eu">tecsec@tu1406.eu</a>       |
| Ana Mandić Ivanković     | IABSE WC1 Member        | <a href="mailto:mandicka@grad.hr">mandicka@grad.hr</a>       |
| Jose Matos               | COST TU 1406 Chair      | <a href="mailto:chair@tu1406.eu">chair@tu1406.eu</a>         |
| Irina Stipanovic         | COST TU 1406 WG2 Leader | <a href="mailto:wg2@tu1406.eu">wg2@tu1406.eu</a>             |
| Daniel Straub            | COST TU 1402 WG3 Leader | <a href="mailto:straub@tum.de">straub@tum.de</a>             |
| Sebastian Thöns          | COST TU 1402 Chair      | <a href="mailto:sebt@byg.dtu.dk">sebt@byg.dtu.dk</a>         |

### 2.5.2. ORGANIZING COMMITTEE

| <i>Name</i>          | <i>Position</i>        | <i>E-mail</i>  |
|----------------------|------------------------|--|
| Niels Peter Höj      | IABSE WC1 Vice chair   | <a href="mailto:niels.hoj@hoj.ch">niels.hoj@hoj.ch</a> |
| Ana Mandić Ivanković | Local Organisers chair | <a href="mailto:mandicka@grad.hr">mandicka@grad.hr</a> |
| Jose Matos           | COST TU 1406 Chair     | <a href="mailto:chair@tu1406.eu">chair@tu1406.eu</a>   |
| Sebastian Thöns      | COST TU 1402 Chair     | <a href="mailto:sebt@byg.dtu.dk">sebt@byg.dtu.dk</a>   |

### 2.5.3. LOCAL ORGANIZERS

| <i>Name</i>          | <i>Position</i>                 | <i>E-mail</i>  |
|----------------------|---------------------------------|--|
| Ana Mandić Ivanković | COST TU 1406 & TU1402 MC member | <a href="mailto:mandicka@grad.hr">mandicka@grad.hr</a>     |
| Alex Kindij          | COST TU 1406 MC member          | <a href="mailto:alex.kindij@p45.hr">alex.kindij@p45.hr</a> |
| Marija Kušter Marić  | COST TU 1406 & TU1402 member    | <a href="mailto:marijak@grad.hr">marijak@grad.hr</a>       |
| Dominik Skokandic    | COST TU 1406 & TU1402 member    | <a href="mailto:dskokandic@grad.hr">dskokandic@grad.hr</a> |
| Mladen Srbić         | COST TU 1406 & TU1402 member    | <a href="mailto:msrbic@grad.hr">msrbic@grad.hr</a>         |
| Anđelko Vlašić       | Local support                   | <a href="mailto:vlastic@grad.hr">vlastic@grad.hr</a>       |

## 2.6. LOCATION, DATES AND TRAVELLING

### 2.6.1. LOCATION AND DATE

The Joint Workshop will be held at the [Faculty of Civil Engineering in Zagreb](#) on 2nd and 3rd of March 2017. Full address of the faculty is as follows:

University of Zagreb, Faculty of Civil Engineering  
Fra Andrije Kačića-Miošića 26, 10 000, Zagreb, CROATIA, [Google map](#)

### 2.6.2. TRAVELING AND LOCAL TRANSPORT

#### From the airport with the taxi:

Taxis are available on the Arrivals exit. The price to the city centre is approximately 160 kn (20 Euro). The ride takes about 30 minutes.

#### From the airport with the bus:

The airport shuttle is available on the Arrivals exit. It leaves every 30 minutes from the airport to the main bus station in the city. The tickets are bought inside a bus and the price is 30 kn (4 Euro). The ride takes about 30 minutes. In front of the main bus station, cross the road to the tram station and take the tram

- no. 2 (stops close to the Westin hotel-Vodnikova station or close to the Faculty-Adžijina station; last station is Črnomerec),
- no. 6 (stops close to the Palace hotel-Zrinjevac station; last station is Črnomerec) or
- no. 8 (stops close to the Sheraton hotel-Sheraton station; last station is Mihaljevac).

#### From the railway station:

In front of the main railway station, cross the road to the tram station. Take

- tram no. 2 (stops close to the Westin hotel-Vodnikova station or close to the Faculty-Adžijina station; last station is Črnomerec) or
- take a 5-10 minutes walk to the Palace hotel or
- take a 5-10 minutes walk to the Sheraton hotel.

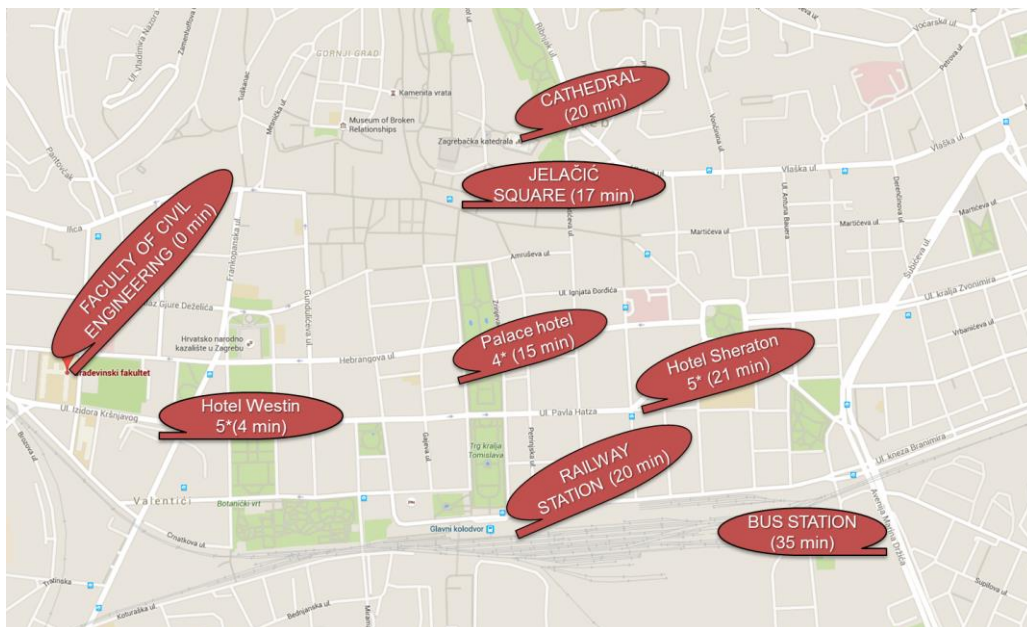


Figure 1. Location of recommended hotels and distances from the Faculty of Civil Engineering

#### Public transport within the city:

The map of trams is available as a [Day Map](#) with the [timetable](#) or as a [Night Map](#) with the [timetable](#). Tram ticket is 10 kn (1,5 Eur) and it is valid for one hour and thirty minutes in any direction.

#### General information:

- All cash payments are realized solely in local currency kn - kunas (1 EUR approx. = 7,5 kn)
- Tickets for airport shuttle and public transport may be purchased in the shuttle/tram.



## 2.7. ACCOMMODATION

The local organizers recommend using the following listed hotels for accommodation, conveniently located nearby the venue.

[Hotel Westin](#) 5\* (5 minutes walking distance)  
[Krsnjavoga 1](#), Zagreb

[Hotel Sheraton](#) 5\* (20 minutes walking distance)  
[Kneza Borne 2](#), Zagreb

[Hotel Palace](#) 4\* (15 minutes walking distance)  
[Trg J.J. Strossmayera 10](#), Zagreb

Special prices are arranged with the **Hotel Westin** only. This rates will be available until February 8, 2017, and are subjected to availability. Please use the following link to make your reservation [HOTEL WESTIN RESERVATION](#).

| <i>Offer type in Hotel Westin</i>        | <i>No. of guests</i> | <i>Price per room per night</i> |
|--|----------------------|---------------------------------|
| <b>Single room - Bed &amp; breakfast</b> | 1 person             | 110 Euro + 1 Euro tourist tax   |
| <b>Double room - Bed &amp; breakfast</b> | 2 persons            | 130 Euro + 1 Euro tourist tax   |

## 2.8. IMPORTANT DEADLINES

The most significant deadlines participants are kindly asked to respect are summarized in the following table.

| <i>Activity</i>                | <i>Responsible</i> | <i>Deadline</i>   |
|--------------------------------|--------------------|-------------------|
| <b>Full Paper Submission</b>   | All participants   | December 31, 2016 |
| <b>Registration</b>            | All participants   | February 10, 2017 |
| <b>Presentation submission</b> | All participants   | February 27, 2017 |

## 2.9. REGISTRATION

Attendance to this event is open to all registered participant. Nevertheless, all participant are expected to pay a fee in a total amount of **80 Euros** covering eligible expense for two lunches and two dinners. This meal related fee will be collected at the registration desk. For COST Action participants invited to the workshop, these expenses will be reimbursed within travel reimbursement.

To register for this event it is necessary to fill up and submit the following form: [Zagreb Joint Workshop – Registration Form](#). The deadline for registration is **February 10th, 2017**.

Invited COST Action members, in addition to submitting this form, need to respond positively to the e-COST official invitation to complete their registration. Namely, COST organization provides a certain amount of financial means for organizing such meetings and to reimburse participants. This includes for example accommodation costs, meals, transport expenses, etc. For more information about travel reimbursement request please visit the following [webpage](#). Please book your flight and hotel as soon as possible in order to find cheaper solutions.

## 2.10. INSTRUCTIONS AND TEMPLATES FOR PRESENTATIONS

The participants are kindly asked to use the presentation templates which will be available at <http://www.grad.unizg.hr/joint-zagreb-workshop> in order to achieve a degree of coherency. Oral presentations should be mailed to [joint-zagreb-workshop@grad.hr](mailto:joint-zagreb-workshop@grad.hr) no later than **February 27<sup>th</sup>, 2017**. The duration of the presentation for a speaker is limited to **15 minutes** and for a keynote speaker to **25 minutes**.

### 3. HOSTS, TECHNICAL VISITS AND SOCIAL EVENTS

#### 3.1. ZAGREB

Zagreb is the cultural, scientific, economic, political and administrative center of the Republic of Croatia. The city is protected from the cold northern winds by the mountain of Medvednica and opens up to the rest of the world thanks to a spacious plain and the Sava River. Zagreb, with a population of nearly one million, contains almost a quarter of the entire population of Croatia. Over the centuries, the city was inhabited by people coming from all over Europe; and, in recent years, by people coming from different parts of Croatia, ensuring a rich cultural life. Zagreb is a safe city whose doors are always open for all visitors.

**Useful websites:**

- <http://www.infozagreb.hr/> - general info about Zagreb
- <http://www.tzzz.hr/> - general info about Zagreb County

#### 3.2. FACULTY & DEPARTMENT FOR STRUCTURES (& BRIDGES)

Faculty of Civil Engineering under the auspices of University of Zagreb is the oldest civil engineering faculty in Croatia conducting education at the undergraduate (>750), graduate (>40) and postgraduate (>180 students) level in all branches of civil engineering. It has a valid ASIIN international Accreditation and high experience with participating in research, educational and networking projects such as FP6, FP7, TEMPUS, COST, EUREKA, LIFE, LLP, CIP-ECO INNOVATION, CIP-IEE-INTELLIGENT ENERGY EUROPE, HORIZON 2020, ERASMUS + and ERASMUS MUNDUS.

Department for structures hosts 4 full professors, 3 associate professors, 2 assistant professors, 8 young researchers and 3 expert associates. Within Department for structures, Department for bridges is the oldest technical Chair of University of Zagreb founded in 1919. It is enrolled as scientific centre in the field of bridges, place where young researchers are educated and at the same time a very productive core where many big bridges are designed. Currently two large bridges but also the Zagreb airport building, designed at the Bridge Department, are under construction in Croatia. Bridge department currently hosts 1 associate professors, 2 assistant professors, 3 young researchers and 3 expert associates. The main current research orientation of the bridge department is to improve performance assessment methods within management of bridges.



Figure 2. Joint workshop hosts: city of Zagreb and Faculty of civil engineering

### 3.3. TECHNICAL VISITS

Two technical visits will be organised depending on the interest of participants.

- Local visit to Sava bridges in Zagreb is planned for March 2<sup>nd</sup> on Thursday afternoon 17-19 h. This trip includes professional tour and drive by bus. A bus will pick up the Workshop participants near the Faculty of Civil Engineering.
- A whole day visit to Krk bridges is planned for March 4<sup>th</sup>, Saturday 9-17 h. This trip includes drive by bus, professional tour and light lunch. A bus will pick up and bring back the Workshop participants near the Faculty of Civil Engineering.

#### 3.3.1. SAVA BRIDGES IN ZAGREB

Bridge building across Sava River in Zagreb started in the end of the 19<sup>th</sup> century and up until now 13 bridges have been built on 11 different locations in Zagreb area, with more planned. During this technical visit, the plan is to visit 5 bridges on 3 different locations – old composite Sava Bridge, railway steel Green Bridge, arch steel Liberty Bridge, prestressed girder Adriatic Bridge and extrados prestressed Homeland Bridge.

The plan of the visit will be adjusted to the weather and traffic situation on March 2<sup>nd</sup> but participant will for sure get an overview of the most relevant overview of all the bridge building eras in Zagreb, each specific with its material, structural and architectural identity.



Figure 3. Left: Liberty Bridge across Sava River in Zagreb, Right: Krk bridges connecting Krk Island with the Croatian Mainland

#### 3.3.2. KRK BRIDGES

Krk bridges, constructed in 1980 by an innovative procedure forming a trussed arch cantilevers, consists of two large reinforced concrete arches, of 390 m and 244 m span. Both arches are of three-cell box cross-section. To achieve exceptionally large spans it was necessary to reduce the dead load as much as possible. The structural members of minimum statically admissible dimensions were utilised, with very small concrete covers. Bridges are located in very aggressive marine environment including very high salinity (approximately 3,5%), very strong winds carrying sea spray and winter drops of temperature below freezing point.

During this technical visit the following data on Krk bridges will be elaborated:

- bridge design details and construction,
- maintenance works including testing and assessing of different protective systems,
- repair works on superstructure, reconstruction of bearings, different repair techniques for columns and arch
- installation of optical sensors for investigation and testing of composite cross sections of repaired columns
- cathodic protection for the submerged elements of the larger arch

The works on the Krk Bridge initiated a further research into durability design of reinforced concrete structures in aggressive maritime environment, namely in developing further specifications for application of surface protection systems on damaged structures as well as integrating surface protection systems with concrete cover in the design of new structures in aggressive maritime environment.

*Registration for technical visits needs to be indicated within the registration form for the complete Workshop (see 2.9).*

### 3.4. SOCIAL EVENTS

Two social events will be organised during the Workshop.

**Networking dinner: Thursday, March 2<sup>nd</sup>, 19:30 – 22h**

After the Technical visit of Sava bridges in Zagreb the bus will take the participants of the visit to the city center. Networking dinner will be held in a Restaurant Vinodol, located in Teslina 10, in the very heart of the downtown Zagreb. Restaurant is proud to use traditional recipes, with a modern approach: <http://www.vinodol-zg.hr>.

The price of this networking dinner for registered participant is included in the overall meal related registration fee of 80 Euros. (to be collected at the registration desk). For accompanying persons, the price of the networking dinner is **30 Euros per person**.

**Social event: Friday, March 3<sup>rd</sup>, 19:30 – 22h**

On Friday evening, one more social event will be organised in restaurant Stari Fijaker, located in Mesnička street only 5 minutes from the main city square – Jelačić square. The Stari Fijaker (or in translation Old coach) offers a full menu of authentic traditional culinary delicacies representing the Zagreb-Zagorje region of Croatia: <http://www.starifijaker.hr>. Live musical background for this dinner will be organized.

The price of this networking dinner for registered participant is included in the overall meal related registration fee of 80 Euros (to be collected at the registration desk). For accompanying persons, the price of the social event is **30 Euros per person**.

*Registration for social events needs to be indicated within the registration form for the complete Workshop (see 2.9).*



Figure 4. Social events will be organised in restaurants located in the very heart of the downtown of Zagreb

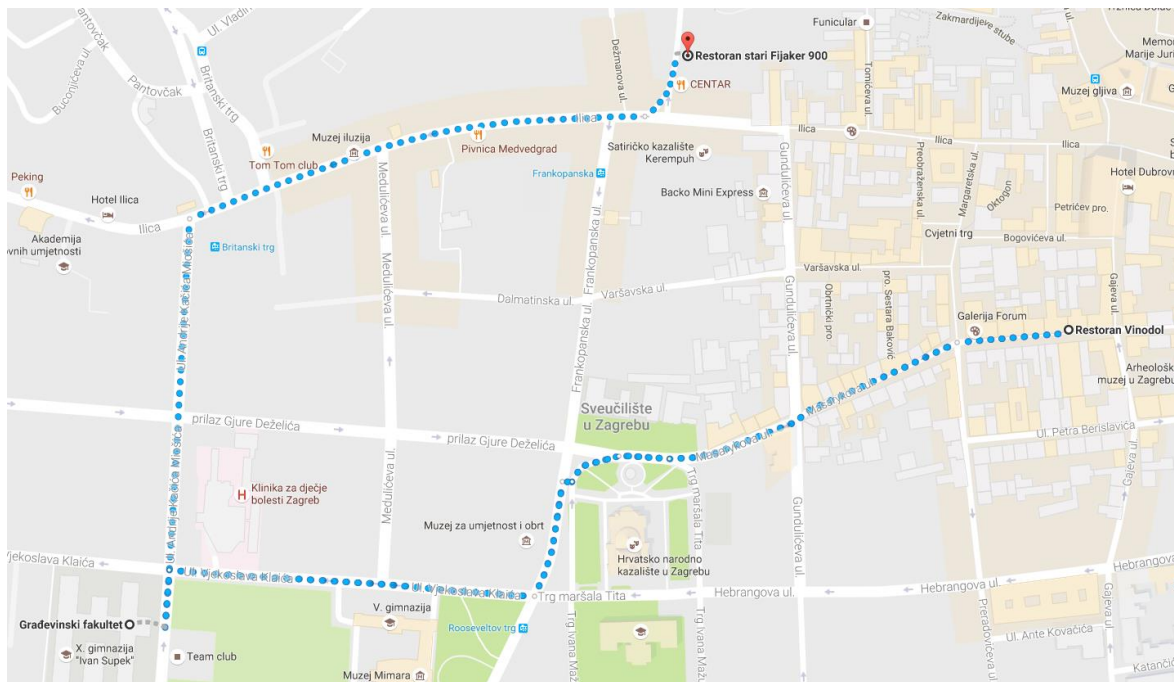


Figure 5. Map showing route from Faculty (Građevinski fakultet) to the restaurant Vinodol (15 min) and from Faculty to the restaurant Stari Fijaker (13 min)

## 4. RECOMMENDATION FOR POST-WORKSHOP ACTIVITIES

For participants who will have the possibility to stay in Zagreb during Saturday and Sunday after the workshop, beside the Technical visit to Krk bridges on Saturday we would recommend to visit Plitvice lakes <http://www.np-plitvicka-jezera.hr>.

Every season has its own unique charm and the Plitvice Lakes, with their alternating colours and every new awakening, both trapped in ice or in the shade of the trees, will leave you with a very distinct, unique and invaluable impression. Nevertheless, please be aware that available tours and opening times and suitable outfit are largely affected by the current season and the weather conditions in the Park.

If more participants will be interested for Sunday trip to Plitvice, we will be happy to get you the adequate information and to help you organise the joint bus or shuttle visit to the lakes. Feel free to contact us at the workshop official e-mail address: [joint-zagreb-workshop@grad.hr](mailto:joint-zagreb-workshop@grad.hr), but not later than February 15<sup>th</sup> of 2017.



Figure 6. Plitvice lakes: diverse season impressions

## 5. WORKSHOP MAP AT THE FACULTY

### FACULTY OF CIVIL ENGINEERING ZAGREB

#### Ground Floor

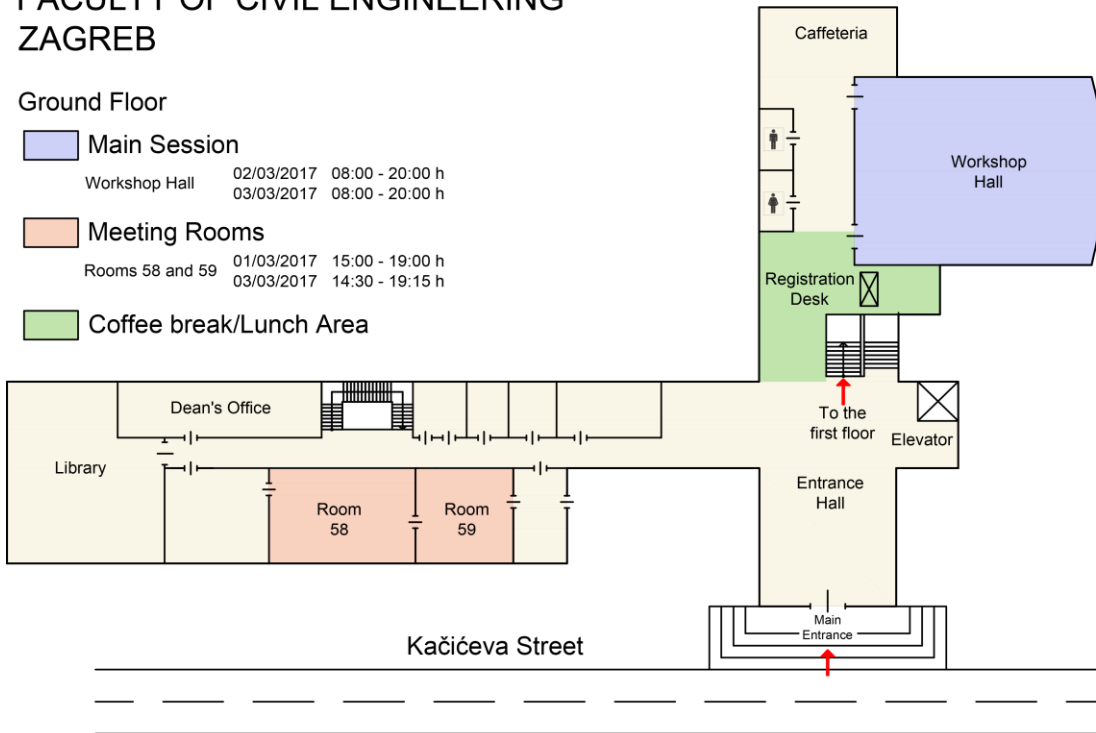
##### Main Session

Workshop Hall 02/03/2017 08:00 - 20:00 h  
03/03/2017 08:00 - 20:00 h

##### Meeting Rooms

Rooms 58 and 59 01/03/2017 15:00 - 19:00 h  
03/03/2017 14:30 - 19:15 h

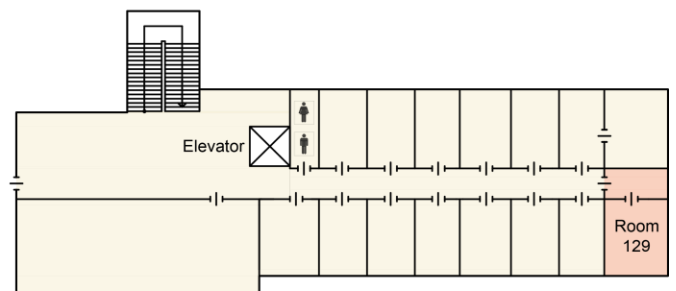
##### Coffee break/Lunch Area



#### 1<sup>st</sup> Floor

##### Meeting Room

Room 129 01/03/2017 14:00 - 19:15 h  
02/03/2017 09:00 - 19:00 h  
03/03/2017 09:00 - 19:00 h



#### 2<sup>nd</sup> Floor

##### Meeting Room

Room 219 03/03/2017 14:00 - 20:00 h

