SHORT TERM SCIENTIFIC MISSION (STSM)
SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: TU1406 - Quality specifications for roadway bridges, standardization at a European level (BridgeSpec)
STSM title: Innovation analysis on the performance assessment of roadway bridges: Application on the existing roadway bridges and comparative analysis with practice in Montenegro
STSM start and end date: 29/01/2019 to 08/02/2019
Grantee name: Jelena Pejovic

PURPOSE OF THE STSM:

The main purpose of the STSM was giving contribution regarding Innovation Analysis on the Performance Assessment of Roadway Bridges that is developed by COST Action TU 1406 Innovation subgroup that is leaded by André Orcesi and Maria Pina Limongelli. The collaborative work carried out by Innovation Subgroup of COST Action TU 1406 is summarized in comprehensive Report. The work in the Innovation Subgroup was focused on innovative indicators and technological innovations that can improve accuracy and precision of quality controls of roadway bridges, thus achieving higher performances in terms of safety and availability. The work was started by assessing the needs of stakeholders asking some of them to answer to three questions related with inspections, testing and monitoring of bridges. Further, the survey was carried out in the COST TU1406 network to gather both Indicators and Technologies that are being currently investigated by researchers within and in connection with the network. The main aim of STSM was to give additional contribution related to specific fields considered in Innovation Report. Focus was on providing more input from industrial partners and academics regarding the innovation on technologies and getting more bridge owners' feedback about innovation in the fields of inspection, monitoring and management of roadway bridges. Additionally, the contribution in creating the final Report is given.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

During this STSM various activities have been done and following work has been carried out:

- At the beginning of STSM, gathering and collecting information and knowledge about innovation analysis on the performance assessment of roadway bridges is done. The collaborative work carried out by Innovation Subgroup of COST Action TU 1406 related to innovative indicators and technological innovations that can improve accuracy and precision of quality controls of roadway bridges, thus achieving higher performances in terms of safety and availability, is investigated. Information and results from Report that have the scope to describe the current state of Research on Performance Indicators and Monitoring Technologies based on the knowledge related to the COST TU1406 network are analysed. Additional contribution related to Innovative Performance Indicators is done by their systematization in Table of Innovative Performance Indicators (with IRL

rating and corresponding References) with the eight main characteristic groups related to Reliability, Serviceability, Life-Cycle Analyses, Climate Change, Seismic Performance, Scour, Social and Economic factors and Resilience.

- The extension of the analysis carried out by Innovation subgroup in the field of assessing the needs of stakeholders is conducted. The work in the innovation subgroup was started by assessing the needs of stakeholders through three questions that were sent to some stakeholders to have their opinion, as on the needs they estimate as the most important when dealing with inspections, testing and monitoring of bridges. More feedback from bridge owners about innovation in the fields of inspection, monitoring and management of roadway bridges is obtained and collected during the STSM. Analysis of the most critical types of bridges and the most feared failures according to bridge owners who participated to this survey is conducted. The derived results are summarized and included in the final version of Report.
- The extension of the study of innovative technological developments is carried out. This study had a focus on non-destructive testing tools and structural health monitoring solutions and is carried out with some academic and industrial partners with aim to identify some novel condition monitoring and sensing technologies for the assessment of structural serviceability and safety of existing structures. More input from industrial partners and academics regarding the innovation on technologies are obtained and collected during the STSM. The derived results are included in the final version of Report.
- The contribution in creating the final version of Innovative Report is given. The results derived by conducted analysis during the STSM are included in final version of Report. Additional contribution is given by writing Executive summary of Innovation Report that present 2-page summary and contains the identified key details of the Report.
- During STSM, laboratory of Materials and Structures Department has visited and information about on ongoing projects and available equipment in laboratory has gathered.
- During the STSM, participating in meeting of Materials and Structures Department is realized. On the meeting, STSM applicant Dr Jelena Pejovic had presentation about own Short Term Scientific Mission (STSM) at IFSTTAR within the COST Action TU1406.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The following main results are obtained:

- As extension of the analysis carried out by Innovation subgroup, six more feedbacks from bridge owners about innovation in the fields of inspection, monitoring and management of roadway bridges are obtained and included in final version of Innovative Report: 1) Croatian Roads Ltd., Croatia; 2) Gebze İzmir İşletme ve Bakım (GİİB), Turkey; 3) Directorate for State Roads of Montenegro, Montenegro; 4) ANAS Gruppo FS Italiane, Italy; 5) The Department of Transport, Tourism and Sport, Ireland and 6) ASFINAG, Austria. Three questions were sent to owners and stakeholders to have their opinion, as on the needs they estimate as the most important when dealing with inspections, testing and monitoring of bridges. Their answers are collected and included in final version of Report. Further, additional analysis is conducted to make conclusions regarding the most critical types of bridges and the most feared failures. Distribution of the most critical types of bridges and the most feared failures according to bridge owners who participated to this survey are summarized in new added figures.
- Contribution related to the study of innovative technological developments is given. The study of innovative technological developments was focused on non-destructive testing tools and structural health monitoring solutions that is carried out with some academic and industrial partners to identify some novel condition monitoring and sensing technologies for the assessment of structural serviceability and safety of existing structures, Three more inputs from industrial partners and academics regarding the innovation on technologies are obtained and included in new subsections of part C (Innovations on technologies) in the final version of Innovation Report: 1) subsection C 1.5. Non-destructive testing for bridge tower bolts; 2) C 2.2 Laser scanning for bridge inspection and 3) C 2.3 Distributed optic fiber sensors (dofs).
- Executive summary of Innovation Report is written. Executive summary present 2-page summary of Report and contains the key details of the Report. The key details of the Report are identified, singled out and highlighted. Additional contribution is given by including two new tables (Table 1 and Table 2). The COST Action TU1406 database of Research Performance Indicators (RPIs) and the The Indicator Readiness Level (IRL) rating of the RPIs is provided in excel format (Table 1) as a deliverable and constitute a base for further integrations and updates. In Table 1 are presented

Innovative Performance Indicators (with IRL rating and corresponding References) divided in the eight main groups related to Reliability, Serviceability, Life-Cycle Analyses, Climate Change, Seismic Performance, Scour, Social and Economic factors and Resilience. The COST Action TU1406 database of Innovations on technologies is provided in excel format (Table 2) as a deliverable and constitute a base for further integrations and updates. In Table 2 are presented Innovations on Technologies (and corresponding References) divided in the two main groups related to non destructive testing (NDT) and structural health monitoring (SHM). Information and results reported in Table 1 and Table 2 have the scope to describe the current state of Research on Performance Indicators and Monitoring Technologies based on the knowledge related to the COST TU1406 network.

- Final version of Innovation Report is made that includes the results of the extended conducted analysis.

FUTURE COLLABORATIONS (if applicable)

Future collaboration with COST Action TU 1406 Innovation subgroup will be continued.
Also, future collaboration of two institutions (IFSTTAR and Faculty of Civil Engineering University of Montenegro) was discussed and it was found that two institutions can cooperate regard topics connected with this cost action, but also in other topics.