



TU1406

COST ACTION

QUALITY SPECIFICATIONS FOR ROADWAY BRIDGES,
STANDARDIZATION AT A EUROPEAN LEVEL

Scientific Report on Short Term Scientific Mission

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1. AIMS AND OBJECTIVES

In the COST TU1406 Geneva Workshop (21-22nd Sept. 2015), the main concept for the key performance indicator (KPI) database structure has been presented by WG1 team. Based on the participants' suggestions at the workshop, that the further work related to development of the database comprise the following tasks:

- Elaboration of simple, user friendly interface to aid in the screening of the data from relevant national documents & elaboration of a tutorial for its application
- Analyze/Control of the gathered data & consideration of the user's feedback on the interface
- Setting up the KPI database in Access workspace
- Elaboration of the user interface on an Access platform to create reports and further data analysis

The main task of the Short Term Scientific Mission (STSM) was cooperation with the colleagues, the WG1 team, at the Institut für Konstruktiver Ingenieurbau (IKI) at Universität für Bodenkultur Wien on goals related to the tasks one and three. Here, it was crucial to define the essentials of a structure for a database which is in turn going to be operated by the COST participant countries.

The secondary task of the STSM was to investigate the practices and procedures in bridge management associated with flooding of the road infrastructure in Austria.

2. WORK CARRIED OUT

The summary of the main tasks which were performed during the STSM:

- Elaboration of the interface for survey of national documents and the tutorial for its application
- Setting up the structure for the KPI database in Access workspace
- Investigation of the possibility to assess the risk of bridge failures in flooding events in the Austrian bridge database

In order to compose the KPI database, the first task is systematic and comprehensive screening of relevant national documents. Here, it must be acknowledged that the amount & level of information varies between documents, even in those of same type. In general, documents address differently the key terms: Performance Indicators/Methods/Index/Thresholds/Goals/Criteria, thus one of the main requirements for the user interface is to allow an unrestricted data input in order to gather as much as information available.

The inspection document from Austria [1] is taken as a basis for the interface structure. The general connections between the key terms that may be extracted in this document are presented in Figure 1. The most of information in the document points to connections between Perf. Level and Damages. However, more connections between key terms may be found on the damage processes of corrosion, and for structural component - bearings (Chapters 5, 6 in Figure 1). In the chapter where the main inspection equipment is discussed, valuable information on some connections between the terms may be found as well. Here, mostly the assessment and estimation Methods for certain types of Damage are discussed. The rating system for bridges given in this document also provides essential relationships between the key terms. The Damage degree on a bridge structure and its elements, which is observed during the inspection, may be connected both with Perf. Index and Perf. Indicators. However, the precise information on Performance Thresholds/Criteria/Goals are not found in this document.

In order to recognize possible relationships among the key terms in documents, an inspection [2] and evaluation document [3] from the UK were additionally screened. In [2], the rating system similar to one found in document [1] is noticed, while in document [3] the focus is on the evaluation of condition rating scores for bridge elements, bridge as a whole and entire bridge stock in a network.

Taking everything into consideration, the user interface for screening is set up in MS Excel. In parallel to its development, the basics of the KPI database structure was elaborated in Access workspace. However, the database in Access requires specific connections between the key terms and these will be added when the screening finishes.

The secondary task of the STSM was to survey the manuals of the Austrian database to investigate the possibility to evaluate the risk of bridge failures in flooding events. The documents [1] and [4] were reviewed, where the guidelines on the inspection procedures and structure of the database are elaborated. The damages induced by flooding adverse action at bridge substructures and related local scour are distinctively acknowledged in the Austrian methodology. However, when it comes to existing bridges, there are no precise guidelines on the methods for assessment of a threat from local scour and it seems that solving of this problem is solely based on engineering judgment and previous experience. Although, a river bed monitoring is mentioned as a procedure to investigate the threat, there are no specific rules which define thresholds for its deployment on bridge sites.

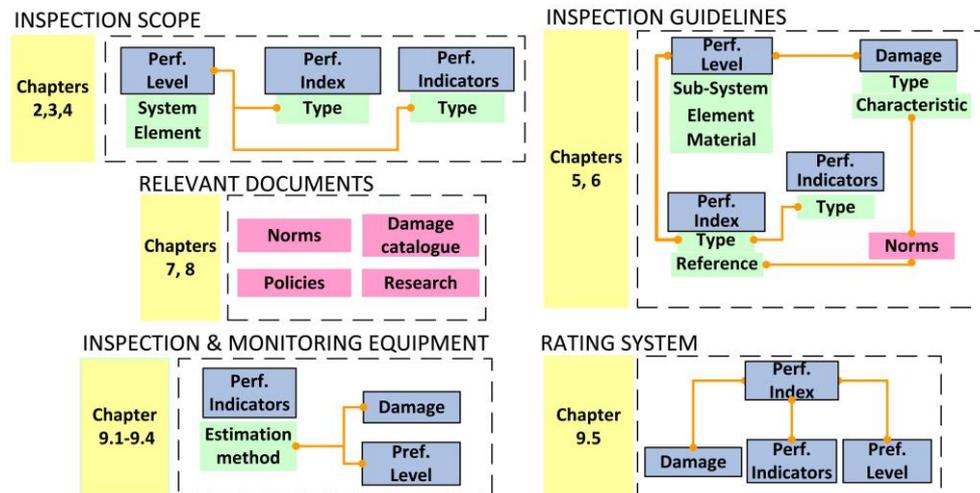


Figure 1. Extracting the information on the key terms from documents – an example

3. MAIN RESULTS

3.1. THE USER INTERFACE FOR PRELIMINARY DATA SCREENING

The primary task in the STSM at IKI comprised elaboration of a user interface which is going to be used for screening of KPI-s in any type of national document. The idea behind the interface arrangement is to reveal the relationships between the key terms, as some of these are not clearly defined in documents. The solution for the interface is set in MS Excel, which structure is presented in Figure 2. First, a user enters general data about the documents which are going to be screened (GeneralData_sheet). The process of screening is performed in separate sheets (i.e. Cou_1 sheet), where the main data structure is organized in the four groups: Performance Level, Damage, Performance Indicator/Index and Performance Assessment. Here, the input of data is realized row-by-row, following the chapters/paragraphs in a document, where the information for each data group is selected from the drop-down lists. Also, there is an opportunity to add additional references and specific information about the elements in groups and their evaluation process.

The Names_Table sheet holds the information of the drop-down lists, and the suggestion is to update this information during the surveying process by the user. In order to support the interface, the Glossary of key terms is structured. Currently, it holds data from the documents [4] and [5]. In the screening process, it is important to update the Glossary with country specific definitions of the key terms given in national documents. At the same time, it is suggested to update the Names_Sheet as well.

The tutorial for application of the user interface [6] has been prepared to give the instructions on how to perform extraction of information from the documents. There are two examples given, which will aid in the screening process. However, more documents need to be screened in order to develop a comprehensive databank in MS Excel. Once collected, the data will help in definition of precise relationships between the key terms thus the work on compilation of the KPI Access database can be continued.

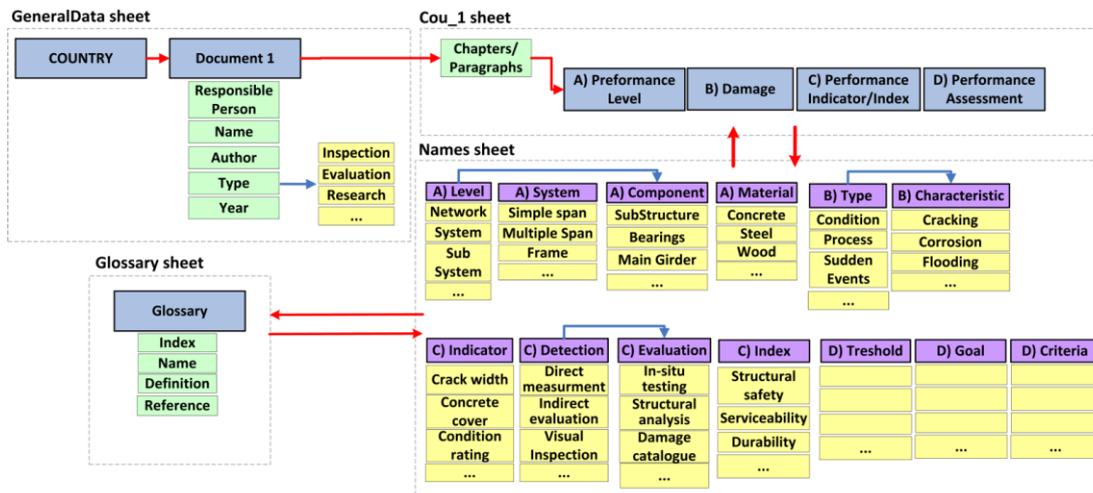


Figure 2. The structure of the interface and the main connections between data fields and sheets

3.2. CONSIDERATION OF THE THREAT OF FLOODING HAZARD TO ROAD BRIDGES IN AUSTRIA

The threat of flooding to road bridges in Austria is currently addressed on a case basis, and there is no comprehensive approach in bridge management to account the risk of bridge failures in an extreme flooding event on a network level. This is a common issue for many countries, where management procedures rest solely on qualitative approaches and regular inspections. Unfortunately, the validation of the current practices is only possible after the failures occur, thus there is a need to assess the vulnerability of bridges to such events. Currently, the data on the bridges from Austrian database, which are near water and have shallow foundations, is being analyzed in order to apply a novel methodology for quantitative vulnerability assessment developed by the report author.

4. FUTURE COLLABORATION

The further collaboration will entail screening of various national documents and consideration of the user's feedback on the Excel interface. The assessment & control of the data gathered through the screening process is going to be performed. Here, it will be an imperative to refine the data and define the relationships between the key terms and consider them in the set-up of the Access database. The complete data obtained from all countries is going to be transferred in the Access workspace. Finally, the user interface is going to be set on Access platform, which will enable tailored data input for certain document types and preliminary report making.

5. FORESEEN PUBLICATIONS/ARTICLES

The article addressing the topic of the quality control plans for roadway bridges affected by flooding hazard is going to be submitted for presentation at the IABMAS 2016 conference in Brazil. It covers the topic of management of bridges exposed to local scour in flooding events and is suggesting the vulnerability as a convenient quantitative performance indicator for planning of timely maintenance interventions.

6. ADDITIONAL COMMENTS

I had an immense pleasure to cooperate with members of WG1 from IKI at the University of Bodenkultur in Vienna during my STSM. They have been exceptional hosts and I have gained invaluable experience

while working on the STSM tasks. I am definitely looking forward to further collaboration with them on the future goals of the COST project.

7. REFERENCES

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4. Bundesministerium für Verkehr, Innovation und Technologie, 2011, Quality Assurance for Structural Maintenance; Structures Data Base; Bridge Structures, Austria.
5. Berichte der Bundesanstalt für Straßenwesen, 2015, IntelligenteBrücke Schädigungsrelevante Einwirkungen und Schädigungspotenziale von Brückenbauwerken aus Beton, SchünemannVerlag, Bremen, Germany.
6. COST TU 1406 WG1 team & Tanasic Nikola, 2015. Data Survey Tutorial. COST Action TU1406 Quality specifications for roadway bridges, standardization at a European level.

8. ANNEXES

8.1.CONFIRMATION BY THE HOST INSTITUTION ON THE SUCESFUL EXECUTION OF THE STSM



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