Quality Control Plans for European Concrete Road Bridges
Experiences from Cooperation within COST Action TU 1406

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ABSTRACT
The main objective of the COST Action TU1406 is to develop a guideline for the establishment of Quality Control plans for roadway bridges, by integrating the most recent knowledge on performance assessment procedures. 36 European countries are working together in this endeavor during 2015-2019.

Key words: Cracking, Corrosion, Execution, Modelling, Performance Indicators, Repair, Reuse and Recycling, Shrinkage, Structural Design, Sustainability, Testing, Quality Control Plans, Quality Specifications.

1. INTRODUCTION

1.1 General
During the implementation of asset management strategies, maintenance actions are required in order to keep assets at a desired performance level. In case of roadway bridges, specific performance indicators are established for their components. These indicators can be qualitative or quantitative based, and they can be obtained during principal inspections, through a visual examination, a non-destructive test or a temporary or permanent monitoring system.
Then, obtained indicators are compared with performance goals, in order to evaluate if the quality control plan is accomplished. There is a large disparity in Europe regarding the way these indicators are quantified and how such goals are specified. Therefore, this action brings together both research and practicing community from 36 countries in Europe in order to accelerate the establishment of a European guideline in this subject [1]. The project is supported by COST, the longest running European framework supporting transnational cooperation among researchers, engineers and scholars in Europe [2]. The COST Action TU1406 on Quality Control Plans for Bridges was started in 2015 and is planned to be working during four years. It has an estimated economic dimension of 128 M€ and will receive about 650 k€ from EU. This paper will focus on applications for bridges of concrete.

1.2 Background
In engineering, quality control (QC) is related to systems development in order to ensure that products or services meet or exceed the expectations and needs of users and the wider community. Concerning road infrastructures, it can be said that asset management and QC are two sides of the same coin. There is an increasing need of developing strategies to ensure the quality of the entire system, with the aim of reducing the risk of unexpected costs.

For this purpose, the authorities need to produce an asset management plan, which should not only define the goals to be achieved by exploiting the roadway bridge network, but that should also identify the investment needs and priorities based on a life cycle cost criteria. In addition, a proper condition assessment of these assets must be conducted to support the decision-making process regarding their preservation. A set of maintenance operations, carefully planned and executed at proper time, is then established through this process. This will allow to reduce the risk of further deterioration, minimize costs and, simultaneously, ensure the quality of delivered service.

The identification of maintenance needs is more effective when developed in a uniform and repeatable manner. This process can be accomplished by the evaluation of performance indicators, improving the planning of maintenance strategies, see Figure 1.

![Figure 1. Main clusters of Performance Indicators related terms, [3].](image)

In this context, a first step would be the establishment of specific recommendations for the assessment of roadway bridges, namely, used methods for the quantification of performance indicators. A second step would be the definition of standardized performance goals.
2. ONGOING WORKS

The following specific objectives/deliverables are in progress: (i) to systematize knowledge on Quality Control (QC) plans for bridges; (ii) to collect and contribute to up-to-date knowledge on performance indicators; (iii) to establish a wide set of quality specifications through the definition of performance goals, aiming to assure an expected performance level; (iv) to develop detailed examples for practicing engineers on the assessment of performance indicators; (v) to create a data basis from COST countries with performance indicator values and respective goals; (vi) to develop a webpage with information about the Action; (vii) to support the development of technical/scientific committees; (viii) to disseminate activities, such as Short-Term Scientific Missions (STSM), training schools and other teaching activities (e.g. e-lectures), for practicing engineers and researchers, regular workshops and conferences.

A first report on Performance Indicators has been issued [3]. Main sub-systems have been discussed, Figure 2 and main approaches in damage detection, Figure 3, see e.g. [4], [5].

Figure 2. Three main sub-systems: substructure, superstructure and roadway/equipment, [3].

Figure 3. Main approaches in damage detection: visual inspection, non-destructive testing, probing and structural health monitoring (SHM), [3].
3. SOME PRELIMINARY CONCLUSIONS AND OUTLINE OF FUTURE DEVELOPMENTS

At the level of an Operational Database, more work is necessary to identify key performance indicators. Further extension of the Operational Database with the Research-based one should help in the following two main tasks:

- to select the most important Performance Indicators for achieving Performance goals that are crucial for optimal Quality Control Plan within bridge management
- to allocate them with appropriate weights (importance level).

In order to select the most important Performance Indicators the following steps should be followed:

- Define crucial Performance Goals (for example: safety, serviceability, reliability, durability, availability, maintainability, ...)
- Categorise Performance indicators in relation to Performance Goals (at different levels: component, system, network; taken into account different aspects: technical, sustainability, socio-economic),

The overall database should include the most important indicators for achieving the goals crucial for optimal quality control.

REFERENCES


[5] MAINLINE. A European FP 7 research project 2011-2014 with 19 partners with the full name: MAINtenance, renewaL and Improvement of rail transport iNfrastructure to reduce Economic and environmental impacts. A project summary and 27 deliverables are available at www.mainline-project.eu