European Cooperation in the field of Scientific and Technical Research
- COST -

Brussels, 14 November 2014

COST 120/14

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action TU1406: Quality specifications for roadway bridges, standardization at a European level (BridgeSpec)

Delegations will find attached the Memorandum of Understanding for COST Action TU1406 as approved by the COST Committee of Senior Officials (CSO) at its 191th meeting on 12-13 November 2014.

MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

COST Action TU1406
QUALITY SPECIFICATIONS FOR ROADWAY BRIDGES, STANDARDIZATION AT A EUROPEAN LEVEL (BridgeSpec)

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 4114/13 "COST Action Management" and document 4112/13 "Rules for Participation in and Implementation of COST Activities", or in any new document amending or replacing them, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to develop a guideline for the establishment of Quality Control plans in roadway bridges, by integrating the most recent knowledge on performance assessment procedures with the adoption of specific goals.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 128 million in 2014 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Section *2. Changes to a COST Action* in the document COST 4114/13.

A. ABSTRACT AND KEYWORDS

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. It is verified that there is a large disparity in Europe regarding the way these indicators are quantified and how such goals are specified. Therefore, this Action aims to bring together, for the first time, both research and practicing community in order to accelerate the establishment of a European guideline in this subject. It will be also analysed new indicators related to sustainable performance of roadway bridges.

Keywords: asset management, performance indicator, performance goal, quality control plan, roadway bridge

B. BACKGROUND

B.1 General 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. Though they belong to the domain of public service, their management mechanism can be conducted by the state or under a private public partnership. However, in both cases, 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.

Road asset management is a task of great responsibility, since it involves vital assets to the community. They allow us, for example, to reach our workplaces, services, schools, to transport goods to their various sale points or to make the most of our free time. An efficient transportation network is essential for the modern society from the economic, societal and environmental point of view. Today, it is a challenge for operators to manage road infrastructures under their responsibility in an efficient way, meeting the present and future needs of the community they serve.

Roadway bridges, together with other roadway structures, such as tunnels, are the most critical components of road infrastructures. Throughout their life, they require regular maintenance actions whose costs are generally supported by the operator. Accordingly, it becomes important to define strategies to maximize the societal benefits, derived from the investment made in these assets. This investment should be planned, effectively managed and technically supported by appropriate management systems.

Some of the main outcomes from the correct implementation of strategies for roadway bridges management are: (i) an improved user satisfaction, by improving the quality of provided service; (ii) an improved sustainable performance; (iii) a guarantee of a pre-specified safety level; (iv) an optimized return of investment; (v) a long-term planning and reliable performance; (vi) an improved risk management.

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.

All over the world, the need to manage roadway bridges in an efficient way led to the development of management systems. Hence, nowadays, many countries have their own system. Although, they present a similar architectural framework, several differences can be appointed, for example, with regard to the condition assessment procedure. These differences constitute a divergent mechanism that may conduct to different decisions on maintenance actions.

Within the roadway bridge management process, 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. Therefore, a discussion at a European networking level, seeking to achieve a standardized approach in this subject, will bring significant benefits.

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 set of reference time periods for these assessment actions should be also presented. A second step would be the definition of standardized performance goals. Finally, a guideline for the establishment of QC plans in roadway bridges would be developed. In these plans, it is emphasized the importance of advanced deterioration prediction models. Moreover, the concept of sustainable

roadway bridge management, involving the evaluation of environmental, economic and social performance indicators during the whole life cycle, is also highlighted.
Since this Action has a high societal relevance, it is important for Europe to sponsor a wide collaborative network of several stakeholders, namely, partners from research and practicing community, aiming to joint efforts to build consensus on this subject. It will be also involved, on such network, people from different research fields, such as on-site testing, visual inspection, numerical modelling, asset management, sustainability, etc. Comparing with other research frameworks, it is thus verified that COST is the best mechanism for this Action, as it is necessary to promote the discussion at a European level on this field, through the support of networking and capacity-building activities.

B.2 Current state of knowledge

Within the last years, significant research has been developed worldwide regarding the condition assessment of roadway bridges, namely through the use of non-destructive tests, monitoring systems and visual inspection techniques. Obtained values, which will provide information regarding the assessed bridge state condition, were then compared with previously established goals. As a result, there are nowadays several ways of evaluating a bridge condition.
More recently, the concept of performance indicators was introduced, simplifying the communication between consultants, operators and owners. However, large deviations are still verified on how these indicators are obtained and, therefore, specific actions should be undertaken in order to standardise this procedure.
It is verified that a QC plan should always address the assessed performance indicators and pre-specified goals. However, these latter values are even more difficult to obtain as they are highly subjective. As a result, a dispersion of QC plans is verified. Once roadway concession contracts are based on such plans, this may become an enormous problem for the future of our society.
It is known that in the past a similar problem was addressed with roadway pavements. Although this was verified worldwide, in Europe it was solved through COST Action 354 (performance indicators for pavements). In a similar way, during this Action, a network of experts in the field of roadway bridges will establish specific recommendations for assessing performance indicators as well as for the definition of corresponding goals. This activity will be supported in a data basis, gathered from different COST countries. The objective is to develop, for the first time, a guideline for the establishment of QC plans in roadway bridges.
Moreover, it will be also analysed the possibility of incorporating new indicators related to

sustainable performance of roadway bridges. Some of these indicators were evaluated with success within the COST Action C25 (sustainability of constructions: integrated approach to life-time structural engineering). The final purpose is to establish detailed recommendations for assessing them as well as for the definition of specific goals, in a similar way as for the other indicators, and then integrating it in the developed guideline.

B.3 Reasons for the Action

Roadway bridges are considered to be, in terms of maintenance, one of the most critical components of road infrastructures. Though they belong to the domain of public service, their management mechanism can be conducted by the state or under a private public-partnership model. In both cases, a QC plan, which compares, for each performance indicator, the assessed value with a pre-specified goal, should be accomplished.
However, it is verified that those plans vary from country to country and, in some occasions, within the same country. This is a huge problem, as large variation in the quality of roadway bridges is verified. Therefore, this Action aims to achieve the European economic and societal needs by standardizing the condition assessment and maintenance level of roadway bridges. Moreover, it will be important to address, in such plans, new indicators related to sustainable performance. This constitutes a scientific advance as, actually, QC plans do not consider them.
In order to establish a standardization procedure for the assessment of performance indicators, namely, those that should be considered in a QC plan, as well as to define the performance goals, a network of experts is needed. Such network should incorporate people from different stakeholders (e.g. universities, institutes, operators, consultants and owners) and from various scientific disciplines (e.g. on-site testing, visual inspection, structural engineering, sustainability, etc.).
To summarize, there is a real problem which is the non-uniform way QC is actually developed for roadway bridges. This is surpassed by establishing a guideline for the establishment of QC plans in roadway bridges, which constitutes the main outcome of this Action. Such guideline will comprise specific recommendations for assessing performance indicators as well as for the definition of performance goals. COST is considered to be the most suitable means to achieve this outcome, namely, through the support given to the networking of experts from different stakeholders and research fields.

B.4 Complementarity with other research programmes

The direct complementarity of this Action with any currently ongoing or planned European research program is not known, although it is verified that there exist currently national and international projects, dealing with management systems, sustainable performance indicators, non-destructive tests, monitoring systems and visual inspection techniques, with which specific synergies may be established. This Action will also provide a platform for experts within the European dimension for developing project proposals under HORIZON 2020. It will be also made an effort to initiate national research projects in order to follow the identified research priorities.

C. OBJECTIVES AND BENEFITS

C.1 Aim

The main objective of the Action is to develop a guideline for the establishment of QC plans in roadway bridges, by integrating the most recent knowledge on performance assessment procedures with the adoption of specific goals. This guideline will focus on bridge maintenance and life-cycle performance at two levels: (i) performance indicators, (ii) performance goals. By developing new approaches to quantify and assess the bridge performance, as well as quality specifications to assure an expected performance level, bridge management strategies will be significantly improved, enhancing asset management of ageing structures in Europe.

C.2 Objectives

In order to reach the main general aim stated above, the following more specific objectives/deliverables have been considered: (i) to systematize knowledge on QC plans for bridges, which will help to achieve a state-of-art report that includes performance indicators and respective goals; (ii) to collect and contribute to up-to-date knowledge on performance indicators, including not only technical indicators but also environmental, economic and social ones; (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 as well as in the establishment of performance goals, to be integrated in the developed guideline; (v) to create a data basis from COST countries with performance indicator values and respective goals, that can be useful for future purposes; (vi) to develop a webpage with information about the Action and its participants, as well as, video-streaming from presentations at training schools, workshops and conferences, e-lectures, written

material (e.g. technical reports), etc.; (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, a conference and special sessions at international conferences.

C.3 How networking within the Action will yield the objectives?

Networking is essential for the success of this Action, since it will: (i) promote the exchange and sharing of knowledge and experience between experts from research and practicing community, necessary to the development of a guideline for the establishment of a QC plan on roadway bridges (ii) guarantee a good quality on scientific and practical engineering developments, within highly specialized research disciplines; (iii) assure, the scientific soundness and practical applicability of developed guideline through the participation of researchers, engineers, operators and owners from different countries; (iv) ensure the confrontation of theoretical idealization with current practical procedures, as well as encounters between scientific disciplines, thus catalysing the inclusion of innovation in developed guideline and its adaption to practice; (v) guarantee an efficient promotion, dissemination and use of the outcomes of the Action within Europe and worldwide; (vi) include new perspectives and experiences from the international research community representatives; (vii) ensure an impact on standardization through the “involvement of” and “outreach to” pre-normative and normative committees.

The networking instruments will comprise: (i) meetings, workshops and conference; (ii) joint peer-reviewed publications and presentations at conferences; (iii) STSM, training schools and other teaching activities (e.g. e-lectures), for engineering students, practicing engineers and young researchers; (iv) website and web 2.0 powerful tools (e.g. facebook); (v) exchange of young researchers; (vi) engagement of international experts and cooperation within the Working Groups (WG) of the Action.

C.4 Potential impact of the Action

The potential impact of the Action can be classified as follows:

Economic and societal

Create new jobs associated with the new QC services. On one hand, equipment and software development companies will benefit from performance/condition evaluation activities. On the other

hand, consultancy and design engineering offices will benefit from specialized tasks related to life-cycle performance and condition assessment.

Improve economic efficiency in the operation, maintenance and management of roadway bridges, by an optimized return of investment and a long-term planning of maintenance strategies, with an impact on owners, operators and society in general.

Increase the competitiveness in structural engineering industry and highway operators, consolidating Europe's position in asset management.

Enhance the management of risks to individuals, environment and economy.

Improve user satisfaction regarding the quality of provided service, namely, by increasing safety and comfort, reducing travel time, among other performance measures.

Environmental/Sustainability

Change the way how roadway bridges are evaluated, as together with traditional technical performance indicators, new sustainable performance indicators will be incorporated. This will also change the way owners, operators, consultants, academics, etc., will look to sustainability.

Improve ecological footprint of bridge structures by reducing their life-cycle cost and increasing their service life. For instance, when establishing a QC plan the maintenance and repair costs may decrease, with a direct impact in the diminishment of total energy consumption and carbon footprint (CO2 emissions).

Sustainable design of new bridges, devoting to maximize the mechanical, durability and environmental performance during the whole life-cycle. In this case, the environmental footprint is reduced by increasing the use of waste materials (e.g. recycled aggregates).

Well-being of general public

The decrease of maintenance, repair and reconstruction activities, due to the establishment of QC plans, will allow the reduction of downtime situations, contributing to a better users' everyday life. Besides that, the risk of disruptions, and consequently, the risk of causalities and fatalities is diminished.

By controlling the service life damages, such as, large cracks, excessive deformations or oscillations, the users' comfort is also increased.

On the research community

Better perception of the real practice problems, which allow to improve the cooperation between research community and practice engineers.

The performance assessment of roadway bridges will be developed in a standardized way throughout Europe, which will allow the establishment of reliable comparisons between different countries regarding their assets maturity.

Improvement on research developments and practical procedures regarding asset management in European countries, reducing the gap between the involved countries in the Action and other countries approach.

C.5 Target groups/end users

The target groups and end users who will exploit the outcome of this Action are: (i) public/private owners, as their assets will be maintained in an upscale level; (ii) operators, as standardized procedures for reducing maintenance costs, guaranteeing the same quality-level, will be introduced; (iii) design and consultant engineers, as the assessment of roadway bridges performance will be established in a uniform way, according to the developed guideline; (iv) equipment and software companies, as a new perspective will be given, regarding the most suitable equipment and software for the assessment of roadway bridges; (iv) academics and researchers engineers, as they will take an advantage of their involvement in the guideline preparation; (v) students, as they will benefit from COST tools (e.g. training schools) and from the contact with different stakeholders, involved in this Action; (vi) relevant European, international and national associations, with which the main outcomes of this Action will be shared; (vii) standardization bodies and code writers, which will benefit from the developed guideline.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

The scientific focus of the Action is centred in the production of a guideline for the establishment of QC plans for roadway bridges across Europe. In this context, this Action deals with recent developments on bridge safety, maintenance and management, according to a life-cycle outlook, aiming to define a standardized procedure for performance assessment as well as for the establishment of performance goals in order to accomplish a pre-specified service level. Moreover, it is intended to demonstrate the applicability of developed guideline, and other recommendations, with case studies.

D.2 Scientific work plan methods and means

The scientific work plan of this Action ensures the working progress in support of the objectives

established in Section C.1 and C.2. It is organized, based on the division of tasks (and subtasks) allocated for each WG listed in Section E.2, and according to the timetable defined at Section F. In the following, each WG is described.

WG1: Performance indicators

Life-cycle analyses methods are used for the assessment of new and existing bridges, as well as for the evaluation of maintenance strategies. Management systems, capturing different degradation processes, are very often used in relation to such life-cycle analyses methods. Such systems, developed for a structural condition assessment, are usually based on deterministic performance prediction models which describe the future condition by a functional correlation between structural condition attributes, such as the structural age, and the mechanical, chemical and thermal loading processes.

The practical implementation of such models requires detailed information about its variables, but due to the non-consideration of uncertainties in input variables (scattering values), it does not allow any statement about the quality of the prediction. However, probabilistic performance prediction models, which can be considered as a relevant goal, presume the incorporation of uncertainties in the descriptive variables by probability distribution functions and support conclusions about the quality of the performance prediction.

Deterioration could lead to a decrease of performance to such an extent that a structure could not be able to satisfy the basic serviceability and safety requirements before the design life has expired. In order to prevent the premature failure of a construction, structural codes provide several practical principles and application rules such as the use of protective systems for material exposed in aggressive environment, the construction detailing aimed at avoiding the initiation of degradation, the maintenance actions to be regularly performed, etc.

Each construction, during its life cycle, will face with deterioration depending on several factors such as the environmental condition, the natural aging, the quality of the material, the execution of works and the planned maintenance. Therefore, several design procedures based on the prediction of the deterioration that will likely act on the structure will be developed in the framework of the international research. In addition, performance indicators for the present and future structural conditions on deterministic and probabilistic level will be defined and determined.

It is known that management systems are supported in QC plans which in turn are supported by performance indicators. Therefore, it is extremely important to analyse such indicators in terms of used assessment frameworks (e.g. what kind of equipment and software is being used), and in terms of the quantification procedure itself. In this particular work package, the objectives will be the definition of:

(a) Technical indicators: the goal in the first step is to explore those performance indicators of bridge structures, in the course of international research cooperation, which capture the mechanical and technical properties and its degradation behaviour. These properties are already partly covered by norm specifications but not their complex time variable performance. Moreover, environmental condition, natural aging, and the quality of the material regarding to determined indicators will be investigated and evaluated in their meaningfulness. These considerations, however, also include service life design methods, aimed at estimating the period of time during which a structure or any component is able to achieve the performance requirements defined at the design stage with an adequate degree of reliability. On the basis of the quality of input information (mainly concerning with the available degradation models), as sketched in the above description, it is possible to distinguish among deterministic methods, usually based on building science principles, expert judgment and past experience, which provide a simple estimation of the service life, and probabilistic methods;

(b) Sustainable indicators: in addition to technical performance indicators, which characterize the ultimate capacity as well as serviceability conditions, sustainability indicators, environmental based, will be also formulated. These variables characterize the environmental impact of a structure in the course of its total life cycle, expressed in terms of total energy consumption, carbon footprint (CO2 emission), balance of raw materials, etc. These indicators can be separated into direct and indirect indicators, where the former are related to the construction/maintenance itself and the latter are caused e.g. as a consequence of limited functionality;

(c) Other indicators: other sustainable indicators, economic and social based, may be used to evaluate a bridge performance. These indicators capture, based on the technical performance of a structure, additional aspects that may influence the decision process and typically represent the discounted (accumulated) direct or indirect costs associated with construction and maintenance. Summed up over the full life-time, they represent part of or the full life-cycle costs. They can, in the context of multi-objective optimization, be understood as a weighting scheme to arrive to a single objective function that is to be minimized.

The milestone for this task is the publication of a report on these performance indicators until the end of year 1. Such report will address a general description of these indicators, how they are assessed (e.g. visual inspection, non-destructive tests and monitoring systems), with what frequency, what values are generally obtained and, finally, some general recommendations. This outcome will be one of the main inputs of WG5, being also used by WG3. The main achievements will be published in refereed scientific journal papers and in international conferences. A summary of obtained results will be also available at both website and web 2.0 (e.g. facebook). A joint

workshop on this field will be organized at the end of this task.

WG2: Performance goals

The main objective of this work package is to define a set of goals for the indicators previously identified in WG1. These goals will vary according to technical, environmental, economic and social factors. Specific recommendations will be given in order to ensure that the definition of such goals should be the most generalized as possible. In particular, it will be established:

(a) Technical goals: it will be analysed what goals are actually used for technical performance indicators in roadway bridges and its components (e.g. bearing, joint, etc.). It will be also evaluated which are being defined in the course of international research cooperation. There will be an open discussion within the experts' network in this field, in order to determine the most important factors for the definition of such goals as well as the most suitable threshold values. It will be established goals, both for deterministic and probabilistic methods, for time-varying indicators and for different assessment procedures (e.g. visual inspection, non-destructive tests and monitoring systems);

(b) Sustainable goals: specific goals will be defined for sustainable indicators, environmental based. This task is much more difficult to perform than for technical indicators, as the historical data basis is much smaller. Nevertheless, an open discussion will be established within a network of experts in this field, in order to identify the most important factors for the definition of these goals as well as the most appropriate threshold values;

(c) Other goals: the definition of goals for other sustainable indicators, economic and social based, is extremely difficult as it largely depends on the established agreement between the owner and the roadway operator (concession model). Nevertheless, it will be important for the future of Europe to define such goals, or at least to provide some recommendations, so that standardized procedures can be implemented. In order to achieve this objective, an open discussion will be developed among a network of experts.

The milestone for this task is the publication of a report on performance goals until the end of year 2. Such report will address a description of the most important technical, environmental, economic and social factors, how to compute each goal, with what frequency, what values are generally obtained as well as some general recommendations. This outcome will be one of the main inputs of WG5, being also used by WG3. The main achievements will be published in refereed scientific journal papers and in international conferences. A summary of such results will be also available at both website and web 2.0 (e.g. facebook). A joint workshop on this field will be organized at the end of this task.

WG3: Establishment of a QC plan

The desired service quality of the whole bridge can be affected by a single dysfunctional component

or by the combination of several dysfunctional components. The decrease in bridge service quality clearly depends on the degree of components' dysfunctionality. This dependency can be modelled, among others, by Bayesian nets, which provide the time variation of each bridge component performance.

However, in order to assure a desired service quality with minimum interruptions, bridge owners launch preventative actions when the risk of service impairment, interruption or losses in life cycle costs reaches some predefined level. Implicitly the owners define herewith the accepted risk which can be different from country to country, based on social equity principles. This accepted risk depends upon the established performance goals for each component or combination of bridge components.

The QC plan mirrors these findings and is used for maintenance planning by defining a criteria for triggering maintenance interventions. Clearly, these QC plans have to be established for each individual bridge. They perform the basis for the asset management of this type of roadway infrastructure. The objective of this task is to establish a procedure, based on Bayesian nets or other heuristic rules used worldwide, which would allow the bridge owner to define a QC plan for each individual bridge.

The milestone for this task is to prepare a report with detailed explanation of the steps towards the establishment of a QC plan for different types of bridges until the middle of year 3. This outcome will constitute the basis of WG5, being also used by WG4. The main achievements will be published in refereed scientific journal papers and in international conferences. A summary of such results will be also available at both website and web 2.0 (e.g. facebook). A joint workshop in this field will be organized at the end of year 3.

WG4: Implementation in a Case Study

During this task a set of roadway bridges, belonging to different COST countries and preferably with identical typologies, will be identified. Then, for those bridges, it will be obtained the performance indicators (identified in WG1). Such values will be then compared with pre-specified goals (identified in WG2) and, finally, a QC plan will be implemented (detailed description at WG3). Different methodologies for obtaining such indicators, as well as different threshold values, will be used as the basis for benchmarking.

At the end of this task, a QC plan will be applied to such bridges, according to the recommendations established by WG3. The main objective of this study is to show the existing dispersion between obtained performance indicator values and its goals. It is important to note that this will reflect the existing dispersion among QC plans. Also, it will be tested and validated the implemented QC plan, according to the recommendations given by WG3. Obtained results will be discussed within a high

level of network of experts in this field.
There are several ongoing national research projects in COST countries with which a close interaction may be established within the scope of this task. Namely, some of the roadway bridges which will be used as case study may be selected from those projects. Additionally, there will be several people from industry (e.g. owners, operators, etc.) involved in this working package.
The milestone of this task is to prepare a data basis from benchmarking, until the middle of year 4. Obtained results will validate the outcomes of WG1, WG2 and WG3, and will be used by WG5. The main achievements will be published in refereed scientific journal papers and in international conferences. A summary of such results will be also available at both website and web 2.0 (e.g. facebook).

WG5: Drafting of guideline / recommendations

In this task it will be joined the work developed in other working packages (especially from WG1, WG2 and WG3) with the objective of writing a guideline, and recommendations, for the implementation of a QC plan for roadway bridges that could be adopted by several roadway agencies. The main goal will be the preparation of a document that can be easily adopted by engineers facing the management of new and existing bridges.
Therefore, the format and content should follow the existing codes / guidelines / recommendations used today by agencies. Hence, the first step will be the analysis of existing documentation and work developed in other similar research programs and by standardization committees at national and international level.
Due to the objective proposed, this working package will have a strong interrelation with all the other working packages, becoming an output for WG6 (dissemination). Finally, the milestone of this task is the development of a new guideline for the establishment of QC plans in roadway bridges until the end of year 4. The main achievements will be published in refereed scientific journal papers and in international conferences. A summary of such results will be also available at both website and web 2.0 (e.g. facebook). A conference, in which the main outcome of this Action will be presented to a broader public, will be organized at the end of this task.

E. ORGANISATION

E.1 Coordination and organisation

The coordination, implementation, management and supervising of this Action activities will be made by the Management Committee (MC), according to the COST directives. The MC will

appoint its Chair, Vice-Chair and members at the Action kick-off meeting. Moreover, the General Secretary, the WG leaders and the Grant Holder will be elected at the Action first meeting. The General Secretary will be responsible for the coordination of efforts to guarantee the successful implementation of the Action, namely: website coordination, meetings and events (e.g. workshops, conference, training schools and other teaching activities), management of STSM and dissemination in general. The MC Chair and Vice-Chair, as well as the General Secretary, the WG leaders, the Grant Holder and an early-stage researcher per WG will constitute the Steering Committee (SC). The SC is responsible for the executive management of the Action (e.g. preparing the agenda for MC meetings), coordinating in an efficient way the necessary decisions for the successful implementation of the Action. The leader of each WG subset (Section E.2) will be nominated on the first WG meeting, being then communicated to the SC.

A website, containing general information for the public as well as technical information targeted to researchers and practitioners, will be developed in the scope of this Action. This website will be continuously updated, according to the timetable defined at Section F. A password-protected area will be also created for members in order to simplify and centralize the exchange of information. A facebook page, containing up-to-date information of the COST Action, will be also developed with the aim of attracting early-stage researchers.

This Action will be direct towards the aim and objectives (Sections C.1 and C.2), the implementation of the scientific work plan (Section D.2) and the follow up of the timetable (Section F). The scientific activities will be coordinated by the WG leaders. The SC will also monitor and assess the Action progress, issuing yearly reports. The WG leaders are responsible to report to the SC their WG state after each WG meeting. The SC advises, on the basis of each report, where to focus further efforts of this Action.

The following milestones (M) and deliverables, with definite instants of occurrence (Section F), will be accomplished for each WG (Section E.2) during this Action:

WG1 Performance indicators:

M1 Elaborate a report (deliverable: report of performance indicators for roadway bridges)

WG2 Performance goals:

M2 Elaborate a report (deliverable: report of performance goals for roadway bridges)

WG3 Establishment of a QC plan:

M3 Prepare recommendations (deliverable: recommendations for the establishment of QC plan in roadway bridges)

WG4 Implementation in a Case Study:

M4 Prepare the data basis (deliverable: data basis from benchmarking)

WG5 Drafting of guideline / recommendations:

M5 Preparation of guideline (deliverable: guideline for the establishment of QC plan in roadway bridges)

E.2 Working Groups

The WG were established according to the strategy, methods and means defined in section D.2. Each WG will be divided in subsets in order to better organize the developed tasks. Additionally, a knowledge dissemination group will be constituted which will be responsible for the disclosure of the results and/or outcomes of the COST Action, according to the strategy defined in Section H. It is also provided the duration of each WG and respective subsets.

WG1 – Performance indicators

a) Technical indicators: *year 1, quarter 1 – year 1, quarter 4*

b) Sustainable indicators: *year 1, quarter 1 – year 1, quarter 4*

c) Other indicators: *year 1, quarter 1 – year 1, quarter 4*

WG2 – Performance goals

a) Technical goals: *year 2, quarter 1 – year 2, quarter 4*

b) Sustainable goals: *year 2, quarter 1 – year 2, quarter 4*

c) Other goals: *year 2, quarter 1 – year 2, quarter 4*

WG3 – Establishment of a QC plan

a) Survey of European roadway QC plans: *year 1, quarter 1 – year 2, quarter 2*

b) Procedures for the establishment of a QC plan for roadway bridges *year 2, quarter 3 – year 3, quarter 2*

WG4 – Implementation in a Case Study

a) Selection of case studies: *year 2, quarter 3 – year 3, quarter 1*

b) Benchmarking: *year 3, quarter 2 – year 4, quarter 2*

c) Application of a QC plan for roadway bridges: *year 3, quarter 3 – year 4, quarter 2*

WG5 - Drafting of guideline / recommendations

a) Standardized performance indicators: *year 2, quarter 1 – year 2, quarter 4*

b) Standardized goals: *year 3, quarter 1 – year 3, quarter 4*

c) Standardized QC plan for roadway bridges: *year 3, quarter 3 – year 4, quarter 4*

WG6 - Knowledge dissemination

E.3 Liaison and interaction with other research programmes

This Action may have liaison with several international programmes, being the most relevant expected interaction with CEN TC 250 “Assessment of Existing Structures” (in progress). Also, there will be several committees from international organizations that will “benefit from” and “interact with” this Action.
Naturally, this Action will have complementarity with national ongoing programmes that support separately each involved institution. Moreover, this Action will provide a platform for experts for developing project proposals under the upcoming calls within the HORIZON 2020 program.

E.4 Gender balance and involvement of early-stage researchers

This COST Action will respect an appropriate gender balance in all its activities and the MC will place this as a standard item on all its MC agendas. The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas.
Although being difficult to achieve, due to the well-known general unbalanced ratio of women in this field, some measures will be taken to evolve more female participants in this Action. One of these measures will be the encouragement of female participants to overtake responsible positions in both MC and SC.
Early-stage researchers will also have responsibilities in all WG as well as in the SC, being supported by experienced researchers. The capacity-building of young researchers is therefore assured. It is important to note that the proposer of this Action, himself is an early-stage researcher, which enhances the previously commitment.

F. TIMETABLE

The timetable for the four years of the Action is provided below, considering the following general principles: (i) SC and MC meetings will take place every six months (same or sequential days); (ii) WG meeting dates will coincide with workshops and SC/MC meetings; (iii) it will be held one workshop at the end of each year (except for the last year); (iv) a conference will be organized at the end of the Action; (v) it will be developed a training school at the end of each year (except for the first year); (vi) during the entire Action it will occur STSM; (vii) a website will be updated all

the semesters; (viii) other teaching activities (e.g. e-lectures) will be developed throughout the Action. The deadline for the established milestones on Section E.1 is also indicated.

Activity/Months	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
Meeting	X			X		X		X		X		X		X		X
Workshop				X				X				X				
Conference																X
Training school								X				X				X
STSM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Website	X			X		X		X		X		X		X		X
Milestone				M1				M2		M3				M4		M5

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, BE, CH, CY, CZ, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IL, IS, IT, LT, LV, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, TR, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 128 Million € for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

H.1 Who?

The success of this Action can be measured by the impact it has on the civil engineering community composed by, among others, infrastructure owners and operators, standardization bodies, scientific community, practicing engineers and other professionals.
The Action will enable useful synergies and disseminate the results to the following target groups and end users: (i) roadway owners and operators; (ii) designers and consultant companies; (iii) equipment and software companies; (iv) researchers and engineers in the field of asset management and structural engineering; (v) relevant national, European and international associations and confederations; (vi) authorities and policy makers at regional and European level; (vii) research

community, relevant standardization bodies and code writers; (viii) teachers and students of engineering schools.

It is important to note that the achievements of this Action will become available in an illustrative, executable and user friendly way, so that it is possible to assure its practical application. Moreover, they will be further disseminated to active research frameworks such as HORIZON 2020 as well as to national research frameworks.

H.2 What?

The MC will assure, through WG6 (Section E.2), effective dissemination mechanisms to publish the progress and results of the Action to those who were identified in Section H.1. Used instruments to disseminate knowledge will be:

Website and other dissemination mechanisms

It is known that nowadays the most powerful tool for dissemination is internet and, therefore, a website will be developed. Also, other strong dissemination mechanisms will be used, such as leaflets, poster and web 2.0 (e.g. facebook, youtube), as well as the establishment of a close interaction with TV channels (e.g. Euronews), radio stations, newsletters and online service news.

Workshops, conference, training schools and STSM

Workshops, conference, training schools and other teaching activities (e.g. e-lectures) are a very good scheme to reach the audience working in research, education and practice. STSM are an ideal tool for this Action and they will be especially promoted to early-stage researchers. STSM will encourage the synergy among institutions, accelerate the learning of students and provide academia and industry with highly trained staff.

Conferences, peer-reviewed articles and reports issued by the Action

The achievements of this Action will be published in international conferences (e.g. organizing special and mini-sessions), as they bring together researchers, academia and industry in an open-discussion forum, in peer-reviewed articles, as they are a very important way to prove the impact and accuracy of obtained results and to make them available for the future, and in technical reports (state-of-art reports and others), which will have the involvement of peer-reviewers from other countries.

Guideline and link to standardization

A specific guideline for the establishment of QC plans in roadway bridges, which comprises the performance indicators assessment and its goals, will be developed (section E.1). An aim of this Action is that the obtained results and developed guideline will be linked to European and

international standards. In order to assure this objective, it will be build up an engagement of the Action network with standardisation committees.

H.3 How?

The Action knowledge dissemination means will respect the timetable, available at Section F, and they will be:

Website and other dissemination mechanisms

A website will be developed at the beginning of the Action and will be continuously updated. It will contain information about the Action itself (e.g. technical reports, video streaming of key-note presentations and teaching activities, etc.), in the public section, and exchange confidential documents, in the private section. At the beginning of this Action it will be also developed a facebook page, which will be permanently updated, as well as a leaflet and a poster. An effort will be made to publish the main achievements of this Action in youtube, TV channels (e.g. Euronews), radio stations, newsletters and online service news.

Workshops, conference, training schools and STSM

The Action workshops, conference, training schools and other teaching activities (e.g. e-lectures) will allow to explain the performed scientific work as well as the practical approach of developed guideline (section E.1) between researchers, industry and stakeholders. It is planned three workshops, a final conference and three training schools during this Action. Other teaching activities will be also developed throughout this Action. STSM will enable synergies with different types of institutions, bringing them closer to the scientific community, promoting also more awareness to COST Actions. They will occur in a permanent basis during the whole Action.

Conferences, peer-reviewed articles and reports issued by the Action

Strong relations can be built with the organizers of national and international conferences in the topic of this Action. These are an important means to disseminate the main achievements of the Action to a broader public. Peer-reviewed journals are also an important means to spread the obtained results to the targeted audience and therefore the Action participants will be encouraged to use such framework. A special issue may be developed at the end of this Action in which the main achievements will be published.

Guideline and link to standardization

The guideline, one of the main outcomes of this Action (section E.1), will be developed in close cooperation with scientific and practicing community. In order to assure that, a WG, with people from both these sectors, will be constituted (section E.2). This WG will play a crucial role in this

Action as it has not only to establish the layout of such guideline but also to closely cooperate with the standardization committees.