ASSESSMENT, REINFORCEMENT AND MONITORING OF TIMBER STRUCTURES: FPS COST ACTION FP1101

Dina D’Ayala⁠¹, Jorge Branco⁠², Mariapaola Riggio⁠³, Annette Harte⁠⁴, Jochen Kurz⁠⁵, Thierry Descamps⁠⁶

ABSTRACT: Interest in extending the life of existing and historic timber structures has increased steadily in the last decade, owing to a shift in emphasis forward sustainability and low carbon emission of the construction industry. This increased interest and the growing number of researchers and institutions active in this field are the motivation for the setting of COST ACTION FP1101 on Assessment, Reinforcement and Monitoring of Timber structures, now nearing completion of its second year of activity. The paper explains what a COST Action is and presents the aims and objectives of this European Research network initiative. It discussed the state of the art in these three fields of research activities as outlined by the work developed jointly by the network. It discusses avenues for further international collaboration beyond Europe by using some of the implementation instruments available within the COST framework. The paper concludes with a discussion on the current research gaps identified through the network workshop, and a view as to how the major outcomes of the network activities can be further disseminated and find institutional outputs through collaboration with RILEM and European Standardisation Technical Committees.

KEYWORDS: Assessment, Strengthening, Monitoring, research networks, standards

1 INTRODUCTION

In recent years, timber in new structures has become increasingly used, both in its natural form and in engineered products, as the argument for sustainable, renewable and low CO₂ emission construction industry gains momentum and acceptance. Moreover timber has been used as structural material for centuries and its durability is demonstrated by numerous heritage structures worldwide, which properly designed and built have stood the test of time. Fundamental to the longevity of these structures is their adequate assessment and monitoring and appropriate strengthening interventions, when needed.

COST is an intergovernmental framework for European Cooperation in Science and Technology, allowing the coordination of nationally-funded research on a European level, through the establishment of research networks. One of the nine COST scientific domains is Forests, their Products and Services (FPS) under which the FP1101 is funded over 4 years. [1]. The main aim of the FP1101 COST Action is to increase the acceptance of timber in the design of new structures and its longevity in historic and existing structures by improving the robustness of methods to assess, reinforce and monitor such structures, and facilitate the dissemination and uptake of these methods. The need for assessment, reinforcement and monitoring of timber structures can arise from multiple motivations such as the expiration of the planned lifetime, materials aging, exceptional incidents, and ever more important, a change of use or of environmental conditions. The FP1101 Action benefits from multidisciplinary views of the problems, as its membership includes material scientists, structural engineers, researchers involved in conservation of historic timber structures, academics involved in novel products development and application, industrialists and contractors. The paper explains the rationale and objectives of the activities set within the network, it then reviews the results achieved after two years of existence and concludes by presenting a strategy for strengthening links with other international networks and standardisation bodies.

2 STRUCTURE AND METHODS OF THE ACTION

The Action is aimed primarily at European economic/societal needs. An increased and more innovative use of timber as a building material based on stronger confidence will bring environmental and
economic benefits since more and more durable timber structures, e.g. with projected service lives longer than 50 years, are vital in the development of a low-carbon economy. The Action is subscribed by 21 European countries and New Zealand as International partner country. [2]. The objective of the Action is to increase the confidence of designers, authorities and end-users in the safe, durable and efficient use of timber and increase its acceptance and use in the design of new and in the repair of historic and existing buildings. The Action is organised in three main streams of activities which mirror the typical process followed when aiming to extend the life in service of a timber structure: Assessment, Monitoring and Strengthening. A working group of scientists and technologist is organised around each of these themes and a set of objectives and tasks is identified to progress and harmonise the state of knowledge through the membership of the Action and promote development of further research where gaps are identified. Currently the WG1 Assessment has a membership of 75 organised in three task groups: TG1 Identification of Vulnerabilities, TG2 Correlation and enhancement of NDT and NDE techniques, TG3 Methods for assessment of traditional carpentry joints. The WG1 has adopted as reference state of the art two publications recently produced by RILEM TC 215. [3, 4]. The WG2 Strengthening has a membership of 50 and works closely with FP1004 and with the RILEM Committee. Two separate task groups work on in-bonded rods and self-tapping screws as means of elements and connection strengthening, while a third task group is working on an electronic based tool to guide the designer in the choice of the most suitable strengthening technique given a structural lay-out, problem, and timber species. The WG3 on Monitoring has a membership of 40 and represents the most novel aspect of the Action. Although applications of monitoring techniques are relatively common in timber engineering, methods and approaches are mostly borrowed from the expertise in use with other materials. This means that techniques are often adapted on a need basis with relatively modest consistency and coherence. Currently however in Europe there is an increasing number of institutions actively researching this topic although output have not yet consolidated in a shared state of the art. Hence the report prepared by WG3 has the critical role of setting a common basis for the timber monitoring international research community. One of the current activities is the review of outputs to classify the most useful monitoring techniques in relation to species of timber, structural problem and overall aim of the investigation.

3 ACHIEVEMENTS

The main measure of success of the Action is the ability to provide through its network international platforms to disseminate knowledge through a number of instruments available through the COST framework:

(i) State of the art reports outlining the current knowledge and needs for future research; (ii) Conferences and meetings; (iii) Workshops and Training Schools, and (iv) Short Term Scientific Missions.

The Action has co-organised in collaboration with Trento University an international conference on Structural Health Assessment of Timber Structures (SHATIS 2013), and three workshops for each of the working groups (Wroclaw 2012, Telc 2013, Trento 2013). Short Term Scientific Missions (STSM) and Training Schools are aimed at knowledge transfer and collaboration between senior and younger researcher across European and international institutions. Two training schools with a participation of more than 25 trainees and 7 international trainers are being organised in Athens and Mons on different themes identified as strategic area of research by the working groups. The paper will report in detail on these activities outlining the added value in research term of this collaborative intensive weeklong activity. The STSMs are instead more of a 1 to 1 exchange in which two institutions exchange researchers and resources over a term of 3 weeks to 3 months, to jointly tackle a common research problem sharing approaches and resources. The themes are chosen strategically to meet the objectives of the Action, and so far 7 young researchers have visited as many institutions. The paper will provide an account of the outcome of these missions and discuss some of the challenges and results achieved.

4 CONCLUSIONS

The success of the Action is ultimately measured by the ability to produce guidelines for dissemination and harmonisation of the knowledge on assessment strengthening and monitoring of existing timber structures. The paper concludes highlighting joint initiatives with CEN TC 250, CEN TC 346, and with RILEM, as the instruments through which the positive impact of the action will be felt.

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REFERENCES

[1] www.costfp1101.eu