European Cooperation in the field of Scientific and Technical Research

- COST -

Secretariat

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MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action : Basis of structural timber design - from research to standards

Delegations will find attached the Memorandum of Understanding for COST Action as approved by the COST Committee of Senior Officials (CSO) at its 176th meeting on 1 December 2009

MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as

COST Action
BASIS OF STRUCTURAL TIMBER DESIGN - FROM RESEARCH TO STANDARDS

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 270/07 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to provide the knowledge and methods necessary to bring new developments in the area of timber construction into building practice (see objectives).

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 84 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 Chapter V of the document referred to in Point 1 above.

A. ABSTRACT AND KEYWORDS

In the last two decades, the basis of scientific knowledge in timber engineering has developed immensely. The documented results, however, are inhomogeneous and fragmented and do not provide timber engineering community with the relevant information to prove the reliable and safe application of newly developed wood products in construction. The aim of the present COST Action is to overcome the gap between broadly available scientific results and the specific information needed by designers, industry, authorities and standardization committees, providing transfer for practical application in timber design and innovation. This will be achieved by the coordination, consolidation, harmonization and dissemination of recent efforts in research and development that aim at enhancing existing or deriving new methods and design rules for timber structures. The results of this Action will increase the confidence of code-writers, authorities, designers and end-users in the safe, durable and efficient use of timber in structures and consequently increase its acceptance and use in the design of buildings.

A.2 Keywords: Wood, wood-based products, timber structures, performance criteria, design rules

B. BACKGROUND

B.1 General background

The European Union stands, among others, for fair trade and free exchange of goods and services. In the last decade this developed into a more efficient use of physical and human resources towards a benefit for European society. As all economic sectors, the construction sector has to a large extent participated in the internationalization. Crucial to this success was the implementation of the Eurocodes.

The Eurocodes are a set of harmonized technical rules for the structural design of construction works in 27 European countries, developed by the European Committee for Standardization (CEN). The Eurocodes regulate to a large extent the reliability, serviceability, durability and cost-efficiency of the built environment and are the principal means to prove that the essential requirements for building products, i.e. mechanical resistance, stability and safety in use are met. They facilitate the exchange of construction works as well as the development and marketing of new products. In other words, the Eurocodes are the most important interface between structural materials research in structural materials and building practice. It is therefore of utmost importance that the rules and

specifications in the Eurocodes are based on the most recent and best scientific knowledge available.

The timber construction industry is also very much influenced by the recent developments of the Eurocodes. The open market and common technical standards, i.e. “Eurocode 5 – Design of Timber Structures” and corresponding product standards, can help to achieve high transparency for the exchange of wood-based building products and services and therefore to a mutual benefit for the timber construction industry and its customers. These European standards encompass expertise from all European countries. This fact, however, describes at the same time one main challenge during this development. Not only technical issues had to be solved but also the variety of cultures and empirically derived building traditions that had developed in the mosaic of 27 individual countries had to be respected. This resulted in the fact that several subjects, vital for the use of timber structures, were not covered due to the lack of background information and consensual approach. The development of the current version of Eurocode 5 took more than a decade. Another decade passed between the final draft and its implementation by national standardization bodies. This led to the situation that the state of the art in timber construction began to overtake the standardization process. Especially the last decade was marked by significant technical advances and developments in the field of timber construction, widening the range of application of timber for structural applications and therefore increasing the potential for its broad use. This development, as described before, is not reflected in the current version of the Timber Design Standards. The lack of common design and construction principles for these new developments results in a variety of applied approaches that often lead to a lower reliability level of such structures at higher cost. This is a clear hindrance with respect to societal confidence, acceptance and consequently the broad use of timber in construction across Europe. Examples of developments, representing an important factor for the success of timber construction, that are not or insufficiently covered by the current version of the European standard for the Design of Timber Structures include:

- Structures: multi-storey timber buildings, towers
- Materials: cross-laminated timber, hybrid elements, e.g. timber-concrete composites
- Connections: self-tapping screws

The timber research community, the relevant standardization committees and the timber industry become increasingly aware of the disadvantageous situation for the timber construction sector.

Several initiatives in this direction have been undertaken especially within the last decade (e.g. CEI Bois Building with Wood “Standardization and Eurocodes”; PRB Initiative by German Construction Federations). These initiatives helped to clarify the areas of importance, as given above. But none of these initiatives could deliver:

- The scientific background necessary to enable standardization in the identified fields.
- The framework and methods to achieve a faster and more reliable transfer of new developments into the construction market.

The aim of the Action is to enlarge the scientific foundation that enables the development of new and the revision of existing methods and design approaches with warranted technical validity and consistency. This necessitates an expert network that links practice with research, i.e. technological developments with scientific background. COST presents the ideal basis to foster this type of joint effort.

B.2 Current state of knowledge

Bio-based materials, and more specifically wood, are fundamental building materials for most nations across the globe. Wood has potential to be a truly low environmental impact material for construction. Yet at the same time work is lacking that allows predicting and satisfying the performance of the products in service. Structural elements have to be designed to meet essential requirements like mechanical resistance, stability and safety in use. This necessitates the derivation of safe and reliable parameters with respect to e.g. strength, stiffness and resistance of materials and structural elements. These parameters have to comply with the general safety concept, its design equations and variables therein. The scientific field “Basis of Design” in which safety concepts, limit states, loading situations and safety factors are developed has no direct link to any structural material. From this follows that experts in this field are rarely also experts in wood as structural material. Vice versa, experts in timber structures are seldom also experts in Basis of Design. This is supported by the fact that both scientific areas have limited interaction. Mutual exchange and interaction, however, is a prerequisite for the development of harmonized and consistent methods and concepts to prove the safe and reliable applicability of wood and wood products in structures. Since structures have to feature a reliable and safe behaviour, the construction market is a very regulated market. This regulation framework is an essential component for the innovation process in the construction sector. Therefore it is seen as necessity for the future success of the timber

construction industry that the best current scientific and technological knowledge is made available to the corresponding committee responsible for the future revision of the design and product standards. Herewith, the main challenges are.

- The basis of scientific knowledge in timber engineering has increased drastically lately, also due to COST Actions E8, E24, E34, E53, E55, FP1004, FP1101 and many projects within the ERA Net WOODWISDOM. The documented results however, are inhomogeneous and fragmented and do not provide the standardization committees with the relevant information for their decision making.

- The developments in the timber engineering industry are fast and manifold. Currently this leads to a situation where standards are continuously becoming outdated.

The Action aims at establishing a framework and at developing methods that enable a faster and more reliable transfer of new developments into the timber construction market. This development will then be applied to three areas of innovation that are not or insufficiently covered by the current set of wood product and timber design standards.

B.3 Reasons for the Action

The reason for the COST Action is the current lack of an expert network that is able to prepare recent fundamental and pre-normative research with respect to an introduction into a revised version of Timber Design standards, i.e. develop and establish the specific information needed for standardization committee decisions. Such an objective necessitates consensus and acceptance on European level. COST is therefore considered an excellent framework for doing this since it will provide a common platform for researchers and developers of technologies all over Europe. The lack of such a network could cause a continuation of abovementioned challenges, resulting in a weakened position of the timber industry on European level and on the international market. The COST Action thereby addresses technological and economic needs.
Apart from the establishment of an expert network that will serve timber construction industry beyond the duration of the COST Action, the Action will produce written outcomes in form of peer-reviewed articles and state-of-the art reports. The first is a good method to prove the importance and accuracy of results and to make these broadly available, also for future generations. All new or adapted methods and technologies which are developed or defragmented in the Action, will be compiled in state-of-the-art reports (STARs). These shall contain proposals that are applicable in practice as well as the specific information needed for the revision of wood product standards and timber design standards. More precisely, they shall clearly display the method or innovation,

including an explicit proposal with respect to its incorporation into standards which is backed by all necessary background information and scientific evidence.

B.4 Complementarity with other research programmes

Previous COST Actions have dealt with many aspects related to the performance of timber structures such as: E8 (mechanical performance), E24 (reliability), E29 (timber elements), E34 (bonding), E37 (durability), E40 (large dimensional lumber), E53 (quality control) and E55 (performance modelling). All Actions mentioned provide very valuable results that widened the scientific basis with respect to timber in construction. None of them, however, directly aimed at overcoming the gap between new methods and innovations and the specific information needed for their proof of applicability through their incorporation into standards or through Technical Approvals. The latter is a pre-requisite of the use of methods, materials and products in construction. Some results from these COST Actions however, can be very useful for this Action in form of background information on timber as a construction material.

The COST Action FP1004 “Enhance mechanical properties of timber, engineered wood products and timber structures” has given new impulses in the characterisation on wood and the development of enhanced wood products. The state-of-the art in the design and application of reinforcement of timber elements is one objective of COST Action FP1101 “Assessment, Reinforcement and Monitoring of Timber Structures”. It is assumed that both COST Actions successfully develop state-of-the art reports on the subjects of glued-in rods (treated in FP1004) and reinforcement of timber structures (treated in FP1101) so that these subjects will be subordinated in this Action.

COST Action FP1303 “Performance of Biobased Building Materials” focuses on the performance of bio-based materials used as building products with respect to durability, degradation and Life Cycle Assessment, enlarging knowledge on bio-based building products with respect to essential requirements 4: Hygiene, 6: Energy Economy and 7: Sustainable use of natural resources, as listed in the Construction Products Regulation. This COST Action will lead to scientific and technological advance of wood and wood products used as structural materials with respect to the essential requirements 1: Mechanical resistance and stability and 4: Safety in use. Liaison between both COST Actions will be sought.

This Action can provide complementarity to a wide range of on-going and future projects that have been funded either through national grants or pan-European programmes. Given its multi-disciplinary approach, this Action has the potential to function as medium for networks to be established that develop successful proposals for calls from e.g. the EU programme “Horizon

2020". The scientific programme focuses on recent developments within research and timber construction practice, giving high potential that future calls within "Horizon 2020" fall into the scope of this Action. An example during the first call is the application of timber or hybrid timber elements in tall facades for the building envelope.

C. OBJECTIVES AND BENEFITS

C.1 Aim

The main objective of the Action is to provide the knowledge and methods necessary to bring new developments in the area of timber construction into building practice. This will be achieved by the coordination, consolidation, harmonization and dissemination of recent efforts in research and development that aim at enhancing existing or deriving new rules for the design of timber structures. The aim is to establish a framework and to develop methods that enable a reliable transfer of new scientific results as well as new technological developments into the building market. In that respect, expected deliverables are state-of-the-art research reports and peer-reviewed papers for each of the Work Packages described below, giving essential background information and results that serve as medium to bring innovations into practical application.

C.2 Objectives

The secondary objectives are:

1. Create a link between the principles of semi-probabilistic design and the recent advances in timber construction technology.

2. Develop a framework and procedure on how existing and new technologies can be implemented in design formats consistently.

3. Collect and pre-process information about the recent advances in the key technologies "Solid Timber", "Connections" and "Hybrid Timber Structures" in order to be implemented in structural design regulations.

4. Encourage communication and optimize collaboration between scientists, industry and all other involved stakeholders.

5. Promote complementary research, avoiding research duplications, thus better use of national and European funding resources.

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

The advantage of the COST Action is, in difference to other European programmes, that it provides a platform where the objectives will be dealt with in a holistic approach. It will allow for a concerted effort with respect to an introduction of recent fundamental and pre-normative research into clear, consistent and up-to-date set of design rules for timber structures. The expected synergies will advance knowledge at a much faster rate than previously and allow fulfilling the request of the European Commission to develop the scientific foundation that enables the development of a revised set of design standards that really represents the state-of-the art in timber construction. The results to be realized shall meet the demands of practice and represent the current state of the art with a broad European consensus. This necessitates a close coordination between research and practice and strong links to standardization committees. Several scientists and practitioners which have already expressed interest in joining this Action are also members of standardisation committees, assuring the dissemination and explanation of the results of this Action to the relevant standardisation bodies.
Since the COST Action has already generated interest from experts outside Europe, cooperation with leading COST international partner countries in this field (North America, Australia and New Zealand) will be initiated. The Action will also provide a network for collaboration within ongoing projects financed by various national and European bodies, to allow for synergies to develop.
The coordination, discussion and harmonization of recent efforts in research and development will be realized through Workshops and short term scientific missions (STSMs). The consolidation and dissemination will be realized by Conferences, Training Schools and the joint elaboration of state-of-the-art papers and best practice guides in the relevant fields.

C.4 Potential impact of the Action

This Action will create scientific, technological, economic, environmental and social benefits. Research activities with the aim to improve the design and construction of timber structures constitute a large share within the domain Forests, their Products and Services, requiring the

exchange of information and identification of new research ideas (scientific benefits). Enabling the authorized (i.e. standardized) utilization of recent advances and developments in timber construction will widen the range of application of timber for structural applications. A clear description of the scientific background that forms the basis for the design of timber structures will lead to increased knowledge and extended possibilities for the use of timber as a structural material, giving architects, engineers, builders and authorities (including their next generations, now in training) a stronger confidence as well as more options for applying timber in the built environment (technological benefits). The development of a framework and methods to achieve a faster and more reliable transfer of new developments into the building market is a clear opportunity for timber industry and will strengthen its position in the international market. Improving the competitiveness of timber and timber products will increase the use of timber in modern and high performance structures. An increased use of the genuinely renewable material wood in buildings and the potential replacement of non-renewable materials will generate greater revenue for the forestry sector (economic benefits).This will support the development of an efficient low-carbon economy and a more efficient and sustainable use of forest resources (environmental benefits). Society benefits from safer structures and a more diverse and appealing built environment (social benefits).

C.5 Target groups/end users

The Action has generated interest from a broad range of stakeholders and is recognized as having the potential of significant impact. Whilst the emphasis within COST is increasing the European dimension, the success of this Action can be increased through the involvement of experts from over the world. The potential international significance is mirrored by the non-European experts that have expressed their interest during the development of this Action.
The target groups and end users of the Action are:

- Representatives of the timber construction industry;
- Architects, structural engineers, consultants and builders;
- Product developers in the sector of timber structures;
- Authorities and policy makers at regional and European levels;

- Research community, relevant standardization bodies and code writers;
- Teachers, lecturers and students of structural design, engineering and architectural schools.

From each target group, at least one stakeholder has already expressed interest in joining this Action. A range of potential stakeholders have been involved in the development of this Action.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

The first scientific focus of this Action is to join the two scientific fields “Basis of Design” and “Basis of Materials”, here: wood and wood products as structural material.
The second scientific focus of this Action is to link the scientific field “Basis of Materials” with practice. It will cover the applicability of wood and wood products as structural material by developing methods to achieve a faster and more reliable transfer of innovations into the building market. The gap shall be closed between new developments and the frequent lack of scientific background that is needed to verify their compliance with essential requirements for building products, i.e. mechanical resistance, stability and safety in use. Amongst this large domain, three areas of recent development still lacking sound scientific background and consensual approach were chosen while subjects that have been sufficiently covered by ongoing COST Actions have been subordinated.
Following the scientific focus and the objectives defined above the associated scientific challenges are addressed in 4 Work Packages (WPs):

- WP 1: Basis of Design
- WP 2: Solid Timber Construction
- WP 3: Connections
- WP 4: Hybrid Timber Structures

The envisaged main research tasks within the four Work Packages (WPs) are:

Work Package 1 (WP 1): Basis of Design

The most important task within this Work Package is the defragmentation and harmonization of techniques and methods that are necessary to prove the reliable, safe and economic application of timber materials or products in the construction industry. The techniques and methods will be documented in an understandable and illustrative guideline, ready to be used by e.g. regulatory bodies. As the corresponding scientific background is principally established, the focus of this Work Package will be associated with consistent harmonization, implementation and documentation.

The guideline will be developed in close collaboration with the other Working Groups of the Action, i.e. the technological areas of WP 2 to 4 will be considered as case studies for the application of the guideline document.

Specifically the following aspects will be considered in WP 1:

- General safety format and performance criteria
- Consequence classes in timber engineering
- Characterization of material properties and structural response
- Correction factors (duration of load, moisture, size, etc.)

The framework and guideline to be developed has also to be seen as a toolbox enabling the fast transition of innovations and new technical developments into practical design.

Work Package 2 (WP 2): Solid Timber Construction: Cross-laminated Timber

The most important task within this Work Package is the derivation of universal product parameters and design approaches for cross-laminated timber by harmonizing the current status. So far, cross-laminated timber (CLT) is only regulated in European Technical Approvals, in other words, only specific configurations by specific manufacturers are applicable in buildings. As the development of common product requirements is already at an advanced stage and the process of harmonization of the thickness of the base material is ongoing, the focus of this Work Package will be associated with the following aspects:

- Testing: the development and implementation of valid test configurations to receive the basic material properties, e.g. to derive strength classes;

- Design: methods to verify the compliance of CLT elements with the essential requirements: mechanical resistance, stability and serviceability.

Work Package 3 (WP 3): Connections

The most important task within this Work Package is the collection and harmonization of methods and parameters to determine the load-carrying capacity of dowel-type fasteners. The aim is to arrive at universal methods and parameters that are applicable to all types of dowel-type fasteners. So far, methods and parameters to determine the load-carrying capacity (in shear and in axial direction) differ according to the type of dowel-type fastener used, in many cases also according to the specific product used. As the fundamental scientific knowledge of the behaviour of dowel-type fasteners in solid timber is principally established, the focus of this Work Package will be associated with the following aspects:

- Design: Improvement of existing calculation models allowing for a simple comparison between different types of fasteners; incorporation of group effects;
- Application of common types of fasteners in wood-based products, including Cross-laminated Timber (CLT) and Laminated Veneer Lumber (LVL);
- Performance criteria: consolidation of knowledge on stiffness, capacity near maximum and ductility of connections, as required for evaluating resistance to earthquake;
- Testing: harmonization and improvement of test configurations, test procedures and analysis to derive the abovementioned properties of interest.

Work Package 4 (WP 4): Hybrid Timber Structures

The fundamental scientific knowledge of the behaviour of hybrid timber structures is less profound as for Solid Timber Construction and Connections. Therefore, the most important task within this Work Package is the collection and pre-processing of principal knowledge with respect to Hybrid Timber structures. The focus of this Work Package will be associated with the following aspects:

- Compatibility: assure the compatibility between the materials of hybrid timber structures, aiming at optimizing the global design and performance.

- Long-term behaviour: variation of stiffness properties and their effect on load redistribution and serviceability of e.g. timber concrete composite (TCC) elements.

- Joints: configurations and methods to determine connection properties in e.g. timber concrete composite (TCC) elements. This issue will be addressed in close coordination with the topics, "performance criteria" and "testing", defined in WP3.

- Components for innovative structures: integrated hybrid systems as critical components for innovative construction solutions (e.g. multi-storey timber buildings).

All 4 Work Packages focus on bringing the best technological knowledge available (WG 2-4) into clear and consistent design rules (WG1). This “vertical” approach, i.e. bringing science into practical application represents a strong innovative aspect of the Action.
The Action also represents an interdisciplinary approach since it will team experts in the fields “Basis of Design” and “Basis of Wood as Structural Material”, bringing together expertise and methodologies from across several domains.
Furthermore, each Working Group will be accompanied by a corresponding Task Group of practitioners from industry and engineering offices. In the initial phase of the Action these Task Groups will develop practical requirements that design regulation should fulfil. In later stages of the Action the Task Groups are expected to assess the developed procedures with regard to practicability and clarity.

D.2 Scientific work plan methods and means

The Action aims to advance activities and collaboration in both a European and global dimension in areas related to the use of wood and wood products as structural material. In each scientific area, activities will focus on increasing and consolidating the current knowledge by performing the following general tasks:

1. Survey amongst stakeholders with respect to existing expertise and results from recent or current research projects including a query on necessities and challenges with respect to programme and work plan of this Action;

2. Analysing the current state of the art in practice (methods and techniques) and evaluating these in terms of validity and applicability;

3. Analysing and comparing these to results from recent fundamental and pre-normative research;

4. Deriving scientifically based but practical performance requirements and design approaches with respect to the evaluated technique or design task;

5. Disseminating knowledge of harmonized approaches, methods and technologies to all stakeholders through background documents, state-of-the-art papers and best practice guides. Their structure and content shall enable a direct application in practice and give standardization committees the relevant information for their decision making.

Four Working Groups (WGs) will cover the research tasks allocated in the four Work Packages described above. Each Working Group will be accompanied and supported by a Task Group. The Task Groups will be staffed with representatives from industry and engineering offices to realize a direct assessment of the practical implications of the methods and design approaches developed within the Working Groups.

Structured Work Plan:

Stage 1: Allocation of tasks, launching the Action website, organizing kick-off seminar, survey amongst stakeholders (completion with Milestone 1).

Stage 2: Analysis of state-of-the art in research and practice, interacting with all stakeholders, organizing first set of workshops, conferences and training schools, enabling short-term scientific missions, preparing first draft of state-of-the-art and background documents (completion with Milestone 2).

Stage 3: Finalizing proposals for performance requirements and design approaches, interacting with all stakeholders, organizing second set of workshops, conferences and training schools, enabling short-term scientific missions, finalizing state-of-the art and background documents, publishing results and proposals in peer-reviewed papers and final report (completion with Milestone 3).

The need for flexibility is recognized by adaptable work plans. As more experts and nationalities express their intent to participate once adoption by COST has been undertaken, a review of the scientific programme with respect to potential improvements will be undertaken, whilst the scientific work will still be carried out within the envisaged 4 Working Groups (WGs).
In each scientific area, activities will focus on increasing and consolidating common knowledge and on understanding of the identified technical issues. Experts participating in this Action will come from different backgrounds and Domains. Therefore workshops, conferences and training schools to be carried out within this Action will promote interdisciplinary research in the fields of wood science and technology, timber engineering and structural reliability.

E. ORGANISATION

E.1 Coordination and organisation

The organization of this COST Action will follow a similar structure for most Actions, as outlined in "Rules and Procedures for Implementing COST Actions". Thus the Action will benefit from elected individuals, acting within a Management Committee (MC). The first MC meeting will be used for the planning and organisation of the Action, including appointment of the Chair and Vice-Chair, the grant holder as well as Working Group (WG) structure and composition. The Action will promote active participation of Early Stage Researchers in the management aspects of the Action, with the aim of appointing a number of Early Stage Researchers to key positions.
The planning, execution, and documentation of the activities will be delegated by the MC to the Steering Group (SG). This Group will consist of the Chair and Vice-Chair of the Action, the Leaders and Vice-leaders of the Working Groups (WG), STSM manager, Website Manager and one member of the Editorial Board. Depending on the scope of workshops, Training Schools and their organization, additional SG members might be appointed by the MC. The SG will form the executive basis for tasks as reporting to the COST Domain Committee, drawing up and controlling the budget, planning and preparing meetings and workshops, approving Short-Term-Scientific Missions and Training Schools, and implementing dissemination activities. Throughout the lifetime of the Action, it is aimed that the SG will stay in close contact by personal meetings and use of modern communication technologies as e-meetings via Skype etc., especially when planning forthcoming meetings. The SG will report on their work in the MC meetings and will be bound to decisions made there.
The MC meetings (minimum one per year) will provide a platform for discussions about the

scientific focus, industrial relevance and relation to practice and standardisation of the Action's work programme. It will supervise and coordinate the research activities in the Action, draw up detailed plans, and track the progress in relation to the scheduled objectives. The MC members will become the spokespeople for the Action, helping to promote its activities to the wider scientific community, to industrial contacts and to end users. The participating members from each country will be required to be active in one or more of the Working Groups, though it is envisaged that a given country will not have both its MC members active in the same WG.

Workshops will help compliment the WG meetings by helping fostering contacts and scientific exchanges between participating groups / countries. These Workshops will be seen as specific milestones in the progression of the Action. They will be held as often as possible within the financial frame of the Action (at least annually), their structure including both plenary sessions for all participants and parallel sessions for the individual WGs, to enable working on concrete subjects in smaller groups. Two workshops will be extended into a public conference where the activities and results of the Action will be disseminated to leading academic and industrial fellows. Ideally, these conferences may be organized in connection with established international conferences. Whenever possible, the SG or MC meetings will be organized in connection with WG meetings or workshops in order to minimize the costs for the coordination of the COST Action.

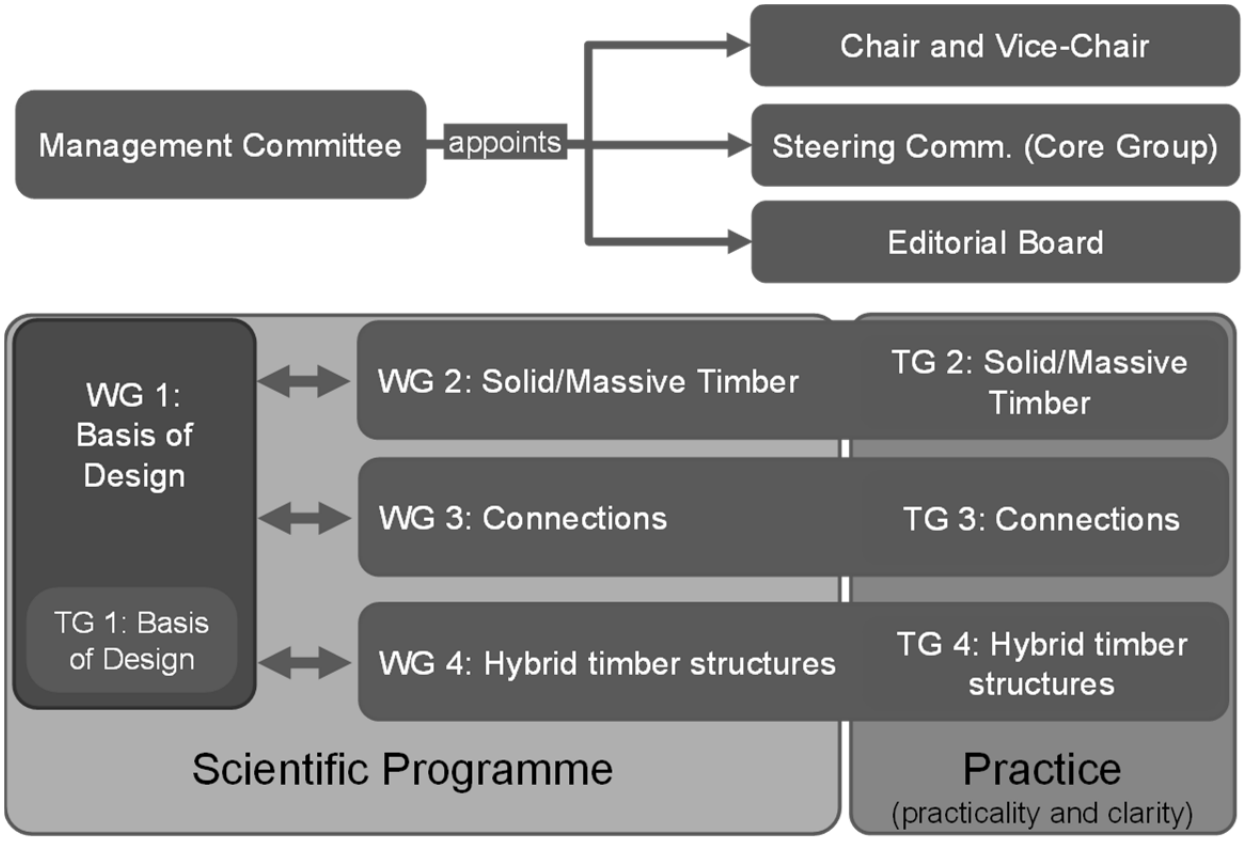
Short Term Scientific Missions (STSMs) will be encouraged, especially among young scientists, as a means foster collaboration between institutions, laboratories and industries of COST countries. Evaluation of STSM applications via the SG will be based on a continual application system. Persons undertaking a STSM will be required to participate and present at the next WG meeting or Workshop. This will both advance the capabilities of the ESRs but also provide justification to other members of the Action of the work being undertaken. Furthermore, Training Schools will be held to provide information and understanding of methods, instruments, and applications. Special attention will be paid to the requirements and the standard of knowledge of young researchers.

An editorial board, consisting of one experienced researcher, one professional from industry and one long-time member in standardization committees will be set up to support and audit the development of high-quality publications like state-of-the art reports (milestone), background documents and peer-reviewed papers (milestones).

E.2 Working Groups

As specified in Section D, four Working Groups will be established within this Action. For each

WG a leader and a Vice-leader will be elected at the first Management Committee (MC) meeting for coordinating the work within the Group and for representing the Group in the Steering Group (SG). Where possible, the WG leader or the Vice-leader will be an Early Stage Researcher (ESR). In the latter case the Vice-leader will take over the role of WG leader in the second of half the Action. The participation of individual researchers in more than one WG will be possible and welcomed to encouraging the information flow between the different Working Groups. A close interlinking of the WGs will have high importance for the MC and will be fostered by joint workshops and Short Term Scientific Missions (STSMs) across different WGs. The WGs will act as links between the COST Action and existing research programmes, and will be the fora for intensive interactions between the industry and the research community. All WGs will be joined by a Task Group, in which participants from industry and practice will assess the practical implications of the results generated within.



E.3 Liaison and interaction with other research programmes

The Action will establish contacts and interaction with relevant European bodies and committees to create efficient synergies and to enable mutual exchange of knowledge and results, facilitated by STSM exchange and organisation of attractive Conferences, Workshops and Training Schools.

Examples of these consortia include, but are not limited to, the following:

- COST Actions FP1004, FP1101 and FP1303;
- CEN committees TC250/SC5 and TC124;
- International committees:, ISO, INTER , RILEM and JCSS;
- Research Projects within "Horizon 2020", if complementary.

The interactions will be in the responsibility of the SG by appointing liaisons, co-organising conferences, joint events and meetings and providing mutual information on planned events. In particular, coordination with other COST Actions will be a permanent item on the agenda for MC and SG meetings. It is foreseen to establish liaison to these Actions and foster the exchange of knowledge by organizing joint workshops between the Actions.
The participation of several experts of this Action in the other mentioned Actions and projects will facilitate the scientific exchange and joint activities. The experts which have already expressed interest in joining this Action represent 21 European countries, whereby countries with a long and profound tradition in timber construction are represented as well as countries in which this sector is momentarily experiencing a strong development. Many of these experts are involved in other European research programmes and will facilitate collaboration between them and the COST Action.

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

Increasing the involvement of women within the scientific community is a key policy within the European Community. This COST Action will respect an appropriate gender balance in all its activities and the Management Committee 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.
The MC of the Action will look at the gender aspects in a professional and sincere way. Out of all currently identified partners, 15% are female researchers and 40% are early stage researches, including the majority of applicants that were directly involved in the development of this Action. The timber community in general has an under-representation of female researchers reflecting the

situation in many fields of the construction and technology research sectors. The role of women and early-stage researchers will be encouraged by recommending them to the COST National Coordinators as national MC delegates. From the early stage and female researchers in the current consortium, several have already expressed their interest to chair a Working Group or represent their country in the MC. Promotion of gender equality and involvement of early stage researchers will be monitored by the SG and the MC and be kept under constant review. During Workshops, it is envisaged to dedicated at least one session to presentations from Early-Stage Researchers, providing them with valuable experience in participating and presenting to their scientific peers. The involvement of early-stage researchers in STSMs, active participation in state-of-the-art reviews and in Training Schools will be promoted.

F. TIMETABLE

The duration of the Action is four years and the time schedule for various activities is shown in the following chart, with the meeting dates being indicative. The timetable is subject to any necessary alteration voted by MC, SG of COST Officers.

	Year 1				Year 2				Year 3				Year 4			
Management																
MC meetings	x		x		x		x		x		x		x		x	
SG meetings			x		x		x		x		x		x		x	
Research																
WG meetings			x		x				x		x		x			
Workshops			x						x				x			
STSMs	min. 6				min. 6				min. 6				min. 6			
Dissemination and Education																
Training schools						x				x				x		
Conference							x									x
Activities																
Define Action Activities	x															
Review Action Activities							x						x			
Creation of Action Brochure		x														
Modification of Action Brochure									x							
Creation of Website	x															
Update of Website		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Reports and Review																
Annual Reports				x				x				x				x
Reviews								x								x
Publications																
Drafts of STARs										x						
STARs													x			
Drafts of Journal Papers												x				
Peer-reviewed Papers accepted for Publications															x	
Draft of Final Report													x			
Final Report																x
Milestones			1							2						3

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, BE, CH, DE, DK, EE, EL, ES, FI, FR, HR, IT, LT, MK, NL, NO, PL, PT, SE, SI, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 84 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 Action has generated interest from a broad range of stakeholders and is recognized as having the potential of significant impact in generating and consolidating research and technological/economic terms by improving the confidence in and the competitiveness of timber structures. The Action will enable useful synergies and provide the most effective way of avoiding duplication and disseminating the results from a large number of projects in the fields covered by this Action to the following target groups and end users of the Action:

- Representatives of the timber industry and construction industry;
- Product developers in the sector of timber structures;
- Architects, structural engineers, consultants and builders;
- Relevant European and national associations and confederations;
- Authorities and policy makers at regional and European levels;
- Research community, relevant standardization bodies and code writers;
- Teachers, lecturers and students of structural design, engineering and architectural schools.

H.2 What?

The MC will set up effective dissemination mechanisms to publish the progress and results of the COST Action, both to the participants and to the extended group of stakeholders, i.e. timber industry, construction industry, structural engineers and builders, authorities and policy makers, scientific community and educational institutions.
The Action's means to disseminate knowledge will be:

1. **Website**
   The most important dissemination tool is the internet, since it offers the highest flexibility and by far the largest reach of all dissemination tools. The website will be geared towards all stakeholders.

2. **Workshops, Training Schools (TS) and Teaching**
   Workshops, Training Schools and Teaching/Seminars are a very good scheme to reach the audience working in research, education, and practice.

3. **Short term scientific missions (STSMs)**
   STSMs are an ideal tool for this Action and will be encouraged especially for early stage researchers. They encourage greater synergy between institutes, accelerate the learning of students and provide academia and industry with new, highly trained and innovative thinking staff.

4. **Conferences, Peer-reviewed articles and state-of-the-art reports**
   International conferences are an important tool to bring together researchers, academia and industry in one forum to discuss the progress achieved to date. Peer-reviewed articles are a good method to prove the importance and accuracy of results and to make these broadly available, also for future generations. Both will increase the external visibility of the Action. All new or adapted methods and technologies, developed within this Action, will be compiled in state-of-the-art reports (STARs).

5. **Link to standardisation and other European bodies**
   Many experts who will participate in the Action are also members of standardisation

committees, assuring the dissemination and explanation of the results of this Action to the relevant standardisation bodies.

H.3 How?

1. **Website**

   The Action's website will have information about the agenda of all planned activities, e.g. meetings, past and upcoming events. All reports and publications will be possible to download from website as well as technical presentations given at meetings/workshops. The central role of the website in the dissemination process requires particular care of its up-to-date status and correctness, which will be assured during the Action's lifetime by a designated Web Manager. The website will be open for at least five year after the completion of the Action.

2. **Workshops, Training Schools and Teaching**

   Workshops are a very good scheme to reach a wide audience in academia and practice. Synergies between institutions and (if possible) between this and other COST Actions will be used to reach a larger audience. Wherever possible, workshops will be arranged in parallel to visiting sites with recognised expertise. Sites of recognised expertise will also be selected as venues for Training Schools for which students, lecturers, and practitioners from woodworking and construction industry will be invited. To support the setup and participation in Training Schools, they will be given a distinct and visible area on the Actions Website, including course material of past Training Schools. Many Action members have teaching obligations that will be used to pass on knowledge to current and future stakeholders secured through courses and seminars at home institutions with the emphasis on timber as a renewable structural material for a modern built environment.

3. **Short term scientific missions (STSMs)**

   STSMs will be encouraged especially for young scientists. A minimum number of 2 missions per WG will be supported each year. To support this objective, STSMs will be given a distinct and visible area on the Actions Website, including all STSMs currently offered and the documentation of past STSMs. Continuous submission, evaluation, and approval of proposals will guarantee maximum flexibility of this tool. An STSM

manager will be chosen amongst the participating early-stage researchers (ESRs). The results of the STSMs will be presented and discussed in the plenary sessions of workshops by the ESRs involved.

4. **Conferences, Peer-reviewed articles and state-of-the-art reports**

It is planned to hold at least one mid-term and one final conference. Opportunities will be explored to link conferences with INTER or RILEM conferences or meetings of CEN TC250, CEN TC124, ISO TC165 and JCSS where relevant and possible. Co-authored papers as well as dissemination of research findings at international conferences will also be encouraged. Relevant scientific journals will be contacted to publish special issues dealing with the topic of the Action. Peer-reviewed State of the Art papers shall serve as background documents for standardization committees. Joint publications and papers co-authored by various research groups will be encouraged and fostered by Short term Scientific Missions. The STARs will contain guidelines and recommendations to support the design engineering community with proper design methods. All publications carried out during the time period of this Action will acknowledge the support of COST. All Action publications will be internationally recognised (through the use of ISBN/ISSN numbers), as well as being available electronically via the Action website.

5. **Link to standardisation and other European bodies**

Many experts who will participate in the Action are also member of CEN TC250/SC5 “Eurocode 5 – Design of Timber Structures” which is mandated to revise the Eurocode standard for the design of timber structures. Several experts that will participate in the Action are also member of CEN TC124 “Timber Structures” which is mandated to further develop the relevant testing and product standards. Since several participants are also member of ISO TC165 “Timber Structures”, the dissemination and explanation of the results of this Action to the relevant standardisation bodies – not only in Europe but also worldwide - is assured. European Platforms like FTP or ECTP will be supported with information to promote the use of timber in structures.