Final Report Summary - PERFORMWOOD (Performance standards for wood in construction - delivering customer service life needs)

Executive Summary:
The PerformWOOD project (Performance standards for wood in construction - delivering customer service life needs) is a coordination and support action (Supporting) funded by the European Commission’s Seventh Framework programme. The work programme topic addressed is NMP.2012.4.0-1 Support for standardisation needs and is coordinated by Dr Ed Suttie of BRE, UK.
The main project objective is to kick-start the development of new standards to enable the service life specification of wood and wood based materials for construction. This is critical to ensure the future sustainable use of European forests, to ensure customers of wood products get satisfactory and reliable products and to provide supplementary evidence of life cycle evaluations of construction products.
The most significant achievements are:
• European consensus has been built on the process of transformation of current standards into a set of instruments suited for performance classification;
• The Strategic Roadmap for transformation of standards has been adopted into CEN/TC38’s business plan;
• Adoption of the concept of material resistance as the key durability parameter for future standardisation need by CEN/TC38 WG21;
• Gathered new data on typical reference products and service expectations from across Europe;
• A draft EN on measurement of moisture dynamics in wood and wood based materials has been activated as a Work Item in CEN/TC38 WG28;
• A comparative dataset has been amassed on laboratory wetting ability tests for wood;
• A deeper experience developed of the statistical methods to deploy to present variability in test outcomes;
• A simple exposure dose proposition that takes a climatic calculation and combines it with how the wood product behaves on exposure to that climatic measure;
• For the first time a comprehensive survey of service life expectations and guarantees for wood and wood based products has been gathered from European construction professionals and citizens;
• A new proposition for a user friendly interface EN460 based on performance classification of wood as has commenced as a Work Item in CEN/TC38 WG28 - a massive step towards integrating performance classification into mainstream specification of wood;
• Reached in excess of 514,000 people from 39 countries through additional dissemination activities alone.

The project socio-economic and societal impacts are significant:
• Economy – the project results will further enhance the demand for European wood (and new innovations with wood) as a sustainable and reliable construction material and encourage afforestation
• Employment and Social Policy - the project will continue to support rural employment and future job creation in areas of Europe where alternative jobs are difficult to acquire and sustain
• Environment – the long-term management of the forest resource provides multiple ecosystem services and contribute to the sequestering of carbon dioxide in wood products
• Consumer protection – performance classification will reduce premature failure of products and its associated impacts and build confidence in the reliability of products
• Cohesion of Europe – fostering cooperative working across regions
• Society - The project fosters a more rational use of wood resources. Citizens have gained a stake in the future standards via the ground breaking survey work

Project PerformWOOD has met all the objectives and has kick-started the transformation of CEN/TC38 standards to meet end users requirements by focussing on performance classification. This will ensure the above societal benefits are accrued and delivered in the coming years.

Project Context and Objectives:
MAIN OBJECTIVES

PerformWOOD focusses on the consolidation of the technical background for standardisation to deliver a new standardisation documents on the service life performance of wood in construction.
Service-life prediction or planning is a process for ensuring that, as far as possible, the service life of a building will equal or exceed its design life, while taking into account (and preferably optimising) its life-cycle costs (ISO 15686). For a long time, the international organisations CIB and RILEM have been leading this development, which has had an impact on standardisation work nationally, regionally, and globally through ISO. The processes and design software are well advanced and have been deployed for many years for primary construction materials such as steel and concrete. The same has not been achieved for wood. The critical area to be tackled is standards that define the durability of wood and provide early insights into performance within CEN/TC38 “Durability of wood and wood based products”.

The main project objective is to kick-start the development of new standards to enable the service life specification of wood and wood based materials for construction. This is critical to ensure the future sustainable use of European forests, to ensure customers of wood products get satisfactory and reliable products and to provide supplementary evidence of life cycle evaluations of construction products.

The specific objectives are to:

• Confirm material resistance measure
• Confirm a moisture risk measure
• Interpretation of field test results with respect to early decay and predicting the service life
• Review present test protocols and make recommendations for updates
• Propose improved test methods (mainly field tests) and possible new tests
• Provide a draft standard for consideration on service life

CONTEXT

The construction sector is under pressure to improve its cost effectiveness, quality, energy efficiency and environmental performance and to reduce the use of non-renewable resources. A key issue for the competitiveness of wood is the delivery of reliable components of controlled durability with minimum maintenance needs and life-cycle costs. The importance of service-life issues is reflected in the Construction Products Regulations (CPR) with its seven essential requirements, which should be fulfilled by construction products during a ‘reasonable service life’.

The development of performance-based design methods for durability requires that models are available to predict performance in a quantitative and probabilistic format. The relationship between performance during testing and in service needs to be quantified in statistical terms and the resulting predictive models need to be calibrated to provide a realistic measure of service life, including a defined acceptable risk of non-conformity.

The sustainability agenda for construction is being driven home with the wide spread emergence of life cycle assessment (LCA) and environmental product declarations (EPD) in practice, ranking and comparison and the activity in CEN/TC350 to harmonise these methods. Pivotal to tackling the need to reduce impacts of the construction industry is to reduce the embodied impacts of the materials and processes and ensure that they deliver meaningful function and service lives.

Wood is a fundamental building material for most of the nations across the globe. It has potential to be one...
Wood is a fundamental building material for most of the nations across the globe. It has potential to be one of the truly lowest impact embodied energy materials for construction yet at the same time work to be able to predict and satisfy the performance of the products in service is lacking. Recent pan-European research Woodexter and Woodbuild has started to build the information needed to develop the first steps in predictive models for wood based on understanding the moisture risk and the resistance of the material. This presents a significant standardisation opportunity to consolidate the technical background to the standards we do have for durability (CEN/TC38).

While the European forests cover only 4% of the global forest with 169 million hectares, Europe plays a significant part in wood transformation, i.e. with 20% of the global saw milling (82 million m3 upon 413 million m3), suggesting an average consumption of 0,27 m3/year/capita. The actual challenge is to prevent deforestation, as far as round wood and sawn timber are concerned, and secure the CO2 storage process of regeneration, increasing the service life of wood is highly desirable as it efficiently uses a finite renewable resource, saves energy and avoids premature failure in service waste.

The future of sustainable and low impact wood products relies on having a system of standards that moves in tune with practice and also reflects the urgent need for better service life or performance classification information from tests, not simply pass or fail. Indeed the service life of wood products needs to reflect the expectations of the user and ultimately provide the most ‘eco-effective’ solution. This supporting action work has focussed on (i) Data access and dissemination (ii) Studies and fact finding (iii) Workshops, seminars and conferences (iv) Information and communication activities and (v) Connecting R&D and enhancement of research infrastructure.

It has considered four key areas of work that will accelerate the work of CEN/TC38 and deliver pivotal new standardisation documents for Europe:

- Data analysis and handling
- Gathering service life expectation data from consumers
- Reference material experiences
- Moisture risk in wooden product – experiences to date

The increasing European softwood resource (which is largely non-durable) needs be utilised sustainably which demands the appropriate use of protection systems to enhance durability, incorporating low or no impact systems and providing materials that can be reused at end of service life. The development of performance standards by CEN for wood preservatives in Europe has largely been driven by the Construction Products Regulations (CPR) which specifies one durability class into construction, class 1 (very durable). This is ensured by a suite of biological tests both in the laboratory and the field (EN599) which have derived pass criteria related to test timber species or control wood preservatives. These standards are largely mature and were developed for the assessment of wood preservative technologies, now there are numerous ways of enhancing durability of a wood product (e.g. wood modification, coatings, design, water repellents). In addition, they have poor to no predictive ability to guide on the performance of wood products in the built environment - an increasing barrier to use.

The Biocidal Products Regulations (BPR) require the demonstration of efficacy of a treatment and if new protection systems are to be fostered and innovation encouraged we either need different test methods for...
protection systems are to be fostered and innovation encouraged we either need different test methods for assessing these products or we need a different way of interpreting the data coming from the tests. A number of product groups do not fit into the establish EN599 assessment protocol and many of these are environmentally improved products:

- maintenance products, there is no way of classifying their efficacy
- cell wall modifications such as acetylation and heat treatments
- physical wood modifications such as resin impregnation
- natural timber durability is determined through EN335 and EN350 which were drafted to identify timbers that were class 1 (very durable) similar to the requirements of CPD.

CEN/TC38 is responsible for European standardisation in the area of durability of wood and wood-based products recognises this urgent need and the wealth of experience that has been developed in the field and also how the tools we currently have might be extended and used in the future:

Resolution no 21 of the 47th Plenary meeting of CEN/TC38 on 24 November 2011:

“CEN/TC38 decides to support the gathering of service life expectations of the customers of wood products, review of data handling for existing biological tests, moisture risk for wood products and reference material studies.”

The concept of service life for specifications of preservative treated timber commodities is included in the process based specification system of some national standards. The issue of specifying service life is of increasing importance as the industry and users require targeted, reduced use of biocides and more innovative solutions. This project is a direct result of the extensive discussions within CEN/TC38 and COST Action E37 of the principles outlined, and of optimising the use and performance of wood protection systems.

Innovations of project PerformWOOD are:

- Framework for specifying environmentally improved wood protection systems
- Encourages innovation in product development
- Encourage a reduction in general use of broad based biocides
- Supports the sustainable use of the European forest resource
- Reduces the volume of long-life maximum durability wood waste
- Delivers targeted wood protection fit for the purpose intended

The project has specifically encouraged sustainable material production and use of the European forestry resource whilst improving the structural integrity of construction products through enhanced service life and specification of durability, improved health & safety and environmental attributes of the treated product in service and in production. Benefits at the end of service life are expected with the waste treated timber being easier to incorporate into disposal or recycling schemes. As the standards embed it will latterly deliver reduced environmental risk, maximise sustainability and is likely to increase competitiveness of treated timber in areas where less sustainable materials dominate; such as u-PVC in the replacement windows and doors market. The range of product systems and the development of a framework for specifying a range of performance service lives will broaden the application of treated timber and lead to
Specifying a range of performance service lives will broaden the application of treated timber and lead to innovative applications, for example, based on the whole systems through its life time rather than a single treatment. Support for this multipurpose use of timber is essential for the sustainable use of the European softwood resource.

Standards provide a far-reaching means of underpinning and developing market confidence in wood products in construction and their performance and environmental credentials. The foundation of CEN/TC38 has been drawn upon to make best use of what we have, improve it and make new standards that truly reflect the needs of users. The existing standard EN460 “Durability of wood and wood-based products - Natural durability of solid wood - Guide to the durability requirements for wood to be used in hazard classes” has started transformation into a user interface document where information from tests and umbrella standards that interpret the results of the tests can be included with product and use class information to consider service life. This user interface will mobilise more performance specified wood and wood based materials into construction by meeting the end user needs and expressing it in their language of buildings and environment.

Project Results:

SUMMARY

Project PerformWOOD has met all the objectives and has kick-started the transformation of CEN/TC38 standards to meet end users requirements by focussing on performance classification. The most significant achievements from each work package are as follows:

• WP1 Adoption of the Strategic Roadmap for transformation of standards into CEN/TC38’s business plan.
• WP2 Adoption of the concept of material resistance as the key durability parameter for future standardisation need by CEN/TC38 WG21.
• WP3 Gathered new data on typical reference products and service expectations from across Europe.
• WP4 A draft EN on measurement of moisture dynamics in wood and wood based materials has been activated as a Work Item in CEN/TC38 WG28.
• WP5 For the first time a comprehensive survey of service life expectations and guarantees for wood and wood based products has been gathered from European construction professionals and citizens.
• WP6 A completely new proposition for EN460 based on performance classification of wood and wood based products using a significantly more user friendly interface has commenced as a Work Item in CEN/TC38 WG28.
• WP7 The project has reached in excess of 514,000 people from 39 countries through additional dissemination activities alone (28 European Member States, Switzerland, Norway, New Zealand, Australia, Macedonia, Japan, USA, Canada, Brazil, China, Chile).
• WP8 Project PerformWOOD met all objectives within budget has kick started the development of new standards to enable the performance specification of wood and wood based materials for construction.

Science & Technology final results:

• A means for classifying wood and wood based products in terms of their material resistance
• A comparative dataset on laboratory wetting ability tests for wood
• A draft standard for assessing the moisture dynamics of wood and wood based products in the laboratory and field tests
laboratory and field tests

• Data on typical national reference products and service life expectations from across Europe
• A deeper experience of the statistical methods to deploy to present variability in test outcomes
• A simple exposure dose proposition that takes a climatic calculation and combines it with how the wood product behaves on exposure to that climatic measure
• A wealth of views gathered from construction professionals and citizens on service life expectations for wooden products
• A redraft of EN460 the user interface standard; a massive step towards integrating performance classification into mainstream specification of wood

OVERARCHING RESULT

Integrating performance classification across the spectrum of CEN/TC38 activity has provided cohesion of activity and clarity of purpose which focuses on the end user and meeting their requirements. Engagement of end users has successfully started to define these requirements for the first time. European consensus has been built on the process of transformation of current standards into a set of instruments suited for performance classification. European research at the forefront of international needs, as expressed by requests from outside the European Union for presentation of the project findings. PerformWOOD presented European FP7 research at the forefront of international needs, as expressed by requests from outside the European Union for presentations of the findings (especially Australia and New Zealand where they are just beginning to tackle wider performance classification issues).

New research initiatives and scientific actions have commenced with possible collaborations are currently being explored between the beneficiaries to develop joint research work in the field of moisture dynamics and performance classification trials via European funding mechanisms including Horizon 2020, COST, Wood-Wisdom-Net and national programmes.

Further opportunities to collaborate and cooperate is provided through the new COST Action FP1303 Performance of bio-based building materials which is chaired by Dr Dennis Jones (SP, Sweden), vice chair is Dr Christian Brischke (LUH, Germany) and Dr Ed Suttie (BRE, UK) is co-convenor of Working Group 3 Adaptation and application. The COST Action started in 2013 as a direct result of PerformWOOD and is scheduled to run for four years. One of the early activities informed by PerformWOOD has been to create a round robin outdoor performance (durability, surface change, colour, checking) test of wood materials mounted on a table. These are being distributed across Europe in April 2014 to build further evidence on regional performance differences (WP6), moisture behaviour (WP4) and local reference products (WP3). This will support the standardisation process underway in CEN/TC38. This meets the expectation expressed in the DoW that a round robin verification trial to test wood components in each climatic zone of Europe (funded through national research funds) will be co-ordinated.

SPECIFIC SCIENCE & TECHNOLOGY RESULTS

S&T RESULT 1. Developed a roadmap for enabling performance classification to be at the heart of future standards developments. This has been incorporated into the TC38 business plan.

The main challenge at the start of the project was to create the momentum for change within the standards
The main challenge at the start of the project was to create the momentum for change within the standards community. The existing CEN/TC38 structure and standards portfolio is based on wood preservation technology and a significant volume of over 80 standards initiated some 20 years ago in many cases. Change was needed to meet the demands of customers of wood products and those specifying and using timber, and the best way to direct and build confidence in the process was to prepare a strategic roadmap. The roadmap was focused on enabling the transformation of TC38 standards to include performance classification at their core.

This coordinating and supporting action held a review workshop with CEN/WG Convenors (and other experts) prioritising and identifying bottlenecks to action. The workshop in Brussels near the beginning of the project was a key component of taking forward the roadmap for standards development. Progress has been excellent. The strategic roadmap in November 2012 was embedded in the business plan of CEN/TC38 which is excellent recognition of the work of PerformWOOD. It has built the foundation for CEN/TC38 WG28 based on open minded and open vision practice and has enabled rapid movement in a standards arena that is notoriously slow. The work has also built lasting momentum for research and improvement with customer needs at the core of the approach and the Strategic Roadmap will guide standards development in CEN/TC38 until at least 2018.

In addition the process of the transformation was kick started by reviewing existing European Standard test methods that have components of performance in them were identified and the principles of data handling and how performance aspects are presently considered was made. A presentation at CEN/TC38 Plenary in November 2012 enabled rapid confirmation of the developed roadmap for standards development and the future tasks. The consortium also reviewed and critiqued the existing CEN/TC38 laboratory testing including EN113, EN807, CEN/TS on durability (inherent and enhanced), and EN12038 on durability of wood-based panels to identify those methods best placed as platforms for performance classification. The findings from previous European funded research including FP5 and FP6 were assimilated to build upon our knowledge base to take the work forward in an intelligent and fully informed way.

A full review and assessment of current state-of-the-art and existing knowledge concerning performance classification was conducted. This literature and standards focussed study reviewed activities of national, European, and pan-European organisations (e.g. IRG, DBMC, COST, RILEM, CIB, FP6, FP7). National best practice and mirror committee input was also reviewed. The main findings were presented in D1.1 essentially aside from the work conducted by Bob Leicester’s team in Australia the key work items had come from European research work.

The findings are being used to guide CEN/TC38 in its transformation truly supporting standards in a critical area for the application and future use of wood in the built environment. The strategic roadmap will be used and reviewed at least every year with CEN/TC38 Plenary and has started a process of objective setting and measurement of achievement against a common focus across the working group structure.

S&T RESULT 2. Established a means for classifying wood and wood based products in terms of their material resistance.

A foundation for the determination of material resistance as a property of wood and wood based materials.
A foundation for the determination of material resistance as a property of wood and wood-based materials has been established. These are being exploited now within CEN/TC38/WG21 as it takes forward the review of natural durability data and how a wetting ability characteristic can be incorporated to provide the needed material resistance parameter. Field data assessments have shown real promise for reanalysis and this has opened the process of suggesting improvements to data handling for critical field durability standard EN252. Alongside the work on reference materials the use of statistical analysis of data outcomes from tests has been deployed for the first time and has inspired a series of publications within this project and further reviews to commence in international arenas including IRG-WP (May 2014) and at the WEI (March 2014).

The findings are being used to guide CEN/TC38 in its transformation, truly supporting standards in a critical area for the application and future use of wood in the built environment. Material resistance is a cornerstone of future performance classification for wood in construction. The next steps in CEN/TC38/WG21 are to continue progress on developing a new standard test method for wetting ability in the laboratory and then combining this with durability class to yield material resistance class in EN350-2.

Further work is needed to evaluate what would be the confidence in predictive ability of test standard EN252 when 20 or 30 pieces are considered, instead of the current 10. One hundred pieces would be better, but it is not a realistic number due to the field space needed and the prohibitive costs of the testing. To support this further work a new project proposal involving several PerformWOOD beneficiaries has been submitted to WoodWisdom-Net led by Dr Christian Brischke (LUH, Germany). The project proposal is “Performance and life cycle cost evaluation of durable European wood products” (D€UROWOOD) and looks towards developing a more reliable test approach for performance classification, by strengthening the material resistance parameter.

Experience has been gathered using a balance of direct beneficiary experience and a short proforma that was developed to capture learning from existing European Standard tests and also other international standard tests.

The evaluation systems for some tests are subjective and a process has been started to seek to find more objective methods where possible. An example is the work that has been put into compiling pictorial guidance on the rating of field test stakes of wood materials to be used alongside EN252 testing. This test requires an expert to assign each stake to fungal decay rating ranging from 0 (no attack) to 4 (failed), the challenge comes in distinguishing between the ratings of 1 (slight attack), 2 (moderate attack) and 3 (severe attack) which are much more subjective and dependent on the individual assessor. Previous experience has shown that the variation between assessors may be significant. To address this issue and as a legacy of PerformWOOD a field evaluation training workshop is being held within COST FP1303 hosted by University of Hannover (Germany) in June 2014.

Overall agreement was found on:
• The necessity to consider the distribution of data for the assessment of the durability.
• The selection of materials selected according to the kind of distribution in order to determine reference materials
• The distribution approach must be taken into account for EN252 interpretation. EN252s use for predictive purposes is considered weak due to the low number of replicates. Twenty replicates are seen to
predictive purposes is considered weak due to the low number of replicates. Twenty replicates are seen to be a minimum number for the establishment of a robust the distribution and of early indicators.

- The absence of significant differences between mean and median values is an interesting observation, communicated to CEN/TC38/WG25.
- It is recommended to keep EN252 tests running, until sufficient data are collected in order to derive information on service life. The present 5 years is functional but too short.

A thorough critical review of existing test method standards has been conducted. Most of the tests classify the performances of treated wood (the material), and not the product. In case of complex construction products, information derived from existing tests far away from what is required to determine the performance of this product in service. A number of improvements to existing tests have been proposed including gathering additional climate data during field tests, determination of the respective moisture hazard, reviewing the time series and the number of replicates used. Existing methods look at very specific issues, some pass and fail. The review identified that more could be done with these existing tests and their outcomes. The annual data gathered during EN252 testing can help us predict performance, though more work is needed, and the distribution of individual piece test outcomes from a natural durability test such as CEN/TS 15083-1 can be used to derive a confidence interval for the material classification achieved as the overall outcome. Interestingly some wood species and wood materials have very narrow distributions of test outcome and others are much wider, spanning several durability classes (and thus material resistance classes). All the assessment data and recommendations have been communicated to CEN/TC38 and the relevant working groups.

The work has successfully:

- Produced a critical assessment of outcomes of existing durability tests and their meaning in the context of delivering a material resistance component for service life estimation.
- Produced examples of how existing data could be used in order to derivate information on material resistance.
- Produced a summary of existing knowledge on performance for wood species and products from field tests. Provided an orientation of how data from field tests could be used to derive information on service life and thus performance class.
- Shown the importance of using statistical tools to characterize the variability of the distribution of data in order to estimate confidence intervals for performance.
- Produced a report for the CEN/TC38 working group convenors highlighting the promising improvements to test standards and their assessment procedures and identifying where there are any gaps concerning service life estimation.

S&T RESULT 3. Developed a comparative evidence based research dataset on wetting ability tests for wood and wood based materials in the laboratory.

A key for unlocking material resistance class is a reproducible and repeatable laboratory test measure of wetting ability. This has been achieved and will enable CEN/TC38 to prepare a standard test method text.

Gaps in test methodology for determining the wetting ability of wood on laboratory scale were identified. Therefore a Round Robin trial with six partners was initiated for comparison of different laboratory methods to quantify moisture dynamics within the time frame of the project. A round robin test on wetting
Methods to quantify moisture dynamics within the timeframe of the project. A round robin test on wetting ability started; this includes some of the beneficiaries and also research teams in Slovenia and Italy. As an outcome of the Round Robin on “wetting ability of wood” test methods have been evaluated regarding their potential to provide data utilizable for performance modelling.

A series of round robin evaluations have been initiated to expand on evaluation skills and to provide a better understanding of regional exposure variations. All testing under the round robins has been conducted at the partner’s expense and outside of project PerformWOOD budgets. The tests are medium to long term (6 to 24 months) so whilst some have fed into the project already others will feed in the future into CEN/TC38 working group discussions.

COST Action FP1303 informed by PerformWOOD has been to create a round robin outdoor performance (durability, surface change, colour, checking) test of wood materials mounted on a table. These are being distributed across Europe in April 2014 to build further evidence on regional performance differences (WP6), moisture behaviour (WP4) and local reference products (WP3).

S&T RESULT 4. Developed a draft standard for assessing the moisture dynamics (wetting and drying) of wood and wood based products in the laboratory and field tests.

In addition to the material resistance parameter there is a need for a classification based on moisture dynamics. Prior to establishing reference materials or products for this parameter it is clear that a relevant test procedure is available. Earlier work on this topic was initiated with a focus on plywood at University of Gent and this has been broadened to and transformed into a draft standard. Work has linked specific laboratory immersion tests with outdoor Continuous Moisture Measurement data and gathered data for numerous wood species and materials that will help identify future references for moisture dynamics.

A decision by correspondence has been launched by CEN/TC38 for the activation of the WI 00038181 – Durability of wood and wood based products – Moisture dynamics of wood and wood-based products.

S&T RESULT 5. New data on typical European reference products to provide a vital link between the outcome of TC38 tests and known expected performance of wood products in buildings.

The project has gathered new data on typical reference products across Europe which subject to discussion with TC38 if they become integrated into test standards provides a vital bridge and link between the outcome of TC38 tests and known expected performance of wood products in direction application in the construction industry and buildings.

Although the ISO 15686 based methodology uses a reference service life alongside factors having an impact on this there is no consistent basis for reference materials and corresponding service life when considering wood products. This work has started with the identification of different well known wood products which are generally for specific end uses and hence can be used for benchmarking on national basis for performance.

Experience has been gathered from beneficiaries and other standard test users experience with the use of reference materials. Clear definitions of what reference materials are have been developed which has
Reference materials. Clear definitions of what reference materials are have been developed which has been fed back into CEN/TC38/WG25 to help their discussions move forward.

In general three levels were explored on how reference material could be used to link with performance.

LEVEL 1: Reference Service Life: Each beneficiary described five national examples of reference service lives for poles, window joinery, cladding, decking and fencing. Identification of similarities and regional differences in commodities both in concept and life expectancy were clear.

LEVEL 2: Reference test products: Both for testing efficacy of wood preservatives as for testing inherent durability reference materials are used. For reference preservatives/biocides it is important to use established products with known performance.

LEVEL 3: Commercial reference products: For regional specific qualification of performance it remains viable to compare new products with existing commercially accepted and tested products available and widely used in construction. The simple approach to assess for equivalent or better performance allows for fast evaluation regarding suitability for the market.

The use of calculations and reference products for assessing biocidal efficacy in laboratory tests show some weaknesses. The results or calculations are based on mean values; however variability is critical. Also interpolations are based on linearity though dose-response is hardly ever linear. Most methods use the criterion mass loss at level 3 % which is equivalent to a so-called ‘detection level’ and hence not suitable for statistics. The limited amount of replicates (often n=6) is not favourable to work with neither benchmarking nor statistics in general (e.g. to exclude outliers). Alongside WP2 information has been supplied to CEN/TC38 working groups (WG22, WG23, WG24, WG25) to progress work on future references and address statistical analysis of test outcomes.

Experience with reference materials for other performance characteristics has been considered, such as UV degradation, chemical attack, checking and splitting. Physical performance characteristics on performance are widely agreed to be critical (e.g. the aesthetic appearance of exterior wood cladding) but the knowledge of references for physical performance are limited and needs to be further researched. Critical physical/chemical performance characteristics (colour change, checking) for UC3 applications need to be further researched and test methods proposed.

Improvements for existing standards have been initiated in the light of legislation which is making the use of CCA wood preservative reference (used in EN807 and EN252) even for research purposes limited. The selection and evaluation of candidate reference material (wood products) has been influenced by project PerformWOOD and work has started to test these and their potential to be used in laboratory fungal testing and nationally within the COST FP1303 round robin outdoor test tables.

A framework was provided of how reference materials vary across the European continent based on traditional uses of wood in construction and also the differences in expectations of performance of different wood products. These results will be exploited as part of the deeper further work of standards revision with CEN/TC38 and also in building the connection between service life expectations for new wood based materials and traditional expectations in the minds of the users, both professional and public (WP5).
The following tasks are ranked high priority as a direct consequence of the work:

- Provide guidance on reference selections for tests and their service life expectations
- Define clearly the objectives of using references in our future test revisions
- Develop a range of references that meet the performance classes in WP6

Further research is needed to fill the wider reference database that will need to be undertaken with CEN/TC38/WG23. Joint efforts from academia, standardisation bodies and the timber sector industries are needed to compile reliable data matched to local expectations of performance. The IRG-WP durability database will become a key reference tool here.

S&T RESULT 6. Large volumes of test data analysed to understand the most appropriate statistical methods to deploy to understand variability in test outcomes.

The reanalysis of existing data was necessary to see how it might be better deployed to inform on performance. Existing pass fail criteria are crude and a presentation of a test outcome with a confidence limits interval (e.g. 95%) has taken a great leap forward.

Re-interpretation of field test data from ground-contact field trials (EN252) has been conducted to build on our experiences of how the data gathered in a test, but not used as part of the standard test interpretation, may help predict the expected service life. Datasets from SP (Sweden) and FCBA (France) have been analysed to see time to average ratings for 1, 2, 3 and 4. This outcome has been linked to the IRG-WP durability database, which is now live and is being populated by the beneficiaries. This provides a platform for ‘storing’ data to allow for re-interpretation by researchers. For field tests, it appears that moderate ratings could be used in order to predict the performance of the material in time.

In cooperation with the work on reference materials a detailed evaluation of the potential for statistical evaluation of test data has been conducted and 5 conference papers have been prepared on this topic during the project lifetime. The statistics of test evaluation (different measures than mean and median, e.g. 5th percentile, 25th percentile, time till rating X; use of Weibull distributions) have been trailed. The statistical analysis of data is vital in enabling us to take the first steps towards associating confidence intervals with data outcomes and providing data on performance in a meaningful context for engineers and architects. An engineer is used to designing the structural performance of a building in terms of confidence intervals of mechanical data considering the specifics of the building needs; we believe a similar approach should be considered for service life expressed as performance (durability, biological, physical).

Recommend statistical tools to be used to improve outcome of existing laboratory and field testing have been considered and presented in papers and at CEN/TC38/WG23. Estimates of relative performance (alongside WP3 and reference products) and the variability in data outcome for UC 3 and UC4 applications have been documented.

Probabilistic approach for the analysis of information has been thoroughly investigated. Information gathered in the project has been collectively reviewed and combined with new information on service life expectations. Within the hierarchy of the CEN/TC38 standards the main focus has been on the test...
expectations. Within the hierarchy of the CEN/TC38 standards the main focus has been on the test methods. The next level is the test protocol or data handling standards such as EN599 and EN350. All partners have contributed thinking to a probabilistic approach to integrate outcomes from EN599 and EN350 adding the concept of time of wetness (ToW) related to the end-uses and microclimate. The impact of climate and micro-climate is far more important for applications out of ground contact (UC3) where moisture risk dominates performance. For in-ground contact applications (UC4) where moisture is typically present (exceptions have been noted for more arid parts of Europe) then material resistance dominates performance.

S&T RESULT 7. Experience of moisture measurement and determination in testing and research of wood and wood based product has been gathered.

The potential and suitability of different modelling approaches to consider a ToW concept on the basis of dose-response relationships for performance classification of wood-based products was evaluated. Therefore a workshop was held in Hannover on July 8/9th 2013. The topic was addressed within 9 invited presentations by the project group and further guests. The outcome of the above mentioned survey was critically discussed as well as different approaches for service life and performance modelling.

A web-based survey on “Moisture risk and Wood Durability Testing” was carried out among in total 177 scientists from 37 European countries. The survey aimed on gathering information about the significance of quantifying the moisture induced risk in wood durability testing and service life prediction of wooden components. Hereby the focus was on degradation by fungi and bacteria as well as on aesthetic aspects related to moulds. The participants had been asked to provide information about their practice in durability testing. The questionnaire was therefore structured according to laboratory tests, field tests, monitoring of structures and finally development of models and service life prediction.

In addition a comprehensive literature review on modelling the service life and performance of wood based building components was carried out and supplemented with own experience and unpublished work of the various project partners.

The combined results of these two activities has supported recommendations for moisture testing research and for test methods, including S&T RESULT 4 moisture dynamics which is now out for consultation by CEN/TC38.

S&T RESULT 8. A simple exposure dose proposition has been made.

A simple exposure dose proposition has been made that takes forward the climatic calculation from earlier work and combines it with how the wood product behaves on exposure to that climatic measure. This has focussed on design of the component, moisture dynamic and response and release of moisture in relative humidity by different wood species. Possibilities for an implementation of the Time of Wetness (ToW) concept were identified. “Wetting ability” of wood-based materials was identified as key property and should be regarded as part of the material resistance. This basic prerequisite allows then to utilize laboratory tools as well as field test methodology for performance modelling. The exposure dose depends on: geographical location determining global climate, local climate conditions, the degree of sheltering, distance from the ground, detailed design of the wood component and maintenance. The work has
distance from the ground, detailed design of the wood component and maintenance. The work has considered how to add the termite risk in this index and agrees that the hazard is either present or not and that defines the performance classification chart. This termite index could be best presented as identified climatic or geographical zones (termite areas).

Research activities on performance modelling have been intensively reviewed and their potential for verifying classification schemes was emphasized. Basic rules for implementing a dose-exposure concept into a new EN460 standard have been developed and may serve as prediction tool. Climate and design related issues are hereby considered as elements within the dose-exposure concept and therefore quantifiable to the same degree as material-intrinsic resistance properties. Based on this numerous recommendations have been given to improve laboratory and field test standards as well as the superior EN460 standard.

Recommendations for moisture risk assessment and measurements (time of wetness) for different products were compiled. Guidance on the technical background of the measurement techniques, their applicability in outdoor tests as well as the interpretation of results should be provided in the frame of CEN/TC38. It was recommended to expedite this in form of a technical report, informative annexes to relevant test standards, or through a combination of both.

A framework was provided of how exposure, dimension, design details, and the material-intrinsic ability to take up and release water can be linked to model the moisture risk in wood products.

Ranked as high priority needs as direct consequence from these results:
• Provide guidance on technical background of measurement techniques, their applicability in outdoor tests as well as the interpretation of results
• Prepare technical report (CEN/TC38), informative annexes to relevant test standards, or through a combination of both
• Define clearly the objectives of moisture monitoring
• Develop test standard to determine wetting ability of wood

Further research is needed to fill the framework developed within this project with further substantial data. Joint efforts from academia, standardisation bodies and the timber sector industries are needed to compile reliable data, which can then fulfil still existing gaps and increase acceptance of both, producers and consumers.

S&T RESULT 9. New evidence and experiences of wood product performance and expectation of service life have been gathered from European construction professionals.

A wealth of views (from 7 member states) and experiences have been gathered from construction professionals on service life expectations for a series of wooden products in their country. In addition attitudes to product guarantees were explored. There was some variation in the outcomes thought to be influenced by national building regulations and codes.

A web-based survey on user expectations on and experiences of actual service lives of wood products in constructions was executed. The survey was directed towards professionals involved in various parts of
A web-based survey on user expectations on and experiences of actual service lives of wood products in constructions was executed. This gathered views from a total of 2296 home-owners in UK, Sweden, France, Germany, Spain, the Netherlands, and the Czech Republic. In each case the questionnaire was given in the main official language of the country in question.

The survey was designed to inform not only about expectations but also observed service lives and reasons for replacement and repair. Generally a fair amount of agreement was found between the expectations and the experiences among home-owners and professionals.

The dominant part of the survey outcome is the expectations and observations on service lives and on maintenance needs, and all the Working Groups of CEN/TC38 have been invited to reflect on these findings in their future development work. The frequency, with which individual standards have been consulted by various professional groups, and experiences of their usefulness, is a particularly valuable part of the results for CEN/TC38 and its working groups. This represents a form of feedback that has never previously been collected.

S&T RESULT 10. New evidence and experiences of wood product performance and expectation of service life have been gathered from European citizens.

For the first time ever a wealth of views (from 7 member states) and experiences have been gathered from the European citizens who own their home on service life expectations for a series of wooden products that may be present in their home. In addition attitudes to product guarantees were explored. There was remarkable consistency in the outcomes across Europe with some influence from national and regional traditional uses of wood products and specific substrates (e.g. untreated spruce cladding in Scandinavia).

The survey was designed to inform not only about expectations but also observed service lives and reasons for replacement and repair. Generally a fair amount of agreement was found between the expectations and the experiences among home-owners and professionals.

The dominant part of the survey outcome is the expectations and observations on service lives and on maintenance needs, and all the Working Groups of CEN/TC38 have been invited to reflect on these findings in their future development work. The frequency, with which individual standards have been consulted by various professional groups, and experiences of their usefulness, is a particularly valuable part of the results for CEN/TC38 and its working groups. This represents a form of feedback that has never previously been collected.

For the first time ever a wealth of views (from 7 member states) and experiences have been gathered from the European citizens who own their home on service life expectations for a series of wooden products that may be present in their home. In addition attitudes to product guarantees were explored. There was remarkable consistency in the outcomes across Europe with some influence from national and regional traditional uses of wood products and specific substrates (e.g. untreated spruce cladding in Scandinavia).
S&T RESULT 11. European citizens and construction professionals are shaping and directing the future of standards preparation in CEN/TC38.

The results of the surveys conducted have gathered new evidence and insight that is now directly influencing the structure of future standards and their connectivity. The results are being used by standardisation committees, in particular CEN/TC38/WG28 to help shape the future EN460 standard. They are also of direct use for several types of industry (house manufacturers, producers of building components, builders, assessors, etc.) in aligning the performance of products with expectations and in issuing product warranties where such demands are expressed.

The results and data gathered which saw the largest ever survey of service life expectations undertaken of European construction professionals and the house owning citizens is being prepared for a number of national articles, including the Timber Trades Journal (UK) and a further timber sector publication (Sweden). The data has already influenced (by advising on typical service life expectations for any future performance classes) the shape of the future EN460 draft and any national interpretative documents that are prepared. This is a very important part of the dissemination of PerformWOOD as the data has huge significance for the industry in guiding how they are trying to meet demands for performance and it is of high relevance to each citizen and consumer groups.

The results will contribute to:
• providing performance-based assessments and classifications of wood products in construction
• building trust among engineers and deliver better data for design and planning
• allowing better precision and higher reliability in Life Cycle Cost analyses
• giving manufacturers of products and components a firmer ground to stand on when self-reporting in product information, including to environmental product declarations
• being helpful in creating a more level field for material neutral comparisons in the construction design phase

S&T RESULT 12. A redraft of EN460:1994 the pivotal user interface standard which has essentially lain dormant for the last 20 years has been prepared and presented to TC38.

A user interface standard redraft is underway in CEN/TC38 to bring together the results of this project and provide a focus of transformation of standards for meeting customer needs. This is a massive step towards integrating performance classification into mainstream specification of wood and wood-based products.

The existing text of EN460 was provided by the CEN/TC38 secretariat to WG28 and project PerformWOOD. This has formed the basis of the revised draft standard that has been put forward as a conclusion of this work to WG28. The main result under the revision was consideration of the previous work outcomes and a creation of a concept for a revised interface standard based on EN460. The new EN460 has focussed on collection together information pertinent and accessible to the envisaged user (architect, designer, engineer) that are about the building, where it is geographically, what wood based material is used, the climate zone and the design. This is the first time this has been proposed and kick
Material is used, the climate zone and the design. This is the first time this has been proposed and kick-started recently a number of things that need to happen:

- There will still be the suite of CEN/TC38 test methods, some of which will need to evolve in order to provide better information on performance – progress is underway in CEN/TC38 WG23, WG24, WG25 primarily.
- The test standards will then need to feed into a process to determine the material resistance class (a combination of durability class and wettability class) – progress is underway in CEN/TC38 WG21 and WG22 primarily.
- New standards will be needed to determine the exposure dose based on the end use application (e.g. windows, design level, region etc.).

The new EN460 and user interface draft standard is structured around five steps:

STEP 1. Determine the Consequence of Failure (COF). For example the consequence of failure of structural elements is the highest as there is a life safety issue, the consequence of failure of a cladding board is lower, no life safety issues and easy to replace. There is good prior art from numerous standards on this that are under discussion for consideration and adoption. If COF are unacceptable then a higher material resistance or techniques to reduce exposure dose need to be selected.

STEP 2. Determine Material Resistance (MR) class. By definition the material is very specific e.g. Western red cedar (no sapwood, North American origin), or wood preservative treated timber treated to national requirement for UC3, or modified wood product X. Material Resistance class (MR) is a combination of Durability Class and wetting ability.

The durability class data is well established within EN350-2 and the wetting ability data from project PerformWOOD is being used in CEN/TC38 WGs to develop a standard method for determining and wood based materials wetting ability class. Future work is considering how to build in a 95% confidence interval for the MR to acknowledge variability in data as an engineer would understand.

CEN/TC38 has been tasked to prepare a Material Resistance Technical Report. It is envisaged that national or European expert groups might prepare tables for Material Resistance classes for wood and wood based materials. These would be readily available to the engineering and construction sectors.

STEP 3. Determine Exposure Dose (ED) parameter. The other key parameter for the performance of wood is the exposure dose. This is based on the moisture risk in that structure in that location.

Exposure Dose (ED) will be determined based on a calculation of climatic zone, size of component, uptake properties and design detailing. These are being translated into moisture risk rules which will assist with improved design of wood in construction at a national level. Extensive data is being gathered in the research community on the Time of Wetness of wooden components and products, which is a result of exposure dose and material resistance.

CEN/TC38 has been tasked to prepare an Exposure dose Technical Report. Previous research has enabled the calculation of exposure dose for a location in Europe based on the climatic zone and weather data. The next step is to calculate how the dose of moisture for that location then translates into the dose within the wooden component based on the structure, design and maintenance. The work is on-going in
STEP 4. Determine the Critical Biological Hazard (CBH). Following the approach of existing interpretative standards EN599 and EN350 this will identify CBH e.g. brown rot fungi, white rot fungi, insects for softwood Use Class 3 cladding.

CEN/TC38 has been tasked to prepare a Product guidance document. This will use existing information from EN599 to clearly present CBH data based on Use Class links. It is also envisaged that this will extend beyond biological hazards and include physical and chemical hazards such as weathering, cracking and those aesthetic qualities that we know are critical for the performance of wood in Use Class 3 e.g. cladding.

STEP 5. Determine performance class (EN460). Using the MR and ED parameters determine the performance class attained for each the relevant CBH charts for the specific application. The principle of following the lowest performance class achieved as an outcome from any CBH will be used.

The performance classes of short, medium and long are not defined and will most likely be set at the national level against the EN460 framework (e.g. it may be 15, 30 and 60 years in the UK to align with BS 8417:2011 or <10, <30 and >30 years in Germany to align with DIN 68800). The customer service life expectation data from will strongly guide this.

CEN/TC38 WG28 has been assigned a Work Item to prepare a fully revised EN460. This will take time as identified at the start in the Strategic Roadmap on day 1. It is expected that the process will kick start in November 2014 and may take up to 5 years to come to complete fruition. Estimated times for completion are given in brackets. The structure will follow the above steps:
1. Consequence of failure (estimated 2015)
2. Material resistance (estimated 2016 including wetting ability)
3. Exposure dose (estimated 2016 moisture rules)
4. Critical biological hazards (estimated 2015)
5. Performance classification (estimated 2018)

The results are fully being exploitable as the new draft standards and work items progress in CEN/TC38 to bring about the transformation of European Standards to have performance classification at the core. The thinking and development will continue to directly influence the structure of future standards and their connectivity. The results are already being used by standardisation committees, in particular CEN/TC38 WG28 and the core objective of creating a performance classification based user interface standard (EN460).

The work has successfully:
• Produced a first draft revision of EN460 the user interface standard D6.1
• Taken forward the critical assessment of existing CEN/TC38 standards from earlier work in D1.1 of this project and presented the case and questions concerning revised standards and future considerations to the relevant Working Groups of CEN/TC38.
• Prioritised activities for Working Groups to consider at their next scheduled meetings in Spring and
Prioritised activities for Working Groups to consider at their next scheduled meetings in Spring and Summer 2014.

S&T RESULT 13. Reached in excess of 514,000 people from 39 countries through additional dissemination activities alone

The core dissemination activities that were to enable internal project communication and management, and also provide a vehicle for public and wider engagement, the project website www.performwood.eu were delivered by a sub-contract to InnovaWood. This proved to be a very efficient and effective way of work, providing cost-effective and focussed engagement to a wide range of pan-European experts. InnovaWood is an umbrella organisation that integrates four European networks in the Forest, Wood-based and Furniture industries comprising 70 members from 24 countries.

The project delivered maximum impact during the reporting period of 18 months through a series of coordinated European key stage events. These included engagement workshops, presentations at industry events, and presentations at scientific conferences, external project reporting, national and European publications and press activity.

For a short CSA project the level of dissemination activity and outreach has been very high, in part due to excellent networks of the beneficiaries, the relevance of the subject area to current sector and societal needs and the deployment of InnovaWood as a dissemination partner via a sub-contract.

This includes 34 publications, of which 4 were peer reviewed journal articles, 25 conference papers and 5 master student theses. The conference papers were presented across Europe from Estonia to Portugal and even in Brazil and the USA.

A further 45 dissemination activities (workshops, presentations and press releases) reaching all European member states and beyond. In total in excess of 514,000 people from 39 countries were reached through additional dissemination activities alone (28 European Member States, Switzerland, Norway, New Zealand, Australia, Macedonia, Japan, USA, Canada, Brazil, China, Chile).

The work continues on dissemination and at present the beneficiaries of the project PerformWOOD are scheduled to present 11 additional conference papers and publish them in April, May and September of 2014 in Austria, UK, USA, Brazil, New Zealand and Australia. The outcomes of the project are thus being carried forward into future work and a wider international audience being made aware of them.

S&T RESULT 14. Presented formally to CEN/TC38 Plenary to facilitate the transformation process.

These primarily coincide with the Plenary meetings of CEN/TC38 in November 2012 and November 2013 and will continue into the future. In addition presentations have been made at select CEN/TC38/WG meetings and national mirror committees. A meeting with ISO TC59/SC 14 Service Life Planning was organised in July 2013 and it is anticipated a repeat and update will occur in July 2014. This has successful engaged stakeholders and built consensus of approach across the standardisation arena.

The Comité Européen de Normalisation (CEN) is the only Associated Partner of the project and has
The Comité Européen de Normalisation (CEN) is the only Associated Partner of the project and has provided a formal liaison connecting the project to CEN process and as well as project access to standard EN460 text. This has helped with wider dissemination of the presence of the project in the standards community; in addition to the formal liaison with CEN/TC38. Ms Magdelena Kutnik is chairman of CEN/TC38 Durability of wood and wood based products has attended in person two of the five project management meetings of PerformWOOD which was very beneficial. The project PerformWOOD also has deep connection into CEN/TC38 working groups through the beneficiaries and the convenors:

- **WG21 Durability classification** (convenor Dr Eric Heisel, FCBA, F – WP2 leader)
- **WG23 Fungal testing** (convenor Prof Joris Van Acker, UGent, BE – WP3 leader)
- **WG24 Insect testing** (convenor Dr Rudy Plarre, BAM, DE – sub-contractor)
- **WG26 Physical/Chemical factors** (convenor Joran Jermer, SP, SE – colleague of WP5 leader who has attended 4 of 5 Project Management Meetings)
- **WG28 Performance classification** (convenor Dr Ed Suttie, BRE, UK - coordinator)

This will ensure that momentum of the transformation will continue well beyond the short CSA project lifetime.

**S&T RESULT 15. Integrated a new research group into the European Research Area**

The project partner VVUD (Czech Republic) had never participated in collaborative European research before. So the project PerformWOOD has contributed to expanding the European Research Area.

**S&T RESULT 16. Engaged 41 companies and associations in the PerformWOOD Project Users Group.**

A Project Users Group comprised of key industry members and stakeholders from the wood product supply chain. Engaged 41 companies and associations (from 13 countries, including Turkey, Australia and French Guiana) in the PerformWOOD Project Users Group. The Group is an active forum for seeking industry and wider views on the development phases proposed especially on performance classification. It continues to function beyond the project as a useful sounding board for CEN/TC38 WG28.

**S&T RESULT 17. Engaged other researchers in shaping PerformWOOD outcomes.**

In addition during the period other non-beneficiary researchers were engaged in shaping PerformWOOD outcomes. The project benefited substantially from inputs and attendance by Dr Hannu Viitanen (VTT, Finland) with any funding to support his involvement. Dr Viitanen is an internationally recognised expert on the modelling of mould and fungal growth in moisture conditions, as well as having a wealth of experience in the use of wood in construction. In addition Mr Wolfgang Gard (TUDelft, the Netherlands) contributed valuable input and experiences especially on wood window performance studies.

**Potential Impact:**

**Summary of potential socio-economic and societal impacts**

The project impacts on numerous European priority and policy areas:

- **Economy** – Utilisation of European grown softwoods is increasing due to innovative use of timber in construction, securing an aspect of a low carbon construction future. The impacts this project can bring and further enhance the demand for wood as a sustainable construction material and encourage
and further enhance the demand for wood as a sustainable construction material and encourage afforestation. The prospects for economic growth are realised through expanding markets for speciality products with improved attributes, responding to increasing environmental legislation and public demand for reliable products. New markets and companies for reliable timber products and design services are anticipated to develop – with service life tailored to end-use.

• Employment and Social Policy - The project will continue to support rural employment and future job creation in areas of Europe where alternative jobs are difficult to acquire and sustain. The project results will contribute to an improved competitiveness of European industry and may provide opportunity for increased exports from the Community. Impacts expected in education will derive from the training requirements to broaden performance classification knowledge.

• Environment – the long-term management of a natural resource provides multiple ecosystem services (e.g. flood risk mitigation). The project will contribute to the sequestering of carbon dioxide in wood products - the IPCC note the need to extend the service life of wood products. The outcomes impact on reducing over specification of treated wood and enable less impacting solutions (e.g. modified wood) thus provide lower emissions to air, water and soil. This offers potential to reduce the environmental impact of the products and when combined with improved service life information in Environmental Product Declarations will improve further the credentials of wood as a low impact construction material and create demand.

• Consumer protection – appropriate performance classification will reduce premature failure of products and the associated impacts and hazards. Confidence in the reliability of products will develop through practical experience.

• Cohesion of Europe – fostering cooperative working across regions. The science and technology prospects further offer opportunities for maintaining Europe at the forefront of the service life, durability and timber utilisation.

• Society - The project fosters a more rational use of wood resources. The service life of these softwoods has to be increased, without the standards to frame this it will not happen. In addition there are substantial amenity benefits associated with forestry in much of Europe. The early stakeholder share gained by citizens (via the largest survey of service life expectations of wood in construction) will ensure a user interface that will be meaningful and readily adopted.

Building upon a solid foundation of collective knowledge, PerformWOOD has absorbed new experience, evidence and conclusions and combined them with necessary auxiliary expertise in e.g. building physics, also available within the consortium. Taken together, this has enabled us to consolidate evidence and experience with both rigour and robustness, to clarify the knowledge state-of-the-art to experts across the board, and to take important steps towards European consensus.

With the convenorships of the three most relevant Working Groups in CEN/TC38 (WG21, WG23 and WG28) and of the TC itself being represented in the consortium, the outcome of PerformWOOD has had an immediate leverage on the standardisation arena. Already within the short lifetime of this project 3 new work items have been adopted within the realm of TC38 in order to pick up and utilise the project results. These are:

1. WI 00038181 – Durability of wood and wood based products – Moisture dynamics of wood and wood-based products (EN). ACTIVE

2. WI 00038152 : End use performance of wood products ACTIVE

3. preWI EN 460: Natural durability of solid wood – Guide to the durability requirements for wood to be
3. PREWI EN 460: Natural durability of solid wood – Guide to the durability requirements for wood to be used in use classes. To be ACTIVATED

In addition there are a further 3 work items that will be activated most likely at the next round of CEN/TC38 Working Group meetings in November 2014. Especially important is that the long needed revision of the centrally important standard EN460 “Guide to the durability requirements for wood to be used in hazard classes”, the updating of which has awaited finalisation of other, underlying standards. The outcome of PerformWOOD will ultimately directly benefit the scientific community, to policy makers and legislators, to the wood industry, to the building industry and to citizens as consumers and users.

A number of expected impacts were articulated in the PerformWOOD Description of Works:

1. EXPECTED IMPACT: Delivery of new standardisation documents (e.g. a CEN new work item)
   ACHIEVED IMPACT: Adoption of 3+ new work items in CEN/TC38/WG28, WG23 and WG21.
   The ground is paved for a revision of the central standard EN 460 as the draft from project PerformWOOD is taken forward by CEN/TC38/WG28 to Plenary 2014.

2. EXPECTED IMPACT: Consolidation of the technical background for standardisation, unification and certification of advanced materials, manufacturing processes and their production environment
   ACHIEVED IMPACT: A combination of established and new evidence and experience has been consolidated and presented as the state-of-the-art knowledge. European consensus has been significantly built regarding the transformation of current standards into a set of instruments suited for performance-based service life predictions. The roadmap from PerformWOOD has been adopted by CEN/TC38 into its business plan.

3. EXPECTED IMPACT: A substantial contribution to international standardisation, helping to strengthen the position of European industry
   ACHIEVED IMPACT: Existing liaison with ISO/TC59/SC14 and with OECD was used to provide contributions to material neutral platforms of international standardisation. Opportunities for European wood industry as multiple technology providers are strengthened.

4. EXPECTED IMPACT: Improved quality control for the entire process chain (from design, over production and certification up to product disposal), increased inter-operability and potentially improved time to market
   ACHIEVED IMPACT: New opportunities to optimise products for targetted fit for purpose products. Facilitation of product communication with architects and building industry. Refined multifaceted understanding of durability.

5. EXPECTED IMPACT: Support to EU policies relying on standardisation
   ACHIEVED IMPACT: Fulfilment of requirements in the Construction Products Regulations. Facilitating the change to a society with a sustainable use of an increased share of renewable construction materials. Support to demands for Low Carbon Building through overall CO2 release reductions.

The impacts of project PerformWOOD are considerable and include:
The standards under consideration and evolving as a result of the project facilitate innovation and will bring new products to market. Service life can be met by many different discrete strategies or combinations of technologies. This might be through technologies for enhancing durability (e.g. wood modification, thermal modified wood, water repellent treatments, densification) or technologies for reducing moisture risk in the product (e.g. good design, moisture barriers, sheltering) that are all excluded from the existing standards. The future of standards must be sufficiently robust to enable new technologies to be adopted yet ensure that this is in the same fashion and rigour as existing technologies operate under. The consortium comprises of experts covering all product groups and experiences. Never before have had this expert team focused so clearly on this topic.

The supporting action project has bridged the gap between research and innovation by triggering consolidation of thought, principles and evidence that exist across Europe for the first time. This provides a focus for taking forward to revise existing standards and present new standards as part of a long term revolution strategy for innovation. It unlocks the degrees of innovation and has enabled open and free discussion of ideas.

Small incremental steps in existing technologies will always be needed and remain the most coherent of market changes. The work will impact on medium technologies that replace existing technologies, revolutionary technologies that provide a new means of deploying active ingredients (e.g. super critical fluids) or a new technology that has no biocidal activity (e.g. a water blocking resin impregnation) sit poorly in the existing standards, and as such are avoided (losing potential environmental and performance benefits) or are specified using weak technical documents that lack the impact and rigour of standards. PerformWOOD has started the process to incorporate all durability enhancing technologies together.

There are numerous projects and R&D outcomes that have been built upon by this supporting action, making excellent continued value of the investments made by society in research. These include but are not limited to:

1. BRITE-EURAM project “Vegwood” (BE96-3132) - natural solvents component
2. Natural Resins project (FAIR CT-95-0089) for assessing the scientific and practical possibilities for protecting wood using non-toxic natural resin systems.
3. A project (AIR CT92-0682) assessing the non-toxic modification reactions of wood to deliver high durability.
4. Plybiotest FP5 project Plybiotest and an industrial follow up project set up by FEIC, called Plywoodmoisture
5. WoodExter Woodwisdom-Net pan-European collaborative project
6. WoodBuild Swedish-German collaborative project
7. WEFAM – German service life project

The preparation of standards and metrology with PerformWOOD will vigorously push knowledge towards industrial innovation. Industrial innovation is guided by existing standards; new technologies often do not fit well. No more so than in this field. At present there are technologies that confer durability to wood using chemical and physical means that do not rely on the biocidal affect such as of wood preservatives that all the standards were developed for. Innovations are waiting, industry needs means of unlocking the
The standards were developed for innovations are waiting, industry needs means of unlocking the technologies and delivering customer innovation, and consumers need a mechanism for confidently using and specifying these technologies.

The work has taken into account international situation whilst building European consensus building through direct activity in CEN/TC38 and the quality of the thinking and outcome of the work. Liaison has been made with ISO TC59/SC14 and they have been and will continue to be kept abreast of the work in this supporting action. There will be occasions where opinions and considerable effort and input from other parties was made at workshops and meetings, the most significant examples from Finland and the Netherlands were very strong in expanding the European consensus. The diversity of the Project Users Group includes Turkey, Australia, French Guiana, Portugal, Estonia and Norway which further has captured international views. Requests for presentations of the project findings have also come from New Zealand and Australia which shows the significance of the work and showcases European research at the cutting edge of standards and performance classification.

The active participation of representatives of technology providers and potential end users such as industrial associations has been encouraged across a number vectors. The project formed a user group of 41 largely industrial and association based organisations and also through the partner networks and standards committees we have actively sought the input of technology providers such as:

- Wood preservatives: Lonza, Osmose, Dr Wolman, Rutgers, Janssen
- Wood modification technologies: Accsys technologies, the International Thermowood Association, Kebony
- Wood industry bodies: CE Bois, TTF, ITTO, EDF, InnovaWood
- Trade associations: WPA, UKFPA, BWF, FEIC

Far reaching impact has been gained from the supportive action through the partner networks and active participation of technology providers (wood preservative manufacturers, wood modification technology companies, thermally modified timber businesses) and groups of trade associations and end users (trade associations, joinery companies, fencing and decking companies).

A key element of the work is the unique opportunity to feed end user expectations back into the standardisation process. The data gathered from construction professionals and the citizens of Europe is of vital importance for shaping the future performance classification standards and national interpretative documentation. The industry have responded very positively to this information and it is expected to be vigorously used to disseminate and communicate back through the project and provide maximum impact for outcomes.

Community added value and contribution to EU policies

The objectives are efficiently addressed at the European level to tackle the technological and scientific basis of timber utilisation to meet the challenges of the new century. If these were addressed at the national or regional or private levels then impact would be limited to that region and it would simply add to the ‘noise’ of local systems and differing opinions being developed and perpetuated.
These challenges, particularly environmental and social improvements, can only be met through co-ordinated and concerted action across Europe because of the wide range of distinctive national codes, standards regulations and customs and practice on environmental issues. The project has provided a really cost-effective way of advancing standards to underpin growth in Europe. The investment of <€500,000 in the project has delivered the early tools and process to enable a much wider and more sound growth of the timber in construction (trade currently estimated to be €17 billion). The work completed in 18 months has transformed CEN/TC38 and the wider standards arena. Viewing the problem from a European perspective has recognised the need to support European business as a whole and is essential for delivering such forward looking technology. In addition a European-wide dimension has allowed for the varying climatic conditions and performance expectations for treated timber in different regions. The spin-off is that pan-European trade in timber construction commodities will benefit and grow as well as further cohesion of the RTD community around new standards and the user requirements.

Contributions to EU Policies:

- Employment and Social Policy - securing rural employment and regional investment across Europe and improving the Health & Working conditions of workers
- Environment Policy – encouraging the sustainable use of the softwood resource, the long-term management of a natural resource (including the amenity value of the countryside) and the support of SME businesses in rural areas. As the technology is adopted, waste management practices will be improved through reduced landfill disposal of treated timber and greater recycling. Non-conventional wood protection systems reduce the risk of harmful emissions to the environment and of the associated industrial hazards. Improved wood protection technologies will also encourage the greater use of timber resources so increasing the sequestration of CO2 (The Kyoto Protocol target for the European Union is by 2008-2012 to reduce CO2 levels by 5%).
- Consumer protection - providing product performance in terms of durability and a definition of service life but with reduced impacts and hazard.
- Cohesion of Europe - providing a trans-European approach which supports the Policy objectives of fostering closer co-operation with potential new entrant nations into a broader European Union (Czech Republic).

Community added value is further demonstrated through the 34 publications and theses and the 45 wider dissemination activities. In addition there have been occasions for interaction with other projects and thematic networks (especially via the IRG-WP conference June 2013; and the new COST Action FP1303) which foster a willingness to co-operate.

The project has already begun to foster a more rational use of wood resources. In Germany for example the forest stands of conifer, especially in the eastern states, are becoming younger and younger because of heavy exploitation. This means that low durability softwoods are being used more and more in construction and the demand for effective service life wood protection systems is, if anything, increasing. In the UK large volumes of non-durable softwoods are coming to harvest as a result of investments made in the 1950’s and 1960’s. Across European member states the standing volume of commercial timber has increased from 7.4 billion m3 in 1950 to 11.5 billion m3 in 2009 (Forestry Own-Initiative-Option document, EC 2009). The service life of these softwoods has to be increased, through the use of a protection system, to optimise whole life costs and reduce wastage. This will encourage the use of environmentally optimised...
to optimise whole life costs and reduce wastage. This will encourage the use of environmentally optimised wood protection systems to meet a particular specification in terms of service life of the timber component. Without the standards to direct this it will not happen.

Within the national regions represented by partners in the project, a minimum of two thirds of the construction timbers used are low durability softwoods. Delivering effective service life of timber construction components contributes significantly to the sustainable development and exploitation of forest resources.

Contribution to Community social objectives:

The longer term potential impact is to provide a means for clear specification of performance of wood in construction mapped against the users need. These improvements will maintain and further enhance the demand for wood as a sustainable construction material. A competitive range of materials provides a healthy environment for innovative design and construction practice. This will encourage the use of wood as a resource and may result in greater planting of trees and subsequent amenity benefit spin-offs.

Employment in rural areas will be secured in the forestry industry and the treatment industries. The project results will contribute to an improved competitiveness of European industry in the world market and may provide an opportunity for increased exports from the Community.

Employment, education and training:

In summary the project and its longer term impacts will secure jobs in remote rural communities and it will increase the competitiveness of timber as a more sustainable alternative compared with other construction materials. Whilst there will be no significant direct creation of employment as a result of this project it contributes to securing and potentially developing jobs in the rural European regions where forestry is often heavily relied upon to sustain remote communities.

Within the European Union an average of 27% of member states land is in commercial forestry, ranging from 58% and 49% in Finland and Sweden respectively to around 12% UK. Forestry products have great importance in many European economies – providing a range of jobs either directly in forestry, felling or saw milling or in treating, machining and manufacturing higher-value end products. In Europe an estimated 2 million people (3% of the working population) work in the timber industry, the majority of which are employed in SMEs located in vulnerable rural communities. These remote communities are often in areas of poor agricultural soils, so growing alternative crops is not a viable option. In addition there are very limited opportunities for re-training for other careers. Employment trends in these sectors have declined slowly due to the increased mechanisation of the forestry sector in felling and processing of logs and sawn timber. In Europe an estimated 4 million were employed in the timber industry in 2001 (Forestry Own-Initiative-Option document, EC 2007). This is especially the case in emerging European economies such as Czech Republic, Slovenia and Croatia but has largely stabilised in the UK and Sweden. To add value to sawn timber, many saw mills have preservative treatment facilities on site and these require additional staff with different skills. The project provides impacts into this area, but also into the high value factory finished timber commodities, and ultimately penetration into the do-it-yourself markets. Securing employment in these sectors is anticipated through the need to innovate and address the issues such as reduced environmental impact; which hinge on performance and specifying appropriately against.
Reduced environmental impact, which hinge on performance and specifying appropriately against expectation of service.

Without these branches of innovation being explored the potential for there to be products that both perform well and satisfy the requirements for environmental and social improvements are likely to be restricted and ultimately compromised. Impacts expected on the improved use of skills or education are more modest but will derive from the training requirements to broaden the skills and knowledge of those engaged in biocide production, protection treatment applications and the specification of treated wood.

Environment:

In summary the project and its longer term benefits will have an impact on environmental benefits as reduced emissions of broad spectrum biocides, reduced Health & Safety hazards at timber treatment facilities, promotion of the sustainable use of timber resource, improved recyclability of treated timber product and easier disposal of non-recyclable treated product.

The risk management in place to handle biocidal products is a costly but necessary exercise, to ensure good management of the products. However, it is a financial resource that may be reduced if the products were of reduced impact due to a targeted low concentration of biocides or if no biocide was used in the protection system. A wider project impact in this field would also reduce impacts as emissions to air, water and soil, and will aid the objectives and obligations to protect the quality of air and water in the EU.

The impacts for improvements in terms of environmental quality are substantial in the medium to long term. Targeted intelligence led performance classification of wood products will reduce the environmental impact of treated products by reducing over- or hugely costly under-specification of durability against needs. It should also reduce the difficulties of disposing of the waste material. The increasingly restrictive requirements of burning waste wood may also be reduced, enabling more to go for energy recovery as valuable heat and hot water. Furthermore the more benign characteristics of this treated wood would facilitate recycling or reworking of timber removed from buildings at the end of the building service life.

Incineration of wood treated with many current preservatives can be a relatively expensive process requiring special ovens with flue gas recovery systems. In Germany for example the costs of disposing of 1m3 of CCA treated timber waste is the same cost as a fresh 1m3 of CCA treated timber. A low-technology approach could be enabled for recycling due to low hazard would not require specialist equipment or the need to transport waste to particular sites. Low-technology solutions may be either by reworking and machining for alternative use on site, or simple feeding into a chipper machine for production of garden ground cover, soil improvers or for clean burning for energy recovery.

The Intergovernmental Panel on Climate Change (IPCC) reports and assesses scientific information concerned with climate change and makes proposals for policy formulators to adopt. Significant emphasis is put on the sequestering of carbon dioxide in wood through increasing the global wood products pool, increasing the competitiveness of timber materials and thus substituting for less sustainably sourced materials such as concrete and steel, and extending the lifetime of these products. It is recognised that this is of course only one component of the strategy to reduce global carbon dioxide emissions as set out at the Kyoto Conference on World Climate in 1997. The target adopted across Europe is for a 5% reduction in
Kyoto Conference on World Climate in 1997. The target adopted across Europe is for a 5% reduction in CO2 for 2008-2012. The final version of the IPCC report was available to the European Commission in May 2000 and contributes to defining an EU policy on climate change. It includes reference to expanding timber utilisation whilst recognising the need to extend the service life of wood products. The project impact of enabling performance specification of wood will foster the use of timber in construction where it can lock up carbon for decades to come.

In addition to the above environmental benefits of forestry products that would be enhanced and grow there are substantial recreational and amenity benefits associated with forestry practice in much of Europe.

Quality of life, health and safety of the citizens, including working conditions:

The summary of project impacts on the quality of life and working conditions benefits included reduced emissions of broad spectrum biocides, reduced Health & Safety hazard from products use in the home and places of work and improved consumer confidence in the role of non-conventional wood protection systems.

The impact of this project will be in the improved safety of wood products and wood protection products through lower concentrations of lower impact biocides required for activity and the specific targeted nature of the molecules. Combined with this the public perception of the usefulness of them will be improved to reflect the need and importance of them in the future of European construction. Beneficiaries from these improvements include the whole industry chain from the operators of treatment plants, through to the end user, occupants of buildings and those impacted by the recycling phase.

Direct improvements for the quality of life of citizens are also anticipated. New products have applications in DIY products, and will present a low risk to end users during or post treatment. The use of non-conventional wood protection systems will increase through the removal of the obstacle of not being able to specify them. Confidence in the performance and service life of the systems will develop and be reinforced through practical experience. Citizens having started to shape the development of the work through the questionnaire on expected service lives and guarantees for wood products will continue to be key stakeholder of the work going forward. The project has started the process of creating a user friendly interface standard to put the specification of wood by performance in the hands of the construction professional and citizen. This will empower the citizen to get products that deliver for them and meet their expectations and avoid costly and wasteful under performance of products.

Spreading excellence, exploiting results, disseminating knowledge:

A key economic dimension of the project is that it provides substantial support to the appropriate specification and use of wood by end users. It provides the first step of new standards towards confidence to understand and utilise the performance of wood to their differing requirements. It also supports the use of timber as a sustainable resource. Utilisation of European grown softwoods is increasing due to innovative use of timber in construction and the harvesting of previous investments in resources. The predicted increased demand for all wood products from 1990 to 2020 is 82% (Network EUROWOOD 1998). Timber as a raw material is especially associated with the rural areas of Europe where traditional
Timber as a raw material is especially associated with the rural areas of Europe where traditional employment skills are relied upon heavily. The project will continue to support rural job security and future job creation around traditional industries and skills in areas of Europe where alternative jobs and skills are difficult to acquire and sustain. Forest industry production in Europe in 1993 was valued at 17 billion euro; an estimated 30% of this market is inherently dependent on wood preservatives (FAO statistics 1993). Thus a market value of approximately 6 billion euro can be associated with preservative treated timber in Europe alone. The other wood protection technologies account for at least the same value again.

The measures employed by the consortium for dissemination have included:
- 34 Publications (International, European, national, popular, trade, scientific, theses)
- 45 Presentations and engagements (International, European, national, popular, trade, scientific)
- Project User Group of 41 members
- The project website www.performwood.eu
- News network (partner websites, blog, twitter feed)

Target groups that have been reached include policy makers (e.g. DCLG, Building regulations, NHBC), interest groups (e.g. Trade Associations, Consumer watchdogs, Forestry groups, Construction groups), the media (Press releases, Articles, Conferences), the public (Twitter, Blog, questionnaire, website) and the Project User Group (manufacturers, specifiers, associations).

Measures proposed to increase the likelihood of market uptake of the results include close alignment and integration with CEN/TC38 and the user community. A verification trial of ‘test tables’ in each climatic zone of Europe (funded through national research funds) has been prepared as a co-ordinated application within COST Action FP1303. The test tables include Thermowood, spruce and oak as three test materials and will be evaluated for performance in terms of physical and biological parameters.

Exploitation and dissemination plans:

The summary of exploitation and dissemination includes workshops, seminars, reports and newsletters, the formation of a User Group to aid dissemination, the sub-contract to Innovawood Ltd for dissemination across Europe, a useful project website and short articles for popular technology promotion vehicles.

Some key consortium connections exploited on behalf of the project include:

ISO TC59/SC14 “Design life” This group looks after service-life planning, as described in ISO 15686, which is extensive and far-reaching, and includes economic, environmental and technical considerations.

CEN/TC 350 “Sustainability of Construction Works” this group is responsible for the development of voluntary horizontal standardised methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products. The objective is to ensure that LCA-based data for environmental product declarations are consistent, comparable, verifiable and scientifically based.

CEN/TC 351 “Construction Products: Assessment of release of dangerous substances” This group is directed to the area covered by the Biocidal Products Directive and REACH. Indicators, criteria and
Directed to the area covered by the Biocidal Products Directive and REACH. Indicators, criteria and
developed standards will have significant influence in the future on the materials available for construction
products and on service-life design options.

The project user’s group set up at the beginning of the project has been allowed to grow during the project
to 41 companies and organisations associated with wood in construction from across Europe and beyond.
The membership of the User Group is transparent and publicised on the website on the project “Partners”
page. The group has successfully allowed the customers and users of standards for wood products to
interface with the project team, particularly SMEs. The beneficiaries have used their networks and
contacts to notify appropriate national organisations and draw in key players.

Improving economic growth and competitiveness:

The project contributes to economic growth by developing a framework for the specification of service life
for timber products of appropriate durability whilst addressing safety and environmental concerns. On a
pan-European scale this investment in standards will allow Europe to compete in the world marketplace of
environmentally improved technologies, enhancing the role of many of the world’s leading enterprises
based in Europe.

Treated timber is ostensibly a low value commodity in structural construction. However, value is added to
it through improving environmental credentials for the products and improving its reliability. The highest
value construction products have value added in the form of different technologies to achieve outstanding
performance, e.g. factory finished and glazed window units ready for use, self-assembly flooring kits and
other joinery products. Major competitors exist in these high value sectors, primarily from u-PVC windows
and doors and aluminium framed windows. Over the last twenty years the wooden windows market share
has reduced dramatically, to around 60% of the new build and 3-4% of the replacement markets.
Aggressive sales tactics and door to door marketing have contributed to the decline in wooden windows;
though the corner has been turned and initiatives such as the Wood Window Alliance have achieved
much. Timber as a sustainable resource has many advantages over competing materials. With more
emphasis on the whole life costs of a component the recycling of the material at the end of its service life is
becoming increasingly important. Timber treated with a non-conventional system sits favourable within this
emerging standards framework and would promote competitiveness in the markets of high value
construction components.

The prospects for economic growth are realised through expanding markets for speciality products with
improved attributes, responding to increasing environmental legislation and public pressure. Providing in
the long term answers concerning “How long will this wood product last?” and improving the reliability of
that answer. New markets for durable timber products are anticipated to develop where durability and
service life are tailored to end-use. Appropriate service lives have potential to avoid waste and thus reduce
the waste disposal costs for treated timber material which would ultimately be realised through reuse of
treated timber material. In the UK alone an estimated 1 million m3 of waste construction timber is
committed to landfill sites every year at high cost (£72 per tonne). Even if only a small fraction of this were
recycled and fed into particleboard manufacturer, composting or some other reuse, the estimated savings
would be substantial.
Future opportunities for economic development include a longer-term increase in the utilisation of timber in construction, securing a low carbon construction future, promoting cheaper and more rapid building processes such as modular housing as well as increasing the use of technologies for multi-storey timber frame building developments.

Creation of market opportunities: Scientific and Technological prospects, dissemination and technology transfer:

The scientific and technological prospects for this project are favourable. Service life reliability creates opportunities for a durable timber product with reduced social and environmental impacts is in real demand as an alternative to conventional products. Naturally durable timbers from certified legal and sustainable sources cannot fulfil the needs for durable construction timber and current preservation technology is under increasing pressure from environmental protection driven legislation. The science and technology prospects offer opportunities for maintaining Europe at the forefront of the service life, durability and timber utilisation market by enabling the application of innovative products in an avenue rich with potential for maintaining the future utilisation of timber in construction. Marketing and manufacturing of products may lead to expansions in the areas of Europe traditionally associated with the chemical manufacturing industry.

The dissemination of the results to the main target groups the biocide and chemical manufacturers, wood preservation manufacturers, non-conventional wood protection companies, timber treatment companies, sawmills, Government departments and the international research communities has been achieved. Outside the project team, the project has been widely publicised in the press and timber trades magazines. The extensive contacts in European wide organisations and networks have been exploited to raise awareness of the project, including Innovawood, COST, the European Committee for Standardisation (CEN), The International Research Group on Wood Preservation and the Western European Institute of Wood Preservation.

The Project User Group has seen the standards framework concept and first steps towards its validation. This has helped with the technology transfer to smaller forest product enterprises with an interest in a successful project outcome. Further technology transfer has been spurred through contribution to CEN/TC38 activities and meetings. The project consortium is all active participants in CEN meetings across Europe. This has been supported through the partner’s individual national representations of committees such as BSI, DIN, AFNOR and technical association committees.

Major dissemination activities:

For a short CSA project the level of dissemination activity and outreach has been very high, in part due to excellent networks of the beneficiaries, the relevance of the subject area to current sector and societal needs and the deployment of Innovawood Ltd as a dissemination partner via a sub-contract.

This include 34 publications, of which 4 were peer reviewed journal articles, 25 conference papers and 5 master student theses. The conference papers were presented across Europe from Estonia to Portugal.
Master student theses. The conference papers were presented across Europe from Estonia to Portugal and even in Brazil and the USA. A further 45 dissemination activities (workshops, presentations and press releases) reaching all European member states and New Zealand and Australia and an audience size of 514,000 people.

The work continues on dissemination and at present the beneficiaries of the project PerformWOOD are scheduled to present 11 additional conference papers and publish them in April, May and September of 2014 in Austria, UK, USA, Brazil, New Zealand and Australia. The outcomes of the project are thus being carried forward into future work and a wider international audience being made aware of them.

The results and data gathered on end user requirements, which saw the largest ever survey of service life expectations undertaken by surveying European construction professionals and the house owning citizens, is being prepared for a number of national articles, including the Timber Trades Journal (UK) and a timber business monthly (Sweden). The data has already influenced (by advising on typical service life expectations for any future performance classes) the shape of the future EN460 draft and any national interpretative documents that are prepared. This is a very important part of the dissemination of PerformWOOD as the data has huge significance for the industry in guiding how they are trying to meet demands for performance and it is of high relevance to each citizen and consumer groups.

List of Websites:
www.performwood.eu

Coordinator: Dr E D Suttie, BRE, Garston, Watford WD25 9XX, United Kingdom
suttiee@bre.co.uk

Related documents

final1-list-of-project-performwood-partners.pdf

Last update: 21 January 2015
Record number: 155719