

IQ-TEST: IMPROVING QUALITY IN OUTDOOR THERMAL TESTING

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ABSTRACT

PASLINK is the grouping of 14 European research institutes involved in the performance assessment of the thermal and solar characteristics of building components under real climate conditions. Most of the members are performing semi-standardised tests using the PASSYS/PASLINK test cells.

IQ-TEST is the European thematic network project aiming at further developing common quality procedures for testing, calibration, data gathering, cleaning and analysis, interpretation of test results and scaling/replication to real buildings, maintenance of test infrastructure. Therefore common activities are set up and coordinated. Pragmatic quality procedures for test site management, testing and data analysis are being updated or developed to become more practicable. The procedures are integrated in a software tool for daily practice. The application of the procedures is subject to an inspection visit at all test sites.

A set of training instruments is under development and is applied in training sessions for the test site managers to promote the compliance of each members test site expertise in design, preparation and execution of tests and analysis of test data with the required quality level.

To assess the inter-site quality of testing and analytical procedures of the members, round robin tests are performed. The synthesis of these test results should make clear whether further standardisation of outdoor testing is feasible.

For dissemination of the network activities, case studies are documented and published on the website www.paslink.org and a series of industrial workshops is organised.

All these activities will consolidate the network, integrate new test sites and strengthen its common approach of support for new product developments in the field of innovative building components through semi-standardised tests and pragmatic, practicable and affordable but accurate procedures, and last but not least, to higher confidence in the results by professional clients and to a broader market for performance evaluation using the tools and facilities of the network.

KEYWORDS

energy performance, test methods, quality procedures, standardization

BACKGROUND

From 1985 on, the European Commission started a concerted action aimed to improving the confidence in passive solar systems for buildings: PASSYS. Major efforts were spent to develop common test methods, test facilities and simulation tools to that end, through large research projects in the field of passive solar system testing and evaluation (PASSYS I,

PASSYS II, COMPASS, PASLINK, PV-HYBRID-PAS, ROOFSOL, ...). These efforts resulted in a powerful method based on outdoor tests in well-defined test facilities and on scaling and replication of the results from testing to real buildings.

Nowadays, a network of 14 test centres in 12 European countries use almost identical facilities and apply common quality procedures for performance assessment of this type of building products. The co-operation between these research centres has been consolidated in a European Economic Interest Grouping, called PASLINK, and in this thematic network project IQ-TEST. The investment, both of the European Union and of the research centres involved, to set up these test facilities and to develop the methods, is huge: some 20 Million EURO, of which the EC has funded about 10 M EURO.

The services provided by this network to the building industry and the research community include full support in product development (advanced glazing and façade and roof systems, BIPV, ...) aimed for improved energy efficiency and indoor environment control of buildings. Hence it contributes to the management of greenhouse gas emissions in the building sector.

The exchange of experiences between the network members and the improvement and co-ordination of the quality procedures is a major effort for co-operation at Europe wide scale. Moreover, the network members play an important role at national level both in the support of industry and in the development of national regulations regarding energy efficiency in buildings.

As a spin-off of the concerted research, several new European standards have been developed with important scientific inputs from members of the network. At the longer term, the collaborative research contributes to the preparation of a European standardised method for performance assessment of the energy performance of building components.

This thematic network is co-ordinating common quality procedures for testing, calibration, data gathering, cleaning and analysis, test results interpretation and scaling/replication to real buildings, maintenance of the test infrastructure. This will consolidate the network and its common approach of support for new product developments in the field of novel building components through semi-standardised tests and pragmatic, practicable and affordable but accurate procedures.

It is the aim of the Network to make use of the various types of competence that exist among the members and to share this knowledge with the others for an optimal performance of the whole network.

All members are contributing to the common goals by sharing their experiences from test and evaluation exercises, by gathering information from other research projects and from case studies, by applying the common procedures, once upgraded and approved, by further training and improving their skills, by disseminating the Network's message towards potential professional users.

The final result on the longer term should be a European standardised method for energy performance evaluation of innovative building components and energy conscious buildings, leading to energy efficient buildings.

The Improved Quality concept to be developed in this thematic Network should finally result in an Integral Quality Assurance Policy of the Network. This Policy will be of value, not only for the Members of the Network, but also for other networks and institutes involved in quality procedures for testing, e.g. Building Integrated Photovoltaic projects, etc.

QUALITY MANUALS: PASLINKIT

One of the main objectives of IQ-TEST was to adapt the quality procedures for test site management, testing and data analysis existing at the beginning of the project, and new ones to be developed (quality check of the data and analysis of results), to make them more practicable and feasible. Although the existing documents dealing with quality procedures in principle guarantee that a good quality level can be achieved, many teams are not fully in line with these agreed procedures because they are sometimes too demanding with respect to the quality to be achieved.

It was thus decided to create a software tool that would make all the pertinent quality documents available on-line. It should include the possibility for easy updating and give all the important information about the status of compliance of a particular team with the quality requirements, namely about the valid calibration of every instrument or sensor. This tool, fully developed within IQ-TEST, written in Visual Basic, was named PASLINKIT. It is now operational at all test sites and is an important help for maintaining the basic quality conditions for testing and analysis.

INSPECTION VISITS

All test sites are subject to an inspection visit by an expert of JRC. The final goal of the regular inspection visits is to improve the quality of the experimental work and to guarantee a coherent experimental set-up at the thermal test sites in the frame of the PASLINK EEIG activities. Inspection visits are carried out on sites of candidate members also.

Aim of the visit is to inspect the implementation of the harmonisation actions defined by the network. Special attention is given to traceability of documents, calibration, data and analysis.

The conclusions from the visits performed up to now are not necessarily reflecting the situation of all participating sites but moreover demonstrate the need for harmonised activities and to bundle the expertise that is available in the network.

TRAINING IN TESTING AND DATA ANALYSIS

A second objective is to develop and apply a set of training instruments, aiming to promote that at each member's outdoor test site the expertise in the design, preparation and execution of tests and the analysis of test data comply with the required minimum quality level.

Therefore a suitable training method has been developed. It was decided to hold a series of three training sessions to assist PASLINK test site managers and other personnel working with the PASLINK test cells on various aspects of the measurements:

- a) Preparation and setting up of experiments
- b) Execution of experiments and data collection
- c) Data analysis and the use of identification techniques

The training is provided in 3 workshops and is supported by a training package. The training package will evolve in the course of the project. Input from the various workshops will be included in the training package. After the project the training packages can serve as a stand-alone training package for new personnel involved in PASLINK experiments.

ROUND-ROBIN TESTS

A round robin test generally produces a clear picture of the overall quality of certain test procedures carried out by the participating organisations. The main activities of the work package are involved with the design and testing of suitable test components and the subsequent analysis of the test data. During the first year of the Thematic Network the specific objectives have been the design and construction of two components and the design of the test procedure to be followed by each participant. The second component should have a higher level of complexity than the first.

Given the number of organisations involved in the Thematic Network it was decided at the beginning that it was impractical to circulate one component for testing for the following reasons:

- Variation in the test aperture size of test cells between sites.
- High transportation costs.
- Likely difficulties in keeping to a strict timetable, given the use of the test cells for other tests.

The approach adopted was for each organisation to construct its own component(s) according to strict instructions regarding the selection of materials, manufacture and instrumentation.

During the second year, the main activities of the teams have been the testing of the components. The inter-site comparison of the testing and analytical procedures was also underway towards the end of the second year.

The results of this intercomparison are described in the paper by P. Baker.

CASE STUDIES

To illustrate the Network's methodology and its potential benefits to designers and manufacturers of existing and novel building components existing case studies are collated, documented and disseminated via the project's website.

Case studies have now been submitted by network members for component tests on the following:

- attached conservatory
- façade heating system
- ventilated roof component
- glazing/shading systems
- electrochromic glazing
- a range of advanced glazing components
- air supply window

REGIONAL WORKSHOPS

Industry is very interested to get more detailed information on new and harmonised testing procedures for complex window or curtain wall systems. Since there is a lack of European testing standards for the measurement of solar energy transmittance of building components, the IQ-TEST network can help to harmonise the test procedures and to improve the quality of the measurements. With regional workshops the information gathered in WP1,3, and 4 is transferred to the industry. A first regional workshop was held at EMPA, Dübendorf Switzerland; a second one is organised at the EPIC2002AIVC conference in Lyon.

THE FUTURE

Following the evaluation of the training workshops and the discussions at the plenary meetings, a number of additional needs were identified to improve the performance of the network. Therefore a new project is now in preparation: DAME-BC is an accompanying measure project within the 5th Framework Programme of the European Commission. DAME-BC stands for: *Dynamic Analysis and Modelling applied to Energy performance assessment and prediction of Buildings and Components (renewables and rational use)*. This project is complementary to the work performed in IQ-TEST. Its main aims are:

- to bridge the gap between expertise from both physical and mathematical/statistical analysis and modelling practice and to set up cooperation with potential beneficiaries, by extending the available software tools and offering support services to a wider public.
- to transfer the necessary know-how to other areas that may take profit from it, e.g. industry, designers, standard organizations (CEN, ISO), networks (IEA, EnerBuild, IQ-TEST, PASLINK) by the creation of support units to continue in a future extended network
- to initiate collaboration with candidate member states and to include them in the existing network.

There to a workshop will be organized to present to invited experts from ERA the new possibilities for support in data analysis and performance prediction. Continuous dissemination will be organised through the website and a dedicated newsletter. To support these activities, the data analysis tool LORD will be extended with a Prediction Error Method; a guidance tool will be developed to assess the anticipated accuracy of the performance evaluation as function of the features of the test element, test conditions and test infrastructure; a data analysis support structure and a performance prediction support structure will be set up.

These tools will enhance the performance of the IQ-TEST network in a substantial way.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the support of the European Union and of the participating institutes of the IQ-TEST thematic network and the PASLINK EEIG.