

TEST CELL IN FLORENCE



@GENERAL DESCRIPTION

Major aim of the test facility

Evaluation of thermal-physical properties of new building components is usually carried out in stationary conditions. In South Mediterranean area, thermal variation is significant and the effect of thermal mass should be investigated and taken into account in new and retrofitted projects focusing on thermal comfort in relation of energy saving.

The poster synthetically describes the project of a new test cell proposed by the Florence University, with the aim to become an outdoor laboratory able to test, in the next future, new energy efficiency building components. The project of the test cell is part of a largest project *Abitare Mediterraneo* financed by the Tuscany Region with the scientific contribution of several experts coming from

Institute/organisation:



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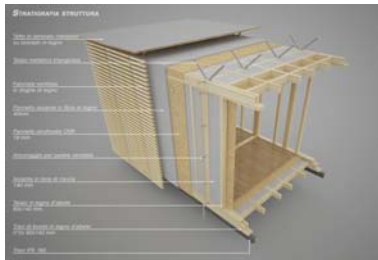
the Florence University and with the collaboration of several regional building sector's companies

The test-cell will be similar to PASSYS test cell but in wooden structure with low thermal bridges, insulated frame, routable platform, accurate flux sensors, with the aim to measure and compare thermal differences of new opaque and transparent components - on dynamic external conditions - also different day-lit distribution due to orientation.

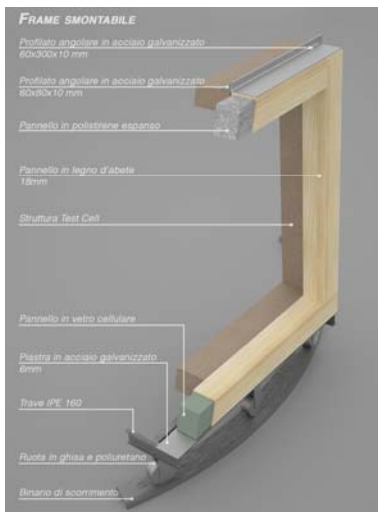
Overall lay-out

The test cell is designed in a platform frame in wood, with horizontal and vertical components made with same thickness, same material, same structure, same U-value ($0.32 \text{ W/m}^2\text{K}$). It is able to test façade components into an insulated frame, with dimensions of 2.80 m x 2.80. m.

It is orientable with measurements of interest for the production of new components suitable for Mediterranean climate.



The test cell project in wood and with the external solar screening.



The insulated frame to test opaque and transparent façade components.

Inside boundary conditions

The outdoor test cell is an instrument that is required by the Tuscany Region for giving the opportunity principally to local building market to test new products that needs to be used in Mediterranean Climate, products that are able to reduce annual energy consumption in buildings working with a sufficient insulation level and appropriate thermal inertia if necessary.

Also, the test cell will be used to evaluate the influence of the orientation when using a transparent components and the correlation with window dimensions and forms in relationship to the daylight factor under clear sky conditions, normally sky during the year in most of the Mediterranean area.

In this way, the test cell has to measure the U and g value of components and also the thermal lag and the DLF. It will have inside a radiator for internal temperature control with a ventilator. They will be used during the winter to evaluate the flux from inside to outside.



View of the site in which is going to be built the test site

Outside boundary conditions

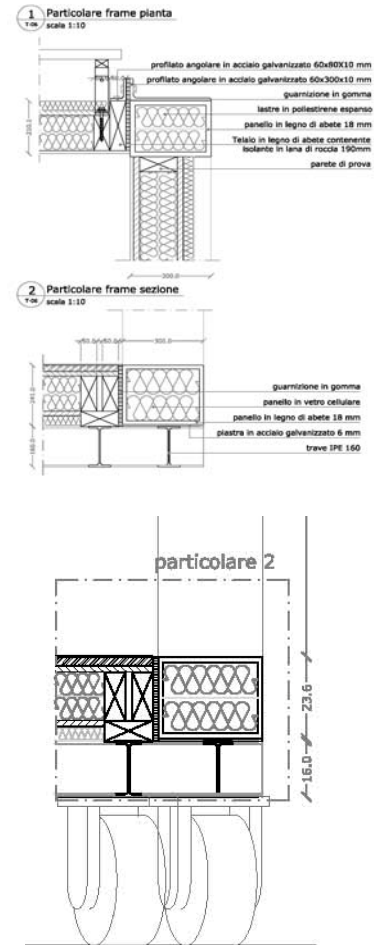
The test facility is located in outdoor under real weather conditions. To reduce the overheating inside the test cell, the envelope is covered by an external shading to reduce to zero the direct solar radiation on test cell components. The screening is realized in wood material at a distance of 20 cm from the test cell envelope to guarantee an adequate ventilation between the test cell and the shading devices.

Special limitations / possibilities

The test cell is going to be realized to test opaque and transparent vertical building components, ventilated facades, shading devises, and all other vertical building components such as PV systems, PCM materials etc.

It has been designed studying PASSLINK test cells and trying to resolve some limitations emerged in outdoor test cell built in the past, such as overheating, thermal bridge effect, problems due to infiltrations, not insulated frame.

It is not an adiabatic test cell, with a very low thermal bridges do to the wooden structure and due to the fact that all test cell's components -facades, floor and roof, are made with the same thickness, same materials, same U value. It is positioned on a routable system to evaluate differences in building components performance in different orientation and also to make measurements in terms of DLF. It is the first realized to make measurements dedicated to the Mediterranean Climate. In the next future and with the experience made with the first test cell, the University of Florence will propose a test cell for roof components and another to test systems in an outdoor test cell in two floors.



Frame's details

DATA ANALYSIS

Typical equipment within test wall

The test cell will be equipped with indoor and outdoor instrumentation.

In outside a meteorological station will record temperature, RH, wind velocity and direction, solar radiation.

Inside, the test cell will be covered by Flux tiles; internally, the ambient temperature, the surface temperature, RH, air movement, light will be measured. Sensors positions will be the same of PASLINK test cells.

EXAMPLES OF PREVIOUS STUDIES

Up to know no hygrothermal studies have been performed because the test cell is not yet realized: it will be ready in summer 2011.

MAINTENANCE / COLLABORATION

Personal involved

The test cell is going to be realized using a project developed for a PhD thesis at the University of Florence, Technological and Design Department. The project is part of *Abitare Mediterraneo*, project proposed by the University of Florence with the financial support of the Tuscany Region and in collaboration with several Tuscany industries. It is going to be enlarged to other industries interested in developing new products for Mediterranean Habits.

The responsible of the project is Marco Sala; the person responsible for adaptation and construction of the test cell is Giuseppina Alcamo; the responsible of the test facilities is Maurizio De Lucia, Energetic and Mechanical department of the University of Florence. The responsible for instrumentation is Carla Balocco also responsible for data analysis.

International collaboration

The test site should be active in the Dynastee Network to exchange experience and to collaborate at an international level.

The project of the test cell has been made with the supervision and support of Hans Bloem, JRC Ispra.

Link with other devices

The test cell is part of a larger strategy of the *Abitare Mediterraneo* Project: new building components need to be certificated not just only from thermo-hygrometric point of view but also they have to be in line with acoustic requirements, fire resistance requirements and structural requirements.

The University of Florence is going to involve internal departments and also external laboratories to give to the companies the most strong and complete support in developing new building components suitable for Mediterranean climate, simulating components with adequate dynamic software, analysing



Partners involved in *Abitare Mediterraneo* Project

LCA and testing under real user conditions and laboratories to certificate new *Abitare Mediterraneo* products.

RELEVANT LITERATURE

General literature about the test facility:

G. Alcamo. *Sistemi per valutare e comparare in opera le prestazioni energetiche di componenti edilizi: progetto di una test - cell per il Clima Mediterraneo*. PhD thesis will be discussed next April 2011.

G. Alcamo. *The overheating control in Mediterranean area: thermophysical evaluation of new facade components through a test cell*. Paper for OSDOTTA 2011, under publication.

More information about the *Abitare Mediterraneo* project are available at the following website: www.abitaremediterraneo.eu