A new database for design in Mediterranean climate

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A new database for design in Mediterranean climate

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Abstract

"Abitare Mediterraneo" is a new research project developed at University of Florence, with Tuscany Region support, aimed finalize to sustainable architecture standard and reduce energy consumption in building in Mediterranean climate. Innovative products and building components has been selected and analyzed using specific performance criteria to provide an interactive database with different technologies and construction systems, to achieve comfort in the Mediterranean climate. Technical solutions has been evaluate with the performance criteria set by European directives, allowing direct comparison and cost control. The database is a flexible, updated subdivision of construction phases and building components, creating a friendly interface suitable for non-specialist users, where they can find specific spread sheets of products and construction systems. The datasheets are an integrated tool for designers to develop a complete project analysis in several specific area: energetic, acoustic, environmental (LCA), construction and maintenance. The database is a finalized archive of appropriate technical solutions for designers and construction companies in Mediterranean climate, based on products interaction and aimed to promote innovative technologies, integration of renewable energy and better comfort under winter and summer condition. It provides a comparison tool allowing companies and research institutions to develop new products and highlight strengths and weaknesses of different components of today building technology.

*Keywords:*Mediterranen Database; technological system; architectural integration; advanced components; development products

1. Introduction: New criteria from European directive

The "Database for design in Mediterranean climate" has been developed with the aim of spreading sustainable construction methodology in Italy. The aim is to reach the goals of 20/20/20 and to diffuse

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regulations that govern energy efficiency in buildings. The European Union established these regulation through the Energy Performance Building 2002/91/CE and EU Directive 2010/31. These aim to diffuse local and national regulations to guarantee high the efficient buildings, using appropriate policies which consider local climate conditions [1].

In Southern Europe, we must think about on winter and summer conditions and avoid copy in Northern Europe energy efficiency architectural solutions, to create appropriate solutions in energy efficient buildings. Southern Europe has specific climatic conditions, with the problems of indoor summer comfort, and the consumption of water resources and natural resources. Therefore it is necessary to improve research into new technologies for envelope solutions with regard to the energy consumption.

1.1. Italian situation: a Mediterranean approach?

In Italy, the constant dependency on fossil fuels, oil and methane gas is still high in housing and office buildings sector. At a national level, Italy has adopted the European Directive 2002/91 with the dlgs 192/2005, that has been integrated and modified over the years. So, in 2009 the energy certification of buildings was made compulsory. In July 2009 the National Guide Lines, about the energy certification of buildings were issued. The UNI TS 11300, that follow the CEN regulations, were adopted. These propose a new and improved calculation method, including which incorporates energy consumption. The new regulation introduce new parameters of evaluation, like the periodic thermal transmittance or the indices of summer energy consumption [2].

The Tuscan Region has always had a strong interest in environmental politics, especially regarding containing energy consumption and promoting renewable energy sources. It has now adopted the European directive EPBD 2002/92 under the Regional Legislative Decree 39/2005, which promoted energy efficiency on a territorial scale and on the building trade.

Within the Research "Abitare Mediterraneo" aims to development an interactive database with a series of datasheets about new systems construction for sustainable building and energy efficiency also in summer condition. The database focus to create new synergy between companies and research institution in order to increase performance and compatibility of products.

2. The research "Abitare Mediterraneo"

"Abitare Mediterraneo" aimed to develop synergy between industrial companies, builders and research centers, to increase competitiveness in building sector and meet Eu and National standard requirements.

The research develops advanced tools:
- an interactive Database;
- a Test Cell;
- a new spin-off on sustainable architecture and innovative products.

The project aims to increase the energy saving in Mediterranean climate, focusing on summer comfort, developing and testing innovative solutions with national and EU companies.

3. Evolution of the technological system: a new systemic database

The building components, following the new requirements, aims to increase performance and reduce energy consumption in the buildings. This focuses on construction system, and identifies the elements that reduce consumption and contribute to indoor comfort, building a technical data network used to classified and compare products and components.

Currently, the subdivision of the building system under Italian regulation is based on the UNI8290:1981. This ranking system has been employed in many commercial databases and construction websites, supplying a quick reference and simple codification for commercial purposes, loosely in line whit energy legislation. This type of cataloguing does not give an objective assessment of individual products, but offer market visibility, which is rarely complete from a performance point of view. Product evolution and the lack of updating in the subdivision of the technological system has created a gap between the scientific approach and the common use of the construction system. This gap leaded to partial diffusion of technical data concerning the performance and use of new products that are necessary for the proper definition of the design process [3].

So a discrepancy is created between the information required by technicians and the information provided by companies, who seeks to shed a positive light on its product [4].

The proposed subdivision seeks to create a typological and technological classification for selected products. This creates a tool for defining components, elements and advanced materials, to integrate them into an architectural context, which revolves around the reduction of energy consumption and the use of renewable energy.

3.1. The Database structure

The database structure define a new method of storage and management of data, through the subdivision of technological system. The research builds a structure that is focused on the characteristics of Mediterranean climate. the database logic level aims to highlight the indicators defined on national legislation about energy consumption in buildings, providing a flexible and independent tool for cataloging and storing data.

The research define the interactive logical level like a flexible and independent instrument of cataloguing and archiving data through the use of standard criteria. The proposed electronic document archiving does not focus on the single product but on the product's location within the technical solutions based on enhanced comfort in the Mediterranean climate, thus allowing for direct integration and comparison of products [7].

The storage of data defines the internal level, and the external level is the user interface: the development of this different level of database is based on the physical and logical independence.

The logical level follows the standard subdivision outlined in UNI8290, developing a commonly nomenclature that comes from to energy labbelings and from building websites..

The first three macro-categories are taxonomy and hierarchically ordered as following:

- Technological classes
- Technological units
- Technological systems

Next this first division the research develops a method based on a faceted search [8], to identify the appropriate products and narrowing the number of results: in our database are specified in decreasing order three invariant macro-categories.

These terms are able to provide more specific information regarding:

- functional invariants properties: defines the structural system

- component Invariant properties: defines the performance of the product and its function
- materials Invariant properties : defines the materials
  This type of logical level storing data in a physical one realized in a tridimensional matrix system:
- in the vertical columns are developed the construction system,
- the horizontal lines are identify the technological layers ;
- in the third dimension are identify materials.

Through this system of invariants the user can identify the appropriate products for specific buildings not only by energy performance or technological functions, but also for the position inside the constructive system [9].

It's possible to increase the energy performance of products through association with other materials or building products.
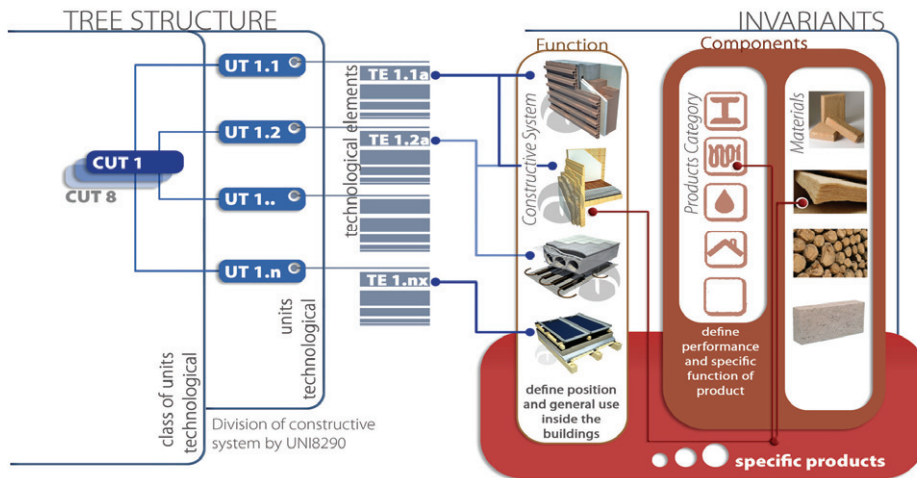

Fig. 2. Structure of logic level: a tree structure, from subdivision of technological system, linked to a faceted search system, based on three invariants: construction system, products category and material

Fig. 3. Structure of physic level: The data store is define by a folder system organized by construction system at first, then divided by layers and materials.

3.2. User Interface

User interface, , is based on the interactive design, through the possibility of multiple search system to facilitate the obtaining of information, made on:

- Key words
- Constructive system
- Functional categories,
- products

The interface is a flexible tool adaptable to users, create to help non-expert user that want find technological solution to define energy-efficient projects in the Mediterranean area. The interface with use of colour and simple label create a visual system, that try to help users in the surfing. The subdivision of construction system become a synthetic scheme, and the research by invariants are simplified:

- Functional invariant are identify by the construction system
- Elements-components invariant are identify by category of product
- Materials invariant are identify whit the generic research of products: the page of research is organized to define a multiple view (materials, companies, alphabetic, products categories)

This subdivision system is thought to create a base for the software to calculate energy consumptions in the buildings. This create a relationship between the user and the software houses, in order to development future partnerships. This relationship also help an expert user that already know this type of division and languages.
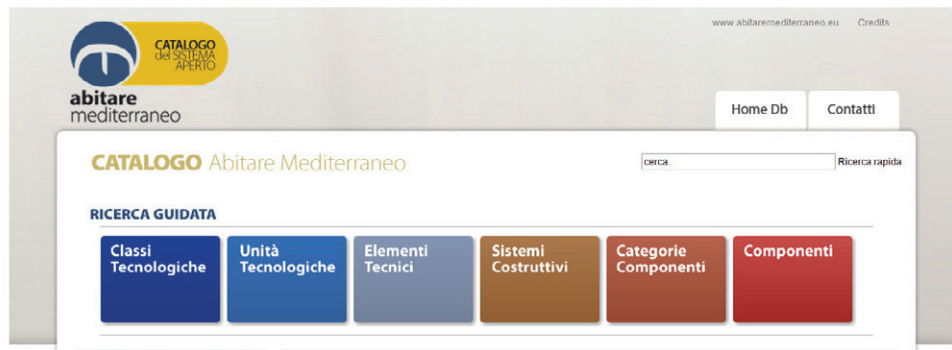

Fig. 4. Home page of products database: a section of the web site www.abitaremediterraneo.eu is dedicate to the database.

4. Tool for the Mediterranean design

The datasheets are achieved to become a practical design tool, through technical aspects, inside the constructive systems and products. Then the datasheets are developed in specific sections, to simplify the use and the reading [10].

The sheets of the building system are designed to define the technical aspects of the products within specific system about hygrothermal, acoustic and ecological footprint. The first part define:

- the performance of the construction system through the technological layers, calculated by free energy software;
- general description of the technological system;
- the acoustic performance.

We have defined for each technological layer size and material. We have developed the second part of sheet to describe the construction system, through a dynamic cross section.[11]. The follow section of sheets included the performance analysis on main products that characterize the specific stratigraphy to

define: the "carbon footprint".. The third part of datasheets is dedicate to explain the hygrothermal simulation, realized by free software TermusG (ACCA software) and termok8Calc (Ivas) [12]. We have choice two of most common free program to promote a common use of data and to create the possibility to change parts of construction system .

Inside the online dedicated page it's downloadable also the analysis about the realization, were can be identify the most important aspects for the correct installation to:

- Security
- Energy saving
- Acoustic insulation
- Comfort indoor

Fig. 5. First (a) and second (b) section of data sheets

With this analysis are developed a research activity to identify weaknesses of products and components, to propose innovation at companies or identify new firm, in specific sector, that would be associated at research "Abitare Mediterraneo".

5. Conclusion

The database aims to define new classification standard for products and building components, based on performance criteria to identify and assess most suitable technical solutions to meet the Mediterranean specific needs. The structural division seeking to create new patterns of integration of advanced products for designers, especially for energy saving solutions. This system is addressed to support designer's work, offering a comparison amongst technical solutions, but also companies that want develop innovative products on performance's base, with particular attention to energy saving in summer condition.

Now the research try to introduce economic and environmental evaluation patterns to expand the actual datasheets towards a complete dedicated tool to design and build in Mediterranean areas.

Nomenclature

A   Logical level - physical level: the structure of Data Base Management System is divided in to three level: external, logical and physic. We can identify the external whit the user interface and the physic whit the archive and the organization of data. The logical level is the structure of data and define the relationship together

B   Faceted search: is based on the faceted classification system allows the assignment of multiple classifications to an object, enabling the classifications to be ordered in multiple ways, rather than in a single, pre-determined, taxonomic order.

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specific legislation

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