From the Past: “New” Technology for Eco-Architecture

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Abstract — This paper concerns a new technologies about ecological architecture: the ventilated facades that can be used in in rural and natural environment. Today, the present aware of the ecological risk imposes a new way to perceive and to organize the environmental knowledge. In this way the correlate processes to the natural resources as the sun, wind, vegetation determine advance technological solutions of the building envelope consistent with the environment. The ventilated facades, receive a great confirmation in contemporary architecture for various factors and some important reasons, they are:
- a new technology about buildings envelopes: focus of today's architecture; the envelop is the crossroad between form and function;
- an opportunity to use the material of architectural tradition;
- an ecological constructive system;
- a means to develop the link between new technology and local material;
- a present technology always developing

Keywords - Architecture, construction, innovation, system, technology.

I. ARCHITECTURE AND ENVIRONMENT

This Please note that in natural, rural and historical areas there is often a spontaneous architecture in addition of traditional architecture. The "envelope" in spontaneous architecture was characterised by a profound coherence between form, function, building technologies and the use of local materials. This coherence was an expression of the unity of the constructive idea. It is important to underline that "Architecture" does not only mean stylistic and formal quality of buildings. It is the formal expression of artificial environment, the visible signal of invisible, complex, wide and deep realities. Nowadays the term "architecture" does synthesize and include town-planning, landscape, environment, the built and the unbuilt, structures and infrastructures. (Ciamarra, 2003). In fact Architecture is characterized by its relations with places and contexts of which it is a part, it lives of immaterial relations with the elements of landscape, whether natural or artificial. The envelope represents the first approach to architecture for the people who look at it or/and is going to posses it. The building envelope has a historical nature as a protective and bearing element. Today it is important to full reconsider costs and times of viability of goods and to recover characters and features in a more sustainable way. The environmental question enlarges and makes more persuasive this indication: particularly, it appoints the envelope to the task of improving relationships between internal micro-environment and external macro-environment and vice versa. The envelopes design must be characterized by local climate.

II. DESIGN

The “ventilated” walls is so named as between the outside wall of a building and the facing there is an air space. One of the advantages is the protection of the skeleton from the atmospheric agents without thermal bridge. This is a guarantee for energy saving. The ventilated wall consists of the following (Figure 1).

Figure 1 - Sub-structure to support the wall covering (a), external covering to protect the building (b), air gap (c), thermal insulation (d)

The sub-structure allows support the wall covering (a). The external covering protects the building (b); from which it is separated by an insulating layer and an air gap (c) allowing air to circulate. Thermal insulation (d) layer placed discontinuously on the external side of the building wall.

III. PERFORMANCE

The ventilated wall guarantees remarkable advantages in terms of thermal insulation, protection of building walls, reduced expenditure and more attractive façades. The natural ventilation together with the porosity of the external cladding allows the elimination by diffusion of the
humidity content either in the walls or inside the building. This is obviously not possible in case of internal insulation.

The double thermal insulation (air gap and thermal insulation) increases the building’s thermal inertia, preventing heat dispersion in winter and overheating in summer. The movement of air inside the gap (Figure 2) thus allows stabilization of the thermo-hygrometric conditions of the building itself.

The heat accumulation near the building - and consequently the load of the air conditioner - is considerably reduced thanks to the insulating effect of the air layer. Inside, you have a comfortable sensation as the walls are not warm. In winter the outside walls have a temperature closed to the one inside the building by eliminating (along the thickness) problems of condensate. The constant temperature of the wall improves the home comfort also with alternate heating cycles (Figure 3).

IV. ADVANTAGES

This type of hi-tech cladding combines technical requirements, aesthetic criteria and avant-garde design choices. The external cladding, the mounting and supporting structures and the insulating panels are the components of a system that assures excellent all-round performance.

A. Traditional material for building

Through facades ventilated technology item is possible to use historical materials for building (wood, earth, stone, glass): just one of this became often the distinctive feature of that building. We learnt a lot from the local beautiful architecture: when we have just one material, we are able to building very good. Thinking for example about the ventilated walls in cotto material: there are many important motifs: the desire to blend tradition and innovation in the materials and techniques used; the need to interpret the mortar less assembly technique as a new vehicle for architectural expression; the attempt to reach a synthesis between the emerging phenomenology of place and the givens of industrial production techniques. Even the qualitative level reached in recent works by famous architects, as in the case of tile ventilated façades by Renzo Piano, undoubtedly contributed to increase the knowledge of such solution and their reliability.

B. Energetic advantage

In contemporary architecture the attention to building envelopes, to its environmental performances, is increasingly more evident. Referring to living organisms, the skin, sensitive interface between organism and environment, has a fundamental role in regulating energetic flows from the outside to the inside space and vice versa, and in acting as a sensor to the external mutations.

Without doubt the increasing interest for hydrothermal performances of technological units with external building
closing and the duration that they seem to guarantee added to ventilated facades interest. Ventilated walls bring major economic and ecological advantages. Humidity in the external wall structure of the building is reduced. Formation of thermal bridges is avoided. Heat dispersion is reduced. Interior overheating caused by high outdoor temperatures is avoided. Energy consumption is reduced. Heating and air-conditioning costs are reduced. Sound insulation is improved. Maintenance costs are reduced. To this recognized performance of ventilated facades other should be added.

C. Constructive advantage

Up-to-date in terms of design and chromatic characteristics, it is available in various sizes/material combinations. Finally, the choice of visible or hidden fixing methods means that the appearance of the finished surface can be designed with great attention. It is possible to use for many different materials (Figure 4), old and new, for example very light external elements made of metals such as aluminium or zinc-copper-titanium alloy, or thin marble panels strengthened with fibres of various nature.

The envelop built with a dry-bag technique without adhesives or other elements such as screws, bolts or rivets, makes the assembling and disassembling operations easier, (Figure 5), in order to hypothesize a concrete possibility to renew the external envelope of the buildings, as the skin of a snake, or also change with time their external aspect, and with it the type of emotions that they communicate. The external panels are fixed to the metal supporting structure so as to cover water and electrical systems while leaving plenty of room for future maintenance work.

D. Technology always developing

Figures Nowadays existing new design methodologies for defining the characteristics and the dimensions of exterior ventilated facades characterized by high "sensitivity" that is, easily adaptable to two different climatic solutions.

This high sensitivity can be traced to the internal presence of change phase materials (salts or paraffin with fusion temperatures adequate to the specific situations) that make the elements’ thermal inertia variable - concentrating the element’s thermal capacity only during specific high temperature intervals. This calls for the set-up of evaluation techniques regarding the building as a whole (whole building analysis – to identify the characteristics of the envelope as related to the construction elements present), and the ventilated façade itself - analyzed in all its stratifications and components. New technology applied of the ventilated facades concerns the diagnostics too: for example the laser vibrometry. This technology provides
objective data, repeatable and easy to consult; for these reasons, this technique may be successfully applied to the construction testing of ventilated walls, to periodic controls and to appraisal validation in the case of a damage that has already occurred. The proposed technique is completely innovative in the field of non-destructive testing for civil engineering: in fact, there is no similar advanced technique to date, and the only viable alternative remains the traditional technique of manual beating.

V. ADVANTAGES

The interaction “architecture-technology” and “tradition-innovation” is essential for our future. In architecture, technologies are diversified in connection with climate, available resources, social organisation, aims. It is important to emphasize the connections to contexts, using appropriate technologies. In rural and natural environment architecture should respect the context: avoiding upset the energetic and visual impact. Suitable technologies make the respect of the environment possible. In fact not only the form of the buildings, but the technology research too, permit to realize an architecture strongly linked with the Environment. The ventilated facade system is currently the most complete synthesis of the characteristics that exterior walls must have in order to ensure well-being inside a building. The ventilated wall is the ideal solution in many situations thanks to special features that make it suitable for both new constructions and renovations.

The efficiency of the ventilate walls depends on the properties of reflection, absorption and acoustic transmission of the materials used, as well as their dimensions, thickness, positioning and the behavior of the building structure. The ventilated walls are, definitely, a complex system that can give real advantages but it needs, also, experts tech guys to be designed and built.

References

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