

# Learning approach from the invariants of earthen construction in Andalusia, Spain

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**ABSTRACT:** The current approach to the conservation of heritage resources in earthen construction, promotes its social valuation and contributes to the recuperation of traditional architectural practices. European Higher Education Area (EHEA) provides the convenient structure to apply locally the architectural conditionings influenced by popular traditions. These particular components offer invariants on construction, materials and design composition off Andalusian vernacular architecture. It is in this context where the opportunity to introduce new subjects of study related to these architectural building techniques and its materials lies. The same thing happens in response to the need of a better relationship between the environment and the important opening to a great diversion of professional specialties. This paper describes the processes to follow during the subject study, in order to start the analysis of the building, including all agents related to the implementation of this architectural technique.

## 1 INTRODUCTION

### 1.1 *Background*

Andalusian popular construction is the reflection of a multicultural heritage on the region which is valuable, important and dispersed. The study on earthen construction and the researches about the local patrimony are setting new standards in its social evaluation.

Nowadays there the recuperation of those traditional techniques in the actual syllabus has been encouraged, wherever the relevancy of earth as a construction material is clear, and it also provides a complete analysis on its application systems through different historical periods.

A great number of cases are representative of the heritage value, creating and introducing the discussion of its conservation criteria. Regarding to intervention on heritage construction, discriminate between those applying a successful criteria from those which just build by means of materials from proximate constructions is seen as fundamental.

This last stance, has generated an unequal as much as uncontrolled combination of elements and construction techniques quite different from the originals and, sometimes, incompatible.

This situation shows up that technicians and operators are unaware of the popular techniques on earthen construction and its characteristics itself.

Exposed this reflection, it is appropriate to redirect and expand the knowledge of these materials and systems that nowadays has been claimed by contemporary architecture through sustainable social solutions.

The existing documentary archaeological and historical sources, and makes the approach easier; however they are insufficient in the context of contemporary architecture.

It can be made the same consideration, from a normative point of view, which offers an unsuitable prescriptive content for the use of this material and the associated building systems.

So, the situation suites to reflect and to propose actions from learning and teaching area and from all agents on the sector. In this paper, we expose the strategy followed by the authors, in order to revalue the earth from the constructive systems to its dissemination as a current material.

### 1.2 *Architecture context of Andalusia*

Andalusian architectural conditionings, where it can be clearly distinguish two predominant uses of raw earth construction techniques, the domestic residential and the monumental.

On residential buildings, housing solutions directly excavated on rock mass with adobe walls in the façade stands out, is been currently resolved with BTC. These buildings can be found mainly in medium and high areas of Alpujarra, between Jaen, Almeria and Granada.

In contrast, throughout Andalusia the solutions are made on rammed earth or adobe which is dispersed and almost undiscovered. This kind of systems is seen on towns with buildings over 100 years old. (Fig. 1). The rammed earth is always used in structural load bearing walls or dividing walls and adobe in the inner divisions.

However, in monumental architecture its dominated by the use of the rammed earth in all forms of buildings that have bearing walls thick multi-storey heights.

These buildings reflect the traditional raw earth use material available in abundance and close to the construction place, especially the characteristics of clay soils in the Guadalquivir valley.

Distinctions are embodied as iconographic traces according to the technique employed in a particular historical period. Combinations with basements, chained stone or ceramic brick underline the Roman and Arabic heritage (Fig. 2).



Figure 1. View of a street in Antequera, Málaga (Rodríguez García, 2010).



Figure 2. East sector view of City Walls of Niebla, Huelva. (González Serrano, 2009).

These features can be defined as constructions invariants, meaning that they remain despite time as a hallmark of the region.

In turn, they are complemented by compositional invariant where the treatment of the façades with the distribution of small gaps (closed with locks of cast iron, stone plinths or re-marked walls in different colors,) on walls and ceramic tiles pitched roofs, follow a line of tradition marking differences between small geographic areas or villages throughout the region.

Similar treatments are detected wherever the walls are coated with lime plaster, and window sills are protected with fired ceramic glazed or enameled.

The materials used define one of the invariables on earth architecture construction, allowing the identification of its main elements such as color, textures and limed details in surfaces are protected with coatings.

Those signs mark an easily detectable identity against the particularities of such a wide varied of solutions on andalusian popular architecture. The wood appears on pitched roofs that made with board and covered with mud and straw or clay tile (Fig. 3).

### 1.3 Learning and professional context

Technical training in the construction sector has been organized and channeled to follow trends



Figure 3. Limed wash façade on andalusian popular architecture. Aracena, Huelva (Rodríguez García, 2011).

of the market, facing conventional construction, which incorporates Portland cement, steel and ceramics as major products in widespread use for nearly a century.

The capacitation has focused mainly on the training of professionals who have chosen these building systems for their designs.

This way of acting has led to knowledge gaps on other traditional techniques and materials that should be used in the intervention of buildings whose diversity requires different responses for preservation, particularly in popular architecture.

Moreover, design criteria should be applied on new proposals for sustainable architecture a, that shows the breakdown between the transmission of traditional knowledge and the actual building ways.

Trained technicians in several skills and specializations are required in the addition of the new requirements in the process of making all building work.

Due to the ignorance of technical difficulties the current training face its crisis when making decisions, especially when it is about intervening the local heritage or eco-construction criteria, so this becomes very clear in the process linked to built with raw earth.

Given this situation it is essential to re-channel the objectives and activities, involving all actors in the construction sector.

It is required to have sufficient and appropriate technical skills and labor that enables the construction and / or maintenance of an durable equipped environment, ecological and economic rationalizing resources and energy.

## 2 PROPOSALS

### 2.1 *Changes in technical training from study programs*

European Higher Education Area (EHEA) has introduced new curricula programs that modifying the rigid study system in Spanish universities.

The process of change in the Degree of Architecture allows the incorporation of earth in new curricula, as a construction material in the agenda of subjects in the first couple of years.

In the academic programs are described and characterized along with the current product catalog: the rammed earth, adobe, the BTC and linings of earth and lime, providing constructive relationship with the systems for its application.

On the other hand, the development of practical exercises in the subjects of Architecture Workshop is completed with the analysis of architectural

models and examples of the last century avant-garde.

These references act as a guideline for appropriate design solutions in response to the various constraints that may arise from an architectural project.

In the second training cycle, particularly for the proposals of the project, techniques mainly used in walls, blocks and earth-engineered, are currently being used. They are oriented mainly to buildings that must meet guidelines for sustainable development, energy saving and use of natural materials.

The subject moves to the third cycle in the Masters. Its focus is directed towards professional specialization or research based on two lines: a guide towards training in the study of the causes and effects of injuries on the building and the importance of knowledge for the expert's report and rehabilitation buildings, both in monumental and popular architecture; and new proposals focused on innovative application of earthen construction in contemporary architecture, as an environmental sustainable solution, which defines relevant building typologies. This view of learning, within the architecture with earth, makes a difference of content in the curricula that is very important to bear in mind because, just a decade ago, none of this item were taken into account considerate.

### 2.2 *Implication of the different agents*

There should be multidisciplinary and cross-agreements between various areas related to construction in order to make them effective and lead the proposals mentioned above into action.

The basic objective of the professional specialization in human resources and the realization of quality works should be given mainly from three areas of society.

*From teaching area:* it should promote activities aimed at teachers' training and technical advice from professionals and future work coordinators, for example, organizing collaborations between research groups, (dedicated on the development of new products and systems or quality control processes and performance in work), and/or get in contact with Vocational Training Centers and Employment Workshops to manage the dissemination and training through courses and workshops for specialization.

These activities must address different topics in modules (by degree of specialization), considering training and application of natural products and construction techniques. It should also reassess the work of local artisans, the importance of their knowledge and manage it as a training tool

for young people in order to obtain a certificate of professionalism.

*From institutional area:* ensure that small city councils promote productive areas and bet on training agreements and participation in improving their own architectural heritage.

These bets allow projects to start business ventures and social improvement against unemployment of the youth population. It points to promote and facilitate the generation of jobs. To manage the support of occupational organizations, including schools of Architects, arrange training courses for specialists and counselors also outreach the publication of updated information that transcends the issue.

*From business area:* it is necessary to establish contacts and cooperation between enterprises in different sectors willing to build a supported commercial network, which through researches help innovation with natural products and their implementation in the market. Favoring small builders who have support from schools workshop to hire labor specifically qualified in these trades.

The availability of facilities and infrastructure it is fundamental to execute the works: machinery, equipment, aids, etc. by coordinating rental management, leasing, and other components.

### 3 STRATEGIES

#### 3.1 Action strategies

Nowadays there are enough resources for knowledge, development and innovation in order to generate a network of communication and interaction channels that can be allocated to rethink the improvement and utilization of our immediate environment.

The strategy is to recreate a construction process that links the production, placing on the market, training of skilled labor and construction work start from hypothetical analysis. All with the purpose of reevaluate a product that can, and should, be applied with innovative environmental benefit on the overall sustainability of construction, like in traditional architecture.

On the other hand, the process for obtaining raw material in local environments, allows the reduction of transport cost and production of the material close to the area. It facilitates the development of networks of small local companies. That would create a small-scale industrial structure of, less centralized and more self-sufficient, in opposition to global growth (sometimes uncontrollable), which now cancels sustainable development.

The environmental commitment by these natural and/or low industrialization will require the

upgrading of traditional crafts associated with building and the development of studies in the use of local natural materials (earth, lime, gypsum, wood and natural fibers), as well as the respect for the environment and energy saving.

The overall restructuring requires all actors-producers agents, distributors, managers, builders, researchers and trainers to interact across, to generate a multidisciplinary network, first locally and later inserted in a feedback process.

#### 3.2 Training strategies

Our University must make proposals focused on boosting projects, generating actions to motivate all the above mentioned actors. As ideas generators researchers, can coordinate training development programs. The link between management of social and productive fabric is based on adequate human resources and information media. Furthermore, it allows a to justify investment in new goals with small companies, stimulating the need to innovate in their products.

The scheduling of tasks oriented towards vocational training is a major activity that can join the three agents. The connection is established by linking the interests of each one of them (Fig. 4):

- The company seeks skilled labor in certain tasks or specialties,
- The University provides monitors or trainers with extensive experience and discretion to manage the tasks of research and experimentation,

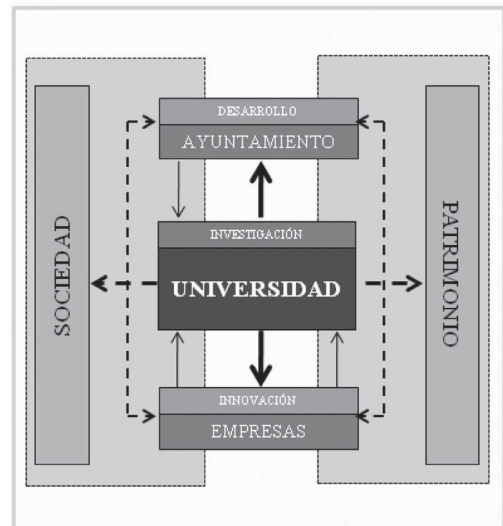


Figure 4. Multidiscipline interconnections and different agents of the proposed structure. (Gonzalez Serrano, 2012).



Figure 5. Course of bio-construction: earth plaster workshop (Canivell, 2006).

- The Council provides spaces for teaching development of teaching tasks and dissemination through social outreach to those most in need.

For the subsequent placing on the market and commercialization of products and improved systems, training cycles will be organized, both for technicians and professionals. To this end, various training (work-shops of employment, schools workshop) will be coordinated, targeted towards European accredited training for professionals and their certificates. This can also promote the implementation of scientific publications showing the results obtained.

### 3.3 Management model

Morón de la Frontera is a sample of self-sourcing management and its influence on local, economic and social development. This community is located in the province of Seville, it is pioneer in local development programs (Environmental 21 City Program of the Government of Andalusia) and has integrated projects promoting its core products.

In 2011, Moron's handmade lime is declared an UNESCO World Intangible Cultural Heritage in the category of Inmaterial-Good Practice entitled "Revitalization of Traditional Knowledge of the Development of Artisanal Lime Morón de la Frontera, Seville, Andalusia".

In this region, where there is an important source of natural products (lime, gypsum, olive wood) is working alongside with researchers at the University of Seville in the study and development of new products.

In recent years, Moron concentrated the location of various buildings that combine raw earth, especially the BTC with adobe and lime plaster. These

examples define a study spectrum on earthen construction to be disseminated because of the quality of the results obtained.

The City Council, -with help of some local companies dedicated specifically at the exploration, production and marketing of natural products— training workshops are managed they are intend to be used for teaching used of these products and their application in various construction techniques.

These advantages of the current model of Moron de la Frontera are driven by needs of resolving social problems such as a high rate of unemployment that's affecting young people and the economic stagnation of various services and firms in the industrial region. The loss-making incentives make the young seek new horizons outside their place of origin.

## 4 CONCLUSIONS

The issue here exposed is a highly topical issue due to the urgent need to rethink development strategies, efficient use and management of environmental re-sources, land use, land occupation and social cohesion. In this context, general and comprehensive, technicians training capacitation has a key role, to plan, to manage and to intervene in the conservation of the local architectural heritage.

Education and motivation must be done in order to achieve readiness to act and participation from all areas of society: education, institutions and socio-economic companies that generate productive movement for a region.

The demonstrable guarantee of natural materials application in construction and knowledge to their application techniques allows the good acceptance from the customer and technicians, reaching to appropriated resoult on architecture.

The proposed strategies help guaranteeing labor training in a profession that allows people to be out of the labor instability and it is oriented to employment need of their local community.

## REFERENCES

- AA.VV. 2003. *Cottages, farms and wineries. Architecture of great farms in Andalusia*. Granada. Consejería de Obras Públicas y Transportes. (ed.) Dirección General de Arquitectura y Vivienda.
- Melero Melero, M.L. 1999. *The inventory of architecture popular in the province of Seville: methodology and results*. Demófilo (ed.). Andalusian Traditional Culture Magazine, 31: 95-110. Seville-Spain.
- Michael Braungart y William McDonough. 2005. *Cradle to cradle*. McGraw-Hill (ed.) Madrid, Spain.

- Picó Valimaña, R. 2005. *The architecture beyond the cities: present and future*. PH: Andalusian Institute of Historical Heritage Magazine, 52: 68–77. Andalusian Institute of Historical Heritage (ed.) Seville-Spain.
- Talego Vázquez, F. 1996. *The inventory of popular architecture of production and processing: the ethnological approach*. Catalogue of Historical Heritage. Notebooks, VI: 94–107. Andalusian Institute of Historical Heritage (ed.) Seville-Spain.
- University of Girona, *Architecture and Engineering Construction*. 2000. Sustainability and construction: applications and working. Girona, Barcelona-Spain.