CONTEMPORARY USE OF RAMMED EARTH IN PORTUGAL. THE CASE OF ALENTEJO COAST

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Abstract *In the last two decades there has been a return to the use of rammed earth construction in the Alentejo coast. This return is somehow driven by the international influence of the "Architectures de terre" 1981-82 exhibition in the Centre George Pompidou that has its national reflex in the 1993 Calouste Gulbenkian Foundation exhibition. Furthermore, concerning to conservation heritage, the 7th International Conference on the Study and Conservation of Earthen Architecture held in Silves in the same year, revealed the technique and started to have its echoes in the local media. In the end, several private and pioneer experiences, driven by the work of some architects, have found in earthen techniques a new (or old) way of build, which was not taught in colleges but instead goes back to our roots.*

Either in the rehabilitation and extension of old building (some rescued from its previous agricultural nature), either in new constructions built from scratch, they just took the option of using the pragmatic principle that the project should be adapted to the place. In fact, this is the technique that better fits the place, by the availability of the material (earth with an adequate percentage of clay) and by the characteristics of the rammed earth wall that naturally faces the wide local temperature range and has less impact in the surroundings.

It is our belief that this 2nd decade of the 21st century will be an important time of changing as the crisis reveals the business strategic potential of the earthen constructions shown by the increase of scale of recent interventions. This study aims to analyse the current situation of rammed earth architecture in the Alentejo coast crossing questions of authorship and architectonic language, involved agents (technician / client / contractor / workers / public institutions), construction methods, economic and environmental issues, and the continuous lack of information about this technique.

1. INTRODUCTION

In 2014, a large rural tourism development is almost completed - located in Aljezur, it's built in rammed earth and corresponds to the construction of a set of cottages, all of them of considerable dimensions.

So, is this intervention an isolated case in rammed earth construction context? Or it constitutes an indicator of an on-going change on the Alentejo coast, which extends to the Algarve coast, and may be a portrait of current situation, integrating in itself a series of contemporary aspects of this practice?

In fact, this tourism development, designed by architect Henrique Schreck covers a considerable plot. It consists of several buildings (service buildings and various sizes cottages), all built in rammed earth, some of them even with two stories. It also represents an execution form that cannot rely on a small contractor or a master builder (with his workers named "taipeiros") but requires a medium sized contractor who has been specializing himself in rammed earth construction techniques.

Works such as this demonstrate that there is an effective growing in this material use and new forms and scales of intervention began to appear. This corresponds to a new attitude that sees on rammed earth construction a highly profitable investment, and a material that can lead to an increased qualitative differentiation value.

2. METHODOLOGICAL ASPECTS

The methodology used in this research work was both literature review and fieldwork.

Initially, some literature review was conducted (both in electronic and traditional resources) on earth architecture with a specific focus on the Alentejo coast, identifying the main actors involved in this process, and the major works. Secondly, the most significant contacts were established - with architects, builders and homeowners - and a set of site visits was organized to a chosen group of buildings, some of them still under construction and others already completed. In most of the cases the architect who designed the building made the visit tour.

This fieldwork resulted in a series of interviews (some informal and others more formal) and in a photographic survey of a substantial number of examples, which served largely as the basis of this reflection.

3. CONTEXT: THE RETURN TO THE RAMMED EARTH CONSTRUCTION

The earth as a building material, and rammed earth as a form of execution, are historically linked to Alentejo coast building culture, either in farm buildings or in small houses that marked the landscape - "montes" as called. The reasons for its use are related to the characteristics of the Alentejo itself - its climate, the availability and composition of soil (earth with a sufficient percentage of clay), low population density and scarcity of resources - that found in earth the most accessible response, but are also related to the rammed earth wall characteristics that naturally face the wide local temperature range and has less impact in the surroundings.

The last decades of the 20th century corresponded, initially, to a lack of interest and

abandonment of technology, partly motivated by the rural exodus and the emergence of new industrial construction materials; and in a second stage, primarily from the 80s, corresponded to a return to rammed earth use, in a more "erudite way". This return was leaded by architects but rooted in traditional knowledge of the old masters "taipeiros", initially in the rehabilitation and extension of old building (some rescued from its previous agricultural nature), and later in new constructions built from scratch.

This process had some key moments that we want to point out. It should be noted that this use reborn was part of a national and international scene sequence of events.

In 1979, CRATerre (*Centre International de la Construction en Terre*) was created at the School of Architecture of University of Grenoble, pioneer institution in the study, training and dissemination of earth construction, at European level. And in 1981-82, Centre George Pompidou organized the exhibition *"Des Architectures de Terre - ou L'avenir d'une tradition millénaire"* and the publication of its exhibition catalogue.

In the words of the architect Alexandre Bastos [1], and our own interpretation of events chronology, it's 1993 the year that defines, in Portugal scene, an important milestone in this reborn: a) The Calouste Gulbenkian Foundation brought to Lisbon the 81-82 Centre Pompidou exhibition; b) it was built from scratch a new building of contemporary lines, entirely in rammed earth, a laboratory for experimentation of the old technique - the atelier of the architect Alexandre Bastos; c) took place in Silves the 7th International Conference on the Study and Conservation of Earthen Architecture.

Later on, in 1996, architect Henrique Shreck, who had already made some research in the technique, also made its first work entirely in rammed earth - a house, followed by two others, along with his own home, that were completed in 1998. In the same year, stands out the first public equipment - S. Luís Market, in Odemira county - built through a year long school-workshop model, for dissemination of knowledge among the population and among construction workers. Architects Teresa Beirão and Alexandre Bastos, who also organized and taught in the workshop, designed it and, for first time, had local public institutions support. Along with the previous work, in partnership, Beirão also marked this rebirth with her own work, beginning with the 1995-96 Nova de Cruz house. With particular interest in rehabilitation processes, should be pointed out 2003 Herdade do Reguenguinho intervention.

Towards the end of the 20th century, several private and pioneer experiences, found in earthen techniques a new (or old) way of build - one that was not taught in colleges but instead goes back to our roots: *"the new generation of architects, engineers and builders who inspired, and influenced each other, towards the re-learning and reutilisation of the traditional rammed earth technique"*. [2] In the decade of 2000, the knowledge that was circulating at scientific meetings and taking shape on the ground, found a milestone with the publication of the book *"Earth architecture in Portugal"* (2005), which brought together works and texts of 54 national authors linked to the theme. Its major importance relies not only in information disseminations provided but also as a connection ground between people involved.

Thus, nowadays we are facing a real resurgence of interest in rammed earth construction, through a shift of attitude that went from an oral and practical knowledge - of local expression and result of the need - to a more erudite and expertise knowledge that crosses borders and

presents itself as a building option - in a tradition revaluation adapted to the current times. In this process, two names have been highlighted in the region, the above-mentioned Alexandre Bastos and Henrique Schreck, who shared with us their knowledge and recent experiences.

4. PRESENT SITUATION OF RAMMED EARTH IN ALENTEJO COAST

4.1 The current paradigm shift

The current situation of rammed earth construction in Alentejo coast is partly characterized by the agents that make it happen: architects, owners and builders, not being this relevance order.

Architects are 'outsiders' (as the locals called them) that settle in that area. At this time they are already divided between 'masters', who were part of that initial return but continue to design, build and share their knowledge; and a new generation of architects who by conviction seek the vernacular and the ecological, or by chance pass those lands and are captivated by what is done better there [3]. Incidentally it was also what happened to the older ones in the 80s: the tiredness of the big city life leads to a change to the Alentejo coast, the (re)discovery of earth construction creates fascination, both at emotional level as technical potential, and shows up the material as the most suitable to the local architectural practice. Currently there is market for these technicians, as Shreck confesses us: *"I watch to the opposite than when I started: more demand than supply, to the extent that architects who have not (yet) mastered the technique are accepting it only by a matter of finding work"*[4].

The learning process was not theoretical but eminently practical, and the client's demands were gradually, and naturally, passing from concrete and brick masonry to rammed earth. Over the past decade, projects and works were focused on a private demand of recovery and expansion of existing ruined dwellings or cottages built from scratch, often second homes. But *"From the housing we pass to more complex programs, a museum of old cars, tourism developments (Tourism in Rural Area or Touristic Resorts), and now a factory"* [5], that witness the shift of scale of recent interventions.

Important role also have the owners, usually external to the site, Portuguese or foreign, coming from large cities and a middle/upper class, educated and informed, sensitive to environmental issues or to tradition, and to the charm of going back to the roots. There is a *"growing demand for healthy and natural housing as an alternative to the fast pace of city life. Also has been increasing in recent years, the number of restorations of rural and urban households, in which we try to respect the original traditional techniques."*[6] Future homeowners seek these architects, increasingly, with rammed earth as an initial premise - by their previous knowledge or affective relationship - as was mentioned by the owner of 'Cerro da Borrega' building. In other cases rammed earth appears following architects suggestion.

Thus, the earth construction may be part of a change towards a more sustainable way of life related to the nature; or it can be a differentiator investment element linked to tourism.

In fact, there is a special attraction in a space built in rammed earth, also integrating other materials and greener options, given *"their aesthetic and technical performance characteristics, associated to careful organization of spaces, combine harmoniously and create an environment inexplicably different from similar buildings, constructed with more conventional technical processes"* [7]. Generically pleasant, this indoor environment is

marked by mild temperatures, regular humidity, insulated from exterior noise, serene and harmonious, symbolically related to the living 'inside the earth', a return to origins and to a lost simplicity. Being subjective questions, we found that the final customer values the experience of living in a rammed earth house. Example of that is the success of the rural tourism 'Cerro da Borrega' with rating of excellence in a specialty site [8].

As for builders, rare are those who came to the rammed earth on their own longstanding conviction. João Pedro Bernardino [9] is an exception. He embrace rammed earth construction at a time when the technique remained associated with poverty, since the old houses had precarious conditions, and initially being 'frowned upon' by that.

Most construction teams were formed by those two architects (Bastos and Shreck), in their several construction sites, in order to create an adequate supply to demand. *"The requests to contractors do not stop to the point of being called to work outside their area of influence, or provide technical support for the implementation of rammed earth."* [10] The practical knowledge, which had its origins in old masters 'taipeiros', was being passed along, at a time when the professional training was scarce, and the biggest learning was done with the experience of countless works over the years. Currently there are over a dozen building contractors operating in the south of the country, able to build in rammed earth, allowing fair competition. This is a niche market that was increasing, and in which the crisis did not have such significant effects as in 'conventional construction', although for some of them the work may scarce. Nowadays, contractors feel the need to diversify the type of works and supply of construction materials and techniques complementary to rammed earth, which may turn each building even more ecological - such is the intention of João Pedro Bernardino.

This is the current portrait of paradigm shift that occurs in the construction of rammed earth: *"from the vernacular to the erudite"* [11]. In a still recent past, earth was a material used by the poorer classes, for the construction of private housing or agricultural support, often under self-construction and using the help of neighbours. This is the same local population which currently rejects the rammed earth or has an opinion of *"inconsistency, expressed in a positive pride for the resumption of their values, and negatively, as it felt like a teaser for 'someone who comes from outside'."* [12] Nowadays, the interest in earth construction arises in the context of an eco-friendly trend, being a life choice of a erudite class or a high standard tourism investment, which requires technical expertise. *"The times when earth was the basic building material for the poor are now over. Today it is used to build houses for the rich. But unfortunately, the State is still unable to come up with the earth to build social housing."*[13] This process is identical to what is found elsewhere in the country, compared to other traditional materials and systems. The first valuation must be exterior. But often this appreciation that comes from outside also drives to an internal valuation.

4.2 Current forms of construction and expression

The choice of rammed earth emerges during the design stage and it implies some specific planning and construction conditions, easily integrated. Its characteristics and benefits are pointed out and the client, not only takes advantage of them, as sometimes has its own requirements that lead to new adaptations. The construction in rammed earth still keeps an execution system very close to the traditional one but begins to change in order to respond to the current time, in a process of technological modernization.

The earth as a building material is extremely eco-friendly and sustainable, because it is directly extracted from construction site, or any close earth bank, reducing resources spent on transport and transformation of materials. Environmental pollution resulting from the production of large quantities of construction waste or demolition waste, also find on rammed earth a good solution because *"we know that the future destruction of the building and the return of the materials to where they came from will make little difference to the balanced continuity of live: speaking prosaically, when the walls come down new vegetal life will flourish."*[14]

The earth comes together with use of other natural materials, if possible local materials, framing itself in a conscientiousness of reducing the constructions' environmental impact: stone (usually schist) for foundations and buttresses, wood for the roof structure, cork as thermal insulation, roof ceramic tiles, floor coverings in natural terracotta, earth and lime based plasters, natural pigments, as can be seen in the visited buildings. Nevertheless, the rammed earth construction is perfectly compatible with the use of contemporary industrial materials and techniques for achieving greater strength, durability and spatial freedom. The use of metallic structural elements and concrete is done consciously and limited to foundations, openings lintels and bond beam walls. If there is a basement, reinforced concrete walls will be used. And, in some cases of upper floors, the use of reinforced concrete slabs and a pillar structure - complementary to the rammed earth load-bearing walls. This structure may arise within building's inside space or embedded in rammed earth walls, by the use (or not) of butterfly pillars - pillar shaped like a bow tie used by Schreck and the builder JP Bernardino, namely in Aljezur and Odemira buildings. The introduction of steel structural elements can be made with steel ties - designed to tie up the building to give a better response to tensile stresses, as used in ‘Caldeirinha house’. It is noteworthy the current use of solid bricks in arches and vaults and hollow brick (11 cm) in interior walls, since there is no competitive production of other earth based materials. In order to fill this gap, new research and investments will be made in a near future by JPB builder in order to produce adobes and CEB's (compressed earth blocks) suitable for interior walls - alternative to hollow bricks - or exterior walls, where the rammed earth is not feasible.

As for the technique itself, there are also some changes. Along with handmade construction process (based on the work of a core team of four workers, three sides individual wood formwork and traditional manual wood rammer), emerges some industrialization of the construction method (that seeks greater profitability, and which leads to the use of machinery, a continuous formwork and mechanical compactors). The choice between these two methods usually falls on the architect, being based on the desired quality for the end result, the degree of compaction and its aesthetic appearance, versus cost and available time. Having already experienced both processes, Shreck currently uses only the traditional method in his works in progress, in order to get the desired compression and final aspect on the entire wall; on the other hand Bastos does not exclude the use of more 'industrial' process, through the use of a continuous formwork and mechanical compactors. In fact, Bastos changed the formwork dimensions so it would fit best with contemporary dimension of doors.

At a time when everyone is talking about energy efficiency, achieved by insulation and expensive HVAC equipment, a rammed earth building faces naturally the climate oscillations and thermal, hygroscopic and acoustic requirements: its 50cm thick walls in compacted soil

absorb the noise and also the air moisture during the coldest season, releasing it in the hot season, maintaining a pleasant indoor temperature and constant moisture content. The solar orientation of the building, the traditional wooden frames, as well as the creation of porches and pergolas with vegetable toppings (eg Carvalhal house) or water elements (Cortinhas atelier) may also contribute to this effect. Nevertheless, combination with other elements and complementary infrastructure are always possible - whenever requested by a more demanding homeowner or investor, who wants to guarantee a priori the comfort standards used in the city, as it happens in the rural tourism 'Cerro da Borrega' or in new tourism accommodation in Aljezur. The use of PVC or aluminium window casements with double-glazing, installing under floor heating or air conditioning, are part of these newer options.

It is always important to speak about the economic issue, as it is a major factor in owner's choice process. In this technology, the raw material, in the case of the Alentejo coast, is an accessible and affordable resource, so naturally cheaper, and construction time can also be reduced. However, the manpower may involve a higher investment. All things considered, the final result is a slightly more economical construction, if correct choices for inside finishes were also made. In the long run, however, there will be a good investment return, given the level of energy saving during its life cycle.

With these constructive modifications also occurs an architectural vocabulary shift, initiated by the architects or by the aesthetic requirements of the urban client, *"the way to affirm earth architecture, thus legitimizing it as a contemporary construction material."*[15]. Architects find in rammed earth a different form to express: *"the full freedom and great flexibility that rammed earth, which can be modified for the coming generations, offers—making the ephemeral with an eternal material and r-using the same material at zero cost, giving it new life."* [16].

Historically we are facing a language of traditional and anonymous elements, driven by building scale and its integration in the surrounding context that can still be seen in rehabilitation works. At the same time, there is a search for a more contemporary expression, which uses the vocabulary of their own time: *"which always aimed at the coexistence of contemporary attitudes in classical compositions (...) proposing the following alterations to the traditional models of rural architecture"* [17]. The architectonic image changes, in a composition of planes and surfaces, sometimes opaque sometimes glazed. The new forms of space and landscape fruition, together with the desired lightning of interior spaces, lead to the creation of courtyards (Cerro da Borrega) and extended glazed plans, sometimes with horizontal proportions (Cortinhas atelier, Caldeirinha house and Aljezur tourism). The interior layout is altered, open spaces with generous areas arise and mezzanines in double height spaces are recurrently used (Cortinhas atelier and some units of the new Aljezur tourism). The rammed earth is now used as a decorative element, either in inside and outside walls. The traditional models are changing up without attempting to interfere with the local simplicity.

"Buildings of more modern character are begin to be constructed, where similarly to what happens abroad, roofs, panelling and the plasters are eliminated from their design and replaced with lower expression elements" [18], as happened in Salvada house (2006, architect Bartolomeu Costa Cabral), in Herdade do Rocim - Beja (2007, architect Carlos Vitorino) and

also a public work, the Évora WWTP (2010, architect João Correia). Those examples are not in Alentejo coast but worth mentioning in this topic.

5. CONCLUSIONS

From the current analysis of these recent works and projects still under development, arises the confirmation that this new social paradigm (grounded in the agents diversity) has its realization in a constructive method that can foster different scales and more contemporary architectural language. It integrates traditional technique but goes beyond, making an update of the earth construction process. This can be seen as a valuation of Alentejo rural architecture with contemporary enrichment.

Although its vernacular roots, this architecture shows that it has a place nowadays, and it's a viable alternative for contemporary construction, being able to meet the new requests. The earthen construction does not pretend to solve the housing problems or replace industrial materials and processes, forgetting it own limitations, but presents itself as a legitimate option in certain contexts. It is our belief that this 2nd decade of the 21st century will be an important time of changing for the earthen constructions, as the crisis reveals its business strategic potential, shown by the increase of scale of recent interventions and the growing of wellness and ecological concerns leading to real changes of modern life. *"In a post-vernacular world, earthen architecture, if it is to experience a lasting resurgence, must be capable of evolving rapidly yet authentically to remain fit, and will be increasingly rooted in political, social, humanitarian, technological, and ecological concerns."[19]* However, there is still much space for growth at these levels. The integration of this traditional architecture - with long lasting and wide presence in the world - in the regular academic education of architects and engineers is still missing [20]. Dissemination and demystification close to local population is also important. A greater awareness of environmental aspects and the potential of local sustainability processes can be better spreaded. And, despite the growing interest of academic research in this matter, it would be positive that new scientific studies arise to better characterize the material, the technique, conservation and rehabilitation issues, in a close relation to historical, cultural and social aspect.

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Figure 1, 2. Cortinhas Atelier (of Alexandre Bastos) São Luís, Odemira, 1993. Arch. Alexandre Bastos

Figure 3, 4. Carvalhal House (second house), São Luís, Odemira, 2001. Arch. Alexandre Bastos

Figure 5, 6, 7. Caldeirinha House (second house), Troviscais - São Luís, Odemira, 2002. Arch. Alexandre Bastos

Figure 8, 9, 10.Cerro da Borrega (rural tourism), São Teotónio, Odemira, 2002. Arch. Henrique Shreck

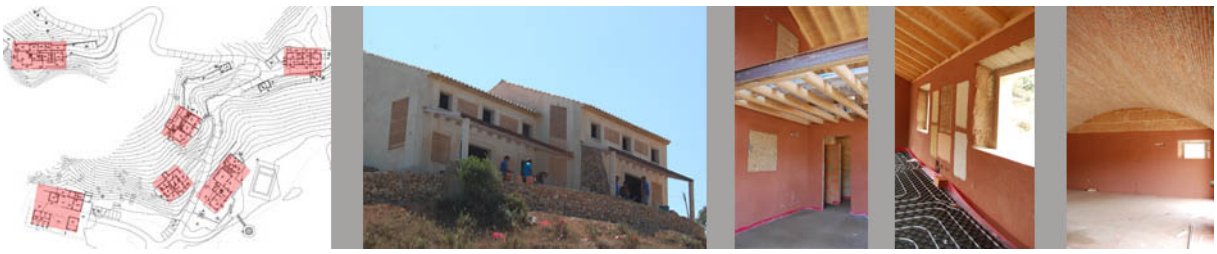

Figure 11, 12, 13, 14, 15. Work in progress Aljezur (touritic resort), Aljezur, 2014. Arch. Henrique Shreck

Figure 16, 17, 18, 19. Work in progress Odemira (rural tourism), Odemira, 2014. Arch. Henrique Shreck