

# Earth Architecture—a Viable Option to a Society in Risk

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**Abstract—Ecological, natural, reusable, endless, non-polluent and, above all, available almost everywhere on our planet, earth presents itself as the efficient answer to social, environment and architectural questions.**

**Emerging once again in construction, both in developed countries, motivated by the need to answer ecological questions, as in countries in need, presenting itself as an engine of development.**

**Index Terms—Environment, man, earth, sustainability.**

## I. INTRODUCTION

Throughout its existence on the planet, Mankind has been adopting models to better accommodate contemporary requirements. However, we think that current models and these requirements are somewhat controversial. The unbridled technological development, as well as excessive consumption of energy primarily by the cities, has led to growing concerns about the future of our habitat.

For several years, there has been a slipping relaxation regarding environmental problems, introduced largely by human activity, leading to successive dysfunctions concerning ecology, such as global warming and ozone layer damage, which consequently must have been altering the natural rhythm of evolution, compromising cohabitation between man and nature that surrounds it.

It is important to realize that at the heart of environmental issues, not only is the relationship Man / Nature, but Man / Nature / Society, and its possible resolution involves the change in social organization, ensuring stability and harmony to the people, looking to reach moral, ethical and fair values.

The constant appeals to the paradigms of sustainability and ecology that we are faced with on a daily basis, have contributed to a growing awareness that we need to change our contemporary construction habits.

It is the architecture and engineering duties to find effective mechanisms to meet these demands. On one hand, to accompany the phenomenon of development, ensuring the public comfort, balance and well-being, and on the other, ensuring the physical conditions required for the proper functioning of the planet in jeopardy.

It is keeping these issues in mind that we approach this article, the issue of building using earth that nowadays is being used again throughout many countries, integrating construction projects once again.

The sustainability gained by adopting technologies leads to globalization, and therefore often destroying local identities. However, sustainable architecture is not only one that uses technological means, and we believe that more decisive than that are the interests of the location, its recognition, its potential. A good architecture is connected to the site, society, culture, climate, region, the planet, the earth.

Along with many materials, land claims as a possibility renovating an architectural increasingly demanding, with proven competitive advantages.

## II. WHY USING EARTH IN CONSTRUCTION?

Earth architecture has existed since the dawn of times, manifesting itself in very different ways depending on the technique adopting. The search for comfort could already be found in the first housing constructions, which, in most cases, worked essentially as shelter. [1] These buildings, and demand for convenience, used local materials and predominantly ecological ones, fruit of the surrounding nature, such as the soil we walk on.

Earth is the most abundant material around the planet and can be used in construction in most countries. However, it is in the countries with temperate and warm climate that it plays its role as the best building material. It is natural and does not require industrial transformation processes to be used, hence no serious energy expenditure; it is recyclable and reusable, environmentally friendly and non-polluting. It is a material economically viable, having a relatively low cost compared to materials such as concrete and steel as it is available on site and the work usually requires no shipping charges, however the lack of skilled labour has raised some questions among researchers [2].

Its construction techniques are easy to perform and still have the particularity to engage the community and encourage collective work during the work, [3] stimulating the local economy and contributing to greater regional sustainability, removing the excessive protagonism from the cities.

It is important to note that, unlike industrial materials, where the mechanics prevails, in earth construction predominates human labour, and men hold a prominent role in the construction process. Despite the developments in the different techniques, such as in mud, the process may be slightly different from the traditional tools for mechanized features that assist construction.

Another feature that distinguishes the earth's many other materials is that the raw earth constructions have good thermal inertia, retaining the heat in winter and keeping temperatures below the spaces inside during summer weather, over time contributing to cost reduction heating

Manuscript received May 22, 2013; revised July 10, 2013.

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and cooling, significantly reducing maintenance costs over the lifetime of the building [4].

In Portugal, the Alentejo region, where the climate is varied during the day and night and between the different seasons, the buildings were mostly built using this material (notably in rammed earth), and within these dwellings we are able to identify this peculiarity [5].

A contemporary example, in the context of Alentejo, is the Cellar of Rocim in the village of Cuba, designed by architect Carlos Vitorino (Fig. 1, 2).

The building creates through the rammed earth a harmonious involvement with the landscape that surrounds it. Getting withdraw his character that characterizes the industrial program (bodega) giving a true and territorial over the place.

It is urgent to make good earthen architecture, and contemporary, which binds only to the present, it is essential to promote buildings capable, which meet the requirements of current and comfort that promote the quality of spaces.



Fig. 1, 2. Rocim cellar, Alentejo, Portugal.

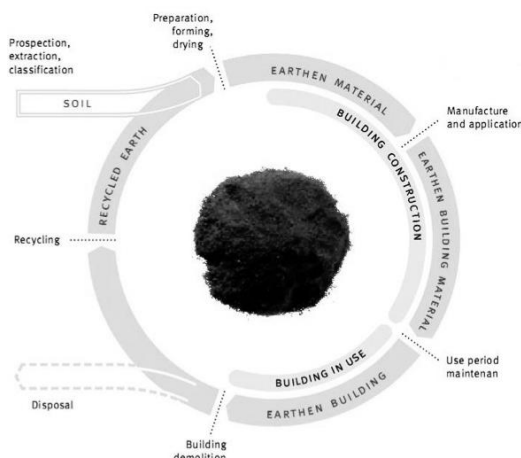


Fig. 3. Explanatory diagram cycle earth.

Another very interesting point is that any piece of land establishes a natural ecological relationship with the environment surrounding it. After a building collapses, the land goes back to the earth and the cycles are renewed, contributing to environmental sustainability desired (Fig. 3).

The land reverts to a new function in addition to

construction; a new tree can be built on the same land that once held up the walls.

This feature is not the case with other materials, both natural and industrial, which sets earth apart from all the others.

All construction methods and materials that favours cleaner and more environmentally responsible must be a reference in the current building landscape.

However, as any material, the earth has its own limitations, thus it is necessary to know them in order to know the best way to work with the material and to be able to ennoble their characteristics and potentials and combat its weaknesses.

One of the harmful characteristics of the material that has undermined the veracity of the architectures of land is the lack of recognition and legal legitimacy in some countries, lacking of legal status that poses some obstacles to construction, contributing to the disbelief of this material.

In a society where bureaucracy and legislation dictate rules, often excessive, the legal validity becomes vital to the evolution of this material, making it actively compete with other materials on the market.

Another weakness of the use of earth on architecture is its weakness facing the action of water. The buildings are subject to the presence of water rises by capillary action, exposure to rain and the water contained by the material itself.

In this sense, when building using land normally performs its walls, a grounding of stone or, where more contemporary materials are available, concrete, to avoid this direct contact with water. So, special attention should be paid to the points of contact (soil-wall and wall-ceiling), reinforcing its structures.

The execution of a separate foundation and extending the coverage are effective solutions to prevent the rapid deterioration caused by water. Suitable natural ventilation is a good option to prevent weariness of the material, allowing the building to breathe, and that moisture does not accumulate in its interiors.

In its turn, the resistance of structures to earthquakes on land is relatively low. There are areas of the globe where seismic activity is violent and systematic, capable to shake entire cities, killing thousands of people. In fact, it is necessary to find effective mechanisms to combat this weakness and instability.

The resurgence of earthen architecture should thus be a thoughtful and conscious action, aware of the strengths and weaknesses of the material, in order to harmoniously meet the program / project / problem posed.

We think that the place of the earthly material should allow greater flexibility and adaptability, which in the past was not required, as we can choose solutions that cumulatively involve land with other materials, especially industrial ones.

As we gain conscience that society has changed, that the habits themselves have changed, that industrial materials hold a key role in the culture of living and habitat today, resultant of a natural evolution, it is essential to realize the meaning of land use in contemporary construction.

The major obstacle to the construction of land, plus some conditions that the material presents, is to compete with

industrial materials and gain credibility among the current construction, one that is developed around a market economy.

### III. THE EARTH IN TWO DIFFERENT REALITIES: DEVELOPED COUNTRIES AND IN NEEDY

The asymmetrical seen social and economic context that we have seen distinguishes society in two different realities, two different worlds with different needs.

On one hand, we see a society enticed by consumption, which emphasizes qualities such as wealth and progress - the industrialized world - and as a parallel, we can verify precarious situations with serious housing problems, allowances, public health, among many others - the so-called Third World countries.

The resurgence of earthen architecture in developed countries where the supply of new materials often relates more closely to the industrial cities rather than to the earth itself has been occurring mainly due to the alarming global situation that has been rising since the 70s, particularly with the oil crisis. The growing concern that exists relating to ecological issues, to the future of the planet and to the better management of resources and energy, makes society rethink their concepts and lifestyles adopted. We believe that the reappearance of natural materials viewed as "healthier", in particular the earth, arise as a consequence of these concerns.

It is essential to be aware that society suffers constant change, in the sense that architecture should not be reductive and must accompany the social metamorphoses and current requirements of communities. We infer that the action space of earthen architecture in the present scenario and future demand should be a deep symbiosis between the earth and other materials available, including industrial ones, especially in developed countries where it is not possible to assume an architecture that completely lives at the margin of constant appeals to technology and consumption. If this is not done the land will surely end up on the sidelines and not on the centre stage of contemporary architecture.

Politicians, researchers, biologists, architects of the industrial world have finally stopped to analyze and reflect on this situation, and a change can be felt in the current paradigm of humanity. However, we hope that this is not just the result of a fad and fleeting sporting to impress and achieve as seen nowadays.

Lately we have resorted to the use of ecological terminology so as to achieve a population more sensitive to these issues. However, not always the use this approach hold the best intentions at heart, thus discrediting the basis of ecology.

It is necessary to make environmentally responsible architecture, motivated not only by the constant calls of society, but with the true understanding of the issue. It is essential to do deep reflection, attentive to all this.

However this is not the reality of the needy countries, building on land here appears as motor development necessary and not as an answer to ambiental issues. In many of these countries, the industrialized arrival of different materials, from Europe, for example, becomes a more complicated and expensive, and in places where the economy is often low or almost nonexistent, it is necessary

to use the resources at our disposal to provide the population with better quality of life and economic prospect.

In these countries, you feel some resistance once again to validate the techniques and traditional vernacular, specifically building on raw land, therefore, will copy the prototypes in major European cities and urbanization is dominant as well, often the land use in construction is associated with poor countries with severe economic problems, those countries who want to free themselves from the stigma of poverty attached to them.

### IV. CASE STUDIES

In this article we highlight some architectural projects in the context of poor countries, which, using the land, have provided better conditions to the communities involved:

The project Adobe for Women (Fig. 4), created by Portuguese atelier Blaanc Borderless Architecture in partnership with architect João Caeiro, currently residing in Mexico, holds some very interesting peculiarities.



Fig. 4. Adobe for women, Mexico.

The current intervention proposes a recovery and reinterpretation of the project conducted in 1990 by the architect Juan José Santibañez, who designed 20 houses for 20 women in delicate housing and social conditions.

The project is part of the municipality of San Juan Mixtepec in the state of Oaxaca, one of Mexico's poorest regions, where housing conditions are really critical, not having the minimum required to live with dignity.

The architectural project develops very simply: by allowing women to work directly with the land, particularly in the production of adobes that will build the walls of their homes, assisting with hand labour required for the work progress.

This way, the installation of solar panels on the roof of the houses has started to become a project as well, which will provide enough power for the average daily expenditure that is expected, mainly for a TV, a radio and four lamps.

Also there is a composting system, where the organic matter, leaves and food scraps are converted into material - compost - similar to the soil and act as fertilizer, allowing better fertilization of land for agriculture, serving as a means livelihood of these families, as women mostly do not work outside the home.

The use and treatment of water, was also a question thought of during this project. There is a deposit that will receive storm water from the roof, allowing you to use it, especially for watering the garden. There is also a system of

gray water treatment that will be reused and thus used for new functions.

The "Dry Bath" is a system similar to composting; it transforms the material (use of feces and urine from the toilet) which will act as a fertilizer for the soil, turning it into a product called dry.

Also the installation of a Lorraine Greenhouse was conducted, which is identical to a traditional wood stove and uses on average 60% less fuel, thereby reducing energy costs needed for cooking.

It is important to realize that the whole project was designed in order to make these sustainable units, thereby minimizing maintenance costs of housing, and saving all materials for possible future use.

The second project is the extension of a primary school in the village Gando, Burkina Faso (1999 - 2001), taken on by atelier KereArchitecture. (Fig. 5)



Fig. 5. Primary school, Burkina Faso.

It uses compressed earth blocks (CEB) as a basic structure, however keeping it harmoniously with other local materials.

The international recognition that the project received was so high, that there were already built attachments, residences for teachers who teach there as well as a library (Fig. 6).



Fig. 6. Library, Burkina Faso.

All projects also use the land as base material, giving a unitary form the suite that was developed in distinct phases.

The third project selected that also uses the land, also in the educational field, was a school in Rudrapur, Bangladesh, by the architects Anna Heringer and Eike Roswag. (Fig. 7, 8)

The initial idea for the project came after Anne Heringer, still a student, and her classmates prepared an analysis on this territory, detecting that the lack of educational infrastructure was stark.



Fig. 7. Handmade school, Bangladesh.



Fig. 8. Handmade school, Bangladesh.

Thus, in response to the study, Anna Heringer designed the Handmade School for his master's thesis (2002).

In 2004, contacts with NGOs (Non Governmental Organizations), who were working at the site and later, in 2005 takes place beginning of the project with the support and guidance of the architect Eike Roswag.

For the execution of its walls and floor, the project uses the earth mixed with straw, so as to make the material stronger and more durable, and in a balanced way, using bamboo for the roof truss.

The population was taught and encouraged to work on the project, making this not only a project of the architects involved, but also the local community.

## V. CONCLUSION

If on one side we find societies that hold little to no worries about the future of those to come, luckily we can also find a minority of mindful ones, attentive of the commitments we have with those to come.

There are no doubts that it is urgent to act, to protect the Planet and save Mankind of silent threats that plague the Earth. Ideally, efforts should be collective in order to achieve solutions on a global scale. However, it becomes a bit of an utopia, in the sense that there are more specific solutions that can truly contribute to alter the current landscape, both environmental and architectural.

Being earth an abundant resource, as well as natural, ecological, reusable, affordable and easy to apply, it promotes regional development as expected. The land is able to foster local progress, to involve communities, to create a spirit of mutual aid critical to exploration of society and its social support.

If on one hand the developed countries have, through the earthen architecture, an opportunity to catch and minimize the current landscape ecological imbalance, developing countries have in earthen architecture a solution to their

problems of deficit and precarious construction.

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