

## SOSTierra: Restoration and rehabilitation of traditional earthen architecture in the Iberian Peninsula – objectives and methodology

The Iberian Peninsula is a territory with a wealth of earthen architecture heritage, both monuments and regular constructions. The wide variety of earthen construction techniques used throughout history (rammed earth, adobe, formwork, cob and its variants) is mostly in response to the vast territory, heterogeneous geography and climate, wide variety of available materials and cultural diversity.

However, earthen architecture and constructive techniques have gradually disappeared, abandoned or replaced by new standardised techniques. This is particularly true from the second half of the 20th century, due to a process stemming from ignorance and the loss of prestige of this architecture, considered to be poor quality and associated with underdevelopment. In this context, the restoration of existing earthen constructions has been carried out using external techniques and materials, which have negative effects in terms of culture and construction, and generate instances of material, constructive and structural incompatibility (Figure 1). In the final decades of the 20th century, research rescued the intrinsic heritage, culture and bioconstruction values of

this type of architecture, helping to overcome lack of knowledge and loss of prestige.

The project *SOSTierra. La restauración y rehabilitación de arquitectura tradicional de tierra en la Península Ibérica. Líneas guía y herramientas para una intervención sostenible* funded by the Spanish Ministry of Economy and Competitiveness (BIA2014-55924-R, main researchers: Camilla Mileto and Fernando Vegas)<sup>1</sup>, began in January 2015 programmed for three years, and aiming to investigate the possibilities of compatible, respectful and sustainable restoration and retrofitting of non-monumental traditional earthen architecture found on the mainland, avoiding external and standardised solutions and giving preference to options which respect technical and cultural diversity while providing lessons in sustainability for the future (Figure 2).

### Principal objectives

The three main objectives of this research project are:

1. To contribute to the recognition of traditional earthen architecture in the Iberian Peninsula as an architecture valid in the contemporary world and

Fig. 1 Images of recurring interventions using industrial brick in the restoration of adobe walls. Left: Congosto de Valdavia (Palencia); Right: Arroyo de Cuéllar (Segovia)





Fig. 2 Images showing the variety of techniques in vernacular earthen architecture. Home in Arcediano (Salamanca) with rammed earth walls built on ashlar foundation, crowned with adobe and repaired with hollow brick.

rich in cultural, technical, bioclimatic and environmental values. In order to ensure this it is essential to transcend the local nature of knowledge of this architecture, through further research and national and international promotion.

2. To encourage conservation and restoration that is sustainable and compatible with traditional earthen architecture in the Iberian Peninsula. This general aim is the main objective of the project. Currently, all the agents (administrations, specialists, owners, companies, etc.) know little of the criteria and techniques to be used in the restoration and retrofitting interventions in order to ensure their compatibility with traditional buildings and reaching current required standards.
3. To contribute to the valorisation of traditional materials and techniques and their use in the restoration of traditional heritage. Traditional earthen architecture employs local materials using the techniques most suited to environmental conditions and local labour, often manual.

### Methodology of the project

This project aims to study the present situation and the restoration and retrofitting interventions of traditional earthen architecture built to date with the aim of proposing real solutions and tools for use in the efficient recovery of this architecture in modern times while taking into account habitability and structural and energy efficiency needs, and maintaining compatibility with its heritage, constructive, environmental, socio-cultural values. A multidisciplinary methodology was used to analyse and assess the interventions carried out, beginning with a comprehensive data collection process regarding the interventions executed to date. These interventions were then ana-

lysed, using this data to further examine the interventions carried out to propose solutions and guidelines for action on this heritage.

The first phase of the work methodology thus consists of the gathering of information and the creation of a database for non-monumental earthen architecture in the Iberian Peninsula. This phase consists in compiling all the information relating to the constructive materials and techniques used in earthen architecture on the Peninsula, as well as to the architectural and constructive morphologies, their incorporation into the landscape and their mechanisms for adapting to local bioclimatic characteristics and restoration. In order to complete this database, work is being carried out on producing a series of fiches for cataloguing earthen architecture to reflect the information for different regions of Spain and Portugal.

The fiches for data collection have been structured into five distinct blocks. The first block reflects general information on the building (and records data such as building location, use, ownership and whether interventions have been carried out); the second block examines the setting of the building (with a view to adaptation); the third block analyses the constructive techniques and variants used in the construction of the building (construction in rammed earth or adobe, formwork, earthen roof, rendering, etc.); the fourth block is dedicated to the assessment of present pathologies in the building (whether or not caused by the interventions executed) and the reasons for the intervention (functional, structural, energy efficiency, water tightness...); the fifth block constitutes the main body of the fiche and analyses the type of intervention (replacement, repair, integration, lining...)

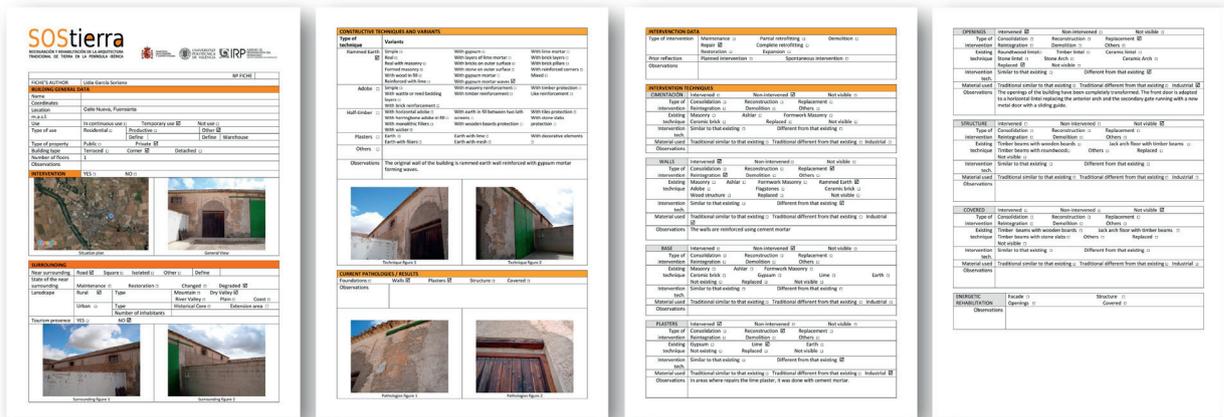


Fig. 3 General images of the catalogue fiche for case studies

and the constructive technique used in the building depending on the area intervened (foundations, walls, floors, roofs, rendering, stairs, vault ...); and finally, the sixth block records the photographic documentation of the building (if possible before and after the intervention). (Figure 3).

Given that the fifth block, the analysis of interventions executed, is the main part of the fiche it should be examined in further depth and defined more extensively.

Part of this block is dedicated to the general analysis of the intervention, defining aspects such as the type of intervention on a general scale in the building (maintenance, partial retrofitting, demolition, repair, complete retrofitting, restoration, expansion), and rather unusually, the degree of reflection on the intervention beforehand (that is, whether it was planned or spontaneous). In many cases, it is observed that the interventions in vernacular earthen heritage are small repairs executed sporadically, without overall reflection or design, and this spontaneity should be very much taken into account when executing an overall analysis of these interventions (Figure 4).

Fig. 4 Image of the section with information on the intervention in the catalogue fiche

INTERVENTION DATA			
Tipo de intervención	Maintenance <input type="checkbox"/>	Partial retrofitting <input type="checkbox"/>	Demolition <input type="checkbox"/>
	Repair <input checked="" type="checkbox"/>	Complete retrofitting <input type="checkbox"/>	
	Restoration <input type="checkbox"/>	Expansion <input type="checkbox"/>	
Prior reflection	Planned intervention <input type="checkbox"/>		Spontaneous intervention <input type="checkbox"/>
Observations			

The intervention techniques proposed are analysed according to the area of the wall being worked on (foundations, the wall itself, base, renderings, openings, floor, roof, and also taking into account any energy retrofitting interventions which may have been carried out on the building).

The following aspects are analysed in each of these areas (Figure 5):

**Type of intervention:** analysis of the extent of the intervention carried out, providing possible solutions ranging from the most conservative interventions, such as consolidation or reintegration, to the most conservative, including reconstruction, replacement or demolition.

**Existing technique:** this subpoint defines the type of original pre-existing technique being worked on. This section is thus adapted depending on the area on which the intervention is carried out, in the foundations (masonry, ashlar, formwork, brick), in the walls (masonry, ashlar, formwork, rammed earth, adobe, flagstones, ceramic brick, wooden structures), in the base (masonry, ashlar, formwork, brick, gypsum, lime,

WALLS	Intervened <input checked="" type="checkbox"/>	Non-intervened <input type="checkbox"/>	Not visible <input type="checkbox"/>
Tipo de intervención	Consolidation <input type="checkbox"/> Reintegration <input checked="" type="checkbox"/>	Reconstruction <input type="checkbox"/> Demolition <input type="checkbox"/>	Replacement <input checked="" type="checkbox"/> Others <input type="checkbox"/>
Existing technique	Masonry <input type="checkbox"/> Adobe <input type="checkbox"/> Wood structure <input type="checkbox"/>	Ashlar <input type="checkbox"/> Formwork Masonry <input type="checkbox"/> Flagstones <input type="checkbox"/> Replaced <input type="checkbox"/>	Rammed Earth <input checked="" type="checkbox"/> Ceramic brick <input type="checkbox"/> Not visible <input type="checkbox"/>
Intervention tech.	Similar to that existing <input type="checkbox"/>		Different from that existing <input checked="" type="checkbox"/>
Material used	Traditional similar to that existing <input type="checkbox"/> Industrial <input checked="" type="checkbox"/>		Traditional different from that existing <input type="checkbox"/>
Observations	The walls are reinforced using cement mortar		

Fig. 5 Image of the part of the fiche analysing the different interventions executed in each specific area of the walls

earth, inexistent), in renderings (gypsum, lime, earth, inexistent), in openings (rolled wood lintels, squared wood lintels, ceramic brick lintels, stone lintels, stone arch, ceramic brick arch), in floors (wood joists and boards, wood joists with small vaults, rolled wood joists, others) and roofs (wood beams and boards, wood beams with reeds, wood beams with stone slabs, others). In all cases boxes have been provided for replacement or non-visibility, as in some instances the original constructive element is no longer conserved but has been replaced in a previous intervention or may not even be visible, making it impossible to define its constructive features.

**Intervention technique:** is recorded if the technique used in the intervention is similar or different to that in existence. This point also takes into consideration aspects such as the structural compatibility of the different techniques proposed.

**Material used:** as regards the materials used in the intervention in each of the areas of the wall a distinction is made depending on whether it is a traditional material (similar or different to the existing one) or an industrial material. If the material is traditional and similar to that existing it is possible to speak of material compatibility, while in the case of industrial materials, the material compatibility of these materials should be analysed for each individual case.

**Observations:** the section on observations covers all the details and specific points that cannot be included in the general sections of the fiche. Here the author of each fiche can record the unique aspects of each case.

**Conclusions**

This methodology for data collection using fiches that are part of a database for interventions in the vernacular earthen heritage in the Iberian Peninsula aims to create a general interpretation of the current situation of this heritage in order to analyse the restoration dynamics in use, confirming their suitability and the aspects that could be changed to ensure greater conservation and recognition of the vernacular earthen heritage.

**Footnotes**

- 1 The research team for project SOSTierra comprised: Camilla Mileto (MR1), Fernando Vegas López-Manzanares (MR2), Fernando Vela Cossío, Luis Maldonado Ramos, J. Luis González Moreno-Navarro, Apolonia Begoña Serrano Lanzarote, Arturo Martínez Boquera, Adolfo Alonso Durá, Miguel Ángel Sorroche Cuerva, Francisco Javier Blasco López, Vincenzina La Spina, Valentina Cristini. The work team is made up of: Hubert Guillaud, Mariana Correia, Saverio Mecca, Maddalena Achenza, Gabriel Barbeta, José Ramón Ruiz Checa, José Manuel López Osorio, Lidia García Soriano, Laura Villacampa Crespo, F. Javier Gómez Patrocinio, Laura Balaguer Garzón.