

World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium 2016,  
WMCAUS 2016

## Status of Historical Buildings Conservation: ICT Method Results in Caneiras Village

Ana Virtudes<sup>a\*</sup>, Filipa Almeida<sup>b</sup>

*<sup>a</sup>Department of Civil Engineering and Architecture, University of Beira Interior, Calçada Fonte do Lameiro, Ed.II das  
Engenharias, 6201-001 Covilhã, Portugal*

---

### Abstract

Good examples of preservation of vernacular architecture buildings are still an exception, whether as iconic and picturesque evocation, translated in a historic revival for tourist attraction, or in museums, neighbourhoods or fishing villages. But, in the majority of the cases, the vernacular architecture of river banks has been subjected to a rapid and significant disappearance, with the irreversible loss of a unique cultural, architectural and environmental legacy, weakening the sense of place, the identity of local communities with their territories and the cultural heritage of the countries.

This problem is not an exception in Portugal, where the forgotten heritage comprises historical structures corresponding to wooden stilt-houses, represented in small villages along Tagus river banks. This legacy has its roots in a migratory movement of a fishing community called the Avieiros, started in the 1860s, coming from the central west coast of the Atlantic to along Tagus river. However, the decline of fishing activities, the search for new sources of income, initially in the crops along the fertile region, and later in cities, the vulnerability of wooden buildings, and the absence of spatial planning policies or building preservation guidelines, has led to a decay in their transformation processes with the disappearance or abandonment of almost all these villages and their buildings. Nowadays, there are only five remaining Avieiras villages, which totals less than 90 buildings and about 300 inhabitants so far, Caneiras is the biggest. They are the only existing examples of river bank vernacular architecture in Portugal as urban settlements. Therefore, this article presents the results of an ICT (information and communication technologies) method application to the evaluation of status of wooden still-houses conservation in Caneiras, in order to highlight preservation and enhancement strategies.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of WMCAUS 2016

---

\* Corresponding author. Tel.: +351 962360882  
E-mail address: [virtudes@ubi.pt](mailto:virtudes@ubi.pt)

**Keywords:** ICT method, vernacular architecture, status of buildings conservation, fishing communities, Caneiras village;

---

## 1. Introduction

All over the world there are examples where historical buildings such as the wooden stilt-houses, as a typology of vernacular architecture, have been threatened by the vulnerability to degradation processes. Among the facts that contribute to this vulnerability are the inadequate spatial planning strategies, unable to protect and enhance these architectural features, the urban morphology or the spatial conditions of these waterfront settlements [1]. However, there are good examples of preservation, such as the cases of Norway, preserving the *rorbu*, a temporary shelter for fishermen with its roots in the 12<sup>th</sup> century; France, preserving the *tchanqu  e* in Arcachon river banks or the *carrelets* in the Gironde estuary; Scotland, preserving the *crannog*, a circular enclosure surrounded by piles, including The Scottish Crannog Centre Despite.

In Portugal, this issue reports to the wooden stilt-house villages of the Tagus river, a legacy with its roots in a migratory movement of a fishing community [2,3] called Avieiros, coming from the Atlantic central coast using the architectural features of this region wooden stilt-houses [4,5], settled since the mid-nineteenth century. Reports from the 1950s identified 80 of these villages but, many didn't survive. Nowadays, four villages stay inhabited, Caneiras is the biggest, and one is empty, with their wooden stilt-houses in a continuous process of degradation, needing to be valued as part of the territory character, creator of a sense of place and identity.

This research presents an analyses of the results from the application of an evaluation method using an ICT platform designed for these historical buildings, considering their status of conservation. This application involves the historical buildings of Caneiras, located 80 kilometers upstream from Lisbon (see Fig. 1.a). It comprises the two typologies of vernacular architecture houses: the stilt-house (used for housing) which is the dominant and the most traditional typology and the single-story house (mainly used for kitchen).

## 2. Evaluation of status of historical buildings conservation

### 2.1. Existing methods in several European countries

As the literature has revealed [6,7,8,9,10,11,12], the known evaluation methods of status of buildings conservation, used in several European countries such as the UK (Home Condition Report, 2004), the Netherlands (NEN 2767), France (Grille d'  valuation de la d  gradation de l'habitat, 2011), Spain (Inspecci  n T  cnica de Edificios, 2011) or Portugal (MAEC, 2006; MANR, 2007), are not applicable to the features and type of information to be collected in the historical vernacular architecture of wooden stilt-houses [13,14].

Nevertheless, their analysis has facilitated an understanding of the contents regarding these kinds of evaluation methods, implementation tools, evaluation criteria, and achieving results. This knowledge was crucial in the developed ICT method as a diagnostic methodology of evaluation, focused on the features of wooden stilt-houses.

The proposed ICT platform is part of a method including as applications tools a diagnosis record and a software. The diagnosis record for each building aims to be applied by visual inspection of its exterior, as data collection method. It includes the application instructions, containing the fill mode of each section, the identification of information to be collected and the scoring grid for the status of building conservation. Its organization comprises a record header including the number of the house; identification of the house (with the address and the correspondence in between the owner and the number of the building); photographs and drawings; general features (including the use, the number of floors, the type of occupation, the volumes, the orientation of the main facade relating to the waterfront, the existence of outbuildings and the number of attached historical houses); constructive features (the building elements and theirs materials, considering traditional architectural characteristics); status of building conservation evaluation.

The software allows the compilation and processing of data, with the advantages of having a comparative analysis of the results, not only between buildings, but also in between villages. The software output is a set of tables and graphics, showing the statistics, regarding the buildings and villages performance.

This ICT platform is a database, showing as results the outlook of each house considering its status of conservation and its needs for immediate intervention, which is the result of a screening of very serious anomalies, that might put in dangerous the safety of inhabitants or that don't ensure the minimum security conditions of use.

## 2.2. ICT method for evaluation of historical buildings conservation

The decision of basing the developed evaluation method on the visual inspection, is due to its easy, rapid and low cost process, very well-adapted to the number of buildings under analysis. It has the advantage of allowing the assignment of a qualitative level of degradation to the building, considering its constructive elements.

The analysis of each building is based on constructive elements allowing not only a greater efficiency in its range as a whole and a further guidance on how to proceed in the evaluation process, but also in obtaining at the same time partial (about a particular element or group of constructive elements) and global results (considering the building as a whole).

The considered constructive elements, concerning the wooden stilt-houses, comprised the following five groups: the structural condition (EA), the non-structural walls (EB), the coatings / finishes (EC), the spans such as doors and windows (ED), and other existent elements (EE) such as chimneys, gutters or stairs protection. The defined criterion for evaluating each constructive element was the severity of the anomalies, based on previously defined parameters, using the score grid and registered in the diagnosis record. The score of each constructive element and group of elements is subject to defined weightings, according to their importance in building performance, and comparing with other constructive element or group of elements.

The levels of anomalies and the weightings followed five measurement points, according to a descending scale, from the highest number of points for the very slight level of anomalies, until the lowest number for the very serious level: very slight (5), slight (4), on average (3), serious (2), and very serious (1).

The final result is expressed in percentages and converted into a scale of qualitative levels (intervals), with less points for a worst condition and more points for a better condition: [0-30] for very bad; [30-50] for bad; [50-70] for average; [70-90] for good; and [90-100] for very good condition.

## 3. ICT method application and results

### 3.1. The case study of Caneiras: a fishing community in a sensitive rural area

The village of Caneiras is a small fishing community, with 125 inhabitants (Census 2011) and its roots in the 1860s. This is a sensitive rural area, usually flooded by the Tagus river during the winter time. Nowadays, its urban morphology (see Fig. 1.b and Fig 1.c) is strongly marked by the historical nucleus layout, to which all the streets converge [15,16]. This nucleus consists of two parallel rows of 32 historical buildings (Avieiras houses), aligned with the waterfront, 20 of them are stilt-houses and 12 are single story-houses (see Fig 1.d).

The most recent houses lie further inland, located on streets perpendicular to the river and having nothing to do with traditional features of vernacular architecture. Since the mid-twentieth century that this fact produces a duality in between both architectural styles (vernacular and contemporary), resulting from a different lifestyle of local community, divided between fishing and agriculture [17,18,19,20,21], between the river and the fertile surrounding fields. However, Caneiras is a landmark for leisure, with history and tradition.

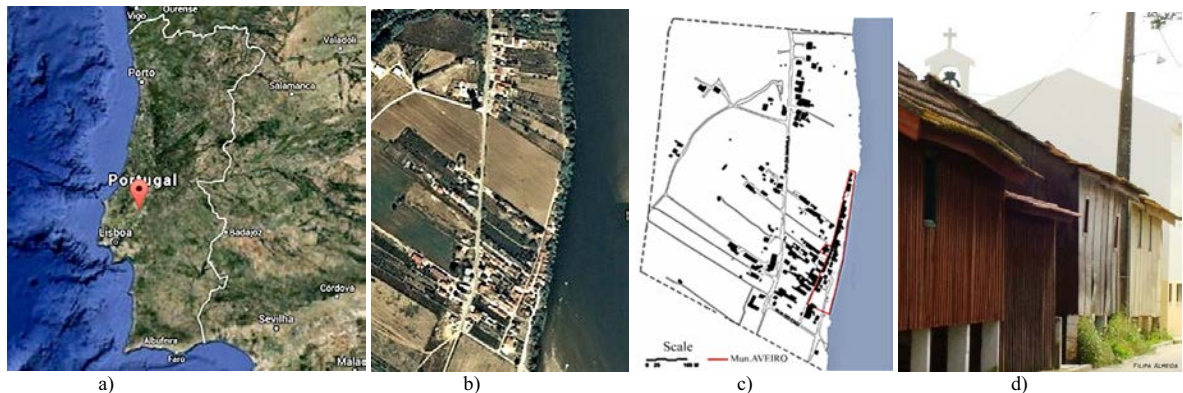


Fig. 1. Caneiras (a) localization; (b) the village; (c) the urban morphology; (d) historical buildings.

### 3.2 Analysis of results from the ICT method application in Caneiras historical buildings

Caneiras totals 36% of all Avieiras houses in Portugal. 20 of these buildings have the architectural typology of stilt-houses, and 12 of them have the architectural typology of single-story houses, which totals 33% and 43% respectively, of each one of these typologies in the country.

Regarding the status of buildings conservation (see Fig. 2), the results from the ICT platform application show that the main number of vernacular houses is in the ‘average condition’ level (40,6%), which corresponds to eight stilt-houses and to five single-story houses. It is also a conclusion that 37,5% of the buildings are in ‘good condition’; eight stilt-houses and four single-story houses.

This method shows that six historical buildings (18,8%) are in ‘bad condition’, four of them are stilt-houses and two of them are single-story houses. There is only one single-story house in ‘very bad condition’, in terms of structure (EA), and coatings and finishes (EC). The single-story houses are more degraded (‘very bad’ or ‘bad’) than the stilt-houses, 25% and 20% respectively, and nine buildings (28%) are requiring deep rehabilitation due to their serious degradation (‘very bad’ or ‘bad’) or because they have active warning indicators, having needs for immediate intervention (see Fig. 3.a). The building in the worse condition is a single-story house (see Fig. 3.b) and the building in the best condition is a stilt-house (see Fig. 3.c).

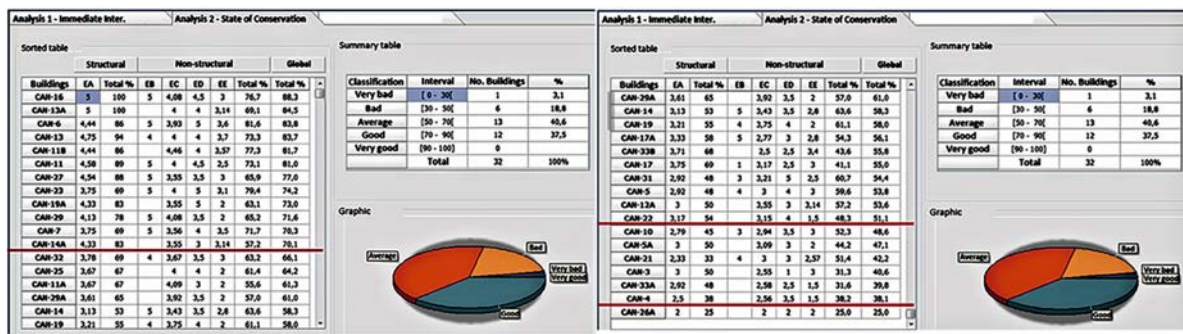


Fig. 2. Caneiras - Status of buildings conservation, evaluation results of ICT method application.



Fig. 3. Caneiras (a) Status of buildings conservation map; (b) building in worse condition; (c) building in the best condition.

## 4. Conclusions

On a European scale it is clear that the development of territories and the historical buildings conservation, whether they are cities or rural areas is closely linked to the collection and analysis of data, facilitated by using ICT. These computing technologies importance have been recognized by the agents of spatial planning, buildings rehabilitation, economic development and in general well-being of citizens. Thus, the developed ICT method results pretend to be a guideline for futures policies, strategies and instruments in order to protect and enhance this legacy. It aims to



contribute to the definition of conservation or rehabilitation actions, reducing these buildings vulnerability to degradation processes. It can also be used in other similar historical houses, in order to check their status of conservation and therefore to define the best rehabilitation solutions.

The developed ICT platform database is the first survey of the wooden stilt-houses of river banks in Portugal. Its results show how many houses are in very poor, poor, medium, good or very good condition, and the less or more degraded they are. The presented method had a comprehensive approach developed by a computing support, taking into account the vernacular features of historical buildings, after being subject to a final review in order to assess its capability to be tested in other alike buildings.

## References

- [1] A.L. Virtudes, F. Almeida, Desafios da reabilitação urbana no processo de planeamento: o património esquecido das aldeias Avieiras. *Agir, Revista Interdisciplinar de Ciências Sociais e Humanas: Renovação Urbana, Memória e Tematização*, Ano 1, Volume 1. 5 (2013) 323-346.
- [2] J. Colas, Avieiros: Étude d'une population de pêcheurs émigrés sur les bords du Tage. Master Thesis, Université de Paris VIII, France, 1988.
- [3] A. Redol, Avieiros, 12.<sup>a</sup> ed. 2011, Editorial Caminho, Lisboa, Portugal, 1948.
- [4] R.S. Brito, Palheiros de Mira: formação e declínio de um aglomerado de pescadores, 2.<sup>a</sup> ed., Centro de Estudos Geográficos, Universidade de Lisboa (Chorographia), 1981.
- [5] E.V. Oliveira, F. Galhano, Palheiros do Litoral Central Português. IAC, CEEP, Lisboa, 1964.
- [6] A. Vilhena, J.B. Pedro, J. Brito, Avaliação do estado de conservação de edifícios: o quadro legal português, in: PATORREB 2012, Santiago de Compostela, España, 2012.
- [7] J.B. Pedro, A. Vilhena, J.V. Paiva, Métodos de avaliação do estado de conservação de edifícios desenvolvidos no LNEC: características e possibilidades de aplicação. *Engenharia Civil*, (UM). 42 (2012) 5-18.
- [8] A. Vilhena, Método de avaliação do estado de conservação de edifícios: análise e contributos para o seu aperfeiçoamento e alargamento do âmbito. Tese de Doutoramento em Engenharia Civil, Instituto Superior Técnico, Universidade Técnica de Lisboa, Portugal, 2011.
- [9] J.B. Pedro, A. Vilhena, J.V. Paiva, Método de avaliação das necessidades de reabilitação: desenvolvimento e aplicação experimental. *Engenharia Civil* (UM). 39 (2011) 5-21.
- [10] J.C.G. Lanzinha, J.P. Castro-Gomes, Intervention on the rehabilitation of rural houses in Portugal as a contribution to sustainable construction. *Architecture, Civil Engineering, Environment / ACEE*. 1 (3) (2010) 5-18.
- [11] V.V. Fierro, Optimización de una metodología de análisis para la rehabilitación y protección sostenible de la arquitectura vernácula: una metodología de investigación aplicada a zonas de valor constructivo, ecológico y cultural. Phd Thesis, UPC, Barcelona, Spain, 2009.
- [12] M.F.S. Rodrigues, Estado de conservação de edifícios de habitação a custos controlados. Phd Thesis, Universidade de Aveiro, Portugal, 2008.
- [13] P. Gaspar, J. Palla, J., Construções palafíticas da bacia do Tejo: levantamento e diagnóstico do património construído da cultura avieira. *Artitextos*. 8 (2009) 153-174.
- [14] AA. VV., *Arquitectura popular em Portugal*. Sindicato Nacional dos Arquitectos, Lisboa, Portugal, 1961.
- [15] A. Virtudes, F. Almeida, Cultural heritage in Portugal: stilt-house villages of the Tagus river, in: R. Amoêda, S. Lira, C. Pinheiro (Eds.) *Heritage 2012*, Green Lines Institute, Barcelos, 2012, pp. 729-738.
- [16] A.L. Virtudes, F. Almeida, F., The territory of 'Avieiras' stilt-house villages in the survey on vernacular architecture: what does the future hold?, in: A. Cardoso, J.C. Leal, M.H. Maia, (Eds.), *Surveys on Vernacular Architecture. Their significance in 20<sup>th</sup> century architectural culture*, conference proceedings, CEAA, ESAP, Porto, 2012, pp. 535-548.
- [17] L. Cosme, O desenvolvimento da aldeia avieira das Caneiras e a sobrevivência da cultura avieira, in: J.M. Serrano (Coord.), 1.º Encontro Nacional da Cultura Avieira, Âncora Editora, Lisboa, 2010, pp. 113-116.
- [18] H. Ferrão, N. Domingos, Caneiras: pescadores avieiros e searas do tomate (história do seu desenvolvimento), in: J.M. Serrano (Coord.), 1.º Encontro Nacional da Cultura Avieira, Âncora Editora, Lisboa, 2010, pp. 117-125.
- [19] M. Soares, A cultura Avieira: continuidade e mudança. in: Colóquio «Santos Graça» de Etnografia Marítima IV, Empresa Norte Editora, Póvoa de Varzim, Portugal, 1986.
- [20] M. Salvado, *Os Avieiros: nos finais da década de 50*. Edição de autor, Castelo Branco, Portugal, 1985.
- [21] J. Gameiro, L. Barbosa, M. Gouveia, *Caneiras: O Homem e o Rio*. Universidade Nova de Lisboa, Portugal, 1982.