INICIACIÓN A LA INVESTIGACIÓN
REVISTA ELECTRÓNICA
UNIVERSIDAD DE JAÉN
Volumen: nº artículo; año

HERITAGE CONSERVATION WITH EXPERTS SYSTEMS

J. M. Macías-Bernal
A. J. Prieto-Ibáñez
Dpto. Construcciones Arquitectónicas II. Universidad de Sevilla.
jmmacias@us.es
andpriiba@alum.us.es

ABSTRACT

We will know the time evolution in terms of the life in a set of churches located in the south of the Iberian Peninsula. For this we have collected enough time series information, based on vulnerability and risk factors that directly affect the degree of conservation. Next, use of prediction experts systems, so that result so useful in processes of maintenance and preventive conservation of heritage. In this way, we make a selection of properties with priority to be preserved by the authorities, resulting in a more efficient management, regarding investments for the preservation of heritage sites.

KEYWORDS

Conservation; restoration; heritage; churches; service life; durability; vulnerability; risks; fuzzy logic; predictive models; artificial intelligence.

SCOPE OF RESEARCH

Contribute to improve the preventive conservation of architectural heritage, using historical main factors, that affecting the conservation of historic buildings series. These sets make use of service life prediction of buildings, science based in areas of fuzzy logic, neural networks systems and genetic algorithms. To this end we make a detailed selection of priority heritage buildings be preserved. The research is fed back into the study of this time series in the present and of course in the past, vulnerabilities and risk factors (Macías-Bernal y Chávez-de Diego, 2014) [1] [2], directly related to the conservation status of churches in Moorish style built between the XVI - XVII centuries and administered by the Western Vicariate of the Archdiocese of Seville.

Factors	
Vulnerability	**Atmospheric risk**
Geological situation	Rainfall intensity
Cover design	Temperature
Environmental conditions	Humidity
Constructive systems	Wind
Conservation	

Figure 1: Vulnerability factors and atmospheric risk factors.

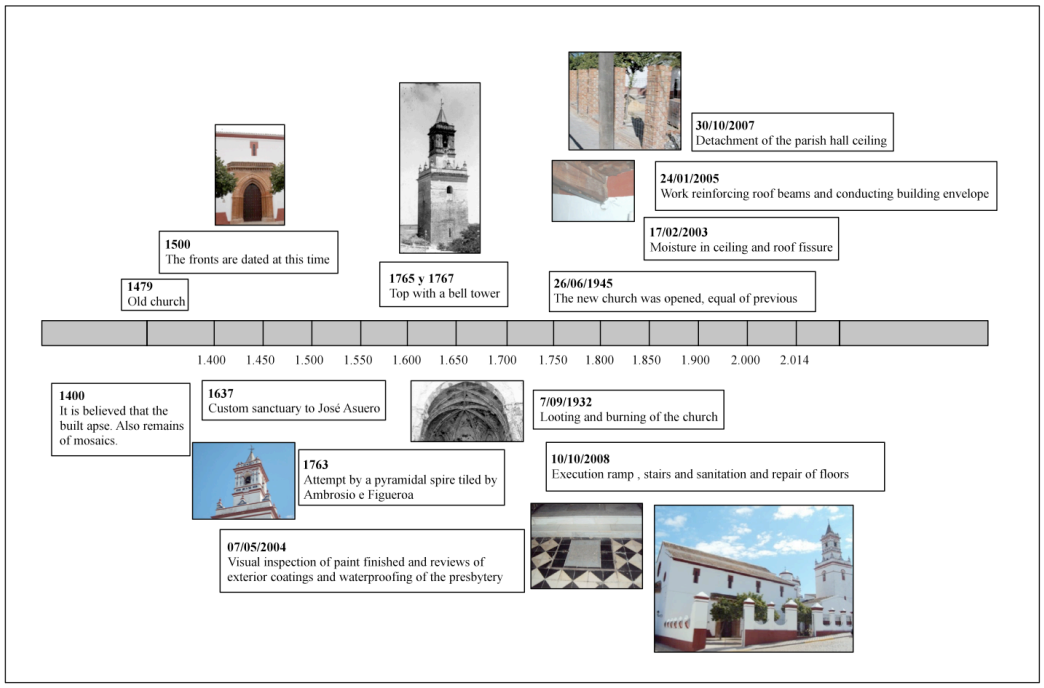

Figure 2: Timeline St. Paul's church. Aznalcázar, Seville.

Based on this, it's built an expert system for durability prediction of buildings [3] [4], where we put in value approximate human reasoning technical, through scientific field of artificial intelligence [5], where the factors of vulnerability and risk factors as inputs into the model, where these are interrelated and obtaining the final output, it is the possible future service life of the buildings [6]. The next step is the construction of the virtual model of the temples, with virtual design programs, like BIM (Building Information Modeling), where we analyse comprehensively considering the exact situation of the buildings, terrain, orientation, including the intrinsic properties of building materials or constructive systems. Where else will we submitted to the various considerations vulnerabilities and risks involved in their service life.

CONCLUSIONS

We have obtained, read and studied historical time series of vulnerability factors (characteristics of the building) and risk factors (elements that affect of the building), which have relation directly with the durability over time of the churches on study, which we use to refine the prediction model. Then we built a prediction model based on approximate human reasoning techniques and artificial intelligence (fuzzy logic, neural networks, genetic algorithms), where the factors are interrelated with the durability. Then, the next step is to continue building virtual models of temples. These models allow detailed study of them. We will have a selection of properties that need actuations of top priority in its preventive maintenance. These results will generate a better management of resources.

BIBLIOGRAPHY

[1] ORTIZ, Pilar, ANTUNEZ, Vanessa, MARTÍN, Jose María, ORTIZ, Rocío, VÁZQUEZ, María Auxiliadora, GALÁN, Emilio. (2013): *Approach to environmental risk analysis for the main monuments in a historical city*. Journal of Cultural Heritage vol. 15.

[2] MACÍAS BERNAL, Juan Manuel, CALAMA RODRÍGUEZ, Jose María y CHÁVEZ DE DIEGO, María José. (2014): Modelo de predicción de la vida útil de la edificación patrimonial a partir de la lógica difusa. Informes de la Construcción vol. 66, nº 533.

[3] TRINIUS, W., SJOSTROM, Ch. (2005): *Service life planning and performance requirements.* Building Research & Information vol. 33.

[4] LACASSE, Michael A., JERNBERG, P., HAAGENRUD, S. E., SJOSTROM, Ch. (2004): *Guide and bibliography to service life and durability research for building materials and components. CIB W80 / RILEM TC 140–TSL.*

[5] ZADEH, Lofti A. (2008): *Is there a need for fuzzy logic?*. Information Science vol. 178.

[6] DE BRITO, J., BRANCO, F., PAULO, P. V. (2014): *BuildingsLife: A building management system*. Structure and Infrastructure Engineering vol. 10, nº 3.