



APT LATIN AMERICA CHAPTER

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Born in Santo Domingo, Dominican Republic.

Architect Cum Laude (UNIBE), Master in Preservation of Monuments and Cultural Heritage (UNPHU), PhD in Architecture (UMSNH, Morelia, Mexico). Specialization in International Development Cooperation.

Degree of Head Researcher in the the National Research Career, at the National Council of Higher Education, Science and Technology (MESCyT). Also, is a Researcher and professor at PUCMM. It is part of the preservation team of the Cathedral of Santo Domingo, and Principal at the Non Destructive Testing Laboratory in the Cathedral. Member of the History and Preservation Research Group of the Built Heritage.

Principal Researcher in national and international researches projects, will publications in scientific journals, books and newspapers. Lecturer and speaker at national and international level. Member of several international scientific committee and reviewer of scientific journals indexed.

Research on the following topics: construction history, heritage preservation, materials science, sustainability and energy efficiency.



CASE STUDY

The Bodden Leroux family house is located in Sanchez, province of Samana, Dominican Republic.. For decades Sanchez was one of the cosmopolitan centers in the country and the region, it was the presence of so foreigners. The imported from the United States and built at the end of the 19th century, on a sloping terrain, so it rose on wooden piles which makes it look bigger. It is rectangular, divided into rooms that communicate by a central corridor and has a perimeter gallery where all the doors and windows open. The structure is made of wood and the sheathing and the floor with pinewood boards. The metal cover is hipped with four gabled dormer windows. The house has been modified and expanded. However its appearance has not changed much. It is currently abandoned despite declared architectural heritage



Non-Destructive Techniques (NDT) for the study of wooden structures in historic building

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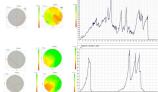
INTRODUCTION

Nondestructive testing (NDT) methods are used to assess the quality of wood and include a variation of testing like: visual inspection, photographic documentation, ultrasonic and sonic testing, electromagnetic and optical among others. Those methods are widely used in the wood industry for mechanical grading of lumber, timber structure inspection, and property assessment of standing trees. The aim of this investigation is to apply various non- destructive techniques (NDT) to diagnose wooden structures in historic buildings.

METHODS

The NDT analysis' have been grouped under four major studies: visual inspection, ultrasound, electromagnetic and optical. The visual inspection was in situ and provides an initial indication of the condition of the wood and the degree of damage (Table 1). The inspection includes, photographic documentation of the house, the history of the structures, the current and past use, the condition of adjacent structures, and environmental condition.



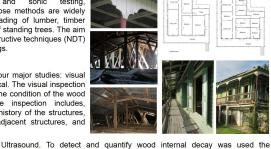




Optical. FLIR System model T420 for Infrared thermography (IRT), The IRT identifies the temperature of the material and offers a thermal image with different temperatures that is interpreted as moisture area, and with that can detect levels of moisture content in wood. This analysis is very important because

CONCLUSIONS

Through visual inspection it was determined that the general structure of the house is in good condition. The main injuries are in the enclosures, floors, ceilings and veranda, which show an advanced deterioration, and are mainly caused by moisture. There is also indications of



Ultrasound. Io detect and quantity wood internal decay was used the Rinntech ARBOTOM, an impulse tomography unit that enables an inside view of condition of timbers and trees and round wood. A series of sensors are placed around the structural elements, each one connected to the next and then to a computer. Each sensor is tapped, which sends a stress wave across the wood to the other sensors, and produce an image. The Image analysis software was used to quantify the proportions of undamaged and damage wood, with Species- specific algorithms, and optional color schemes allow for detailed analysis of decay data. The structural pieces were measured different heights and width. Tests were performed on different structural elements as: bean, column, board, post and piles.

Electromagnetic. Rinntech Resistograph model R650-ED, is an electronically controlled, drill that provides unsurpassed accuracy in measuring the relative density of wood in trees and timber structures. Use DECOM software to analyse the data and produce credible charts that properly reflect actual wood conditions, lectrical Resistance Measuring (ERM) with DELMHORST BD-2100 pin moisture meter (Protimeter), is used to assess and monitor the relative moisture level of timbers, MASTERGRIP Digital Thermometer with Laser for superficial temperature, is used to assess the material external temperature.











improper repair, loose joint and connection, missing wood and color change are some of the damage that are appreciated by sight. Ultrasonic tomography, coupled with image analysis and the resistograph provides an efficient, noninvasive approach to evaluate the condition of the internal decay of the timber and the structural. In general, the Arbotom indicated that some structural elements had internal lesions although they were not visually appreciated. Gaps and soft areas were detected in some columns while in others can observed the good state in which they are. The resistograph affirmed the data obtained with the ultrasound and also indicated the resistance of the samples. The thermographic inspection allowed to know the presence of moisture on the pieces, detect insects and anomalies. The moisture level was tested with thermohygrometer. In conclusion, the benefit to used NDT is that it can be applied "in situ", it does not require big samples that destroy the building to obtain important information. Also, these instruments are the most appropriate methods for the evaluation of the external and internal wood structure and materials quality in cultural heritage.