NON-DESTRUCTIVE DOCUMENTATION METHODS FOR FUTURE SEISMIC AND DAMAGE ANALYSIS OF MODERN HERITAGE BUILDINGS USING NEW TECHNOLOGY

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ABSTRACT

This paper presents a comparative approach between a digital documentation workflow of a hyperbolic parabolic heritage building using new tools versus a traditional documentation technique. Such comparison is done to better understand the building's structure, its evolution, and to assess the performance of this modern concrete structure for future seismic and damage analysis. Furthermore, this paper will explain the challenges of producing a 3D model of this building using point cloud in Revit Software.

Felix Candela's Cosmic Rays pavilion built in 1951 in Mexico City with 5/8" thin reinforced concrete shell still stands after 68 years; while undergoing 3 major earthquakes in 1985, 1999, and 2017 over magnitude of 7.1. This paper showcases two different approaches of documenting this modern heritage pavilion. The first approach was done by Laila Cordero, in Mexico City, over a period of 64 days, who used a traditional technique specifically for documenting hyperbolic parabolas to measure and produce a new set of 2D drawings. During this process, she discovered that some of the measurements of the existing pavilion did not match the original drawings. The second approach was done by Carleton University Students and CIMS lab from Canada over a period of 49 days. The team spend 6 days in Mexico City recording the data from this pavilion. They used new technologies such as DSLR cameras, a drone, and computer software to capture and process the data which resulted in the creation of an accurate 3D point cloud model and 2D drawings.

This paper states the importance of a back and forth study between the traditional and the new documentation methods; which led to discoveries about the current state of the extrados of the hyperbolic parabola. After analyzing the created 3D model, we discovered that there is a gap between the moisture barrier membrane and the concrete shell. Visualizing such deeper and accurate understanding of the current state of this building is one of many advantages of using new technologies. Meantime, by analyzing the historical images of the pavilion, we discovered that the curvature has changed over time. The results that we found could suggest two hypothesis. Either, the profile of the curvature has been modified due to earthquakes, or the modification is due to improper maintenance (multiple additions of the membrane layers) of the pavilion. Furthermore, a series of pictures using thermography show uneven temperature distribution on the concrete shell from inside which strengthens the poor maintenance of the membrane theory. This could not have been noticed by only relying on traditional documentation technique.

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