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# Dome of Nuestra Señora de los Ángeles, case study and assessment

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## Abstract

Preserving Masonry structures represents a considerable challenge due to the loss of knowledge in their construction and materials, creating a need for appropriate tools and methods to understand their structural behavior accurately, especially when a hazard occurs that gravely affects the integrity and safety of the structure.

Different calculation methods have been implemented to explain the behavior of masonry; a particularly useful model for masonry is based on the limit analysis implemented by Jaques Heyman, considering a unilateral compression-only material in which the geometry of the structure is essential to assess its level of stability and in which equilibrium analysis is essential. The basis of this method is to find a thrust line within the structure's thickness. One of the benefits of this approach is the correlation of the tangent positions of the thrust line with the structure's contour, allowing the interpretation of the visible crack pattern present in the real structure.

In Mexico City in 2017, the Dome of the Church of Nuestra Señora de los Ángeles partially collapsed after an earthquake. This dome was the only one to collapse in Mexico City in 2017th earthquakes; this paper aims to explain the partial collapse of the dome and its geometric safety by assessing the collapse load using different equilibrium approaches, like the slicing technique that fits the segmented nature of masonry, comparing its results with discrete element modeling. Since the dome has a three-dimensional behavior, the analysis can consider the influence of hoop forces and ties and the particular soil conditions and their effect as differential settlements in the dome's behavior can be addressed as the boundary conditions change throughout its history. The above can be managed using laser scanning and photogrammetric surveys that correctly register the geometry and help identify cracking patterns.

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