Scale Model Collapse Analyses of Free-Standing Multi-Drum Pompeian Columns

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Abstract

From the catastrophic eruption of Mount Vesuvius in 79AD until its intentional excavation in 1748, the city of Pompeii had been covered by meters of pumice and volcanic ash, which restricted the exposure of the contained structures and art to air, moisture, and environmental events, leaving them in a well-preserved state for centuries. The free-standing multi-drum Pompeian columns found throughout the archaeological area are one such example of structures that are now at risk of damage, particularly in the event of seismic activity. This work presents the results of an interdisciplinary case study of three such columns from the Tempio di Apollo (Pompeii, Italy) (Fig. 1).

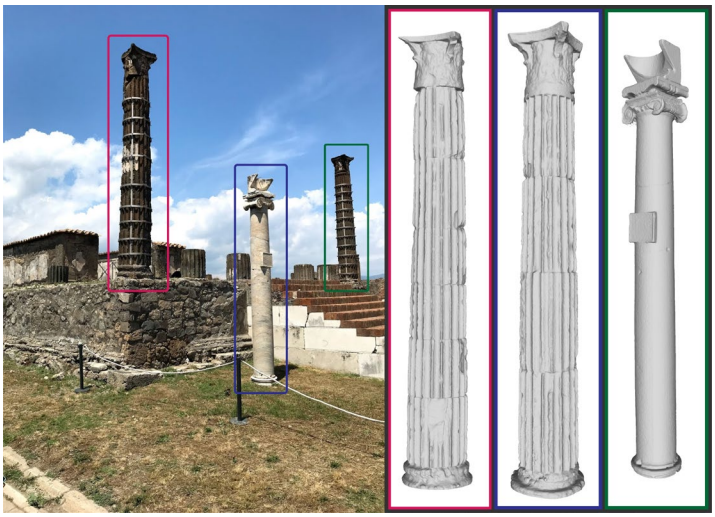

Fig. 1 Photographs and 3D models of columns in the Tempio di Apollo (Pompeii, Italy).

3D models of the structures were used to numerically predict each column's most probable collapse mechanism and collapse angle, which were used to estimate the equivalent lateral acceleration necessary to cause structural failure [1], [2]. The theoretical results found were then corroborated using 3D printed scale model physical studies [2], [3]. Material point method (MPM) models were used to determine the damage that would be sustained by the drums in the event of structural collapse under a variety of collision conditions. The presented methodologies and results show great promise in both the analysis of invaluable ancient masonry structures, the assessment of the efficacy of existing interventions, and the design of preservation strategies to protect them.

References

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