Application of adaptive pushover analyses to a multi-tiered pagoda temple

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ABSTRACT

The paper presents nonlinear static analysis adopted to a multi-tier pagoda temple with a focus on interface behaviour between timber and masonry. The studied pagoda structure is composed of masonry walls and timber frameworks. The masonry is composed of solid bricks and mud mortar. The timber frameworks located inside of the masonry walls are considered to improve box behaviour of masonry walls. Nonetheless, experimental investigations are limited to adopt the interaction between timber and masonry in mud mortar.

The present research consists of two phases: the experimental and numerical phase. As for the experimental phase, a pull-out test is carried out. The test is conducted, taking into account the past experiment to study behaviour of the connection between the masonry wall and timber beam [1]. The specimen is composed of a single-leaf masonry wallette and timber beam. The wallette is 50x50 cm^2 in elevation and 20 cm in depth. The timber beam is 20x20 cm^2 in the cross section. The mechanical characterisation of the timber and masonry materials is conducted in advance of the pull-out test. As for the pull-out test, a monotonic incremental load is applied to the timber beam till the sliding of the beam occurs. The test would provide suggestions on input parameters for the interface behaviour between timber and masonry in mud mortar.

As for the numerical phase, taking into account the experimental results, pushover analysis is conducted on a pagoda structure. In this study, adaptive pushover analysis (APA) is considered [2]. The case study objective is a five-tier pagoda, Kumbeshwar temple in Nepal. The structure was seriously damaged by the 2015 Gorkha earthquake. The collapse of the top tier was observed. The obtained results are compared with the damage and collapse mechanism observed in the real structure. The comparison of the results is also made between APA and nonlinear dynamic analysis.

The challenge of the research lies in the study of interface behaviour between timber and masonry in mud mortar and in the application of adaptive pushover analysis. The study of the discussed interface behaviour is considered challenging due to the limitation of experimental evidences on similar tests. The application of the APA demonstrates advantages and limitations for its application to historical structures. The paper contributes to a more efficient and realistic approach to the seismic assessment of multi-tier pagoda type structures.

REFERENCES

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