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COLLAPSE ANALYSIS OF URM CAVITY-WALL BUILDINGS WITH DIFFERENT GROUND FLOOR OPENING LAYOUTS

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Abstract

The terraced house building typology, which typically consists of low-rise unreinforced masonry (URM) constructions with cavity walls, rigid floor diaphragms and timber roof, is largely widespread in the Groningen region (The Netherlands), now exposed to low-intensity ground motions due to gas extraction. Recent experimental evidence has shown that, in addition to the lack of seismic details, the presence of large openings at the ground floor makes these structures particularly vulnerable towards horizontal actions. In this paper, detailed micro-models, developed within the framework of the Applied Element Method, are employed to extend experimental findings through a comprehensive study on the impact of ground floor openings percentage on the dynamic response of cavity-wall systems representative of the typical Dutch terraced houses, up to complete collapse. After a preliminary calibration with full-scale shake-table test results, the behavior of two additional models, which can be regarded as representative of lower and upper bounds with respect to the extent of ground floor openings of the shake-table-tested prototype, is investigated considering the same experimental loading protocol. Preliminary results confirm that the percentage of ground floor openings may affect significantly the dynamic performance of typical Dutch terraced houses, with the overall strength capacity of the latter decreasing with increasing openings percentage, which also causes deformations and failure mechanisms to concentrate on the ground floor.

Keywords: Unreinforced masonry, cavity-wall systems, openings, shake-table, Applied Element Method

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