17th Symposium on Earthquake Engineering
November 14-17, 2022
IIT Roorkee, India
Paper No. 5

Performance Analysis of a Random Rubble Stone Masonry Building with Different Configurations of Seismic Bands

Sonali Upadhyaya[1], Shivendra Kumar Maurya[1], Vaibhav Singhal[1], Martijn Schildkamp[2]

[1]Indian Institute of Technology Patna, Patna, India
[2]Smart Shelter Research, Alphen aan den Rijn, Netherlands

Abstract

The traditional construction technique of masonry building with rubble stone has become obsolete due to the lack of scientific study of its performance analysis. Seismic bands are one such great technique to strengthen masonry buildings, the application of which is yet to be investigated in-depth. The objective of this study is to evaluate the requirement of reinforced concrete seismic bands on random rubble stone masonry buildings due to seismic activity. The paper also deals with the effect of the roof diaphragm on the lateral load response of stone masonry buildings. In this study, a single-story school building constructed with random rubble stone and cement mortar is considered for analysis. Numerical modelling of the stone masonry building is carried out to perform the parametric analysis of the building due to seismic bands and diaphragms. The Finite element modelling is performed by adopting the macro-modelling-based approach implemented in Abaqus software. A non-linear pushover analysis is performed by uniformly applying the body force to obtain the global force-deformation responses of the building models. Finite element analysis illustrates that continuous horizontal bands at the roof and lintel level of the stone masonry building, result in a note-worthy increment of 95% in the base shear capacity. Furthermore, it is found that with successive addition of horizontal bands the improvement in the base shear capacity of the building models is insignificant, with comparable capacity to a building with a rigid diaphragm. The obtained results highlight the importance of horizontal bands in ensuring the box-action even without diaphragm or with negligible contribution of the diaphragm, thus providing the desirable seismic performance.

Keywords: Random rubble stone masonry, Seismic band, Flexible and rigid diaphragm