

According to the observed failure patterns in the wall panels, the possibility of enhancing their seismic capacity can be observed in future studies by adopting some earthquake resistant features such as reinforced concrete bands, PP-bands, GFRP strips, wire mesh, etc in weak regions of the wall panels.

The accuracy of the results is the direct outcome of element type, material properties, boundary conditions, interaction properties, loading condition and mesh size and control. Therefore, with the developed model, a sensitivity analysis can be carried out for the above-mentioned parameters.

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### **References**

- R. Bahar, M. Benazzoung, and S. Kenai, “Performance of compacted cement stabilized soil”, *Cement and concrete composites*, vol.26, pp. 811-820, 2006.
- M. Betti, L. Galano, and A. Vignoli, “Comparative analysis on the seismic behaviour of unreinforced masonry buildings with flexible diaphragms”, *Eng. Str.*, vol.61, pp.195-208, 2014.
- M. Blondet, J. Vargas, J. Velásquez, and N. Tarque, “Experimental study of synthetic mesh reinforcement of historical adobe buildings”, in *Proceedings of Structural Analysis of Historical Constructions, New Delhi, India*, 2006. pp.1-8.
- A. Bulkhi, “25 Worst Earthquakes in History”, 2016.[Online].Available : <https://list25.com/25-worst-earthquakes-in-history/>. [Accessed: 10-Jul-2018].
- E. Çaktı, Ö. Saygılı, J.V. Lemos, and C.S. Oliveira, “Discrete element modeling of a scaled masonry structure and its validation”, *Eng. Str.*, vol. 126, pp.224-236, 2016.
- V. P. P. Cole, E.F. Gad, C. Clifton, N.T.K. Lam, C. Davies, and S. Hicks, “Out-of-plane performance of a brick veneer steel-framed house subjected to seismic loads”, *Constr. Build. Mater.*, vol.28, pp.779-790, 2012.
- K.M. Dolatshahi, and A.J. Aref, “Three Dimensional Modeling of Masonry Structures and Interaction of In-Plane and Out-of-Plane Deformation of Masonry Walls”, *Engineering Mechanics Institute Conference*, 2011.
- “El Centro Earthquake-Vibrationdata”, [Online].Available : <http://www.vibrationdata.com/elcentro.htm>. [Accessed: 04-Aug-2017].

- K.A. Heathcote, "Durability of earth wall buildings", *Constr. Build. Mater.* vol. 9(3), pp 185-189, 1995.
- R. Illampas, D.C. Charmpis, and I. Ioannou, "Laboratory testing and finite element simulation of the structural response of an adobe masonry building under horizontal loading", *Eng. Str.*, vol. 80, pp. 362-376, 2014.
- C. Jayasinghe, and N. Kamaladasa, "Compressive strength characteristics of cement stabilized rammed earth walls", *Constr. Build. Mater.*, vol. 21, pp.1971-1976, 2007.
- C. Jaysinghe, and R.S. Mallawaarachchi, "Flexural strength of compressed stabilized earth masonry materials", *Materials and Design*, Elsevier, vol.30, pp. 3859-3868, 2009.
- L. Kai, W. Ming, and W. Yaan, "Seismic retrofitting of rural rammed earth buildings using externally bonded fibers", *Constr. Build. Mater.*, vol.100, pp.91-101, 2015.
- L. Keshav, V. G. Srisanthi, and G. Balamurugan, "Shaking Table Study of Two Reduced-Scale Single-Storey HCSE Block Masonry Building Models", *Civil Engineering*, DOI 10.1007/S13369-013-0893-6, 2013.
- M. Lorenzo, D. Anastasios, and M. Urs, "In-plane behaviour of rammed earth under cyclic loading: Experimental testing and finite element modeling", *Eng. Str.*, vol.125, pp.144-152, 2016.
- M., Lorenzo, M. Urs, and P. Stanislav, "Rammed earth walls strengthened with polyester fabric strips: Experimental analysis under in-plane cyclic loading", *Constr. Build. Mater.*, vol.149, pp.29-36, 2017.
- P.B. Lourenço, L. Avila, G. Vasconcelos, J. P. Alves, N. Mendes, and A.C. Costa, "Experimental investigation on the seismic performance of masonry buildings using shaking table testing", *Bull Earthquake Eng.*, vol.11, pp.1157-1190, 2013.
- R. Ma, L. Jiang, M. He, C. Fang, and F. Liang, "Experimental investigations on masonry structures using external pre-stressing techniques for improving seismic performance", *Eng. Str.*, vol.42, pp.297-307, 2012.
- E.A.Mehmet, and E. M, Y.Ahmet, "Structural behaviour of rammed earth walls under lateral cyclic loading: A comparative experimental study", *Constr. Build. Mater.*, vol. 133, pp.433-442, 2017.
- Meillyta, "Finite Element Modelling of Unreinforced Masonry (URM) Wall with Openings": *Studies in Australia, The Proceedings of 2nd Annual International Conference Syiah Kuala University 2012 & 8th IMT-GT Uninet Biosciences Conference Banda Aceh*, 2012. pp.22-24.
- R. Nabouch, Q.B. Bui, O. Ple, P. Perrotin, C. Poinard, T. Goldin, and J.P. Plassiard, "Seismic assessment of rammed earth walls using pushover tests", *Cons. Build. Mater.*, vol.145, pp.1185-1192, 2016.

- S. Nayak, and S.C. Dutta, “Failure of masonry structures in earthquake: A few simple cost effective techniques as possible solutions”, *Eng. Str.*, vol.106, pp.53-67,2016.
- R.S. Nezhad, M.Z. Kabir, and M. Banazadeh, “Shaking table test of fibre reinforced masonry walls under out-of-plane Loading”, *Constr.Build.Mater.*, vol.120, pp. 89-103, 2016.
- X. Palios, M. N. Fardis, E. Strepelias, and S.N. Bousias, “Un-bonded brickwork for the protection of infills from seismic damage”, *Eng. Str.*, vol.131,pp.614-624, 2017.
- S. Priyantha, “Seismic hazard assessment for Colombo city with local site effects”, *Research Project for Master of Engineering, Department of Civil Engineering, University of Moratuwa, Sri Lanka*, 2016.
- V. Ratnam, “Development of Earthquake resistant designs, methodologies and construction technologies for masonry buildings in Sri Lanka”. *Research Project for Master of Engineering in Structural Engineering Design, Department of Civil Engineering, University of Moratuwa, Sri Lanka*, 2014.
- B.V. Reddy, and J.S. Jagadish,“Properties of soil-cement block masonry”, *Masonry International, British Masonry Society*, vol. 3(2), pp 80-84,1989.
- M. U. Saleem, M. Numada, M. N. Amin, and K. Meguro, “Seismic response of PP-band and FRP retrofitted house models under shake table testing”, *Constr.Build.Mater.*, vol. 111,pp. 298-316, 2016.
- A. Sánchez, G. Solar, P.E. Martín, and N.G. Maldonado, “Surface Interaction Model for Great thickness Masonry”, *Frontiers in Built Environment*, DOI:10.3389/fbuil.2017.00025.
- D.G. Sapir, and F. Vos, ”Human Casualties in Earthquakes”, *An Epidemiological Perspective on Patterns and Trends*, pp. 322, ISBN: 978-90-481-9454-4, 2011.
- B. Silva, M.D. Benetta, F. Porto, and C. Modena, “Experimental assessment of in-plane behavior of three-leaf stone masonry walls”, *Constr.Build.Mater.*, vol.53,pp.149-161,2014.
- S.S. Sivaraja, T.S. Thandavamoorthy, S. Vijayakumar, S. Mosesaranganathana, P.T. Rathnasheela, and A.K. Dasarathy, “GFRP Strengthening and Applications of Unreinforced Masonry wall (UMW)”, *Procedia Engineering*, vol.54, pp.428-439, 2013.
- V.G. Srisanthi, L. Keshav, P.P. Kumar, and T. Jayakumar, “Finite element and experimental analysis of 3D masonry compressed stabilized earth block and brick building models against earthquake forces”, *Civil Engineering*, 58/3(2014)255-265.

N. Tarque, G. Camata, E. Spacone, M. Blondet, and H. Varum, “The use of continuum models for analysing adobe structures”, *Constr.Build.Mater.*, vol.28,pp.779-790,2012.

P. Vidal, P.Cole , E. F. Gad , C.Clifton , N.T.K. Lam , C.Davies, and S.Hicks, “Out-of-plane performance of a brick veneer steel-framed house subjected to seismic loads”,2012.

W. Yaan, W. Ming, L. Kai, P. Wen, and Y. Xiaodong, “Shaking table tests on seismic retrofitting of rammed earth structures”, *Bull Earthquake Eng.* (2016)DOI:10.1007/s10518-016-9996-2.