SIMULATION OF EARTHQUAKE-INDUCED COLLAPSE IN A SUPER TALL BUILDING WITH MEGA BRACED TUBE

Sima ARAMESH
Faculty Member, Technical and Vocational University of Semnan, Semnan, Iran
aramesh_sima@yahoo.com

Hadi ZIARI
Civil Engineer, Technical and Vocational University of Semnan, Semnan, Iran
hadicivil_1384@yahoo.com

Keywords: Super tall buildings, Collapse simulation, Finite element model, Fiber-beam model, Framed tube

Research on the collapse caused by the earthquake is very important for super tall buildings. Although buildings with a framed tube are one of the structural resistance systems structures in seismic area, the failure mode and the mechanism of collapse of such a building in earthquake are rarely studied. The purpose of this paper is to investigate the collapse of a super tall building with a 500 m height with braced tube. The building is considered in a high-risk seismic region with a maximum acceleration of 0.9 g. Finite Element Model (FE) is analysed with sells and fiber-beam design building is based on laminated shell and fiber-beam designs.
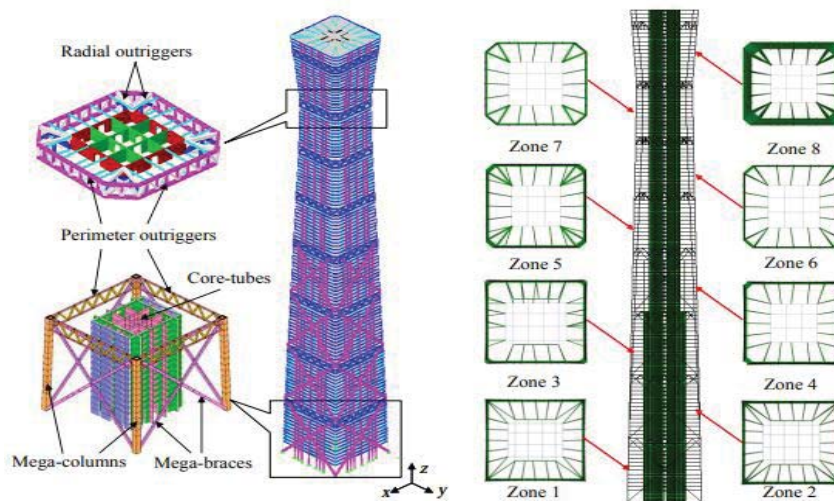

Figure 1. The FE model of the super-tall building. (a) Three dimensional view; (b) planar layout of different zones.

Finally, the dynamic characteristics of the building were analyzed and the collapse considered under earthquake. In this paper, the failure mode and the mechanism of earthquake collapse have been discussed in detail. This study is a reference to design the resistance to the collapse of very high-rise buildings of the same type.

REFERENCES

Aramesh, S. and Ghiasi, E. (2017). Structural design challenges in tall buildings. *Fourth International Conference on Structural Engineering*, Tehran, Bahman 1396.

Aramesh, S., Kermani, A., and Ghiasi, E. (2018). Seismic design of high-rise composite buildings with steel reinforced steel columns reinforced with concrete and steel beams and reinforced concrete core. *Third International Conference and 4th National Civil, Urban Design and Architecture Conference*, Tabriz.

CTBUH Elnimeiri; *Height Systems for Tall Buildings*. Illinois Institute of Technology.

CTBUH Height Criteria. *Council on Tall Buildings and Urban Habitat*. Online (Retrieved 7 December 2011): http://www.ctbuh.org/HighRiseInfo/TallestDatabase/Criteria/tabid/446/language/en-US/Default.aspx.

Khairuddin, A. and Aramesh, S. (2015). *Structural Resilient Systems in Tall Buildings*. Semnan University Press, Second Edition.

Li, C.S., Lam, S.S.E., Zhang, M.Z., and Wong, Y.L. (2006). Shaking table test of a 1:20 scale high-rise building with a transfer plate system. *ASCE J. Struct. Eng.*, *132*(11), 1732-1744.

Lu, X.L., Zou, Y., Lu, W.S., and Zhao, B. (2007). Shaking table model test on Shanghai world financial center tower. *Earthq. Eng. Struct. Dyn*. 36/4, 439-457.

Mao, Y.J., Lu, X.L., Lu, W.S., and Kang, L.P. (2010). Shaking table model test on Shanghai tower. *J. Civ., Archit. Environ.,* 32(Sup. 2), 534-536+549 (in Chinese. *Eng.)*.

Toshikazu, K., Toshimi, K., Taizo, M., Toshinori, K., and Yousok, K. (2007). 3-D collapse tests and analyses of the three-story reinforced concrete buildings with flexible foundation. *ASCE Conference Proceedings*, Long Beach, California, USA, 249/15, 1-14.

Wu, C.L., Kuo, W.W., Yang, Y.S., Hwang, S.J., and Loh, C.H. (2007). Dynamic collapse simulation of 3-bay RC frame under extreme earthquake loadings. *ASCE Conference Proceedings*, Long Beach, California, USA 249/13, 1-14. doi:http://dx.doi.org/10.1061/40944(249)13.

Xu, L., Shi, W.X., and Zhang, J. (2001). Simulated earthquake experiment study of a high-rise building structure model. *J. Build. Struct.*, *22*(5), 15-19 (in Chinese).

Yamada, S., Suita, K., Tada, M., Kasai, K., Matsuoka, Y., and Sato, E. (2008). Collapse experiment on 4-story steel moment frame: Part 1. *Proceedings of 14ᵗʰ World Conference on Earthquake Engineering*, Beijing, China.

Zhao, Z.Z., Dong, H.J., and Qian, J.R. (2008). Shaking table test and numerical analysis on structural model of Beijing new .poly plaza. *Proceedings of 14ᵗʰ World Conference on Earthquake Engineering*, Beijing, China, CDROM.