ACCELERATION RESPONSES FOR TALL REINFORCED CONCRETE OFFICE BUILDINGS UNDER WIND LOADING

ALI AL-BALHAWI[1,2] AND BINSHENG ZHANG[3]

[1]PhD researcher, School of Engineering and Built Environment, Glasgow Caledonian University, 70 Cowcaddens Road, Glasgow G4 0BA, UK, Ali.AlBalhawi@gcu.ac.uk

[2]Assistant Lecturer, Department of Civil Engineering, Engineering College, Al-Mustansiriyah University, Baghdad, Iraq

[3]Professor, School of Engineering and Built Environment, Glasgow Caledonian University, 70 Cowcaddens Road, Glasgow G4 0BA, UK, Ben.Zhang@gcu.ac.uk

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Abstract. The serviceability limit state design of tall reinforced concrete buildings under wind induced vibrations requires accurate estimations of the dynamic properties, e.g. fundamental vibration period, damping ratio and wind field characteristics. Dynamic responses of tall buildings in terms of maximum lateral displacements and accelerations are of utmost interest. In this study, the acceleration responses of tall RC office buildings are comprehensively investigated by considering various parameters, i.e. number of storeys, side ratio of buildings, damping ratio and wind characteristics including basic wind velocity, peak factors, etc., and evaluated based on various international design codes and standards, namely ASCE 7, AS/NZS 1170.2, AIJ recommendations and BS EN 1991-1-4, and the database-enabled design module for high-rise buildings (DEDM-HR) in two principal alongwind and acrosswind directions. The height and plan aspect ratio of buildings have a significant impact on the peak accelerations due to their direct correlations to the stiffness and mass of the buildings. For alongwind direction with fixed damping ratio, AIJ recommendations give the largest estimated alongwind peak accelerations compared with other codes and standards for 10- and 20-storey buildings. With the increase of building height, BS EN 1991-1-4 gives the highest accelerations. For the acrosswind direction, AIJ recommendations give the highest acrosswind peak accelerations compared with AS/NZS 1170.2 and DEDM-HR. Variations in the damping ratio between 0.009 and 0.01592 with the building height for a fixed basic wind velocity increase the accelerations by 3% for 10-storey buildings, by 19% for 20-storey buildings and 33% for 30- and 40-storey buildings. The variations in the wind characteristics and damping ratio between the design codes and standards are the main sources for the high discrepancies in the corresponding acceleration responses.