EFFECTS OF ECCENTRIC CORES ON BEHAVIOUR OF TALL BUILDINGS

THESIS SUBMITTED TO THE
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Declaration

I, Manoj Fernando, hereby declare that the content of the thesis is the original work carried out over a period of 15 months at the Department of Civil Engineering, University of Moratuwa. Whenever others' work is included in this thesis, it is appropriately acknowledged as a reference.

Abstract

The latest advances of concrete technology, efficient structural forms as well as construction techniques make the new trends in the construction of tall buildings in commercial city centres of the developing countries. This is generally considered as an economical solution for the optimisation of the usable land space, especially in the countries where steel is an imported material. The planning of the tall buildings will have to fulfil the requirement of many parties, therefore, the eccentric arrangement cores in the buildings is a common situation for the structural engineers. Since the developments in concrete technology make the latest tall buildings much more taller and lighter than the earlier buildings, the behavioural studies on non-symmetric core structures are very important for various decisions made by structural engineers.

The eccentric core structures are subjected to torsional moments when resisting the lateral loads due to the eccentricity. The cores are also subjected to warping effects due to the torsional moments, therefore, the additional vertical stresses will be created. This could affect the behaviour of the building. The magnitudes of these vertical stresses are depended on eccentricity, type of loading, pattern of vertical distribution of the loads etc.

This study was carried out to determine the effects of non-symmetric cores on behaviour of tall buildings. A detail case study was carried out for the buildings from twenty to thirty storey ranges for various loading conditions with different eccentricity levels to achieve the objectives of the study. The results of this study shows that it is not prudent to design buildings with eccentric cores, simply because it could be designed for the lateral loads of lower magnitude. It is shown that such structures could be subjected to severe stresses under stronger earthquakes. This could be the reason for the failure of the major structural elements and it could be the cause for the collapse of the buildings as well. Therefore, limiting the eccentricity of cores are advisable and it is prudent to have a secondary system to protect the building by improving the ductility of the building significantly, with special reinforcement details.

Key words:

Tall buildings, concrete cores, earthquake forces, wind forces, torsional moments

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