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Thesis
Torsional Response of Buildings during Earthquakes

Abstract
Damage reports on recent earthquakes have indicated that torsional motions often cause significant damage to buildings, at times leading to their collapse. Many researchers have studied the elastic and inelastic torsional response of building models. However, the results of these studies have not always been consistent. Inconsistencies also exist in the torsional design provisions of various building codes. The objective of the work presented here is to provide a better understanding of the torsional behaviour of building systems and to develop design recommendations that are both rational and simple to implement.

Analytical studies are carried out on the elastic torsional response of a single storey building models for a range of governing parameters. Based on the response results, a new set of design provisions is proposed which gives design forces that are closer to the results obtained from a dynamic analysis. A series of elastic response analysis of single storey models can be applied to mutistorey buildings in which the ratio of uncoupled torsional frequency to the uncoupled translational frequency, defined at the storey level, does not vary appreciably along the height.

Inelastic time history analyses of single storey models, carried out as a part of this work, show that the buildings designed according to the proposed expressions exhibit peak ductility demands that are equal to or less than those for the associated torsionally balanced buildings. Inelastic response studies are also carried out on a multistorey models. They indicate that the proposed torsional design expressions can reasonably be used for the design of multistorey buildings that are asymmetric in plan but otherwise fairly regular.

The effect of orthogonal plane on the inelastic torsional response is studied. The results show that it is the total torsional stiffness and not how it is distributed between parallel and orthogonal planes that controls the response.

A comparison of the proposed expressions with the torsional design provisions of selected building codes is presented. The study shows that the proposed expressions provide and improved rational and simple method for the design of buildings against torsion.

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Supervisor

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