Special issue on the state of the art of earthquake induced torsion in buildings and on inelastic torsion

Preface

This special issue of Earthquakes & Structures aims at presenting an extensive critical review of the State of the Art of earthquake induced torsion in buildings, followed by some new investigations that are based on inelastic dynamic analyses of realistic structural models. Such analyses have shed new light into the problem of inelastic torsion of buildings under strong earthquakes, settling old controversies and allowing a fresh look at modern code provisions for torsion, originated in the past and supported by results from very simple models.

Although building torsion due to earthquakes has been investigated since earthquake engineering started emerging as a distinct field of engineering science about 60 years ago, earthquake resistant design of asymmetric or irregular buildings is still an open area of research, while its treatment by different modern codes varies significantly. What has characterized research in this area over the past several decades is the lack of consensus among scholars on results and conclusions addressing key aspects of this problem. This is attributed primarily to the following two reasons: (a) The large number of parameters affecting this problem and consequently the varying sets of assumptions made by different researchers in their studies, including degrees of simplification and bases of comparisons (b) The failure of many researchers to explicitly recognize the limitations of their results and conclusions, which although correct for specific cases, are unjustifiably generalized and appear conflicting to conclusions of other studies based on different models, sets of assumptions or inputs. This lack of agreement generated debates, with several papers supporting opposite views, while when new studies were published with some of the earlier assumptions and model limitations removed, the validity of previous results was either questioned or completely rejected.

A source of the above problems that often led to erroneous conclusions for realistic buildings is the wide use by many researchers of oversimplified, one story, shear beam type systems. Such systems have several shortcomings, especially when their member strength properties are determined only from earthquake loads, ignoring other loadings, e.g., due to gravity, or other code requirements such as drift limitations, etc. In spite of their shortcomings however, their simplicity made such models very popular among researchers in the past. Consequently, they were used in great many past studies to obtain results, which without much thought were extrapolated to realistic buildings. This has been pointed out a few years ago and has contributed to the use of more detailed and sophisticated models for studying inelastic torsion. Such models have been applied in the papers included in this special issue of Earthquakes and Structures.

It is hoped that the reader will find the material herein interesting and helpful for addressing and solving torsional problems of realistic buildings.

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