Estimation of Column Loads in Eccentrically Braced Frames

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Abstract: Current requirements in the AISC Seismic Provisions mandate that column loads in eccentrically braced frame (EBF) systems be computed assuming that all links have yielded. While this may be a reasonable simplification for shorter buildings, it is unlikely that taller buildings will be able to develop yielding in all links simultaneously. The likely result of this requirement is the overestimation of column loads. The goal of the proposed research is to obtain a more comprehensive understanding of the magnitude of column loads in EBF systems by using nonlinear dynamic analyses that permit a more realistic assessment of link yielding. The research would involve using a suite of time histories available from public records to load different EBF systems and obtain a statistical estimate of the maximum column load. The results of this research would be used to validate or propose revisions to current seismic design requirements.

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Performance-based Assessment of Various Plan Conformations

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Abstract: Several plan conformations are ordinarily used by architects and designers. Performance-based criteria were determined for comparing square, rectangular, circular and octagonal plan conformations for tall structures according to Pacific Earthquake Engineering (PEER) tall buildings guidelines. Building performance models for all cases with both structural and non-structural damageable components were developed considering their corresponding fragilities. Consequence functions depending on repair time, repair costs and loss of utility during downtime were defined for loss estimation of the structures. Five different ground motions were selected depending on their intensities. Ground motions for service level, design, maximum-considered and over-the-top intensities were considered in order to assess losses comprehensively for all models. The results of this study would be used propose guidelines and provisions in pertinent codes.
Deformation Capacities of Reinforced Concrete Structures with Non-Rectangular Column Cross Section Geometry

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Abstract: Designers often encounter a situation where different conformations of column cross sections are possible, the choice of which ultimately affects ductility properties of the structure. Different cross section RC column shapes like Square, plus shaped, L-shaped, T shaped and circular, with same cross sectional area and reinforcement are modelled and studied for their inelastic deformation capacities. The performance is evaluated by the capacity curves which are obtained by nonlinear static analysis. In order to make this study more practically applicable, several models each of multi storeyed structures of different number of storeys were analysed. One of the models used conventional rectangular columns, second used circular columns throughout and another model employed combination of various geometrically possible column cross sections such as L, T and plus (+) shaped columns. The study suggests effects of cross section geometry on nonlinear deformation capacities of structures. The output of this study may be used by many practising engineers and architects.
Effect of Column Cross Section Geometry on Damage Capacities of Structures

Shivam Mishra, a) Vimala Anthugari, b) and Pradeep Kumar Ramancharla c)

Abstract: Various column cross section shapes are possible for design of structures which ultimately affect the overall performance. Various cross section reinforced concrete columns like square, circular, plus, L, and T shaped with same cross sectional area and reinforcement are modelled and analysed for their nonlinear performance. Three models each of 5, 10, 15, 20, 25 and 30 storeyed structures of were analysed by nonlinear static analyses. One of the models used conventional rectangular columns, second used circular columns throughout and another model employed combination of various geometrically possible column cross sections such as L, T and plus (+) shaped columns. Displacement-based damage index is used to compute and compare the damage capacities for all the structures.

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Effect of Column Cross Section Geometry on Response Modification Factors

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Abstract: Different shapes of column cross sections are possible for design of structures which ultimately affect the overall performance. Various cross section reinforced concrete columns like square, circular, plus, L, and T shaped with same cross sectional area and reinforcement are modelled. In order to make this study more practically applicable, three models each of multi storeyed structures of different number of storeys were analysed for non-linear static responses. One of the models used conventional rectangular columns, second used circular columns throughout and another model employed combination of various geometrically possible column cross sections such as L, T and plus (+) shaped columns. The study compares response modification factors for above mentioned structures.

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Study of Various Configurations in High-Rise Structures

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SUMMARY:

Earthquake is one of the most devastating natural calamities known to man. Most earthquake related deaths are caused by the collapse of structures. The structural configuration plays a role of paramount importance in reducing the death toll in an earthquake. Numerous researchers have suggested the use of seismic isolation as a method to reduce vibrational damage and to increase seismic sustainability. Seismic isolators have proved to be efficient for low to medium rise structures but for high-rise structures, this method has not been feasible because of high over turning moments. Scarcity of land has insinuated a growing trend of high-rise structures. The protection of engineering structures, including material content and human occupants has been a worldwide priority. Recent devastating earthquakes around the world have confirmed the need to understand the dynamic response of structural conformations. A comprehensive study has been carried out on various possible structural configurations and their corresponding seismic performance. The advantages and disadvantages of various possible configurations have been discussed. The behaviour of structures of different shapes has been analysed. This research provides an insight in understanding the contribution of structural layout to overall seismic resistance of the structural system.
Asymmetry Indices: Quantifying Structural Asymmetry

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Abstract: It is widely observed that structures usually have some kind of asymmetry, be it mass asymmetry, stiffness asymmetry or conformational asymmetry. An attempt has been made in the following research paper to measure the degree of asymmetry associated with a given structure. An index known as ‘Asymmetry Index’ has been proposed applicable for all structures which would help quantify mass asymmetry, stiffness (rigidity/strength) asymmetry and conformational (geometric) asymmetry. Methods to calculate the same and its applications have been discoursed in detail in this paper. The results of this research may be used to correlate structure’s seismic performance and behavior with its asymmetry index. These indices would enable an easier method of assessment and evaluation of asymmetric structures. It would also make performance prediction easier if the asymmetry index of the structure is known.
Variation of Seismic Performance of Asymmetric Structures with Asymmetry Indices

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Abstract: A lot of research has been done on the effects of asymmetry of structures on its overall behavior and it’s a well known fact that it affects the structures’ performance adversely. But it has always been difficult to know the extent to which the performance varies for corresponding variation in degree of asymmetry from one structure to another. The following paper proposes a correlation between the asymmetry index of the structure and its performance. Using these, structures may conveniently be classified and evaluated for their performance. A comprehensive study of various cases of asymmetrical structures has been done and their static and dynamic response has been used for correlating it with asymmetry index. This research aims at providing a simplified approach in understanding the response of asymmetric structures.
Fatigue Life Determination of Structures for Near-Fault Earthquake Excitation

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Abstract: Recent research on some past earthquakes, has insinuated that the contribution of fatigue in damage of a structure due to EQ is significant for near fault (source) areas. This damage is considerable and cannot be neglected for regions lying in and around tectonic plates with high and frequent earthquakes. Not much is known about the damage done to the structures due to the cyclic nature of earthquakes. At times, it becomes intractable to draw relations between the ground motion parameters of an earthquake and corresponding damage in various members of the induced structure. This paper attempts to provide an account of the damage developed on a member during an event of an earthquake due to cyclic nature of loading. Time history data of earthquakes are used to compute the fatigue response of the structural member. A simple strain based low cycle fatigue model is formulated in this paper.
Innovative Seismic Base Isolation

Shivam Mishra\textsuperscript{a)} and Samir Dhuri\textsuperscript{b)}

\textbf{Abstract:} The disadvantages of currently available isolators are high cost of devices and their installation, short life span of bearings (high maintenance) and, in case of Lead Rubber Bearings the toxic nature of lead makes it difficult to dispose-off, posing severe environmental issues and health hazards. In the present work, an experimental study has been carried out by conducting series of tests on multi-storeyed scaled building model by incorporating a viscous fluid and springs. This system basically comprises of two components viz. a highly viscous incompressible fluid present below the super-structure and a spring as stiffness element installed at the sides of the superstructure. This innovative design is an alternative to isolation system with Rubber Bearings. The building model is tested under seismic excitations generated by shake-table. Significant reductions in displacement and acceleration response quantities are found for the building with proposed isolation technique as compared to the non-isolated building. This technique may be used for light single storeyed structures.

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