

Plastic Behavior of Steel Frames Using Different Concentric Bracing Configurations

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Abstract : Among the entire natural calamities earthquake is the one which is most devastating. If the losses due to all other calamities are added still it will be very less than the losses due to earthquakes. So it means we must be ready to face such a situation, which is only possible if we make our structures earthquake resistant. A review of structural damages to the braced frame systems after several major earthquakes—including recent earthquakes—has identified some anticipated and unanticipated damage. This damage has prompted many engineers and researchers around the world to consider new approaches to improve the behavior of braced frame systems. Extensive experimental studies over the last forty years of conventional buckling brace components and several braced frame specimens have been briefly reviewed, highlighting that the number of studies on the full-scale concentric braced frames is still limited. So for this reason the study surrounds the words plastic behavior, steel structure, brace frame system. In this study, there are two different analytical approaches which have been used to predict the behavior and strength of an un-braced frame. The first is referred as incremental elasto-plastic analysis a plastic approach. This method gives a complete load-deflection history of the structure until collapse. It is based on the plastic hinge concept for fully plastic cross sections in a structure under increasing proportional loading. In this, the incremental elasto-plastic analysis- hinge by hinge method is used in this study because of its simplicity to know the complete load- deformation history of two storey un-braced scaled model. After that the experiments were conducted on two storey scaled building model with and without bracing system to know the true or experimental load deformation curve of scaled model. Only way, is to understand and analyze these techniques and adopt these techniques in our structures. The study named as Plastic Behavior of Steel Frames using Different Concentric Bracing Configurations deals with all this. This study aimed at improving the already practiced traditional systems and to check the behavior and its usefulness with respect to X-braced system as reference model i.e. is how plastically it is different from X-braced. Laboratory tests involved determination of plastic behavior of these models (with and without brace) in terms of load-deformation curve. Thus, the aim of this study is to improve the lateral displacement resistance capacity by using new configuration of brace member in concentric manner which is different from conventional concentric brace. Once the experimental and manual results (using plastic approach) compared, simultaneously the results from both approach were also compared with nonlinear static analysis (pushover analysis) approach using ETABS i.e how both the previous results closely depicts the behavior in pushover curve and upto what limit. Tests results shows that all the three approaches behaves somewhat in similar manner upto yield point and also the applicability of elasto-plastic analysis (hinge by hinge method) to know the plastic behavior. Finally the outcome from three approaches shows that the newer one configuration which is chosen for study behaves in-between the plane frame (without brace or reference frame) and the conventional X-brace frame.

Keywords : elasto-plastic analysis, concentric steel braced frame, pushover analysis, ETABS

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