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SUGGEST A NEW ANALYTICAL TYPE OF PANEL ZONE IN SEISMIC CALCULATIONS OF STEEL FRAMES

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The moment resisting frame system is used in most steel structures based on its behavior against the lateral loads. The most important property of this system is the way its members are connected, which effectively contributes to the seismic structural behavior, ductility, stability and architectural interests. Generally, in structural engineering analysis, connections are modeled as rigid nodes. In this model, there is an error that this region imposes more displacement on the system in non-elastic deformation.

There is a fact that in these types of frames, in addition to the non-elastic flexural deformation of beams, more non-elastic shear deformation even more than flexural deformation can occur in panel zone.

Much research has been done to identify the true behavior of panel zone in recent years.

When a moment resisting frame is exposed to lateral loads, many shear forces are imposed on the panel zone which causes the shear deformation of the panel zone. These deformations will have a significant effect on the frame response in both linear and nonlinear regions.

In simple computational models that ignore the deformation of the panel zone, the relative displacement of the floor is underestimated and the capacity base shear are overestimated. In this paper, the effect of deformation of the panel zone on the seismic behavior of steel moment frames has been studied. Finally, a new equivalent stiffness is proposed for the panel zone model considering the non-elastic shear and bending.

First, finite element software is used to calculate the bending and shear stiffness of the panel zone by nonlinear static analysis of the model

Analysis of the structure with the stiffness of the finite element model shows the actual behavior of the structure. The results of this analysis are compared with the results of analysis of structure using the stiffness of Krawinkler model, scissors model and rigid node. Because the responses of these models are not close to the actual behavior of the structure and the finite element model has no engineering application due to the large number of junction nodes, the complexity and being time consuming, in this study an equivalent stiffness that is close to the real behavior is recommended. The proposed stiffness is the result of the combination of bending and shear stiffness.

Finally, to illustrate the accuracy of the proposed model, the stiffness of the other panel zone models (Krawinkler model, scissors model, rigid node and finite element model) is compared with the proposed model. To show the applicability and speed of computation in the proposed model in engineering computation, by using SAP2000 software several nonlinear dynamic analysis under earthquakes such as Tabas, Manjil, Bam, and others was done.

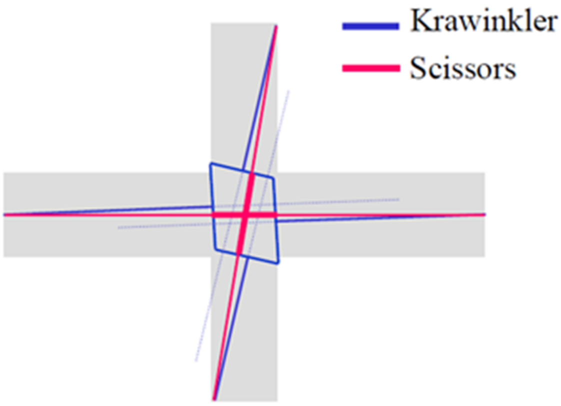

Figure 1. Comparison between scissors model and Krawinkler model.

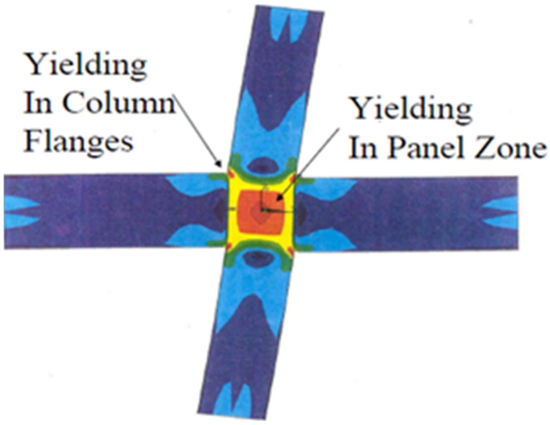

Figure 2. Sources of Inelastic Deformation in Typical Joint.

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