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Performance Evaluation of R.Cseismic Structure by Considering Effects of Joints Flexibility

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Abstract:*-Reinforced concrete (RC) buildings designed before the mid-1970s may have serious structural deficiencies and are considered substandard according to current seismic design criteria. Specifically, the failure of the beam-column joints has been the cause of building collapse in many recent earthquakes worldwide. This report evaluates the seismic performance of beam column joints with three different details of beam and beam-column joint reinforcement. So in the present work pushover analysis is being done using SAP 2000 for increasing moment capacity ratio at beam column joints and its effect on the global ductility and lateral strength of the structure is studied. This work shows that the comparison study of SMRF and OMRF .It carried out to observe thedifference in behaviour of buildings.*
Keywords - *Pushover analyasis , Capacity spectrum curves ,base shear, displacement,plastic hinge.*

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I. Introduction

Reinforced concrete (RC) is a composite structural material that combined by steel and concrete. Concrete with its compressive strength and steel with its strong tension strength have formed RC material. During an earthquake,a reinforced concrete (RC) moment frame is subject to moment reversal in the beams and columns at the joints. This results in high shear and bondstress demands in the joint, which in turn affects the overall performance of the moment frame. The compressive stresses were covered by concrete and tensile stresses were covered by steel in the structures was revealed RC materials.

II. Research Objectives : -

1.To carry out extensive literature survey and this structure is proposed to design
2.To study nonlinear seismic analysis.
3.To analyse the joint rigidity factor and the effects and factor.

III. Methodology

Performance Assessment Using Non-Linear Static Analysis
The building is modelled using SAP2000 and the hinge properties are defined and assigned as per FEMA 356 and ATC 40 guidelines.In the model, beams and columns were modelled using frame elements,into which the hinges were inserted. Diaphragm action was assigned to the floor slabs to ensure integral lateral action of beams in each floor.

Analysis
This capacity curve is generally constructed to represent first mode response of the structure assuming that fundamental mode of vibration is predominant. This assumption holds good for structures with fundamental period up to about one second.

Comparison of Results
a.The result obtained are compared in terms of the performance of ordinary moment resisting frames and special moment resisting frames with fixed support conditions are considered.
b. Initially the base shear increases linearly with the roof displacement. After reaching a certain base shear the building yields. The frame designed as OMRF exhibit a higher capacity of base shear than the SMRF frame. However, the frame designed as SMRF undergoes a higher value of displacement as compared to the OMRF frame.
c. It is observed that ductility is more for SMRF configuration, in all cases, while OMRF performs better in its ability to resist base shear.

Effects of Plastic Hinge
The plastic hinge formation predicted by the various pushover methods was the same as that predicted by the nonlinear dynamic analysesThe inclusion in the analyses of the strain hardening effect did not delay the

occurrence of the first hinge with respect to the EPP model but it did delay the occurrence of the mechanism's formation. The development of the plastic hinges predicted by **both nonlinear dynamic analyses and pushover analyses. Creating basic computer model using graphical interface of SAP-2000The program includes several built in default hinge properties that are based on average value from ATC-40 for concrete member FEMA-356 for steel. These built in properties can be useful for preliminary analysis, but user-defined properties are recommended for final analysis.**

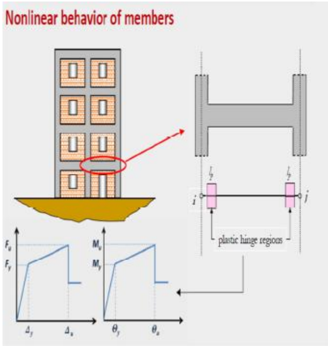


Fig- Nonlinear behavior of member

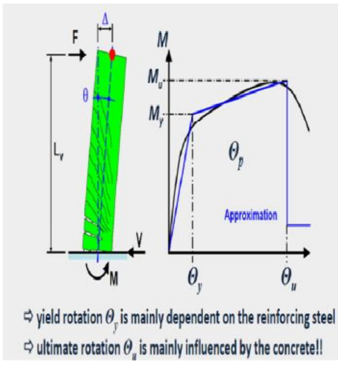


Fig- Yield rotation for concrete & steel

Default Nonlinear Hinge Properties

For Beam

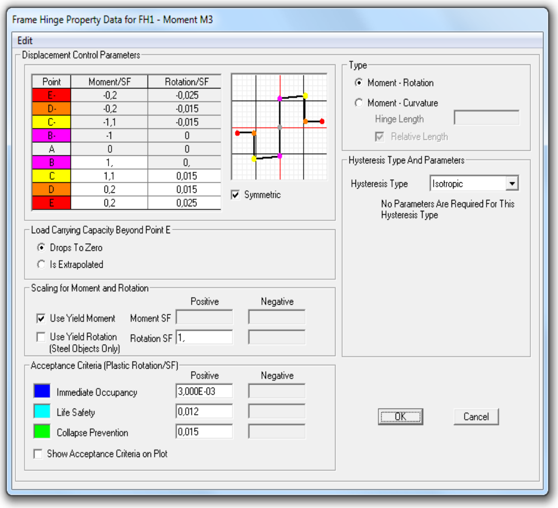
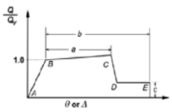


Fig: Hinge Properties For Beam

For Column

Table 6-7 ***Modeling Parameters and Numerical Acceptance Criteria for Nonlinear Procedures— Reinforced Concrete Beams***



Conditions			Modeling Parameters[3]			Acceptance Criteria[3] (Plastic Rotation Angle, radians; Performance Level)				
			Plastic Rotation Angle, radians		Residual Strength Ratio		Component Type			
							Primary		Secondary	
			a	b	c	IO	LS	CP	LS	CP
i. Beams controlled by flexure[1]										
$\frac{\rho - \rho'}{\rho_{bal}}$	Trans. Reinf.[2]	$\frac{V}{b_w d \sqrt{f'_c}}$								
≤ 0.0	C	≤ 3	0.025	0.05	0.2	0.010	0.02	0.025	0.02	0.05
≤ 0.0	C	≥ 6	0.02	0.04	0.2	0.005	0.01	0.02	0.02	0.04
≥ 0.5	C	≤ 3	0.02	0.03	0.2	0.005	0.01	0.02	0.02	0.03
≥ 0.5	C	≥ 6	0.015	0.02	0.2	0.005	0.005	0.015	0.015	0.02
≤ 0.0	NC	≤ 3	0.02	0.03	0.2	0.005	0.01	0.02	0.02	0.03
≤ 0.0	NC	≥ 6	0.01	0.015	0.2	0.0015	0.005	0.01	0.01	0.015
≥ 0.5	NC	≤ 3	0.01	0.015	0.2	0.005	0.01	0.01	0.01	0.015
≥ 0.5	NC	≥ 6	0.005	0.01	0.2	0.0015	0.005	0.005	0.005	0.01

Fig: Hinge Properties For Column

IV. Conclusions

1.From above observations we can conclude that inaccurate modeling of joint stiffness also results in wrong prediction of seismic behavior of structure and failure of structural element may result in such buildings where joint rigidity is not taken in account structure during earthquake.

2.The current study highlighted that joint flexibility is essential for simulating existing RC structures constructed in Iran before the 1970s with non-seismic joint detailing and conventional analyses (rigid joint assumption) may not reflect the realistic responses of those types ofRC structures under earthquake loading.

3.Plastic hinge length expression typically gives the hinge length as a proportion of either the member length or the member width. In reality the plastic hinge length is a function of member depth and length, as well as the diagonal shear crack angle.

4.The study of reinforced concrete columns clearly demonstrates the significance of plastic hinge behavior in its contribution to column failure. For fixed columns, a fully formed hinge releases the boundary constraints and enables the member to continue to act as though it were a simple support system. The final hinge to develop in a fixed column, or the only one to do so in simply supported column, provides the ultimate failure mechanism around which the column will invariably collapse under extreme forces.

5. Plastic hinge length ($L\ p$) has considerable effects on the displacement capacity of the frames. Comparisons show that there is a variation of about 30% in displacement capacities due to $L\ p$.

Scope for Future Work

1.Experimental investigation on the behaviour of beam when it is semi- rigidly connected with column.

2.Further research need to establish the theoretical model for semi-rigidly connected continuous beam.

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