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PERFORMANCE EVALUATION OF R.C SEISMIC 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.This work shows that the comparison study of SMRF and OMRF .It carried out to observe the difference in behaviour of buildings.
KEYWORDS - *Pushover analyasis , Capacity spectrum curves ,base shear, displacement,plastic hinge.*

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.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

- To evaluate the behaviour of structure under different joint flexibility.
- To examine estimation of optimum rigidity factor.
- Analyse of beam column joint behaviour.

III. METHODOLOGY

A pushover analysis is performed by subjecting a structure to a monotonically increasing pattern of lateral loads, representing the inertial forces which would be experienced by the structure when subjected to ground shaking. Under incrementally increasing loads various structural elements may yield sequentially. Consequently, at each event, the structure experiences a loss in stiffness. Using a pushover analysis, a characteristic non-linear force displacement relationship can be determined

Analysis

Beams and columns were modelled as frame elements available in SAP 2000, with the central lines joined at nodes. Beam-column joints are considered as rigid beam-column joints and these are modelled by givingend offsets at the joints.

Analysis Output

The main output of pushover analysis is in the form of base shear versus roof displacement curve called pushover curves. This capacity curve is generally constructed to represent first mode response of the structure assuming that fundamental mode of vibration is predominant.

Effects of Plastic Hinge

The plastic hinge formation predicted by the various pushover methods was the same as that predicted by the nonlinear dynamic analyses .The 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.

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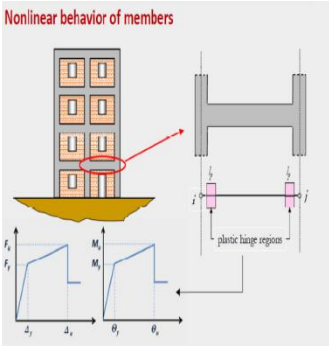


Fig- Nonlinear behavior of member

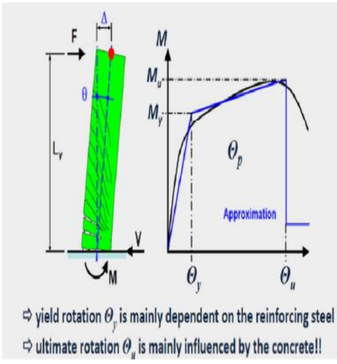


Fig- Yield rotation for concrete & steel

Default Nonlinear Hinge Properties

For Beam

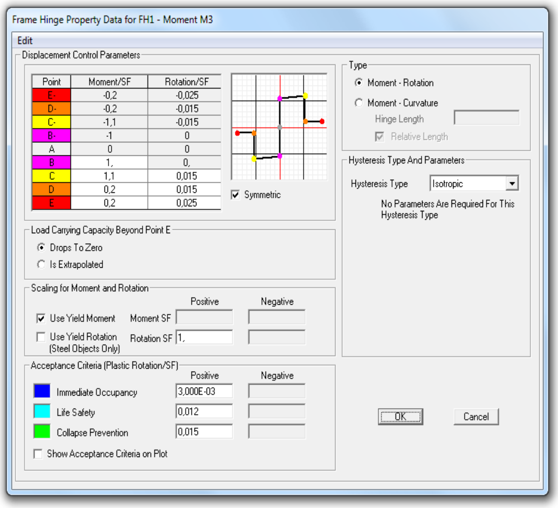
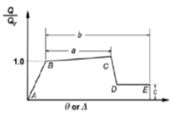


Fig: Hinge Properties For Beam

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		Residual Strength Ratio	Plastic Rotation Angle, radians				
						Performance Level				
							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

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.

Scope for Future Work

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

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

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