Pushover Analysis of Multistoried Building

Prof. Ms. Swati D.Ambadkar[1]

[1]

Received: 15 December 2012 Accepted: 2 January 2013 Published: 15 January 2013

Abstract

A large number of multi-storey reinforced concrete (R/C) framed building structures in urban India are constructed with masonry in fills for architectural, aesthetic or economic reasons. We have investigated the effect of the layout of masonry infill panels over the elevation of masonry in filled R/C frames on the seismic performance and potential seismic damage of the frame under strong ground motions using nonlinear static push-over analysis based on realistic and efficient computational models. From output non-linear analysis, we compare Base shear and Displacement in bare frame, in fill wall frame and ground, it seen that at roof level, displacement in bare frame is more than other two frames and displacement at ground floor in weak story is more than other two frames. Mostly hinges are formed in beam than in column.

Index terms— pushover analysis, infill wall, soft story, non-linear analysis, bare frame, seismic performance

1 Introduction

onlinear static analysis, or pushover analysis, has been developed over the past twenty years and has become the preferred analysis procedure for design and seismic performance evaluation purposes as the procedure is relatively simple and considers post elastic behavior. However, the procedure involves certain approximations and simplifications that some amount of variation is always expected to exist in seismic demand prediction of pushover analysis.

Although, in literature, pushover analysis has been shown to capture essential structural response characteristics under seismic action, the accuracy and the reliability of pushover analysis in predicting global and local seismic demands for all structures have been a subject of discussion and improved pushover procedures have been proposed to overcome the certain limitations of traditional pushover procedures. However, the improved procedures are mostly computationally demanding and conceptually complex that uses of such procedures are impractical in engineering profession and codes.

As traditional pushover analysis is widely used for design and seismic performance evaluation purposes, its limitations, weaknesses and the accuracy of its predictions in routine application should be identified by studying the factors affecting the pushover predictions. In other words, the applicability of pushover analysis in predicting seismic demands should be investigated for low, mid and high-rise structures by identifying certain issues such as modeling nonlinear member behavior, computational scheme of the procedure, variations in the predictions of various lateral load patterns utilized in traditional pushover analysis, efficiency of invariant lateral load patterns in representing higher mode effects and accurate estimation of target displacement at which seismic demand prediction of pushover procedure is performed.

2 a) Analysis and Design

The recent advent of performance based design has brought the nonlinear static pushover analysis procedure to the forefront. Pushover analysis is a static, nonlinear procedure in which the magnitude of the structural loading is incrementally increased in accordance with a certain predefined pattern. With the increase in the magnitude of the loading, weak links and failure modes of the structure are found. The loading is monotonic with the effects of the cyclic behavior and load reversals being estimated by using a modified monotonic force-deformation criteria and with damping approximations. Static pushover analysis is an attempt by the structural engineering profession to evaluate the real strength of the structure and it promises to be a useful and effective tool for performance based design. The ATC-40 and FEMA-273documents have developed modeling procedures, acceptance criteria and analysis procedures for pushover analysis. These documents define force-deformation criteria for hinges used in pushover analysis. As shown in Figure **??**.1, five points labeled A, B, C, D, and E are used to define the force deflection behavior of the hinge and three points labeled IO, LS and CP are used to define the acceptance criteria for the hinge. (IO, LS and CP stand for Immediate Occupancy, Life Safety and Collapse Prevention respectively.) The values assigned to each of these points vary depending on the type of member as well as many other parameters defined in the ATC-40 and FEMA-273 documents. This article presents the steps used in performing a pushover analysis of simple three-dimensional building.SAP2000, a state-of-the-art, general-purpose, three-dimensional structural analysis program, is used as a tool for performing the pushover.

The SAP2000 static pushover analysis capabilities, which are fully integrated into the program, allow quick and easy implementation of the pushover procedures prescribed in the ATC-40 and FEMA-273 documents for both two and three-dimensional buildings. Pushover analysis is performing for old as well as new building. In our case we consider the new

3 Results & Discussion

4 Conclusion

The result of the nonlinear static pushover analysis quantitatively establish that the seismic performance of a masonry infill R/C adversely and significantly affected if the infill panels were discontinued in the ground story resulting in the structural configuration with an open story, commonly termed as 'weak' story , at the ground levels. Hinges formation in the beam is more than column and demonstrates rational nonlinear displacement-based analysis methods for a more objective performance-based seismic evaluation of the masonry infilled R/C frames with seismically undesirable (and preferred) distribution of masonry infill panels over the frame elevation.
[1] [2] [3]

2

Figure 1: 2 e

1

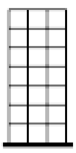


Figure 2: Figure 1 :

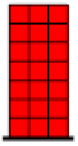
3 

Figure 3: Figure 3 :

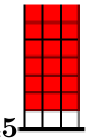
45 

Figure 4: Figure 4 :Figure 5 :

4 CONCLUSION

1

Step	BARE FRAME Displace-ment Base Force		Story Shear
	M	KN	KN
0 1 2 3 4 5 6 0.05 0.1 0.15 0.2 0.25 0.3 Dis-place-ment in m	2.97E-06 0.00958 0.013547 0.05683 0.138688 0.168203 0.269185 Storey Vs Displacement in m 0 119		
0	0 Bare Frame	2	4 Storey from GF Infill Walls Weak Storey

Figure 2 : Story Level Vs Displacement Curve

Figure 5: Table 1 :

Story Level Vs Storey Shear 40000

40000

Storey Shear in kN 0 10000 20000 30000 1 2 BARE FRAME 3 Storey No. 4 INFILL WALL 5 WEAK STORY 6 0 Storey Bare 0 2 4 20000 Shear Frame 6 8

8

Year 2013
rsion I
XIII Issue v
Volume
D D D D)
(
Global Journal of Researches in Engineering

Figure 6: in kN Storey from GF Storey Vs Storey Shear

[Criteria for Earthquake Resistant Design of Structures ()] *Criteria for Earthquake Resistant Design of Structures*, IS 1893(Part1): 2002. 2002. New Delhi: Bureau of Indian Standards.

[Fema-273 (1997)] Fema-273 . *Federal Emergency Management Agency ,NEHRP Guidelines for the Seismic Rehabilitation of Building*, (Redwood city, California, California Seismic Safety Commission, Washington D.C) October-1997. (ATC-33 Project) (Applied Technology Council)

[Fema-356 (2000)] Fema-356 . *Federal Emergency Management Agency Prestandard and Commentary for the Seismic Rehabilitation of Building*, Nov-2000.

[Fema-440 ()] Fema-440 . *Federal Emergency Management Agency ,Improvement of Non-Linear Static Seismic Analysis Procedure*, (Redwood city, California, Federal Emergency Management Agency Washington D.C) 2004-2005. 240. (Appliedb Technology Council (ATC-55 Project) 201 Redwood Shores Parkway)

[Seismic Evaluation and Retrofitting of Concrete Builing ATC40] 'Seismic Evaluation and Retrofitting of Concrete Builing'. *ATC40* 1. (Applied Technology Council)