International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

PERFORMANCE BASED PUSHOVER ANALYSIS, CYCLIC LOADING, DETERIORATION EFFECT IN RC MOMENT FRAMES

Afna P.S

M Tech, Structural Engineering and Construction Management, Indira Gandhi Institute of Engineering and Technology, Nellikuzhi, Kerala, India

---

Abstract - *Pushover is a static –nonlinear analysis method where a structure is subjected to gravity loading and monotonic displacement controlled lateral load pattern which continuously increases through elastic and inelastic behaviour until an ultimate condition is reached. As the name states "push over", push the building you reach its maximum capacity to deform. It helps in understanding the deformation and cracking of a structure in case of earthquake and gives you a kind of fair understanding of deformation of building and formation of plastic hinges in the structure. In this project I would like to analyse a multistory RC buildings using different bracing systems by using Etabs software. Push over analysis gives pushover curve which consist of capacity spectrum, demand spectrum, and performance point. It shows the performance point if the building*

1. INTRODUCTION

Earthquakes are very common in every part of the world. In order to resist the buildings from the severe motions many analysis methods were developed. Pushover analysis is a method to evaluate the performance level of building. This paper highlights the performance evaluation of building subjected to seismic load and pushover analysis is done to determine capacity curve, demand curve, and performance point by using different bracings system. The present study the model was designed in Etabs 2015.

1.1 PUSHOVER ANALYSIS

Pushover analysis procedure is a static nonlinear analysis, under permanent gravity loads and progressively increasing lateral loads. Capacity curve, which is base shear against roof displacement can obtained through the pushover analysis. The structural pushover analysis assesses performance by estimating force and deformation capacity and seismic demand using a nonlinear static analysis algorithm. The seismic demand parameters are story drifts, global displacements, story forces, component deformations and component forces.

1.2 Capacity Curve (Pushover Curve)

Capacity curve is evaluated the capability of a building against earthquakes. It is the plot of the total lateral force on a structure, against the lateral deflection of the roof of the structure. Performance point and location of hinges in different stages can be determined in capacity curves as in Figure 2.1. A to B is the elastic range, B to IO represents the immediate occupancy range, IO to LS represents the life safety range, and LS to CP represents the collapse prevention range.

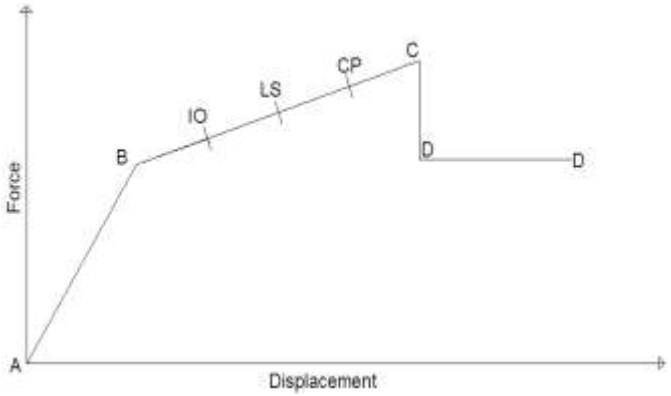

Figure 1: Different phases of plastic hinges.

1.3Demand Curves

It gives the displacement, which is an estimate of the maximum expected response of the building during ground motion.

1.3 Performance level

The main output of a pushover analysis is in terms of response demand versus capacity. If the demand curve intersects the capacity envelope near the elastic range (then the structure has a good resistance. If the demand curve intersects the capacity curve with little reserve of strength and deformation capacity, the structure will behave poor.

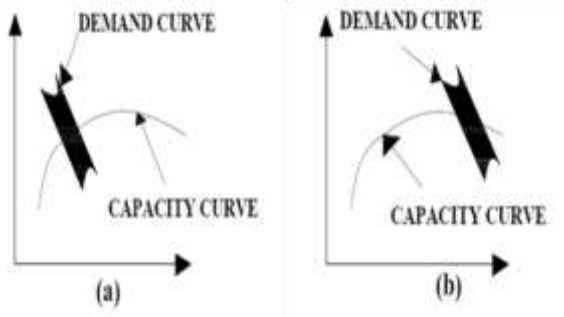

Fig .2 Typical seismic Demand vs. Capacity (a) Safe design (b) Unsafe design

2. DESIGN CONSIDERATIONS

In order to understand the behaviour of reinforced concrete frame with and without bracings.

- 5,10,15 storey building are analysed
- Building with X and inverted v bracings are used.
- The present study deals with 9-different kinds of Building models:
- RC Frame without Bracings in 5, 10,15 storeys.
- 2. Model-1: RC Frame with X Bracings in 5,10,15 storeys.
- 3. Model-2: RC Frame with Inverted V Bracings in 5,10,15 storeys

2.1 PRILIMINERY DATAS

Table 1: Dimensions of Model

No of stories	5,10,15
Height of each storey	3.3 m
Size of beam	300x230mm
Size of column	400x400mm
Concrete Grade	M25
Thickness of slab	125mm
Grade of steel	Fe250
Live Load	4.5 KN/sq.m
Wall Load	10KN/m

3. RESULTS AND DISCUSSION

3.1. Lateral Load analysis

The lateral load analysis is carried out according using IS 1893 Part 1 -2002. The Seismic inputs are shown in Table 2

Table 2: Seismic Inputs

Seismic Zone	0.36
Response reduction factor	5
Important factor	1
Site	2

3.2. Pushover Analysis

The Pushover analysis is performed on the models and the pushover curves is plotted.

4. CONCLUSIONS

4.1 PUSHOVER RESULTS

Table 3

story	Spectrum acceleration g($10^{-}3$)	Spectrum displacement(mm) 10^3
15withoutbracing	170	1.1
15x	85	0.58
15 inverted v	120	0.85
10withoutbracing	98	0.35
10x	50	0.15
10 inverted v	60	0.22
5withoutbracings	68	0.23
5x	40	0.14
5 inverted v	55	0.2

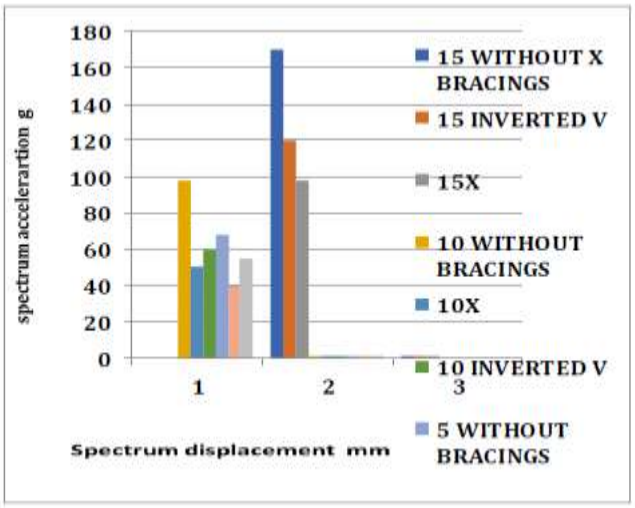

Chart 1: Pushover values of 5,10,15 stories

4.2 HINGE RESULTS OF BEST BRACINGS (X BRACINGS)

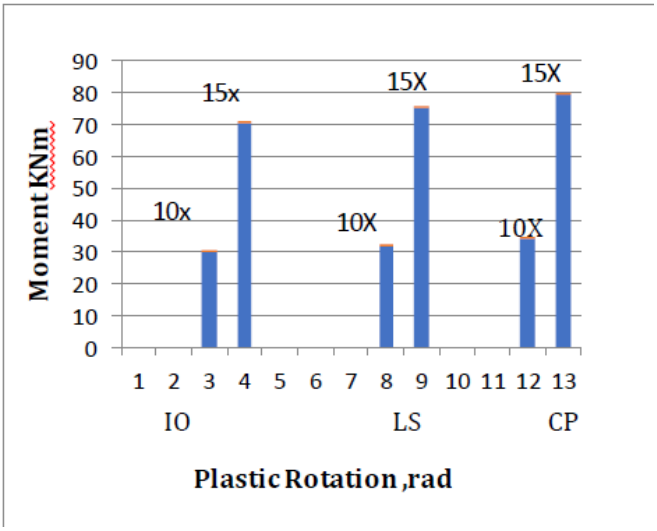

Chart 3: Hinge results of x bracings

5. CONCLUSIONS

 The pushover analysis is a useful tool for assessing the inelastic strength and deformation demands and for exposing design weakness.

 The pushover analysis is a relatively simple way to explore the non-linear behaviour of the structure.

 From the pushover results It is clear that building with x bracings have good performance than inverted v and without bracings.

 The spectrum displacement for the x bracing is 50% lesser than the model without bracing. The inverted v bracing gives only 25% lesser displacement compared to the model without bracing.

REFERENCES

1.Mukul Rathore "Pushover analysis of a multi-storeyed building", International Conference On Engineering Science & Management December 2016 .

2. Nishant Rana "Non-Linear Static Analysis (Pushover Analysis) A Review", International Journal of Engineering and Technical Research Volume-3, Issue-7, July 2015.

3. Komal Joshi " Non-linear static analysis (pushover analysis)", International Journal of Engineering and Technical Research Volume-2, Issue-6, may 2016

4. Mohammad Taghipour(2015) "Seismic Analysis (Non-linear Static Analysis (Pushover) and Nonlinear Dynamic) on Cable - Stayed Bridge",American Journal of Civil Engineering2015