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A Review on Pushover Analysis of Building Using Soft Storey at Different Levels

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ABSTRACT—In India, there has been a huge loss of life and property in the last few decades attributable to earthquake-induced structural failure. A response is now being received to assess the sufficient strength of framed RCC structures to resist solid ground movements. In this project, the seismic response of the RCC building frame in terms of performance point and earthquake forces on the reinforced frame of the building is carried out using displacement analysis. In this method of analysis, the building model is subjected to lateral loads. Pushover analysis can provide substantial insight into the weak links in the seismic concert of the structure and we can know the weak zones in the structure. In this project, efforts have been made to investigate the effect of pushover analysis on lateral displacement and base shear in RCC frames. RCC frames with G+13 are considered, one with soft floor at 3rd, 5th, 8th and 10th floor and the other with normal L-shaped building. Displacement analysis of RCC building frame is done using ETABS static analysis and design software.

KEYWORDS: ETABS, Pushover, Dynamic Analysis, Soft storey, RCC

I. INTRODUCTION

The term earthquake can be used to describe any type of seismic event, either natural or human-initiated, that generates seismic waves. Earthquakes are commonly caused by the rupture of geological faults; but they can also be triggered by other events such as volcanic activity, mine explosions, landslides, and nuclear tests. There are many buildings that have a primary structural system that does not meet current seismic requirements and will suffer extensive damage during an earthquake. According to the IS Seismic Zone Map: 1893-2002, India is divided into four zones based on seismic activities. They are Zone II, Zone III, Zone IV, and Zone V. Some industries typically produce full-scale models and perform extensive testing before producing thousands of identical structures that have been analyzed and designed based on the test results. Unfortunately, this option is not available to the construction industry, making the economics of large-scale creation unfeasible. In India, many existing structures are of Indian Standard Code 456:2000 construction, but to make the building earthquake resistant, IS 1893-2002 should be used to avoid earthquake vulnerability of future buildings.

In general, the loads on these structures are gravity loads only and result in elastic behavior of the structure. However, during a strong seismic event, the structure may actually be subjected to forces exceeding its elastic limit. Since the last earthquake in the last 4 crumbled, in which many concrete structures were severely damaged or collapsed, indicated the need for an evaluation of the seismic suitability of the current building or purpose-built building. Therefore, a structure susceptible to damage must be determined. Simplified linear elastic methods are not suitable to achieve or achieve this goal. Thus, the designer developed a new design method and seismic procedure that includes a performance-based structure towards a non-linear technique.

1.1. Push over Analysis

Pushover analysis, which is an iterative procedure, is considered an alternative to conventional analytical procedures. Displacement analysis of multi-storey RCC framed buildings subjected to increasing lateral forces is carried out until the current performance level (target displacement) is achieved. The promise of performance-based seismic engineering (PBSE) is to create structures with predictable seismic performance.

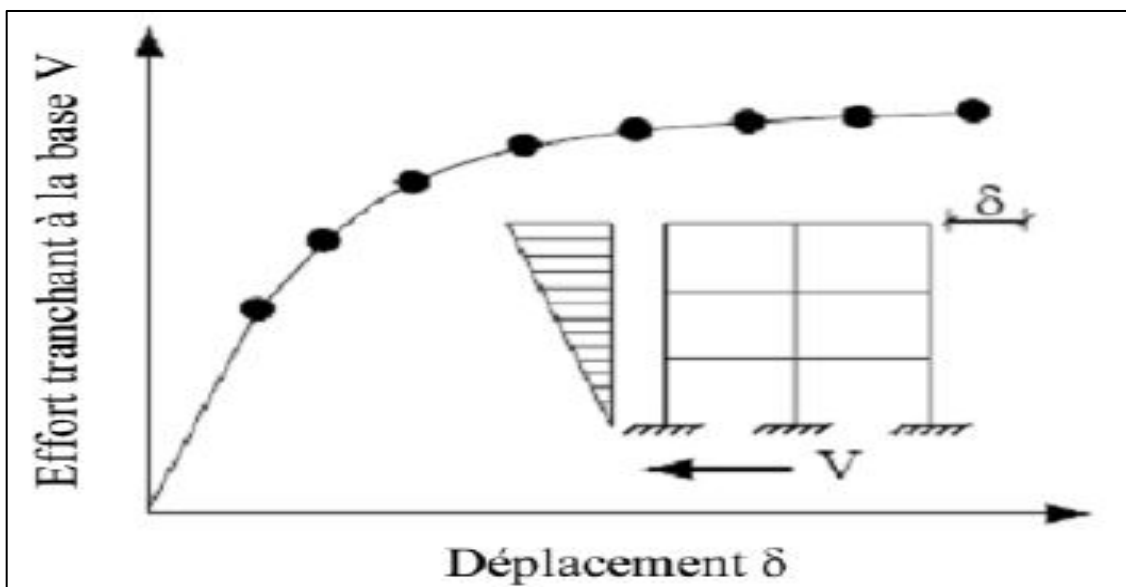


Fig 1: Pushover Curve

II. STATE OF DEVELOPMENT

Sangeetha.S et. al. The rapid discharge of energy in the earth's crust forms seismic waves that arrive at different moments of time with different intensity, they are called earthquakes. It causes a random movement of the earth in all directions, radiating from the epicenter, causing the structure to vibrate, which induces inertial forces in them. Many existing structures are seismically inadequate due to a lack of awareness of the seismic behavior of structures. For this reason, there is a fundamental requirement to reverse this situation and carry out seismic assessment of existing and proposed structures. In this project, the seismic response of the RCC building frame in terms of performance point and earthquake forces on the reinforced frame of the building is carried out using displacement analysis. In this analysis method, the building model is subjected to lateral load and the lateral load force is slowly increased. As a result, a number of cracks, yielding, settling of plastic hinges and failure of many structural components are recorded. Pushover analysis can provide substantial insight into the weak links in the seismic concert of the structure and we can know the weak zones in the structure. In this study, the existing building frame is designed and evaluated as per the Indian standard and also suggests the recommended retrofitting methods to strengthen the existing structure. The displacement analysis of RCC building frame is done using SAP 2000 static analysis and design software.

Patel Jalpa R. et. al. This article deals with the performance analysis of an existing building. The building gate as a case study was Dharti flat, Unjha. It is a G+4 apartment building without an elevator core and a water tank. A typical floor height is 3m. The year of construction of Dharti apartment was 2011. The selection of the existing building was with the intention of finding the capacity of the building to verify its earthquake safety. Each floor has four apartments of almost equal construction. The analysis of the building was carried out for different positions of the shear walls. Typical slab details, terrace slab details, column and foundation details were the four design drawings available for the Dharti flat. The concrete grade was M25 and the reinforcement was Fe415. All beams were 115 mm thick and 420 mm deep unless otherwise noted. All plates were 115 mm thick. Because of the symmetry of the building in plan, the details of the beams were the same on both sides of the axis of symmetry. Figure 1 shows a diagram of the columns and beams of the building. The size of the building column was taken to be 230x460 mm.

VaishnaviV. Deshinge et. al. Elastic static analysis, or pressure analysis, is an ideal method for evaluating seismic performance due to its simplicity. It is a static analysis that directly involves non-linear material characteristics. Inelastic static analysis procedures include the capacitance spectrum method, the displacement coefficient method, and the Secant method. Pushover analysis is a static, nonlinear procedure in which the magnitude of lateral loads is gradually increased while maintaining a predefined distribution of distribution along the height of the building. In this article, in the last 4 defunct collapses, a seismic event has seriously destroyed the R.C building and also human life. Therefore, the question arose about the safety of R.C. building in the future earthquake "how to create an earthquake resistant structure?" there are no ways to evaluate the behavior of a building up to the elastic limit, but it is difficult to



evaluate it beyond the elastic limit. In order to assess the performance of the structure in the event of a future unpredictable earthquake, a static nonlinear pressure analysis was performed. This method provides a level of building performance.

III. SYSTEM DEVELOPMENT

In this work, three G+13 building models for RCC have been developed, for soft floors in different stories will be analyzed in ETAB software. All buildings are subjected to the same earthquake loading to verify their seismic and compressive behavior at the same floor and floor heights. To analyze these models, the compressive force will be analyzed in this work. Details of the methods are given below.

Table 1 Models

Model 1	G+13 without soft storey
Model 2	G+13 with soft storey at 3 rd floor
Model 3	G+13 with soft storey at 5 th floor
Model 4	G+13 with soft storey at 8 th floor
Model 5	G+13 with soft storey at 10 th floor

Table 2 Problem Statement (Model Description)

No.	Parameter	Values
1	Number of storey	G+13
2	Base to plinth	1.5m
3	Floor height	3m
4	Materials	Concrete M25 and Reinforcement Fe 500
5	Grid spacing	4 m grids in X-direction and 4m grids in Y- direction. 10 No
6	Size of column	380 mm x 400 mm
7	Size of beam	250mm x 380 mm
8	Depth of slab	150 mm
9	Dead load	In ETABS the software itself calculates the dead loads by applying a self-weight multiplier factor of one which is taken by the structure and the rest load cases are kept zero. Its defined in the load cases section.
10	Live load on roof and floors	2 kN/m ² (roof) and 4 kN/m ² (Floors) as per IS:875 (part - 2)
11	Floor finish on roof and floors	1.5 kN/m ² as per IS:875 (part -2)
12	Wall load on all levels	7.8 kN/m
13	Type of structure	Special RC moment resisting frame
14	Seismic zone	III
15	Location	Pune
16	Zone factor (Z)	0.16
17	Type of soil	Rock or Hard Soil
18	Damping	5 %
19	Response spectra	As per IS 1893 (part 1):2016

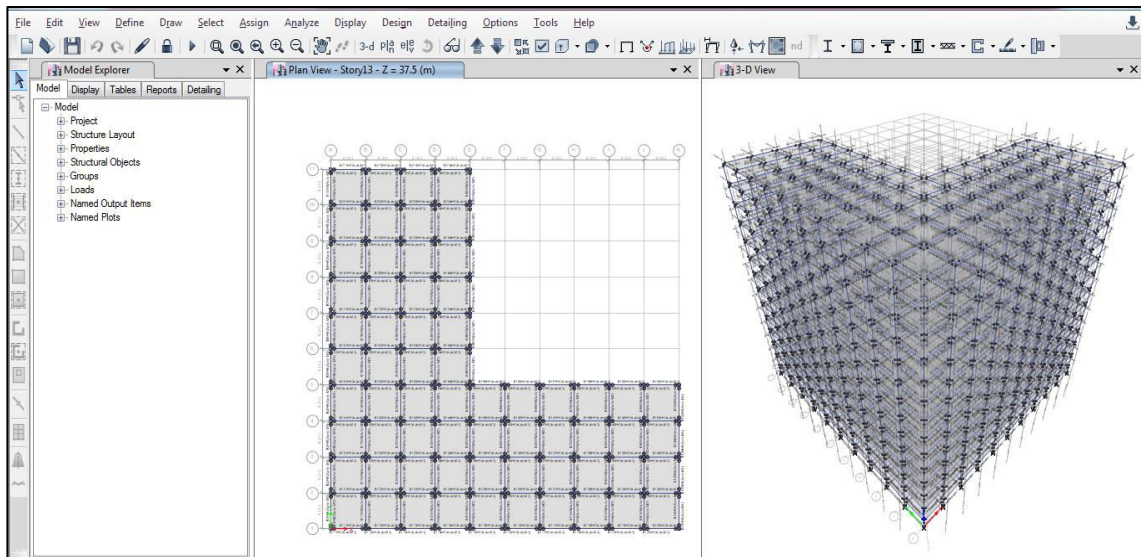


Fig 1 L shape building G+13 without soft storey

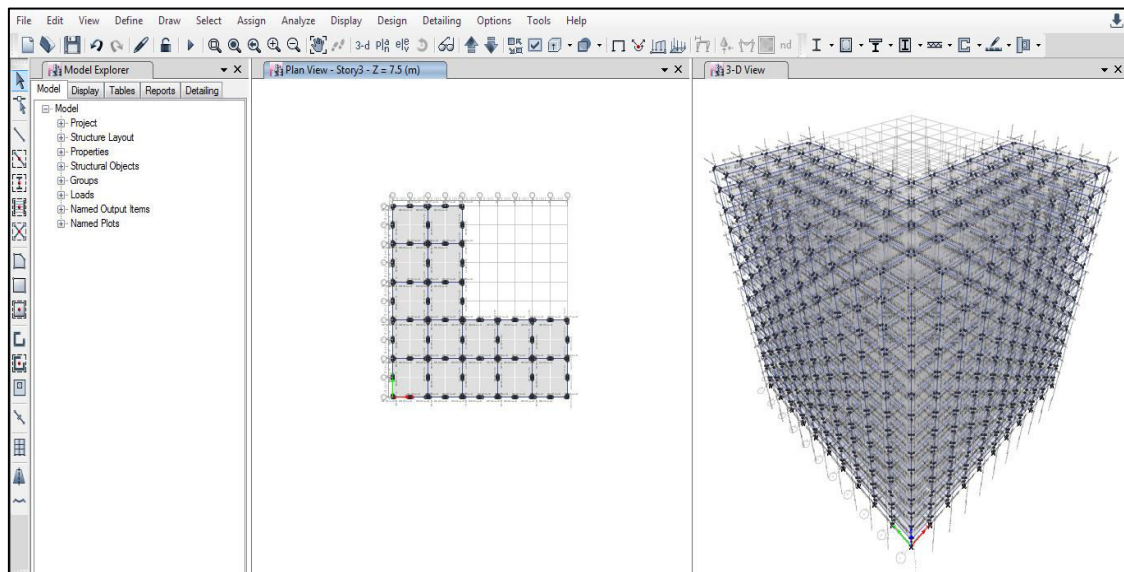


Fig 2 L shape building G+13 with soft storey at 3rd floor , 5th floor , 8th floor , 10th floor

3.1. Check for the soft storey (Model - Soft storey at 8th floor)

Table 3 Check As per IS 1893 - Using Stiffness

USING STIFFNESS				
Level	Stiffness	K_i/K_{i+1}	$K_i/((K_{i+1}+K_{i+2}+K_{i+3})/3)$	Check
	KN/m	0.7	0.8	
15				
14				
13	374211.821	-		
12	451423.047	1.21	3.618990809	OK
11	469243.116	1.04	1.705026523	OK
10	473873.626	1.01	1.097880183	OK



9	457036.721	0.96	0.983199027	OK
8	377678.728	0.83	0.809222856	Soft Storey
7	369572.123	0.98	0.847260909	OK
6	474975.964	1.29	1.18321232	OK
5	493347.212	1.04	1.210938606	OK
4	497960.799	1.01	1.116591409	OK
3	503364.427	1.01	1.029877777	OK
2	519360.846	1.03	1.042424078	OK
1	621396.045	1.20	1.225886243	OK
GB	3542257.20	5.70	6.463496032	OK

IV. CONCLUSION & FURTHER STUDY

This article focuses only on a literature review of previously published studies. From the research study analysis is done using software like STAAD Pro, ETABS, SAP2000 etc. The future scope of the work is analytical models of soft story as per given data in above chapters in ETABS for pushover analysis and check its soft story for stiffness as per IS code as per following.

REFERENCES

1. Sangeetha.S “Pushover Analysis For Seismic Assessment Of RCC Building” (IRJET)Volume: 04 Issue: 06 | June - 2017
2. Patel Jalpa R. “Pushover analysis of an existing R.C.C. building with use of software e-tabs” © 2016 IJEDR | Volume 4, Issue 4 | ISSN: 2321-9939
3. VaishnaviV. Deshinge “Pushover Analysis of R.C.C Building A Review” ISBN 10th march 2018
4. Achyut S. Naphade “Pushover Analysis Of RCC Building With Soft Storey At Different Levels.”ISSN: 2320–334X
5. Akshay V. Raut “Pushover Analysis of G+3 Reinforced Concrete Building with soft storey” ISSN: 2320-334X, Volume 11, Issue 4 Ver. I (Jul- Aug. 2014)
6. Noor Mohammed “Non-Linear Pushover Analysis of RCC Building with Base Isolation System” ISSN: 2277-9655 August, 2016
7. Yousuf Dinar “Descriptive Study of Pushover Analysis in RCC Structures of Rigid Joint” ISSN: 2320-334X, Volume 11, Issue 1 Ver. II (Jan. 2014)
8. Kadid “Pushover Analysis of Reinforced Concrete Frame Structures” Asian Journal vol. 9, NO. 1 (2008)



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