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Study the Effect of Push Over Analysis for G+15 STORY R.C.C Structure with and without Zipper Frame using Sap-2000

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Abstract **-The modern earthquakes including the last Algerian earthquake in which many concrete structures have been severely damaged or failed have shown the need for assessing the seismic capacity of existing buildings. In particular, the improvement of older concrete structures in high seismicity areas is a focus of increasing concern, since structures venerable to damage must be identified and an adequate level of safety must be determined. To make such an assessment, simplified linear-elastic methods are not sufficient. Thus, the structural engineering community has developed a new generation of design and seismic procedures that include performance-based structures and are moving away from Simplified linear elastic methods and towards a more non-linear technique. Modern concerns in the development of performance-based codes for the design or improvement of buildings in seismic alert areas show that an inelastic procedure commonly referred to as the pushover analysis is a viable approach to assess damage vulnerability of buildings. Pushover analysis is a range of incremental static analysis carried out to produce a capacity curve for the structure. Based on the capacity curve, a target displacement which is an evaluation of the displacement that the design earthquake will produce on the building is determined. The extent of damage encountered by the structure at the target displacement is estimated representative of the damage experienced by the building when subjected to design level ground shaking. Many methods were presented to apply the nonlinear static pushover (NSP) to buildings. Certain systems can be listed as (a) the capacity spectrum method (CSM) (b) the displacement coefficient method (DCM) (FEMA-356), (c) ATC 40 and (d) modal pushover analysis (MPA).**

In this paper Study the effect of Push over analysis for G+15 STORY R.C.C Structure with and without Zipper frame by using SAP-2000 software. Also for the increasing performance of R.C.C. framed structure types of bracing systems are used in framed structure for seismic design such as Zipper braced frame. Improving seismic behaviour of structure by the new bracing system is called zipper braced frame.

Key Words*: *Push-over analysis, Zipper bracing, SAP-2000, Hinges formations etc.

1. INTRODUCTION

Nonlinear Static Analysis (PUSH-OVER): The nonlinear static analysis uses the simple inelastic approach which differs from a traditional static linear procedure that reduces seismic forces to levels that allow designing buildings under the assumption that they remain. Though chimerical and doubtless offensive, this oversimplified approach works well for brand spanking new buildings and typical existing buildings.

Secant Method- When the analysis of building is complete with the Secant technique, a worldwide elastic model of the structure made. The stiffness values calculated for the modelled parts and parts. In general, the response spectrometry can predict a unique displacement pattern than assumed. The pushover curves area unit accustomed to choose a brand new set of part secant stiffness supported the displacements foretold by the world analysis.

Method of Pushover Analysis

a. Load Control: It is used once the load is thought (such as gravity load) and also the structure is predicted to be able to support the total magnitude of the load that is applied in this procedure steps.

b. Displacement Control: In this methodology, the magnitude of the load combination is exaggerated or diminished as necessary until the management displacement reached a predefined price. it is used once specified drifts are unit wanted, the magnitude of the applied load isn't acknowledged before, the structure is often expected to lose strength or become unstable or once displacement occurring within the design earthquake is understored.

The pushover analysis of a structure may be a static non-linear analysis underneath permanent vertical masses and step by step increasing lateral masses. The equivalent static lateral masses or so represent earthquake evoked forces. A plot of the entire base shear versus high displacement in an exceedingly structure is obtained by this analysis that may indicate any premature failure or weakness.

Non-Linear Static Pushover Analysis- The existing building will become seismically deficient since seismic design code needs are unit perpetually upgraded and improvement in engineering data. Further, Indian buildings engineered over the past 20 years are system seismically deficient owing to lack of awareness concerning seismic behavior of structures.

Zipper Bracing Frame:

- One of the practical ways to prevent these frames undergoing large lateral displacements is to use diagonal members, called brace.
- A-frame in which bracing is used called braced frames.

- This system is similar to Chevron system, but only just one additional element, which was a vertical structural member, connected at the top and down to the beams at the this vertical strut named as the zipper, and a frame in which zipper braces were added called zipper brace frame.
- These members increase the lateral stiffness of the frame and enhance the capacity of the energy dissipation by plastic deformations. Adding steel braces enhance greatly the strength capacity of the buildings on the dynamic characteristic of the building the zipper bracing systems are found the most efficient.

2. PRELIMINARY DATA CONSIDERED FOR THE ANALYSIS:

Building Details:-

1) Architectural details:-

To study the behavior of RCC building under high Seismic forces as here taken

- Area covering : 24.5 x 19.5 m.
- Total Height of the building : 45 m
- Floor to Floor Height : 3 m

- Column Details:

Floor Level	Rcc Without Zipper (MM)	Rcc With Zipper Frame (MM)
Foundation to Ground	230X600	230X600
Ground to 10th floor	230X600	230X600
10th to 15th floor	230X530	230X530

- Beam Details:

Floor Level	Rcc Without Zipper	Rcc With Zipper Frame
Foundation to Ground	230X600	230X600
Ground to 10th floor	230X530	230X530
10th to 15th floor	230X450	230X450

3-D model is being prepared for the frame nonlinear static analysis of the building in SAP-2000 software

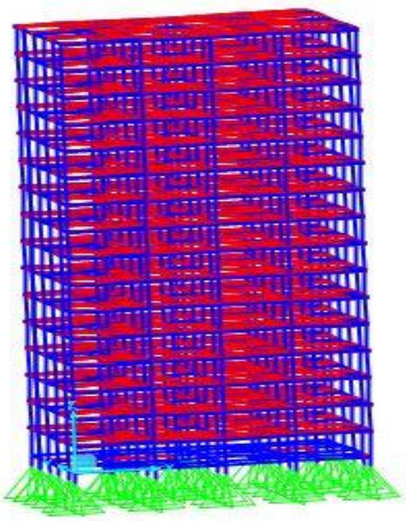


Fig 01: Shows The Skeleton Model And 3d View Of The Structure without Zipper Frame

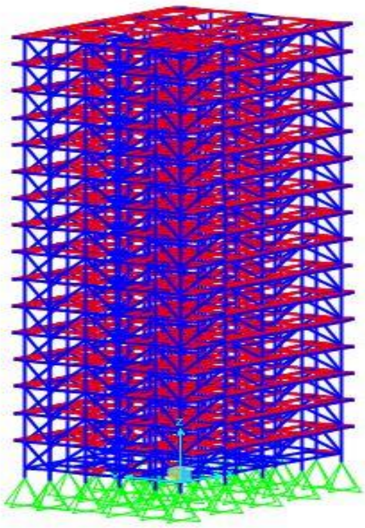


Fig 02: Shows the Skeleton Model And 3d View Of The Structure with Zipper Frame

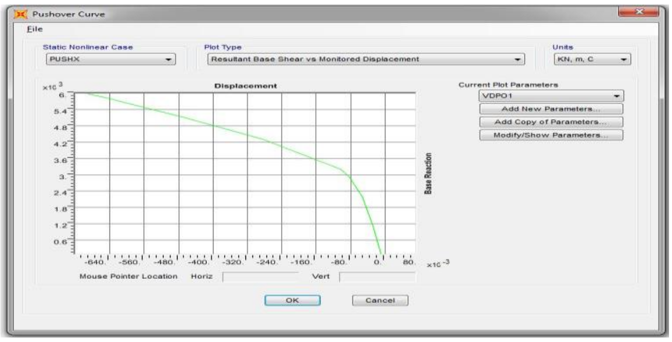
4. RESULTS: -

(A) Time Period Of The Structure Under Earthquake Load Consideration (For Normal Frame)

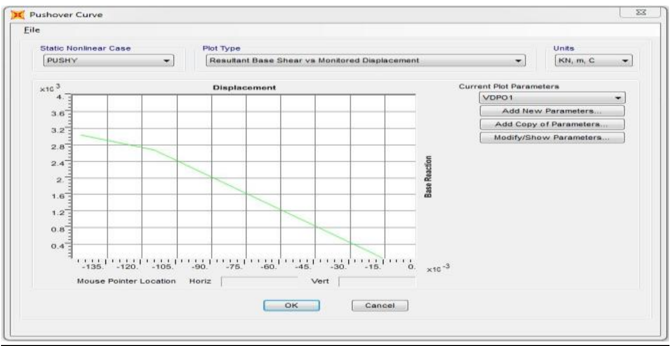
Mode	Time Period In Sec For Normal Frame	Time Period In Sec For Zipper Frame
1	3.54	2.02
2	3.05	1.69
3	2.65	1.19

A) Base shear Vs displacement in both directions

1) RCC normal frame –

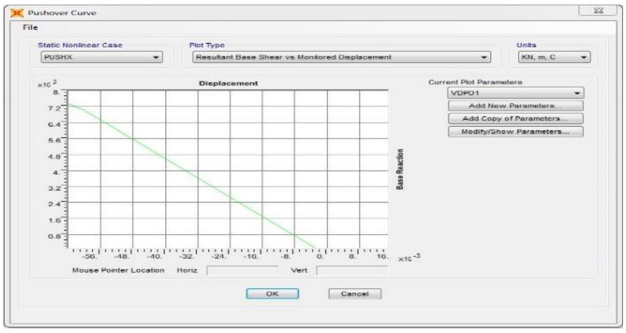


Graph-01 Base shear V displacement in push X direction

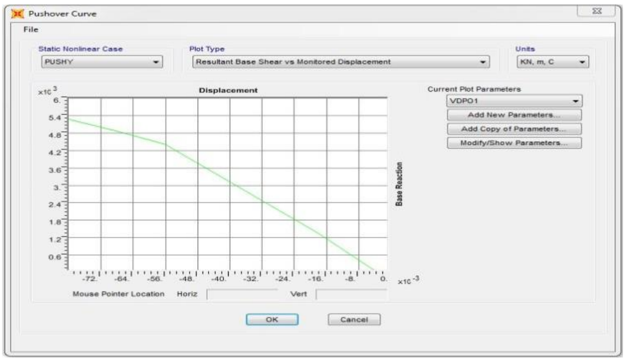


Graph-02 Base shear V displacement in push Y direction

2) RCC Zipper frame –



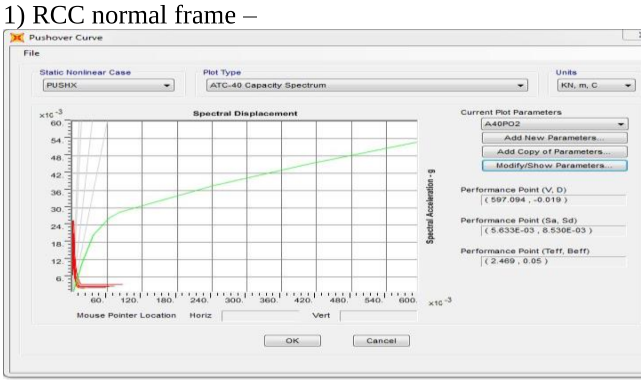
Graph-03 Base shear V displacement in push X direction



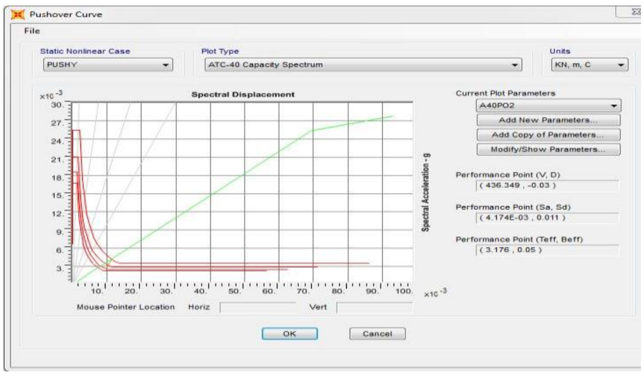
Graph-04 Base shear V displacement in push Y direction

B) Spectral Acceleration Vs Spectral Displacement in Both Directions

1) RCC normal frame –

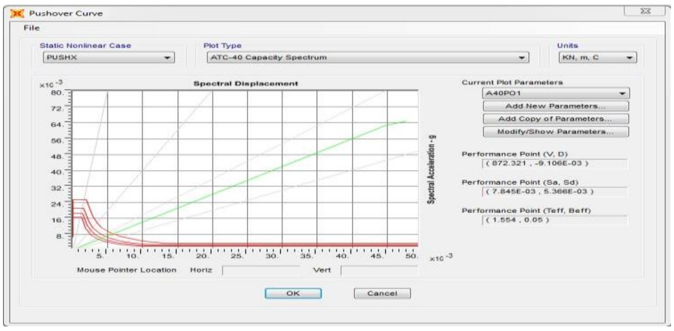


Graph-05 SpectralAcceleration V Spectral Displacement In Push X Direction

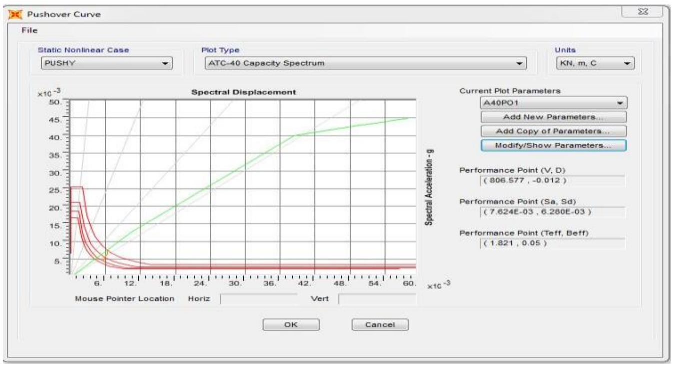


Graph-06 Spectral Acceleration V Spectral Displacement In Push Y Direction

2) RCC Zipper frame –



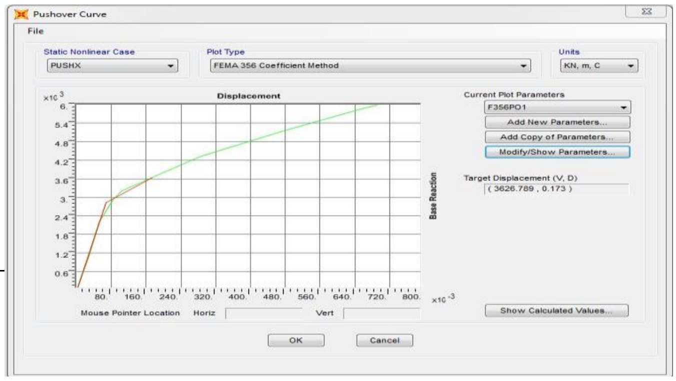
Graph-07 Spectral Acceleration V Spectral Displacement In Push X Direction



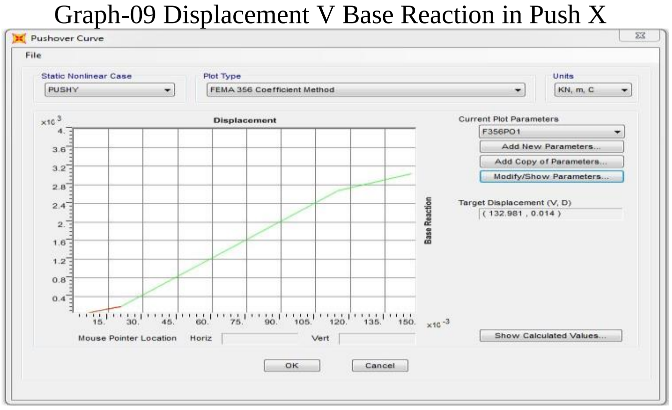
Graph-08 Spectral Acceleration V Spectral Displacement In Push Y Direction

C) FEMA 365 Displacement V base reaction in both directions

1) RCC normal frame –



Graph-09 Displacement V Base Reaction in Push X



Graph-10 Displacement V Base Reaction in Push Y

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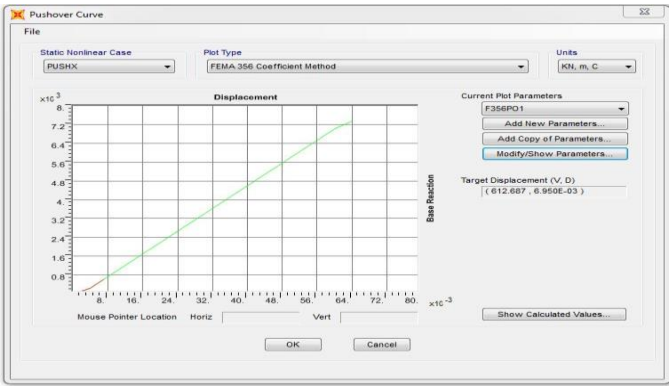
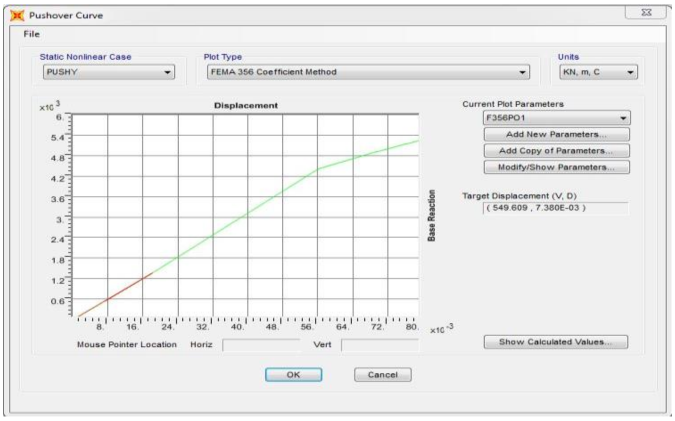
2) RCC Zipper frame –



Graph-11 Displacement V Base Reaction in Push X



Graph-12 Displacement V Base Reaction in Push Y

D) Push over result for FEMA 365-

TABLE: Pushover Results - FEMA356				
Output Case	**Step Type**	**Step No.**	**Base Force**	**Displacement**
Text	Text	Unless	KN	m
PUSHX	Step	0	0	0
PUSHX	Step	1	0.028	1116.33084
PUSHX	Step	2	0.052	2195.4332
PUSHX	Step	3	0.083	2930.006451
PUSHX	Step	4	0.104	3207.946532
PUSHX	Step	5	0.284	4309.060667
PUSHX	Step	6	0.469	5119.075893
PUSHX	Step	7	0.651	5835.762419
PUSHX	Step	8	0.692	5986.801334
PUSHY	Step	0	0	0
PUSHY	Step	1	0.02	190.984229
PUSHY	Step	2	0.115	2673.290432
PUSHY	Step	3	0.147	3038.317143

TABLE: Pushover Results - FEMA356				
Output Case	**Step Type**	**Step No**	**Base Force**	**Displacement**
Text	Text	Unitless	KN	m
PUSHX	Step	0	0	0
PUSHX	Step	1	0.00379	233.032171
PUSHX	Step	2	0.06	7028.457419
PUSHX	Step	3	0.064	7326.948285
PUSHY	Step	0	0	0
PUSHY	Step	1	0.018	1356.755434
PUSHY	Step	2	0.056	4423.971782
PUSHY	Step	3	0.069	4925.852674
PUSHY	Step	4	0.069	4921.352429
PUSHY	Step	5	0.07	4923.509679
PUSHY	Step	6	0.076	5138.504648
PUSHY	Step	7	0.076	5140.958119
PUSHY	Step	8	0.079	5228.446584
PUSHY	Step	9	0.079	5227.706226
PUSHY	Step	10	0.079	5227.971507
PUSHY	Step	11	0.079	5234.276417
PUSHY	Step	12	0.08	5271.169366
PUSHY	Step	13	0.08	5273.113869

E) Different Hinges Forms On Different Steps In Both Directions-

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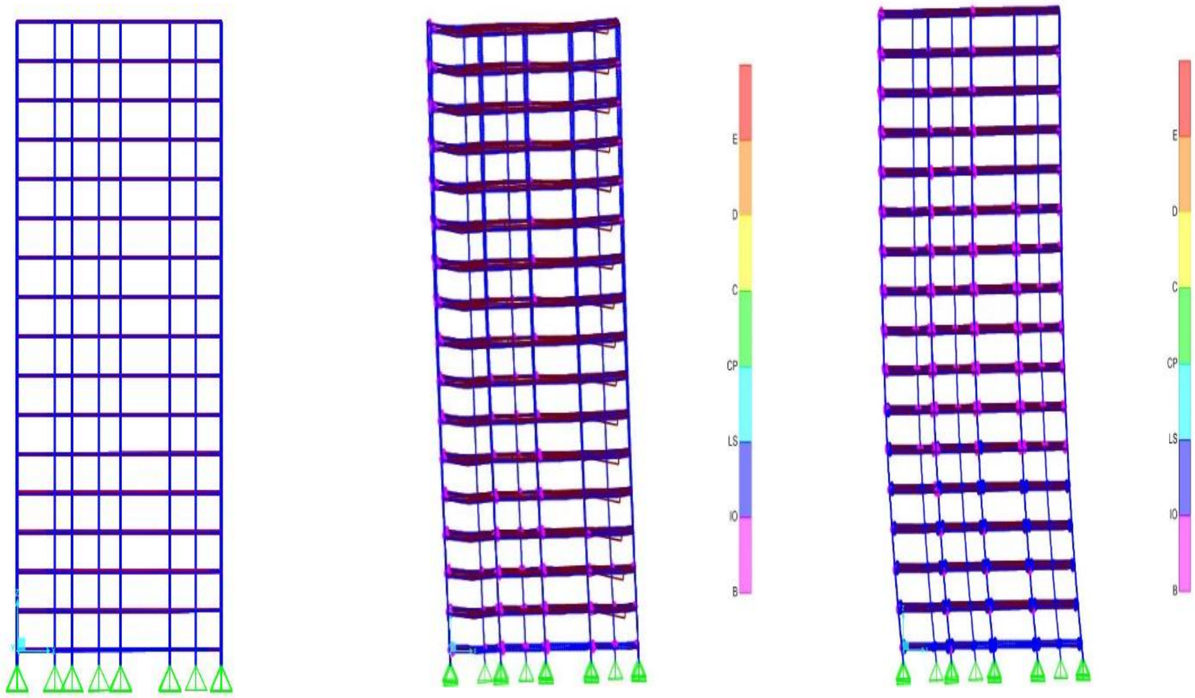
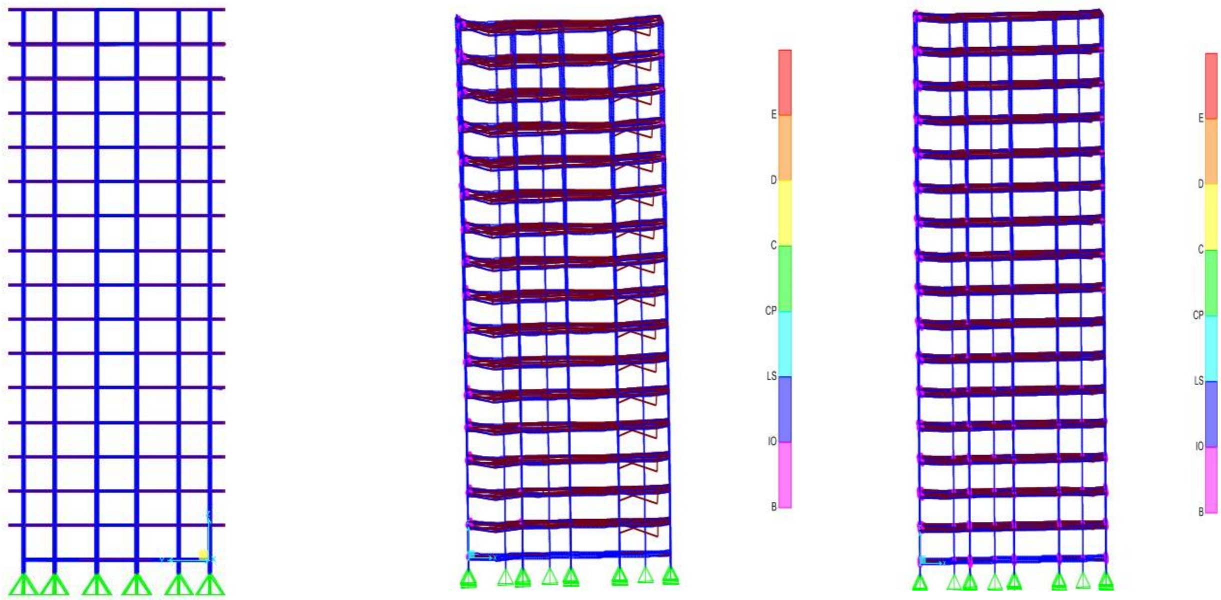
1) RCC normal frame:-

(A) Hinges Formed in Push X –



(B) Hinges Formed In Push Y



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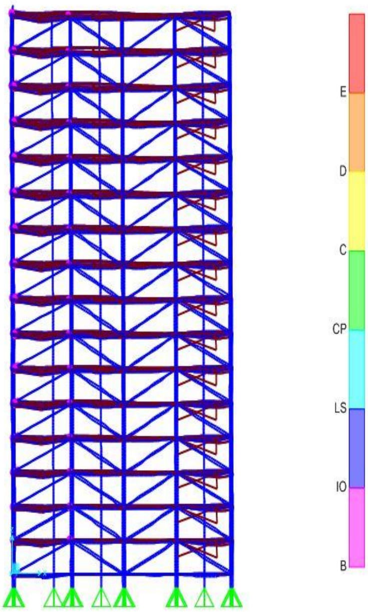
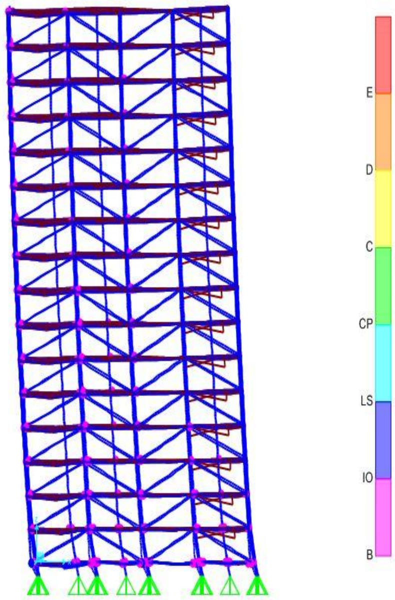
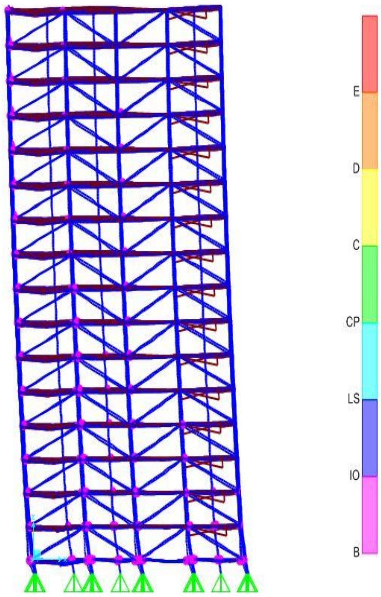
2) RCC Zipper frame:-

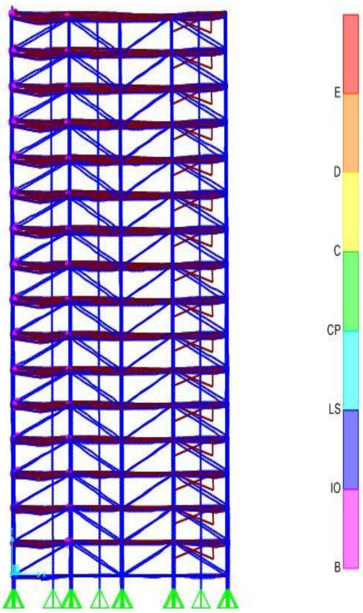
(A) Hinges Formed In Push X-

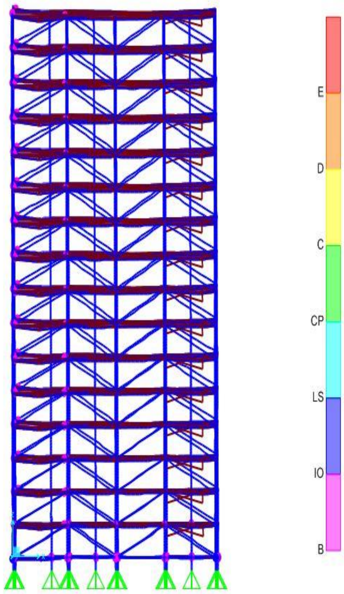


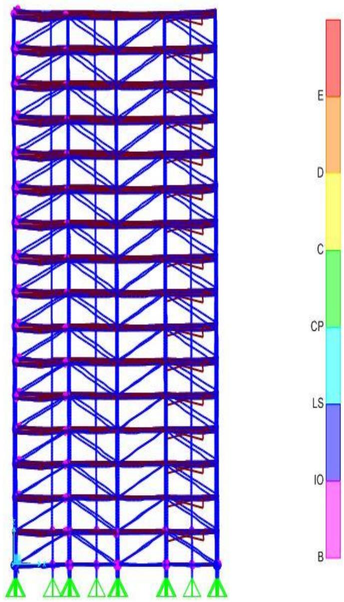




B) Hinges Formed In Push Y-







5. CONCLUSIONS:

1} The displacement values for RCC normal building (without Zipper brace frame is increasing when compared with the Zipper brace frame displacement.

2} The hinges formed in Zipper braced frame model are comparatively less than that of Without zipper frame model.

3} Due to high stiffnes in Zipper frame model the hinges are not going towards collaps, the hinges are going upto life safety.

4} After applying the zipper frame the model stiffness is increasing due to that the time period is less .

5} Displacement in all cases of Pushover analysis are going to increasing in normal model and decreasing in Zipper braced frame model as shown in above graph.

6} The pushover analysis are helping to understand the model behavior and its demand as well as capacity as shown in above results.

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