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ANALYSIS OF REINFORCED CONCRETE FRAMED STRUCTURE(G+15) WITH STEEL BRACING SYSTEM USING ETABS

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Abstract - *Earthquakes represent one of the largest potential sources of casualties and damage for inhabited areas due to a natural hazard. There was a need to control the damage caused by earthquake to the existing buildings. Many strengthened solid structures need retrofit to overcome inadequacies to oppose seismic loads. Bracing was the best technique which can be used to existing reinforced concrete buildings. Steel bracing is economical, simple to erect, involves less space and has adaptability to plan for meeting the required strength and stiffness. The current work manages investigation of impact of steel bracings on RC outlined structures. With the end goal of this review, built up concrete outlined building (G+15) was displayed and broke down in three sections 1) Model without steel bracings and shear wall 2) Model with various propping framework 3) Model with shear wall. Bracings and shear walls were set at the center inlets and this multitude of models were investigated for seismic powers at various seismic zones utilizing E tabs 2015 programming. To figure out seismic execution of steel propping and shear wall to RCC building, boundaries as Lateral dislodging and Story shear should be examined. It was found that the chevron kind of steel propping was viewed as additional proficient in zones II&III and V sort of supporting was viewed as additional productive in Zones IV&V.*

***Key Words*: BRACING SYSTEMS, ,ZONE II,III,IV,V.**

1. INTRODUCTION

Propped outlines are known to be productive primary frameworks for structures under high parallel loads, for example, seismic or wind loadings. The way that the horizontal obstruction of edge can be fundamentally worked on by the expansion of a propping framework has prompted retrofitting seismically lacking supported substantial casings with steel propping framework. Steel supporting frameworks have both down to earth and financial benefits. The expected benefit of supporting framework is the relatively little expansion in mass related with the retrofitting plan since this is an extraordinary issue for a few retrofitting strategies.

1.2 STEEL BRACINGS

On a worldwide premise of opposing tremor loads, shear walls are usually utilized in RC outlined structures, while steel supporting is most frequently utilized in steel structures. Over the most recent twenty years, various reports have additionally demonstrated the viable utilization of steel propping in RC outlines. There are quantities of potential outcomes to organize steel bracings, for example, quantities of potential outcomes to orchestrate steel bracings like Diagonal, X, K, V, Inverted V or chevron and worldwide sort concentric bracings. The propping frameworks can be gathered by their area in the built up substantial edges as inward or outside and as per their association style as erratic or concentric supporting framework

2. LITERATURE REVIEW

Study on the Heat of Hydration and Strength Prof. Bhosle Ashwini Tanaji and Prof. Shaikh A. N (2015) studied the seismic analysis of reinforced concrete (RC) structures with various sorts of propping .The supporting were accommodated fringe segments and at any two equal sides of building model. A thirteen-story building is taken for examination which is situated at seismic zone III according to IS 1893: 2002 utilizing ETABS programming. The rate decrease in story uprooting is found out. The paper expresses that the X sort of substantial propping fundamentally adds to the primary firmness and lessens the most extreme story float of the edges. The supporting framework works on the firmness and strength limit as well as the uprooting limit of the construction.

Hussain Imran K.M and Sowjanya G.V (2014) studied the stability analysis of rigid steel frames with and without bracing systems under the effect of seismic and wind loads. For this project they had taken five models in which one is without bracing structure and four models with different bracing systems and analysed the response of buildings with and without bracings systems subjected to seismic load and wind load using ETABS. The model is analysed by equivalent static analysis as per IS 1893:2002. Effect of Wind Loads on the Structural Systems are analysed and compared as per IS 875 (part 3).Finally they came into a conclusion that for highly affected earthquake zones and for different wind speeds the structure having X- type Bracings are highly effective type of bracing style.

3. METHODOLOGY, MODELLING AND ANALYSIS OF FRAMES

The current work manages investigation of impact of steel bracings on RC outlined structures. With the end goal of this review, six models of built up concrete outlined building (G+15) fortified with various kinds of concentrically supported casings and shear walls in different seismic zones (i.e., zone-II, III, IV and V) is chosen. The casings in each floor were dissected and intended for gravity loads according to IS 456:2000 and for parallel burdens (tremor loads) according to IS 1893:2002 (section 1)

3.1 STRUCTURAL CONFIGURATION

Following are the different types of models:-

- Model without bracings and shear wall(Base model)
- Model with V Bracing
- Model with Chevron Bracing(Inverted V Bracing)

3.2 ETABS 2015

ETABS 2015 is a program intended for structures plan and primary investigation. ETABS 2015 offers 3D item based demonstrating and representation devices, quick straight and nonlinear logical power, modern and extensive plan capacities for many materials, and keen realistic showcases, reports, and schematic drawings.

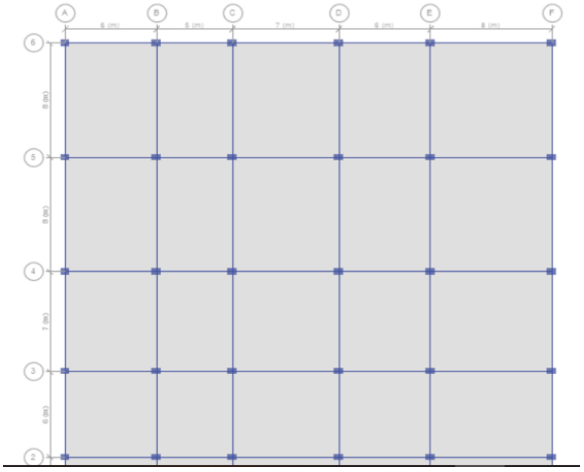

Fig 3.1 plan of building

Table 3.1: Description of the Building

General Description	
Plan dimension	32 x 35 m
Structure	OMRF
No. of storey	G + 15
Floor to floor height	3.00 m
Foundation type	Isolated footing	
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Soil strata	Medium	
Member Properties		
Slab Thickness		200mm
Beams	Plinth Beam	350 x 350 mm
	Floor Beam	300 x 550 mm
Columns		450 x 600mm
Wall Thickness	Exterior wall	230mm
	Interior wall	115mm
Shear wall thickness		230mm
Steel Bracing Size		ISMB300
Material Properties		
Grade of concrete		M30
Grade of steel		Fe 550
Density of concrete		25 kN/m^3
Density of brick		19.20 kN/m^3
Modulus of elasticity of concrete		27400 N/mm^2
Modulus of elasticity of steel		2×10^5 N/mm^2
Load Intensities		
Floor finish	1 KN/m^2	
Live load	2 KN/m^2	

Table 3.2: Parameters of Earthquake Loads Considered for the Study

Parameters		values
Seismic Zone Factor	Zone 5	0.36
	Zone 4	0.24
	Zone 3	0.16
	Zone 2	0.10
Importance factor		1.0
Response reduction factor		3.0
Percentage of damping		5%
Soil type		Medium soil

4. RESULTS AND DISCUSSIONS

A detailed study was conducted to evaluate the performance of concrete structures under seismic loading with and without lateral load resisting elements. Results of Response Spectrum Analysis have been used to observe and compare floor response of all the models.

- Comparison of seismic performance of Models with Different Bracing system from zone 2 to zone 5.

4.1 Comparison of Seismic Performance of Models with Different Bracing system from Zone 2 to Zone 5.

The following result shows the variation of Story Displacement for different braced building in various seismic zones

Table 4.1: Comparison of Story Displacement of different braced models in Zone 2

Story	Elevation m	Location	Base Model mm	V Bracing mm	Chevron Bracing mm
Story15	45	Top	27.2	17.2	11.9
Story14	42	Top	26.8	16.7	12.8
Story13	39	Top	25.7	15.9	13.6
Story12	36	Top	24.6	15.2	14.2
Story11	33	Top	23.5	14.8	14.6
Story10	30	Top	22.7	14	13.9
Story9	27	Top	21.5	12.9	12.8
Story8	24	Top	19.8	11.8	11.6
Story7	21	Top	17.8	10.5	10.3
Story6	18	Top	15.5	9.1	9
Story5	15	Top	13	7.7	7.6
Story4	12	Top	10.4	6.4	6.3
Story3	9	Top	7.7	5.1	5
Story2	6	Top	4.9	3.8	3.8
Story1	3	Top	1.7	2.8	2.9
Base	0	Top	0	0	0

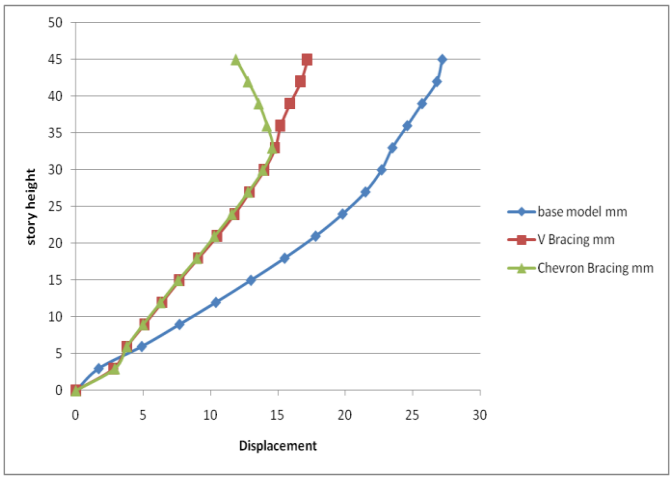

Fig 4.1: Comparison of Story Displacement of different braced models in Zone 2

Table 4.2 Comparison of Story Displacement of different braced models in Zone 3

Story	Elevation m	Location	Base Model mm	V Bracing mm	Chevron Bracing mm
Story15	45	Top	41.3	26.1	19.6
Story14	42	Top	40.5	25.3	20.9
Story13	39	Top	39.7	24.9	21.8
Story12	36	Top	38.4	24.3	22.6
Story11	33	Top	37.5	23.9	23.7
Story10	30	Top	36.3	22.4	22.3
Story9	27	Top	34.3	20.7	20.5
Story8	24	Top	31.6	18.8	18.6
Story7	21	Top	28.4	16.8	16.5
Story6	18	Top	24.7	14.6	14.4
Story5	15	Top	20.8	12.4	12.2
Story4	12	Top	16.6	10.2	10
Story3	9	Top	12.3	8.1	8
Story2	6	Top	7.8	6.1	6.1
Story1	3	Top	2.6	4.4	4.5
Base	0	Top	0	0	0

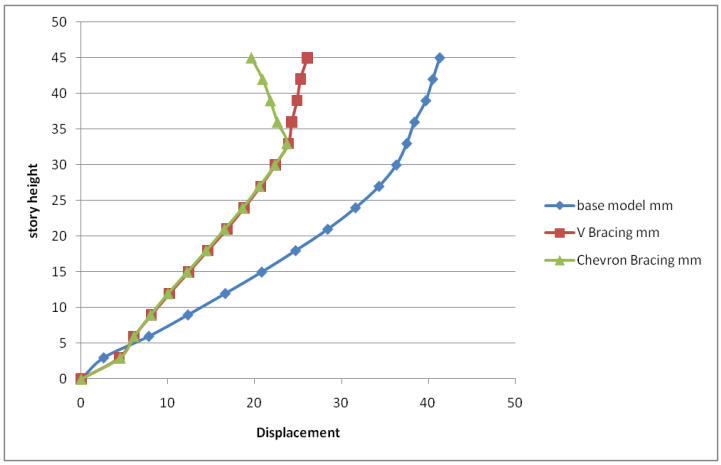

Fig 4.2 Comparison of Story Displacement of different braced models in Zone 3

Table 4.3 Comparison of Story Displacement of different braced models in Zone 5

Story	Elevation m	Location	Base Model mm	V Bracing mm	Chevron Bracing mm
Story15	45	Top	88.8	56.1	49.6
Story14	42	Top	87.7	55.6	50.7
Story13	39	Top	86.4	54.7	51.7
Story12	36	Top	85.6	53.9	52.4
Story11	33	Top	84.4	53.2	53.4
Story10	30	Top	81.7	50.1	50.3

Story9	27	Top	77.3	46.2	46.6
Story8	24	Top	71.2	41.9	42.4
Story7	21	Top	63.9	37.2	37.7
Story6	18	Top	55.6	32.3	32.8
Story5	15	Top	46.7	27.4	27.8
Story4	12	Top	37.3	22.6	22.9
Story3	9	Top	27.6	18	18.2
Story2	6	Top	17.5	13.7	13.7
Story1	3	Top	5.9	10	9.9
Base	0	Top	0	0	0

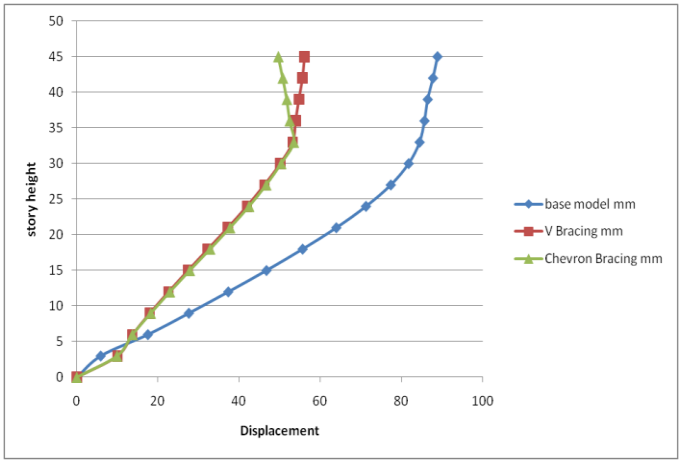

Fig 4.3 Comparison of Story Displacement of different braced models in Zone 5

4.2 Story Shear

The following result shows the variation of Story Shear for different braced building in various seismic zones

Table 4.4Comparison of Story Shear of different braced models in Zone 2

Story	Elevation m	Location	Base Model KN	V Bracing KN	Chevron Bracing KN
Story15	45	Top	87.24	44.782	40.289
Story14	42	Top	99.86	66.298	86.2854
Story13	39	Top	110.87	110.268	100.2897
Story12	36	Top	142.008	152.287	162.798
Story11	33	Top	176.6095	337.6879	328.3968
Story10	30	Top	335.092	642.8866	624.5052
Story9	27	Top	462.9	889.16	863.450
			798	73	5
Story8	24	Top	563.5509	1082.843	1051.357
Story7	21	Top	640.0833	1230.225	1194.35
Story6	18	Top	695.8549	1337.628	1298.554
Story5	15	Top	734.1439	1411.363	1370.093
Story4	12	Top	758.2281	1457.744	1415.092
Story3	9	Top	771.3857	1483.082	1439.675
Story2	6	Top	776.8946	1493.691	1449.968
Story1	3	Top	777.2459	1494.374	1450.629
Base	0	Top	0	0	0

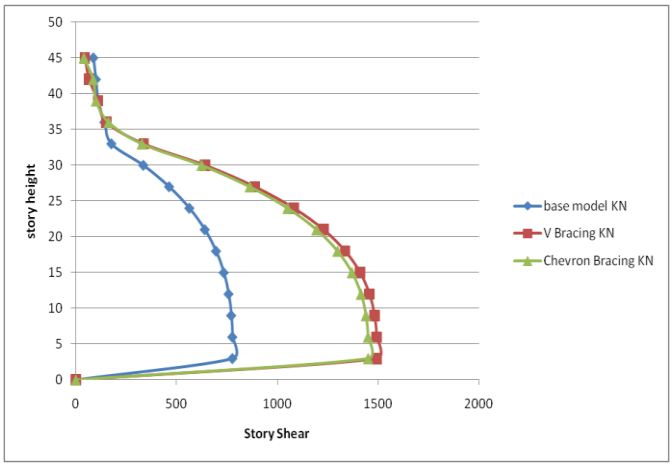

Fig 4.4: Comparison of Story Shear of different braced models in Zone 2

Table 4.5: Comparison of Story Shear of different braced models in Zone 4

Story	Elevation m	Location	Base Model KN	V Bracing KN	Chevron Bracing KN
Story15	45	Top	190.26	86.244	98.4756
Story14	42	Top	247.58	147.2598	153.29
Story13	39	Top	350.21	272.296	232.276
Story12	36	Top	410.74	501.285	410.2569
Story 11	33	Top	423.8627	810.451	788.1524

Story 10	30	Top	804.2208	1542.928	1498.813
Story 9	27	Top	1111.152	2134.002	2072.281
Story 8	24	Top	1352.522	2598.823	2523.257
Story 7	21	Top	1536.2	2952.541	2866.44
Story 6	18	Top	1670.052	3210.307	3116.529
Story 5	15	Top	1761.945	3387.272	3288.223
Story 4	12	Top	1819.748	3498.585	3396.22
Story 3	9	Top	1851.326	3559.396	3455.221
Story 2	6	Top	1864.547	3584.857	3479.923
Story 1	3	Top	1865.39	3586.497	3481.509
Base	0	Top	0	0	0

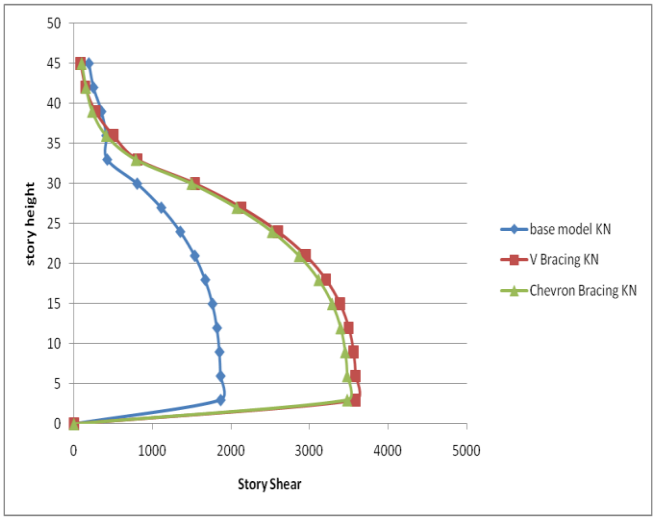

Fig 4.5: Comparison of Story Shear of different braced models in Zone 4

Table 4.6.Comparison of Story Shear of different braced models in Zone 5

Story	Elevation m	Location	Base ModelKN	V Bracing KN	Chevron Bracing KN
Story15	45	Top	99.87	88.294	140.246
Story14	42	Top	147.58	168.279	210.754
Story13	39	Top	212.45	342.299	350.276
Story12	36	Top	321.76	650.2975	612.785
Story11	33	Top	635.794	1215.676	1182.229
Story10	30	Top	1206.331	2314.392	2248.219
Story9	27	Top	1666.727	3201.002	3108.422
Story8	24	Top	2028.783	3898.234	3784.886
Story7	21	Top	2304.3	4428.811	4299.66
Story6	18	Top	2505.078	4815.461	4674.793
Story5	15	Top	2642.918	5080.907	4932.334
Story4	12	Top	2729.621	5247.877	5094.33
Story3	9	Top	2776.989	5339.094	5182.831
Story2	6	Top	2796.821	5377.286	5219.885
Story1	3	Top	2798.085	5379.745	5222.263
Base	0	Top	0	0	0

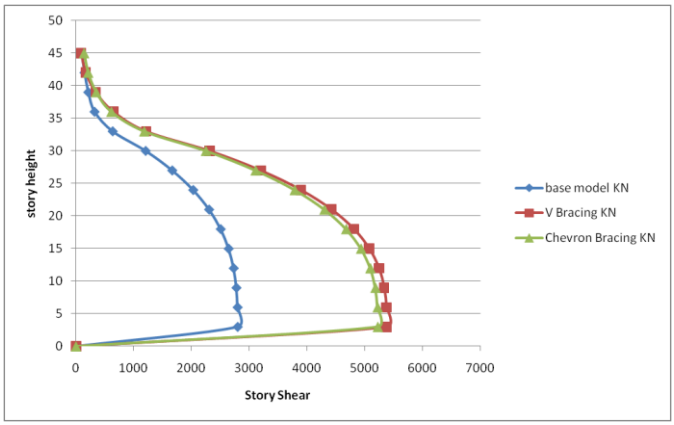

Fig 4.6: Comparison of Story Shear of different braced models in Zone 5

DISCUSSION

- In Zone 2, greatest story dislodging of a typical structure is diminished by 37.02% and 37.87%, by utilizing V and chevron bracings separately.

- In Zone 3, most extreme story removal of a typical structure is decreased by 36.26% and 36.8%, by utilizing V and chevron separately.

- In Zone 5, most extreme story dislodging of a typical structure is diminished by 36.96% and 36.72%by utilizing V and chevron bracings separately.

5. CONCLUSION

- Steel propping is one of the favorable ideas which can be utilized to fortify or retrofit the current designs as reinforcing of designs ends up being a superior choice giving to the monetary contemplations and quick sanctuary issues as opposed to substitution of structures.

- The chevron sort of steel supporting was viewed as additional proficient in Zones II&III and V kind of propping was viewed as additional productive in Zones IV&V.

- Steel bracings can be utilized as an option in contrast to other fortifying or retrofitting strategy as the total load of the current structure wont change altogether..

- The story shear of a propped fabricating was extremely high when contrasted with unbraced building which demonstrates that solidness of building has expanded.

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