Analysis of Seismic Behaviors of RC Frame Structure With Bracing System and Without Bracing System

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Abstract – In *this research work time history analysis is carried out for G+23 RC building of square shape 52mX52m (plan configuration) frame structure without and with different steel bracing system viz. X, V, inverted V, Eccen Forward, Eccen Back. The member property of beams 300mm X 400mm and columns 300mm X 500mm and ISLB250 sections are used to compare for same patterns of beam, column and bracings. We provide different seismic and other parameters like Seismic Zone- III, Soil Site factor 2 for Medium Soil, Damping = 5% (as per table-3 clause 6.4.2), Zone factor for zone III, Z=0.16), Importance Factor I=1.5 (Important structure as per Table-6), Response Reduction Factor R=5 for Special steel moment resisting frame Table-7), Sa/g= Average acceleration coefficient (depend on Natural fundamental period)Grade of concrete is considered M25, Grade of Rebar is considered Fe-415, Grade of Steel –Fe-345,Dead Load for Wall 12.88 KN/m, Dead Load for Slab 3 KN/m2. . The property of the section is used as IS 456:2016 and per IS 800:2007 by using Etab Software and analyzed as per 1893-2016 by Response Spectrum Method. The comparative analysis is done in the term of storey displacement.*

Key Words: Retrofit, ,Seismi analysis, braced RC structures, Seismic Zone, types of Soil, Steel Brace, RC Structure, Etab Software's etc.

1. INTRODUCTION

The concrete structure with Steel braced frame is one amongst the structural system comfortable repel the earthquake masses within the multistorey buildings, several existing bolstered cement concrete buildings must be retrofitting to beat deficiencies to resist seismal masses. the employment of steel bracing systems for strengthening or retrofitting seismically light concrete frames could be a viable answer for enhancing tremor confrontation.

The primary purpose of every kind of structural systems employed in the building form of structures is to transfer gravity masses effectively. the foremost common masses ensuing from the result of gravity ar loading, load and snow load. Besides these vertical masses, buildings also are subjected to lateral masses caused by wind, blasting or earthquake. Lateral masses will develop high stresses, turn out sway movement or cause vibration. Therefore, it's important for the structure to own ample strength against vertical masses along with adequate stiffness to resist lateral forces. Strengthening of structures proves to be a more robust choice business to the economic issues and immediate shelter issues instead of replacement of buildings. Hence, we all know this retrofitting and while not retrofitting structure within which economical as compared to every different structure. Therefore, seismal retrofitting or strengthening of building structures is one amongst the foremost vital aspects for mitigating seismal hazards particularly in earthquake prone areas.

1.1 BUILDING CONFIGURATIONS

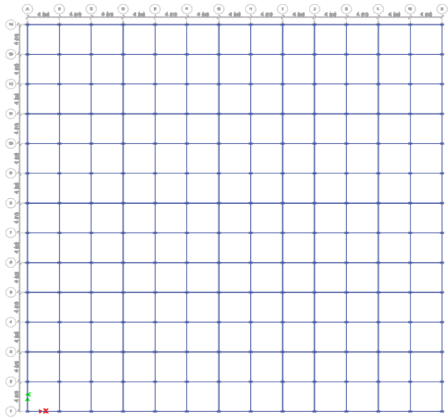

Fig.1a: Building Plan

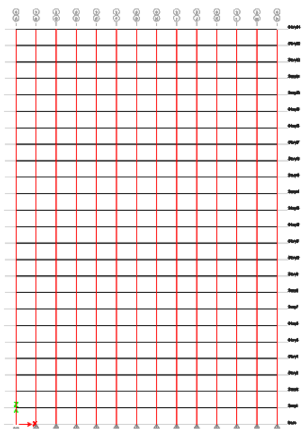

Fig.1b: Elevation without Bracing

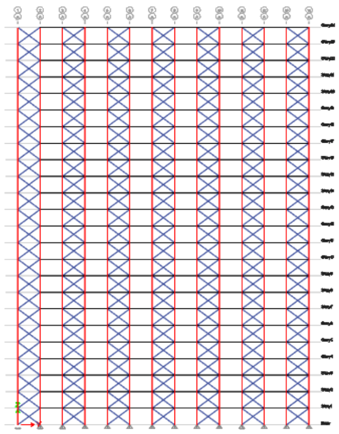

Fig.1c: Elevation with X Bracing

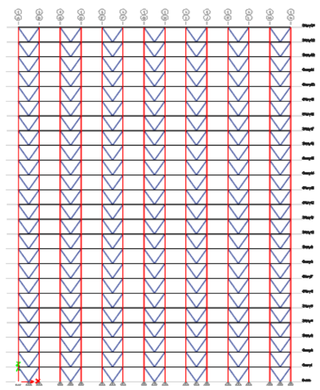

Fig.1d: Elevation with V Bracing

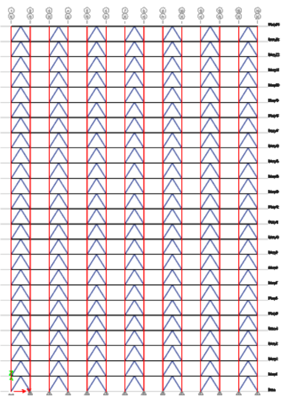

Fig.1e: Elevation with inverted V Bracing

1.3. Objective of Work

The objective of the study comprises of the following:

1. Comparative study of the behavior of different type of steel bracing structures such as with and without braced, X, V and inverted V-braced in RC Buildings.

2. To perform the Response Spectrum Method of analysis on RC structures.

3. To compare the different model of RC structures with & without steel bracing system.

3. LITERATURE SURVEY

Dheeraj Dheshmukh, Amol Patil, etc al- He studied that analysis and designed eccentric bracing system in tall (G+20) steel structure with different type of lateral loading by using Staad Pro. in earthquake zone III with medium soil type. He selected the building plan size of 20mX20m along to the X & Z direction with each floors of 3m and five bays of 4m along to x and z direction. He observed that diagonal braced system have smallest displacement, inverted V braced system have less base shear as compared to without braced building structures.

I. Anusha etc al - He studied the analysis of steel building frame G+5 structure against the seismic loads and different loading conditions. He selected the six story building fame structure with three bays in lateral and horizontal direction and height of each floor was 3m and spacing between bays 8m along to horizontal while 6m along the lateral direction. He also selected different seismic parameters like seismic zone III, response reduction factor 3, importance facto 5 and damping ratio five percent. He selected two methods for analysis the structure as Equivalent static load method and response spectrum method and also checked the P-delta analysis and connection design of exterior and interior joint. He observed different results like story drift, story shear more in lateral forced method as response spectrum method and Dynamic analysis values are smaller than the lateral force method.

Rishi Mishra, Dr. Abhay Sharma, Dr. Vivek Garg - They are worked on the G+10 storey RC building framed structure with different bracing system like X bracing, K bracing, V and inverted V bracing system and compared the these structures output to the RC bared frame structures and they work done all these models on Staad Pro software to evaluate the structure of a particular type braced system in order to control the lateral displacement , forces and also observed that inverted V braced system is more economical as compared to the other braced structures.

4. METHODOLOGY

Using Etabs Software.

2. Creating Modelling of RC building without and with steel bracing system.

3. Applying property like beam, column, slab dimension and support on structure.

4. Applying Load like Dead load, Live load, seismic load and load combination as per IS code.

5. Getting Results in the form of Max Overturning Moments, Max Story Shears. Max Story Displacement, Max. Story Drifts etc.

6. Results Analysis: Graphical analysis in the term of Max Overturning Moments, Max Story Shears. Max Story Displacement, Max. Story Drifts etc.

7. Conclusion Discussion & Future Scope.

5. RESULTS AND ANALYSIS

5.1 STOREY DISPLACEMENTS

Table: 5.1.1 Storey Displacements in MODEL-I

DISPLACEMENT IN X - DIRECTION IN mm			
MODEL-I WITHOUT BRACING SYSTEM			
STOREY	ELEVATION (m)	X-DIRECTION	Y-DIRECTION
Story24	76.8	186.378	282.433
Story23	73.6	184.795	280.388
Story22	70.4	182.549	277.296
Story21	67.2	179.62	273.149
Story20	64	176.043	267.992
Story19	60.8	171.855	261.87
Story18	57.6	167.088	254.822
Story17	54.4	161.769	246.884
Story16	51.2	155.924	238.092
Story15	48	149.578	228.483
Story14	44.8	142.76	218.099
Story13	41.6	135.494	206.979
Story12	38.4	127.803	195.16
Story11	35.2	119.703	182.677
Story10	32	111.211	169.564
Story9	28.8	102.346	155.86
Story8	25.6	93.131	141.607
Story7	22.4	83.59	126.852
Story6	19.2	73.741	111.633
Story5	16	63.595	95.982
Story4	12.8	53.15	79.922
Story3	9.6	42.395	63.474
Story2	6.4	31.25	46.649
Story1	3.2	18.984	28.916
Base	0	0	0

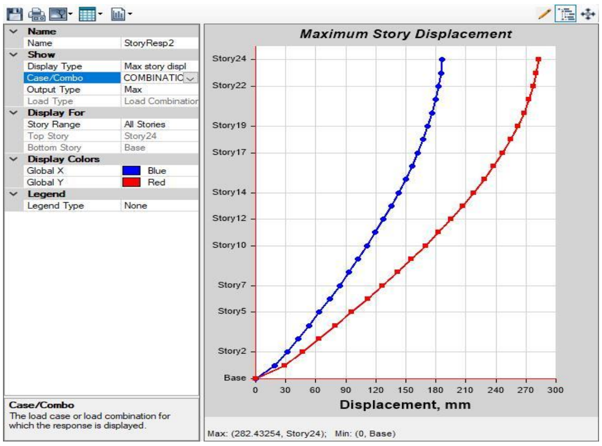

Fig. 5.1.a

Table: 5.1.2 Storey Displacements in MODEL-II

DISPLACEMENT IN X - DIRECTION IN mm			
MODEL-II WITH X-BRACING SYSTEM			
STOREY	ELEVATION (m)	X-DIRECTION	Y-DIRECTION
Story24	76.8	145.966	180.449
Story23	73.6	143.633	177.362
Story22	70.4	140.912	173.803
Story21	67.2	137.728	169.72
Story20	64	134.112	165.118
Story19	60.8	130.073	159.993
Story18	57.6	125.618	154.344
Story17	54.4	120.755	148.177
Story16	51.2	115.495	141.506
Story15	48	109.852	134.35
Story14	44.8	103.845	126.731
Story13	41.6	97.494	118.675
Story12	38.4	90.82	110.213
Story11	35.2	83.846	101.38
Story10	32	76.6	92.219
Story9	28.8	69.115	82.774
Story8	25.6	61.429	73.104
Story7	22.4	53.585	63.278
Story6	19.2	45.63	53.382
Story5	16	37.622	43.518
Story4	12.8	29.641	33.809
Story3	9.6	21.821	24.422
Story2	6.4	14.408	15.625
Story1	3.2	7.705	7.938
Base	0	0	0

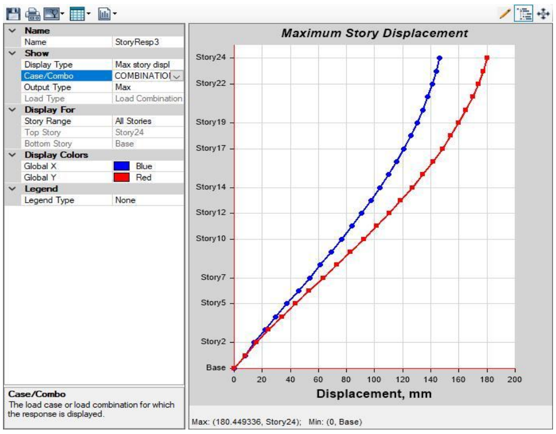

Fig. 5.1.2 Storey Displacements in MODEL-II

Table: 5.1.3 Storey Displacements in MODEL-III

DISPLACEMENT IN X - DIRECTION IN mm			
MODEL-III WITH V-BRACING SYSTEM			
STOREY	ELEVATION (m)	X-DIRECTION	Y-DIRECTION
Story24	76.8	149.943	193.964
Story23	73.6	147.801	191.057
Story22	70.4	145.227	187.599
Story21	67.2	142.162	183.548
Story20	64	138.642	178.919
Story19	60.8	134.684	173.715
Story18	57.6	130.301	167.943
Story17	54.4	125.505	161.614
Story16	51.2	120.31	154.746
Story15	48	114.731	147.36
Story14	44.8	108.788	139.481
Story13	41.6	102.5	131.136
Story12	38.4	95.886	122.354
Story11	35.2	88.966	113.166
Story10	32	81.76	103.608
Story9	28.8	74.295	93.719
Story8	25.6	66.604	83.548
Story7	22.4	58.718	73.155
Story6	19.2	50.67	62.61
Story5	16	42.494	51.992
Story4	12.8	34.233	41.384
Story3	9.6	25.964	30.89
Story2	6.4	17.845	20.694
Story1	3.2	9.999	11.195
Base	0	0	0

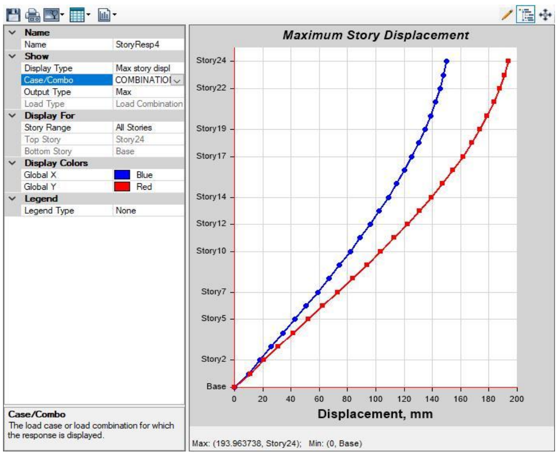

Fig. 5.1.3 Storey Displacements in MODEL-III

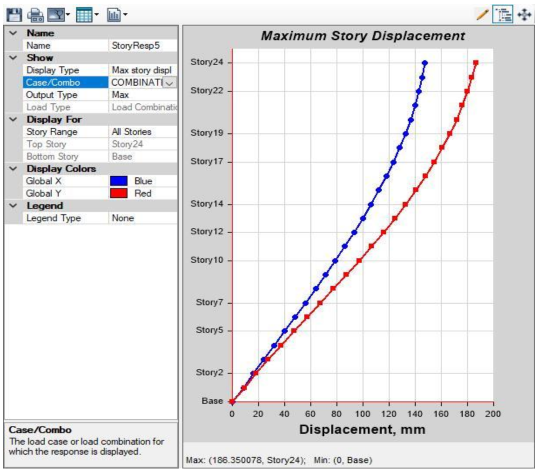

Fig. 5.1.4 Storey Displacements in MODEL-IV

Table: 5.1.4 Storey Displacements in MODEL-IV

DISPLACEMENT IN X - DIRECTION IN mm			
MODEL-IV WITH INVERTED V-BRACING SYSTEM			
STOREY	ELEVATION (m)	X-DIRECTION	Y-DIRECTION
Story24	76.8	147.657	186.35
Story23	73.6	145.559	183.585
Story22	70.4	142.994	180.22
Story21	67.2	139.917	176.241
Story20	64	136.369	171.671
Story19	60.8	132.371	166.52
Story18	57.6	127.94	160.801
Story17	54.4	123.09	154.527
Story16	51.2	117.835	147.72
Story15	48	112.195	140.405
Story14	44.8	106.189	132.61
Story13	41.6	99.84	124.362
Story12	38.4	93.168	115.696
Story11	35.2	86.196	106.645
Story10	32	78.95	97.25
Story9	28.8	71.462	87.556
Story8	25.6	63.769	77.62
Story7	22.4	55.913	67.514
Story6	19.2	47.938	57.323
Story5	16	39.889	47.145
Story4	12.8	31.83	37.085
Story3	9.6	23.861	27.277
Story2	6.4	16.175	17.941
Story1	3.2	8.938	9.505
Base	0	0	0

6. CONCLUSIONS

It is seen that the maximum storey displacement 186.378 mm in X direction and 282.433 mm in Y direction at 24th storey top of the structure in the Model-I without bracing system.

It is seen that the maximum storey displacement 145.966 mm in X direction and 180.449 mm in Y direction at 24th storey of the structure and as comparing both direction in which in y direction, the displacement is found maximum in Model-II in which the building with cross (X) bracing system.

It is found that the maximum storey displacement 149.943 mm in X direction and 193.964 mm in Y direction at top of the structure in Model-III with V bracing system.

It is seen that the maximum storey displacement 147.657 mm in X direction and 186.350 mm in Y direction at top of the structure in model-IV with inverted V bracing system.

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