ANALYSIS AND DESIGN OF RESIDENTIAL BUILDING WITH X BRACING AND VISCOUS DAMPER BY USING ETABS 2015

S.Md.HUSSAIN[1],Dr.K.THULASIRAJAN[2], K SAI ABHINAV[3] A.KALPANA[4]

[1]*P.G Student, Annamacharya Institute of Technology and Sciences(AUTONOMOUS),Tirupati, India*
[2,3,4]*Annamacharya Institute of Technology and Sciences(AUTONOMOUS),Tirupati, A,P, India*

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Abstract - *From the ancient we know earthquake is a disaster causing occasion. Up to date days construction are fitting increasingly narrow and extra inclined to sway and consequently detrimental within the earthquake. Researchers and engineers had worked out within past to make the construction as earthquake resistant. After many functional reports it have been proven that use of lateral load resisting methods in the constructing configuration has drastically increased the performance of the structure. In the present analysis, a residential building is analyzed and designed with X bracing and Viscous Damper for a G+12 building. The building is analyzed in both static and dynamic analysis response spectrum method is carried out for the building. The building is analyzed in condition i.e., in Zone-4 in Soil B.A commercial package of ETABS 2015 has been utilized for the analyzing residential building. The result has been compared using tables and graphs to find out the most optimized solution. Concluding remark has been made on the basis of that analyzing and comparison tables.*

Key Words : ETABS 2015, Residential Building, X Bracing and Viscous Damper.

1. INTRODUCTION

During earthquake motions, deformations take place across the elements of the load-bearing system as a result of the response of building to the ground motion. Because of these deformations, internal forces develop across the elements of the load-bearing system and displacement behavior appears across the building. The resultant displacement demand varies depending on the stiffness and mass of the building. In general, building with higher stiffness and lower mass have smaller horizontal demands. On the other hand each building has a specific displacement capacity. In other words, the amount of horizontal displacement that a building can afford without collapsing is limited. The purpose of strengthening methods is to ensure that the displacement demand of a building is to be kept below its displacement capacity. This can mainly be achieved by reducing expected displacement demand of structure during strong motion or improving the displacement capacity of the structure.

From a structural engineer's factor of view the tall constructing or high upward thrust constructing may be outlined in concert that, with the inside the structural type. Tall constructions have involved grouping from the beginning of civilization. Such structures were made for safeguard and to indicate pleasure. The system of urbanization that began with the age of industrialization remains to be ongoing in setting up nations like India. Industrialization motives migration of contributors to urban centers wherever jobs opportunities are critical. The land accessible for structures to accommodate this migration is changing into scarce, main too fast expand inside the cost of land.

Earthquake explanations two types of losses often called primary loss and secondary loss. A main loss irrecoverable loss, which results in the human lifestyles in earthquake. All of the different termed as secondary losses. Thus minimum common in a code to resist earthquake is prescribed such that whole crumple of structure is prevented which ensures that no human lifestyles is lost. This requires a forecast of the strongest depth of probably ground movement at a distinct site throughout the service lifetime of constitution. Seismic zoning map of a nation segregates nation in quite a lot of of areas of an identical probable highest intensity of ground motion.

1.1 ETABS

The innovative and revolutionary new ETABS is that the final integrated software package for the structural analysis and style of buildings. Incorporating forty years of continuous analysis and development, this latest ETABS offers unmatched 3D object primarily based modeling and visualization tools, blazingly quick linear and non-linear analytical power, comprehensive style capabilities for a wide-range of materials and perceptive graphic displays, reports and schematic drawing that enable users to quickly and simply decipher and perceive analysis and style results.

2. MATERIALS AND GEOMETRICAL PROPERITES

Table -1: Materials and Geometrical Properites

S.No	DESCRIPTION OF PARAMETER	
01	Grade of Concrete	M35
02	Grade of steel	Fe 550
		Fe 415
03	Column Sizes	1600mm x 1800mm For Story 01
		1400mm x 1500mm For Story 02 to 07
		900mm x 1000mm For Story 08 to 12
04	Beam Sizes	800mm x 900mm For Story 01 to 06
		700mm x 800mm For Story 07 to 12
05	Slab Thickness	150mm
06	Type of Bracing	ISMB 175
07	Type of Damper	Viscous Damper 250
		Weight 42kgs
		Force 250kN
08	Seismic Zone	Zone - IV
09	Zone Factor	0.24
10	Importance Factor	1.0
11	Response Reduction Factor	5.0
12	Percentage of Damping	5%
13	Type of Soil	B – Medium Soil

3.RESULTS

3.1 STATIC ANALYSIS

Table -2: Static Analysis Without X Bracing and Viscous Damper

Story No	Displacement	Shear Force	Bending Moment	Axial Force	Story Drift
Story 12	15.638	375.66	364.11	43.14	0.634
Story 11	13.736	414.55	308.07	59.37	0.616
Story 10	11.886	406.7	293.46	88.9	0.602
Story 09	10.079	402.32	287.46	108.08	0.581
Story 08	8.335	393.29	273.99	122.34	0.541
Story 07	6.712	387.07	333.86	160.91	0.503
Story 06	5.203	483.99	318.03	198.35	0.442
Story 05	3.876	467.4	312.42	203.72	0.385
Story 04	2.721	447.59	307.44	212.38	0.308
Story 03	1.795	423.36	311.07	228.63	0.197
Story 02	1.203	392.98	298.48	242.48	0.063
Story 01	1.012	350.18	422.39	253.85	0.037
Base Story	0	350.18	422.39	253.85	0

Table -3: Static Analysis With X bracing Viscous Damper.

Story No	Displacement	Shear Force	Bending Moment	Axial Force	Story Drift
Story 12	0.503	216.38	245.02	3.63	0.031
Story 11	0.409	227.94	200.32	35.65	0.023
Story 10	0.340	226.98	192.92	52.56	0.021
Story 09	0.276	227.74	186.85	61.05	0.011
Story 08	0.243	226.95	199.60	63.21	0.008
Story 07	0.150	230.26	228.60	63.38	0.007
Story 06	0.140	241.12	204.30	105.71	0.006
Story 05	0.120	240.68	180.60	115.68	0.005
Story 04	0.105	240.1	159.00	118.36	0.002
Story 03	0.097	239.38	158.35	124.36	0.003
Story 02	0.097	238.47	157.59	134	0.003
Story 01	0.088	224.25	155.15	115.68	0.002
Base Story	0	224.25	155.15	115.68	0

3.2 DYNAMIC ANALYSIS

Table -4: Dynamic Analysis Without X Bracing and Viscous Damper.

Story No	Displacement	Shear Force	Bending Moment	Axial Force	Story Drift
Story 12	12.867	345.98	418.19	98.35	0.179
Story 11	12.329	363.38	465.15	104.64	0.329
Story 10	11.342	431.25	553.12	113.60	0.389
Story 09	10.175	498.14	642.27	128.34	0.412
Story 08	8.789	530.02	650.5	130.92	0.428
Story 07	7.293	659.38	1063.0	158.42	0.436
Story 06	5.984	759.36	1034.8	175.67	0.420
Story 05	4.724	769.44	1063.7	180.91	0.402
Story 04	3.516	770.79	1117.2	192.00	0.377
Story 03	2.383	734.14	1216.3	215.45	0.333
Story 02	1.348	619.08	1385.1	261.38	0.276
Story 01	0.519	562.67	2280.1	266.57	0.173
Base Story	0	562.67	2280.1	266.57	0

Table -5: Dynamic Analysis With X Bracing and Viscous Damper

Story No	Displacement	Shear Force	Bending Moment	Axial Force	Story Drift
Story 12	9.223	332.99	410.68	33	0.297
Story 11	8.331	310.47	413.61	34.09	0.309
Story 10	7.403	300.34	435.39	45.14	0.327
Story 09	6.421	309.47	464.64	51.26	0.342
Story 08	5.395	285.07	382.12	62.09	0.342
Story 07	4.368	478.56	770.28	71.19	0.330
Story 06	3.377	452.89	754.39	119.23	0.307
Story 05	2.456	411.04	729.08	130.14	0.279
Story 04	1.619	361.55	689.46	142.58	0.237
Story 03	0.906	318.21	647.72	161.89	0.176
Story 02	0.378	255.62	651.73	173.65	0.094
Story 01	0.094	191.92	458.03	183.39	0.031
Base Story	0	191.92	458.03	183.39	0

3.3 STATIC ANALYSIS COMPARISON

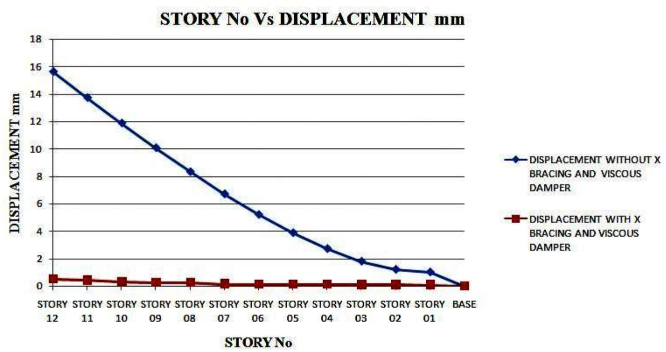

Chart -1: STORY No Vs DISPLACEMENT mm

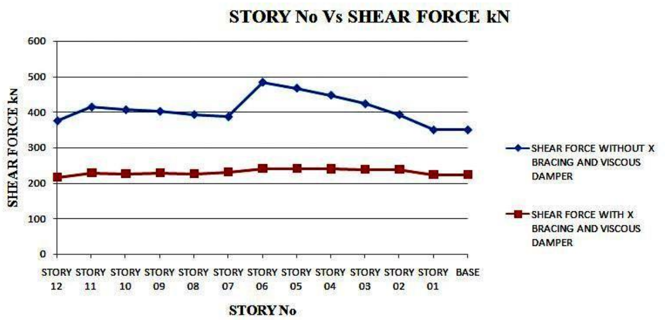

Chart -2: STORY No Vs SHEAR FORCE Kn

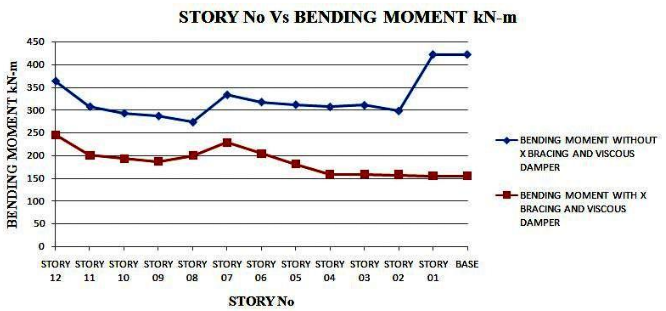

Chart -3: STORY No Vs BENDING MOMENT kN-m

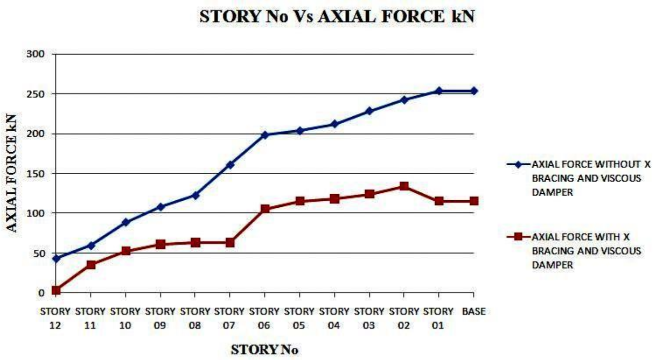

Chart -4: STORY No Vs AXIAL FORCE kN

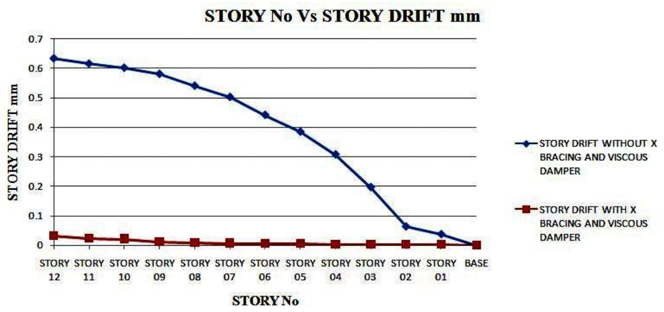

Chart -5: STORY No Vs STORY DRIFT mm

3.4 DYNAMIC ANALYSIS COMPARISON

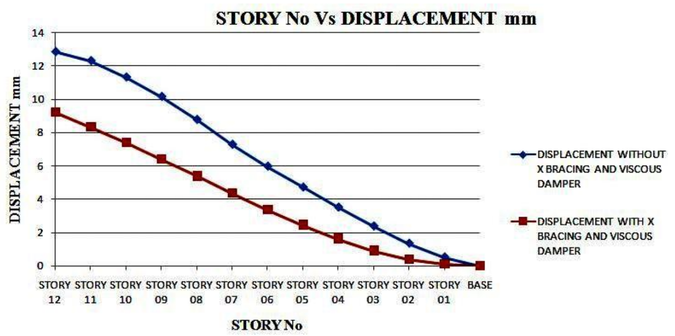

Chart -6: STORY No Vs DISPLACEMENT mm

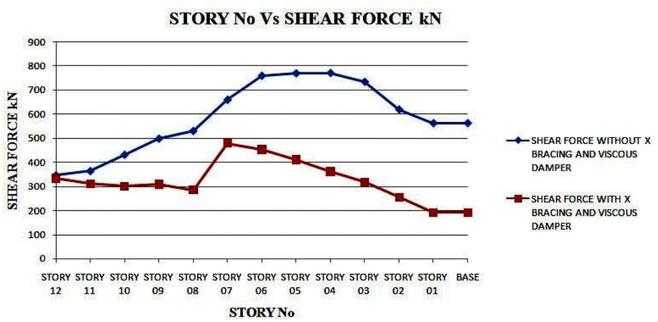

Chart -7: STORY No Vs SHEAR FORCE Kn

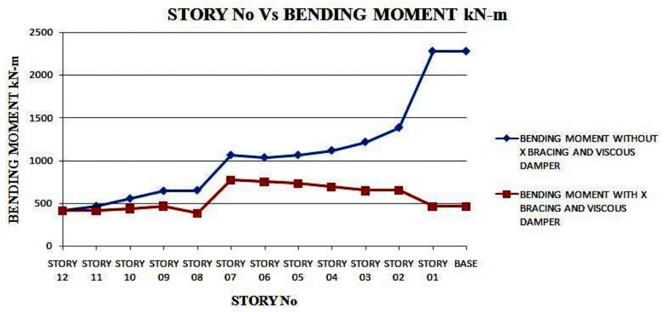

Chart -8: STORY No Vs BENDING MOMENT kN-m

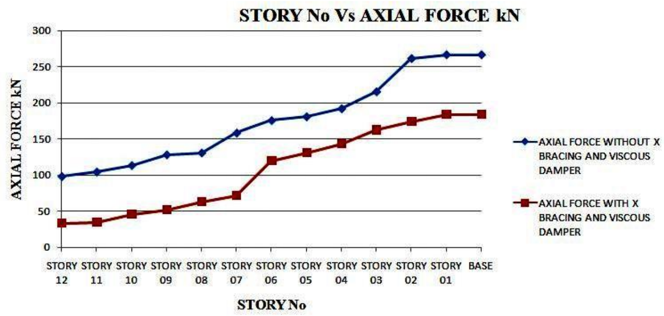

Chart -9: STORY No Vs AXIAL FORCE kN

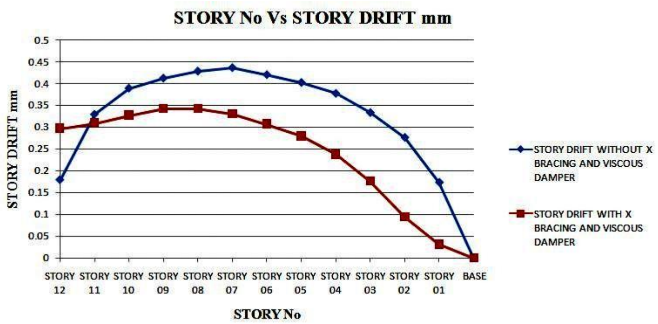

Chart -10: STORY No Vs STORY DRIFT mm

3.5 REINFORMENT DETAILS

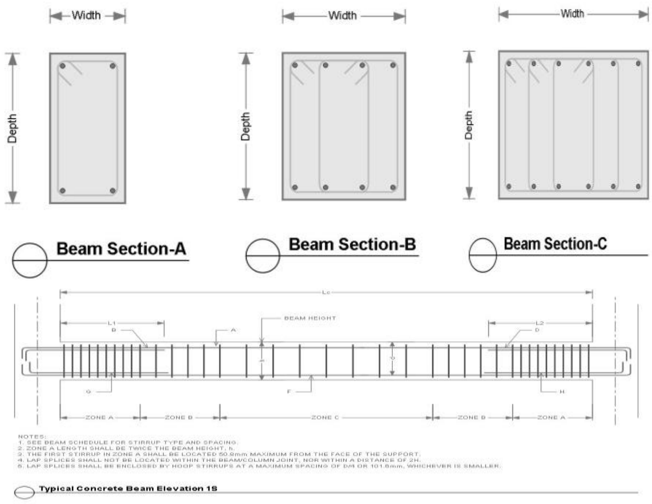

Fig -1: Beam Detailing

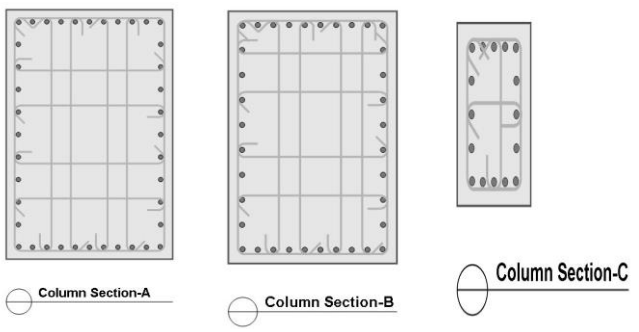

Fig -2: Column Detailing

4. CONCLUSIONS

1) **In Static Analysis** the displacement is reduced by assignment X bracing and Viscous damper to the building.

2) The shear force which is nearly 100 kN to 150 kN reduced in each story in building with X bracing and Viscous damper.

3) The bending moment of 100 kN-m is decreased in each story by providing X bracing and Viscous damper.

4) The axial force nearly 60% is reduced in building with X bracing and Viscous damper.

5) The story drift is 90% decreased in building with X bracing and Viscous damper.

6) **In Dynamic Analysis** the displacement 80% is reduced in X bracing and Viscous damper of the building.

7) The shear force at top storey is more compare to without X bracing and Viscous damper but it is gradually decreased in building with X bracing and Viscous damper.

8) In normal building bending moment at base is very higher than building with X bracing and Viscous damper.

9) The axial force nearly 80% is reduced in building with X bracing and Viscous damper.

10) The story drift is decreased in each story in X bracing and Viscous damper of the building.

By assignment of X bracing and Viscous damper to the normal building the displacement, shear force, bending moment, axial force and story drift can be reduced.

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