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Comparison of Shear Wall and Bracing in RCC Framed Structures

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***Abstract*— In past few years considerable emphasis has been given on performance based design for earthquake resistant structure. Therefore to increases the ductility of the structure a shear wall or a bracing system is introduced in a moment resisting frame. A shear wall and a bracing system in a RCC framed structure is a wall or system which is designed to resist shear, the lateral force due to earthquake or wind and to control the deflection and to increases the ductility demand. In this paper a comparison of shear wall and bracing in rcc framed structure with different locations is studied and results are presented.**
***Keywords*—RCC framed structure, shear wall, bracing system, earthquake force, gravity load.**

I. INTRODUCTION

To resist the lateral load due to earthquake and wind to increase stiffness of hise rise building a shear wall or bracing in place of infill wall is introduced. To resist the lateral load due to earthquake and wind to increase stiffness of hise rise building a shear wall or bracing in place of infill wall is introduced.The term shear wall is actually a misnomer as far as high rise building are concerned,
Since a slender shear wall when subjected to lateral forces has predominantly moment deflections and only very insignificant shear distributions. The shear wall accepts a shear of the lateral load proportional to its stiffness. Although the major shear walls are usually in the transverse direction of the building, stability in the longitudinal direction is normally provided by staircase shafts or some longitudinal shear wall The great majority of multistoried buildings today are, in fact, shear wall-frame structures, sin Elevator shafts ,stair wells , and central core units of tall buildings are mostly treated as shear wall, Frame structures depend primarily on the rigidity of member connections for their resistance to lateral forces, and they tend to be uneconomical beyond 5 to 6 stories. To improve the rigidity and economy, shear wall are introduced in building exceeding 5 to 6 stories in height.

The term shear wall-frame structure is used here to denote any combination of frames and shear walls. The shear wall can have any plan shape and may be linear, angular, rectangular or circular in plan.

The common assumption to neglect the frame and assume that all the lateral load is resisted by shear walls may not always be conservative,Consideration of shear wall – frame interaction leads to a more economical design.

Since the shear wall moments are reduced less reinforcing is needed as the frames takes over some of the lateral load movement .in most cases the frames can accept the additional moment due to lateral loads within the 33 % of increase in allowable stresses, except for the top stories of the frame. Which often require additional reinforcing .Shear walls are efficiently utilized if they are distributed about the plan so that they carry their proportional shear of the vertical load, rather than having them function mainly as lateral load resisting element. This condition may, however, conflict with the desirability of locating the principal lateral load resisting elements along or near the periphery of a building.

The main function of a shear wall for the type of structure being considered here is to increase the rigidity for lateral load resistance. Shear walls also resist vertical load, and the difference between a column and shear wall may not always be obvious. The distinguishing features are the much higher moment of inertia of the shear wall than a column and the width of shear wall, which is not negligible in comparison with the span of adjacent beam. The moment of inertia of shear wall would normally be at least 50 times greater than that of a column, and a shear wall would be at least 5 ft. wide.

The introduction of deep vertical element (shear wall) represents a structurally efficient solution to the problem of stiffening a frame system. The frame deflects predominantly in a shear mode. While the shear wall deflects predominantly in a bending mode.

In a building, the in plan rigidity of the floor slab forces the deflection of the walls and the frames to be identical at each story. To force the wall and the frame into the same deflected shape, internal forces are generated that equalize the deflected shape of each. . Thus, the frame in the upper stories pulls back the frame. These internal interactive forces greatly reduce the deflection of the overall combined system, creating a considerably higher overall stiffness than would be the sum of the individual components, each resisting a portion of the exterior loads. In the distinctive feature of increasing the stiffness through a set of internal forces lies the great advantage of shear wall – frame interactive systems.

Steel bracing is a highly efficient and economical method of resisting horizontal forces in a frame structure. Bracing has been used to stabilize laterally the majority of the world's tallest building structures as well as one of the major retrofit measures. Bracing is efficient because the diagonals work in axial stress and therefore call for minimum member sizes in providing stiffness and strength against horizontal shear. A number of researchers have investigated various techniques such as infilling walls, adding walls to existing columns, encasing columns, and adding steel bracing to improve the strength and/or ductility of existing buildings. A bracing system improves the seismic performance of the frame by increasing its lateral stiffness and capacity. Through the addition of the bracing system, load could be transferred out of the frame and into the braces, bypassing the weak columns while increasing strength. Steel-braced frames are efficient structural systems for buildings subjected to seismic or wind lateral loadings. Therefore, the use of steel-bracing systems for retrofitting reinforced-concrete frames with inadequate lateral resistance is attractive.

II. PROBLEM

A 15- storied reinforced concrete building with shear wall ,without shear wall and with different types of bracing in zone V has been considered for the illustration .The main emphasis in this chapter is on calculation of base shear, frequency, period and displacement for different story , and comparing this with shear wall and bracing.

A. Building description

Analyze a 15- storied RC building as shown in fig. The live load on all the floors is $2KN/m^2$ and soil below the building is hard. The site lies in zone V. All the beams are of size 40 x 50 cm and slabs are 15 cm thick. The sizes of columns are 60 x 60 cm in all the story and the wall around is 12 cm thick. (SP : 22- 1982)

Analysis using response spectrum method .Using the software frequency, period, mode participation factor, base shear, displacement is calculatedand presented in tabular format. Results are shown in tables for different location of shear wall and bracing. also for different type of bracing system.

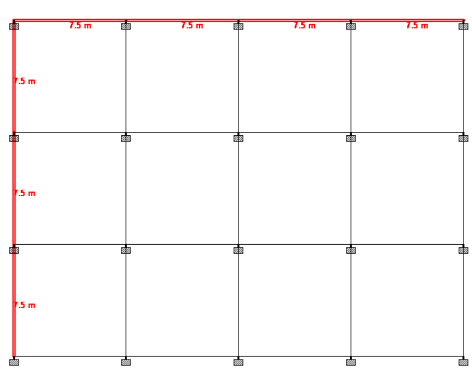

Fig 1 – PLAN

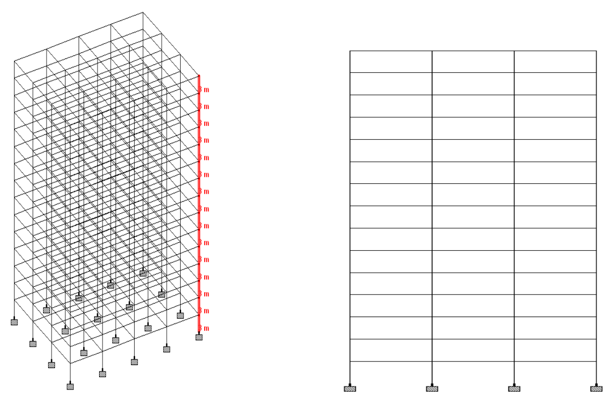

Fig2 - 3 D MODEL AND ELEVATION

B. Load calculation

Consider only one middle frame of building to calculate the lump weight.

1) Dead Load

Joint load

Weight of brickwork – 20 x 7.5 x 0.12 x 3 = 54 kN

Weight of beams – 25 x 7.5 x 0.40 x 0.50 = 37.5 kN

Weight of columns – 25 x 3 x 0.60 x 0.60 = 27 kN

Member load

Weight of beams – 25 x 0.40 x 0.50 = 5 kN/m

Weight of brickwork – 20 x 1.0 x 0.12 x 3 = 7.2 kN/m

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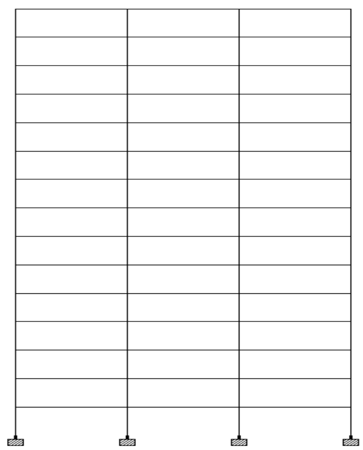
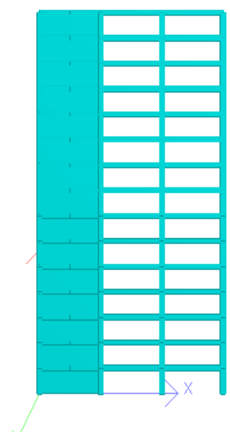
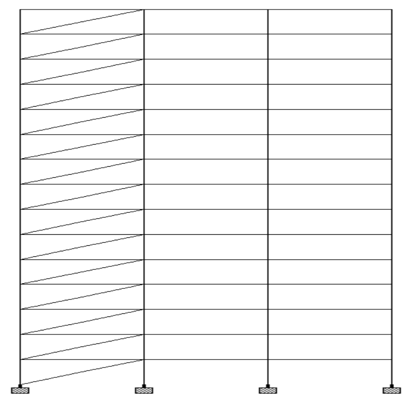
Weight of slabs – 25 x 1.0 x 7.5 x 0.15= 28.125 kN/m
Live/ imposed load– 7.5 kN/m
Weight of brickwork – 20 x 1.0 x 0.12 x 3 = 7.2 kN/m
Live/ imposed load– 7.5 kN/m
Weight of beams – 25 x 7.5 x 0.40 x 0.50 = 37.5 kN
Weight of columns – 25 x 3 x 0.60 x 0.60 = 27 kN
Weight of brickwork – 20 x 7.5 x 0.12 x 3 = 54 kN


2D frame


shear wall at first bay


diagonal bracing at first bay

THE FLOOR WISE DISPLACEMENT IN MM

STEEL **DIGONAL(D)** BRACING AT FIRST BAY

FLOOR↓	FRAME	SHEAR WALL	BRACING D D ISMB500	BRACING D D ISMB600	BRACING D D ISWB600A
base shear (kN)	522.1	**792.25**	693.75	716.14	**726.34**
1	1.46	0.375	0.839	0.711	0.65
2	1.459	0.388	0.85	0.724	0.665
3	2.978	0.954	1.859	1.637	1.532
4	4.476	1.649	2.921	2.62	2.478
5	5.93	2.432	4.004	3.638	3.466
6	7.33	3.271	5.086	4.667	4.471
7	8.672	4.141	6.154	5.694	5.479
8	9.954	5.025	7.2	6.708	6.478
9	11.174	5.909	8.221	7.702	7.461
10	12.328	6.783	9.211	8.673	8.423
11	13.409	7.637	10.166	9.612	9.356
12	14.407	8.462	11.078	10.513	10.252
13	15.309	9.252	11.933	11.363	11.1
14	16.098	10	12.718	12.15	11.888
15	16.754	10.701	13.417	12.86	12.603
16	17.258	11.327	14.009	13.47	13.224

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STEE V-TYPE BRACING AT FIRST BAY

FLOOR↓	FRAME	SHEAR WALL	BRACING V D ISMB500	BRACING V D ISMB600	BRACING V D ISWB600A
Base Shear	522.1	**792.25**	752.32	773.54	**782.74**
1	1.46	0.375	2.111	2.17	2.196
2	1.459	0.388	2.016	2.067	2.089
3	2.978	0.954	2.867	2.849	2.842
4	4.476	1.649	3.69	3.606	3.571
5	5.93	2.432	4.555	4.415	4.356
6	7.33	3.271	5.448	5.261	5.183
7	8.672	4.141	6.357	6.132	6.038
8	9.954	5.025	7.272	7.015	6.908
9	11.174	5.909	8.815	7.903	7.785
10	12.328	6.783	9.09	8.786	8.659
11	13.409	7.637	9.977	9.657	9.522
12	14.407	8.462	10.838	10.506	10.366
13	15.309	9.252	11.664	11.323	11.18
14	16.098	10	12.444	12.102	11.958
15	16.754	10.701	13.17	12.835	12.693
16	17.258	**11.327**	13.82	13.499	**13.363**

STEEL **X-TYPE** BRACING AT FIRST BAY

FLOOR↓	FRAME	SHEAR WALL	BR X D ISMB500	BR X D ISMB600	BR X D ISWB600A
Base Shear	522.1	**792.25**	639.74	655.15	660.88
1	1.46	0.375	0.548	0.453	0.41
2	1.459	0.388	0.556	0.463	0.421
3	2.978	0.954	1.234	1.061	0.984
4	4.476	1.649	1.996	1.757	1.651
5	5.93	2.432	2.813	2.52	2.391
6	7.33	3.271	3.664	3.328	3.18
7	8.672	4.141	4.532	4.161	3.998
8	9.954	5.025	5.404	5.007	4.832
9	11.174	5.909	6.272	5.853	5.67
10	12.328	6.783	7.125	6.691	6.501
11	13.409	7.637	7.958	7.512	7.316
12	14.407	8.462	8.76	8.307	8.108
13	15.309	9.252	9.523	9.068	8.869
14	16.098	10	10.24	9.789	9.592
15	16.754	10.701	10.901	10.462	10.27
16	17.258	**11.327**	**11.487**	11.066	10.882

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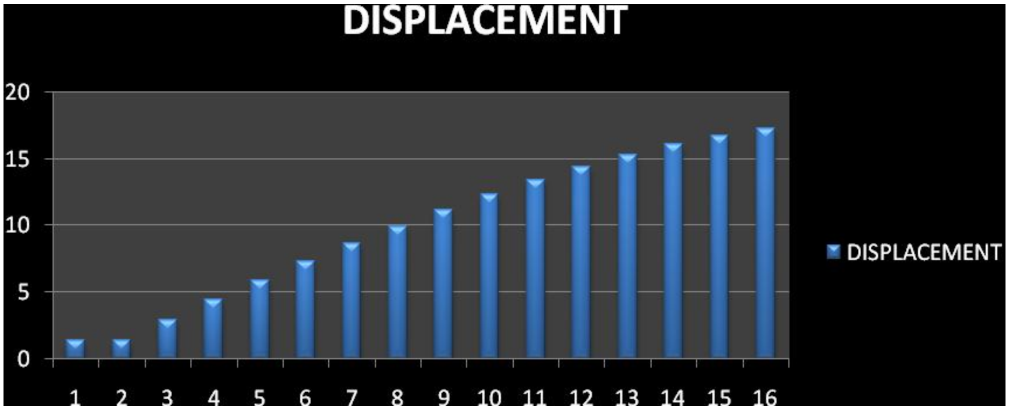
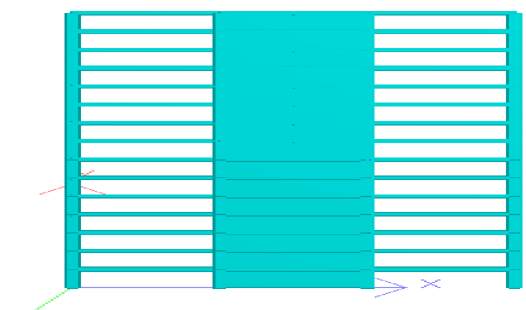
	FRAME	SHEAR WALL	BR V D ISWB600A
BASE SHEAR	522.1	792.25	782.74
MAX. DISPLACEMENT	17.258	11.327	13.363

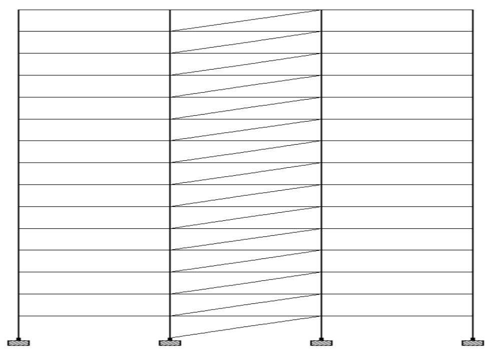
FIG. - GRAPH- DISPLACEMENT FOR EACH STORY



GRAPH- DISPLACEMENT FOR SHEAR WALL AND DIFFERENT TYPES OF BRACING IN FIRST BAY

SHEAR WALL AT MIDDLE BAY





STEEL **DIAGONAL-TYPE** BRACING AT MIDDLE BAY

FLOOR↓	FRAME	SHEAR WALL	BR D DISMB500	BR D D ISMB600	BR D D ISWB600A
Base Shear	522.1	**824.5**	710.94	738.8	751.93
1	1.46	0.373	0.965	0.86	0.81
2	1.459	0.376	0.862	0.74	0.681
3	2.978	0.923	1.873	1.656	1.554
4	4.476	1.583	2.915	2.618	2.477
5	5.93	2.317	3.966	3.598	3.425
6	7.33	3.1	5.009	4.582	4.382
7	8.672	3.912	6.037	5.56	5.337
8	9.954	4.742	7.044	6.526	6.284
9	11.174	5.578	8.028	7.476	7.219
10	12.328	6.413	8.986	8.406	8.136
11	13.409	7.238	9.912	9.31	9.03
12	14.407	8.046	10.799	10.18	9.892
13	15.309	8.827	11.634	11.005	10.713
14	16.098	9.575	12.403	11.771	11.478
15	16.754	**10.283**	13.09	12.465	12.175
16	17.258	10.944	13.681	13.072	12.792

STEEL **V-TYPE** BRACING AT MIDDLE BAY

FLOOR↓	FRAME	SHEAR WALL	BR V D ISMB500	BR V D ISMB600	BR V D ISWB600A
Base Shear	522.1	**824.5**	790.45	816.88	**828.22**
1	1.46	0.373	2.195	2.268	2.299
2	1.459	0.376	2.157	2.226	2.256
3	2.978	0.923	2.907	2.896	2.892
4	4.476	1.583	3.666	3.581	3.546
5	5.93	2.317	4.457	4.31	4.249
6	7.33	3.1	5.271	5.07	4.986
7	8.672	3.912	6.1	5.852	5.749
8	9.954	4.742	6.937	6.651	6.532
9	11.174	5.578	7.778	7.46	7.327
10	12.328	6.413	8.616	8.271	8.127
11	13.409	7.238	9.444	9.077	8.925
12	14.407	8.046	10.253	9.871	9.711
13	15.309	8.827	11.033	10.641	10.478
14	16.098	9.575	11.775	11.379	11.215
15	16.754	10.283	12.468	12.078	11.916
16	17.258	**10.944**	13.103	12.728	**12.574**

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STEEL **X-TYPE** BRACING AT MIDDLE BAY

FLOOR↓	FRAME	SHEAR WALL	BR X D ISMB500	BR X D ISMB600	BR X D ISWB600A
Base Shear	522.1	**824.5**	792.98	**823.66**	**836.91**
1	1.46	0.373	0.652	0.542	0.492
2	1.459	0.376	0.654	0.544	0.495
3	2.978	0.923	1.406	1.2	1.108
4	4.476	1.583	2.219	1.93	1.802
5	5.93	2.317	3.071	2.712	2.552
6	7.33	3.1	3.945	3.526	3.341
7	8.672	3.912	4.83	4.362	4.154
8	9.954	4.742	5.719	5.209	4.984
9	11.174	5.578	6.604	6.06	5.82
10	12.328	6.413	7.48	6.91	6.658
11	13.409	7.238	8.341	7.749	7.488
12	14.407	8.046	9.178	8.571	8.303
13	15.309	8.827	9.981	9.365	9.094
14	16.098	9.575	10.738	10.122	9.851
15	16.754	10.283	11.438	10.832	10.565
16	17.258	**10.944**	12.072	**11.485**	**11.228**

FLOOR↓	FRAME	SHEAR WALL	BR X D ISMB600	BR V D ISWB600A	BR X D ISWB600A	BR V D ISMB600
BASE SHEAR	522.1	824.5	823.66	828.22	836.91	816.88
MAX. DISPLACEMET	17.258	10.944	11.485	12.574	11.228	12.728

GRAPH- DISPLACEMENT FOR SHEAR WALL AND DIFFERENT TYPES OF BRACING IN MIDDLE BAY

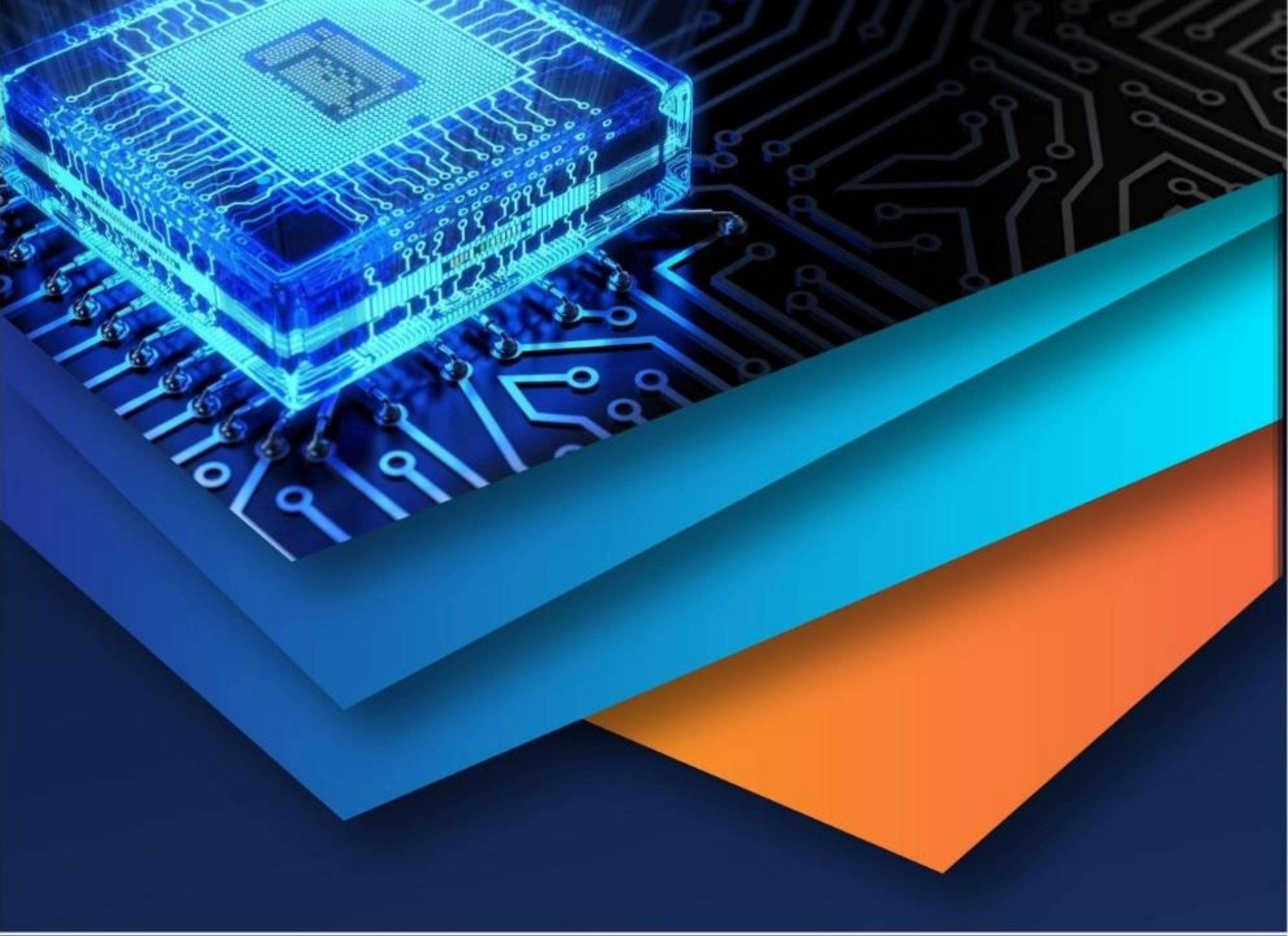
III. CONCLUSIONS

The fifteenth story symmetrical RC frame is extensively studdied for seismic loading

A. When shear wall is provided, displacement and storey drift reduces and storey shear and base shear increases.
B. As thickness and width of shear wall increases, displacement and storey drift reduces and storey shear and base shear increases.
C. When shear wall is placed symmetrical and well distributed along the periphery the displacements reduce.
D. The concept of using steel bracing is one of the advantageous concepts which can be used to strengthen or retrofit the existing structurs.
E. Steel bracings can be used as an alternative to the other strenthen or retrofitting techniques available as the total weight on the existing building will not change significantly.
F. The lateral displacement of bulding reduced by the use of X type of bracing system.
G. Steel bracing reduce flexure and shear demand on beams and columns and transfer the lateral loads through axial load mechanism.

REFERENCES

[1] Mark fintel , fazlur khan "Handbook of concrete engineering"
[2] Thorburn Kulak and Montgomery "Analysis of steel plate shear wall" Structural Engineering report 1983
[3] Elgaaly and Liu "Analysis of Steel Plate Shear Wall "Journal of Structrual Engineering Nov 1997
[4] Astaneh-Asl "Seismic Behavior and Design of Steel Shear Walls" SEAONC Seminar, November 2001, San Francisco
[5] H.Ghaffarzadeh and M.R. Maheri "cyclic tests on the internally braced RC frames "JSEE FALL 2006 Vol.8 no.3/177.
[6] T.D. Bush , E.A. Jones " Behavior of RC frame strengthened using structural steel bracing "Journal of ASCE Structrual Engineering AUG 2010.
[7] M . A. Youssef , H. Ghaffarzadeh , M. Neheli "Seismic performance of RC frames with concentric internal steel bracing " Engineering structures 29 (2007)1561-1568 oct 2006.
[8] M. R. maheri & A. Saheri . "Use of steel bracing in reinforced concrete frames." Engineering structures vol. 19 no.12 oct 1996.
[9] A.K.Chopra (2007), "Dynamics of Structure", Prentice Hall, Englewood cliffs, New Jesey, 2007
[10] IS 1893 (part 1): 2002, Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi
[11] Shrikande and Agrawal **"**Earthquak**e** Resistant Structures"



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