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A Comparative Study on RCC Verses Different Steel Bracing in Multi Storey RC Structures

Vinayaka D, Satish G.N

Post Graduate Student, Department of Structural Engineering, Bapuji Institute of Engineering and Technology,
Davangere, Karnataka, India

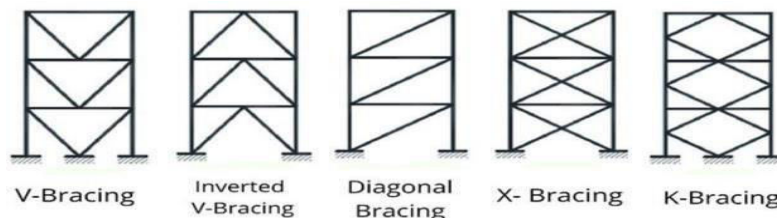
Assistant Professor, Department of Structural Engineering, Bapuji Institute of Engineering and Technology, Davangere,
Karnataka, India

ABSTRACT: Now a days, bracings are most popular system. It is the best method for lateral load resisting systems and it will be the viable solution for enhancing earthquake resistance. It provides for minimizing the lateral deflection of buildings. In the present study Multi storeys is analyzed for Z-V by considering soil type Medium. The analysis carried out to assess the structural performance under earthquake ground motions. In this study there are different types of bracing i.e. X bracing, V bracing, Inverted V bracing and by using same plan in both X & Y Directions. Results are obtained by considering Storey Displacement, Base Shear, Time period for equivalent static analysis and response spectrum analysis. A braced frame is designed primarily to resist wind and earthquake forces in and a structural system. Bracings are provided to increase stiffness and stability of the structure under lateral loading and also to reduce lateral displacement significantly.

KEYWORDS: Storey displacement, base shear, time period, STADD PRO

I. INTRODUCTION

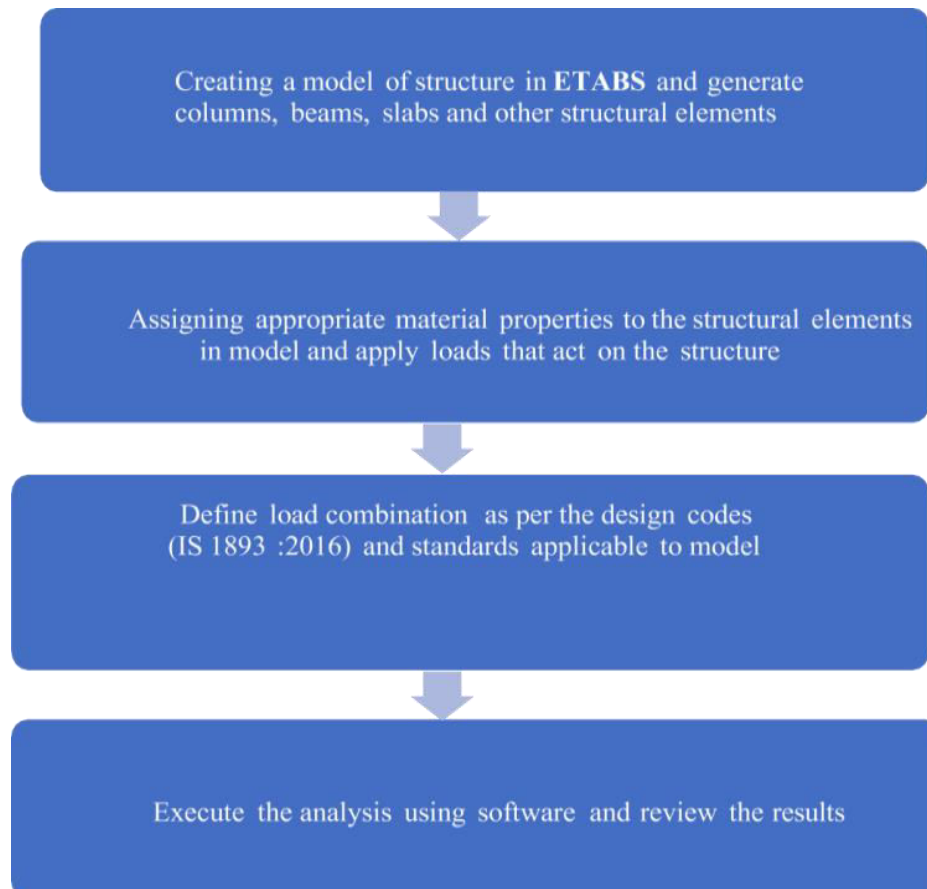
In the steel structure bracing system, though a minor component of a steel building, plays a crucial role in its functionality. In portal steel structures, the bracing system serves several key purposes. It enhances the overall stability of the structure and its individual components, transfers horizontal forces to the foundation, and supports auxiliary installations. Additionally, in complex layouts, the bracing system helps adjust structural stiffness, ensuring uniform and balanced stress distribution, thereby improving the integrity of the entire structure.



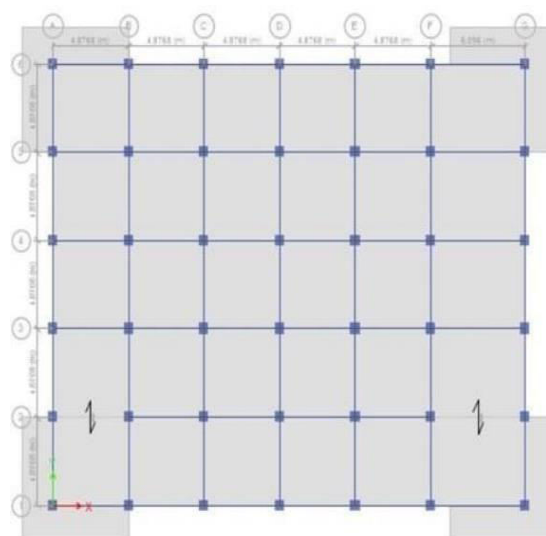
OBJECTIVES:

- 1 To compare behavior between X & V & inverted V Bracings for maximum Storey Displacement, Storey Shear and Auto lateral load on a multistorey structure.
- 2 To examine the effects of earthquake lateral forces (Zone V) on a multistorey building.

II. METHODOLOGY



BUILDING PLAN AND LAYOUT

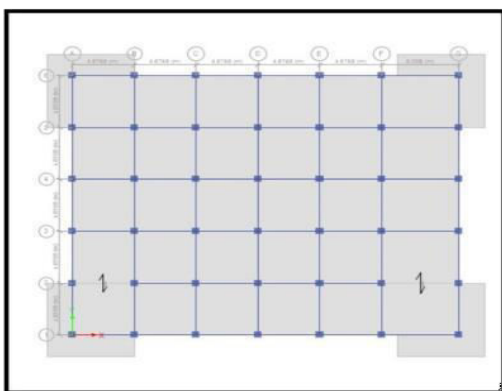


General Specification of Building

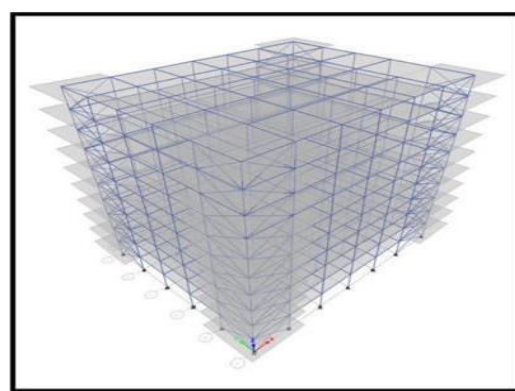
CONTENT	
Material property	Concrete: For all column and beams M45.
	Steel: HYSD of grade Fe500
Column size	300x600 mm
Beam size	600x450 mm
Slab thickness	200 mm
Storey height	3m
Seismic Zone	V
Type of Soil	Medium
Type of Structure	R.C Frame Structure
Importance Factor (I)	1.0
Response Reduction Factor	5.0
Density of Concrete (fck)	25 KN/m ³
Density of Brick Wall	22 KN/m ³
Floor Finish	1 KN/m ²

III. MODELING AND ANALYSIS

X BRACING

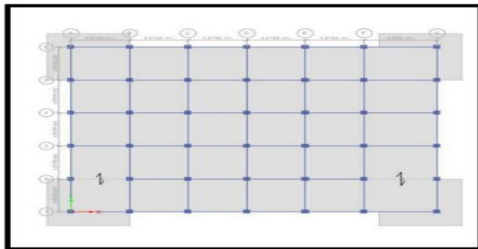


PLAN VIEW

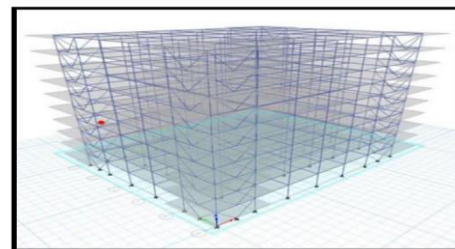


3D VIEW

V BRACING

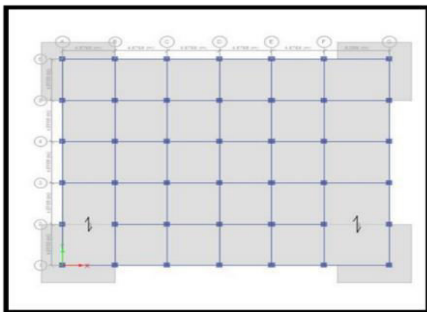


PLAN VIEW

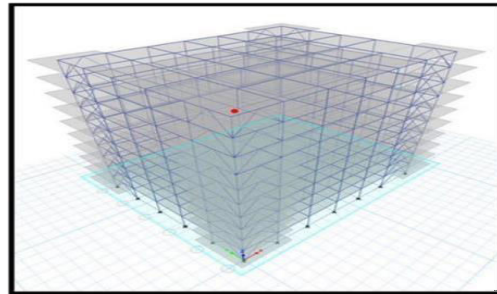


3D VIEW

INVERTED V BRACING



PLAN VIEW



3D VIEW

MAXIMUM STOREY DISPLACEMENT

Storey	X- Bracing		V – Bracing		INVERTED V Bracing	
	X- DIR	Y -DIR	X-DIR	Y -DIR	X- DIR	Y -DIR
10	16.858	17.162	17.393	17.729	16.552	16.89
9	15.872	16.07	16.431	16.702	15.648	15.924
8	14.66	14.778	15.233	15.461	14.49	14.716
7	13.214	13.261	13.797	13.986	13.085	13.266
6	11.569	11.554	12.151	12.305	11.47	11.607
5	9.764	9.697	10.334	10.455	9.688	9.786
4	7.851	7.744	8.391	8.483	7.801	7.862
3	5.895	5.761	6.378	6.447	5.865	5.903
2	3.967	3.855	4.359	4.434	3.959	4
1	2.156	2.121	2.415	2.514	2.164	2.235
Base	0	0	0	0	0	0

MAXIMUM STOREY SHEAR

Storey	X- Bracing		V – Bracing		INVERTED V Bracing	
	X- DIR	Y -DIR	X-DIR	Y -DIR	X- DIR	Y -DIR
10	1062.0	1056.36	1017.88	993.19	1062.32	1041.98
9	2105.35	2083.95	2017.59	1962.23	2109.45	2062.14
8	3012.32	2969.55	2888.83	2802.45	3024.52	2948.45
7	3799.12	3731.19	3646.71	3529.16	3820.45	3714.78
6	4479.41	4386.44	4304.33	4158.00	4509.28	4375.47
5	5061.81	4946.15	4870.34	4699.53	5098.68	4940.87
4	5550.29	5415.01	5348.79	5158.38	5592.35	5414.47
3	5942.84	5792.85	5737.18	5533.77	5988.65	5797.89
2	6234.91	6074.67	6029.76	5819.08	6283.44	6085.02
1	6412.56	6248.47	6210.25	5998.81	6463.48	6263.45
Base	0	0	0	0	0	0

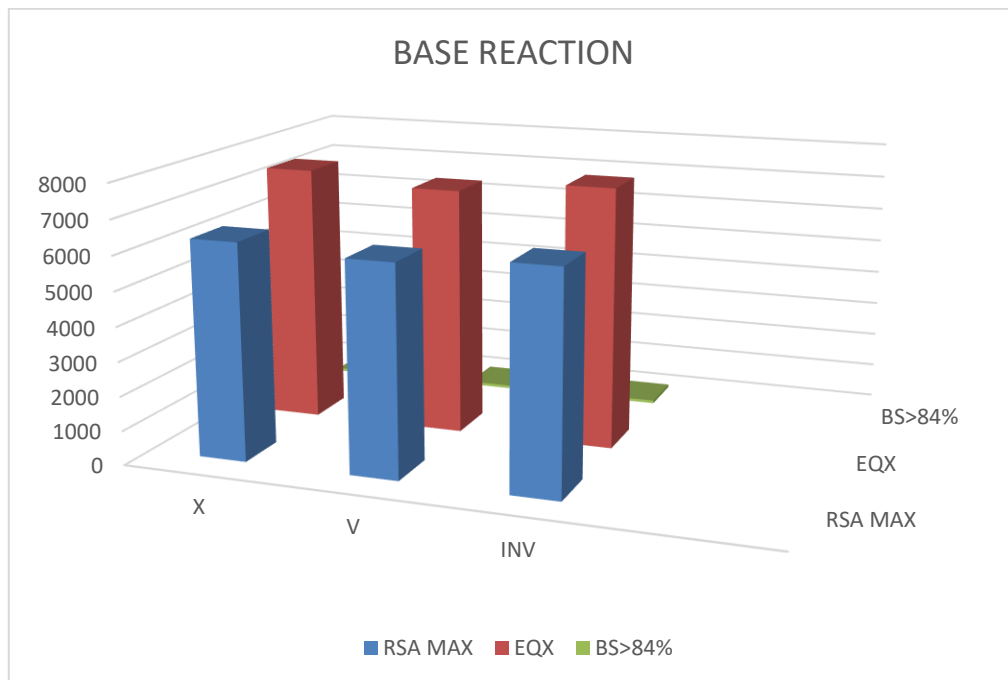
AUTO LATERAL LOAD

Storey	X- Bracing		V – Bracing		INVERTED V Bracing	
	X- DIR	Y -DIR	X-DIR	Y	X- DIR	Y -DIR
10	1848.38	1811.04	1775.0149	1717.06	1062.25	1041.95
9	1645.15	1611.98	1576.1501	1524.69	2109.42	2062.11
8	1299.87	1273.68	1245.3532	1204.69	3024.44	2948.52
7	995.218	975.11	953.4735	922.34	3820.41	3714.76
6	731.180	716.40	700.5112	677.64	4509.26	4375.54
5	507.76	497.50	486.4661	470.58	5098.47	4940.75
4	324.96	318.44	311.3383	301.17	5592.32	5414.92
3	182.79	179.10	175.1278	169.45	5988.66	5797.98
2	81.24	79.60	77.8346	75.29	6283.47	6085.45
1	20.31	19.90	19.4586	18.82	6463.46	6263.78
Base	0	0	0	0	0	0

IV. RESULTS AND DISCUSSION

BASE REACTION RESULTS

BRACINGS MODEL	RSA MAX	EQX	BS>84%
X	6312.569	7536.901	83.95821
V	6110.245	7220.728	84.82097
INV [^]	6363.445	7585.966	84.08412

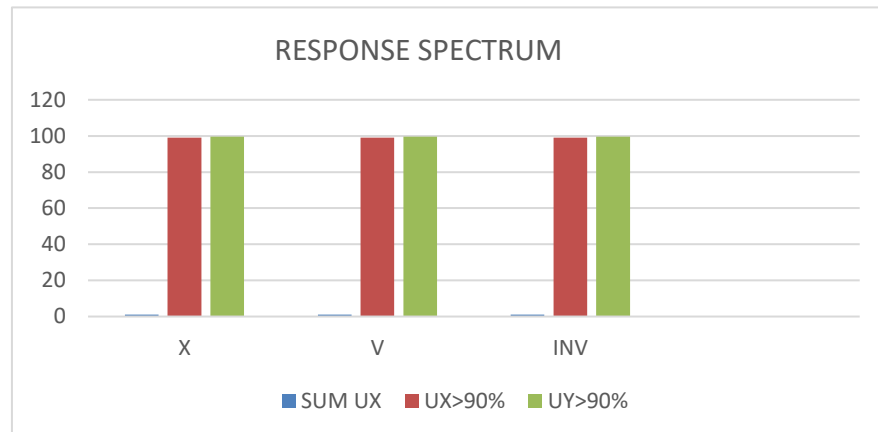


GRAPH 1 BASE REACTION

From the IS, the scale factor 1428 by determining the reactions in relation to the RSA. The values occurred for the EQX and EQY models indicate that the location offers a safety margin of greater than 84%, as per the code book's guidelines. This suggests that the enhanced model can withstand all the good reactions as per ISC, ensuring its safety and reliability.

RESPONSE SPECTRUM RESULTS

BRACINGS MODEL	SUM UX	UX>90 %	UY >90%
X	0.99	99	99.50
V	0.9902	99.02	99.54
IN V	0.9902	99.02	99.54



GRAPH 2 : RESULT OF RESPONSE SPECTRUM

From the IS, the response spectrum model occurring mass ratio requires a value greater than 90% for sum of values along both axes. Our analysis reveals that the model participating mass ratio for the valley is 99.51%, the web is 99.5%, and inverted V bracings is also 99.5%. Since all values exceed the required 90%, the model are fully validated and considered safe for result consideration.

DISPLACEMENT IN X DIRECTION

BRACINGS MODEL	X in mm
X	16.958
V	17.393
INVERTED V	16.652

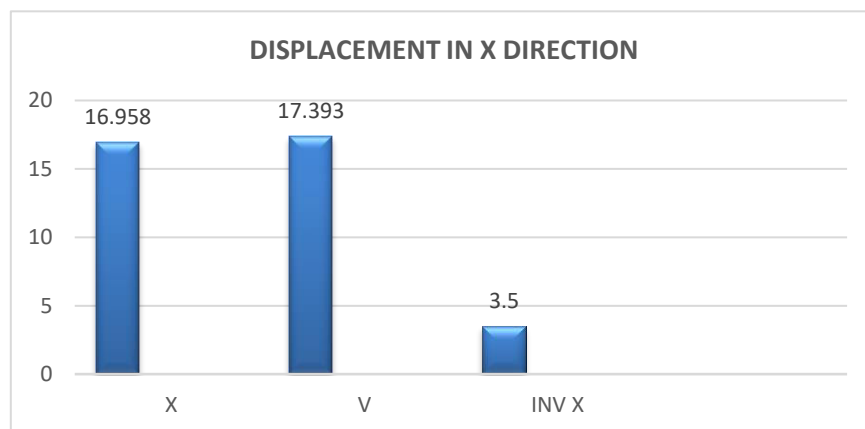


FIG 3 DISPLACEMENT IN X DIRECTION

As per above results for the X direction in X-bracing is 16.85mm, V-bracing is 17.39mm, and inverted Bracing is 16.65mm. The inverted V-bracing has the least displacement.

DISPLACEMENT IN Y DIRECTION

BRACINGS MODEL	Y Dir
X	17.162
V	17.729
INVERTED V	16.89

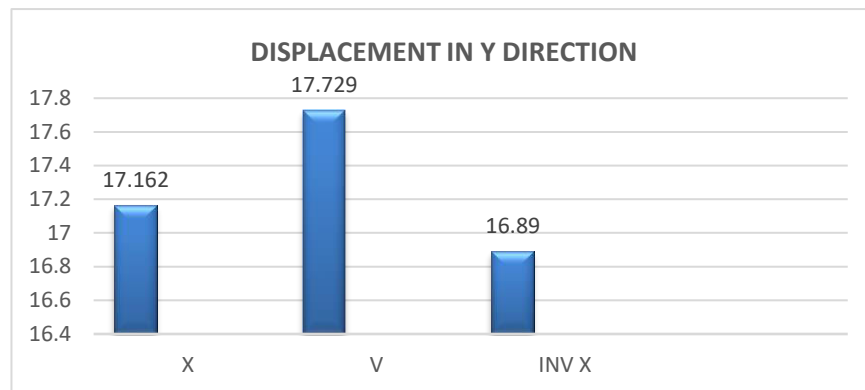


FIG 3 DISPLACEMENT IN Y DIRECTION

The maximum storey displacement for the Y direction in X-bracing is 17.16mm, V-bracing is 17.72mm, and inverted Bracing is 16.89mm. The inverted V-bracing has the least displacement

STORY SHEAR IN X DIRECTION

BRACINGS MODEL	X Dir
X	1062.33
V	1017.86
INVERTED V	1062.22

The maximum story Shear for X- direction in X- Bracing is 1062.33 KN, V- Bracing is 1017.8KN

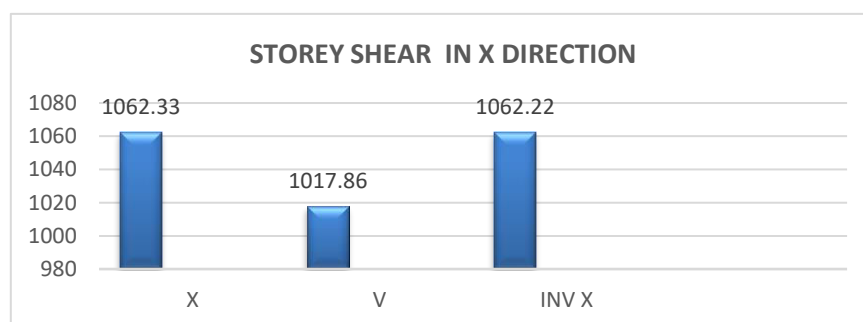


FIG 4 STOREY SHEAR IN X DIRECTION

is 1062.33 KN, V- Bracing is 1017.8KN and inverted Bracing is 1062.55KN. the inverted V-bracing has the least displacement when compare

STORY SHEAR IN Y DIRECTION

BRACINGS MODEL	Y Dir
X	1056.40
V	993.25
INVERTED V	1041.92

The storey shear for the Y-direction in X-bracing is 1056.40KN, V-bracing is 993.25KN, and inverted Bracing is 1041.92KN. The V-bracing has the least displacement

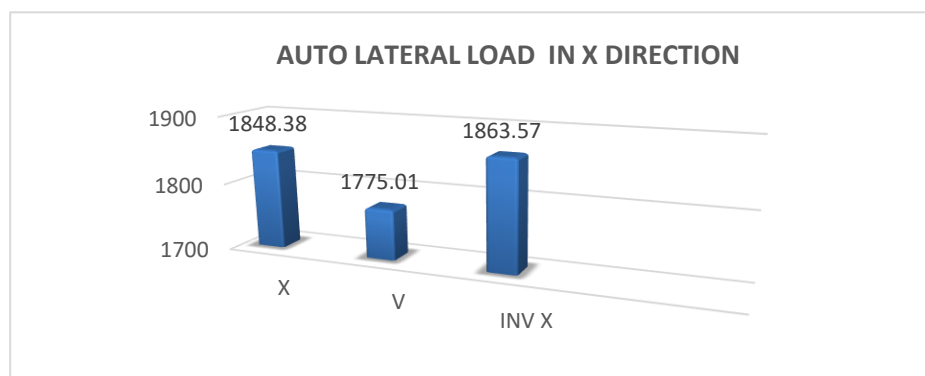


FIG 5 STOREY SHEAR IN X DIRECTION

AUTO LATERAL LOAD IN X DIRECTION

BRACINGS MODEL	X Dir
X	1848.38
V	1775.01
INVERTED V	1863.57

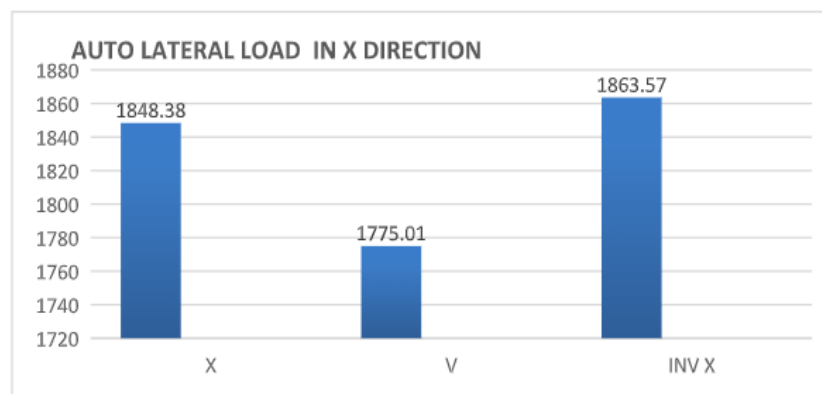


FIG 6 AUTO LATERAL LOAD IN X DIRECTION

the Auto lateral load of X- direction in X-bracing is 1848.38KN, V-bracing is 1775.01 KN and inverted Bracing is 1863.57KN. the V-bracing has the least displacement when compared.

AUTO LATERAL LOAD IN Y DIRECTION

BRACINGS MODEL	Y in KN
X	1811.048
V	1717.067
INVERTED V	1805.821

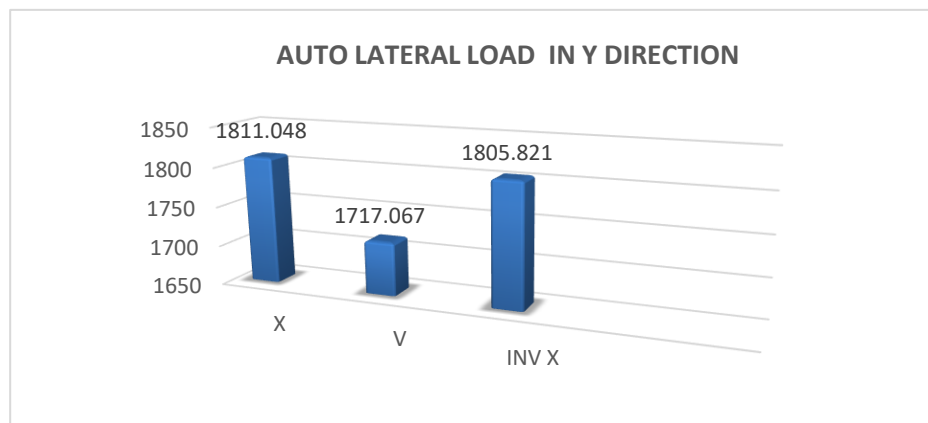


FIG 6 AUTO LATERAL LOAD IN Y DIRECTION

The Auto lateral load of Y- direction in X-bracing is 1811.04 KN, V-bracing is 1717.06 KN and inverted Bracing is 1805.82 KN. the V-bracing has the least displacement when compared.

V. CONCLUSION

1. In the X direction, V-bracing has 5.08% more displacement than the X-bracing, which has 1.84% more displacement than the inverted V-bracing.
2. In the Y direction, V-bracing has 4.91% more displacement than X-bracing, which has 1.59% more displacement than inverted V-bracing.
3. In the X direction inverted V-bracing has 6.36% more Storey shear when compared with the X-bracing has 1.84% more Storey shear when compared with the V-bracing.
4. In the Y direction, X-bracing has 5.47% more Storey shear than V-bracing, which has 4.9% more storey shear than inverted V-bracing.
5. In the X direction, V-bracing has 5.08% more Auto lateral load than the X-bracing, which has 1.84% more auto lateral load than the inverted V-bracing.
6. In the Y direction, the V-bracing has 5.08% more Auto lateral load than the X- bracing, which has 1.84% more auto lateral load than the inverted V-bracing.
7. In the X direction, V-bracing has 84% more base reaction than the X-bracing, which has 83.9% more base reaction than the inverted V-bracing.
8. As per above results the maximum storey displacement and auto lateral load on both directions has occurred good results on V-bracing and the maximum storey shear in X direction is of inverted V-bracing & Y- direction has X-bracing are given good results.

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