Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 11, November-2023

Comparative Seismic Analysis Of Concrete And Steel Structures With Shear Wall Using Etabs

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Abstract : The requirement for tall buildings has increased dramatically as a result of population growth and rising metropolitan area space demands. Tall buildings are vulnerable to dynamic loading, which mostly poses a risk in the form of lateral stress that varies over time and is mostly brought on by wind and earthquakes. In these situations, response spectrum analysis is frequently employed to assess a structure's seismic capabilities. The two models with and without shear walls with various percentage openings are the subject of the current literature. The parametric research for base shear comparison, and displacement for various shear wall locations inside the building is presented in this paper. The outcomes are distinct and worthwhile of further study.

KeyWords: Linear Dynamic Analysis, Response Spectrum Analysis, Shear wall, ETABS,Sear wall **opening.**

1. INTRODUCTION

The relative movement of the tectonic plates along and across plate boundaries causes earthquakes, which are natural phenomena. There are three types of plate boundaries: transform, divergent, and convergent. While divergent borders result in less harm, convergent and transformative plate boundaries do more. An earthquake of a given magnitude causes different levels of intensities of shaking in the neighbouring locations of its focal point and therefore the structural damage induced in the buildings differs from location to location. In earthquake resistant design, due to the random motion of ground the building will reacts differently which can be classified into three different cases as (i) minor shaking with no structural damage, (ii) moderate shaking with minor structural damage and (iii) severe earthquake with both structural and non-structural damage.

Ground motion induces inertia force in the building in terms of a displacement-type loading. Among the structural elements columns and walls are the most important in transferring the loads, so for tradition construction designing of the floor slab and beam should receive more important. Poorly designed reinforced concrete columns can be disastrous. It was observed that during the BHUJ earthquake in 2001 (India), many buildings collapsed due to the failure of the ground storey column. Therefore, engineers have come out with many techniques to resist the lateral forces by increasing the stiffness

by providing shear walls, bracing system, and moment-resisting system. Nowadays, structures are normally design based on the performance of the building or structure.

Shear wall system is one of the most commonly used lateral load resisting system in high rise buildings. Shear wall is high in plane stiffness and strength which can be used to simultaneously resist large horizontal loads and support gravity loads, which significantly reduces lateral sway of the building and thereby reduces damage to structure and its contents. Steel Plate Shear Wall (SPSW) system is an effective seismic load resisting system for new building and seismic up gradation of existing buildings. Its robust post-buckling strength, large ductility, great initial stiffness and stable hysteretic behaviours have introduced it as an alternative to conventional lateral load resisting systems.

1.1 CLASSIFICATION OF SHEAR WALLS

a) Simple rectangular types and flanged walls (bar bell type)
b) Coupled shear walls
c) Rigid frame shear walls
d) Framed walls with in filled frames
e) Column supported shear walls
f) Core type shear walls

1.2 TYPES OF SHEAR WALLS

a) RC Shear Wall
b) Plywood Shear Wall
c) Mid ply Shear Wall
d) RC Hollow Concrete Block Masonry Wall
e) Steel Plate Shear Wall

1.2.1.RC Shear Wall: It comprises of strengthened solid dividers and fortified solid pieces. Divider thickness differs from 140 mm to 500 mm, contingent upon the quantity of stories, building age, and warm protection prerequisites. By and large, these dividers are consistent all through the building stature; be that as it may, a few dividers are suspended at the road front or storm cellar level to take into account business or parking spots. Typically the divider design is symmetrical regarding no less than one Floor pieces are either thrown in-

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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situ level sections or less frequently, precast empty center chunks. Structures are upheld by solid strip or tangle establishments; the last kind is basic for structures with storm cellars. Auxiliary changes are not exceptionally normal in this sort of development. Fortification prerequisites depend on construction standard necessities particular for every nation. All in all, the divider support comprises of two layers of appropriated fortification (even and vertical) all through the divider length. What's more, vertical support bars are given near the entryway and window openings, and in addition at the divider end zones (otherwise called limit components or barbells).

1.2.2 Steel Plate Shear Wall:

When all is said in done, steel plate shear divider framework comprises of a steel plate divider, limit segments and even floor shafts. Together, the steel plate divider and limit sections go about as a vertical plate support. The sections go about as spines of the vertical plate brace and the steel plate divider goes about as its web. The level floor shafts act, pretty much, as transverse stiffeners in a plate brace Steel plate shear divider frameworks have been utilized as a part of ongoing years in exceptionally seismic zones to oppose sidelong loads. Figure demonstrates two fundamental sorts of steel shear dividers; unstiffened and hardened with or without openings.

1.3.RESPONSE SPECTRUM ANALYSIS

The response spectrum is the linear-dynamic response analysis of building or structure which is subjected to lateral/seismic force. Response spectrum is a single degree of freedom system based analysis. Response spectrum curve of building subjected to lateral/earthquake force can be plotted considering time period (horizontal axis) vs. acceleration, velocity, displacement (vertical axis) to find the peak response of structure with respect to past earthquake force applied on it. It is an elastic dynamic approach which assumes that the dynamic response of a structure can be found by considering the response of the building to different modes of vibration independently and then recombining them suitably to study their combined effects. The plot of the peak responses (viz. Displacement, acceleration etc.) of an elastic structure having single degree of freedom can be obtained after applying ground acceleration with a specified damping in the structure. The dynamic response spectrum analysis (IS code 1893-2016) gives us following engineering properties below;

- The natural period of vibration of the structures response to the dynamic motion.
- Building provided with different types of foundation
- The damping properties of the structure
- Importance factor of the building
- The structural ductility can be represented by response reduction factor.

1.4. Objectives of study

The present work aims at studying the following characteristics using linear dynamic analysis:

- To investigate the behaviour of RCC building and steel buildings with shear wall.
- To study the effect of different percentage of openings in shear wall
- To study various responses such as Roof displacement, Time period, Storey Shears, Overturning moments of buildings.

2.0. MODELING

The structural models consists of Twenty one storey's (G+20). The floor diaphragms are assumed to be rigid.Preliminary sizes of structural components are calculated for gravity loads only.
For structural elements, for columns, beams and slabs Fe500 grade steel and M30 grade Concrete is used for concrete structure.Fe 345 grade steel is used for steel structure.The height of typical floor height was considered as 3.00m.The Fig 1 represent the plan in Ground and typical floor plan of the building. The models considered were:

2.1.1. Details of G+20 Concrete Structure with RCC Shear wall:

- **Model 1**: RCC structure without Shear wall.
- **Model 2**: RCC with Shear wall.
- **Model 3**: RCC with 10%Shear wall opening.
- **Model 4**: RCC with 20% Shear wall opening
- **Model 5**: RCC with 30% Shear wall opening

2.1.2. Details of G+20 Steel Structure with Steel Plate shear wall:

- **Model 1**: Steel structure without Shear wall.
- **Model 2**: Steel with Shear wall.
- **Model 3**: Steel with 10% Shear wall opening.
- **Model 4**: Steel with 20% Shear wall opening.
- **Model 5**: Steel with 30% Shear wall opening.

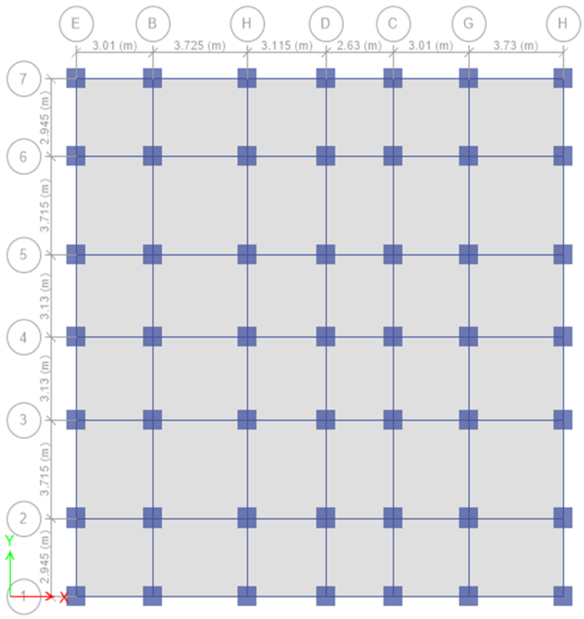

Fig.1: Ground Floor and Typical Floor Plan

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ISSN: 2278-0181
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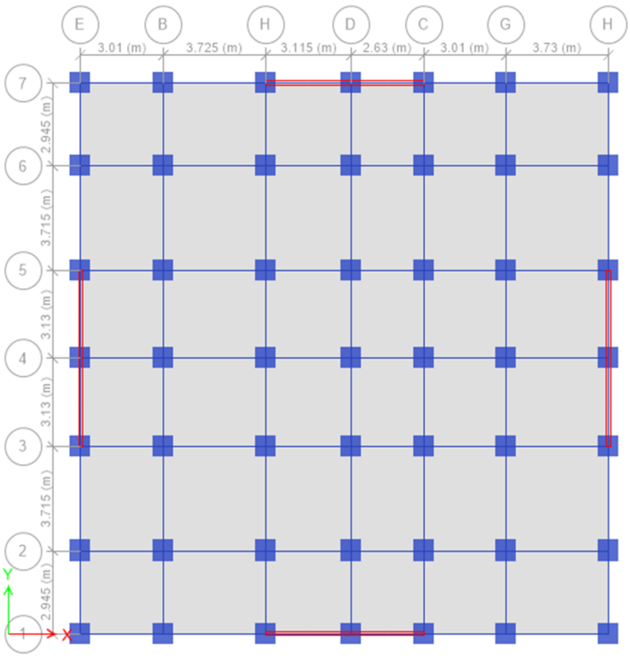

Fig.2: Ground Floor and Typical Floor Plan with shear wall

Table 2.1: Details Of Concrete Structure

Number of storeys	20 Storey
Shear wall thickness	120 mm
Slab thickness	120 mm
Beam dimensions	450x230 mm
Column dimensions	750x750 mm
Grade of concrete	M30
Grade of steel	HYSD500
Unit weight of concrete	25 KN/m^3
Live loads (a) Floor loads (b) Floor finishes	4 KN/m^3 1.5 KN/m^2
Importance factor	1.0
Seismic zone factor	0.36
Response reduction factor	5

Table 2.2: Details Of Steel Structure

Number of storeys	20 Storey
Shear wall thickness	8 mm
Slab thickness	120 mm
Beam dimensions	ISMB350
Column dimensions	ISMB550
Grade of steel	Fe345
Live loads (a) Floor loads (b) Floor finishes	4 KN/m^3 1.5 KN/m^2
Importance factor	1.0
Seismic zone factor	0.36
Response reduction factor	5

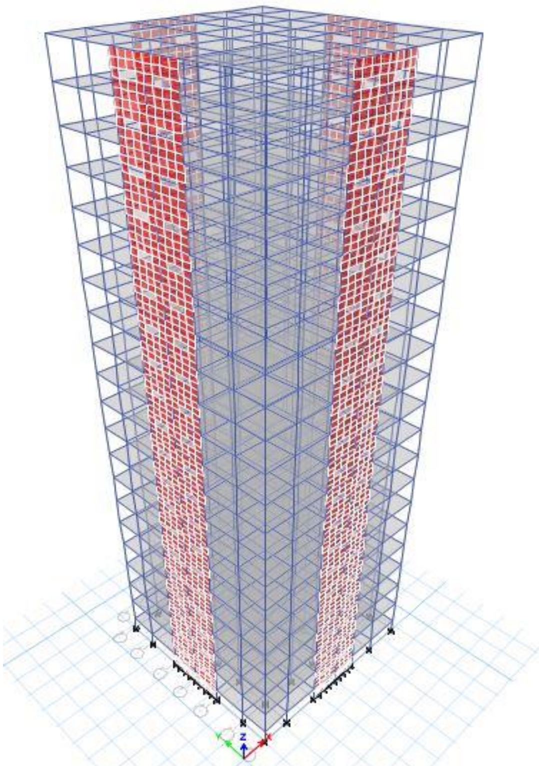

Fig.3: Isometric view of shear wall with 10% opening

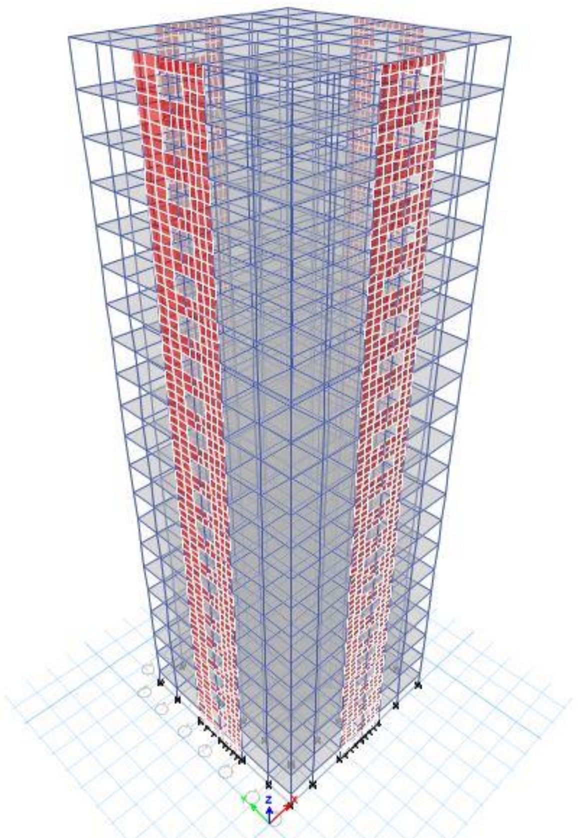

Fig.4: Isometric view of shear wall with 20% opening.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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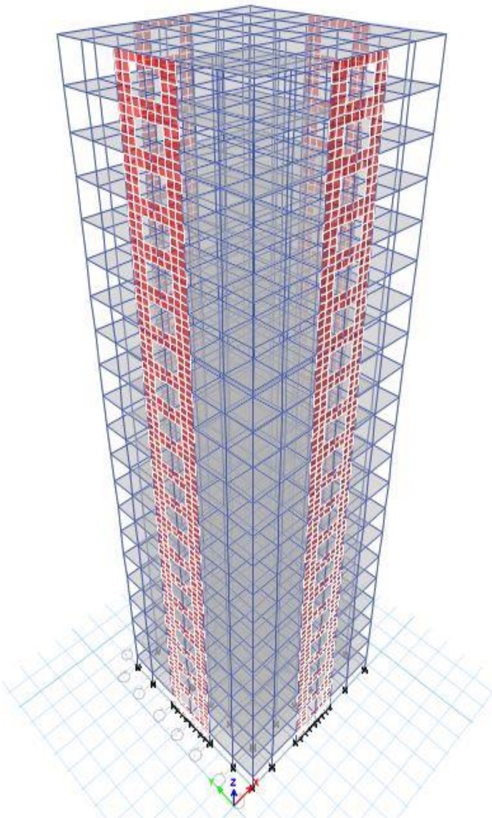

Fig 5: Isometric view of shear wall with 30% opening.

2.2. Seismic Analysis:

For the analysis purpose, these structures are assumed to be located in Zone V (Zone factor-0.36)on site with medium soil and *Sa/g* value taken from the figure 2A &2B of IS 1893-2016 i.e., Response spectra for and soil sites for 5% damping for equivalent and response spectrum analysis respectively. These structures are considered having importance factor is 1.0 and the frames are proposed to have special RC moment resisting frames(SMRF) and hence the Reduction factor is taken as 5.

3. RESULTS FROM SEISMIC ANALYSIS:

a) G+20 Concrete Structure:

Table3.1: Horizontal Storey Displacements(mm) of G+20 Concrete Building RSX

Storey Displacements G+20 Concrete structure (RSX)					
Storey	X-Direction (mm)				
	Without	with	10%	20%	30%
Story1	4.73	2.80	0.91	0.93	0.99
Story2	17.02	9.28	6.56	6.92	7.53
Story3	34.61	17.98	15.53	16.44	18.12
Story4	55.76	28.24	26.55	28.12	31.18
Story5	79.13	39.70	38.92	41.17	45.73
Story6	103.73	52.09	52.21	55.11	61.15
Story7	128.80	65.22	66.15	69.64	77.04
Story8	153.78	78.93	80.56	84.54	93.14
Story9	178.27	93.08	95.26	99.66	109.27
Story10	201.98	107.55	110.15	114.88	125.29
Story11	224.70	122.21	125.11	130.08	141.11
Story12	246.27	136.98	140.05	145.19	156.65
Story13	266.61	151.76	154.88	160.12	171.82
Story14	285.61	166.47	169.52	174.79	186.56
Story15	303.23	181.03	183.88	189.11	200.79
Story16	319.42	195.37	197.89	203.00	214.42
Story17	334.17	209.41	211.46	216.39	227.38
Story18	347.50	223.09	224.51	229.19	239.60
Story19	359.50	236.38	237.01	241.37	251.04
Story20	370.37	249.22	248.91	252.89	261.74
Story21	380.45	261.62	260.31	263.87	271.83

Fig 1: Storey Displacements G+20 Concrete structure (RSX)

Table3.2: Horizontal Storey Displacements(mm) of G+20 Concrete Building (RSY)

Published by :
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International Journal of Engineering Research & Technology (IJERT)
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Storey Displacements G+20 Concrete Structure (RSX)					
Storeys	Y-Direction (Mm)				
	Without	With	10%	20%	30%
Story1	4.75	2.74	0.89	0.98	0.98
Story2	17.09	9.00	6.41	7.51	7.45
Story3	34.77	17.38	15.14	17.87	17.90
Story4	56.05	27.24	25.82	30.63	30.77
Story5	79.59	38.24	37.78	44.81	45.08
Story6	104.39	50.15	50.63	59.87	60.24
Story7	129.69	62.80	64.13	75.44	75.85
Story8	154.93	76.04	78.09	91.29	91.68
Story9	179.69	89.74	92.37	107.25	107.54
Story10	203.69	103.77	106.85	123.20	123.31
Story11	226.70	118.05	121.44	139.05	138.89
Story12	248.60	132.46	136.04	154.70	154.21
Story13	269.25	146.93	150.57	170.09	169.18
Story14	288.59	161.36	164.94	185.13	183.74
Story15	306.55	175.69	179.08	199.74	197.81
Story16	323.08	189.83	192.89	213.83	211.30
Story17	338.18	203.71	206.30	227.32	224.15
Story18	351.87	217.28	219.23	240.14	236.26
Story19	364.23	230.47	231.63	252.23	247.62
Story20	375.47	243.26	243.47	263.59	258.25
Story21	385.92	255.62	254.81	274.36	268.28

Fig 2: Storey Displacements G+20 Concrete structure (RSY)

Table3.3: Storey Shear (KN) of G+20 Concrete Building (RSX)

Storey Shears G+20 Concrete structure(RSX)					
Storey	X-Direction (mm)				
	Without	With	10%	20%	30%
Storey1	3603.1	5800.9	6966.4	6230.4	6473.0
Storey2	3602.0	5799.0	6965.9	6229.9	6472.5
Storey3	3597.4	5791.6	6960.6	6224.7	6467.5
Storey4	3587.0	5774.9	6945.6	6210.0	6453.7
Storey5	3568.7	5745.3	6916.4	6181.4	6426.5
Storey6	3539.9	5699.1	6868.0	6134.1	6381.6
Storey7	3498.6	5632.5	6795.8	6063.3	6314.5
Storey8	3442.3	5541.8	6694.9	5964.6	6220.7
Storey9	3368.8	5423.3	6560.6	5833.1	6095.9
Storey10	3275.7	5273.4	6388.1	5664.1	5935.6
Storey11	3160.9	5088.4	6172.6	5453.2	5735.4
Storey12	3021.8	4864.5	5909.3	5195.4	5490.8
Storey13	2856.4	4598.0	5593.5	4886.2	5197.4
Storey14	2662.2	4285.3	5220.4	4520.9	4850.8
Storey15	2437.1	3922.5	4785.2	4094.8	4446.5
Storey16	2178.6	3506.2	4283.2	3603.3	3980.0
Storey17	1884.5	3032.4	3709.5	3041.6	3447.0
Storey18	1552.4	2497.6	3059.4	2405.1	2843.0
Storey19	1180.2	1898.0	2328.1	1689.1	2163.6
Storey20	765.5	1230.3	1510.9	889.0	1404.3
Storey21	305.9	490.0	602.9	590.5	560.7

Table3.4: Storey Shear (KN) of G+20 Concrete Building (RSY)

Storey Shears G+20 Concrete structure					
Storey	Y-Direction (mm)				
	Without	With	10%	20%	30%
Storey1	3564.7	5968.6	7147.5	6849.7	6588.3
Storey2	3563.6	5966.7	7147	6849.2	6587.9
Storey3	3559	5959.1	7141.5	6843.9	6582.8
Storey4	3548.8	5942	7126.2	6829.3	6568.7
Storey5	3530.6	5911.5	7096.2	6800.5	6541
Storey6	3502.2	5863.9	7046.6	6753	6495.3
Storey7	3461.3	5795.4	6972.4	6681.9	6427
Storey8	3405.6	5702.1	6868.9	6582.7	6331.6
Storey9	3332.9	5580.2	6731.1	6450.7	6204.6
Storey10	3240.8	5426	6554.1	6281.1	6041.4
Storey11	3127.1	5235.6	6333	6069.2	5837.6
Storey12	2989.6	5005.2	6062.9	5810.3	5588.7
Storey13	2825.9	4731	5738.9	5499.8	5290.1
Storey14	2633.8	4409.3	5356.1	5133	4937.2
Storey15	2411.1	4036.1	4909.6	4705.1	4525.7
Storey16	2155.3	3607.7	4394.5	4211.5	4051
Storey17	1864.4	3120.3	3805.9	3647.4	3508.5
Storey18	1535.9	2570	3138.9	3008.2	2893.7
Storey19	1167.6	1953.1	2388.6	2289.2	2202.2
Storey20	757.31	1265.8	1550.1	1485.7	1429.4
Storey21	302.67	504.18	618.56	592.96	570.74

Fig 3: Storey Shear G+20 Concrete structure (RSX)

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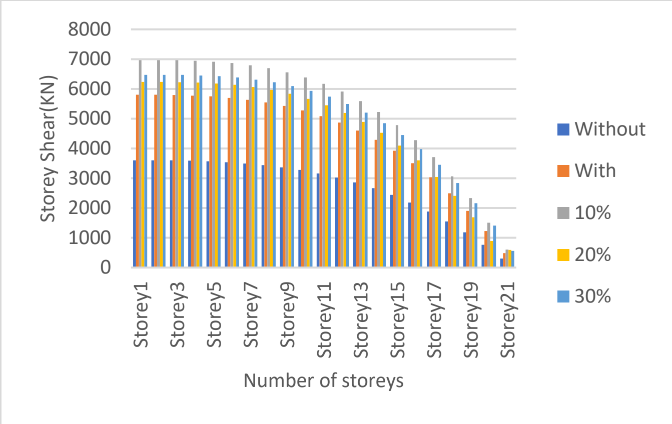

Fig 4: Storey Shear G+20 Concrete structure (RSY)

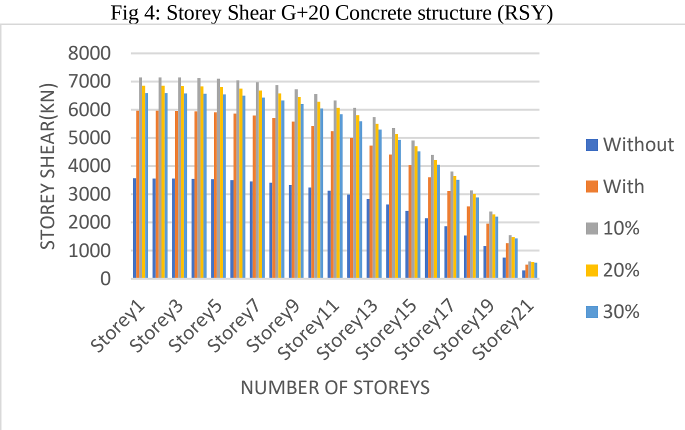

Table3.5: Lateral Loads G+20 Concrete structure (RSX)

Lateral Loads G+20 Concrete structure(RSX)					
Storey	X-Direction (mm)				
	Without	With	10%	20%	30%
Storey1	1.15	1.85	0.48	0.47	0.45
Storey2	4.60	7.40	5.37	5.26	4.99
Storey3	10.34	16.65	14.92	14.61	13.87
Storey4	18.38	29.61	29.25	28.64	27.18
Storey5	28.72	46.26	48.35	47.34	44.92
Storey6	41.32	66.62	72.23	70.72	67.11
Storey7	56.29	90.68	100.89	98.78	93.73
Storey8	73.53	118.44	134.32	131.51	124.79
Storey9	93.06	149.89	172.52	168.91	160.29
Storey10	114.89	185.05	215.50	211.00	200.22
Storey11	139.01	223.92	263.26	257.75	244.59
Storey12	165.44	266.48	315.79	309.19	293.40
Storey13	194.16	312.74	373.10	365.30	346.64
Storey14	225.18	362.71	435.19	426.08	404.32
Storey15	258.49	416.37	502.05	491.54	466.44
Storey16	294.11	473.74	573.68	561.68	533.00
Storey17	332.02	534.89	650.09	636.49	603.99
Storey18	372.23	599.58	731.28	715.98	679.42
Storey19	414.74	668.05	817.24	800.15	759.28
Storey20	459.54	740.22	907.98	888.99	843.59
Storey21	305.93	490.03	602.89	590.46	560.75

Table3.6: Lateral Loads G+20 Concrete structure (RSY)

Lateral Loads G+20 Concrete structure(RSY)					
Storey	Y-Direction (mm)				
	Without	With	10%	20%	30%
Storey1	1.14	1.90	0.49	0.47	0.45
Storey2	4.55	7.62	5.51	5.28	5.08
Storey3	10.23	17.14	15.31	14.67	14.11
Storey4	18.19	30.46	30.01	28.76	27.66
Storey5	28.42	47.60	49.61	47.54	45.73
Storey6	40.92	68.54	74.11	71.02	68.31
Storey7	55.69	93.30	103.51	99.19	95.40
Storey8	72.74	121.86	137.81	132.06	127.02
Storey9	92.07	154.22	177.01	169.63	163.14
Storey10	113.66	190.40	221.11	211.89	203.79
Storey11	137.53	230.38	270.10	258.84	248.95
Storey12	163.67	274.17	324.00	310.49	298.63
Storey13	192.09	321.77	382.80	366.84	352.82
Storey14	222.77	373.18	446.50	427.88	411.53
Storey15	255.74	428.40	515.10	493.62	474.75
Storey16	290.97	487.42	588.59	564.05	542.50
Storey17	328.48	550.25	666.99	639.18	614.75
Storey18	368.26	616.89	750.29	719.01	691.53
Storey19	410.31	687.34	838.49	803.53	772.82
Storey20	454.64	575.78	931.58	892.74	858.62
Storey21	302.67	504.18	618.56	592.96	570.74

Fig 5: Lateral Load G+20 Concrete structure (RSX)

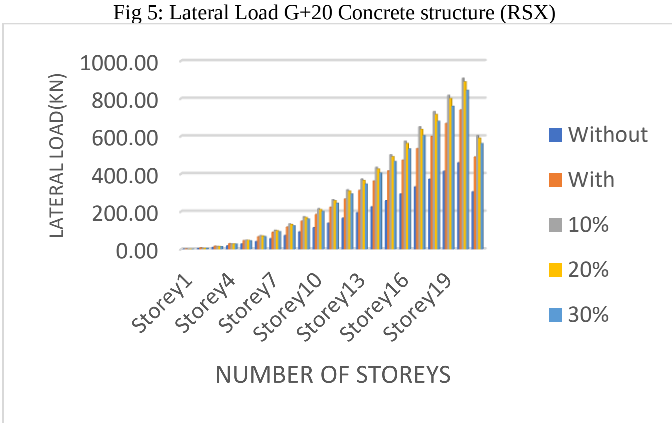

Fig 6: Lateral Load G+20 Concrete structure (RSY)

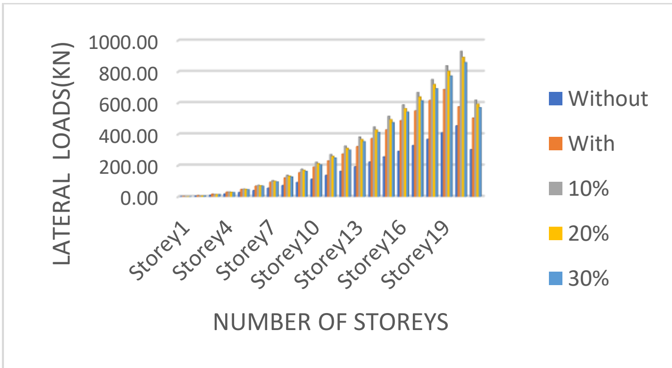

Table3.7: Time Periods of G+20 Concrete structure

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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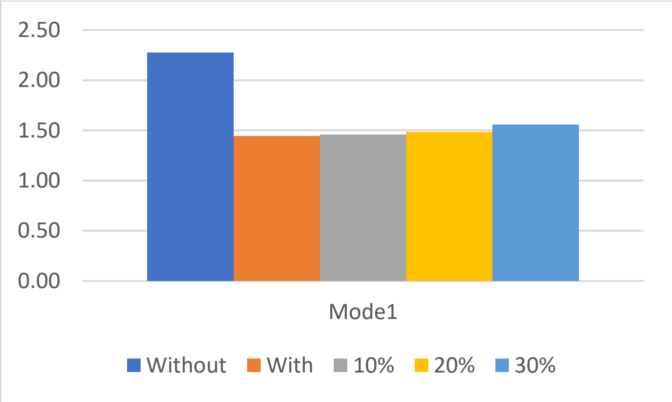
Time Periods of G+20 Concrete Structure					
Mode	Without	With	10%	20%	30%
	Time Period (sec)				
Mode1	2.27	1.44	1.46	1.48	1.56

Fig 7: Time Period (sec) G+20 Concrete structure



b) G + 20 Steel Structure:

Table3.8: Horizontal Storey Displacements(mm) of G+20 Steel Building RSX

Storey Displacements for G+20 Steel Structure(RSX)					
Storey	**X-Direction (mm)**				
	Without	**with**	**10%**	**20%**	**30%**
Story1	44.315	7.369	9.579	12.111	13.81
Story2	76.127	18.48	22.128	26.81	29.76
Story3	104.095	33.02	37.829	44.048	47.82
Story4	130.609	50.03	55.779	63.035	67.28
Story5	156.262	68.76	75.266	83.201	87.65
Story6	181.17	88.63	95.731	104.09	108.5
Story7	205.334	109.2	116.73	125.34	129.7
Story8	228.73	130	137.94	146.68	150.7
Story9	251.335	150.9	159.07	167.87	171.6
Story10	273.126	171.5	179.94	188.76	192.2
Story11	294.076	191.8	200.37	209.2	212.3
Story12	314.149	211.5	220.24	229.08	231.8
Story13	333.291	230.6	239.45	248.3	250.6
Story14	351.427	249	257.89	266.77	268.8
Story15	368.46	266.5	275.5	284.42	286.1
Story16	384.27	283.2	292.2	301.17	302.5
Story17	398.721	298.9	307.95	316.94	317.9
Story18	411.665	313.7	322.71	331.69	332.3
Story19	422.959	327.6	336.5	345.39	345.6
Story20	432.515	340.6	349.38	358.01	357.7
Story21	440.46	352.8	361.23	369.42	368.6

Table3.9: Horizontal Storey Displacements(mm) of G+20 Steel Building RSY

Storey Displacements G+20 Steel Structure(RSY)					
Storey	**Y-Direction (mm)**				
	without	**with**	**10%**	**20%**	**30%**
Story1	240.04	6.63	8.53	12.55	14.62
Story2	309.94	18.85	22.74	31.71	36.00
Story3	375.27	35.70	41.66	55.22	61.96
Story4	438.81	56.23	64.24	82.00	90.23
Story5	500.44	79.60	89.60	110.82	119.95
Story6	560.01	105.08	116.97	140.89	150.57
Story7	617.38	132.09	145.73	171.70	181.68
Story8	672.39	160.13	175.39	202.88	212.97
Story9	724.89	188.81	205.54	234.13	244.19
Story10	774.72	217.82	235.88	265.25	275.17
Story11	821.74	246.92	266.18	296.08	305.76
Story12	865.79	275.92	296.27	326.50	335.85
Story13	906.70	304.70	326.01	356.41	365.33
Story14	944.30	333.13	355.31	385.73	394.10
Story15	978.40	361.13	384.08	414.37	422.06
Story16	1008.82	388.64	412.26	442.23	449.10
Story17	1035.36	415.60	439.79	469.20	475.09
Story18	1057.81	441.97	466.63	495.16	499.90
Story19	1075.95	467.77	492.77	520.03	523.40
Story20	1089.54	493.03	518.25	543.76	545.51
Story21	1098.45	517.84	543.13	566.43	566.27

Fig 8: Storey Displacements G+20 Steel structure (RSX)

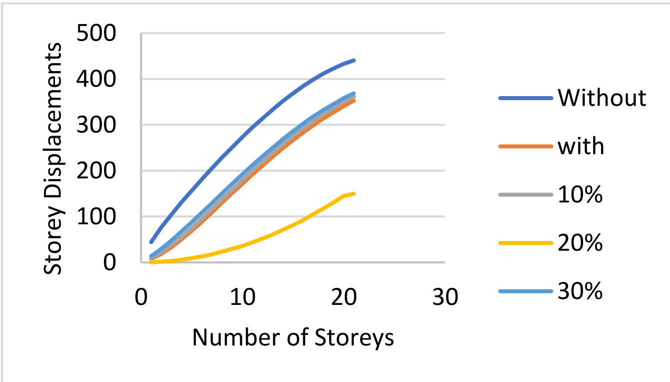


Fig 9: Storey Displacements G+20 Steel structure (RSY)

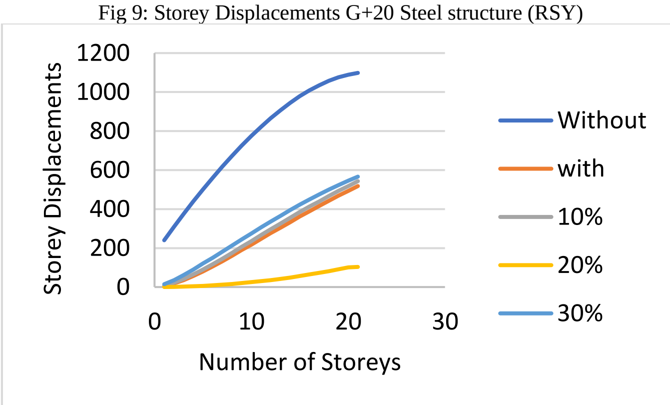


Table3.10: Storey Shear (KN) of G+20 Steel Building (RSX)

International Journal of Engineering Research & Technology (IJERT)
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Storey Shears of G+20 Steel Structure (RSX)					
Storey	X-Direction (mm)				
	without	with	10%	20%	30%
Story1	9504.32	11866	11697	11670	11524
Story2	9330.65	11758	11572	11538	11385
Story3	9062.57	11547	11343	11296	11134
Story4	8749.34	11252	11035	10975	10805
Story5	8423.11	10895	10669	10598	10422
Story6	8101.03	10495	10264	10187	10009
Story7	7789.64	10072	9840.7	9762.9	9588
Story8	7491.32	9641	9416.4	9342.7	9176
Story9	7207.94	9218	9004.9	8938.3	8783
Story10	6939.08	8811	8614.7	8557	8416
Story11	6678.03	8423	8244.8	8196.7	8071
Story12	6410.78	8048	7887.7	7848.8	7738
Story13	6119.78	7673	7531.9	7499.8	7402
Story14	5789.11	7280	7157.2	7128.5	7040
Story15	5405.86	6846	6738	6709.6	6627
Story16	4956.55	6343	6248.1	6216.9	6137
Story17	4422.63	5745	5659	5620.9	5540
Story18	3780.75	5022	4940.6	4890.7	4807
Story19	3009.97	4135	4058.6	3995	3911
Story20	2102.34	3026	2959.1	2889.6	2815
Story21	1069.73	1623	1576.3	1525.3	1478

Table3.11: Storey Shear (KN) of G+20 Steel Building (RSY)

Storey Shears Of G+20 Steel Structure (RSY)					
Storey	Y-Direction (mm)				
	without	with	10%	20%	30%
Story1	4632.44	9679	9372	8902.4	8435
Story2	4515.37	9558	9237.6	8782.7	8317
Story3	4392.75	9310	8978.1	8538.9	8081
Story4	4268.35	8963	8625.1	8205.2	7766
Story5	4139.76	8542	8205.9	7813	7407
Story6	4004.49	8076	7749.5	7395.5	7036
Story7	3861.69	7593	7284.5	6980.5	6675
Story8	3711.82	7123	6838.9	6593.5	6343
Story9	3555.38	6694	6440.2	6251.7	6049
Story10	3392.18	6330	6106.1	5964.7	5795
Story11	3221.04	6042	5845.1	5734.3	5582
Story12	3040.24	5830	5654.3	5551.3	5399
Story13	2847.91	5676	5515.6	5400.7	5235
Story14	2642.58	5553	5401.4	5257.7	5068
Story15	2423.07	5421	5274.1	5092.4	4876
Story16	2187.51	5232	5089.9	4869.8	4631
Story17	1931.62	4943	4806.2	4550	4299
Story18	1646.54	4506	4375.9	4092.9	3843
Story19	1318.68	3863	3745	3453.3	3221
Story20	932.681	2939	2842.4	2585.3	2397
Story21	479.757	1634	1575	1421.5	1312

Fig 10: Storey Shear G+20 Steel structure (RSX)

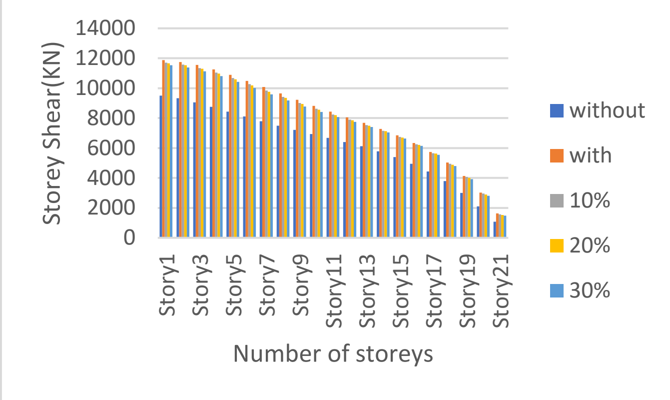

Fig 11: Storey Shear G+20 Steel structure (RSY)

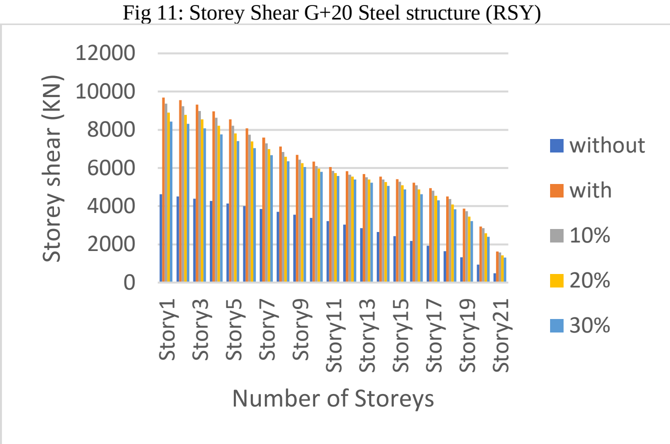

Table3.12: Lateral Loads G+20 Steel structure (RSX)

Lateral Loads for G+20 Steel Structure (RSX)					
Storey	X-Direction (mm)				
	without	with	10%	20%	30%
Story1	173.666	108.3	124.38	131.92	138.7
Story2	268.084	211	228.98	241.67	250.8
Story3	313.231	294.7	308.19	321.13	329.5
Story4	326.233	357.6	366.26	376.81	382.8
Story5	322.074	399.6	404.97	411.2	413.1
Story6	311.394	423.4	423.21	424.01	420.7
Story7	298.317	430.7	424.25	420.27	412.1
Story8	283.379	422.9	411.5	404.39	392.7
Story9	268.86	406.7	390.22	381.31	367.2
Story10	261.049	388.4	369.94	360.23	345
Story11	267.257	375	357.04	347.91	333
Story12	290.996	374.7	355.83	349.04	336.3
Story13	330.666	392.7	374.67	371.26	361.8
Story14	383.257	434.5	419.22	418.97	413
Story15	449.312	503.1	489.92	492.7	490.1
Story16	533.915	597.5	589.08	595.98	596.8
Story17	641.881	722.9	718.41	730.21	733.1
Story18	770.777	887.9	882.02	895.73	896.2
Story19	907.628	1108	1099.5	1105.4	1096
Story20	1032.62	1403	1382.8	1364.3	1336
Story21	1069.73	1623	1576.3	1525.3	1478

Table3.13: Lateral Loads G+20 Steel structure (RSY)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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Lateral Loads for G+20 Steel Structure (RSY)					
Storey	Y-Direction (mm)				
	without	with	10%	20%	30%
Story1	117.073	121.4	134.41	119.64	118.1
Story2	122.614	247.3	259.52	243.86	236.5
Story3	124.398	347.5	352.99	333.65	314.3
Story4	128.593	420.9	419.19	392.17	359.3
Story5	135.273	465.8	456.41	417.57	371.1
Story6	142.799	482.8	465.06	414.93	360.5
Story7	149.865	470.8	445.56	387.03	332.4
Story8	156.445	428.4	398.71	341.82	294.4
Story9	163.197	364.1	334.08	286.96	253
Story10	171.138	288.1	260.96	230.44	213.2
Story11	180.806	212.6	190.83	183	182.9
Story12	192.33	153.4	138.76	150.56	164.7
Story13	205.325	122.6	114.17	143.08	166.6
Story14	219.513	132.4	127.32	165.24	191.7
Story15	235.558	188.8	184.22	222.61	245.2
Story16	255.896	288.9	283.64	319.77	332.4
Story17	285.076	437.1	430.29	457.15	455.8
Story18	327.857	642.7	630.89	639.57	621.8
Story19	386.003	924.4	902.61	868.04	824.6
Story20	452.924	1305	1267.5	1163.8	1084
Story21	479.757	1634	1575	1421.5	1312

Fig 12: Lateral Load G+20 Steel structure (RSX)

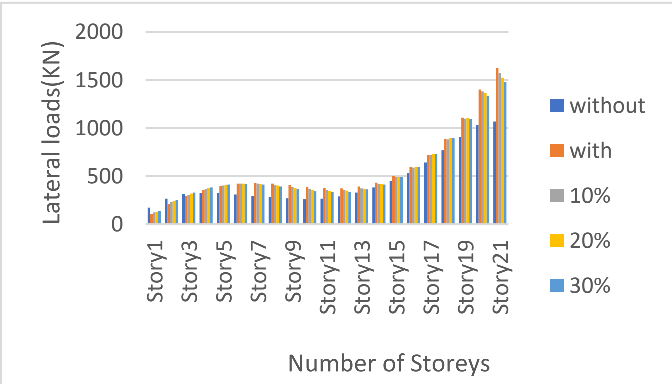


Fig 13: Lateral Load G+20 Steel structure (RSY)

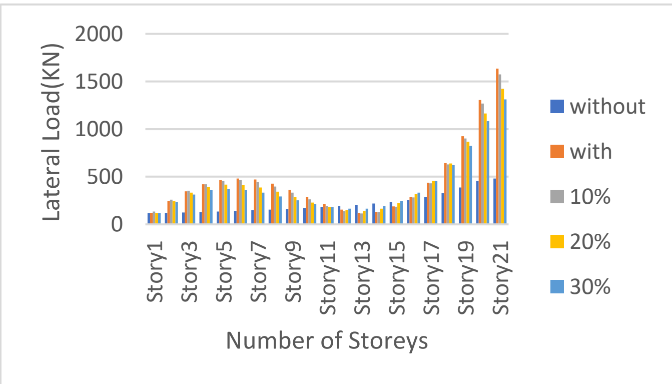
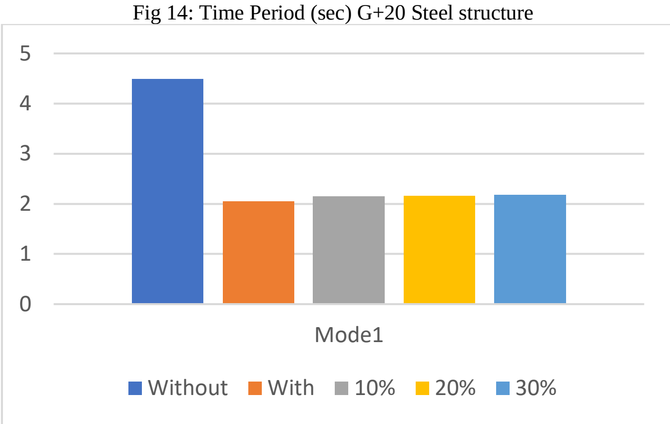


Table3.14: Time Periods of G+20 Steel structure

Time Periods of G+20 Steel Structure					
Mode	Without	With	10%	20%	30%
	Time Period (sec)				
Mode1	4.484	2.046	2.142	2.16	2.178

Fig 14: Time Period (sec) G+20 Steel structure



4.CONCLUSIONS:

This study presents a summary of the project work, for R.C.C Shear wall building and Steel Shear wall building for different opening percentages. The effect of Seismic load has been studied for a building with different openings of shear wall. On the basis of the results following conclusions have been drawn:

- Shear walls are considered to be a gift to the future construction industry. Scope of shear walls in construction field is immense.
- Steel Plate Shear wall buildings have more roof displacement than RCC shear wall Buildings. This is as time period is less, lesser is mass of structure and more is the stiffness, the time period is observed less in RCC shear wall models which reflects more stiffness of the structure and lesser mass of structure
- Storey Shear of SPSW models is more than the RCSW models. This is due to stiffness and the seismic weight of the building. Storey shear increases as the stiffness and the seismic weight increases. But in this study stiffness effect is more compared to seismic weight of the structure. Though SPSW models are lighter in weight than the RCSW models due to the high ductile nature of steel i.e. less stiffness, Storey shears are higher.
- As the opening % increases there is an increase in the storey shear of RCSW models as well as SPSW models. In RCSW it is 5% to 32% which is lesser than SPSW having 6% to 49% increase compared to Shear walls without openings.
- Due to the RCC shear walls have more stiffness than the steel shear walls which are more flexible due to the ductility property.
- As the opening % increases in the shear wall the Roof Displacement increases, as the stiffness of the structure is disturbed.
- Time period of steel shear wall building is more than the RCC shear wall building by 25% to 30%. Time period of a structure is inversely proportional to the

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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- stiffness of the structure. Hence as the stiffness of a structure increases the Time period of the structure decreases and vice versa. As the SPSW are less stiff than the RCSW, steel shear wall building has more time period.
- There is an increase in the Time period as the opening % increases in both RCSW and SPSW models. But in SPSW it is more by 3.41%, 5.71% and 8.7% increase for 10%, 20%and 30% respectively when compared to SPSW without openings. In RCC it is somewhat lesser compared which is 4.13% ,6.08%and 10.32% increase for 10%, 20% and 30% respectively.
- On studying the results for both Steel structure with SPSW and RC structure with RCSW it was observed that shear wall with 10% opening performed much similar to that of complete shear wall.

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