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Performance of RCC Building considering Effect of Presence of Steel Shear Walls

Kaustubh P. Gatlewar[1], Vishal Gajghate[2], Dr. Atulkumar Manchalwar[3]
[1]M.Tech Structural Engineering, [2, 3]Assistant Professor, Department of Civil Engineering, G. H. Raisoni College of Engineering, Nagpur

Abstract: In the early time of improvement, the Steel Plate Shear Walls (SPSW) was utilized for seismic retrofit of low to medium-ascent existing structures. Steel being a nearly much bendable material can be connected successfully in the structures situated in the seismic inclined locales. As far as possible state for the SPSW was out-of-plane clasping of the infill board. This prompted the utilization of some degree thicker steel plate with a generally shut even and vertical stiffeners, which offered minimal monetary favorable position over the fortified solid shear dividers. The thick steel plates with stiffeners showed the yielding of the plate before buckling during the earthquakes.
Keywords: Steel Shear Wall, Multistory building, Earthquake, Seismic analysis, comparision of results

I. INTRODUCTION

When contrasted with the RCC the steel has got some essential physical properties like the high quality per unit weight and malleability. The high return and extreme quality outcome in thin segments. Being pliable the steel structures give adequate guidance ahead of time before disappointment by method for unnecessary distortions. These properties of steel are of particularly imperative in the event of the seismic obstruction structure. The flexibility of steel is an exceptional property of steel that no other building material displays in an incredible same way. Through pliability steel can experience an extensive disfigurement past as far as possible without risk of crack. In this way a definitive limit is far in overabundance of that assessed by the versatile plan. These attractive properties of steel are made utilization of in the skyscraper structures by utilizing steel as the basic components. In low, medium and skyscraper structures the heaps following up on the structures basically comprise of the gravity loads and the parallel burdens. The gravity loads which incorporate oneself load of the structure and the piece of the live burden that remaining parts steady. The sidelong loads are because of wind, impact and seismic tremor and so on and are extremely serious because of quake. So the structure ought to have adequate firmness and quality along the side to perform palatably to these intermittent burdens. The basic framework comprises of flat confining framework (bars and piece) and the other is the vertical encircling framework made of dividers and sections. Flat framework exchanges the vertical burdens and torsional burdens to the vertical encircling framework, which is in charge of exchange of vertical burdens and parallel burdens to the balance.

II. DETAILS OF STRUCTURAL MODEL

In this paper one model is consider Hence to find out the effect of the introduction of steel shear walls on the behaviour of related different structural components, like beams and columns, a G+6 story building is analysed for without and with steel shear wall conditions. The building is a simple 22.5m high RCC structure As shown in **fig 1**

III. DATA TAKEN FOR STRUCTURE

1)	Type of structure	Multistory (G+6 story) RCC building
2)	Lateral load resisting system	Steel Plate Shear Walls
3)	Height of the building	22.5 m
4)	Floor to floor height	3.0 m
5)	Depth of foundation	1.5 m
6)	Height of parapet wall	1.0 m
7)	Depth of slab	150 mm
8)	External walls	230 mm
9)	Internal walls	150 mm
10)	Shear wall thickness	6 mm

11) Brick masonry 19 kN/m^3
12) Floor finish 2 kN/m^2
13) Imposed load on floors 4 k N/m^2
14) Importance factor 1.5
15) Type of soil medium
16) Response reduction factor 5
17) Zone IV
18) Zone factor 0.24

The load combinations are considerd as per IS1893 (Part1 2016)

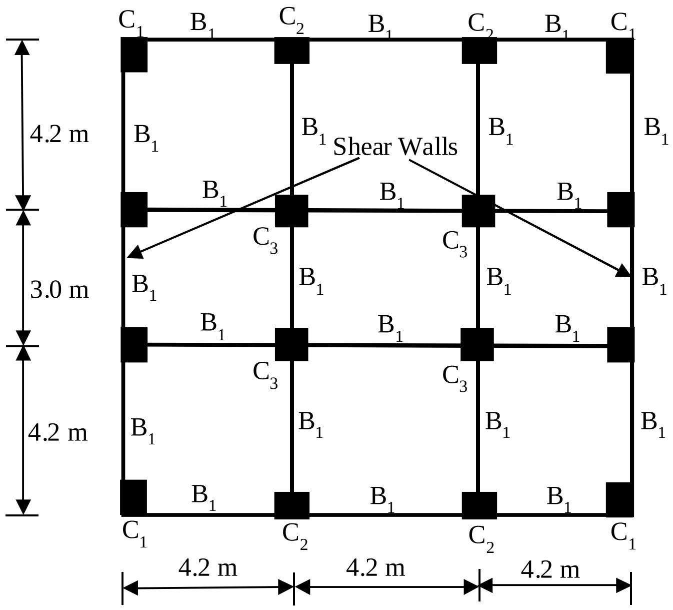

Fig 1 .Plan of a G+6 story building with steel shear walls

A. Calculation Of Seismic Weight Of The Building

Data taken for seismic weight calculation is as follows:

Plan size of the building 12.6 m × 11.4 m
Total plan area 225.12 m^2
Total length of shear wall 6 m
Total length of beams in plan 96 m
Brick wall length:
a) Peripheral 48 m
b) Inner 48 m
Total c/s area of columns in plan 0.14 m^2

Table4.1 Calculation of seismic weight of the building for different floors.

Level	ParapetWall (kN)	Walls (kN)	Slab+FF (kN)	Beams (kN)	Columns (kN)	Live load (kN)	Total Load (kN)
Roof	232	487	682	60	14.8	0	1475
6	0	974	825	60	29.5	287	2176
5	0	974	825	60	29.5	287	2176
4	0	974	825	60	29.5	287	2176
3	0	974	825	60	29.5	287	2176
2	0	974	825	60	29.5	287	2176
1	0	974	825	60	29.5	287	2176
plinth	0	487	0	60	29.5	0	576
$\sum$	232	6818	5637	480	221	1722	15107

$$T = \frac{0.09h}{\sqrt{d}} = 0.599 \text{ sec.}$$

$$A_h = \frac{Sa}{g}\frac{Z}{2}\frac{I}{R} = 0.076$$

$V_b = A_h W = 0.076 \times 15107$

$= 1149$ kN

B. Distribution of Seismic Weight

Distribution of seismic weight in KN along the building height at different floors is shown in **Table 4.2**

Table 4.2 Distribution of seismic weight

Level	w_i (kN)	h_i (m)	$wihi^2/1000$	$\frac{Wihi^2}{\sum Wihi^2}$	$V_b \frac{Wihi^2}{\sum Wihi^2}$ (kN)
Roof	1475	22.5	746	0.25	
6	2176	19.5	827	0.28	288
5	2176	16.5	592	0.2	321
4	2176	13.5	396	0.13	229
3	2176	10.5	239	0.08	153
2	2176	7.5	122	0.04	92
1	2176	4.5	44.1	0.01	47.1
plinth	576	1.5	1.9	0.004	11.5
$\sum$	15107			1.002	1149

IV. RESULTS

A. Comparison of Results

1) Variation of bending moments of beams

Sr. No.	Building level	Beam No.	With shear walls	Without shear walls
1	1st	233	444	93.6
2	2nd	234	208	77
3	3rd	235	157	84
4	4th	236	103	89
5	5th	237	72.2	92
6	6th	238	54.5	94
7	7th	239	45.6	95
8	8th	240	81.3	97

Above table shows bending moments of beams in (KN/M).

2) Variation of Shear Forces in Beams

Sr. No.	Building level	Beam No.	With shear walls	Without shear walls
1	1st	233	756	112
2	2nd	234	473	193
3	3rd	235	320	200
4	4th	236	214	194
5	5th	237	153	178
6	6th	238	117	155
7	7th	239	97.6	126
8	8th	240	163	89

Above table shows shear force in beam (KN) constituting steel plate shear wall system.

3) Variation of axial forces in the columns

Sr. No.	Story Level	Column No.	With shear walls	Without shear walls
1	Bottom	113	4894	3066
2	Ground	447	4510	2925
3	1st	453	3663	2475
4	2nd	459	2570	2032
5	3rd	465	1798	1591
6	4th	471	1320	1152
7	5th	477	903	715
8	Top	483	445	279

Above table shows value of axial force (KN) for columns with and without shear walls.

V. CONCLUSION

With the utilization of steel shear walls in the structures, the bending moments in the beams are seen to decrease because of the almost equivalent and opposite force applied by the vertical segments of diagonal tension of the SPSWs present on the two sides (lower and upper) of the beams.For topmost and bottommost (plinth beam) beams, the bending moments are seen to be higher similarly due to the force applied by the shear walls present on single side of the beams (for example on upper side of bottom beam and lower side of top beam).The shear forces on bottommost beams are higher nearly because of the presence of the SPSWs on just a single side of the beams.The shear force and bending moment quantities for the plinth beam are extremely high similarly when the shear wall is available, so it should be anchored tightly to the foundation.The nearness of steel shear walls critical increment in the column loads especially in a portion of the lower column

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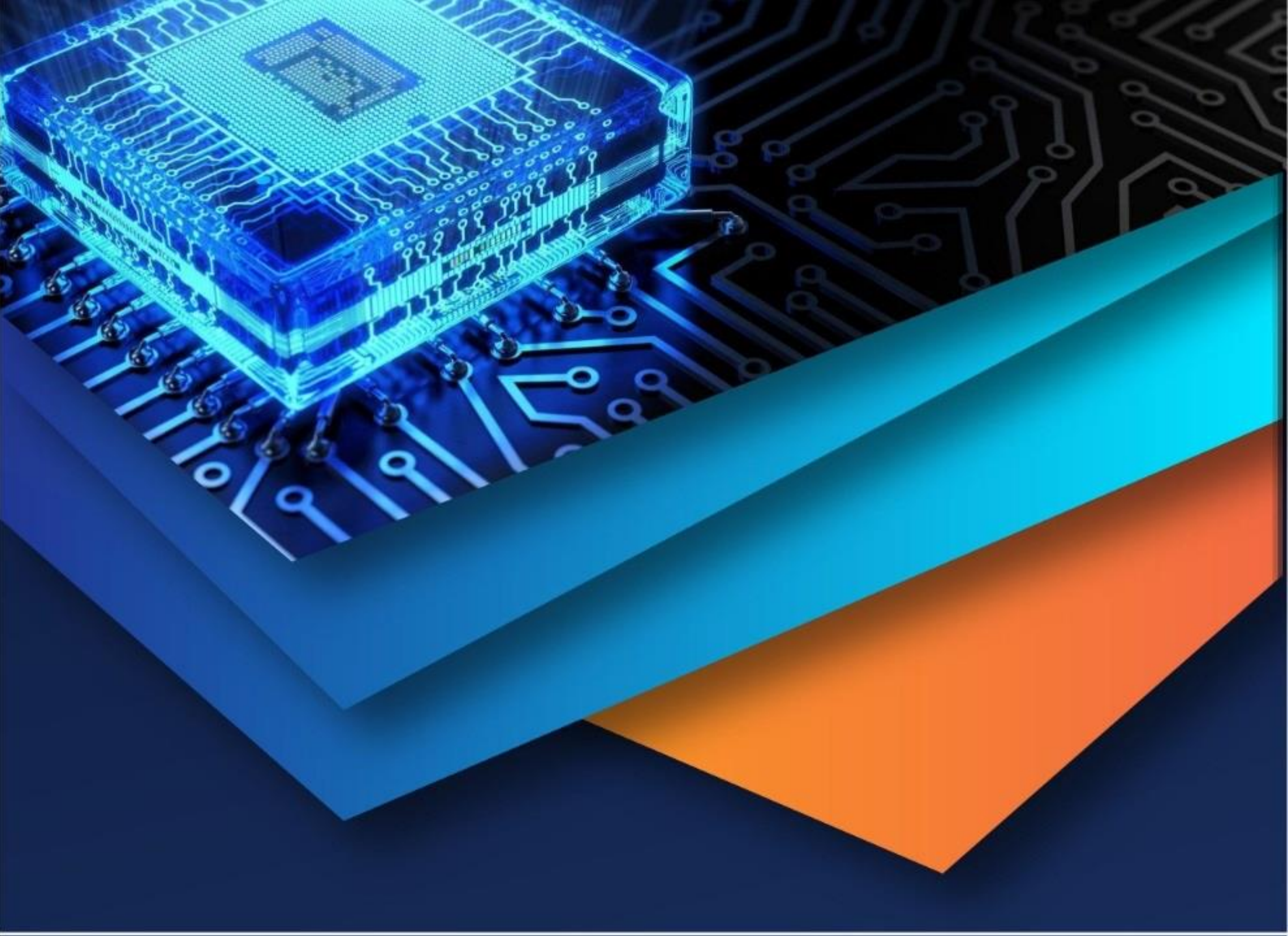

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