International Journal of Interdisciplinary Innovative Research &Development (IJIIRD)
ISSN: 2456-236X
Vol. 06 Issue 01 | 2021

Seismic Behaviour of High-Rise Structure with Coupled Shear wall

Vivek V. Dandi[1], Prof. A. S. Gawande[2], Dr. S. K. Deshmukh[3]

[1]*Post-Graduate Student, College of Engineering and Technology Akola, Maharashtra, India.*
[2] *Professor, College of Engineering and Technology, Akola, Maharashtra, India*
[3] *Principal, College of Engineering and Technology, Akola, Maharashtra, India.*

ABSTRACT

The present work-study is carried out for the behavior of G+10 storied buildings with a rectangular shaped plan of the story. Floor height is provided as 3.5m and also properties are defined for the irregular building modeled in STAAD Pro V8i software. Here two models are created in which building with column beam joint and building with coupled shear wall analyzed in seismic zone v. From result it is found the behavior of building with the coupled shear wall has the best performance in zone v condition. As the coupled shear wall building gives a more stable structure compared to a normal building with column beam joint. Coupled Shear wall structure at any level of structure is more stable than normal building. Coupled Shear wall building at top level gives Lower values of displacement in v seismic zones. Coupled shear wall structure gives lowest values of Axial forces, bending moment and maximum displacement.

In this paper, four different models are considered for analysis of coupled shear walls. Following Models of Multi-storey(G+10) Building will be modelled in Stadd-ProV8i: Model 1. Building with only column beam joint. Model 2. Building with Coupled Shear wall. These all models have modelled in Stadd-ProV8i software by considering all geometric property are same. Stadd-ProV8i software is used for equivalent static analysis.

***Keywords**: Coupled shear wall, Stadd-ProV8i, Storey drift, Lateral load, Shear Force, Storey displacement.*

1. INTRODUCTION

1.1 Shear wall:

It is defined as a structural member used to resist lateral forces i.e. parallel to the plane of the wall. For slender walls where the bending deformation is more, Shear wall resists the loads due to cantilever action. These walls will consumptives shear forces & will prevent changing location-position of construction & consequently destruction. The bending moment, shear force, torsion, axial force contribution by rest of the structural element and the ultimate design of all the structural components also affected by that.

1.2 Coupled Shear wall

Coupled shear walls consist of two shear walls interconnected by beams along their height. The use of coupled as an earthquake resistant system, the use of coupled shear walls is one of the potential options in comparison with special moment resistant frame (SMRF) and shear wall frame combination systems in RCC high-rise buildings. They provide an architecturally practical structural system

1.3 Problem Statement:

Table 1.3.1 Structural Details of RC building

1	Type of structure	Multistory rigid jointed plane frame
2	Number of stories	G+10
3	Floor's height	3.5m
4	Size of column	550x550 mm
5	Size of beam	230x550 mm
6	Depth of slab(RCC)	150 mm
7	Live load	1.On floor = 4 KN/m^2
8	Shear wall thickness	230 mm
9	Material	M30 and Fe415 steel
10	Grid lines along X-direction	4
11	Grid lines along Y-direction	4
12	Spacing along X and Y axis	5 m
13	Zone considered	V
15	Importance factor	1
16	Response reduction factor	5

17	Damping Factor	0.05
18	Type of soil	Medium Stiff
20	Floor Finish	1.5 KN/m^2

MODEL 1: Normal Building with Column beam joint: As per fig.1 is the G+10 building model modelled in Stadd-ProV8i software by considering only column, beam & slab members. shear wall is not considered in this model. Grid spacing and all other geometric parameters are same for all models as per specified in table (Structural Details of RC Building for research work). All columns are interconnected by beams along X as well Y direction.

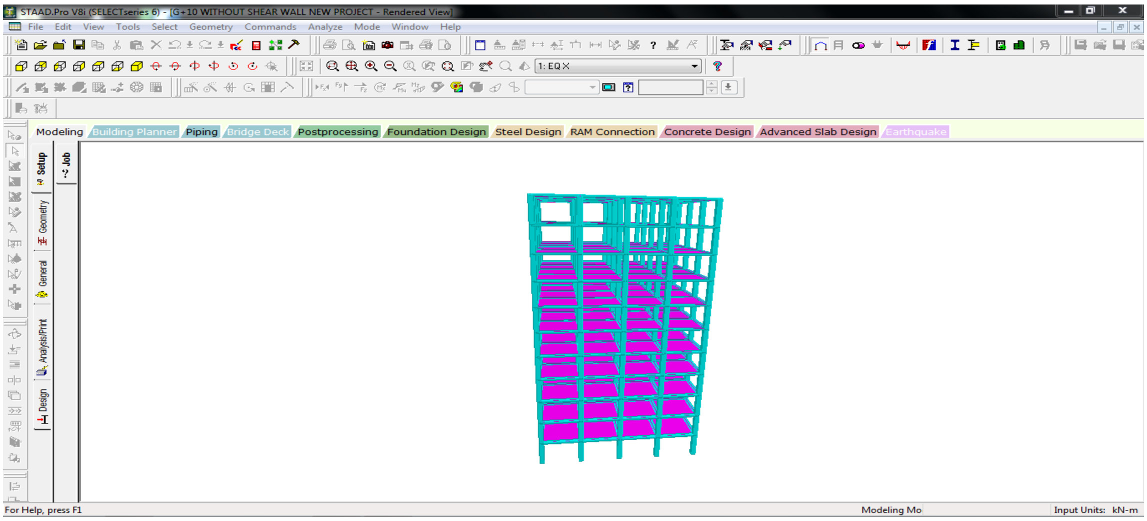

Figure 1 : Normal Building with Column beam joint.

MODEL 2 Building with Coupled Shear wall : As per fig.2 G+10 building model modelled in Stadd–ProV8i software by considering shear wall, column, beam & slab members. shear wall with opening is considered while modelling model. Grid spacing and all other geometric parameters are same for all models as per specified in table (Structural Details of RC Building for research work). In this model at center point columns are provided which are 9 in numbers of size 550mmx550mm as shown in above figure. All columns are interconnected by beams along X as well Y direction.

Shear Wall provided throughout the height of building. The column is provided only inside portion of the building and shear wall is provided at outer periphery of the building. Slab of 150 mm thickness considered at every floor.

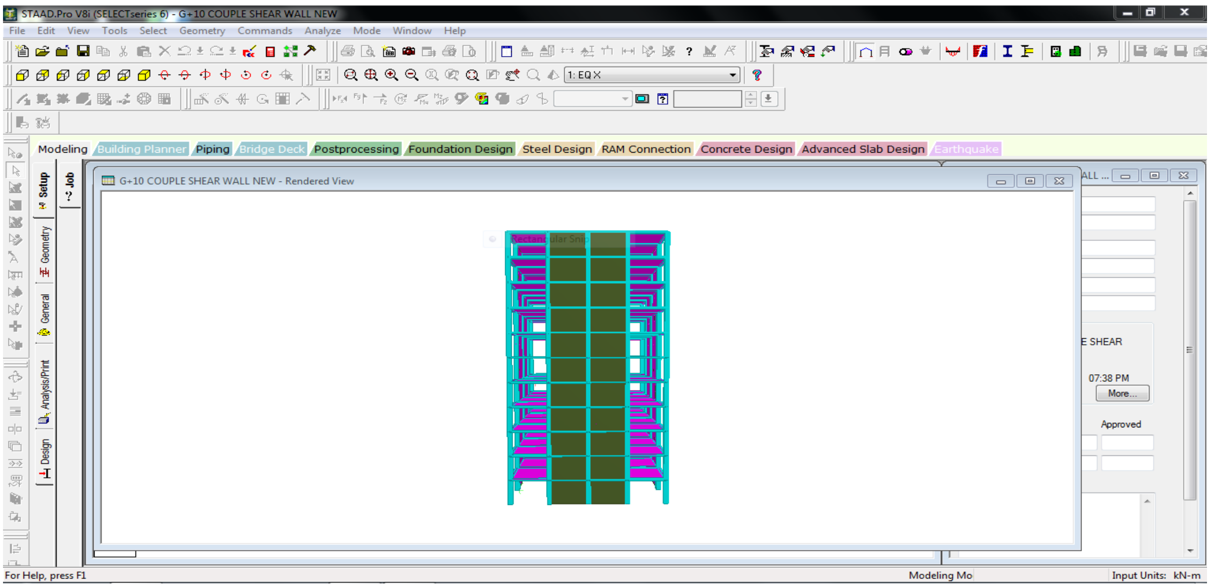

Figure 2 : Building with Coupled Shear wall

2. RESULTS AND DISCUSSION

2.1 Axial Force, Moment and Displacement:

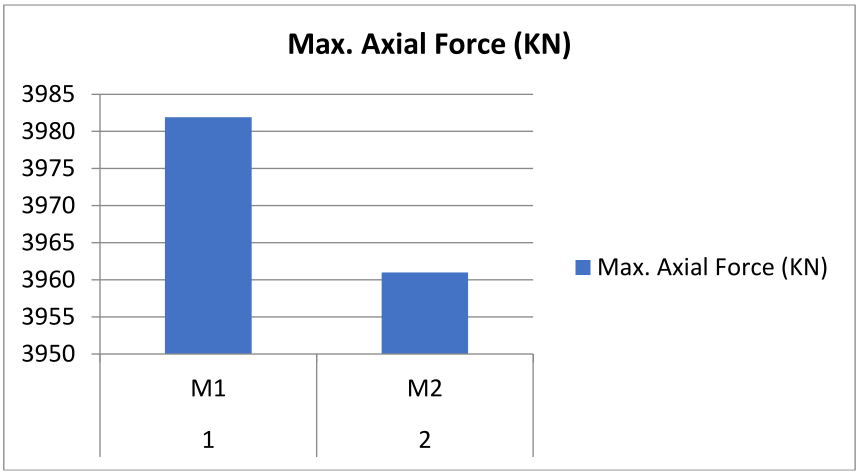

Fig 3 : Comparison for Maximum Axial Force for model M1,M2

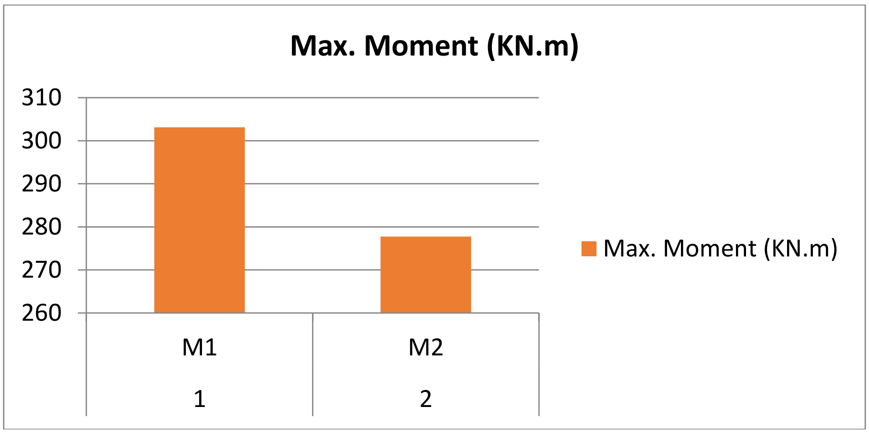

Fig 4 : Comparison for Maximum Moment for model M1,M2

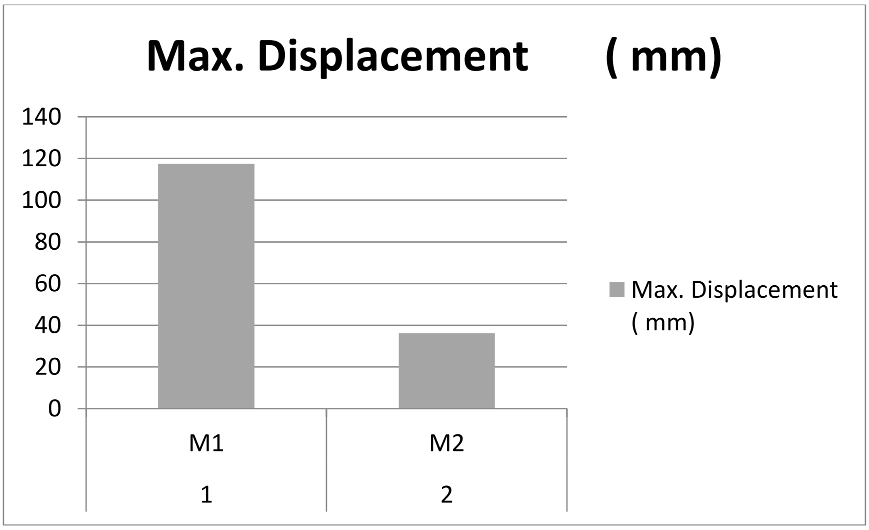

Fig 5 : Comparison for Maximum Displacement for model M1,M2

The Fig 4,5,6 shows that max axial force, max moment and max displacement for all models. From above graphical comparison it is clear that axial force, moment & displacement is maximum for model no.1 (Building with column beam joint) then decreases for model no.2 (Building with coupled shear wall). So, from the above graphical comparison it is clear that model no.2 least axial force, moment & displacement compare to another model. So, coupled shear wall is best option in high rise buildings.

2.2 Storey Displacement:

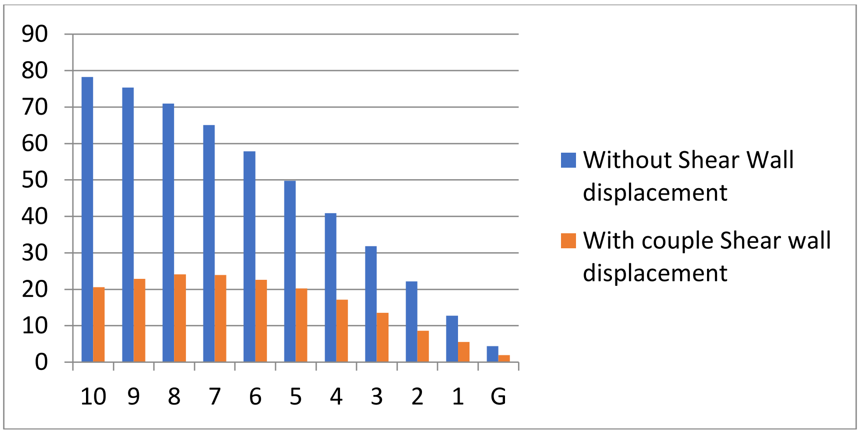

Fig.6 : Comparison for Storey Displacement for model M1,M2

From the above Fig 6 it is clear that displacement values from result obtained from Stadd-Pro V8i are comparable, From that comparison we saw that storey displacement of couple shear wall is less as compare to without shear wall. So, validation case is ok.

2.3 Storey Drift:

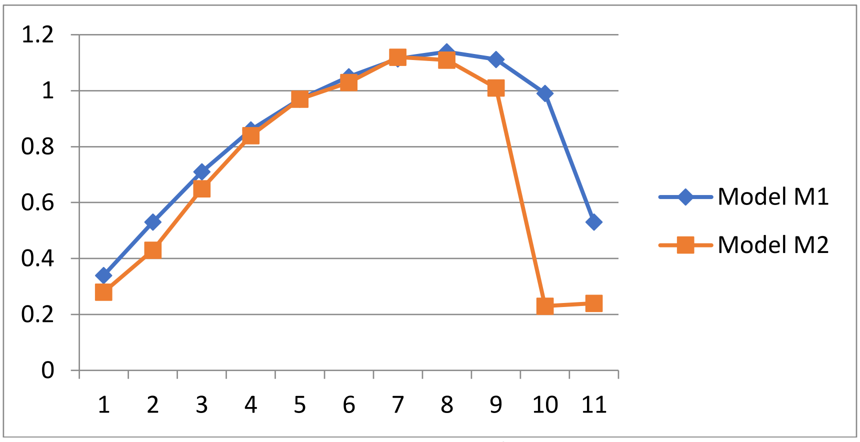

Fig 7 : Storey drift

The fig.7 shows that it is clear that storey drift values from result obtained from Stadd-Pro V8i are comparable, From that comparison we saw that storey drift of couple shear wall is less as compare to without shear wall. So, validation case is ok.

2.4 Lateral Load:

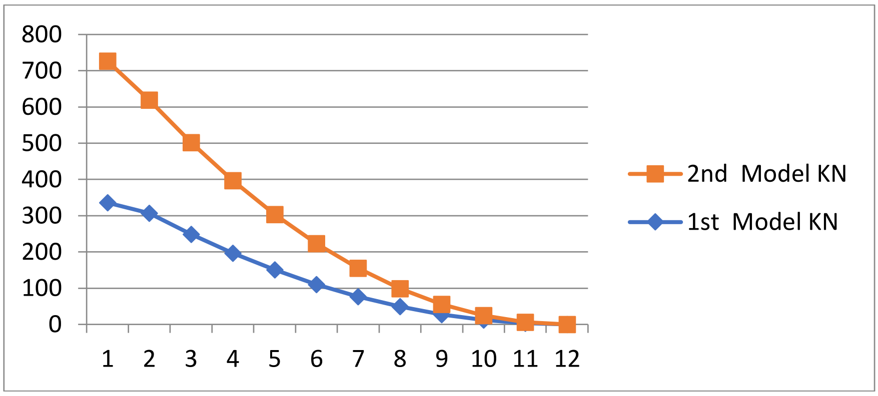

Fig.8 : Lateral load

The fig.8 shows that From the above graph it is clear that Lateral Load values from result obtained from Stadd-Pro V8i are comparable, From that comparison we saw that lateral load of couple shear wall is more as compare to without shear wall. So, validation case is ok.

2.5 Storey Shear:

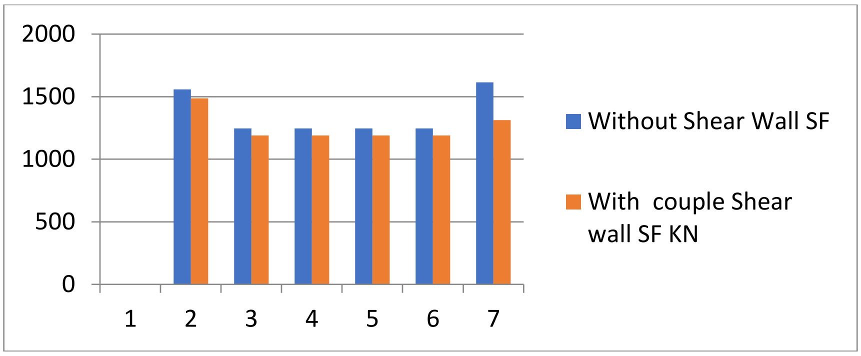

Fig.9 : Shear Force

From the above Fig 9 it is clear that shear force values from result obtained from Stadd-Pro V8i are comparable, From that comparison we saw that shear force value of couple shear wall is less as compare to without shear wall. So, validation case is ok

3. CONCLUSION:

- The max axial, max moment and max displacement values are least for the Building with couple shear walls model compared to other model.
- Storey displacement values are less for the Building with couple shear walls model compared to other model.
- Storey drift values for Building with column beam joint model is highest than couple shear wall model.
- The Shear force values for the Building with couple shear walls model are less as compare to other model.
- Lateral load values are minimum for Building with column beam joint model and maximum for Building with Couple shear wall.

From the above conclusions, it is concluded that 2nd (Building with couple shear wall) model performance is having better performance than other as1st(Building with column beam joint) models. So, couple shear wall is the potential option in high-rise building

4. REFERENCES

[1] Waleed Khaleel Nayel ,"Seismic Performance of High Rise RC Structures with and Without Openings in Shear Wall", International Journal of Engineering Science and Computing Volume 7 Issue No.4, pp.11177-11183 April 2017

[2] Hasan Kaplan,"Seismic strengthening of RC structures with exterior shear walls", Indian Academy of Sciences Vol. 36, Part 1, pp. 17–34.

[3] Kiran Tidke, Rahul Patil, Dr. G.R.Gandhe,"Seismic Analysis of Building with and Without Shear Wall", International Journal of Innovative Research in Science, Engineering and Technology,Volume 5 Issue No.10,pp.17852-17858 October 2016

[4] Misam Abidi, Mangulkar Madhuri N,"Review on Shear Wall for Soft Story High-Rise Buildings", International Journal of Engineering and Advanced Technology (IJEAT) Volume-1 Issue-6, ISSN: 2249 – 8958, August 2012

[5] Ashish Kumar Gupta [1], Dr. Saleem Akhtar [2], Dr. Aslam Hussain,"Analysis of A Tall Building with Shear Wall of RCC and Steel Plate", International Journal of Engineering Research & Technology (IJERT),Vol. 9 Issue 01, ISSN: 2278-0181, January-2020

[6] Ravi Kumar, K. Sundar Kumar, Badipati Anup,"Analysis and Design of Shear Wall for an Earthquake Resistant Building using ETABS", International Journal for Innovative Research in Science & Technology(IJIRST),Volume 4 ,Issue 5 , ISSN (online): 2349-6010, October 2017

[7] Chillu S Nandakumar1, Nusra S2, "Comparative Study of C & L Shape Shear Wall in RC Flat Slab Structure", International Journal of Science and Research (IJSR),Volume 6 Issue 6, ISSN (Online): 2319-7064, June 2017

[8] Sonali Pandey, Dr.Krishna Murari,Ashish Pathak,Chandan Kumar, "A Review on Shear wall in High Rise Buildings", International Journal of Engineering Inventions, Volume 6, Issue 12 e-ISSN: 2278-7461, p-ISSN: 2319-6491 PP: 19-21 December 2017

[9] Ankit Dane, Umesh Pendharkar, “Effective Positioning of Shear Wall in G+5 Storey Building on Sloping Ground”, International Journal of Engineering and Advanced Technology (IJEAT) ,Volume-9 Issue-2, ISSN: 2249 – 8958,December 2019

[10] P.Kalpana1, R.D. Prasad , B.Kranthi Kumar, “Analysis of Building with and without Shear Wall at Various Heights and Variation of Zone III and Zone V”P.Kalpana et al”,
Int. Journal of Engineering Research and Application ,Vol. 6, Issue 12, ISSN : 2248-9622,(Part -2) pp.05-11 December 2016

[11] IS Codes:-
IS 1893:2002 (part 1) - Criteria for Earthquake Resistant Design of Structures
IS 456:2000 - Plain And Reinforced Concrete - Code Of Practice
IS 875 (part1):1987 - Code Of Practice For Design Loads (Other Than Earthquake) For Buildings And Structures (Dead Load)
IS 875 (part2):1987 - Code Of Practice For Design Loads (Other Than Earthquake) For Buildings And Structures (Live Load)