

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

Behaviour of Box Shape Shearwall in High Rise Residential Building Using Etabs

Eshwar Khanna.E¹, B.K.Vishwanath²

P.G. Student, Department of Civil Engineering, Dr.K.V.Subba Reddy Institute of Technology , Dupadu,
Andhra Pradesh, India¹

Assistant Professor, Department of Civil Engineering, Dr.K.V.Subba Reddy Institute of Technology , Dupadu,
Andhra Pradesh, India²

ABSTRACT: Constructions made of shear walls are high in strength ,they majorly resist the seismic force, wind forces and even can be build on soils of weak bases by adopting various ground improvement techniques. In the present analysis a building with a height of 50 meters is analysed in ZONE-2 with three different soils. Moment is compared with different zones & soils in both Static & Dynamic analysis.

We are verifying and designing this structure using Extended Three Dimension Analysis of Buildings (ETABS) 2013software.

KEYWORDS: High-rise building, Etabs2013, Dynamic Analysis,

I. INTRODUCTION

Concrete or masonry continuous vertical walls may serve both architecturally as partitions and structurally to carry gravity and lateral loading. There will be no architectural difficulty in extending them through the height of the building; their very high in plane stiffness and strength had proved them to be ideally suited for resisting lateral loads. Compared to frame type structures, shear-wall structures offer less distortion and less damage to non structural elements. Care shall be taken to have symmetrical configuration of walls in the building so that torsion effect in plan could be avoided.

Modern office buildings are designed for large open spaces that can be subdivided with light weight partitioning to suit the individual tenant's needs. Consequently, the structures main vertical components i.e. columns are arranged as far as possible around the perimeter of the plan and internally around the stair case, service shafts and elevators, thus leaving large column free areas available for office planning. Above the partitioning the services are distributed horizontally in each storey and are usually concealed in a ceiling space. The typical storey height required to accommodate the extra depth required is in the range of 3.5m or more. In the case of residential building or hotel, the services then can be run vertically adjacent to the columns and walls or in a separate shafts to emerge in each storey either very close or to be distributed horizontally from where to where required, along the corridor ceiling spaces.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

Structural systems for concrete buildings																	
No.	System	Number of stories										Ultra-tall buildings 120-200 stories					
		0	10	20	30	40	50	60	70	80	90		100	110			
1	Flat slab and columns	█															
2	Flat slab and shear walls	█	█														
3	Flat slab, shear walls and columns	█	█	█													
4	Coupled shear walls and beams	█	█	█	█												
5	Rigid frame	█	█	█	█	█											
6	Widely spaced perimeter tube	█	█	█	█	█	█										
7	Rigid frame with haunch girders	█	█	█	█	█	█	█									
8	Core supported structures	█	█	█	█	█	█	█	█								
9	Shear wall—frame	█	█	█	█	█	█	█	█	█							
10	Shear wall—Haunch girder frame	█	█	█	█	█	█	█	█	█	█						
11	Closely spaced perimeter tube	█	█	█	█	█	█	█	█	█	█	█					
12	Perimeter tube and interior core walls	█	█	█	█	█	█	█	█	█	█	█	█				
13	Exterior diagonal tube	█	█	█	█	█	█	█	█	█	█	█	█	█			
14	Modular tubes, and spine wall systems with outrigger and belt walls	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

1.3.5 Shear wall structures:

Reinforced concrete walls are classified according as bearing walls, non-bearing walls, shear walls, flexural shear walls, and squat shear walls. Shear walls are an area of the lateral force resisting system that carries vertical masses, bending moments regarding the wall sturdy axis, and shear forces parallel to the wall length. Shear wall system is one amongst the foremost common and effective lateral load resisting systems that are wide utilized in medium- to high-rise buildings. It will give the adequate stiffness and strength required for the building to resist wind and earthquake loadings, as long as a correct style is conscientious that cares for each wall strength and malleability.

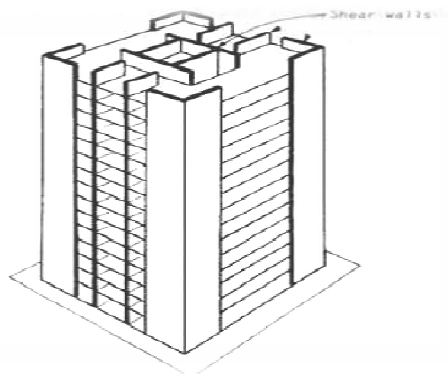


Fig.1.6 Shear wall structure

It is vital to notice that shear walls meant to resist earthquakes and wind forces ought to be designed for plasticity. wherever a concrete frame is intended to resist lateral forces then a stiff however brittle masonry filler wall is positioned among this frame there's a very nice chance that attributable to its larger stiffness, it'll draw a lot of of the earthquake forces and fill in shear once the brittle masonry fails. So, unreinforced brick walls shouldn't be used as shear walls to resist lateral hundreds. Shear walls area unit classified as follows:

1. Simple rectangular types and the flanged walls,
2. Coupled shear walls
3. Rigid frame shear walls
4. Framed walls with infilled frames
5. Column supported shear walls
6. Core type shear walls

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

Shear walls are rectangle in cross section, i.e. one dimension is much larger than the other. While rectangular cross-section is frequent, L- and U-shaped sections are also used. Thin-walled hollow RC shafts around the elevator core of the structure also act as shear walls, and should be taken advantage of to resist earthquake forces.

The Shear Wall sections are classified as six types.

- (a) Box Section
- (b) L – Section
- (c) U - Section
- (d) W – Section
- (e) H - Section
- (f) T – Section



Box Section

II. NUMERICAL MODELLING

1. Height of typical storey	=	3.6 m
2. Height of ground storey	=	3 m
3. Length of the building	=	40 m
4. Width of the building	=	30 m
5. Span in X- direction	=	4 m
6. Span in Y-direction	=	5 m
7. Height of the building	=	107.4 m
8. Number of stores	=	30
9. Wall thickness	=	230 mm
10. Slab Thickness	=	120 mm
11. Grade of the concrete	=	M40
12. Grade of the steel	=	Fe415
13. Thickness of shear wall	=	230 mm
14. Support	=	fixed
15. Column sizes	=	0.8 m X 1 m up to 8 th story 0.65 m X 0.8 m from 9 th to 16 th story 0.5 m X 0.7 m from 17 th to 24 th story 0.4 m X 0.5 m from 25 th to 30 th story
16. Beam sizes	=	0.4 m X 0.8 m up to 15 th story 0.3 m X 0.6 m from 16 th to 30 th story

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

LOADS CONSIDERED:

DEAD LOADS:

S.No	Materials	Unit Weight kN/m ³
1	Plain concrete	24
2	Reinforced concrete	25
3	Brick masonry , cement plaster	20
4	Stone masonry	24
5	Wood	8
6	Steel	78.5
7	Floor finish	0.6-1.2

LIVE LOADS (OR) IMPOSED LOADS:

S.No	Type of Floors	Minimum Live Load kN/m ²
1	Floors in dwelling houses, tenements, hospitals wards, hostels and dormitories	2
2	Office floors other than entrance halls, floors of light	2.5-4.0
3	Floors of banking halls , office entrance halls and reading rooms	3
4	Shops ,educational buildings, assembly buildings, restaurants	4
5	Office floors for storage ,assembly floor space without fixed seating, public rooms in hotels, dance halls and waiting halls	5
6	Ware houses, workshops and factories	
	a) Light weight loads	5
	b) Medium weight loads	7.5
	c) Heavy weight loads	10
7	Garages(light handling vehicles of weight <25KN)	4
	Garages(heavy vehicles of weight >25KN)	7.5
8	Stairs, landings, balconies and corridors for floors mentioned in 1, but not liable to overcrowding and for all other floors	3
9	Flat slabs, sloped roofs	5
	a)access provided	1.5
	b)access not provided	0.75

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017

EARTHQUAKE LOADS:

Seismic Zone	II	III	IV	V
Seismic Intensity	low	moderate	severe	very severe
Zone Factor (Z)	0.10	0.16	0.24	0.36

WIND LOADS :

Wind loads IS: 875; (part-3)-1987

Design wind speed, $V_z = V_b K_1 .K_2.K_3$

Where

K_1 = probability facts [risk at any height z in m/sec]

K_2 = terrain height and structure size factor **clause [5.3.2]**

K_3 = topography factor **clause [5.3.3]**

NOTE:

Design wind speed up to 10m height from mean G.L shall be considered constant.

K_2 = Category 3

For k_1 = basic wind speed =44 m/sec

III. EXPERIMENTAL RESULTS

Moment values for Zone II soil-I in under X-direction

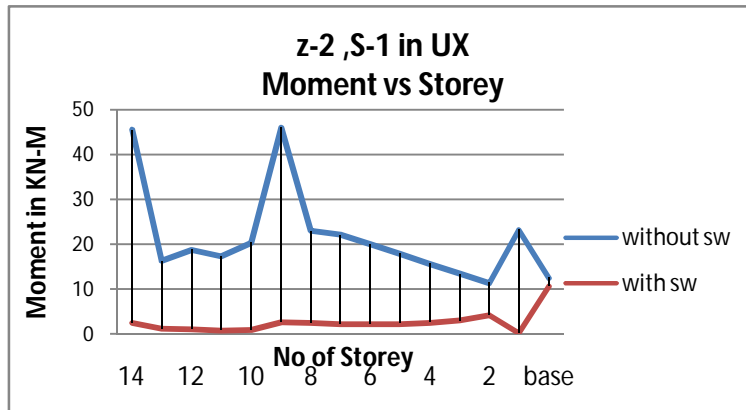
zone II soil I		
Storey	1.2(dd+ll+eqx)	
	without sw	with sw
14	45.4325	2.4778
13	16.235	1.1983
12	18.722	1.1033
11	17.2808	0.8381
10	20.237	0.8791
9	45.931	2.6787
8	22.9039	2.4808
7	22.0605	2.2376
6	19.9269	2.2379
5	17.81	2.2638
4	15.608	2.5477
3	13.3587	3.0467
2	11.2744	4.207
1	23.17479	0.2338
base	12.414	10.624

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017



Graph55: Moment vs Storey for Zone II soil-I in under X-direction

Moment values for Zone II soil-II in under X-direction

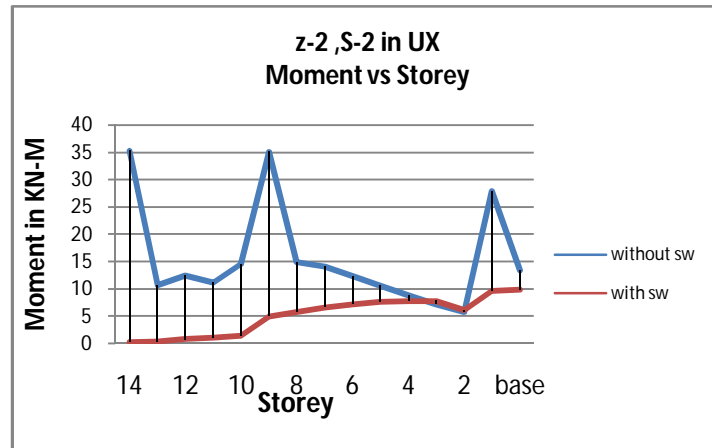
Storey	zone II soil II	
	1.2(dd+ll+eqx)	
	without sw	with sw
14	35.2304	0.1899
13	10.7122	0.3464
12	12.3874	0.7297
11	11.1798	1.0738
10	14.5635	1.3706
9	35.0464	4.9701
8	14.8314	5.7686
7	14.0924	6.5773
6	12.2869	7.2124
5	10.5817	7.6499
4	8.8438	7.7781
3	7.1352	7.7638
2	5.7486	6.079
1	27.8171	9.6074
base	13.3827	9.8693

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017



Moment vs Storey for Zone II soil-II in under X-direction

Moment values for Zone II soil-III in under X-direction

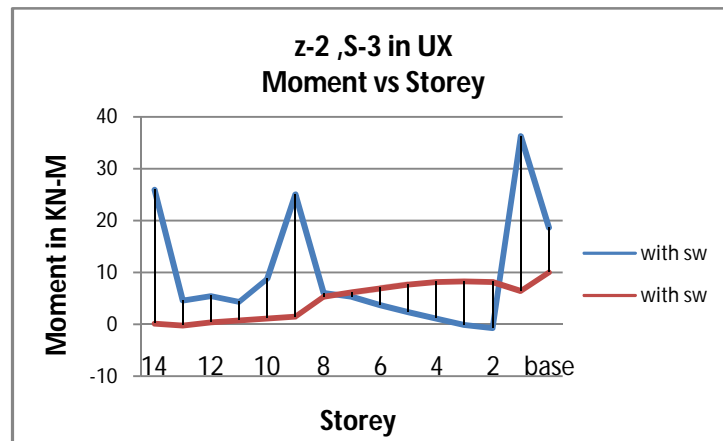
Storey	zone II soil III	
	1.2(dd+ll+eqx)	
	without sw	with sw
14	25.8821	0.1758
13	4.6241	-0.212
12	5.4374	0.3886
11	4.3954	0.7929
10	8.7732	1.15882
9	25.0597	1.4675
8	6.0817	5.3125
7	5.37	6.1593
6	3.7836	7.0126
5	2.4262	7.6839
4	1.101	8.1464
3	-0.0911	8.2808
2	-0.6975	8.2474
1	36.2464	6.4499
base	18.6719	10.0538

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 12, December 2017



Moment vs Storey for Zone II soil-III in under X-direction

IV. CONCLUSION

1. The center of mass and center of rigidity is influenced by adding and positioning of shear wall. It can be concluded that all models are symmetric about x-direction and there is no effect of torsion due to center of mass and center of rigidity in x-direction. The performance of structure with shear wall is better than structure without shear wall because center of mass and center of rigidity become closer.
2. Provision of shear wall generally results in reducing the displacement because the shear wall increases the stiffness of building and sustains the lateral forces. The better performance is observed and displacement is reduced in both x and y directions and shows better performances with respect to displacement when analysis is carried out by using response spectrum method.

REFERENCES

1. Agarwal P. and M Shrikhande (2007), "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd., 2007, New Delhi.
2. Stefano, M.D., and Pintucchi, B., June 2-5, 2002, "A Model For Analyzing Inelastic Seismic Response Of Plan-Irregular Building Structures", 15th ASCE engineering mechanics conference, Columbia University, New York, NY
3. Aoyama, H., 2001, *Design of Modern High Rise Reinforced Concrete Structures*, Imperial College Press, London, UK
4. Ashraf, M., Siddiqi, Z.A., and Javed, M.A. (2008). "Configuration of a multi-storey building subjected to lateral forces." *Asian Journal of civil Engineering (Building and Housing)*, Vol. 9, No.5 Pages 525-537.
5. Anshuman, S., Dipendu Bhunia, Bhavin Ramjiyani (2011), "Solution of shear wall location in Multi-storey building." *International Journal of civil and structural Engineering* Vol. 2, No.2 Pages 493-506.