Solution for Shear Wall in RC structures

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***Abstract*—Shear wall systems are one of the most commonly used lateral-load resisting systems in high- rise buildings. Shear walls have very high in-plane stiffness and strength, which can be used to simultaneously resist large horizontal loads and support gravity loads, making them quite advantageous in many structural engineering applications. There are lots of literatures available to design and analyse the shear wall. However, the decision about the location of shear wall in multi-storey building is not much discussed in any literatures. In this paper, therefore, main focus is to determine the solution for shear wall location in multi-storey building based on its both elastic and elasto-plastic behaviours. An earthquake load is calculated and applied to a building of fifteen stories located in zone IV. Elastic and elasto-plastic analyses were performed using both STAAD Pro 2004 and ETAB software packages. Shear forces, bending moment and story drift were computed in both the cases and location of shear wall was established based upon the above computations.**
Keywords- linear behaviour of shear wall, Non-linear behaviour of shear wall, seismic analysis, STAAD Pro 2004 and ETAB software.

I. INTRODUCTION

The design of these walls for seismic forces requires special considerations as they should be safe under repeated loads. Shear walls may become imperative from the point of view of economy and control of lateral deflection. There are lots of literatures available [Cardan, B. (1961), Syngellakis et al. (1991), Wight et al. (1991), Qiusheng et al. (1994), White et al. (1995) and Rosowsky, D.V. (2002)] to design and analyse the shear wall. However, any of these literatures did not discuss much about the location of shear wall in multi-storey building.
Hence, this paper has been described to determine the proper location of shear wall based on its elastic and elasto-plastic behaviours. A RCC medium rise building of 15 stories subjected to earthquake loading in Zone IV has been considered.
In this regard, both STAAD Pro 2004 and SAP V 10.0.5 (2000) software packages have been considered as two tools to perform. Shear forces, bending moments and storey drifts have been calculated to find out the location of shear wall in the building.

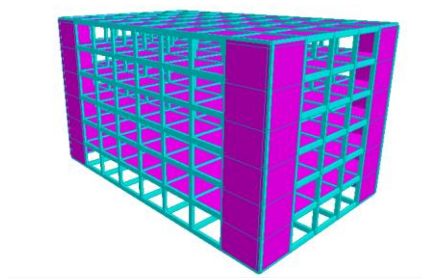

Fig 1: Shear wall at the edge

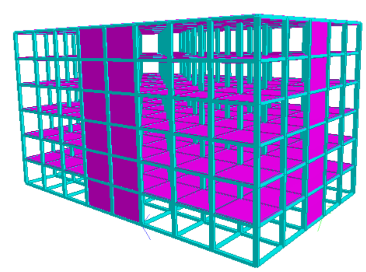

Fig 2: Shear wall at the center of each side

II RESULTS AND DISCUSSION

A. Load consideration

Dead Load (DL) and Live load (LL) have been taken as per IS 875 (Part 1) (1987) and IS 875 (Part 2) (1987), respectively. Seismic load calculation has been done based on the IS 1893 (Part 1) (2002)‟s approach.

B. Preliminary Data for considered structures:

Zone	-	IV
External wall	-	250mm thick including Plaster
Ground storey height	-	4.0m From Foundation
Internal wall	-	150mm thick including Plaster
Floor to floor height	-	3.35m
Grade of Concrete	-	M20 and Fe 415
Size of exterior column	-	300×500 mm2
Number of storeys	-	(G+6)
Size of interior column	-	300×300 mm2
Shear wall thickness	-	300 mm
Size of beams	-	300×450 mm2
Depth of slab	-	150 mm
Ductility design	-	IS:13920-1993

C. Comparison of results

Table 1: Maximum BM and SF at the ground floor after providing shear wall at the center of all side of the building

Software	Load Combination	Calculated Bending Moment (kN-m)	Calculated Shear Force (kN)
STAAD PRO 2004	1.2(DL+LL+EQ) 1.5(DL+EQ) 0.9DL+1.5EQ,	698.24 861.27 854.41	337.97 416.28 412.29
ETAB	1.2(DL+LL+EQ) 1.5(DL+EQ) 0.9DL+1.5EQ,	630.90 778.78 779.73	308.57 380.24 381.03

Table 2: Maximum BM and SF at the ground floor at the ground floor providing shear wall at the corner of the structure

Software	Load Combination	Calculated Bending Moment (KN-m)	Calculated Shear Force (KN)
STAAD PRO 2004	1.2(DL+LL+EQ) 1.5(DL+EQ) 0.9DL+1.5EQ,	698.24 861.27 854.41	337.97 416.28 412.29
ETAB	1.2(DL+LL+EQ) 1.5(DL+EQ) 0.9DL+1.5EQ,	630.90 778.78 779.73	308.57 380.24 381.03

Table 3: Result for base shear using staad pro software

OPTIONS	Max In X	Max in Y
Length	32.2	20.4
base shear with shear wall at the centre	4568.15	3425.34
base shear with shear wall at the corner	2465.71	2225.24

Table 4: Result for base shear using ETAB software

OPTIONS	Max In X	Max in Y
Length	32.2	20.4
base shear with shear wall at the centre	4568.15	3425.34
base shear with shear wall at the corner	2465.71	2225.24

CONCLUSION

- The above study shows the idea about the location for providing the shear wall which was based on the elastic and inelastic analyses in this paper.
- It has been observed that the bending moment and shear forces should be reduced after providing the shear wall in corner of the building.
- It has been also observed that the bending moment and shear force should be considerably reduced after providing shear wall at the center of the each direction of building. Base shear also reduced after providing the shear wall at the center of the each side of the structure.
- Thus comparison of this result also done and the result obtained using staad pro and the ETAB software are considerably same values.

REFERENCE

[1]. Bureau of Indian Standards: IS-875, part 1 (1987), dead loads on buildings and Structures, New Delhi, India.

[2]. Bureau of Indian Standards: IS-875, part 2 (1987), live loads on buildings and Structures, New Delhi, India.

[3]. Bureau of Indian Standards: IS-1893, part 1 (2002), "Criteria for Earthquake Resistant Design of Structures: Part 1 General provisions and Buildings", New Delhi, India.

[4]. Bernhard Cardan, "Concrete Shear Walls Combined with Rigid Frames in Multistory Buildings Subject to Lateral Loads", Journal of American Concrete Institute, (September 1961) 58, pp 299-316,

[5]. Li Qiusheng, Cao hong and Li Guiqing "analysis of free vibrations of tall buildings" ASCE.

[6]. David V. Rosowsky "Reliability-based seismic design of wood shear walls" Journal of Structural Engineering" (November 2002), ASCE.

[7]. SAP2000: Advanced 10.0.5 (2006), static and Dynamic Finite Element Analysis of Structures, Computers and Structures Inc., Berkeley, CA.

[8]. Stavros Syngellakis' and Idris A. Akintilo (1991), "nonlinear dynamics of coupled shear walls using transfer matrices" ASCE.

[9]. Maurice W. White and J. Daniel Dolan (1995), "Nonlinear shear wall analysis" Technical Notes, Journal of Structural Engineering" ASCE.

[10]. John Bolander Jr. and James K. Wight (1991), "Finite element modeling of shearwall- dominant buildings" ASCE.