

SEISMIC ANALYSIS AND COMPARATIVE STUDY OF A STRUCTURE WITH SHEARWALL AND WITHOUT SHEARWALL FRAME SYSTEM

Obaid Yassin, M-Tech (Structure and Foundation Engineering)
Rizwanullah, Assistant Professor

Department of Civil Engineering, Al-Falah University, Faridabad, India

Abstract- The main objective of the research work presented in this paper is to study the seismic behavior and to compare the results of buildings with reinforced concrete shearwall and without shearwall. Three buildings with same plan and equal number of storeys with two different configurations of shearwalls and one structure with no shearwall are considered. A brief review of design concept is presented and need of shear wall, effect of earthquake are discussed. Response spectrum analysis has been done to buildings with different configurations of shearwall with same plan. The storey displacements are obtained and compared to each other for different models to meet the shear wall effect. The analysis and design of models are done according to IS codes in an eco friendly software ETAB 2015.

Key Words: - Etabs , Response spectrum, Shearwall, Stiffness, Story drifts

1. INTRODUCTION

Shear walls are vertical elements that resist the horizontal forces. Shear walls are like vertically-oriented wide beams that carry earthquake loads, wind loads and transfer them to the foundation. Shear wall system is often used for resisting the lateral forces caused by seismic excitation, because of their high stiffness and strength. Shear wall can be used effectively for controlling the drift against seismic loads acting on them.

1.1 MODEL CONFIGURATION

Three buildings with thirty five story regular reinforced concrete building are considered in seismic zone IV. The beam length in (x) transverse direction are 6m, and beams in (y) direction are of length 6m. Figure 1 and 2 shows the plan and 3D view of the thirty five story building having 7 bays in x-direction and seven bays in y-direction upto twenty story and five bays in x-direction and five bays in y-direction from story twenty one to thirty five. Story height of each building is assumed

3m. Beam cross section 450X600 mm and Column cross section is 750x750 mm (upto 10 floors), 600x600 (from 11th story to 20th storey) and 450x450 above.

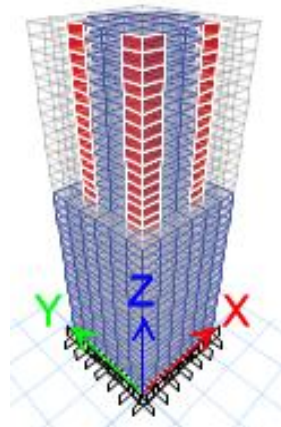


Fig-1.1: Building 1

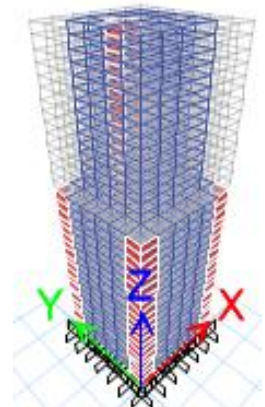


Fig-1.2: Building 2

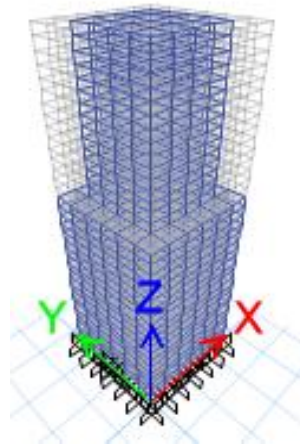


Fig-1.3: Building 3 without shearwall

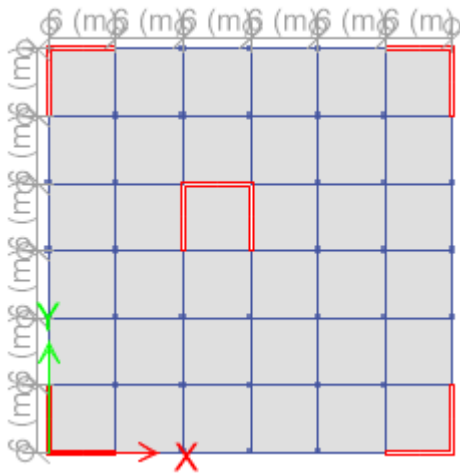


Fig-1.4: Plan Of Building 2

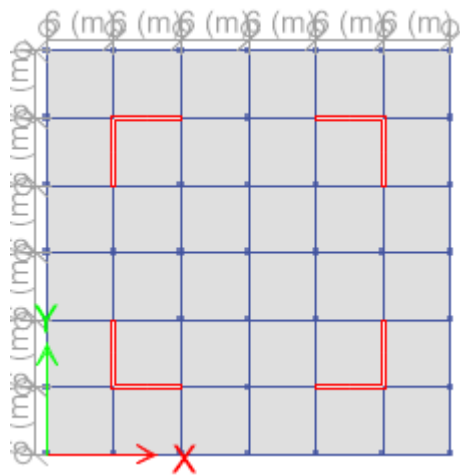


Fig-1.5: Plan Of building 1

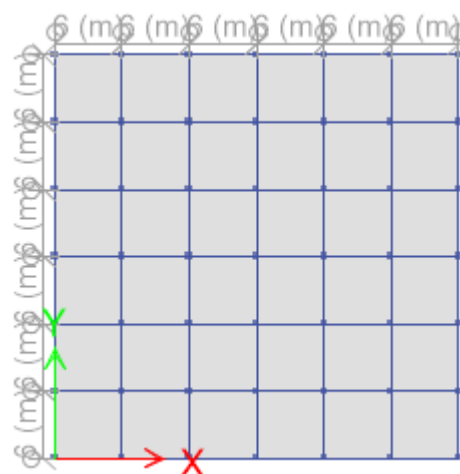


Fig-1.6: Plan Of Building3

1.2 TIME PERIOD

IS-1893-2016 defines different S_a/g values for different values of approximate time period (T). The fundamental natural period (T_a) is taken for moment resisting frame building without brick infill panels as $T_a = 0.075h^{0.75}$, Where, h = Height of the building in m

Table 1.1- Time Period for Building 1,2 and 3 .

Time Period	Building 1	Building 2	Building 3
Global x	2.46sec	2.46sec	2.46sec
Global y	2.46sec	2.46sec	2.46sec

1.3 DESIGN BASE SHEAR

The design base shear of a building can be calculated by using the code IS-1893-2002

$$V_b = A_h \cdot W$$

Where A_h = design horizontal seismic coefficient

W = seismic weight

The Design horizontal seismic coefficient (A_h) is a function of peak ground acceleration (z), Importance Factor (I), Response Reduction Factor (R) and Design acceleration coefficient (S_a/g) for different types of soil normalized corresponding to 5 % damping.

$$A_h = \frac{z I S_a}{2 R g}$$

S_a/g values for medium soil according to IS-1893-2002

For medium soil sites

$$\frac{S_a}{g} = \begin{cases} 1 + 15 T; & 0.00 \leq T \leq 0.10 \\ 2.50 & 0.10 \leq T \leq 0.55 \\ 1.36/T & 0.55 \leq T \leq 4.00 \end{cases}$$

Table 1.2- Design Base Shear of Building 1,2 and 3 for Equivalent Static Load

Design base shear	Building 1	Building 2	Building 3
Global X(KN)	4524.8659	4647.1664	1949.8072
Global Y(KN)	4507.9978	4860.1705	1894.1824

Story11	2225127	2459581	1325328
Story10	2340574	2617225	1337849
Story9	2512603	2811380	1526922
Story8	2678568	3026401	1541771
Story7	2902680	3306739	1558958
Story6	3198674	3677287	1588130
Story5	3616874	4197985	1654464
Story4	4255396	4988078	1848429
Story3	5354901	6339829	2712356
Story2	7675323	9175584	9790680
Story1	16868653	20218692	9787738
Base	0	0	0

1.4 STIFFNESS

Table-1.3:Story Stiffness in x direction for equalent static loads

Story	SW2	SW1	WSW
Story35	118793.7	120253.7	177090.4
Story34	248371.8	231602	264527.4
Story33	366247.6	321026.3	309371.3
Story32	471965.9	391462.8	337344.7
Story31	566407.5	447765	356611.4
Story30	650790.7	493787.8	370874.1
Story29	726590	532496.3	382037.7
Story28	795403.3	566181.5	391199.9
Story27	858858.6	596746.5	399041.5
Story26	918594.3	626009	406011.8
Story25	976279.2	656094.7	412431.8
Story24	1033621	690058.6	418554
Story23	1092718	733406.6	425075.7
Story22	1155339	795987.3	435797.6
Story21	1227680	922322.9	508573
Story20	1381498	1476312	1228143
Story19	1482575	1589763	1251401
Story18	1585220	1700410	1264875
Story17	1678840	1803913	1273926
Story16	1767401	1904355	1282296
Story15	1852962	2004154	1290421
Story14	1938149	2106076	1298612
Story13	2025946	2213332	1307026
Story12	2119832	2330048	1315901

Table -1.4Storey Stiffness in Y Direction for equalent static loads

Story	SW2	SW1	WSW
Story35	109819.6	118793.7	176903.3
Story34	220006.3	248371.8	264322
Story33	316896.7	366247.6	309180.8
Story32	400453.5	471965.9	337170.6
Story31	472488.3	566407.5	356451.3
Story30	535119.8	650790.7	370725.3
Story29	590571.8	726590	381898
Story28	641014	795403.3	391067.4
Story27	688548.8	858858.6	398914.5
Story26	735282.7	918594.3	405889.2
Story25	783481.4	976279.2	412312.4
Story24	835811.1	1033621	418436.9
Story23	895917.9	1092718	424959.1
Story22	968583.5	1155339	435674.7
Story21	1068614	1227680	508338.4
Story20	1390491	1381498	1226435
Story19	1504897	1482575	1249737
Story18	1618667	1585220	1263255
Story17	1724348	1678840	1272349
Story16	1825441	1767401	1280750
Story15	1924372	1852962	1288895

