SEISMIC ANALYSIS OF MULTISTOREY STRUCTURE

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Abstract - *The seismic design of buildings is continuing to evolve. Traditional design methods have the objective of achieving life safety in a building by providing sufficient strength and ductility to resist total and/or partial collapse. In this proposed study G+14 Two Building With And Without Shear Wall model is generated & tested by the ETABS under the guideline of IS-875-Part3 & IS1893- 2002-Part1.And we find Base shear, Displacement, Seismic analysis , Storey drift, stiffness dynamic story shear is less than static story shear for all cases From all cases, it is concluded that lateral force obtained from response spectrum method is higher than those obtained by equivalent static lateral force method for story one up to five and the rest higher stories have less values.The maximum story displacement, overturning moment obtained from response spectrum method is lesser than those obtained by equivalent static lateral force method. The base shear, lateral force, story shear, maximum story displacement and overturning moment are increased.in both directions (i.e., X & Y) as the seismic zone goes from II to V for the same frame type building in both methods.*

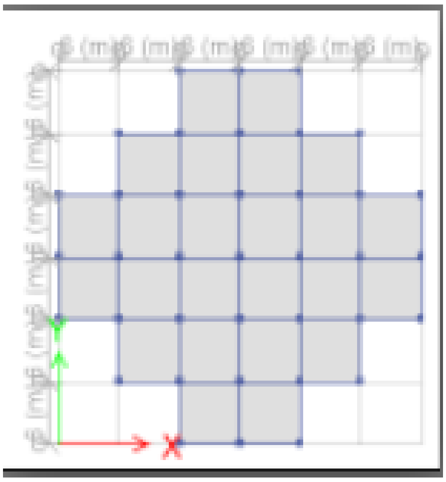
KeyWords: Stiffness,Response sprctrum,Dynamic analysis, Etab,Story Drift

1.INTRODUCTION

In many respects concrete is an ideal building material, combining economy, versatility of form and function, and noteworthy resistance to fire and the ravages of time. The raw materials are available in practically every country, and the manufacturing of cement is relatively simple. It is little wonder that in this century it has become a universal building material. Tall buildings are the most complex built structures since there are many conflicting requirements and complex building systems to integrate. Today's tall buildings are becoming more and more slender, leading to the possibility of more sway in comparison with earlier high-rise buildings. Thus the impact of wind and seismic forces acting on them becomes an important aspect of the design. Improving the structural systems of tall buildings can control their dynamic response. With more appropriate structural forms such as shear walls and tube structures, and improved material properties, the maximum height of concrete buildings has soared in recent decades. Therefore; the time dependency of concrete has become another important factor that should be considered in analyses to have a more reasonable and economical design. In this paper, we introduce the reinforced concrete tower, located in high seismic zone. Having a general overview of the case, some especial aspects of the tower, and the assessment of its seismic load bearing system with considering some important factors will be discussed.Shear walls are vertical elements of the horizontal force resisting system. Shear walls are like vertically-oriented wide beams that carry earthquake loads transfers 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.

1.1 MODEL CONFIGURATION

Fifteen story regular reinforced concrete building is considered. The beam length in (x) transverse direction are 6m longitudinal direction are 6m. Figure 1.1 shows the plan and 3D view of the fifteen story building without shear wall having seven bays in x-direction and seven bays in y-direction. Story height of each story is assumed 3m. Figure 1.2 shows plan and the 3D view of the fifteen story RC building i.e building 2(with shearwall).Beam cross sectionis 450x600 mm and Column cross section is 750x750 mm.



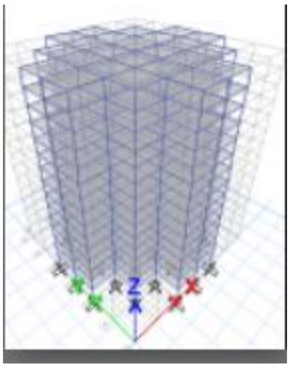
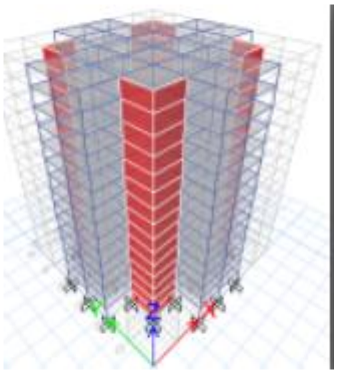


Fig-1.1:Plan and 3D view of building 1



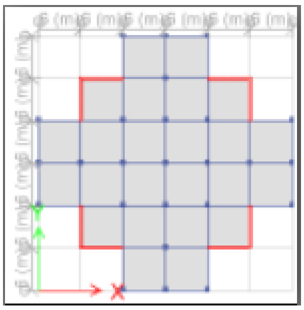


Fig-1.2:Plan and 3D view of building 2 i.e with shear wall.

1.2SEISMIC BASE SHEAR

The design of base shear is the sum of lateral forces applied at all levels that are finally transferred to the ground.
Vb = Ah x W
Ah = (ZI/2R) (Sa/ g)
The fundamental natural period for buildings are in IS 1893(part 1) 2002 Class 7.6.
Ta = $0.075h^{075}$ for moment resisting RC frame building without brick infill walls
Ta = $0.085h^{0.75}$ for moment resisting steel frame building without brick infill walls
Ta = 0.09h/√d for all other buildings including moment resisting RC frame building with brick infill walls.

Fundamental natural period for buildings with brick infill walls
Ta = 0.09h/√d
Z = 0.24
I = 1.5
R = 5
Sa/g = 2.5
Ah = (ZI/2R) (Sa/ g)
Vb = Ah x W

1.3 Fundamental Natural Period

Fundamental natural period of vibration [T] of a moment resisting frame building may be estimated by:
Ta=0.075 $h^{0.75}$ =.075*45 $^{.75}$ =for RC structures
Ta=$0.085h^{0.75}$ for steel structures
Where
h=building height in m. Basement storey are excluded, where walls of basement are fitted between the building columns or connected with the ground floor deck. When they are not so connected, it includes the basement storey.

Table 1:Time Period

Time Period	Building 1	Building 2
Global x	1.303sec	1.303sec
Global y	1.303sec	1.303sec

1.4 MAXIMUM STORY DISPLACEMENTS

Table-1.4:Max Displacement in X Direction

story	without shearwall	shearwall 1
Story15	16.46	7.724
Story14	16.063	7.205
Story13	15.487	6.648
Story12	14.723	6.068
Story11	13.786	5.465
Story10	12.703	4.843
Story9	11.505	4.21
Story8	10.247	3.576
Story7	8.923	2.95
Story6	7.546	2.342
Story5	6.132	1.768
Story4	4.701	1.242
Story3	3.278	0.78
Story2	1.913	0.403
Story1	0.723	0.129
Base	0	0

Chart -1.1:Displacement in x direction

Table 1.2:Max displacement in Y direction

story	without shearwall	shearwall 1
Story15	16.469	7.763
Story14	16.069	7.244
Story13	15.491	6.681
Story12	14.725	6.095
Story11	13.791	5.487
Story10	12.711	4.861
Story9	11.517	4.223
Story8	10.258	3.586
Story7	8.933	2.957
Story6	7.554	2.347
Story5	6.139	1.771
Story4	4.706	1.244
Story3	3.282	0.782
Story2	1.913	0.404
Story1	0.723	0.129
Base	0	0

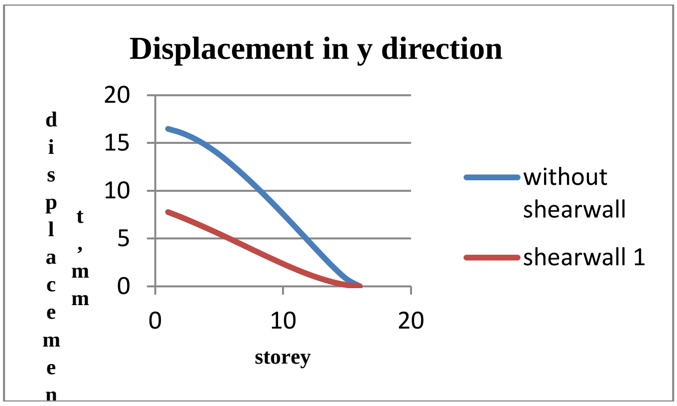


Chart-1.2:Displacement in Y direction

1.5 STORY DRIFTS

Table-1.3:Story drifts of buildings without shearwalls i.e building 1(B1) due to earthquake.

story	EQX	EQY
Story15	0.000134	0.000134
Story14	0.000192	0.000193
Story13	0.000255	0.000256
Story12	0.000312	0.000313
Story11	0.000361	0.000363
Story10	0.000401	0.000402
Story9	0.00042	0.00042
Story8	0.000441	0.000442
Story7	0.000459	0.00046
Story6	0.000471	0.000472
Story5	0.000477	0.000478
Story4	0.000474	0.000475
Story3	0.000456	0.000457
Story2	0.000406	0.000406
Story1	0.000241	0.000241
Base	0	0

Table-1.4:Story drifts of buildings without shearwalls i.e building 1(B1)) due to Response spectrum and wind loads.

story	RSX	RXY	WX	WY
Story15	6.90E-05	7.00E-05	4.40E-05	4.50E-05
Story14	0.0001	0.000101	6.80E-05	6.80E-05
Story13	0.000132	0.000132	9.80E-05	9.90E-05
Story12	0.000159	0.000159	0.00013	0.00013
Story11	0.000181	0.000181	0.000161	0.000162
Story10	0.000199	0.000198	0.000192	0.000193
Story9	0.000208	0.000207	0.000215	0.000215
Story8	0.00022	0.000219	0.000241	0.000241
Story7	0.000232	0.000232	0.000267	0.000267
Story6	0.000245	0.000244	0.000292	0.000292
Story5	0.000256	0.000256	0.000313	0.000313
Story4	0.000264	0.000264	0.00033	0.00033
Story3	0.000263	0.000262	0.000334	0.000334
Story2	0.000241	0.00024	0.000311	0.000311
Story1	0.000146	0.000146	0.000192	0.000192
Base	0	0	0	0

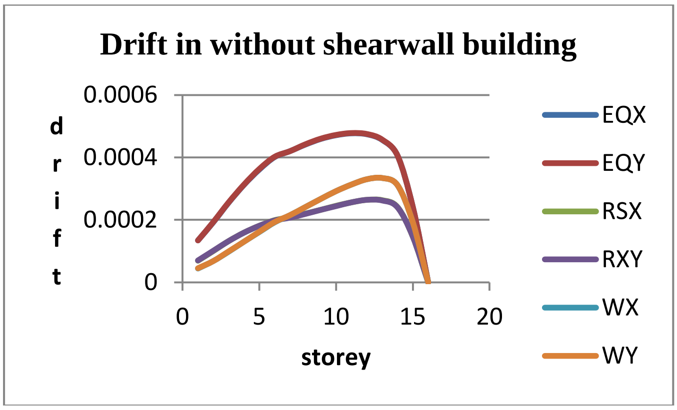


Chart-1.3:Story drifts of building 1 i.e without shearwall.

Table-1.4:Story drifts of buildings with shearwall i.e building 2(B2) due to earthquake.

story	EQX	EQY
Story15	0.000176	0.000177
Story14	0.000186	0.000188
Story13	0.000194	0.000195
Story12	0.000201	0.000203
Story11	0.000207	0.000209
Story10	0.000211	0.000212
Story9	0.000211	0.000212
Story8	0.000209	0.00021
Story7	0.000202	0.000203
Story6	0.000192	0.000192
Story5	0.000176	0.000176
Story4	0.000154	0.000154
Story3	0.000126	0.000126
Story2	9.20E-05	9.20E-05
Story1	4.30E-05	4.30E-05
Base	0	0

Table-1.5:Story drifts of buildings with shearwall i.e building 2(B2) due to response spectrum and wind loads.

story	RSX	RXY	WX	WY
Story15	0.000126	0.000127	8.00E-05	8.10E-05
Story14	0.000134	0.000134	8.50E-05	8.60E-05
Story13	0.000139	0.00014	8.90E-05	9.00E-05
Story12	0.000144	0.000145	9.40E-05	9.50E-05
Story11	0.000149	0.00015	9.90E-05	0.0001
Story10	0.000152	0.000153	0.000104	0.000105
Story9	0.000153	0.000153	0.000107	0.000108
Story8	0.000152	0.000152	0.000109	0.00011
Story7	0.000149	0.000149	0.000109	0.00011
Story6	0.000143	0.000142	0.000107	0.000107
Story5	0.000132	0.000132	0.000102	0.000102
Story4	0.000118	0.000117	9.20E-05	9.30E-05
Story3	9.80E-05	9.80E-05	7.80E-05	7.90E-05
Story2	7.30E-05	7.30E-05	6.00E-05	6.00E-05
Story1	3.50E-05	3.50E-05	3.00E-05	3.00E-05
Base	0	0	0	0

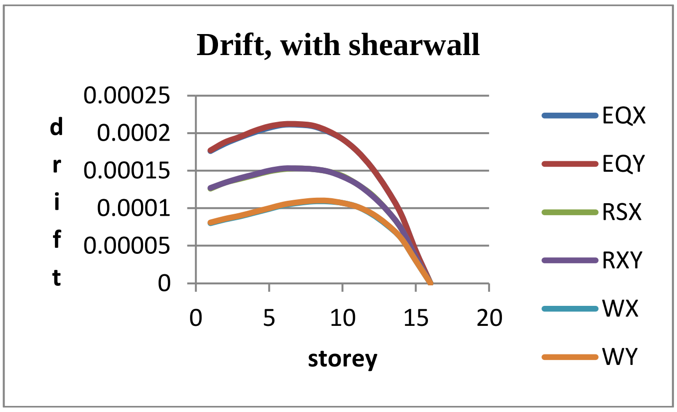


Chart-1.4: :Story drifts of building 2 i.e with shearwall.

2.CONCLUSIONS

1.Designing using Software's like Etab reduces lot of time in design work.
2.Details of each and every member can be obtained using Eatb.
3.All the List of failed beams can be Obtained and also Better Section is given by the software.
4.Accuracy is Improved by using software.
5. The base shear, lateral force, story shear, maximum story displacement and overturning moment are increased in both directions (i.e., X & Y) as the seismic zone goes from II to V for the same frame type building in both methods.
6. Dynamic story shear is less than static story shear for all cases.
7. The Axial Force for Continuous type in P-delta analysis is increase 22% has compared to static analysis. Etc.

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