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Effect of Shear Walls on Seismic Behaviour in Multistory Building by Varying the Shear Wall Size and Location

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Abstract: This paper is study about how multi story structure get affects the story shear Base shear & story stiffness parameters which are directly aligned with inclusion of shear wall in the building which indirectly affects the effectiveness during earthquake. A four-story structure for zone factor 0.16 as per Indian code were analyzed in ETABS 18.1.1 software where we carried four model with & without shear wall, varying thickness of shear wall & location of shear wall particularly at soft story. Incorporating shear walls increases story shear compared to structures without them, though placement at the soft story slightly reduces story shear, with negligible further change upon reducing wall thickness. Base shear remains largely unaffected by shear wall inclusion, placement, or dimensional properties. Conversely, adding shear walls solely at the soft story significantly enhances story stiffness relative to structures lacking shear walls, though stiffness is sensitive to reductions in wall thickness.
Keywords: Soft Story, Rectangular shear wall with Boundary Elements, Story Shear, Base shear, Story Stiffness.

I. INTRODUCTION

Following parameters considered in this paper are storey shear base shear & Storey stiffens all these indirectly get affected with & Without shear wall & its location. Storey Shear is the total horizontal force acting on a specific level (storey) of a building due to lateral loads. It represents the cumulative shear force resisted by the structural elements (columns, walls, braces) at that level. It is calculated at each storey of the building, varying from one level to another depending on the distribution of lateral forces. Storey shear at a given level is the sum of all lateral forces (from the applied load, like seismic or wind forces) acting above that level. Storey shear used to design the lateral force-resisting system (e.g., shear walls, braced frames) at each storey to ensure they can resist the horizontal forces without failure. Base reaction, often referred to as base shear in seismic analysis, is the total horizontal force at the base of the building (at the foundation level) required to resist all lateral loads applied to the entire structure. It occurs specifically at the ground level or foundation interface. Base shear used to design the foundation and ensure the structure can transfer the total lateral load to the ground. It's critical for foundation stability and overall structural integrity. Storey stiffness, often referred to in structural engineering as "story stiffness," is a measure of a building's resistance to lateral deformation (e.g., swaying or displacement) at a specific level or floor (storey) under horizontal forces, such as those caused by wind or earthquakes. It is a critical parameter in the design and analysis of multi-storey buildings, particularly in seismic regions, as it influences how forces are distributed through the structure.

II. LITERATURE

Priya Kewat, Kavita Golghate Studied by varying different thickness of shear wall as well as shape at different location studied about story drift & Lateral displacement.

Balaji Salunke, Prof. R.M. Desai focused by placing shear wall at outer boundary & at the centre carried out analysis of story shear story drift & story displacement.

S.P.Pawar Dr.C.P.Pise studied For buildings on slopes shortest column on higher stiffness & straight shape (or rectangular) shear walls configuration proves to be better among all configurations for resisting the lateral displacement.

III. ANALYTICAL METHODOLOGY

Through this scientific paper, several models proposed, which is part of a multi-story reinforced concrete building. The proposed models have been analysed through the method of response spectrum integrated into the software ETABS [18.1.1]. After analysis of the proposed models, the Base shear, Storey Stiffness & Storey Shear data were extracted.

A. Model Description

Different models have analysed with the same span length of 4.50 m, as well as the same number of bays, i.e. 5. 4-storey models were chosen. The floor height is set at 3.2m for all models. The Indian code of IS 456:2000 reinforced concrete was used to choose the properties of materials used, the compressive strength of concrete is 25 MPa and the yield strength of TMT bar is 550 MPa.

In this study, the Indian code of IS 456:2000 reinforced concrete & IS 1893:2016 were used. There is variation in structural elements were done & location placement. First model was analysed with 230 x 600 mm column size, second model were analysed with 230 x 600 mm column size along with shear wall on opposite side in parallel direction on boundary wall side where chosen thickness of 230mm shear wall from bottom storey to top storey, Third Model were analysed by keeping Shear wall of 230mm thick at soft storey only & Fourth Model were analysed with 230 x 600 mm column along with 150mm thick shear wall at soft storey.

Table 1 of Material & Dimensional Properties

Description	Values
Concrete strength (Mpa)	25
Modulus of elasticity of concrete, Ec (Mpa)	25000
Steel tensile yield strength (Mpa)	550
Storey height (m)	3
Number of stories	4
Span length (m)	4.5m
Shear wall thickness	230mm&150mm
Column sizes	230 x600 mm
Number of Bays	5 x 5
Beam Size(mm)	230 x 450
Importance Factor I	1
Slab Thickness	125mm

B. Loads

Live load Reduction factor was applied as per IS code The model was designed for Response Spectrum Function of Zone Factor Z=0.16 Response reduction factor R= 3 For Soil type II with super imposed dead load for wall masonry infill taken 13kN/m which Red solid brick & For Shell load Super imposed Dead load and taken to be 2kN/m2 & Live load of 2.5 kN/m2.

In the Analysis of 4 Story Following load combination obtained for Concrete frame design & concrete shear wall design as per IS code: so total 28 Load combination we have obtained 14 for concrete frame design & 14 for Concrete shear wall design.

1) 1.5DL+1.5SIDL
(2) 1.5DL+1.5LL+1.5SIDL
(3) 1.2DL+1.2LL+1.2SIDL+1.2E_x
(4) 1.2DL+1.2LL+1.2SIDL-1.2E_x
(5) 1.2DL+1.2LL+1.2SIDL+1.2E_y
(6) 1.2DL+1.2LL+1.2SIDL-1.2E_y
(7) 1.5DL+1.5SIDL+1.5E_x
(8) 1.5DL+1.5SIDL-1.5E_x
(9) 1.5DL+1.5SIDL+1.5E_y
(10) 1.5DL+1.5SIDL-1.5E_y
(11) 0.9DL+0.9SIDL+1.5E_x
(12) 0.9DL+0.9SIDL-1.5E_x
(13) 0.9DL+0.9SIDL+1.5E_y
(14) 0.9DL+0.9SIDL-1.5E

C. Models

Model 1- 4 storied building without shear wall

Model 2- 4 Storied building with shear wall of 230mm thick extends over full height of building placed parallel to each other outer boundary of building.

Model 3- 4 Storied building with shear wall of 230mm thick placed at soft story parallel to each other outer boundary of building.

Model 4- 4 Storied building with shear wall of 150mm thick placed at soft story parallel to each other outer boundary of building.

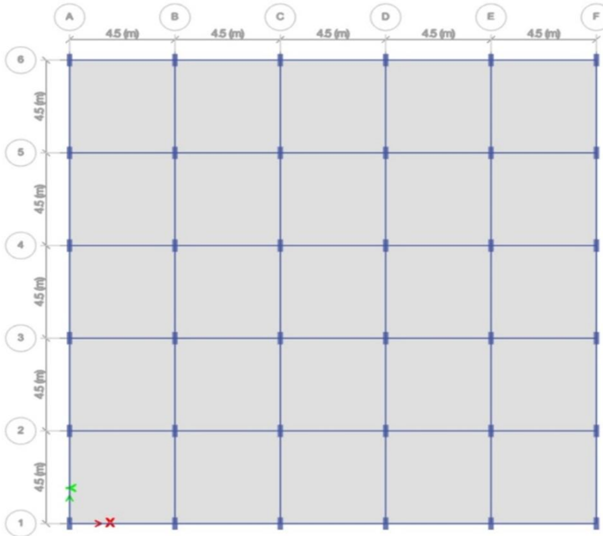


Fig-1: Model 1

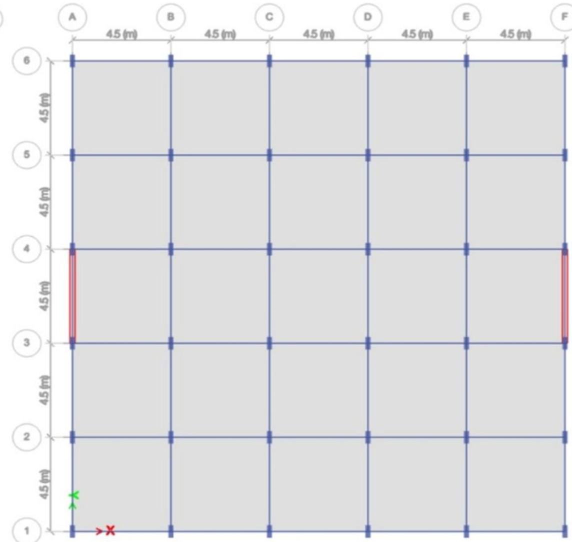


Fig-2: Model 2&3

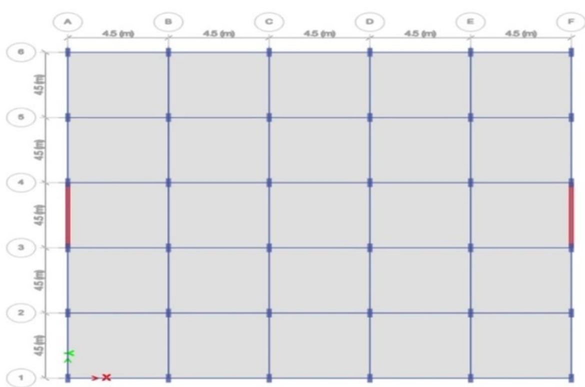


Fig-3: Model 4

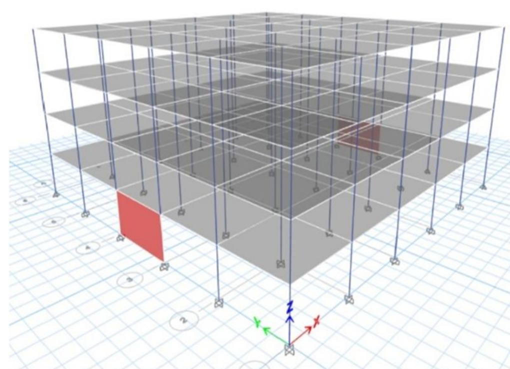
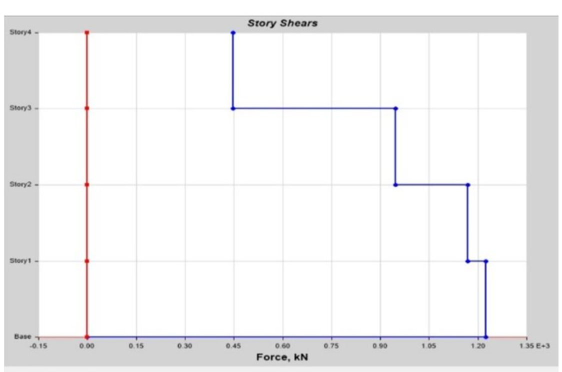
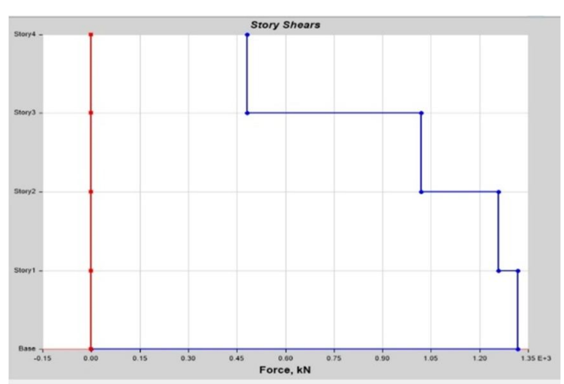


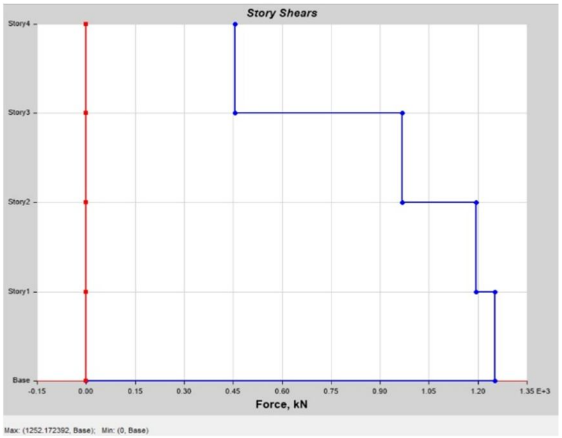
Fig-4:3D View



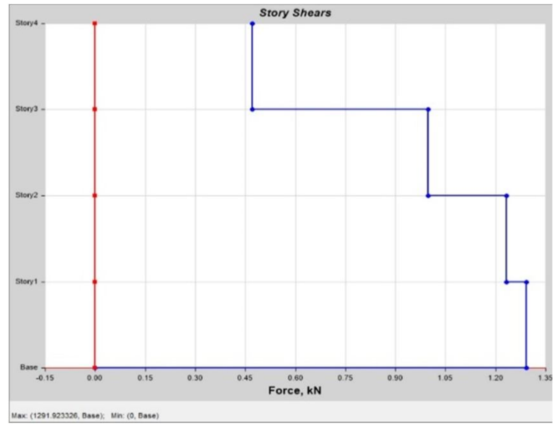
Story Shear Graph-1(Model-1)



Story Shear Graph-2(Model-2)



Story Shear Graph-3(Model-3)



Story Shear Graph-4(Model-4

Table 2: Percentage of Steel Reinforcement (Model-1)

TYPES OF COLUMNS	STOREY 1	STOREY 2	STOREY3	STOREY 4
2 POINT JUNCTION CORNER COLUMN	1.76	1.64	1.54	1.36
3 POINT COLUMN TRIAXIAL	2.27	2.27	1.77	1.45
4-POINT COLUMN AXIAL LOADED COLUMN	4.3	3.76	2.99	2.79

Table 3: Percentage of Steel Reinforcement (Model-2)

TYPES OF COLUMNS	STOREY 1	STOREY 2	STOREY3	STOREY 4
2 POINT JUNCTION CORNER COLUMN	1.76	1.64	1.54	1.36
3 POINT COLUMN TRIAXIAL	2.27	2.27	1.77	1.45
4-POINT COLUMN AXIAL LOADED COLUMN	4.3	3.76	2.99	2.79

Table 4: Percentage of Steel Reinforcement (Model-3)

TYPES OF COLUMNS	STOREY 1	STOREY 2	STOREY3	STOREY 4
2 POINT JUNCTION CORNER COLUMN	1.76	1.64	1.54	1.36
3 POINT COLUMN TRIAXIAL	2.27	2.27	1.77	1.45
4-POINT COLUMN AXIAL LOADED COLUMN	4.3	3.76	2.99	2.79

Table 5: Percentage of Steel Reinforcement (Model-4)

TYPES OF COLUMNS	STOREY 1	STOREY 2	STOREY3	STOREY 4
2 POINT JUNCTION CORNER COLUMN	1.76	1.64	1.54	1.36
3 POINT COLUMN TRIAXIAL	2.27	2.27	1.77	1.45
4-POINT COLUMN AXIAL LOADED COLUMN	4.3	3.76	2.99	2.79

D. Reinforcement Percentage Discussion

From Table 2: The Reinforcement from above analysis shows that for 2-point junction corner column varies from bottom to top story were 22.72%, for 3-point junction triaxial column varies from bottom to top story was 36.12% & for 4-point junction axial column varies from bottom to top story were 35.11%.

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From Table 3: The Reinforcement from above analysis shows that for 2-point junction corner column varies from bottom to top story were 13.92%, for 3-point junction triaxial column varies from bottom to top story were 15.81% & for 4-point junction axial column varies from bottom to top story were 22.47%. From this we can say the variation of reinforcement is more in centrally located column followed by triaxial column & Corner column.

From Table 4: The Reinforcement from above analysis shows that for 2-point junction corner column varies from bottom to top story were 20.46%, for 3-point junction triaxial column varies from bottom to top story were 21.24% & for 4-point junction axial column varies from bottom to top story were 32.61%. From this we can say the variation of reinforcement is more in centrally located column followed by triaxial column & Corner column.

From Table 5: The Reinforcement from above analysis shows that for 2-point junction corner column varies from bottom to top story were 17.57%, for 3-point junction triaxial column varies from bottom to top story were 28.57% & for 4-point junction axial column varies from bottom to top story were 33.25%. From this we can say the variation of reinforcement is more in centrally located column followed by triaxial column & Corner column.

Table 6: Base Shear (Reactions)-Model-1

TABLE: Base Reactions									
Output Case	Case Type	Step Type	Step Number	FX	FY	FZ	MX	MY	MZ
				kN	kN	kN	kN-m	kN-m	kN-m
Dead	LinStatic			0	0	10352.2521	116462.8366	-116462.8366	0
Live	LinStatic			0	0	5062.5	56953.125	-56953.125	0
Modal	LinModEigen	Mode	1	-1.4384	0.0076	0	-0.0565	-11.337	17.0096
Modal	LinModEigen	Mode	2	-0.1306	-0.5633	0	4.4608	-1.2791	-35.0972
Modal	LinModEigen	Mode	3	-0.0115	3.7921	0	-31.0087	-0.1305	36.0212
Modal	LinModEigen	Mode	4	-3.9654	-0.0122	0	0.1802	11.7719	43.1592
Modal	LinModEigen	Mode	5	-1.2188	1.0495	0	4.777	-3.9916	123.2315
Modal	LinModEigen	Mode	6	-4.7343	-0.5435	0	-1.9094	-13.9692	4.6515
Modal	LinModEigen	Mode	7	0.076	-15.0368	0	-15.1733	0.2401	-149.2174
Modal	LinModEigen	Mode	8	-3.023	0.0028	0	-0.0023	11.0116	30.4334
Modal	LinModEigen	Mode	9	-0.7976	0.1628	0	-0.5442	-1.8822	-167.5386
Modal	LinModEigen	Mode	10	-0.037	29.001	0	-65.5444	-0.0981	299.052
Modal	LinModEigen	Mode	11	0.5444	-2.4728	0	7.0093	1.418	124.5281
Modal	LinModEigen	Mode	12	0.0211	-30.2464	0	-0.5074	0.0614	-316.2425
SIDL	LinStatic			0	0	14580	164025	-164025	0
EX	LinStatic			-815.9553	0	0	0	-7569.8815	9179.4973
EY	LinStatic			0	-1355.9344	0	12579.4419	0	-15254.2616
DCon1	Combination			0	0	37398.3782	420731.7549	-420731.7549	0
DCon2	Combination			0	0	44992.1282	506161.4424	-506161.4424	0
DCon3	Combination			-979.1464	0	35993.7026	404929.1539	-414013.0118	11015.3968
DCon4	Combination			979.1464	0	35993.7026	404929.1539	-395845.2961	-11015.3968
DCon5	Combination			0	-1627.1212	35993.7026	420024.4842	-404929.1539	-18305.1139
DCon6	Combination			0	1627.1212	35993.7026	389833.8237	-404929.1539	18305.1139
DCon7	Combination			-1223.933	0	37398.3782	420731.7549	-432086.5772	13769.246
DCon8	Combination			1223.933	0	37398.3782	420731.7549	-409376.9326	-13769.246
DCon9	Combination			0	-2033.9015	37398.3782	439600.9177	-420731.7549	-22881.3924
DCon10	Combination			0	2033.9015	37398.3782	401862.5921	-420731.7549	22881.3924
DCon11	Combination			-1223.933	0	22439.0269	252439.053	-263793.8752	13769.246
DCon12	Combination			1223.933	0	22439.0269	252439.053	-241084.2307	-13769.246
DCon13	Combination			0	-2033.9015	22439.0269	271308.2157	-252439.053	-22881.3924
DCon14	Combination			0	2033.9015	22439.0269	233569.8902	-252439.053	22881.3924

Table 7: Base Shear (Reactions)-Model-2

TABLE: Base Reactions									
Output Case	Case Type	Step Type	Step Number	FX	FY	FZ	MX	MY	MZ
				kN	kN	kN	kN-m	kN-m	kN-m
Dead	LinStatic			0	0	10973.0688	123447.0236	-123447.0236	0
Live	LinStatic			0	0	5062.5	56953.125	-56953.125	0
Modal	LinModEigen	Mode	1	1.603	-0.0001	0	0.0004	12.808	-18.0721
Modal	LinModEigen	Mode	2	4.8694	-0.0071	0	0.0547	-10.907	-57.0484
Modal	LinModEigen	Mode	3	0.0046	17.9785	0	-155.0783	-0.0014	204.7978
Modal	LinModEigen	Mode	4	-0.1183	0.2801	0	-2.5302	-0.0557	-209.2917
Modal	LinModEigen	Mode	5	7.0583	-0.0009	0	-0.0141	19.1859	-77.3516
Modal	LinModEigen	Mode	6	5.958	-0.0034	0	-0.0048	-7.1742	-66.843
Modal	LinModEigen	Mode	7	-0.0306	-104.6547	0	153.4497	-0.0769	-1198.033
Modal	LinModEigen	Mode	8	-0.6345	2.3999	0	-5.2468	-1.6597	-1272.7186
Modal	LinModEigen	Mode	9	-0.0662	-85.9704	0	133.7532	-0.1733	-971.2322
Modal	LinModEigen	Mode	10	-1.0198	2.6861	0	-6.8147	-2.7642	-909.6938
Modal	LinModEigen	Mode	11	-0.041	-56.3134	0	17.5105	-0.1075	-626.5177
Modal	LinModEigen	Mode	12	0.3896	-2.754	0	2.5463	1.0608	277.913
SIDL	LinStatic			0	0	14580	164025	-164025	0
EX	LinStatic			-879.1529	0	0	0	-8156.1035	9890.4703
EY	LinStatic			0	-1770.3231	0	16423.6941	0	-19916.135
DWal1	Combination			0	0	38329.6031	431208.0354	-431208.0354	0
DWal2	Combination			0	0	45923.3531	516637.7229	-516637.7229	0
DWal3	Combination			-1054.9835	0	36738.6825	413310.1783	-423097.5025	11868.5643
DWal4	Combination			1054.9835	0	36738.6825	413310.1783	-403522.8542	-11868.5643
DWal5	Combination			0	-2124.3877	36738.6825	433018.6113	-413310.1783	-23899.362
DWal6	Combination			0	2124.3877	36738.6825	393601.7454	-413310.1783	23899.362
DWal7	Combination			-1318.7294	0	38329.6031	431208.0354	-443442.1906	14835.7054
DWal8	Combination			1318.7294	0	38329.6031	431208.0354	-418973.8802	-14835.7054
DWal9	Combination			0	-2655.4847	38329.6031	455843.5766	-431208.0354	-29874.2025
DWal10	Combination			0	2655.4847	38329.6031	406572.4943	-431208.0354	29874.2025
DWal11	Combination			-1318.7294	0	22997.7619	258724.8213	-270958.9765	14835.7054
DWal12	Combination			1318.7294	0	22997.7619	258724.8213	-246490.666	-14835.7054
DWal13	Combination			0	-2655.4847	22997.7619	283360.3624	-258724.8213	-29874.2025
DWal14	Combination			0	2655.4847	22997.7619	234089.2801	-258724.8213	29874.2025

Table 8: Base Shear (Reactions)-Model-3

TABLE: Base Reactions									
Output Case	Case Type	Step Type	Step Number	FX	FY	FZ	MX	MY	MZ
				kN	kN	kN	kN-m	kN-m	kN-m
Dead	LinStatic			0	0	10507.4563	118208.8834	-118208.8834	0
Live	LinStatic			0	0	5062.5	56953.125	-56953.125	0
Modal	LinModEigen	Mode	1	-1.5746	0.0001	0	-0.001	-12.6095	17.7439
Modal	LinModEigen	Mode	2	-0.0028	0.0012	0	-0.0063	-0.0581	-50.839
Modal	LinModEigen	Mode	3	-0.0001	-5.7624	0	51.4959	-0.0045	-64.8309
Modal	LinModEigen	Mode	4	4.6359	0.0006	0	-0.0132	-9.3558	-52.2653
Modal	LinModEigen	Mode	5	-6.2774	0.0042	0	0.0013	-18.0905	71.7781
Modal	LinModEigen	Mode	6	4.3389	-0.0098	0	0.0128	-7.921	-52.1656
Modal	LinModEigen	Mode	7	0.1642	0.0047	0	-0.0114	0.1566	194.0821
Modal	LinModEigen	Mode	8	0.009	25.7277	0	-43.7566	0.0154	289.7623
Modal	LinModEigen	Mode	9	-0.1758	-0.1907	0	0.566	-0.4503	-322.7093
Modal	LinModEigen	Mode	10	-0.0232	-60.6813	0	202.205	-0.0579	-690.9053
Modal	LinModEigen	Mode	11	-1.191	-15.8334	0	35.6714	-3.2215	-1838.9891
Modal	LinModEigen	Mode	12	0.1167	-141.5291	0	325.4953	0.3259	-1361.7781
SIDL	LinStatic			0	0	14580	164025	-164025	0
EX	LinStatic			-861.2822	0	0	0	-7987.8316	9689.4249
EY	LinStatic			0	-1739.2823	0	16130.7103	0	-19566.9257
DWal1	Combination			0	0	37631.1844	423350.825	-423350.825	0
DWal2	Combination			0	0	45224.9344	508780.5125	-508780.5125	0
DWal3	Combination			-1033.5387	0	36179.9476	407024.41	-416609.8079	11627.3099
DWal4	Combination			1033.5387	0	36179.9476	407024.41	-397439.0121	-11627.3099
DWal5	Combination			0	-2087.1387	36179.9476	426381.2624	-407024.41	-23480.3108
DWal6	Combination			0	2087.1387	36179.9476	387667.5576	-407024.41	23480.3108
DWal7	Combination			-1291.9233	0	37631.1844	423350.825	-435332.5724	14534.1374
DWal8	Combination			1291.9233	0	37631.1844	423350.825	-411369.0777	-14534.1374
DWal9	Combination			0	-2608.9234	37631.1844	447546.8905	-423350.825	-29350.3885
DWal10	Combination			0	2608.9234	37631.1844	399154.7596	-423350.825	29350.3885
DWal11	Combination			-1291.9233	0	22578.7107	254010.495	-265992.2424	14534.1374
DWal12	Combination			1291.9233	0	22578.7107	254010.495	-242028.7476	-14534.1374
DWal13	Combination			0	-2608.9234	22578.7107	278206.5605	-254010.495	-29350.3885
DWal14	Combination			0	2608.9234	22578.7107	229814.4295	-254010.495	29350.3885

Table 9: Base Shear (Reactions)-Model-4

TABLE: Base Reactions									
Output Case	Case Type	Step Type	Step Number	FX	FY	FZ	MX	MY	MZ
				kN	kN	kN	kN-m	kN-m	kN-m
Dead	LinStatic			0	0	10453.4722	117601.5628	-117601.5628	0
Live	LinStatic			0	0	5062.5	56953.125	-56953.125	0
Modal	LinModEigen	Mode	1	1.4946	-0.0002	0	0.0012	11.8517	-16.8576
Modal	LinModEigen	Mode	2	0.0054	-0.0027	0	0.0221	0.1068	50.1149
Modal	LinModEigen	Mode	3	0.0002	5.6521	0	-50.1601	0.0056	63.6172
Modal	LinModEigen	Mode	4	-4.2272	-0.0008	0	0.0162	10.8797	47.5818
Modal	LinModEigen	Mode	5	5.3825	-0.0048	0	-0.0024	15.7486	-61.9034
Modal	LinModEigen	Mode	6	-3.4727	0.0131	0	-0.0164	9.982	44.3412
Modal	LinModEigen	Mode	7	0.2298	0.0747	0	-0.1231	0.1347	195.8336
Modal	LinModEigen	Mode	8	0.0099	25.4847	0	-40.074	0.0157	286.8659
Modal	LinModEigen	Mode	9	0.2549	0.4568	0	-1.305	0.6515	355.7813
Modal	LinModEigen	Mode	10	0.0311	61.6151	0	-195.3666	0.078	705.792
Modal	LinModEigen	Mode	11	-1.1431	-6.2475	0	11.4825	-3.0733	-1418.7094
Modal	LinModEigen	Mode	12	-0.0656	116.786	0	-248.9174	-0.186	1184.0689
SIDL	LinStatic			0	0	14580	164025	-164025	0
EX	LinStatic			-834.7816	0	0	0	-7742.9191	9391.2929
EY	LinStatic			0	-1737.4828	0	16115.8187	0	-19546.6817
DWal1	Combination			0	0	37550.2084	422439.8441	-422439.8441	0
DWal2	Combination			0	0	45143.9584	507869.5316	-507869.5316	0
DWal3	Combination			-1001.7379	0	36115.1667	406295.6253	-415587.1282	11269.5515
DWal4	Combination			1001.7379	0	36115.1667	406295.6253	-397004.1224	-11269.5515
DWal5	Combination			0	-2084.9794	36115.1667	425634.6078	-406295.6253	-23456.018
DWal6	Combination			0	2084.9794	36115.1667	386956.6428	-406295.6253	23456.018
DWal7	Combination			-1252.1724	0	37550.2084	422439.8441	-434054.2228	14086.9394
DWal8	Combination			1252.1724	0	37550.2084	422439.8441	-410825.4655	-14086.9394
DWal9	Combination			0	-2606.2242	37550.2084	446613.5722	-422439.8441	-29320.0225
DWal10	Combination			0	2606.2242	37550.2084	398266.116	-422439.8441	29320.0225
DWal11	Combination			-1252.1724	0	22530.125	253463.9065	-265078.2851	14086.9394
DWal12	Combination			1252.1724	0	22530.125	253463.9065	-241849.5278	-14086.9394
DWal13	Combination			0	-2606.2242	22530.125	277637.6346	-253463.9065	-29320.0225
DWal14	Combination			0	2606.2242	22530.125	229290.1784	-253463.9065	29320.0225

Model Graph	Story shear Value(kN)	Models	Base Shear (Base Reaction) kN
Model 1	1223.93	Model 1	44992.12 (Dcon2)
Model 2	1318.72	Model 2	45923.35 (Dwal2)
Model 3	1291.92	Model 3	45224.93(Dwal2)
Model 4	1252.17	Model 4	45153.95 (Dwal2)

IV. RESULTS & DISCUSSION

A. Storey Shear

Comparing for above four Models graphs the following parameters are Shear story were evaluated from this we can say how the values for above parameters are changed as well as we can determine which above case is effective in terms of strength.

1) Comparing story Shear Graph 1&2: the story shear value for column with shear wall 230mm from bottom to top story increases by 7.18% with column section of 230 x 600 only.
2) Comparing story Shear Graph 2&3: the story shear value for column with shear wall 230mm at soft story only decreases by 2.03% with column with shear wall 230mm from bottom to top story.

Comparing story Shear Graph 3&4: the story shear value for column with shear wall 150 mm at soft story only decreases by 3.07% with column with shear wall 230mm at soft story.

B. Base Reaction

The Maximum Base Shear Value obtained for above all model cases for load combination Don2 (without shear wall) & Dwal2 (with shear wall) as stated below

Comparing the above table 6&7 the base reaction value for column with shear wall 230mm from bottom to top story increases by 2.02% with column section of 230 x 600 only.

Comparing the above table 7&8 the base reaction value for column with shear wall 230mm at soft story only decreases by 1.54% with column with shear wall 230mm from bottom to top story.

Comparing the above table 8&9 the base reaction value for column with shear wall 150 mm at soft story only decreases by 0.18% with column with shear wall 230mm at soft story.

Table10: Story Stiffness Model 1

TABLE: Story Stiffness										
Story	Output Case	Case Type	Step Type	Step Number	Shear X	Drift X	Stiff X	Shear Y	Drift Y	Stiff Y
					kN	mm	kN/m	kN	mm	kN/m
Story4	EX	LinStatic	Step By Step	1	297.5861	2.172	137015.478	0	0.002	0
Story3	EX	LinStatic	Step By Step	1	630.8235	4.315	146194.512	0	0.008	0
Story2	EX	LinStatic	Step By Step	1	778.9289	5.372	144995.682	0	0.053	0
Story1	EX	LinStatic	Step By Step	1	815.9553	5.468	149232.862	0	0.176	0
Story4	EY	LinStatic	Step By Step	1	0	0.001	0	494.5212	1.903	259821.094
Story3	EY	LinStatic	Step By Step	1	0	0.006	0	1048.2868	3.169	330841.087
Story2	EY	LinStatic	Step By Step	1	0	0.046	0	1294.4049	3.694	350427.629
Story1	EY	LinStatic	Step By Step	1	0	0.212	0	1355.9344	2.693	503569.176

Table11: Story Stiffness Model 2

TABLE: Story Stiffness										
Story	Output Case	Case Type	Step Type	Step Number	Shear X	Drift X	Stiff X	Shear Y	Drift Y	Stiff Y
					kN	mm	kN/m	kN	mm	kN/m
Story4	EX	LinStatic	Step By Step	1	320.6156	2.323	138001.605	0	0.004	0
Story3	EX	LinStatic	Step By Step	1	679.6753	4.377	155273.784	0	0.003	0
Story2	EX	LinStatic	Step By Step	1	839.2574	5.496	152700.112	0	0.009	0
Story1	EX	LinStatic	Step By Step	1	879.1529	4.751	185048.331	0	0.019	0
Story4	EY	LinStatic	Step By Step	1	0	0.008	0	645.6137	1.005	642265.842
Story3	EY	LinStatic	Step By Step	1	0	0.008	0	1368.6412	1.09	1255652.61
Story2	EY	LinStatic	Step By Step	1	0	0.008	0	1689.9867	0.919	1838061.656
Story1	EY	LinStatic	Step By Step	1	0	0.006	0	1770.3231	0.495	3576498.171

Table12: Story Stiffness Model 3

TABLE: Story Stiffness										
Story	Output Case	Case Type	Step Type	Step Number	Shear X	Drift X	Stiff X	Shear Y	Drift Y	Stiff Y
					kN	mm	kN/m	kN	mm	kN/m
Story4	EX	LinStatic	Step By Step	1	313.9684	2.287	137254.714	0	0.0003579	0
Story3	EX	LinStatic	Step By Step	1	665.5506	4.544	146462.68	0	0.002	0
Story2	EX	LinStatic	Step By Step	1	821.8094	5.638	145766.287	0	0.013	0
Story1	EX	LinStatic	Step By Step	1	861.2822	4.613	186701.051	0	0.019	0
Story4	EY	LinStatic	Step By Step	1	0	0.001	0	634.031	2.365	268041.719
Story3	EY	LinStatic	Step By Step	1	0	0.003	0	1344.0198	3.773	356230.273
Story2	EY	LinStatic	Step By Step	1	0	0.033	0	1659.5704	3.534	469637.868
Story1	EY	LinStatic	Step By Step	1	0	0.039	0	1739.2823	0.514	3383196.877

Table13: Story Stiffness Model 4

TABLE: Story Stiffness										
Story	Output Case	Case Type	Step Type	Step Number	Shear X	Drift X	Stiff X	Shear Y	Drift Y	Stiff Y
					kN	mm	kN/m	kN	mm	kN/m
Story4	EX	LinStatic	Step By Step	1	304.3581	2.218	137223.603	0	0.0003541	0
Story3	EX	LinStatic	Step By Step	1	645.1787	4.409	146335.986	0	0.002	0
Story2	EX	LinStatic	Step By Step	1	796.6546	5.496	144962.239	0	0.011	0
Story1	EX	LinStatic	Step By Step	1	834.7816	5.125	162891.369	0	0.024	0
Story4	EY	LinStatic	Step By Step	1	0	0.001	0	633.4795	2.367	267645.77
Story3	EY	LinStatic	Step By Step	1	0	0.003	0	1342.8506	3.783	354933.152
Story2	EY	LinStatic	Step By Step	1	0	0.032	0	1658.1267	3.589	461996.566
Story1	EY	LinStatic	Step By Step	1	0	0.037	0	1737.4828	0.65	2673758.242

C. Story Stiffness

From Table:10 for Model 1 the Story Stiffness (Siff X) kN/m at soft story increases by 8.18% from story 4 to story 1

From Table:11 for Model 2 the Story Stiffness (Siff X) kN/m at soft story increases by 25.42% from story 4 to story 1

From Table:12 for Model 3 the Story Stiffness (Siff X) kN/m at soft story increases by 26.48% from story 4 to story 1 (we conclude the story stiffness for shear wall of 230mm at softy story only perform better than shear wall of 230mm from top to bottom)

From Table 13 for Model 4 the Story Stiffness (Siff X) kN/m at soft story increases by 15.75 % from story 4 to story 1

The Storey Stiffness value for Model 3 performed better in all case

Comparing the above table 10&11 the Story Stiffness (Siff X) kN/m at soft story for column with shear wall 230mm from bottom to top story increases by 24% with column section of 230 x 600 only.

Comparing the above table 11&12 the Story Stiffness (Siff X) kN/m at soft story for column with shear wall 230mm at soft story only increased by 0.89% with column with shear wall 230mm from bottom to top story.

Comparing the above table 12&13 the Story Stiffness (Siff X) kN/m at soft story for column with shear wall 150 mm at soft story only decreases by 12.75% with column with shear wall 230mm at soft story.

V. CONCLUSION

Inclusion of shear wall in the structure the story shear value amplifies in terms of without Shear wall structure. Locating Shear wall at soft story only there is bit reduction in story shear & further shrinking in thickness the story shear stands almost same. In event that the Base Shear value remains unaffected by the incorporation of shear wall their placement & dimensional properties. In instances where story stiffness is addressed by incorporating shear walls solely at the soft story, the stiffness performance of the story is markedly enhanced. Furthermore, this configuration demonstrates a substantial improvement in story stiffness compared to structures lacking shear walls. Additionally, the story stiffness is influenced by reductions in the dimensional thickness of the shear walls.

A. Scope of Future Works

Different shapes of Shear wall with variation of shear wall thickness & mainly considering soft story location as prime concern instead extend throughout the building height.

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