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Performance-Based Seismic Design of RC Frames Using ETABS

Krishna Teja Uppu[1], U.Srinivasarao[2]
[1]PG Scholar, Department of Civil Engineering, Chalapathi Institute of Technology(Autonomous), Abburi Raghavaiah Nagar, CITY College Rd, Mothadaka, Andhra Pradesh, India-522016.
[2]Assistant Professor, Department of Civil Engineering, Chalapathi Institute of Technology(Autonomous), Abburi Raghavaiah Nagar, CITY College Rd, Mothadaka, Andhra Pradesh, India-522016.

Abstract- — In present day multi-tale structures in urban India, floating columns are a ordinary architectural function. Such functionalities need to not be universally used in systems constructed in seismically lively regions. This remark underscores the importance of figuring out the floating column in structural evaluation. We provide an change method for mitigating the unpredictable behaviour of floating columns. Achieving equilibrium between the principle and superior floors's stiffness is critical to this method. The hazards associated with inadequately constructed edifices and the destruction because of earthquakes are stark realities in several regions worldwide. Floating columns are a exclusive characteristic in numerous present day multi-story structures in India's predominant towns. The floating column exemplifies a vertical element supported by means of a beam at its base. To mitigate the risky inertia forces produced at various floor levels of a large shape, the burden transfer mechanism ought to be directed from the pinnacle to the lowest. Any departure or divergence from this channel will result in poor overall performance. Floating columns need to no longer be used within the design of systems located in seismically active areas. The donation research take a look at the unfavorable outcomes of the building's floating columns. This studies used body fashions to study the effect of unstable excitation on several structural traits in multi-story strengthened concrete systems, inclusive of herbal frequency, base shear, and horizontal displacement. The constructions are in comparison with and with out floating columns.The modern-day observe used ETABS 2018 for seismic evaluation and the layout of floating multi-tale buildings. This examination covers both inner and outside floating. To take a look at the effects on story go with the flow, shear pressure, bending moment, and structural torsion, we compared G+10 models with and with out floating columns.

Keywords: floating columns, Earthquakes, story drift, Shear force, Bending moment, Building torsion.

I. INTRODUCTION

Open floor thoughts have gained reputation in multi-story homes at some stage in India's major areas. The number one incentive for its adoption is the supply of area for first-ground parking or reception lobbies. During an earthquake, a shape's overall seismic base shear is reduced in relation to its natural length, while the allocation of seismic forces along the pinnacle is ascertained by way of stiffness and mass.

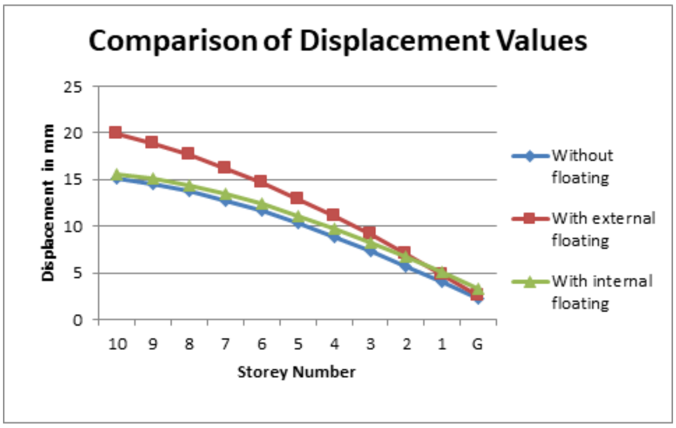
The geometry, length, and customary shape of a structure, together with the manner wherein seismic forces are transmitted to the floor, considerably affect the structure's seismic overall performance. The most efficient transmission of forces from various levels to the ground occurs alongside the load switch route; subsequently, any interruption or alteration on this path diminishes the structure's overall performance at some point of earthquakes. Seismic pressures on the discontinuity stage can also experience surprising increases in homes with vertical setbacks, mainly in structures with broader testimony than others, or in inns. In the context of constructions, the configuration with the least columns or walls, or an surprisingly high range of testimonies, is the most liable to damage or fall apart. Numerous structures in Gujarat with an open ground parking configuration sustained both complete or massive harm all through the 2001 Bhuj earthquake. Buildings show off load transmission discontinuities when columns fail to reach the foundation completely and rather suspend or rest on beams at an intermediate stage.

II. RESULTS AND ANALYSIS

Response Spectrum in X direction (RSX)
Displacement

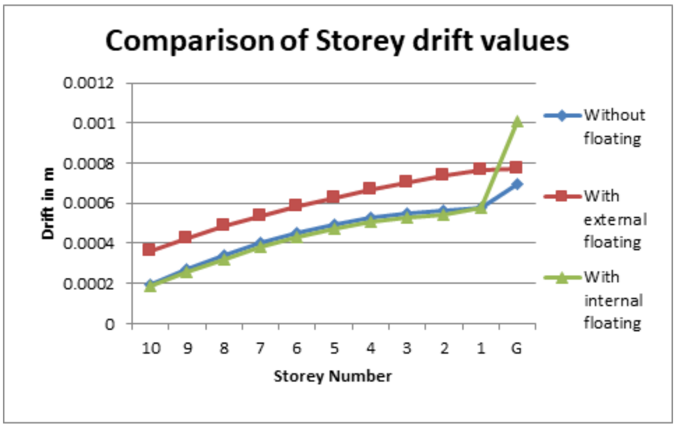
Storey Number	Without floating	With external floating	With internal floating
10	15.053	19.904	15.614
9	14.495	18.825	15.084

8	13.739	17.589	14.366
7	12.778	16.186	13.455
6	11.632	14.627	12.367
5	10.319	12.92	11.118
4	8.868	11.076	9.734
3	7.309	9.105	8.242
2	5.674	7.016	6.67
1	3.994	4.819	5.044
G	2.297	2.583	3.336



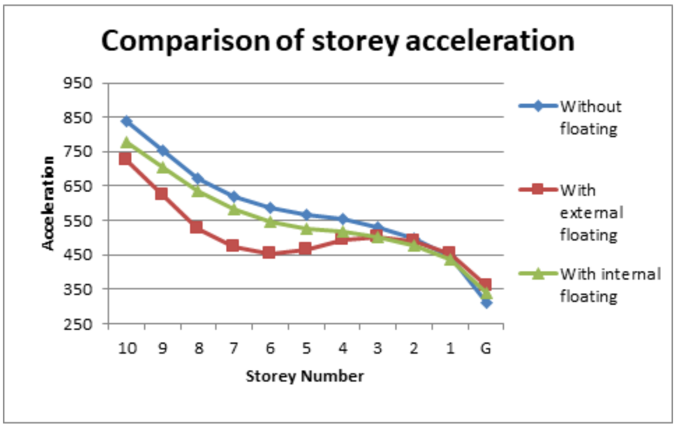
Storey drift

Storey Number	Without floating	With external floating	With internal floating
10	0.000195	0.000365	0.000185
9	0.000269	0.000425	0.000255
8	0.000339	0.000484	0.000322
7	0.000401	0.000537	0.000382
6	0.000454	0.000586	0.000434
5	0.000497	0.000628	0.000475
4	0.000529	0.000667	0.000507
3	0.000551	0.000703	0.00053
2	0.000562	0.000738	0.000546
1	0.000577	0.000764	0.000577
G	0.000696	0.000775	0.001011



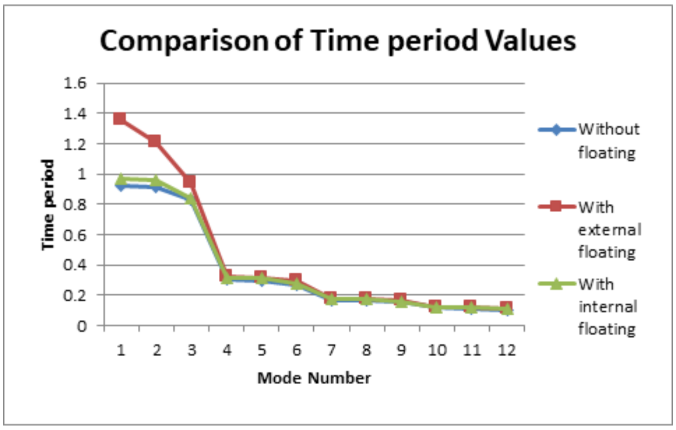
Storey acceleration

Storey Number	Without floating	With external floating	With internal floating
10	839.69	723.82	776.82
9	752.95	622.07	706.07
8	671.83	526.6	633.73
7	620.73	472.85	581.77
6	585.26	454.52	546.57
5	565.28	466.24	526.47
4	555.04	492.26	517.22
3	531.71	500.94	502.12
2	498.84	488.65	477.81
1	444.27	452.15	436.37
G	310.49	360.17	337.55



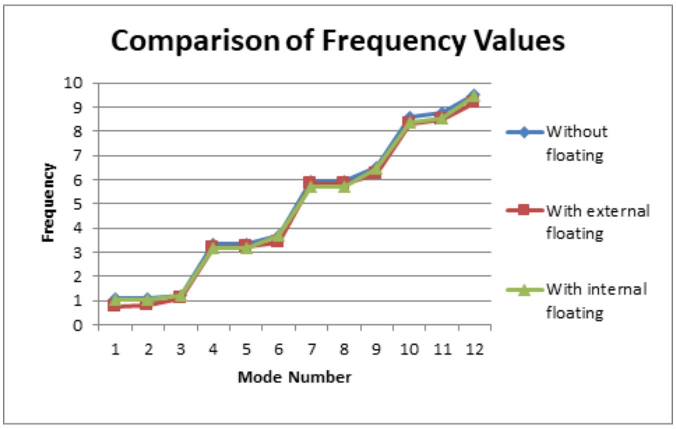
Time period

Mode number	Without floating	With external floating	With internal floating
1	0.924	1.36	0.973
2	0.909	1.204	0.962
3	0.827	0.94	0.84
4	0.3	0.318	0.316
5	0.298	0.312	0.315
6	0.27	0.292	0.273
7	0.169	0.172	0.175
8	0.168	0.171	0.174
9	0.154	0.161	0.155
10	0.116	0.12	0.119
11	0.114	0.118	0.117
12	0.105	0.109	0.106



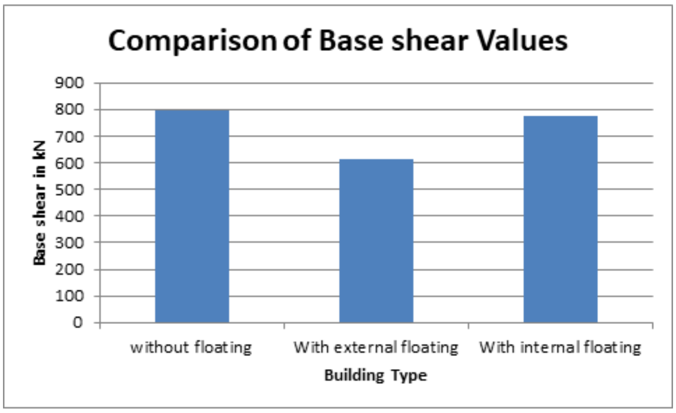
Frequency

Mode number	Without floating	With external floating	With internal floating
1	1.082	0.735	1.027
2	1.1	0.83	1.04
3	1.209	1.064	1.19
4	3.335	3.142	3.16
5	3.361	3.201	3.177
6	3.71	3.425	3.663
7	5.925	5.822	5.702
8	5.962	5.835	5.736
9	6.487	6.204	6.433
10	8.617	8.318	8.382
11	8.746	8.47	8.512
12	9.517	9.194	9.465



Base shear

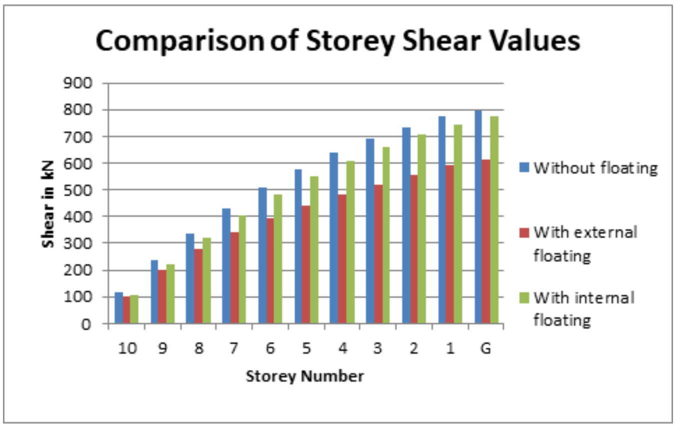
S. No	without floating	With external floating	With internal floating
1	797.4088	613.8465	774.6452



Storey shear

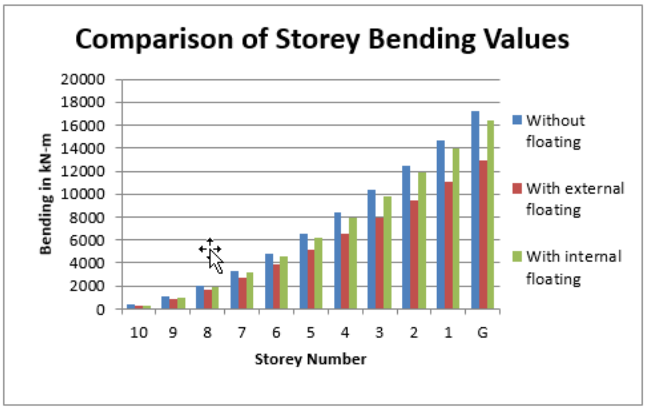
Storey Number	Without floating	With external floating	With internal floating

10	114.8814	99.0235	106.2839
9	235.3456	198.4807	219.4786
8	338.8822	278.5892	318.4139
7	427.9579	342.2331	404.2443
6	509.2566	396.4165	482.8441
5	577.1148	440.2984	548.7125
4	637.1778	480.5058	607.2937
3	690.2557	519.4546	659.7195
2	735.8313	556.7671	706.0159
1	772.6754	590.2492	745.3798
G	797.4088	613.8465	774.6452



Storey bending

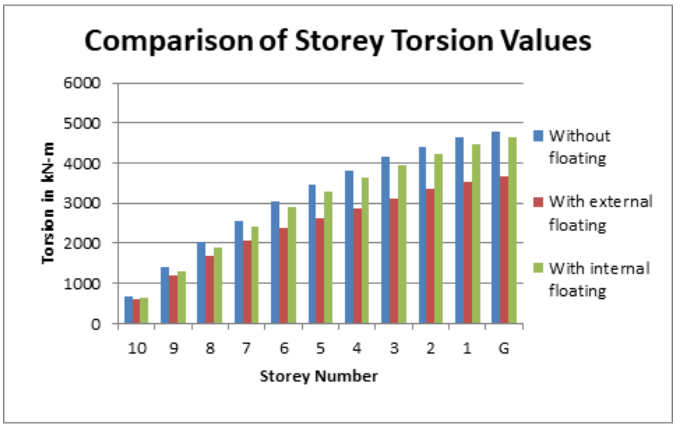
Storey Number	Without floating	With external floating	With internal floating
10	344.6441	297.0705	318.8518
9	1049.8202	891.7552	976.7125
8	2061.415	1722.8144	1928.523
7	3331.1551	2735.2801	3131.211
6	4830.8271	3893.4478	4558.532
5	6519.2747	5162.2762	6170.5528
4	8370.3503	6524.0661	7942.3269
3	10362.3737	7971.2988	9853.6898
2	12475.079	9501.1855	11887.027
1	14687.1398	11109.7129	14024.9003
G	17203.4212	12954.4874	16469.5748



Storey torsion

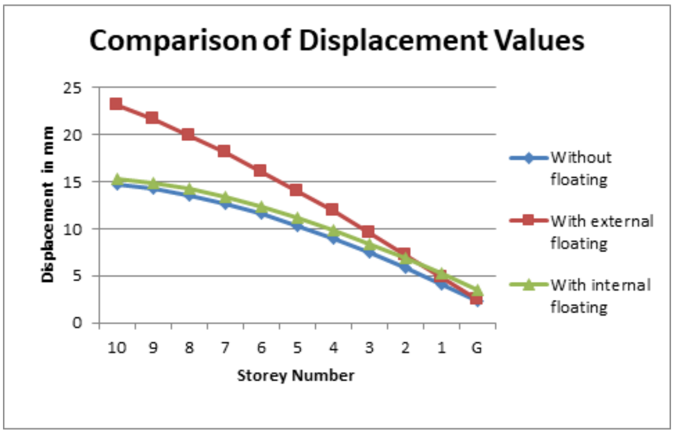
Storey Number	Without floating	With external floating	With internal floating
10	689.2882	594.1413	637.7037
9	1412.0737	1190.884	1316.8714
8	2033.2929	1671.5357	1910.483
7	2567.7474	2053.3983	2425.4656
6	3055.5396	2378.4992	2897.0648
5	3462.6885	2641.7904	3292.2747

4	3823.0669	2883.035	3643.7623
3	4141.5342	3116.7278	3958.3167
2	4414.988	3340.6025	4236.0954
1	4636.0525	3541.4957	4472.2789
G	4784.453	3683.0791	4647.8714



Response Spectrum in X direction (RSY)
Displacement

Storey Number	Without floating	With external floating	With internal floating
10	14.663	23.122	15.269
9	14.195	21.563	14.825
8	13.519	19.868	14.186
7	12.633	18.032	13.351
6	11.559	16.072	12.336
5	10.311	13.999	11.156
4	8.918	11.829	9.835
3	7.404	9.571	8.395
2	5.791	7.236	6.856
1	4.102	4.834	5.235
G	2.356	2.432	3.446



Storey drift

Storey Number	Without floating	With external floating	With internal floating
10	0.000164	0.000524	0.000156
9	0.000241	0.000576	0.000227
8	0.000314	0.000627	0.000296
7	0.000377	0.000671	0.000357
6	0.000432	0.000709	0.00041
5	0.000477	0.000739	0.000454
4	0.000514	0.000765	0.00049
3	0.000543	0.000788	0.000519
2	0.000565	0.000808	0.000546
1	0.000593	0.000822	0.000598
G	0.000714	0.000732	0.001053

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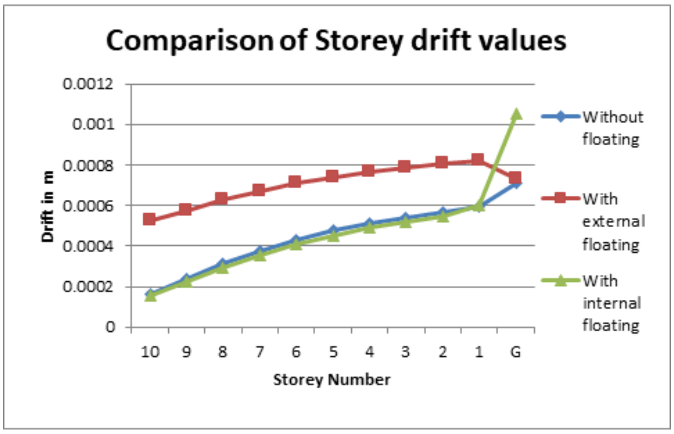

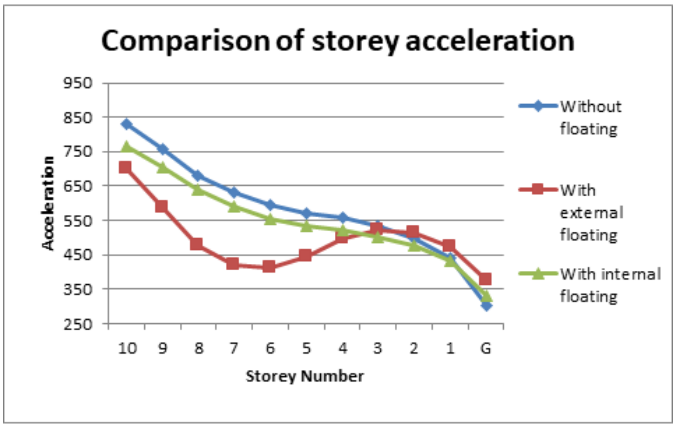

Storey acceleration

Storey Number	Without floating	With external floating	With internal floating
10	832.61	700.59	767.2
9	756.44	587.07	706.21
8	681.65	478.98	640.49
7	632.05	420.3	590.93
6	594.77	411.84	554.8
5	571.8	446.65	532.02
4	558.74	496.24	519.83
3	532.65	520.12	502.14
2	497.57	513.97	475.79
1	440.76	474.76	432.82
G	303.72	377	332.65

Time period

Mode number	Without floating	With external floating	With internal floating
1	0.924	1.36	0.973
2	0.909	1.204	0.962
3	0.827	0.94	0.84
4	0.3	0.318	0.316
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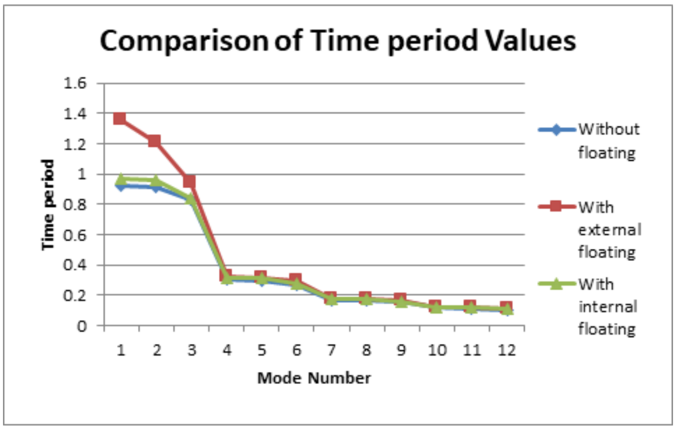

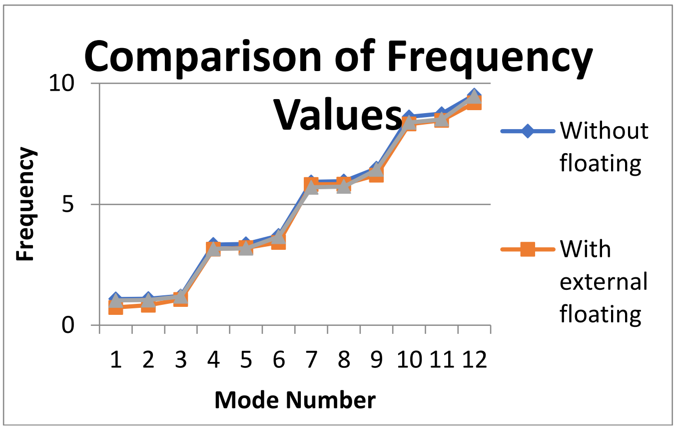

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Base shear

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Storey shear

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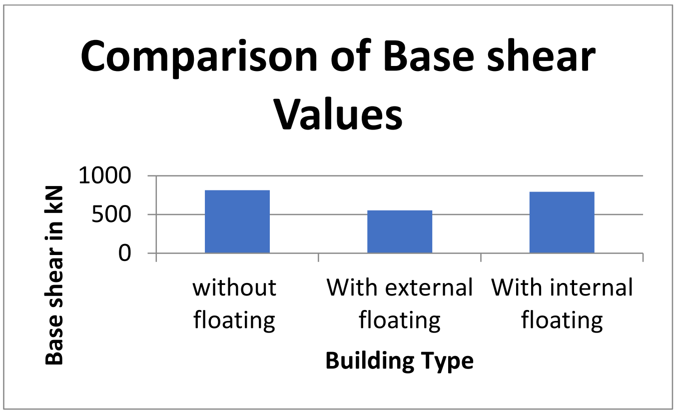
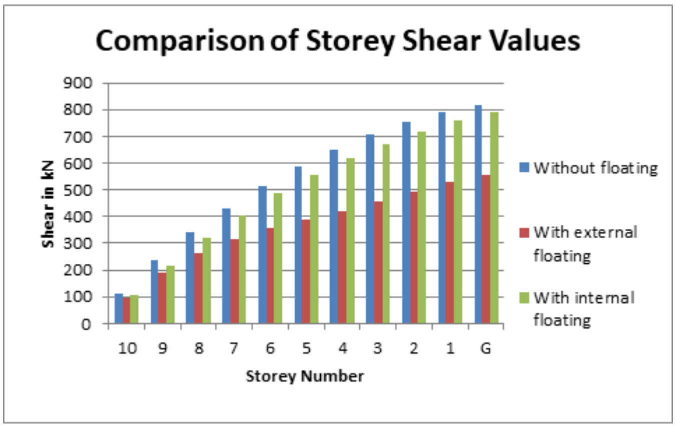


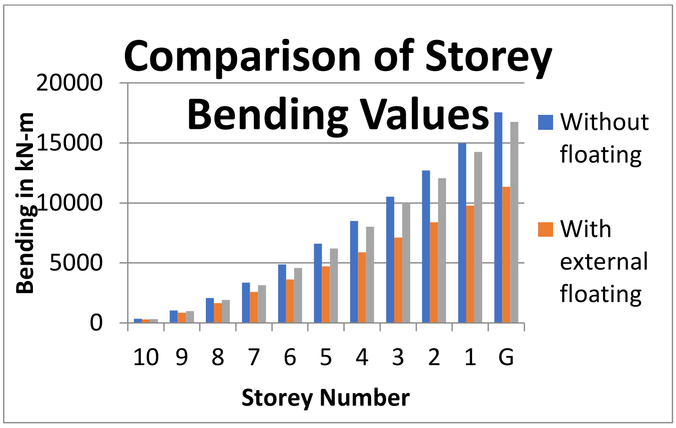


Storey bending

Storey Number	Without floating	With external floating	With internal floating
10	113.9011	95.8326	104.9612
9	235.0043	189.6606	218.2437
8	340.487	261.8514	318.5788
7	432.2458	315.3432	406.656
6	516.6129	357.4141	488.0334
5	587.2857	390.1066	556.597
4	649.8576	421.7024	617.6904
3	705.0059	456.0988	672.2926
2	752.1185	492.8199	720.3361
1	789.867	528.3954	760.9506
G	814.7824	554.8979	790.7277

Storey torsion

Storey Number	Without floating	With external floating	With internal floating
10	341.7033	287.4977	314.8835
9	1045.9341	855.7534	969.1074
8	2062.7103	1636.6226	1921.7388
7	3346.3092	2567.9497	3132.5641
6	4870.1745	3606.443	4577.4115
5	6592.5684	4716.5933	6216.3352
4	8486.5376	5883.5899	8024.0607
3	10529.034	7108.3876	9979.467
2	12697.9748	8400.4147	12063.5029
1	14969.7716	9768.5104	14256.8771
G	17552.5057	11358.3653	16764.7691



III. CONCLUSIONS

The following findings were drawn from the aforementioned research:

- Another name for a vertical feature that, either to site conditions or architectural design, rests on a horizontal beam at its lowest point is a floating column. Beams then distribute the weight to columns below them.
- Compared to other models, such as internal floating and regular structures, the displacement values for external floating column sections are larger and decrease from the top to the lowest level.
- As you go down the building's stories, you'll see that the storey drift values go larger for the exterior floating column sections compared to the other types, such as the normal and internal floating ones.
- By offering floating on the bottom level, the acceleration of the story is increased.
- Compared to normal columns and internal floating, the intensity of base shear values is lower for external floating column construction.
- Floating allows building structures to have lower shear, bending, and torsion values.
- From node 1 to node 12, the values of the time period are dropping, while the values of the frequency are rising.

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