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Effect of Seismic Load on Column Forces in RC Structures by Response Spectrum Analysis

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Abstract- In the present research work 30 story building with different type of RC Shear wall at the center in concrete frame structure with fixed support conditions under different type of soil for high seismic zone are analyzed.

This paper aims to study the effect of seismic load on column forces in different type of RC shear walls in concrete frame structures under different type of soil condition and different load combination. Estimation of column forces such as; column axial force, column moment, column shear force, column torsion, time period and frequency and modal load participation ratios is carried out. In dynamic analysis; Response Spectrum method is used. It was found that the axial force and moment in the column increases when the type of soil changes from hard to medium and medium to soft. Since the column moment increase as the soil type changes, soil structure interaction must be suitably considered while designing frames for seismic force.

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Keywords: seismic load, linear dynamics analysis, column forces, high seismic zone.

I. Introduction

a) Structural Systems

In the earliest structures at the beginning of the 20th century, structural members were assumed to carry primarily the gravity loads. Today, however, by the advances in structural design/systems and high-strength materials, building height is increased, which necessitates taking into consideration mainly the lateral loads such as wind and earthquake. Understandably, especially for the tall buildings, as the slenderness, and so the flexibility increases, buildings suffer from the lateral loads resulting from wind and earthquake more and more. As a general rule, when other things being equal, the taller the building, the more necessary it is to identify the proper structural system for resisting the lateral loads. Currently, there are many structural systems that can be used for the lateral resistance of tall buildings[2,3].

Structural systems of tall buildings can be divided into two broad categories: interior structures and exterior structures.

This classification is based on the distribution of the components of the primary lateral load-resisting system over the building.

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b) Shear Wall Structure

Shear Wall–Frame Systems (Dual Systems), The system consists of reinforced concrete frames interacting with reinforced concrete shear walls are adequate for resisting both the vertical and the horizontal loads acting on them.

c) Necessity of Shear Walls

Shear wall system has two distinct advantages over a frame system.

- It provides adequate strength to resist large lateral loads with-out excessive additional cost.
- It provides adequate stiffness to resist lateral displacements to permissible limits, thus reducing risk of non-structural damage.

d) Seismic Load

The seismic weight of building is the sum of seismic weight of all the floors [8]. The seismic weight of each floor is its full dead load plus appropriate amount of imposed load, the latter being that part of the imposed loads that may reasonably be expected to be attached to the structure at the time of earthquake shaking. Earthquake forces experienced by a building result from ground motions (accelerations) which are also fluctuating or dynamic in nature, in fact they reverse direction somewhat chaotically[2,3]. In theory and practice, the lateral force that a building experiences from an earthquake increases in direct proportion with the acceleration of ground motion at the building site and the mass of the building. As the ground accelerates back and forth during an earthquake it imparts back-and-forth (cyclic) forces to a building through its foundation which is forced to move with the ground [1].

e) Geo-Technical Consideration

The seismic motion that reaches a structure on the surface of the earth is influenced by local soil conditions. The subsurface soil layers underlying the building foundation may amplify the response of the building to earthquake motions originating in the bedrock.

Bearing Capacity of Foundation Soil

Three soil types are considered here:

I. Hard - Those soils, which have an allowable bearing capacity of more than 10t/m2.
II. Medium - Those soils, which have an allowable bearing capacity less than or equal to 10t/m2.

III. Soft - Those soils, which are liable to large differential settlement or liquefaction during an earthquake.

The allowable bearing pressure shall be determined in accordance with IS: 1888-1982 load test (Revision 1992).

II. Methodology

a) To understand and evaluation building structures and aims to the effect of Seismic load on column Forces in Different Type of RC Shear Walls in Concrete Frame Structures under Different Type of Soil Condition with seismic loading.
b) Modeling a G+29 story high building for five different cases [9-11].
c) Analyzing the building dynamic analysis using linear, i.e. Response Spectrum Analysis [1-3].
d) Analyzing the results and arriving at conclusions.

a) Dynamic Analysis

Dynamic analysis may be executed to get the design seismic force, and its spread in different levels through the height of the building, and also various lateral load resisting element[1-2-3,8].

b) Response Spectrum Method

This method is executed to design spectrum, where as it is specified with a code for specific- site design can be used for a project site for the purposes of dynamic of steel and reinforce concrete buildings, the values of damping for building may be taken as 2 and 5 percent of the critical, respectively. response spectrum method is typically implemented in linear elastic procedures and also very much easier to use. This also called as or mode superposition method or model method, It also made on the idea of the superposition of responses given by the building through various modes of vibrations, each vibration modes is recorded as with its own particular deformed shape, with its own modal damping and its own frequency [7,8].

III. Modeling of Building

a) Details of the Building

A symmetrical building[15] of plan 38.5m X 35.5m located with location in high Seismic zone considered. Four bays of length 7.5m & one bays of length 8.5m along X - direction and four bays of length 7.5m & one bays of length 5.5m along Y - direction are provided. Shear is provided the center inner core of model building.

Struct I: G+29 story'stall building with Plus shape RC shear wall at the center of structure.
Struct II: G+29 story'stall building with Box shape RC shear wall at the center of structure.
Struct III: G+29 story'stall building with C- shape RC shear wall at the center of structure.
Struct IV: G+29 story'stall building with E- shape RC shear wall at the center of structure.
Struct V: G+29 story'stall building with I- shape RC shear wall at the center of structure.

b) Load Combinations

As per IS 1893 (Part 1): 2002 Clause no. 6.3.1.2, the following load cases have to be considered for analysis:

"1.2 (DL + IL ± EL)"

"1.5 (DL ± EL)"

"EQXP&EQYP"

Earthquake load must be considered for +X, -X, +Y and –Y Directions [5-7].

c) The Building Details

Type of frame: Special RC moment resisting frame fixed at the base, Number of storeys: G+29, Floor height: 3.5 m, Depth of Slab: 225 mm, Size of beam: (300 × 600) mm, Size of column (exterior): (1250×1250) mm up to story five, Size of column (exterior): (900×900) mm Above story five, Size of column (interior): (1250×1250) mm up to story ten, Size of column (interior): (900×900) mm Above story ten, Live load on floor: 4 KN/m2, Floor finish: 2.5 KN/m2, Wall load: 25 KN/m, Grade of Concrete: M 50 concrete, Grade of Steel: Fe 500, Thickness of shear wall: 450 mm, Seismic zone: V, Important Factor: 1.5, Density of concrete: 25 KN/m3, Type of soil: Type I=Soft Soil, Type II=Medium Soil, Type III= Hard Soil, Response spectra: As per IS 1893(Part-1):2002, Damping of structure: 5 percent & All the analyses has been carried out as per the Indian Standard code books [4-8].

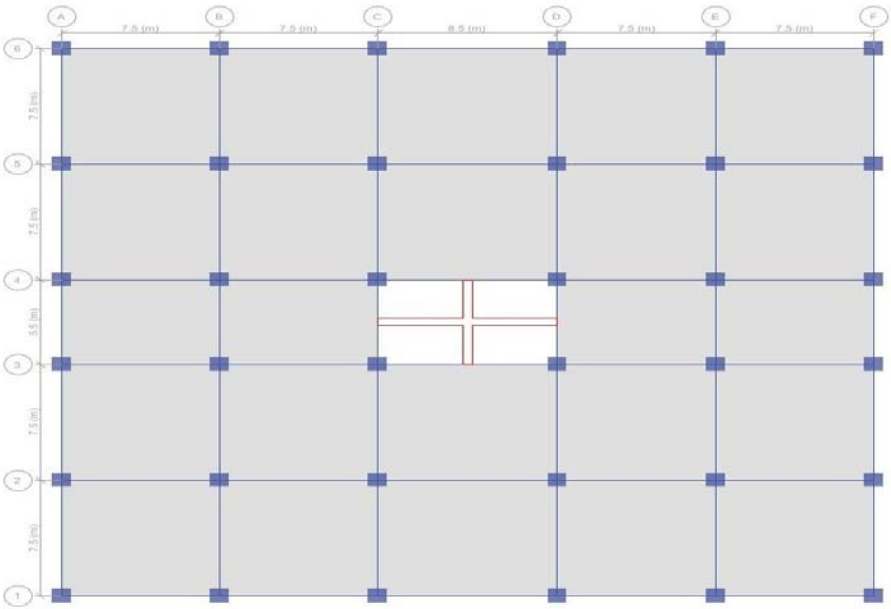


Figure 1: Plan of the Structure I

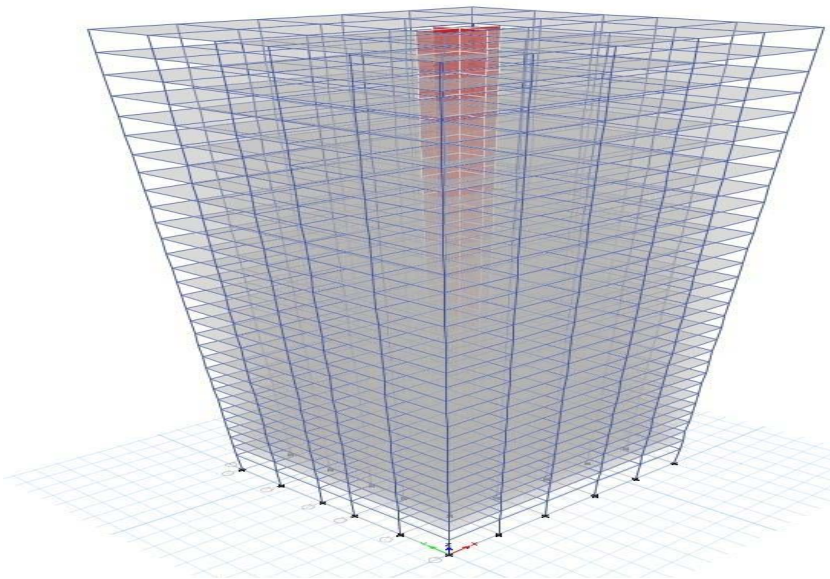


Figure 2: 3D view showing shear wall location for Structure I

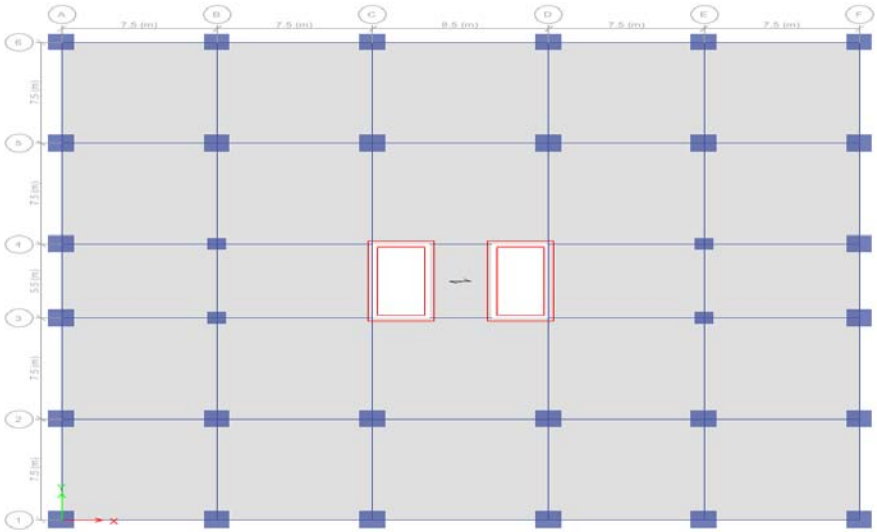


Figure 3: Plan of the Structure II

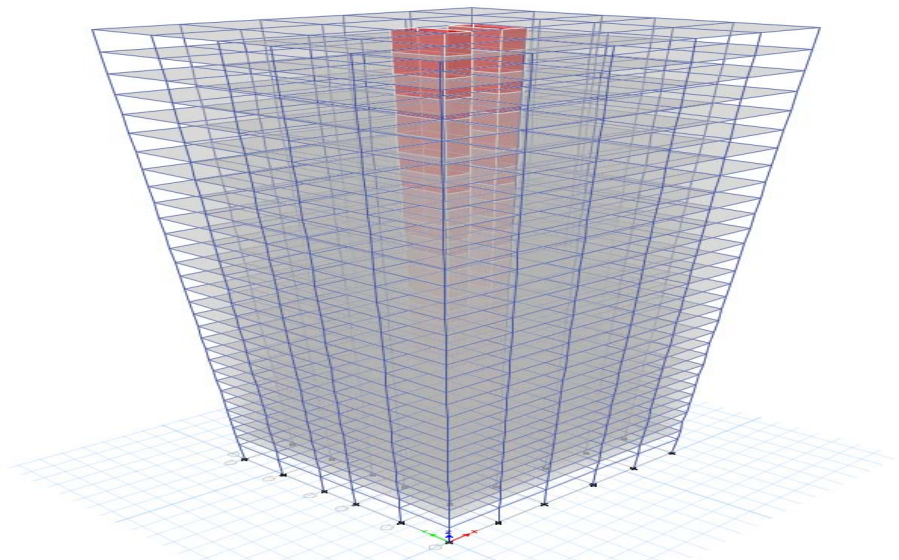


Figure 4: 3D view showing shear wall location for Structure II

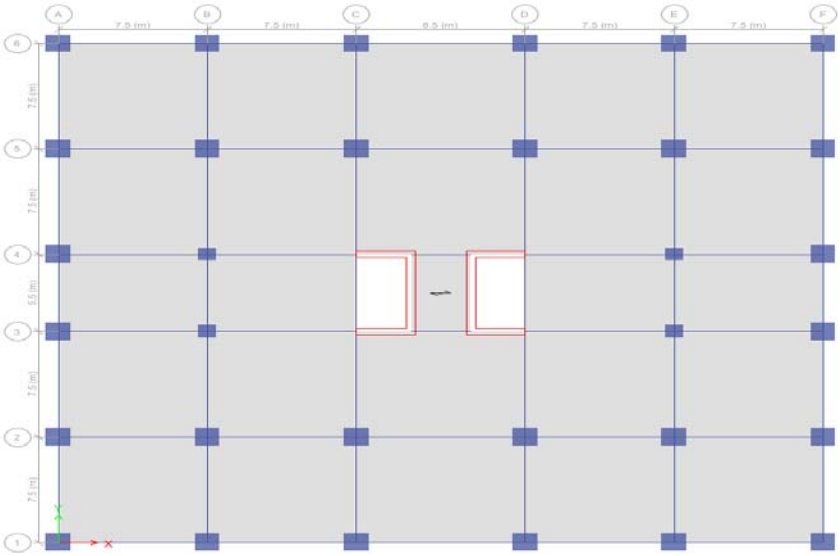


Figure 5: Plan of the Structure III

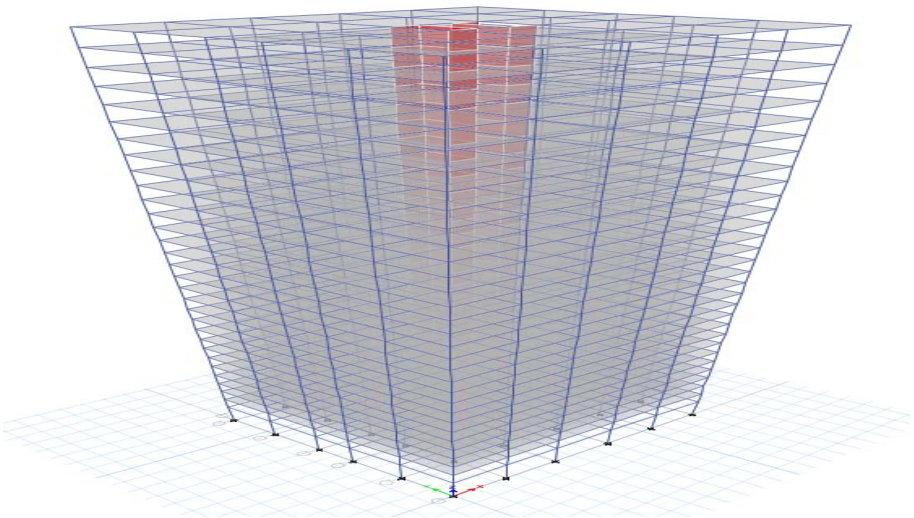


Figure 6: 3D view showing shear wall location for Structure III

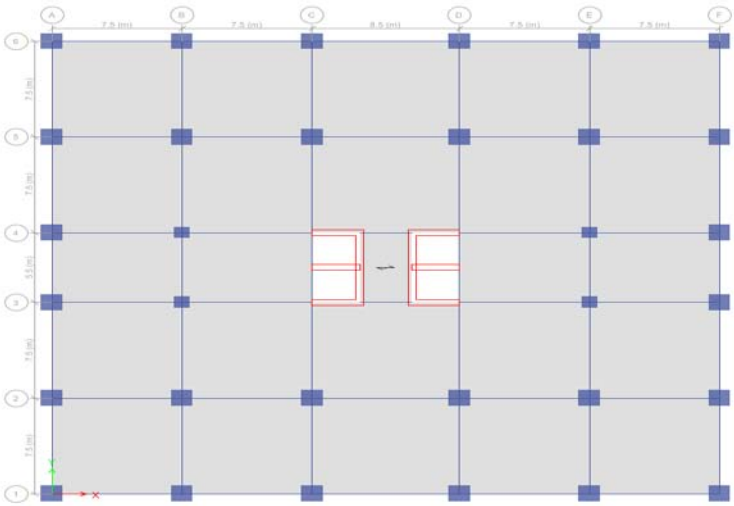


Figure 7: Plan of the Structure IV

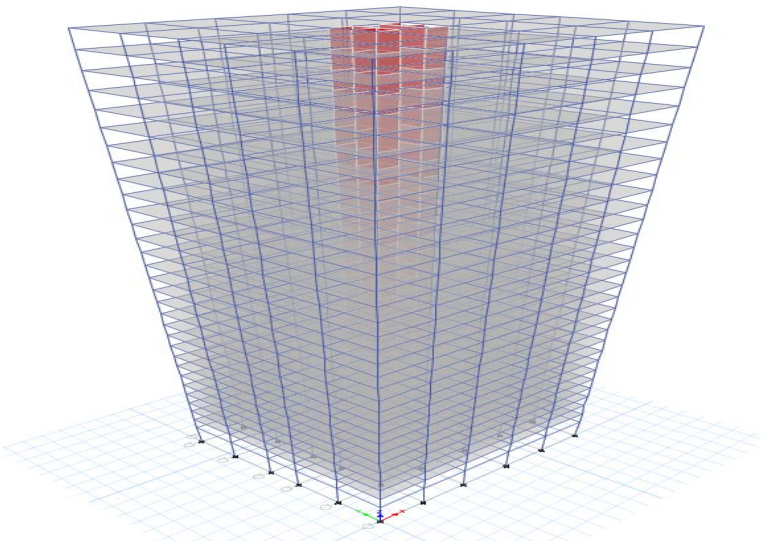


Figure 8: 3D view showing shear wall location for Structure IV

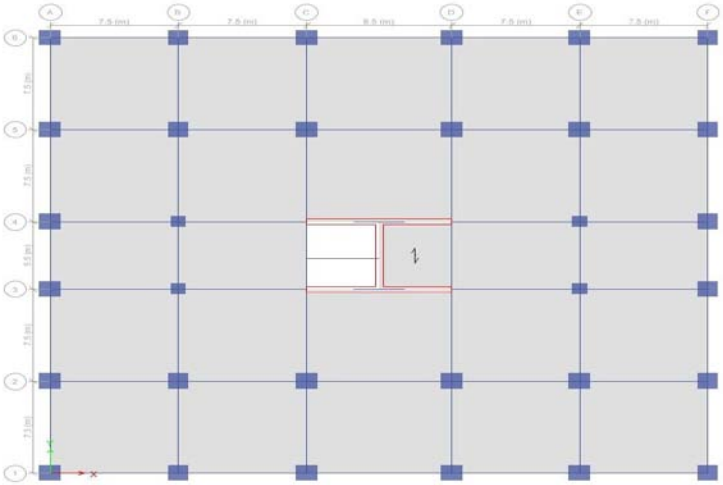


Figure 9: Plan of the Structure V

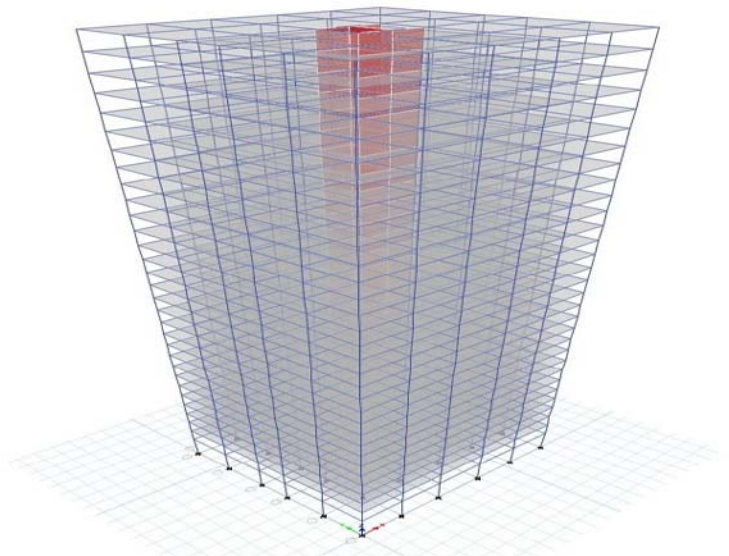


Figure 10: 3D view showing shear wall location for Structure V

IV. Results and Discussions

Parametric results in column forces such as column axial force, column moment, column shear force & column torsion with different load combination/load Cases such as 1.2 (DL+LL+EQXP), 1.2 (DL+LL+EQYP), 1.5 (DL+EQXP), 1.5 (DL+EQYP), EQXP & EQYP in different type of soil conditions (soft, medium and hard) were considered, in this regard we compared all column forces in different type of soil condition of structures II, III, IV, V with structure I (plus shape shear wall), also compared forces in hard and medium soils with soft soil for all five structures.

Table 1: Column Axial Force, P for structures with the load combination 1.2 (DL+LL+EQXP) & 1.2 (DL+LL+EQYP), All value in "kN"

Column Axial Force, P in Soft Soil					Struct I	Struct II	Struct III	Struct IV	Struct V
Story	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"P"	"P"	"P"	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0	-24171.0618	-24285.0493	-24629.8602	-24381.5444	-24398.1773
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-24103.093	-24217.0806	-24561.8915	-24313.5757	-24330.2086
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-24035.1243	-24149.1118	-24493.9227	-24245.6069	-24262.2398
1ST	C34	67	1.2(DL+LL+EQYP)	0	-23630.6382	-23276.1711	-23447.6424	-23345.1752	-23441.1649
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	-23562.6694	-23208.2023	-23379.6736	-23277.2065	-23373.1961
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	-23494.7007	-23140.2336	-23311.7049	-23209.2377	-23305.2274
Column Axial Force, P in Medium Soil									
1ST	C34	67	1.2(DL+LL+EQXP)	0	-24937.4993	-25121.0698	-25571.6279	-25446.3503	-25240.6514
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-24869.5305	-25053.1011	-25503.6591	-25378.3816	-25172.6826
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-24801.5618	-24985.1323	-25435.6904	-25310.4128	-25104.7139
1ST	C34	67	1.2(DL+LL+EQYP)	0	-24202.5232	-23748.9954	-23963.8116	-23949.6572	-23939.1144
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	-24134.5545	-23681.0267	-23895.8428	-23881.6884	-23871.1456
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	-24066.5857	-23613.0579	-23827.8741	-23813.7197	-23803.1769
Column Axial Force, P in Hard Soil									
1ST	C34	67	1.2(DL+LL+EQXP)	0	-25597.4871	-25840.9764	-26382.5944	-26235.5482	-25966.1151
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-25529.5184	-25773.0076	-26314.6257	-26167.5794	-25898.1464
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-25461.5496	-25705.0389	-26246.6569	-26099.6107	-25830.1776
1ST	C34	67	1.2(DL+LL+EQYP)	0	-24694.9798	-24156.1497	-24408.2906	-24397.697	-24367.9043
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	-24627.011	-24088.181	-24340.3219	-24329.7283	-24299.9355
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	-24559.0423	-24020.2122	-24272.3531	-24261.7595	-24231.9668

Table 2: Column Moment, M for structures with the load combination 1.2 (DL+LL+EQXP) &1.2 (DL+LL+EQYP), All value in "kN-m"

Column Moment, M in Soft Soil					Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
Story	Column	Unique Name	Load Case/Combo	Station m	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"
1ST	C34	67	1.2(DL+LL+EQXP)	0	-244.0118	979.4715	-171.6774	1061.1112	-251.8641	1421.2435	-239.9922	1271.7973	-249.7758	971.7283
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-146.2684	805.6993	-84.4168	912.7196	-151.3927	1219.8181	-142.186	1095.4925	-150.8748	826.9906
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-48.5251	631.9271	2.8438	764.328	-50.9213	1018.3927	-44.3799	919.1878	-51.9738	682.2529
1ST	C34	67	1.2(DL+LL+EQYP)	0	1727.5733	-24.7075	1026.407	-134.6353	1218.6199	-173.1854	1153.6344	-157.4043	1174.9664	-74.8523
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	1393.6416	-70.5194	893.9723	-94.628	1027.4053	-112.2758	974.8851	-107.0072	954.7475	-81.4083
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	1059.71	-116.3313	761.5375	-54.6207	836.1907	-51.3663	796.1358	-56.6101	734.5287	-87.9644
Column Moment, M in Medium Soil														
1ST	C34	67	1.2(DL+LL+EQXP)	0	-312.5242	1329.5266	-216.79	1461.8423	-325.8538	1958.0803	-325.927	1862.7469	-322.5699	1328.7543
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-197.6708	1112.7719	-115.9939	1264.1942	-207.082	1683.6228	-206.7527	1610.877	-205.9796	1142.9081
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-82.8175	896.0172	-15.1978	1066.5461	-88.3102	1409.1652	-87.5785	1359.0072	-89.3893	957.0619
1ST	C34	67	1.2(DL+LL+EQYP)	0	2368.8316	-36.1568	1412.6049	-164.3729	1674.0045	-210.3429	1686.2828	-200.7817	1615.0795	-94.5952
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	1896.6069	-78.8855	1214.6153	-105.7985	1396.0833	-128.025	1406.1652	-125.3418	1297.6668	-92.5144
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	1424.3822	-121.6142	1016.6256	-47.2242	1118.1621	-45.707	1126.0477	-49.9019	980.2541	-90.4336
Column Moment, M in Hard Soil														
1ST	C34	67	1.2(DL+LL+EQXP)	0	-371.5209	1630.9629	-255.6369	1806.9164	-389.5671	2420.3565	-389.6526	2300.9465	-385.2537	1636.1935
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-241.934	1377.1956	-143.1853	1566.8529	-255.0367	2083.0102	-254.632	1993.0377	-253.431	1414.9482
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-112.3471	1123.4282	-30.7336	1326.7894	-120.5062	1745.6638	-119.6113	1685.1289	-121.6082	1193.703
1ST	C34	67	1.2(DL+LL+EQYP)	0	2921.0262	-46.0159	1745.1642	-189.9802	2066.1412	-242.3397	2081.2226	-232.9453	1994.0659	-111.5961
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	2329.7158	-86.0897	1490.7245	-115.4176	1713.556	-141.5867	1725.9364	-138.9369	1592.9584	-102.078
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	1738.4055	-126.1634	1236.2848	-40.855	1360.9708	-40.8338	1370.6502	-44.9285	1191.851	-92.5599

Table 3: Column Shear, V for structures with the load combination 1.2 (DL+LL+EQXP) & 1.2 (DL+LL+EQYP), All value in "KN"

Column Shear, V in Soft Soil					Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
Story	Column	Unique Name	Load Case/Combo	Station m	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"
1ST	C34	67	1.2(DL+LL+EQXP)	0	119.8429	-67.4092	102.339	-60.1798	138.9141	-69.2906	121.5895	-67.4525	99.8191	-68.2076
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	119.8429	-67.4092	102.339	-60.1798	138.9141	-69.2906	121.5895	-67.4525	99.8191	-68.2076
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	119.8429	-67.4092	102.339	-60.1798	138.9141	-69.2906	121.5895	-67.4525	99.8191	-68.2076
1ST	C34	67	1.2(DL+LL+EQYP)	0	31.5944	230.2977	-27.5912	91.3343	-42.0066	131.8722	-34.7566	123.2754	4.5214	151.8751
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	31.5944	230.2977	-27.5912	91.3343	-42.0066	131.8722	-34.7566	123.2754	4.5214	151.8751
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	31.5944	230.2977	-27.5912	91.3343	-42.0066	131.8722	-34.7566	123.2754	4.5214	151.8751
Column Shear, V in Medium Soil														
1ST	C34	67	1.2(DL+LL+EQXP)	0	149.486	-79.2092	136.3091	-69.5145	189.2811	-81.9116	173.7034	-82.1892	128.1698	-80.4071
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	149.486	-79.2092	136.3091	-69.5145	189.2811	-81.9116	173.7034	-82.1892	128.1698	-80.4071
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	149.486	-79.2092	136.3091	-69.5145	189.2811	-81.9116	173.7034	-82.1892	128.1698	-80.4071
1ST	C34	67	1.2(DL+LL+EQYP)	0	29.4681	325.6722	-40.3961	136.5446	-56.771	191.6698	-52.0275	193.1845	-1.435	218.9053
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	29.4681	325.6722	-40.3961	136.5446	-56.771	191.6698	-52.0275	193.1845	-1.435	218.9053
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	29.4681	325.6722	-40.3961	136.5446	-56.771	191.6698	-52.0275	193.1845	-1.435	218.9053
Column Shear, V in Hard Soil														
1ST	C34	67	1.2(DL+LL+EQXP)	0	175.012	-89.3703	165.561	-77.5528	232.6527	-92.7796	212.3509	-93.1177	152.5829	-90.9122
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	175.012	-89.3703	165.561	-77.5528	232.6527	-92.7796	212.3509	-93.1177	152.5829	-90.9122
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	175.012	-89.3703	165.561	-77.5528	232.6527	-92.7796	212.3509	-93.1177	152.5829	-90.9122
1ST	C34	67	1.2(DL+LL+EQYP)	0	27.6371	407.8002	-51.4225	175.4757	-69.4848	243.1622	-64.8334	245.025	-6.5642	276.6258
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	27.6371	407.8002	-51.4225	175.4757	-69.4848	243.1622	-64.8334	245.025	-6.5642	276.6258
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	27.6371	407.8002	-51.4225	175.4757	-69.4848	243.1622	-64.8334	245.025	-6.5642	276.6258

Table 4: Column Torsion, T for structures with the load combination 1.2 (DL+LL+EQXP) & 1.2 (DL+LL+EQYP), All value in "kN-m"

Column Torsion, T in Soft Soil					Struct I	Struct II	Struct III	Struct IV	Struct V
Story	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"	"T"	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0	-41.6175	-29.3334	-44.901	-42.3525	-43.8436
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-41.6175	-29.3334	-44.901	-42.3525	-43.8436
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-41.6175	-29.3334	-44.901	-42.3525	-43.8436
1ST	C34	67	1.2(DL+LL+EQYP)	0	45.3145	31.9525	48.8724	46.1375	48.5638
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	45.3145	31.9525	48.8724	46.1375	48.5638
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	45.3145	31.9525	48.8724	46.1375	48.5638
Column Torsion, T in Medium Soil									
1ST	C34	67	1.2(DL+LL+EQXP)	0	-56.5981	-39.8539	-61.0208	-61.1008	-59.584
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-56.5981	-39.8539	-61.0208	-61.1008	-59.584
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-56.5981	-39.8539	-61.0208	-61.1008	-59.584
1ST	C34	67	1.2(DL+LL+EQYP)	0	61.6294	43.4949	66.5111	66.66	66.09
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	61.6294	43.4949	66.5111	66.66	66.09
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	61.6294	43.4949	66.5111	66.66	66.09
Column Torsion, T in Hard Soil									
1ST	C34	67	1.2(DL+LL+EQXP)	0	-69.4981	-48.9132	-74.9017	-75.004	-73.1383
1ST	C34	67	1.2(DL+LL+EQXP)	1.45	-69.4981	-48.9132	-74.9017	-75.004	-73.1383
1ST	C34	67	1.2(DL+LL+EQXP)	2.9	-69.4981	-48.9132	-74.9017	-75.004	-73.1383
1ST	C34	67	1.2(DL+LL+EQYP)	0	75.6784	53.4342	81.6999	81.8788	81.182
1ST	C34	67	1.2(DL+LL+EQYP)	1.45	75.6784	53.4342	81.6999	81.8788	81.182
1ST	C34	67	1.2(DL+LL+EQYP)	2.9	75.6784	53.4342	81.6999	81.8788	81.182

Table 5: Column Axial Force, P for structures with the load combination 1.5 (DL+EQXP) & 1.5 (DL+EQYP), All value in "kN"

Column Axial Force, Pin Soft Soil					Struct I	Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"P"	"P"	"P"	"P"	"P"
1ST	C34	67	1.5(DL+EQXP)	0	-25183.8699	-25355.396	-25767.3656	-25468.0736	-25450.8356
1ST	C34	67	1.5(DL+EQXP)	1.45	-25098.9089	-25270.435	-25682.4047	-25383.1127	-25365.8747
1ST	C34	67	1.5(DL+EQXP)	2.9	-25013.948	-25185.4741	-25597.4437	-25298.1518	-25280.9137
1ST	C34	67	1.5(DL+EQYP)	0	-24508.3404	-24094.2982	-24289.5933	-24172.6121	-24254.57
1ST	C34	67	1.5(DL+EQYP)	1.45	-24423.3794	-24009.3372	-24204.6324	-24087.6512	-24169.6091
1ST	C34	67	1.5(DL+EQYP)	2.9	-24338.4185	-23924.3763	-24119.6714	-24002.6903	-24084.6481
Column Axial Force, P in Medium Soil									
1ST	C34	67	1.5(DL+EQXP)	0	-26141.9168	-26400.4216	-26944.5752	-26799.081	-26503.9282
1ST	C34	67	1.5(DL+EQXP)	1.45	-26056.9558	-26315.4607	-26859.6142	-26714.1201	-26418.9672
1ST	C34	67	1.5(DL+EQXP)	2.9	-25971.9949	-26230.4998	-26774.6533	-26629.1591	-26334.0063
1ST	C34	67	1.5(DL+EQYP)	0	-25223.1967	-24685.3286	-24934.8048	-24928.2146	-24877.0069
1ST	C34	67	1.5(DL+EQYP)	1.45	-25138.2357	-24600.3677	-24849.8439	-24843.2537	-24792.046
1ST	C34	67	1.5(DL+EQYP)	2.9	-25053.2748	-24515.4068	-24764.8829	-24758.2927	-24707.0851
Column Axial Force, P in Hard Soil									
1ST	C34	67	1.5(DL+EQXP)	0	-26966.9016	-27300.3048	-27958.2834	-27785.5783	-27410.7578
1ST	C34	67	1.5(DL+EQXP)	1.45	-26881.9407	-27215.3439	-27873.3224	-27700.6174	-27325.7969
1ST	C34	67	1.5(DL+EQXP)	2.9	-26796.9797	-27130.383	-27788.3615	-27615.6564	-27240.836
1ST	C34	67	1.5(DL+EQYP)	0	-25838.7674	-25194.2715	-25490.4036	-25488.2644	-25412.9943
1ST	C34	67	1.5(DL+EQYP)	1.45	-25753.8064	-25109.3106	-25405.4426	-25403.3035	-25328.0334
1ST	C34	67	1.5(DL+EQYP)	2.9	-25668.8455	-25024.3496	-25320.4817	-25318.3425	-25243.0724

Table 6: Column Moment, M for structures with the load combination 1.5 (DL +EQXP) & 1.5 (DL+EQYP), All value in "kN-m"

Column Moment, M in Soft Soil					Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"
1ST	C34	67	1.5(DL+EQXP)	0	-300.9713	1225.747	-213.58	1343.434	-313.8242	1800.2079	-298.9771	1609.5397	-311.2144	1219.4677
1ST	C34	67	1.5(DL+EQXP)	1.45	-185.7663	1027.6976	-111.2483	1165.8496	-194.9693	1551.5389	-183.4603	1395.0708	-194.3203	1051.1982
1ST	C34	67	1.5(DL+EQXP)	2.9	-70.5614	829.6482	-8.9167	988.2653	-76.1145	1302.8699	-67.9436	1180.6019	-77.4263	882.9288
1ST	C34	67	1.5(DL+EQYP)	0	2163.5101	-29.4766	1284.0256	-151.2491	1524.2808	-192.8282	1443.0562	-176.9623	1469.7135	-88.758
1ST	C34	67	1.5(DL+EQYP)	1.45	1739.1213	-67.5757	1111.738	-93.3349	1278.5282	-113.5785	1212.8786	-108.0539	1187.7076	-84.3004
1ST	C34	67	1.5(DL+EQYP)	2.9	1314.7324	-105.6748	939.4504	-35.4206	1032.7756	-34.3288	982.7011	-39.1454	905.7018	-79.8429
Column Moment, M in Medium Soil														
1ST	C34	67	1.5(DL+EQXP)	0	-386.6118	1663.3159	-269.9707	1844.3479	-406.3113	2471.254	-406.3956	2348.2268	-402.207	1665.7503
1ST	C34	67	1.5(DL+EQXP)	1.45	-250.0193	1411.5384	-150.7197	1605.1929	-264.581	2131.2948	-264.1687	2039.3015	-263.2013	1446.0951
1ST	C34	67	1.5(DL+EQXP)	2.9	-113.4269	1159.7609	-31.4687	1366.0378	-122.8506	1791.3356	-121.9418	1730.3762	-124.1957	1226.44
1ST	C34	67	1.5(DL+EQYP)	0	2965.0829	-43.7883	1766.7729	-188.4211	2093.5115	-239.2751	2108.8666	-231.184	2019.8549	-113.4367
1ST	C34	67	1.5(DL+EQYP)	1.45	2367.8278	-78.0334	1512.5417	-107.2981	1739.3757	-133.2649	1751.9788	-130.972	1616.3567	-98.183
1ST	C34	67	1.5(DL+EQYP)	2.9	1770.5727	-112.2785	1258.3105	-26.175	1385.2398	-27.2547	1395.0909	-30.7601	1212.8586	-82.9294
Column Moment, M in Hard Soil														
1ST	C34	67	1.5(DL+EQXP)	0	-460.3577	2040.1114	-318.5293	2275.6905	-485.953	3049.0992	-486.0526	2895.9762	-480.5617	2050.0492
1ST	C34	67	1.5(DL+EQXP)	1.45	-305.3483	1742.068	-184.7089	1983.5162	-324.5243	2630.529	-324.0177	2517.0023	-322.5155	1786.1453
1ST	C34	67	1.5(DL+EQXP)	2.9	-150.3389	1444.0245	-50.8885	1691.342	-163.0956	2211.9588	-161.9828	2138.0283	-164.4693	1522.2413
1ST	C34	67	1.5(DL+EQYP)	0	3655.3261	-56.1122	2182.472	-220.4303	2583.6823	-279.2711	2602.5414	-271.3885	2493.5878	-134.6877
1ST	C34	67	1.5(DL+EQYP)	1.45	2909.214	-87.0386	1857.6783	-119.3219	2136.2165	-150.2171	2151.6928	-147.9659	1985.4712	-110.1375
1ST	C34	67	1.5(DL+EQYP)	2.9	2163.1019	-117.965	1532.8845	-18.2135	1688.7508	-21.1632	1700.8441	-24.5434	1477.3547	-85.5873

Table 7: Column Shear, V for structures with the load combination 1.5 (DL+EQXP) & 1.5 (DL+EQYP), All value in "kN"

Column Shear, V in Soft Soil					Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"
1ST	C34	67	1.5(DL+EQXP)	0	136.5858	-79.4517	122.472	-70.5736	171.4959	-81.9689	147.9096	-79.6667	116.0479	-80.6166
1ST	C34	67	1.5(DL+EQXP)	1.45	136.5858	-79.4517	122.472	-70.5736	171.4959	-81.9689	147.9096	-79.6667	116.0479	-80.6166
1ST	C34	67	1.5(DL+EQXP)	2.9	136.5858	-79.4517	122.472	-70.5736	171.4959	-81.9689	147.9096	-79.6667	116.0479	-80.6166
1ST	C34	67	1.5(DL+EQYP)	0	26.2752	292.6819	-39.9409	118.819	-54.6549	169.4846	-47.5231	158.7431	-3.0742	194.4868
1ST	C34	67	1.5(DL+EQYP)	1.45	26.2752	292.6819	-39.9409	118.819	-54.6549	169.4846	-47.5231	158.7431	-3.0742	194.4868
1ST	C34	67	1.5(DL+EQYP)	2.9	26.2752	292.6819	-39.9409	118.819	-54.6549	169.4846	-47.5231	158.7431	-3.0742	194.4868
Column Shear, V in Medium Soil														
1ST	C34	67	1.5(DL+EQXP)	0	173.6397	-94.2017	164.9345	-82.2421	234.4546	-97.7451	213.0519	-98.0875	151.4863	-95.866
1ST	C34	67	1.5(DL+EQXP)	1.45	173.6397	-94.2017	164.9345	-82.2421	234.4546	-97.7451	213.0519	-98.0875	151.4863	-95.866
1ST	C34	67	1.5(DL+EQXP)	2.9	173.6397	-94.2017	164.9345	-82.2421	234.4546	-97.7451	213.0519	-98.0875	151.4863	-95.866
1ST	C34	67	1.5(DL+EQYP)	0	23.6173	411.9001	-55.9469	175.3319	-73.1105	244.2316	-69.1117	246.1296	-10.5197	278.2746
1ST	C34	67	1.5(DL+EQYP)	1.45	23.6173	411.9001	-55.9469	175.3319	-73.1105	244.2316	-69.1117	246.1296	-10.5197	278.2746
1ST	C34	67	1.5(DL+EQYP)	2.9	23.6173	411.9001	-55.9469	175.3319	-73.1105	244.2316	-69.1117	246.1296	-10.5197	278.2746
Column Shear, V in Hard Soil														
1ST	C34	67	1.5(DL+EQXP)	0	205.5472	-106.9031	201.4995	-92.2899	288.6691	-111.3302	261.3613	-111.7482	182.0027	-108.9974
1ST	C34	67	1.5(DL+EQXP)	1.45	205.5472	-106.9031	201.4995	-92.2899	288.6691	-111.3302	261.3613	-111.7482	182.0027	-108.9974
1ST	C34	67	1.5(DL+EQXP)	2.9	205.5472	-106.9031	201.4995	-92.2899	288.6691	-111.3302	261.3613	-111.7482	182.0027	-108.9974
1ST	C34	67	1.5(DL+EQYP)	0	21.3285	514.5601	-69.7299	223.9957	-89.0027	308.5971	-85.119	310.9301	-16.9312	350.4252
1ST	C34	67	1.5(DL+EQYP)	1.45	21.3285	514.5601	-69.7299	223.9957	-89.0027	308.5971	-85.119	310.9301	-16.9312	350.4252
1ST	C34	67	1.5(DL+EQYP)	2.9	21.3285	514.5601	-69.7299	223.9957	-89.0027	308.5971	-85.119	310.9301	-16.9312	350.4252

Table 8: Column Torsion, T for structures with the load combination 1.5 (DL+EQXP) & 1.5 (DL+EQYP), All value in "kN-m"

Column Torsion, T in Soft Soil					Struct I	Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"	"T"	"T"	"T"
1ST	C34	67	1.5(DL+EQXP)	0	-52.0172	-36.6355	-56.0881	-52.909	-54.7871
1ST	C34	67	1.5(DL+EQXP)	1.45	-52.0172	-36.6355	-56.0881	-52.909	-54.7871
1ST	C34	67	1.5(DL+EQXP)	2.9	-52.0172	-36.6355	-56.0881	-52.909	-54.7871
1ST	C34	67	1.5(DL+EQYP)	0	56.6478	39.9718	61.1286	57.7035	60.7221
1ST	C34	67	1.5(DL+EQYP)	1.45	56.6478	39.9718	61.1286	57.7035	60.7221
1ST	C34	67	1.5(DL+EQYP)	2.9	56.6478	39.9718	61.1286	57.7035	60.7221
Column Torsion, T in Medium Soil									
1ST	C34	67	1.5(DL+EQXP)	0	-70.743	-49.7861	-76.2378	-76.3444	-74.4626
1ST	C34	67	1.5(DL+EQXP)	1.45	-70.743	-49.7861	-76.2378	-76.3444	-74.4626
1ST	C34	67	1.5(DL+EQXP)	2.9	-70.743	-49.7861	-76.2378	-76.3444	-74.4626
1ST	C34	67	1.5(DL+EQYP)	0	77.0414	54.3999	83.1769	83.3566	82.6299
1ST	C34	67	1.5(DL+EQYP)	1.45	77.0414	54.3999	83.1769	83.3566	82.6299
1ST	C34	67	1.5(DL+EQYP)	2.9	77.0414	54.3999	83.1769	83.3566	82.6299
Column Torsion, T in Hard Soil									
1ST	C34	67	1.5(DL+EQXP)	0	-86.8679	-61.1102	-93.589	-93.7234	-91.4055
1ST	C34	67	1.5(DL+EQXP)	1.45	-86.8679	-61.1102	-93.589	-93.7234	-91.4055
1ST	C34	67	1.5(DL+EQXP)	2.9	-86.8679	-61.1102	-93.589	-93.7234	-91.4055
1ST	C34	67	1.5(DL+EQYP)	0	94.6026	66.824	102.1629	102.3801	101.4949
1ST	C34	67	1.5(DL+EQYP)	1.45	94.6026	66.824	102.1629	102.3801	101.4949
1ST	C34	67	1.5(DL+EQYP)	2.9	94.6026	66.824	102.1629	102.3801	101.4949

Table 9: Column Axial Force, P for structures with the load Cases EQXP & EQYP, All value in "kN"

Column Axial Force, P in Soft Soil					Struct I	Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"P"	"P"	"P"	"P"	"P"
1ST	C34	67	EQXP	0	-1774.1609	-1935.2327	-2180.0176	-1997.9011	-1950.1714
1ST	C34	67	EQXP	1.45	-1774.1609	-1935.2327	-2180.0176	-1997.9011	-1950.1714
1ST	C34	67	EQXP	2.9	-1774.1609	-1935.2327	-2180.0176	-1997.9011	-1950.1714
1ST	C34	67	EQYP	0	-1323.8079	-1094.5008	-1194.8361	-1134.2601	-1152.661
1ST	C34	67	EQYP	1.45	-1323.8079	-1094.5008	-1194.8361	-1134.2601	-1152.661
1ST	C34	67	EQYP	2.9	-1323.8079	-1094.5008	-1194.8361	-1134.2601	-1152.661
Column Axial Force, P in Medium Soil									
1ST	C34	67	EQXP	0	-2412.8589	-2631.9165	-2964.824	-2885.2394	-2652.2331
1ST	C34	67	EQXP	1.45	-2412.8589	-2631.9165	-2964.824	-2885.2394	-2652.2331
1ST	C34	67	EQXP	2.9	-2412.8589	-2631.9165	-2964.824	-2885.2394	-2652.2331
1ST	C34	67	EQYP	0	-1800.3788	-1488.5211	-1624.9771	-1637.9951	-1567.6189
1ST	C34	67	EQYP	1.45	-1800.3788	-1488.5211	-1624.9771	-1637.9951	-1567.6189
1ST	C34	67	EQYP	2.9	-1800.3788	-1488.5211	-1624.9771	-1637.9951	-1567.6189
Column Axial Force, P in Hard Soil									
1ST	C34	67	EQXP	0	-2962.8488	-3231.8386	-3640.6295	-3542.9042	-3256.7862
1ST	C34	67	EQXP	1.45	-2962.8488	-3231.8386	-3640.6295	-3542.9042	-3256.7862
1ST	C34	67	EQXP	2.9	-2962.8488	-3231.8386	-3640.6295	-3542.9042	-3256.7862
1ST	C34	67	EQYP	0	-2210.7593	-1827.8164	-1995.3763	-2011.3616	-1924.9438
1ST	C34	67	EQYP	1.45	-2210.7593	-1827.8164	-1995.3763	-2011.3616	-1924.9438
1ST	C34	67	EQYP	2.9	-2210.7593	-1827.8164	-1995.3763	-2011.3616	-1924.9438

Table 10: Column Moment, M for structures with the load Cases EQXP & EQYP, All value in "kN-m"

Column Moment, M in Soft Soil					Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"	"M2"	"M3"
1ST	C34	67	EQXP	0	-158.5935	810.3128	-104.4272	927.6184	-171.2725	1242.6779	-161.363	1109.5618	-168.5048	826.4492
1ST	C34	67	EQXP	1.45	-118.987	710.8162	-73.0951	813.5986	-128.9104	1073.6219	-121.2367	967.6594	-127.5574	731.2906
1ST	C34	67	EQXP	2.9	-79.3805	611.3197	-41.763	699.5788	-86.5484	904.566	-81.1104	825.7569	-86.6099	636.1319
1ST	C34	67	EQYP	0	1484.3941	-26.503	893.9766	-68.837	1054.1309	-86.0128	999.9925	-81.4395	1018.7804	-45.7012
1ST	C34	67	EQYP	1.45	1164.2714	-19.366	742.2291	-25.8578	853.4212	-36.4563	809.6559	-34.4238	793.7946	-25.7085
1ST	C34	67	EQYP	2.9	844.1487	-12.229	590.4817	17.1215	652.7116	13.1002	619.3193	12.592	568.8088	-5.7158
Column Moment, M in Medium Soil														
1ST	C34	67	EQXP	0	-215.6871	1102.0254	-142.0209	1261.561	-232.9306	1690.0419	-232.9754	1602.0199	-229.1666	1123.971
1ST	C34	67	EQXP	1.45	-161.8223	966.7101	-99.4093	1106.4941	-175.3182	1460.1258	-175.0423	1397.1465	-173.478	994.5552
1ST	C34	67	EQXP	2.9	-107.9575	831.3948	-56.7977	951.4271	-117.7058	1230.2098	-117.1093	1192.273	-117.7895	865.1394
1ST	C34	67	EQYP	0	2018.776	-36.0441	1215.8081	-93.6183	1433.618	-116.9775	1443.8661	-117.5873	1385.5413	-62.1537
1ST	C34	67	EQYP	1.45	1583.4091	-26.3378	1009.4316	-35.1666	1160.6529	-49.5806	1169.056	-49.7025	1079.5607	-34.9636
1ST	C34	67	EQYP	2.9	1148.0422	-16.6314	803.0551	23.2852	887.6878	17.8162	894.2459	18.1822	773.58	-7.7735
Column Moment, M in Hard Soil														
1ST	C34	67	EQXP	0	-264.8511	1353.2223	-174.3934	1549.1227	-286.0251	2075.2721	-286.08	1967.1862	-281.4031	1380.1702
1ST	C34	67	EQXP	1.45	-198.7083	1187.0631	-122.0688	1358.7096	-215.2804	1792.9486	-214.9417	1715.6137	-213.0208	1221.2553
1ST	C34	67	EQXP	2.9	-132.5655	1020.9039	-69.7443	1168.2965	-144.5358	1510.6252	-143.8033	1464.0411	-144.6386	1062.3403
1ST	C34	67	EQYP	0	2478.9381	-44.26	1492.9409	-114.9578	1760.3985	-143.6414	1772.9827	-144.3903	1701.3633	-76.321
1ST	C34	67	EQYP	1.45	1944.3332	-32.3412	1239.5226	-43.1825	1425.2135	-60.8821	1435.532	-61.0318	1325.637	-42.9332
1ST	C34	67	EQYP	2.9	1409.7283	-20.4224	986.1044	28.5929	1090.0284	21.8773	1098.0813	22.3267	949.9107	-9.5454

Table 11: Column Shear, V for structures with the load Cases EQXP & EQYP, All value in "kN"

Column Shear, V in Soft Soil					Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"	"V2"	"V3"
1ST	C34	67	EQXP	0	68.6183	-27.3148	78.6344	-21.6083	116.5903	-29.2152	97.8638	-27.6733	65.6267	-28.2396
1ST	C34	67	EQXP	1.45	68.6183	-27.3148	78.6344	-21.6083	116.5903	-29.2152	97.8638	-27.6733	65.6267	-28.2396
1ST	C34	67	EQXP	2.9	68.6183	-27.3148	78.6344	-21.6083	116.5903	-29.2152	97.8638	-27.6733	65.6267	-28.2396
1ST	C34	67	EQYP	0	-4.9221	220.7743	-29.6409	104.6534	-34.1769	138.4204	-32.4246	131.2666	-13.7881	155.1626
1ST	C34	67	EQYP	1.45	-4.9221	220.7743	-29.6409	104.6534	-34.1769	138.4204	-32.4246	131.2666	-13.7881	155.1626
1ST	C34	67	EQYP	2.9	-4.9221	220.7743	-29.6409	104.6534	-34.1769	138.4204	-32.4246	131.2666	-13.7881	155.1626
Column Shear, V in Medium Soil														
1ST	C34	67	EQXP	0	93.3209	-37.1481	106.9427	-29.3873	158.5628	-39.7327	141.292	-39.9538	89.2523	-38.4059
1ST	C34	67	EQXP	1.45	93.3209	-37.1481	106.9427	-29.3873	158.5628	-39.7327	141.292	-39.9538	89.2523	-38.4059
1ST	C34	67	EQXP	2.9	93.3209	-37.1481	106.9427	-29.3873	158.5628	-39.7327	141.292	-39.9538	89.2523	-38.4059
1ST	C34	67	EQYP	0	-6.694	300.253	-40.3116	142.3286	-46.4806	188.2518	-46.8171	189.5242	-18.7518	211.0212
1ST	C34	67	EQYP	1.45	-6.694	300.253	-40.3116	142.3286	-46.4806	188.2518	-46.8171	189.5242	-18.7518	211.0212
1ST	C34	67	EQYP	2.9	-6.694	300.253	-40.3116	142.3286	-46.4806	188.2518	-46.8171	189.5242	-18.7518	211.0212
Column Shear, V in Hard Soil														
1ST	C34	67	EQXP	0	114.5926	-45.6157	131.3194	-36.0859	194.7058	-48.7894	173.4983	-49.0609	109.5965	-47.1602
1ST	C34	67	EQXP	1.45	114.5926	-45.6157	131.3194	-36.0859	194.7058	-48.7894	173.4983	-49.0609	109.5965	-47.1602
1ST	C34	67	EQXP	2.9	114.5926	-45.6157	131.3194	-36.0859	194.7058	-48.7894	173.4983	-49.0609	109.5965	-47.1602
1ST	C34	67	EQYP	0	-8.2199	368.693	-49.5002	174.7712	-57.0754	231.1621	-57.4886	232.7246	-23.0261	259.1216
1ST	C34	67	EQYP	1.45	-8.2199	368.693	-49.5002	174.7712	-57.0754	231.1621	-57.4886	232.7246	-23.0261	259.1216
1ST	C34	67	EQYP	2.9	-8.2199	368.693	-49.5002	174.7712	-57.0754	231.1621	-57.4886	232.7246	-23.0261	259.1216

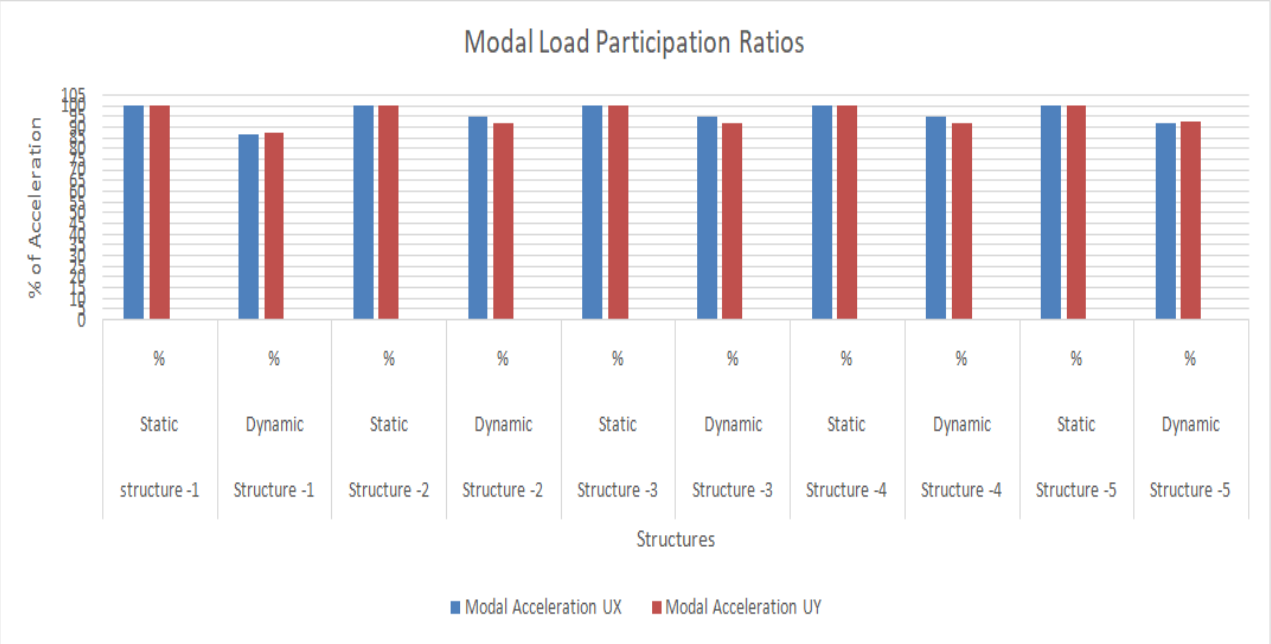
Table 12: Column Torsion, T for structures with the load Cases EQXP & EQYP, All value in "kN-m"

Column Torsion, T in Soft Soil					Struct I	Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"	"T"	"T"	"T"
1ST	C34	67	EQXP	0	-34.6774	-24.353	-37.3143	-35.2051	-36.4362
1ST	C34	67	EQXP	1.45	-34.6774	-24.353	-37.3143	-35.2051	-36.4362
1ST	C34	67	EQXP	2.9	-34.6774	-24.353	-37.3143	-35.2051	-36.4362
1ST	C34	67	EQYP	0	37.766	26.7186	40.8301	38.5365	40.5699
1ST	C34	67	EQYP	1.45	37.766	26.7186	40.8301	38.5365	40.5699
1ST	C34	67	EQYP	2.9	37.766	26.7186	40.8301	38.5365	40.5699
Column Torsion, T in Medium Soil									
1ST	C34	67	EQXP	0	-47.1612	-33.12	-50.7475	-50.8287	-49.5533
1ST	C34	67	EQXP	1.45	-47.1612	-33.12	-50.7475	-50.8287	-49.5533
1ST	C34	67	EQXP	2.9	-47.1612	-33.12	-50.7475	-50.8287	-49.5533
1ST	C34	67	EQYP	0	51.3617	36.3373	55.529	55.6386	55.1751
1ST	C34	67	EQYP	1.45	51.3617	36.3373	55.529	55.6386	55.1751
1ST	C34	67	EQYP	2.9	51.3617	36.3373	55.529	55.6386	55.1751
Column Torsion, T in Hard Soil									
1ST	C34	67	EQXP	0	-57.9112	-40.6695	-62.315	-62.4147	-60.8485
1ST	C34	67	EQXP	1.45	-57.9112	-40.6695	-62.315	-62.4147	-60.8485
1ST	C34	67	EQXP	2.9	-57.9112	-40.6695	-62.315	-62.4147	-60.8485

1ST	C34	67	EQYP	0	63.0692	44.62	68.1863	68.321	67.7517
1ST	C34	67	EQYP	1.45	63.0692	44.62	68.1863	68.321	67.7517
1ST	C34	67	EQYP	2.9	63.0692	44.62	68.1863	68.321	67.7517

Table 13: Modal Load Participation Ratios

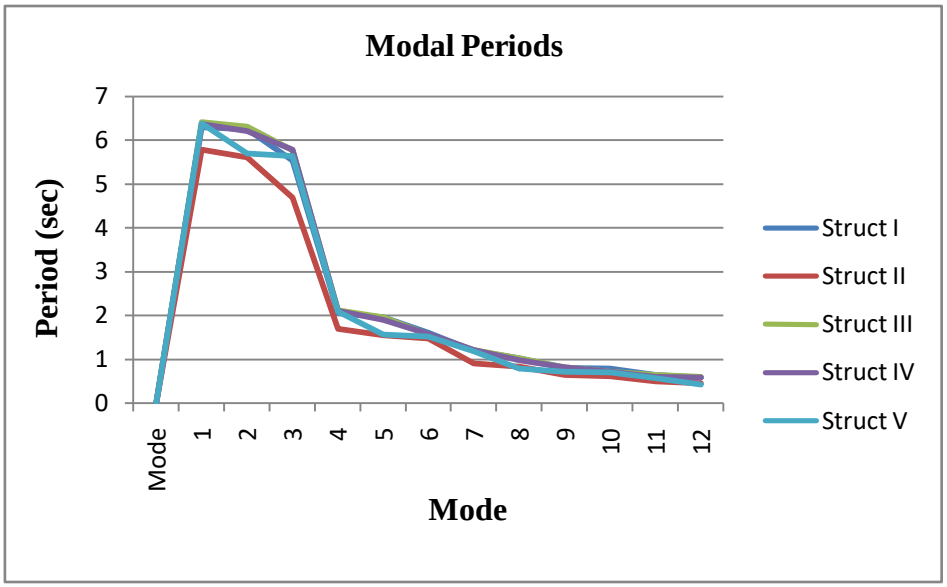
Modal Load Participation Ratios			Struct I	Struct I	Struct II	Struct II	Struct III	Struct III	Struct IV	Struct IV	Struct V	Struct V
"Case"	"Item Type"	"Item"	"Static"	"Dynamic"	"Static"	"Dynamic	"Static"	"Dynamic"	"Static"	"Dynamic"	"Static"	"Dynamic"
			%	%	%	%	%	%	%	%	%	%
Modal	Acceleration	UX	99.82	86.71	99.99	94.7	99.98	94.59	99.99	94.54	99.97	91.54
Modal	Acceleration	UY	99.79	87.46	99.98	91.46	99.97	91.85	99.97	91.83	99.97	92.51
Modal	Acceleration	UZ	0	0	0	0	0	0	0	0	0	0



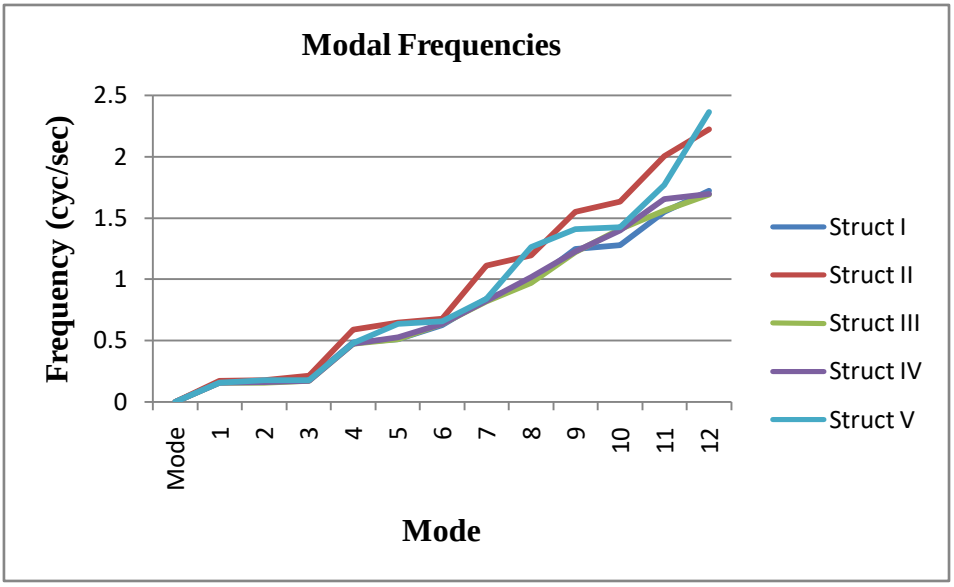
Graph 1: Modal Load Participation Ratios of Structures

Table 14: Modal Periods and Frequencies

Struct I				Struct II		Struct III		Struct IV		Struct V	
Case	Mode	Period	Frequency	Period	Frequency	Period	Frequency	Period	Frequency	Period	Frequency
		sec	cyc/sec	sec	cyc/sec	sec	cyc/sec	sec	cyc/sec	sec	cyc/sec
Modal	1	6.298	0.159	5.785	0.173	6.415	0.156	6.375	0.157	6.382	0.157
Modal	2	6.248	0.16	5.606	0.178	6.32	0.158	6.21	0.161	5.694	0.176
Modal	3	5.545	0.18	4.684	0.213	5.767	0.173	5.792	0.173	5.642	0.177
Modal	4	2.062	0.485	1.701	0.588	2.114	0.473	2.102	0.476	2.088	0.479
Modal	5	1.952	0.512	1.547	0.646	1.958	0.511	1.901	0.526	1.565	0.639
Modal	6	1.603	0.624	1.475	0.678	1.568	0.638	1.575	0.635	1.524	0.656
Modal	7	1.191	0.84	0.9	1.112	1.219	0.82	1.212	0.825	1.19	0.84
Modal	8	1.027	0.974	0.838	1.193	1.028	0.972	0.983	1.017	0.791	1.264
Modal	9	0.803	1.245	0.645	1.551	0.82	1.22	0.815	1.226	0.711	1.406
Modal	10	0.782	1.279	0.613	1.632	0.711	1.406	0.714	1.401	0.703	1.423
Modal	11	0.645	1.55	0.5	2.002	0.641	1.56	0.604	1.656	0.565	1.769
Modal	12	0.581	1.72	0.45	2.222	0.592	1.689	0.589	1.697	0.423	2.363



Graph 2: Modal Periods and Frequencies



Graph 3: Modal Frequencies

Table 15: Compared of column axial forces in soft soil of structures II, III, IV, V with structure I

Column axial forces "P"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"P"	"P"	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	0%	2%	1%	1%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-2%	-1%	-1%	-1%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	1%	2%	1%	1%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-2%	-1%	-1%	-1%
1ST	C34	67	EQXP	0,1.45,2.9	8%	19%	11%	9%
1ST	C34	67	EQYP	0,1.45,2.9	-21%	-11%	-17%	-15%

Table 16: Compared of column axial forces in medium soil of structures II, III, IV, V with structure I

Column axial forces "P"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"P"	"P"	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	1%	2%	2%	1%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-2%	-1%	-1%	-1%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	1%	3%	2%	1%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-2%	-1%	-1%	-1%
1ST	C34	67	EQXP	0,1.45,2.9	8%	19%	16%	9%
1ST	C34	67	EQYP	0,1.45,2.9	-21%	-11%	-10%	-15%

Table 17: Compared of column axial forces in hard soil of structures II, III, IV, V with structure I

Column axial forces "P"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"P"	"P"	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	1%	3%	2%	1%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-2%	-1%	-1%	-1%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	1%	4%	3%	2%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-3%	-1%	-1%	-2%
1ST	C34	67	EQXP	0,1.45,2.9	8%	19%	16%	9%
1ST	C34	67	EQYP	0,1.45,2.9	-21%	-11%	-10%	-15%

Table 18: Compared of column moment in soft soil of structures II, III, IV, V with structure I

Column moment forces "M"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"M"	"M"	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	564%	4%	-5%	4%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-54%	-35%	-42%	-46%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-54%	4%	-1%	4%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-62%	-39%	-47%	-47%
1ST	C34	67	EQXP	0,1.45,2.9	0%	45%	41%	44%
1ST	C34	67	EQYP	0,1.45,2.9	0%	13%	8%	5%

Table 19: Compared of column moment in medium soil of structures II, III, IV, V with structure I

Column moment forces "M"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"M"	"M"	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-187%	5%	5%	5%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-55%	-35%	-34%	-46%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-55%	5%	5%	4%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-62%	-39%	-38%	-47%
1ST	C34	67	EQXP	0,1.45,2.9	0%	45%	45%	44%
1ST	C34	67	EQYP	0,1.45,2.9	0%	13%	13%	5%

Table 20: Compared of column moment in hard soil of structures II, III, IV, V with structure I

Column moment forces "M"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"M"	"M"	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-127%	6%	5%	5%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-55%	-35%	-34%	-46%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-55%	6%	6%	5%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-62%	-39%	-38%	-47%
1ST	C34	67	EQXP	0,1.45,2.9	0%	45%	45%	44%
1ST	C34	67	EQYP	0,1.45,2.9	0%	13%	13%	5%

Table 21: Compared of column shear in soft soil of structures II, III, IV, V with structure I

Column shear forces "V"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"V"	"V"	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-17%	14%	1%	-20%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	215%	175%	191%	-599%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-12%	20%	8%	-18%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	166%	148%	155%	955%
1ST	C34	67	EQXP	0,1.45,2.9	13%	41%	30%	-5%
1ST	C34	67	EQYP	0,1.45,2.9	83%	86%	85%	64%

Table 22: Compared of column shear in medium soil of structures II, III, IV, V with structure I

Column shear forces "V"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"V"	"V"	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-10%	21%	14%	-17%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	173%	152%	157%	2154%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-5%	26%	18%	-15%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	142%	132%	134%	325%
1ST	C34	67	EQXP	0,1.45,2.9	13%	41%	34%	-5%
1ST	C34	67	EQYP	0,1.45,2.9	83%	86%	86%	64%

Table 23: Compared of column shear in hard soil of structures II, III, IV, V with structure I

Column shear forces "V"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"V"	"V"	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-6%	25%	18%	-15%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	154%	140%	143%	521%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-2%	29%	21%	-13%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	131%	124%	125%	226%
1ST	C34	67	EQXP	0,1.45,2.9	13%	41%	34%	-5%
1ST	C34	67	EQYP	0,1.45,2.9	83%	86%	86%	64%

Table 24: Compared of column torsion in soft soil of structures II, III, IV, V with structure I

Column torsion forces "T"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-42%	7%	2%	5%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-42%	7%	2%	7%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-42%	7%	2%	5%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-42%	7%	2%	7%
1ST	C34	67	EQXP	0,1.45,2.9	-42%	7%	1%	5%
1ST	C34	67	EQYP	0,1.45,2.9	-41%	8%	2%	7%

Table 25: Compared of column torsion in medium soil of structures II, III, IV, V with structure I

Column torsion forces "T"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"T"	"T"	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-42%	7%	7%	5%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-42%	7%	8%	7%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-42%	7%	7%	5%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-42%	7%	8%	7%
1ST	C34	67	EQXP	0,1.45,2.9	-42%	7%	7%	5%
1ST	C34	67	EQYP	0,1.45,2.9	-41%	8%	8%	7%

Table 26: Compared of column torsion in hard soil of structures II, III, IV, V with structure I

Column torsion forces "T"					Struct II	Struct III	Struct IV	Struct V
"Story"	"Column"	"Unique - Name"	"Load Case-Combo"	"Station"m	"T"	"T"	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	-42%	7%	7%	5%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-42%	7%	8%	7%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	-42%	7%	7%	5%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-42%	7%	8%	7%
1ST	C34	67	EQXP	0,1.45,2.9	-42%	7%	7%	5%
1ST	C34	67	EQYP	0,1.45,2.9	-41%	8%	8%	7%

Table 27: Compared of column axial forces of medium soil and hard soil with soft soil for Structure -I

Column Axial Forces "P"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique- Name"	"Load Case-Combo"	"Station"m	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	3%	6%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	2%	4%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	4%	7%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	3%	5%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 28: Compared of column axial forces of medium soil and hard soil with soft soil for Structure -II

Column Axial Forces "P"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	3%	6%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	2%	4%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	4%	7%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	2%	4%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 29: Compared of column axial forces of medium soil and hard soil with soft soil for Structure -III

Column Axial Forces "P"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	4%	7%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	2%	4%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	4%	8%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	3%	5%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 30: Compared of column axial forces of medium soil and hard soil with soft soil for Structure -IV

Column Axial Forces "P"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique- Name"	"Load Case-Combo"	"Station"m	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	4%	7%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	3%	4%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	5%	8%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	3%	5%
1ST	C34	67	EQXP	0,1.45,2.9	31%	44%
1ST	C34	67	EQYP	0,1.45,2.9	31%	44%

Table 31: Compared of column axial forces of medium soil and hard soil with soft soil for Structure -V

Column Axial Forces "P"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"P"	"P"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	3%	6%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	2%	4%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	4%	7%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	3%	5%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 32: Compared of column moment of medium soil and hard soil with soft soil for Structure -I

Column Moment Forces "M"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	20%	32%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	-7%	-14%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	21%	34%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	-11%	-23%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 33: Compared of column moment of medium soil and hard soil with soft soil for Structure -II

Column Moment Forces "M"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	25%	38%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	32%	46%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	26%	39%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	29%	43%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 34: Compared of column moment of medium soil and hard soil with soft soil for Structure -III

Column Moment Forces "M"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	27%	40%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	27%	41%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	25%	39%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 35: Compared of column moment of medium soil and hard soil with soft soil for Structure -IV

Column Moment Forces "M"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	30%	43%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	33%	46%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	31%	43%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	31%	44%
1ST	C34	67	EQXP	0,1.45,2.9	31%	44%
1ST	C34	67	EQYP	0,1.45,2.9	31%	44%

Table 36: Compared of column moment of medium soil and hard soil with soft soil for Structure -V

Column Moment Forces "M"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"M"	"M"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	22%	35%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	415%	169%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	23%	36%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	71%	82%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 37: Compared of column shear of medium soil and hard soil with soft soil for Structure -I

Column Shear Forces "V"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	30%	44%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	29%	42%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 38: Compared of column shear of medium soil and hard soil with soft soil for Structure -II

Column Shear Forces "V"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	56%	61%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	40%	52%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 39: Compared of column shear of medium soil and hard soil with soft soil for Structure -III

Column Shear Forces "V"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	31%	45%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	29%	43%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 40: Compared of column shear of medium soil and hard soil with soft soil for Structure -IV

Column Shear Forces "V"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	36%	48%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	31%	43%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	34%	47%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	31%	43%
1ST	C34	67	EQXP	0,1.45,2.9	31%	44%
1ST	C34	67	EQYP	0,1.45,2.9	31%	44%

Table 41: Compared of column shear of medium soil and hard soil with soft soil for Structure -V

Column Shear Forces "V"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"V"	"V"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	30%	44%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	29%	43%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 42: Compared of column torsion of medium soil and hard soil with soft soil for Structure -I

Column Torsion Forces "T"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	0%	0%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	26%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 43: Compared of column torsion of medium soil and hard soil with soft soil for Structure -II

Column Torsion Forces "T"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	27%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	27%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 44: Compared of column torsion of medium soil and hard soil with soft soil for Structure -III

Column Torsion Forces "T"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	27%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	27%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

Table 45: Compared of column torsion of medium soil and hard soil with soft soil for Structure -IV

Column Torsion Forces "T"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	31%	44%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	31%	44%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	31%	44%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	31%	44%
1ST	C34	67	EQXP	0,1.45,2.9	31%	44%
1ST	C34	67	EQYP	0,1.45,2.9	31%	44%

Table 46: Compared of column torsion of medium soil and hard soil with soft soil for Structure -V

Column Torsion Forces "T"					"Medium soil"	"Hard soil"
"Story"	"Column"	"Unique-Name"	"Load Case-Combo"	"Station"m	"T"	"T"
1ST	C34	67	1.2(DL+LL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.2(DL+LL+EQYP)	0,1.45,2.9	27%	40%
1ST	C34	67	1.5(DL+EQXP)	0,1.45,2.9	26%	40%
1ST	C34	67	1.5(DL+EQYP)	0,1.45,2.9	27%	40%
1ST	C34	67	EQXP	0,1.45,2.9	26%	40%
1ST	C34	67	EQYP	0,1.45,2.9	26%	40%

a) Discussion on Results

When a structure is subjected to earthquake, it responds by vibrating. An example force can be resolved into three mutually perpendicular directions-two horizontal directions (X and Y directions) and the vertical direction (Z) [8]. This motion causes the structure to vibrate or shake in all three directions; the predominant direction of shaking is horizontal. All the structures are primarily designed for gravity loads-force equal to mass time's gravity in the vertical direction. Vertical acceleration should also be considered in structures with large spans those in which stability for design, or for overall stability analysis of structures. The basic intent of design theory for earthquake resistant structures is that buildings should be able to resist minor earthquakes without damage, resist moderate earthquakes without structural damage but with some non-structural damage. To avoid collapse during a major earthquake, Members must be ductile enough to absorb and dissipate energy by post elastic deformation. Redundancy in the structural system permits redistribution of internal forces in the event of the failure of key elements. When the primary element or system yields or fails, the lateral force can be redistributed to a secondary system to prevent progressive failure.

When a structure is subjected to an earthquake excitation, it interacts with the foundation and the soil, and thus changes the motion of the ground[2,8]. This means that the movement of the whole ground-structure system is influenced by the type of soil as well as by the type of structure. Understanding of soil structure interaction will enable the designer to design structures that will behave better during an earthquake.

V. Conclusions

From the above results and discussions, following conclusions can be drawn:

- The shear wall and it is position has a significant influenced on the time period, the time period is not influenced by the type of soil, in tall building with box shape Shear Walls is showing the low time period which shows a very significant performance.
- Shear is effected marginally by placing of the shear wall, grouping of shear wall and type of soil. The shear is increased by adding shear wall due to increase the seismic weight of the building.
- The Axial force and Moment in the column increases when the type of soil changes from hard to medium and medium to soft. Since the column moment increase as the soil type changes, soil structure interaction must be suitably considered while designing frames for seismic force.
- It is evident that the maximum column axial force is various with type of soil and placing of the shear wall.
- It is evident that the maximum column shear force in X-direction is influenced by the type of soil and placing of the shear wall.
- It is evident that the maximum column shear force in Y-direction has no influence on the type of soil and placing shear wall.
- It is evident that the maximum column torsion is same for all columns in a structure, but is influenced by the type of soil and placing shear wall.
- It is evident that the maximum column moment in X-direction has no influence on the type of soil and placing shear wall.
- It is evident that the maximum column moment in Y-direction is influenced by the type of soil and placing of shear wall.
- It is evident that the results from1.2 (DL + IL ± EL) combination load is closed to the 1.5 (DL + EL) and there is no more difference between these combination load.
- Based on the analysis and discussion, shear wall are very much suitable for resisting earthquake induced lateral forces in multistoried structural systems when compared to multistoried structural systems whit out shear walls. They can be made to behave in a ductile manner by adopting proper detailing techniques.
- According to IS-1893:2002 the number of modes to be used in the analysis should be such that the total sum of modal masses of all modes considered is at least 90 percent of the total seismic mass. Here the maximum mass is for the tall building with box shape RC shear wall.
- ETABS is the robust software which is utilized foranalyzing any kind of multi building structures.

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Conflict of Interest

The author declare no conflict of interest.

Data Availability Statement

All data generated or analysed during this study are included in this article.

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