Global Journal of Researches in Engineering: E
Civil And Structural Engineering
Volume 18 Issue 1 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Study the Impact of the Drift (Lateral Deflection) of the Tall Buildings Due to Seismic Load in Concrete Frame Structures with Different Type of RC Shear Walls

By Mahdi Hosseini & N.V. Ramana Rao
Jawaharlal Nehru Technological University

Abstract- Story Drift is defined as the difference in lateral deflection between two adjacent stories. Lateral deflection and drift have three effects on a structure; the movement can affect the structural elements (such as beams and columns); the movements can affect non-structural elements (such as the windows and cladding); and the movements can affect adjacent structures. Without proper consideration during the design process, large deflections and drifts can have adverse effects on structural elements, nonstructural elements, and adjacent structures. Drift problem as the horizontal displacement of all tall buildings is one of the most serious issues in tall building design, relating to the dynamic characteristics of the building during earthquakes and strong winds. Drift shall be caused by the accumulated deformations of each member, such as a beam, column and shear wall. lateral forces due to wind or seismic loading must be considered for tall building design along with gravity forces vertical loads. Tall and slender buildings are strongly wind sensitive and wind forces are applied to the exposed surfaces of the building, whereas seismic forces are inertial (body forces), which result from the distortion of the ground and the inertial resistance of the building.

Keywords: dynamic analysis, seismic load, story drift, RC shear walls, software ETABS.

GJRE-E Classification: FOR Code: 090599

Study the Impact of the Drift (Lateral Deflection) of the Tall Buildings Due to Seismic Load in Concrete Frame Structures with Different Type of RC Shear Walls

Mahdi Hosseini [α] & N.V. Ramana Rao [σ]

Abstract- Story Drift is defined as the difference in lateral deflection between two adjacent stories. Lateral deflection and drift have three effects on a structure; the movement can affect the structural elements (such as beams and columns); the movements can affect non-structural elements (such as the windows and cladding); and the movements can affect adjacent structures. Without proper consideration during the design process, large deflections and drifts can have adverse effects on structural elements, nonstructural elements, and adjacent structures. Drift problem as the horizontal displacement of all tall buildings is one of the most serious issues in tall building design, relating to the dynamic characteristics of the building during earthquakes and strong winds. Drift shall be caused by the accumulated deformations of each member, such as a beam, column and shear wall. lateral forces due to wind or seismic loading must be considered for tall building design along with gravity forces vertical loads. Tall and slender buildings are strongly wind sensitive and wind forces are applied to the exposed surfaces of the building, whereas seismic forces are inertial (body forces), which result from the distortion of the ground and the inertial resistance of the building. These forces cause horizontal deflection is the predicted movement of a structure under lateral loads and The structural prototype is prepared and lots of data is been collected from the prototype. All the aspects such as safety of structure in shear, moment and in story drift have been collected. Main problems that would be arising due to earthquake in the structure are story drift and deflection of the building due to its large height and also torsion and others, so if the structure is proved to be safe in all the above mentioned problems than the structure would be safe in all cases in respect earthquake. Shear Wall is A Structural Element Used to Resist Lateral, Horizontal, Shear Forces Parallel to the Plane of the Wall By: Cantilever Action For Slender Walls Where The Bending Deformation Is Dominant. Truss Action For Squat/Short Walls Where The Shear Deformation is Dominant. Shear walls are analyzed to the provide necessary lateral strength to resist horizontal forces. Shear walls are strong enough, to transfer these horizontal forces to the next element in the load path below them. 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. Three types soil are considered here: Hard soil ,Medium soil, soft soil. In the present work thirty story buildings with C Shape, Box shape, E Shape, I shape and Plus shape RC Shear wall at the center in Concrete Frame Structure with fixed support conditions under different type of soil condition for earthquake zone V as per IS 1893 (part 1) : 2002 in India are analyzed using software ETABS by Dynamic analysis. All the analyses has been carried out as per the Indian Standard code books. This paper aims to Study the effect on the drift (lateral deflection) of the tall buildings due to earthquake loading. In dynamic analysis; Response Spectrum method is used.

Keywords: dynamic analysis, seismic load, story drift, RC shear walls, software ETABS.

Author α: Ph.D. scholar student in Structural Engineering, Dept. of Civil Engineering, Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, Telangana, India.
e-mail: civil.mahdi.hosseini@gmail.com
Author σ: Professor, Dept. of Civil Engineering, Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, & Director of National Institute of Technology Warangal, Telangana, India.

I. Introduction

a) Earthquake Load

Earthquake forces experienced by a building result from ground motions (accelerations) which are also fluctuating or dynamic in nature, in fact they reverse direction some what chaotically. The magnitude of an earthquake force depends on the magnitude of an earthquake, distance from the earthquake source(epicenter), local ground conditions that may amplify ground shaking (or dampen it), the weight(or mass) of the structure, and the type of structural system and its ability to with stand aI busive cyclic loading. 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 (i.e., a doubling in ground motion acceleration or building mass will double the load).This theory rests on the simplicity and validity of Newton's law of physics: F = m x a, where 'F' represents force, 'm' represents mass or weight, and 'a' represents acceleration. For example, as a car accelerates forward, a force is imparted to the driver through the seat to push him forward with the car (this force is equivalent to the weight of the driver multiplied by the acceleration or rate of change in speed of the car). As the brake is applied, the car is decelerated and a force is imparted to the driver by the seatbelt to push him back toward the seat. Similarly, 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 to the ground. One can imagine a very light structure such as a fabric tent that will be undamaged in almost any earthquake but it will not survive high wind. The reason is the low mass (weight) of the tent. Therefore, residential buildings generally perform reasonably well in earthquakes, but are more vulnerable in high-wind load prone areas. Regardless, the proper amount of bracing is required in both cases.

Story drift, which is defined here as the relative horizontal displacement of two adjacent floors, can form the starting point for assessment of damage to non-structural components such as facades and interior partitions. However, it is more informative in high-rise buildings to assess these relative movements in each story as components due to:

A) Rigid body displacement.

b) Racking (shear) deformation.

Rigid body displacement is associated with the 'rotation' of the building as a whole at upper levels due to vertical deformations in the columns below, and induces no damage.

Racking hear deformation is a measure of the angular in-plane deformation of a wall or cladding panel. This will in general vary at different positions on a floor, and may exceed the story drift ratio in some locations, (e.g. partition panels spanning between a core and a perimeter column). Inelastic element deformations form the basis for assessment of structural damage and potential for structural collapse. Assessments are generally performed one component at a time by comparing deformation demands with permissible values (e.g., maximum plastic hinge rotations) that are based on structural details (e.g. tie spacing in concrete elements) and co-existing member forces.

When a building is subjected to wind or earthquake load, various types of failure must be prevented:

- Slipping off the foundation (sliding)
- Overturning and uplift (anchorage failure)
- Shear distortion (drift or racking deflection)
- Collapse (excessive racking deflection)

The first three types of failure are schematically shown in the Figure. 1 Clearly, the entire system must be tied together to prevent building collapse or significant deformation.

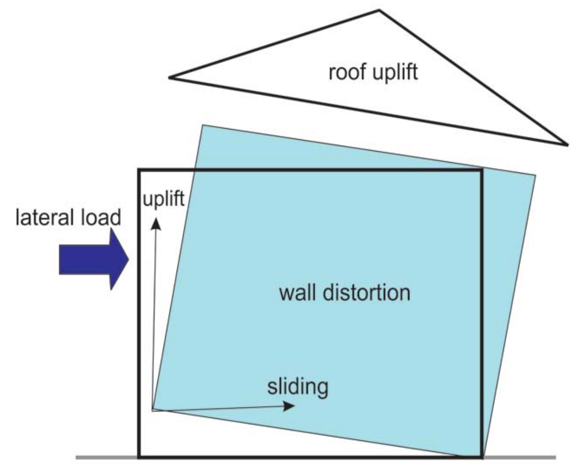


Fig. 1: Schematic of the deformations of the structure due to the lateral loads

II. Methodology

Earthquake motion causes vibration of the structure leading to inertia forces. Thus a structure must be able to safely transmit the horizontal and the vertical inertia forces generated in the super structure through the foundation to the ground. Hence, for most of the ordinary structures, earthquake-resistant design requires ensuring that the structure has adequate lateral load carrying capacity. Seismic codes will guide a designer to safely design the structure for its intended purpose. Seismic codes are unique to a particular region or country. In India, IS 1893(Part1): 2002is the main code that provides outline for calculating seismic design force. This force depends on the mass and seismic coefficient of the structure and the latter in turn depends on properties like seismic zone in which structure lies, importance of the structure, its stiffness, the soil on which it rests, and its ductility. IS 1893 (Part 1): 2002deals with assessment of seismic loads on various structures and buildings. Whole the code centers on the calculation of base shear and its distribution over height.

The analysis can be performed on the basis of the external action, the behavior of the structure or structural materials, and the type of structural model selected. Depending on the height of the structure and zone to which it belongs, type of analysis is performed. In all the methods of analyzing multi- storey buildings recommended in the code, the structure is treated as discrete system having concentrated masses at floor levels, which include half that of columns and walls above and below the floor. In addition, appropriate amount of live load at this floor is also lumped with it.

Quite a few methods are available for the earthquake analysis of buildings; two of them are presented here:

1- Equivalent Static Lateral Force Method (pseudo static method).
2- Dynamic analysis.
   I. Response spectrum method.
   II. Time history method.

a) Dynamic analysis

Dynamic analysis shall be performed to obtain the design seismic force, and its distribution in different levels along the height of the building, and in the various lateral load resisting element, for the following buildings:

Regular buildings: Those greater than 40m in height in zones IV and V, those greater than 90m in height in zone II and III.

Irregular buildings: All framed buildings higher than 12m in zones IV and V, and those greater than 40m in height in zones II and III.

The analysis of model for dynamic analysis of buildings with unusual configuration should be such that it adequately models the types of irregularities present in the building configuration. Buildings with plan irregularities, as defined in Table 4 of IS code: 1893-2002 cannot be modeled for dynamic analysis.

Dynamic analysis may be performed either by the TIME HISTORY METHOD or by the RESPONSE SPECTRUM METHOD

b) Time History Method

The usage of this method shall be on an appropriate ground motion and shall be performed using accepted principles of dynamics. In this method, the mathematical model of the building is subjected to accelerations from earthquake records that represent the expected earthquake at the base of the structure.

c) Response Spectrum Method

The word spectrum in engineering conveys the idea that the response of buildings having a broad range of periods is summarized in a single graph. This method shall be performed using the design spectrum specified in code or by a site-specific design spectrum for a structure prepared at a project site. The values of damping for building may be taken as 2 and 5 percent of the critical, for the purposes of dynamic of steel and reinforce concrete buildings, respectively. For most buildings, inelastic response can be expected to occur during a major earthquake, implying that an inelastic analysis is more proper for design. However, in spite of the availability of nonlinear inelastic programs, they are not used in typical design practice because:

1- Their proper use requires knowledge of their inner workings and theories. design criteria, and
2- Result produced are difficult to interpret and apply to traditional design criteria, and
3- The necessary computations are expensive.

Therefore, analysis in practice typically use linear elastic procedures based on the response spectrum method. The response spectrum analysis is the preferred method because it is easier to use.

d) Response Spectrum Analysis

This method is also known as modal method or mode superposition method. It is based on the idea that the response of a building is the superposition of the responses of individual modes of vibration, each mode responding with its own particular deformed shape, its own frequency, and with its own modal damping.

According to IS-1893(Part-I): 2002, high rise and irregular buildings must be analyzed by response spectrum method using design spectra shown in Figure 4.1. There are significant computational advantages using response spectra method of seismic analysis for prediction of displacements and member forces in structural systems. The method involves only the calculation of the maximum values of the displacements and member forces in each mode using smooth spectra that are the average of several earthquake motions. Sufficient modes to capture such that at least 90% of the participating mass of the building (in each of two orthogonal principle horizontal directions) have to be considered for the analysis. The analysis is performed to determine the base shear for each mode using given building characteristics and ground motion spectra. And then the storey forces, accelerations, and displacements are calculated for each mode, and are combined statistically using the SRSS combination. However, in this method, the design base shear (VB) shall be compared with a base shear (Vb) calculated using a fundamental period T. If V_B is less than V_b response quantities are (for example member forces, displacements, storey forces, storey shears and base reactions) multiplied by VB/V_b Response spectrum method of analysis shall be performed using design spectrum. In case design spectrum is specifically prepared for a structure at a particular project site, the same may be used for design at the discretion of the project authorities. Figure 4.1 shows the proposed 5% spectra for rocky and soils sites.

e) Seismic Analysis Procedure as per the Code

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). 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

Global Journal of Researches in Engineering (E) Volume XVIII Issue I Version I Year 2018

time's gravity in the vertical direction. Because of the inherent factor used in the design specifications, most structures tend to be adequately protected against vertical shaking. 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.

IS 1893 (part- 1) Code recommends that detailed dynamic analysis, or pseudo static analysis should be carries out depending on the importance of the problems.

IS 1893 (part- 1) Recommends use of model analysis using response spectrum method and equivalent lateral force method for building of height less than 40m in all seismic zones as safe., but practically there may be the building which are more than 40m in height. So there exist so many problems due to the increase in height of the structure.

The earthquake resistant structures are constructed using IS 1893 part-1 and there are some assumptions to be made in the design according to the codal provisions and these assumptions account to one of the uncertainties that occur in the design starting from mix design to workmanship and many other.

The following assumptions shall be made in the earthquake resistant design of structures:

Earthquake causes impulsive ground motions, which are complex and irregular in character, changing in period and amplitude each lasting for a small duration. Therefore, resonance of the type as visualized under steady-state sinusoidal excitations will not occur as it would need time to buildup such amplitudes.

III. Modeling of Building

a) *Details of The Building*

A symmetrical building of plan 38.5m X 35.5m located with location in zone V, India is 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 Wall is provided at the center core of building model.

Structure 1: In this model building with 30 storey is modeled as a (Dual frame system with shear wall (Plus Shape) at the center of building, The shear wall acts as vertical cantilever.

Structure 2: In this model building with 30 storey is modeled as (Dual frame system with shear wall (Box Shape) at the center of building ,The shear wall acts as vertical cantilever.

Structure 3: In this model building with 30 storey is modeled as (Dual frame system with shear wall (C- Shape) at the center of building, The shear wall acts as vertical cantilever.

Structure 4: In this model building with 30 storey is modeled as (Dual frame system with shear wall (E- Shape) at the center of building ,The shear wall acts as vertical cantilever.

Structure 5: In this model building with 30 storey is modeled as (Dual frame system with shear wall (I - Shape) at the center of building, The shear wall acts as vertical cantilever.

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:

1.5 (DL + IL)

1.2 (DL + IL ± EL)

1.5 (DL ± EL)

0.9 DL ± 1.5 EL

Earthquake load must be considered for +X, -X, +Y and –Y directions.

Table 1: Details of the Building

Building Parameters	Details
Type of frame	Special RC moment resisting frame fixed at the base
Building plan	38.5m X 35.5m
Number of storeys	30
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
Spacing between frames	7.5-8.5 m along x - direction 7.5-5.5 m along y - direction
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	Soft, Medium, Hard Soil Type I=Soft Soil Soil Type II=Medium Soil Soil Type III= Hard Soil
Response spectra	As per IS 1893(Part-1): 2002
Damping of structure	5 percent

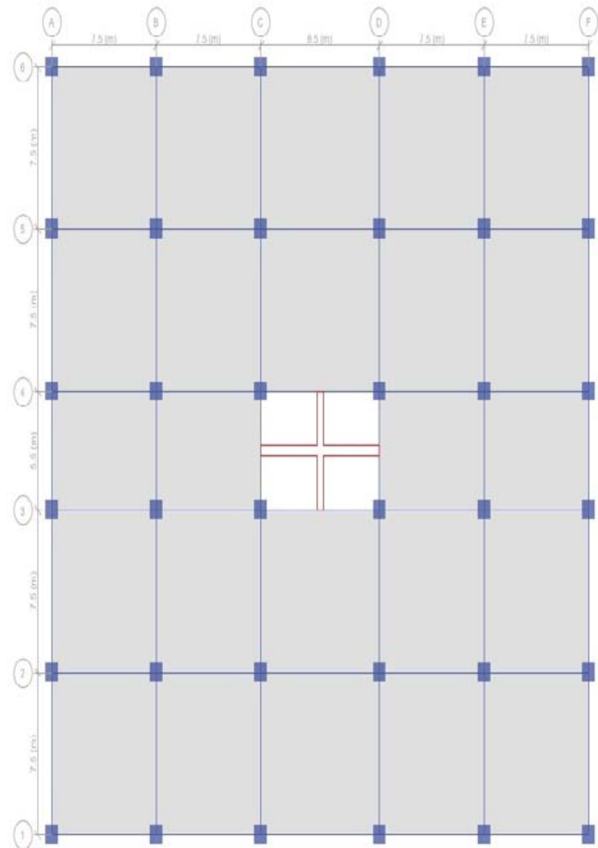


Figure 1: Plan of the Structure 1

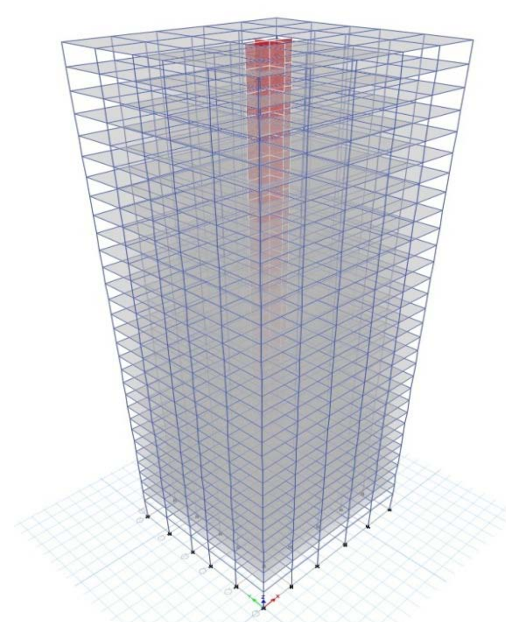


Figure 2: 3D view showing shear wall location for Structure 1

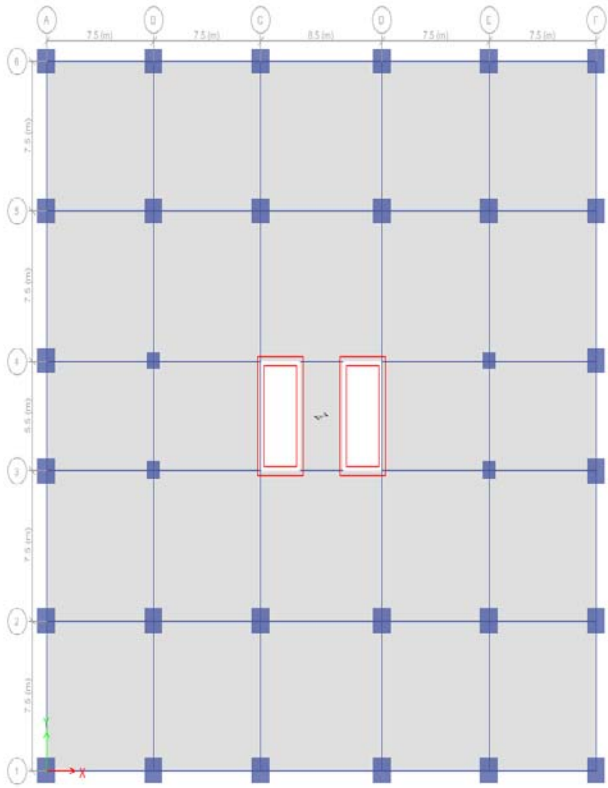


Figure 3: Plan of the Structure 2

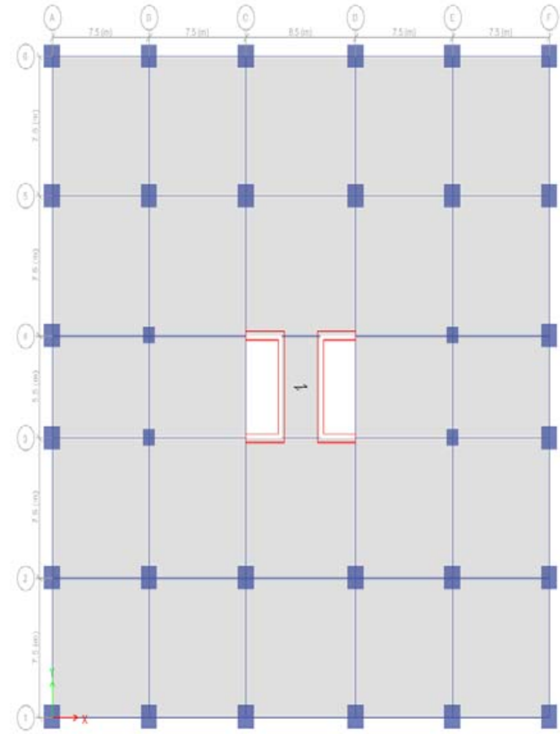


Figure 5: Plan of the Structure 3

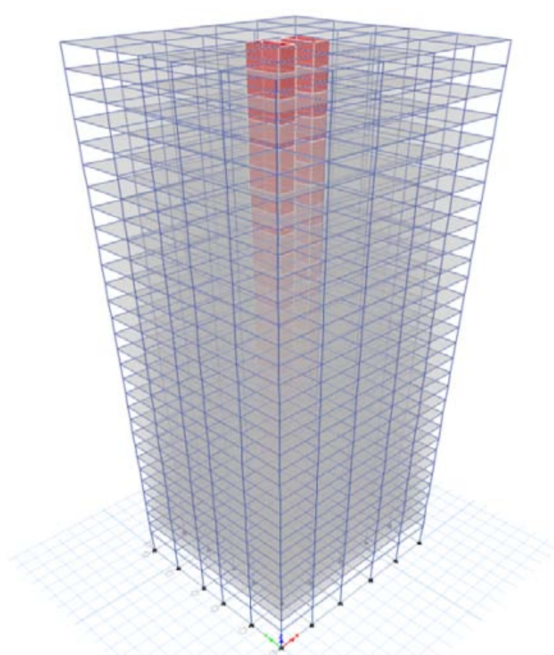


Figure 4: 3D view showing shear wall location for Structure2

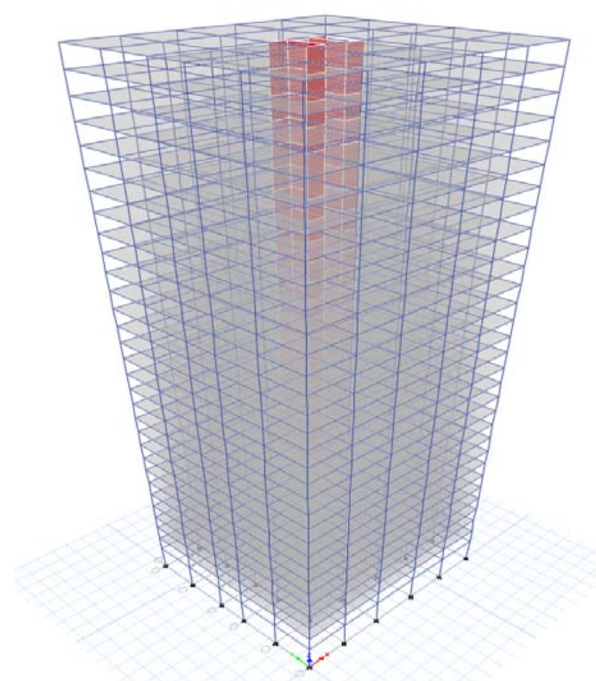


Figure 6: 3D view showing shear wall location for Structure 3

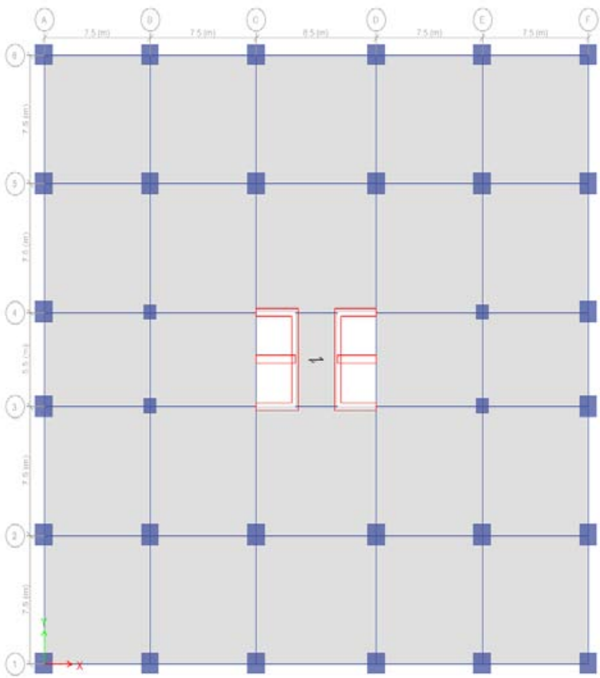


Figure 7: Plan of the Structure 4

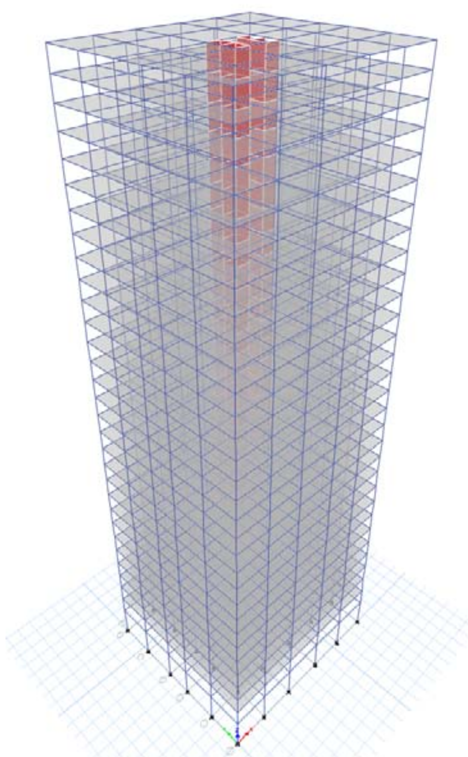


Figure 8: 3D view showing shear wall location for Structure 4

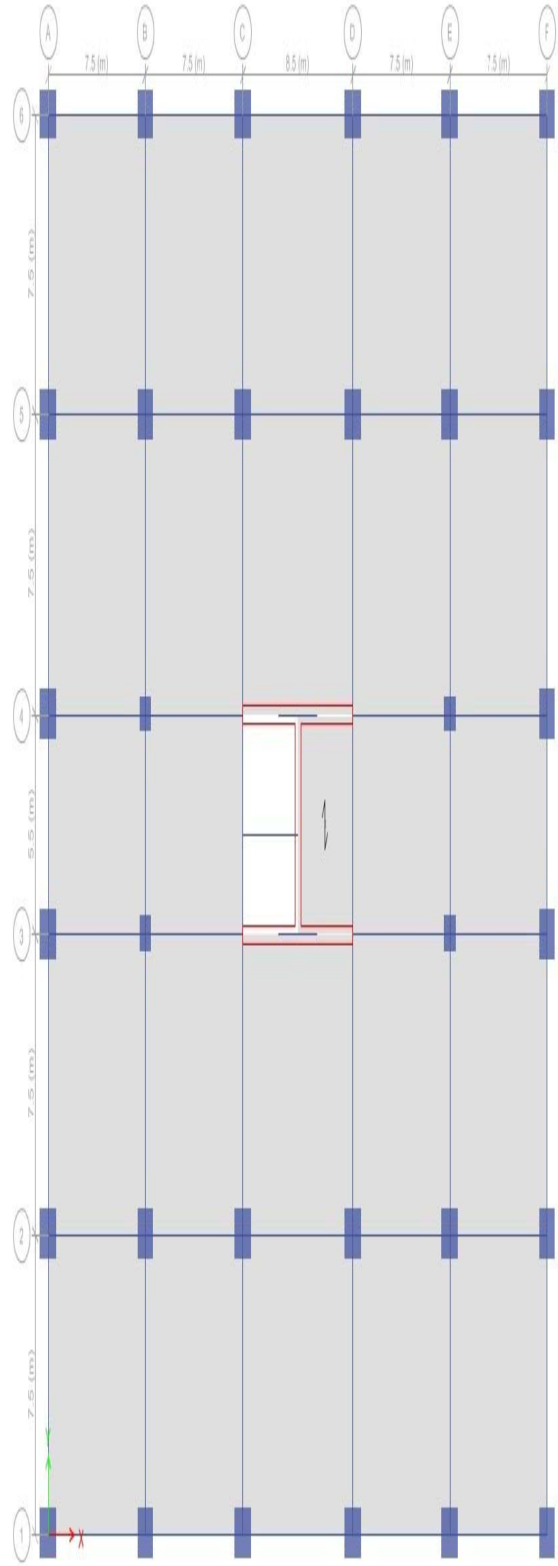


Figure 9: Plan of the Structure 5

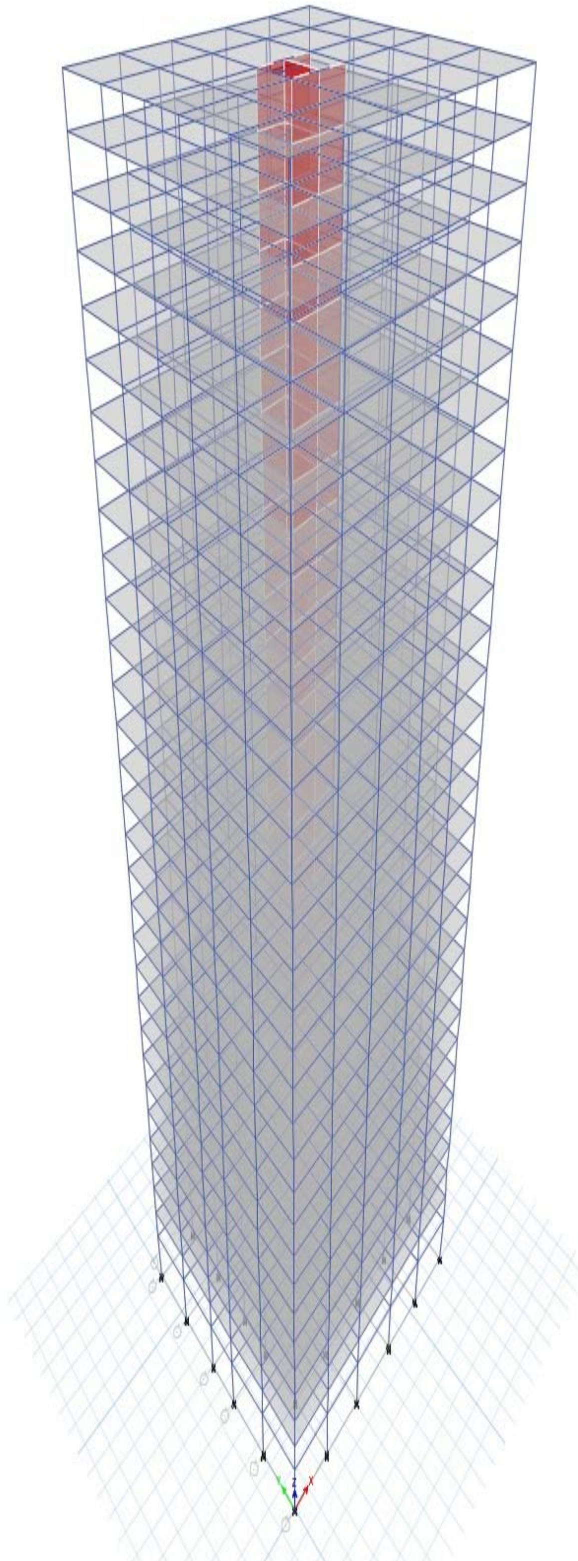


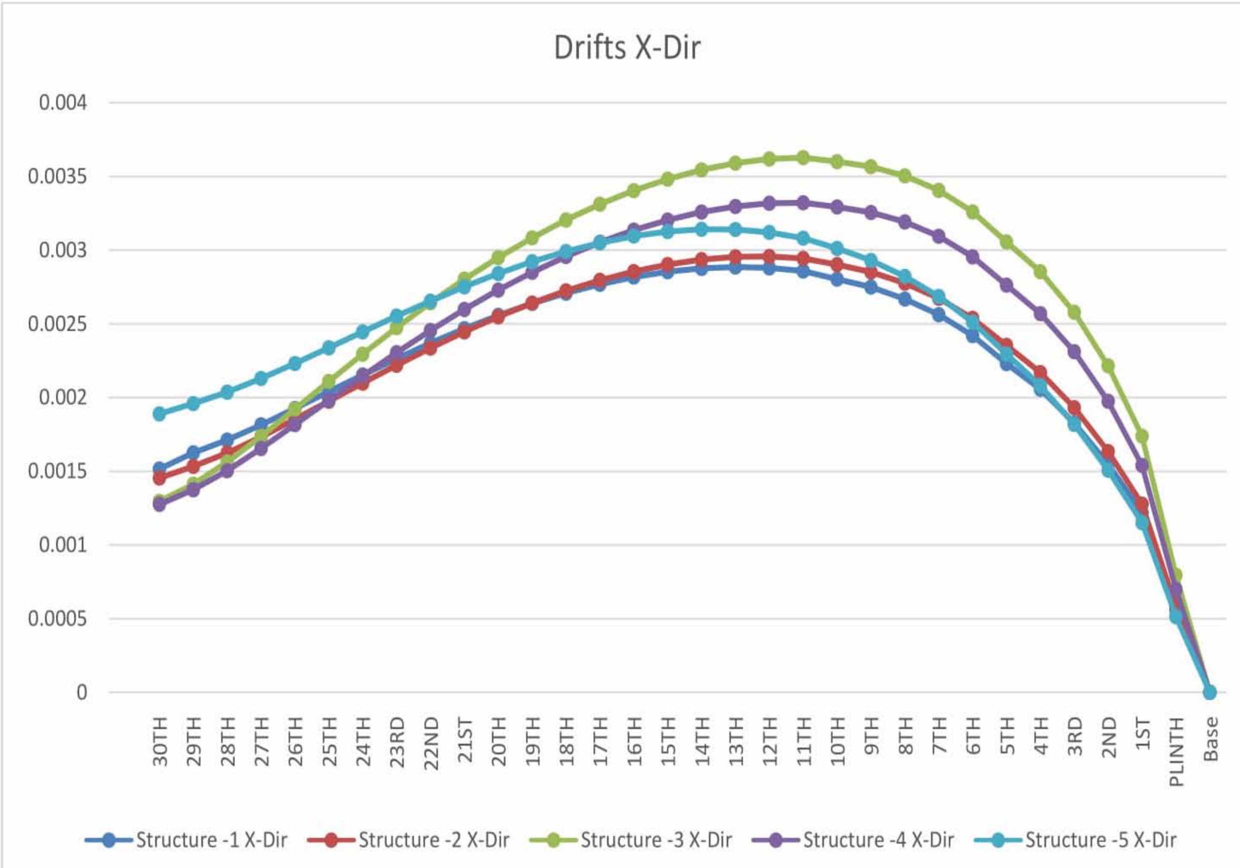
Figure 10: 3D view showing shear wall location for Structure 5

IV. Results and Discussions

Table 2: Storey Drifts of Structures in Soft Soil in X - Direction with load combination (DL+LL+EQXP)

			Structure -1	Structure -2	Structure -3	Structure -4	Structure -5
Story	Elevation	Location	X-Dir	X-Dir	X-Dir	X-Dir	X-Dir
	m						
30TH	111	Top	0.001515	0.001454	0.001295	0.001275	0.001889
29TH	107.5	Top	0.001625	0.001533	0.001411	0.001374	0.001959
28TH	104	Top	0.001711	0.001624	0.001562	0.001503	0.002036
27TH	100.5	Top	0.001814	0.001733	0.001736	0.001654	0.002129
26TH	97	Top	0.001925	0.001852	0.001921	0.001816	0.002231
25TH	93.5	Top	0.00204	0.001975	0.002109	0.001981	0.002337
24TH	90	Top	0.002153	0.002098	0.002294	0.002145	0.002445
23RD	86.5	Top	0.002263	0.002219	0.002473	0.002304	0.002552
22ND	83	Top	0.002369	0.002336	0.002643	0.002455	0.002654
21ST	79.5	Top	0.002467	0.002446	0.002802	0.002597	0.002751
20TH	76	Top	0.002557	0.002548	0.002949	0.002729	0.002841
19TH	72.5	Top	0.002638	0.002641	0.003083	0.002849	0.002921
18TH	69	Top	0.002708	0.002724	0.003204	0.002957	0.002991
17TH	65.5	Top	0.002768	0.002796	0.003311	0.003053	0.003049
16TH	62	Top	0.002817	0.002855	0.003403	0.003135	0.003095
15TH	58.5	Top	0.002853	0.002902	0.003481	0.003203	0.003126
14TH	55	Top	0.002876	0.002936	0.003544	0.003258	0.003141
13TH	51.5	Top	0.002885	0.002955	0.00359	0.003296	0.00314
12TH	48	Top	0.002879	0.002957	0.003618	0.003318	0.00312
11TH	44.5	Top	0.002858	0.002944	0.003627	0.003321	0.003081
10TH	41	Top	0.002803	0.002902	0.0036	0.003293	0.003011
9TH	37.5	Top	0.002749	0.002852	0.003566	0.003255	0.00293
8TH	34	Top	0.002668	0.002776	0.003503	0.003191	0.002822
7TH	30.5	Top	0.002562	0.002674	0.003405	0.003094	0.002685
6TH	27	Top	0.00242	0.002537	0.003259	0.002954	0.002511
5TH	23.5	Top	0.00223	0.002354	0.003055	0.002762	0.002294
4TH	20	Top	0.002056	0.00217	0.002853	0.002569	0.00208
3RD	16.5	Top	0.001827	0.001931	0.002578	0.002311	0.001817
2ND	13	Top	0.001548	0.001634	0.002214	0.001974	0.001506
1ST	9.5	Top	0.00122	0.001277	0.001738	0.001539	0.001151
PLINTH	6	Top	0.00056	0.000581	0.000794	0.000698	0.000513
Base	0	Top	0	0	0	0	0

A plot for Storey Drifts of Structures in Soft Soil in X - Direction with load combination (DL+LL+EQXP) has been shown here



Graph 1: Storey Drifts of Structures in Soft Soil in X - Direction

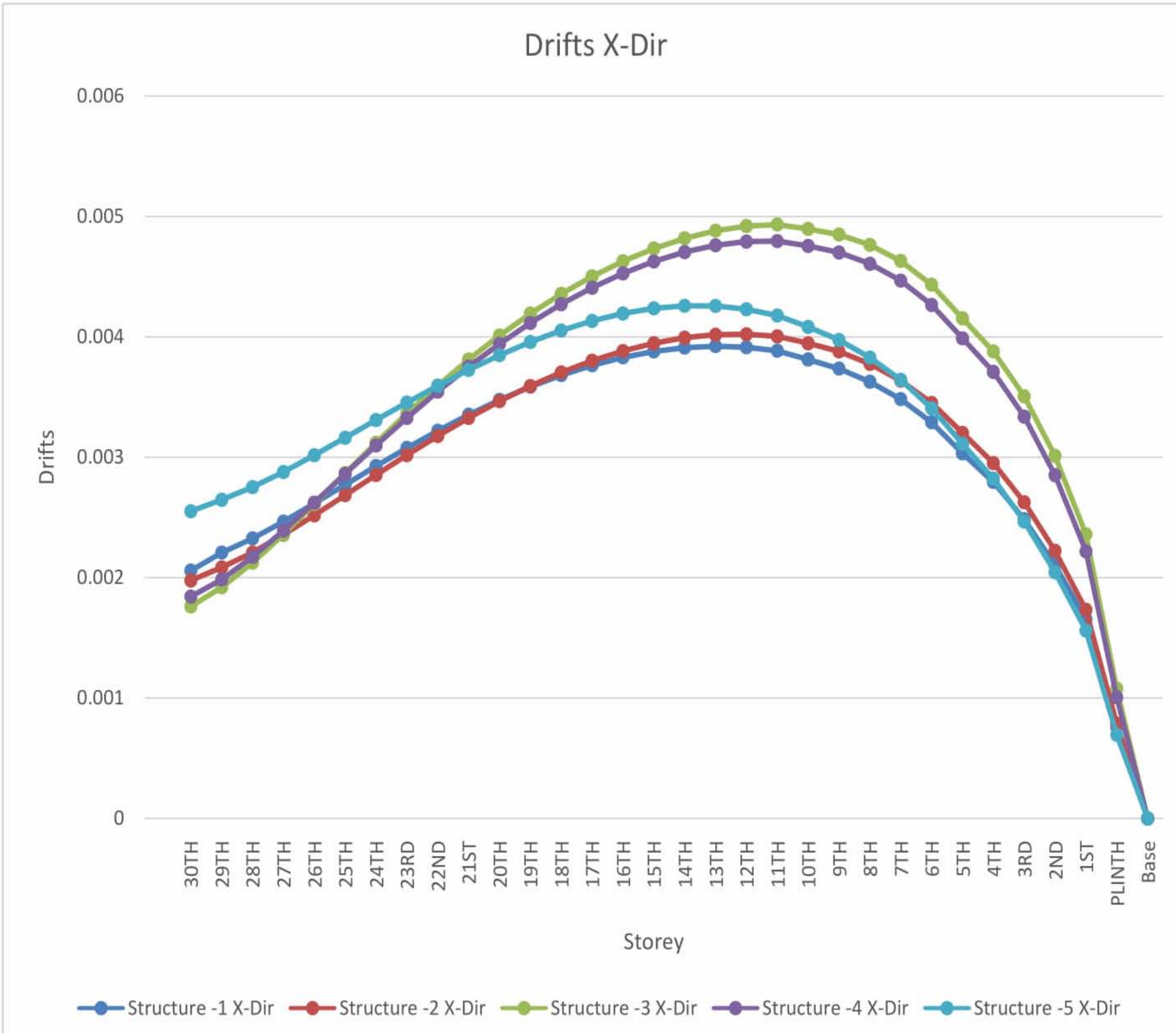
Table 3: Storey Drifts of Structures in Medium Soil in X - Direction with load combination (DL+LL+EQXP)

			Structure -1	Structure -2	Structure -3	Structure -4	Structure -5
Story	Elevation	Location	X-Dir	X-Dir	X-Dir	X-Dir	X-Dir
	m						
30TH	111	Top	0.002059	0.001977	0.001761	0.001843	0.002552
29TH	107.5	Top	0.002208	0.002085	0.00192	0.001985	0.002647
28TH	104	Top	0.002326	0.002209	0.002124	0.002172	0.002752
27TH	100.5	Top	0.002465	0.002357	0.00236	0.00239	0.002878
26TH	97	Top	0.002617	0.002518	0.002612	0.002623	0.003017
25TH	93.5	Top	0.002772	0.002685	0.002868	0.002861	0.003162
24TH	90	Top	0.002927	0.002853	0.00312	0.003098	0.003309
23RD	86.5	Top	0.003077	0.003018	0.003364	0.003327	0.003454
22ND	83	Top	0.00322	0.003177	0.003595	0.003546	0.003594
21ST	79.5	Top	0.003353	0.003327	0.003811	0.003751	0.003726
20TH	76	Top	0.003476	0.003466	0.004011	0.003941	0.003848
19TH	72.5	Top	0.003586	0.003592	0.004193	0.004115	0.003957

Global Journal of Researches in Engineering (E) Volume XVIII Issue I Version I Year 2018

18TH	69	Top	0.003682	0.003705	0.004357	0.004271	0.004053
17TH	65.5	Top	0.003764	0.003802	0.004503	0.004408	0.004132
16TH	62	Top	0.00383	0.003883	0.004628	0.004527	0.004194
15TH	58.5	Top	0.003879	0.003947	0.004734	0.004626	0.004237
14TH	55	Top	0.003911	0.003993	0.004819	0.004704	0.004258
13TH	51.5	Top	0.003923	0.004018	0.004882	0.00476	0.004257
12TH	48	Top	0.003914	0.004022	0.00492	0.004791	0.00423
11TH	44.5	Top	0.003885	0.004004	0.004933	0.004795	0.004177
10TH	41	Top	0.003812	0.003947	0.004897	0.004755	0.004083
9TH	37.5	Top	0.003737	0.003879	0.00485	0.0047	0.003974
8TH	34	Top	0.003627	0.003776	0.004764	0.004607	0.003828
7TH	30.5	Top	0.003483	0.003637	0.004631	0.004467	0.003643
6TH	27	Top	0.00329	0.003451	0.004433	0.004265	0.003407
5TH	23.5	Top	0.003032	0.003202	0.004154	0.003988	0.003112
4TH	20	Top	0.002795	0.002952	0.00388	0.003709	0.002823
3RD	16.5	Top	0.002485	0.002627	0.003507	0.003337	0.002466
2ND	13	Top	0.002104	0.002223	0.003011	0.002851	0.002045
1ST	9.5	Top	0.001656	0.001733	0.00236	0.002218	0.001561
PLINTH	6	Top	0.00076	0.000787	0.001079	0.001006	0.000695
Base	0	Top	0	0	0	0	0

A plot for Storey Drifts of Structures in Medium Soil in X - Direction with load combination (DL+LL+EQXP) has been shown here



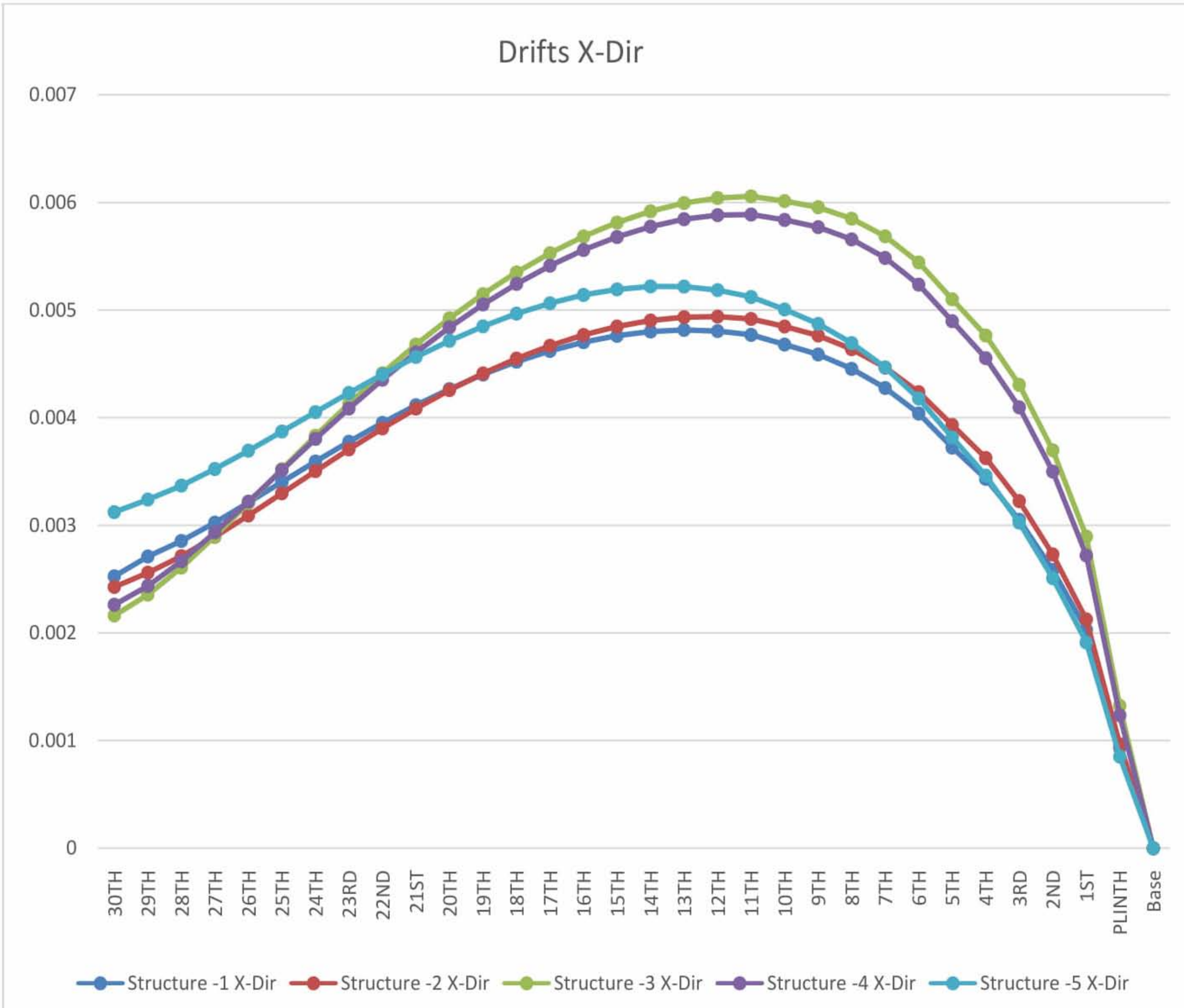
Graph 2: Storey Drifts of Structures in Medium Soil in X - Direction

Global Journal of Researches in Engineering (E) Volume XVIII Issue I Version I Year 2018

Table 4: Storey Drifts of Structures in Hard Soil in X - Direction with load combination (DL+LL+EQXP)

			Structure -1	Structure -2	Structure -3	Structure -4	Structure -5
Story	Elevation	Location	X-Dir	X-Dir	X-Dir	X-Dir	X-Dir
	m						
30TH	111	Top	0.002527	0.002428	0.002163	0.002263	0.003123
29TH	107.5	Top	0.002711	0.00256	0.002357	0.002438	0.00324
28TH	104	Top	0.002855	0.002713	0.002608	0.002667	0.003369
27TH	100.5	Top	0.003026	0.002894	0.002899	0.002935	0.003524
26TH	97	Top	0.003213	0.003092	0.003208	0.003221	0.003694
25TH	93.5	Top	0.003403	0.003297	0.003522	0.003514	0.003872
24TH	90	Top	0.003593	0.003504	0.003832	0.003804	0.004052
23RD	86.5	Top	0.003777	0.003706	0.004131	0.004086	0.004231
22ND	83	Top	0.003953	0.003901	0.004414	0.004354	0.004402
21ST	79.5	Top	0.004117	0.004085	0.00468	0.004606	0.004565
20TH	76	Top	0.004267	0.004256	0.004925	0.00484	0.004715
19TH	72.5	Top	0.004402	0.004411	0.005149	0.005053	0.004849
18TH	69	Top	0.004521	0.004549	0.005351	0.005244	0.004967
17TH	65.5	Top	0.004621	0.004669	0.005529	0.005413	0.005064
16TH	62	Top	0.004702	0.004768	0.005684	0.005559	0.005141
15TH	58.5	Top	0.004762	0.004847	0.005814	0.00568	0.005193
14TH	55	Top	0.004801	0.004903	0.005918	0.005776	0.00522
13TH	51.5	Top	0.004816	0.004934	0.005995	0.005845	0.005219
12TH	48	Top	0.004805	0.004939	0.006042	0.005883	0.005186
11TH	44.5	Top	0.00477	0.004917	0.006057	0.005888	0.005122
10TH	41	Top	0.00468	0.004847	0.006013	0.005838	0.005006
9TH	37.5	Top	0.004588	0.004763	0.005956	0.005771	0.004873
8TH	34	Top	0.004454	0.004637	0.00585	0.005657	0.004694
7TH	30.5	Top	0.004276	0.004466	0.005686	0.005485	0.004467
6TH	27	Top	0.004039	0.004237	0.005443	0.005237	0.004179
5TH	23.5	Top	0.003723	0.003932	0.005101	0.004897	0.003817
4TH	20	Top	0.003432	0.003625	0.004764	0.004554	0.003463
3RD	16.5	Top	0.003051	0.003225	0.004306	0.004097	0.003026
2ND	13	Top	0.002584	0.002729	0.003698	0.0035	0.002509
1ST	9.5	Top	0.002031	0.002126	0.002896	0.002721	0.001913
PLINTH	6	Top	0.000932	0.000967	0.001324	0.001235	0.000852
Base	0	Top	0	0	0	0	0

A plot for Storey Drifts of Structures in Hard Soil in X - Direction with load combination (DL+LL+EQXP) has been shown here



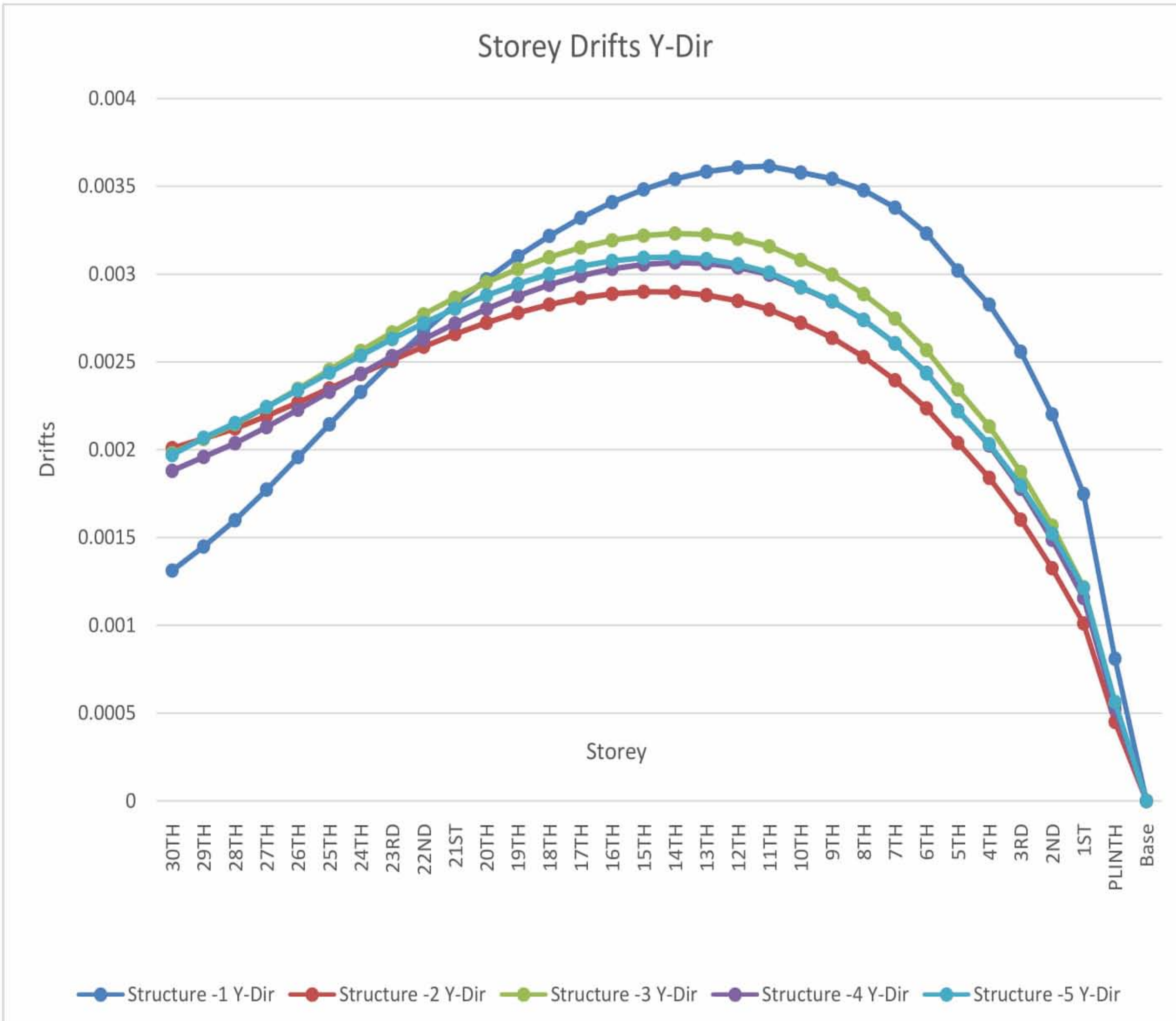
Graph 3: Storey Drifts of Structures in Hard Soil in X - Direction

Table 5: Storey Drifts of Structures in Soft Soil in Y - Direction with load combination (DL+LL+EQYP)

			Structure -1	Structure -2	Structure -3	Structure -4	Structure -5
Story	Elevation	Location	Y-Dir	Y-Dir	Y-Dir	Y-Dir	Y-Dir
	m						
30TH	111	Top	0.001312	0.002009	0.00198	0.00188	0.00197
29TH	107.5	Top	0.001449	0.002063	0.002063	0.001959	0.002069
28TH	104	Top	0.001599	0.002121	0.002146	0.002037	0.002152
27TH	100.5	Top	0.001773	0.002192	0.002243	0.002129	0.002243
26TH	97	Top	0.001958	0.002269	0.002347	0.002228	0.00234
25TH	93.5	Top	0.002145	0.002349	0.002455	0.00233	0.002439
24TH	90	Top	0.002329	0.002431	0.002563	0.002433	0.002536
23RD	86.5	Top	0.002505	0.002511	0.002669	0.002533	0.002631
22ND	83	Top	0.002672	0.002587	0.002771	0.002629	0.002721
21ST	79.5	Top	0.002828	0.002659	0.002866	0.002719	0.002804
20TH	76	Top	0.002971	0.002723	0.002953	0.002802	0.002879
19TH	72.5	Top	0.003102	0.00278	0.00303	0.002875	0.002945
18TH	69	Top	0.003218	0.002827	0.003097	0.002939	0.003001
17TH	65.5	Top	0.003321	0.002864	0.003152	0.00299	0.003045
16TH	62	Top	0.00341	0.002888	0.003193	0.00303	0.003076
15TH	58.5	Top	0.003483	0.0029	0.00322	0.003055	0.003094
14TH	55	Top	0.003542	0.002898	0.003232	0.003066	0.003098
13TH	51.5	Top	0.003584	0.002881	0.003226	0.003061	0.003086
12TH	48	Top	0.003608	0.002848	0.003202	0.003038	0.003057
11TH	44.5	Top	0.003615	0.002798	0.003159	0.002997	0.00301
10TH	41	Top	0.003579	0.002723	0.003081	0.002924	0.002928
9TH	37.5	Top	0.003544	0.002637	0.002998	0.002845	0.002848
8TH	34	Top	0.003478	0.002528	0.002887	0.002739	0.00274
7TH	30.5	Top	0.003379	0.002396	0.002747	0.002606	0.002606
6TH	27	Top	0.003232	0.002236	0.002568	0.002437	0.002435
5TH	23.5	Top	0.003021	0.002039	0.002343	0.002224	0.00222
4TH	20	Top	0.002827	0.00184	0.002133	0.002024	0.002032
3RD	16.5	Top	0.002559	0.001602	0.001874	0.001778	0.001797
2ND	13	Top	0.002202	0.001325	0.001568	0.001487	0.001523
1ST	9.5	Top	0.001748	0.001011	0.001217	0.001155	0.001213
PLINTH	6	Top	0.00081	0.00045	0.000551	0.000523	0.000564
Base	0	Top	0	0	0	0	0

Global Journal of Researches in Engineering (E) Volume XVIII Issue I Version I Year 2018

A plot for Storey Drifts of Structures in Soft Soil in Y - Direction with load combination (DL+LL+EQXP) has been shown here



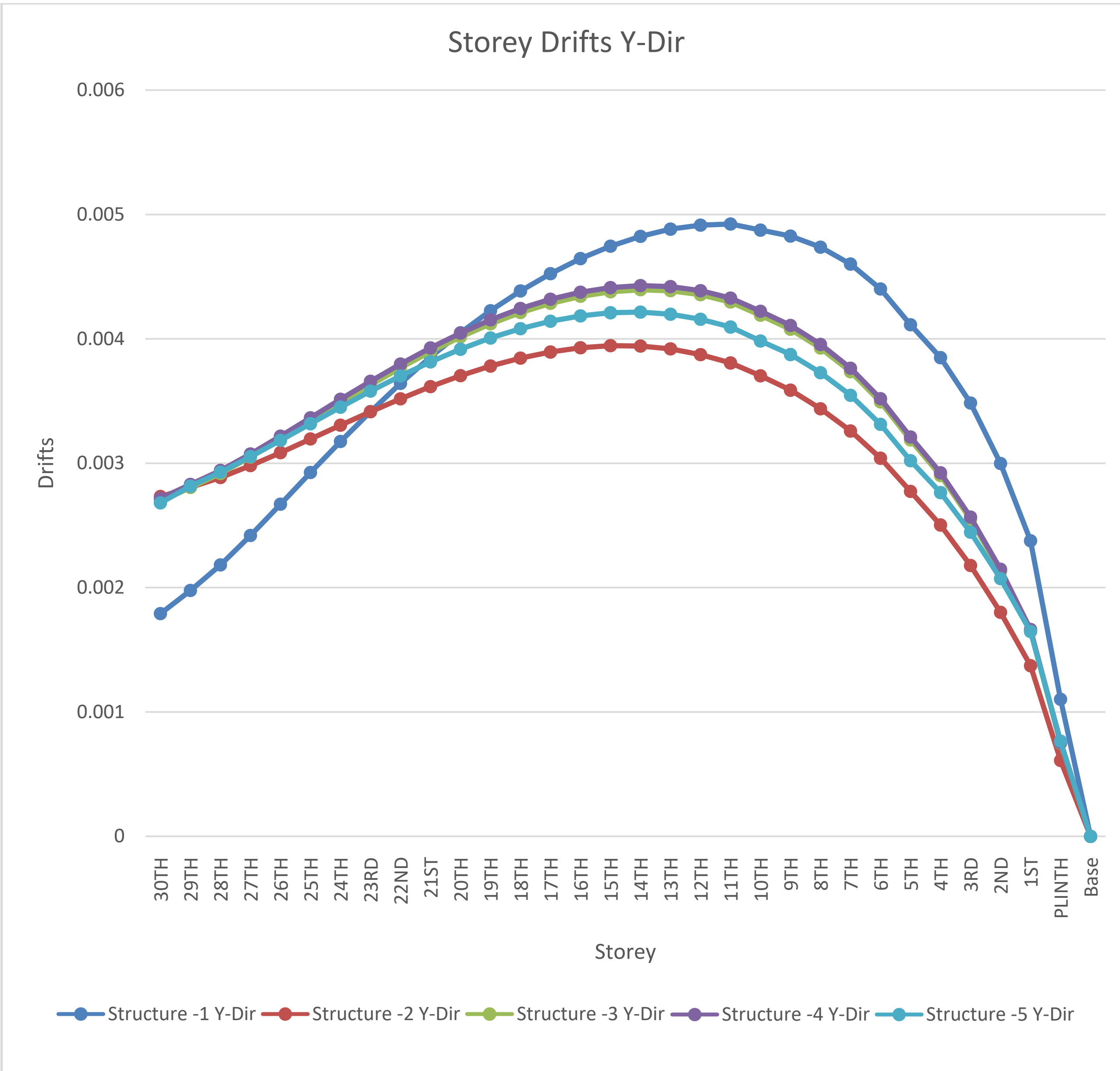
Graph 4: Storey Drifts of Structures in Soft Soil in Y - Direction

Table 6: Storey Drifts of Structures in Medium Soil in Y - Direction with load combination (DL+LL+EQYP)

			Structure -1	Structure -2	Structure -3	Structure -4	Structure -5
Story	Elevation	Location	Y-Dir	Y-Dir	Y-Dir	Y-Dir	Y-Dir
	m						
30TH	111	Top	0.001791	0.002732	0.002693	0.002717	0.002681
29TH	107.5	Top	0.001977	0.002806	0.002806	0.00283	0.002816
28TH	104	Top	0.002182	0.002885	0.002918	0.002942	0.002928
27TH	100.5	Top	0.002419	0.002981	0.00305	0.003075	0.003053
26TH	97	Top	0.002671	0.003085	0.003192	0.003218	0.003184
25TH	93.5	Top	0.002926	0.003195	0.003339	0.003365	0.003318

24TH	90	Top	0.003175	0.003306	0.003486	0.003514	0.003451
23RD	86.5	Top	0.003415	0.003414	0.00363	0.003659	0.00358
22ND	83	Top	0.003642	0.003518	0.003768	0.003797	0.003702
21ST	79.5	Top	0.003854	0.003616	0.003897	0.003927	0.003815
20TH	76	Top	0.004049	0.003704	0.004016	0.004046	0.003917
19TH	72.5	Top	0.004226	0.003781	0.004121	0.004153	0.004007
18TH	69	Top	0.004385	0.003845	0.004212	0.004244	0.004082
17TH	65.5	Top	0.004524	0.003894	0.004286	0.004319	0.004142
16TH	62	Top	0.004645	0.003928	0.004342	0.004375	0.004185
15TH	58.5	Top	0.004745	0.003945	0.004379	0.004412	0.00421
14TH	55	Top	0.004824	0.003942	0.004395	0.004428	0.004215
13TH	51.5	Top	0.004882	0.003919	0.004387	0.00442	0.004198
12TH	48	Top	0.004914	0.003873	0.004355	0.004387	0.004158
11TH	44.5	Top	0.004923	0.003806	0.004296	0.004328	0.004095
10TH	41	Top	0.004874	0.003703	0.00419	0.004222	0.003983
9TH	37.5	Top	0.004826	0.003587	0.004077	0.004108	0.003874
8TH	34	Top	0.004737	0.003438	0.003926	0.003955	0.003728
7TH	30.5	Top	0.004601	0.003259	0.003736	0.003764	0.003546
6TH	27	Top	0.004401	0.00304	0.003493	0.003519	0.003313
5TH	23.5	Top	0.004113	0.002773	0.003187	0.003211	0.003021
4TH	20	Top	0.003849	0.002503	0.002901	0.002923	0.002764
3RD	16.5	Top	0.003484	0.002178	0.002548	0.002567	0.002445
2ND	13	Top	0.002998	0.001801	0.002132	0.002147	0.002072
1ST	9.5	Top	0.002376	0.001372	0.001652	0.001663	0.001647
PLINTH	6	Top	0.001102	0.00061	0.000749	0.000754	0.000766
Base	0	Top	0	0	0	0	0

A plot for Storey Drifts of Structures in Medium Soil in Y - Direction with load combination (DL+LL+EQYP) has been shown here

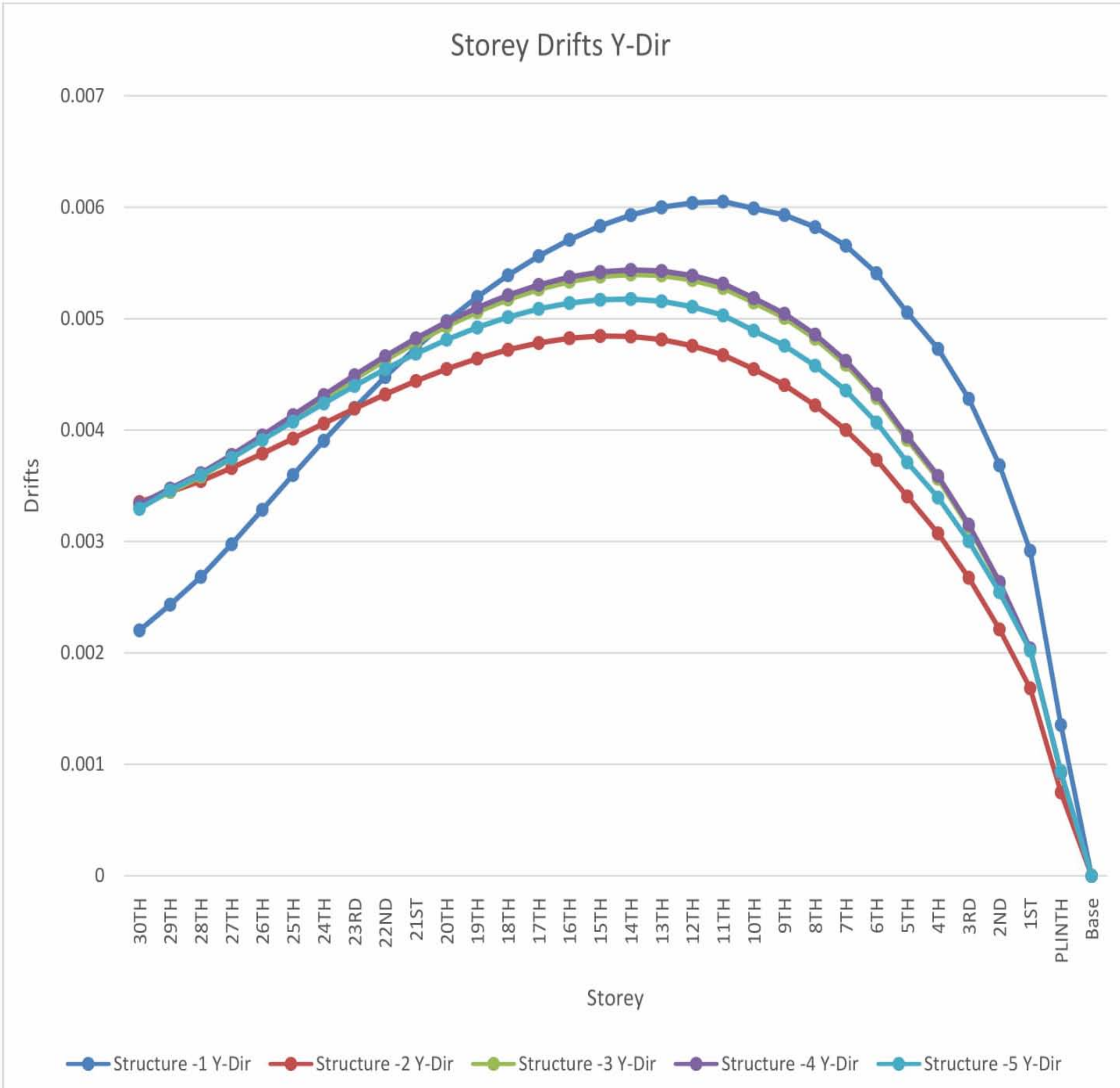


Graph 5: Storey Drifts of Structures in Medium Soil in Y - Direction

Table 7: Storey Drifts of Structures in Hard Soil in Y - Direction with load combination (DL+LL+EQYP)

			Structure -1	Structure -2	Structure -3	Structure -4	Structure -5
Story	Elevation	Location	Y-Dir	Y-Dir	Y-Dir	Y-Dir	Y-Dir
	m						
30TH	111	Top	0.002203	0.003354	0.003306	0.003336	0.003293
29TH	107.5	Top	0.002433	0.003446	0.003446	0.003475	0.003459
28TH	104	Top	0.002683	0.003542	0.003584	0.003613	0.003597
27TH	100.5	Top	0.002976	0.00366	0.003746	0.003776	0.00375
26TH	97	Top	0.003285	0.003789	0.00392	0.003951	0.003911
25TH	93.5	Top	0.003597	0.003923	0.0041	0.004133	0.004076
24TH	90	Top	0.003904	0.004059	0.004281	0.004314	0.004239
23RD	86.5	Top	0.004199	0.004193	0.004458	0.004492	0.004397
22ND	83	Top	0.004477	0.00432	0.004627	0.004663	0.004547
21ST	79.5	Top	0.004737	0.00444	0.004786	0.004823	0.004686
20TH	76	Top	0.004977	0.004548	0.004931	0.004969	0.004811
19TH	72.5	Top	0.005194	0.004642	0.00506	0.005099	0.004921
18TH	69	Top	0.005389	0.004721	0.005172	0.005211	0.005014
17TH	65.5	Top	0.005561	0.004782	0.005263	0.005303	0.005088
16TH	62	Top	0.005708	0.004824	0.005332	0.005373	0.00514
15TH	58.5	Top	0.005831	0.004844	0.005378	0.005418	0.00517
14TH	55	Top	0.005929	0.00484	0.005397	0.005437	0.005176
13TH	51.5	Top	0.005999	0.004812	0.005388	0.005428	0.005156
12TH	48	Top	0.006038	0.004756	0.005347	0.005387	0.005107
11TH	44.5	Top	0.00605	0.004673	0.005275	0.005314	0.005029
10TH	41	Top	0.005989	0.004547	0.005145	0.005184	0.004892
9TH	37.5	Top	0.00593	0.004404	0.005007	0.005044	0.004758
8TH	34	Top	0.005821	0.004222	0.004821	0.004857	0.004578
7TH	30.5	Top	0.005654	0.004001	0.004587	0.004621	0.004355
6TH	27	Top	0.005407	0.003733	0.004289	0.004321	0.004069
5TH	23.5	Top	0.005054	0.003405	0.003913	0.003943	0.00371
4TH	20	Top	0.004729	0.003073	0.003563	0.003589	0.003394
3RD	16.5	Top	0.004281	0.002675	0.003129	0.003152	0.003003
2ND	13	Top	0.003684	0.002212	0.002618	0.002637	0.002545
1ST	9.5	Top	0.002917	0.001683	0.002026	0.00204	0.00202
PLINTH	6	Top	0.001354	0.000749	0.00092	0.000926	0.00094
Base	0	Top	0	0	0	0	0

A plot for Storey Drifts of Structures in Hard Soil in Y - Direction with load combination (DL+LL+EQYP) has been shown here



Graph 6: Storey Drifts of Structures in Hard Soil in Y - Direction

V. 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). 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. Because of the inherent factor used in the design specifications, most structures tend to be adequately protected against vertical shaking. 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.

The structural prototype is prepared and lots of data is been collected from the prototype. All the aspects such as safety of structure in shear, moment and in story drift have been collected. So now to check whether to know whether the structure is safe with established shear walls and all construction of core wall in the center we need to compare the graphical values of structure with the shear wall and a simple rigid frame structure.

The structures are supported on soil, most of the designers do not consider the soil structure interaction and its subsequent effect on structures during an earthquake. 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. 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.

a) Story Drift

The tallness of a structure is relative and cannot be defined in absolute terms either in relation to height or the number of stories. The council of Tall Buildings and Urban Habitat considers building having 9 or more stories as high-rise structures. But, from a structural engineer's point of view the tall structure or multi-storied building can be defined as one that, by virtue of its height, is affected by lateral forces due to wind or earthquake or both to an extent. Lateral loads can develop high stresses, produce sway movement or cause vibration. Therefore, it is very important for the structure to have sufficient strength against vertical loads together with adequate stiffness to resist lateral forces. So lateral forces due to wind or seismic loading must be considered for tall building design along with gravity forces vertical loads. Tall and slender buildings are strongly wind sensitive and wind forces are applied to the exposed surfaces of the building, whereas seismic forces are inertial (body forces), which result from the distortion of the ground and the inertial resistance of the building. These forces cause horizontal deflection is the predicted movement of a structure under lateral loads and story drift is defined as the difference in lateral deflection between two adjacent stories. Lateral deflection and drift have three effects on a structure; the movement can affect the structural elements (such as beams and columns); the movements can affect non-structural elements (such as the windows and cladding); and the movements can affect adjacent structures. Without proper consideration during the design process, large deflections and drifts can have adverse effects on structural elements, nonstructural elements, and adjacent structures.

When the initial sizes of the frame members have been selected, an approximate check on the horizontal drift of the structures can be made. The drift in the non-slender rigid frame is mainly caused by racking. This racking may be considered as comprising two components: the first is due to rotation of the joints, as allowed by the double bending of the girders, while the second is caused by double bending of the columns. If the rigid frame is slender, a contribution to drift caused by the overall bending of the frame, resulting from axial deformations of the columns, may be significant. If the frame has height width ratio less than 4:1, the contribution of overall bending to the total drift at the top of the structure is usually less than 10% of that due to racking. The following method of calculation for drift allows the separate determination of the components attributable to beam bending, and overall cantilever action. Drift problem as the horizontal displacement of all tall buildings is one of the most serious issues in tall building design, relating to the dynamic characteristics of the building during earthquakes and strong winds. Drift shall be caused by the accumulated deformations of each member, such as a beam, column and shear wall. In this study analysis is done with changing structural parameters to observe the effect on the drift (lateral deflection) of the tall building due to both wind and earthquake loading. There are three major types of

Global Journal of Researches in Engineering (E) Volume XVIII Issue I Version I Year 2018

structures were identified in this study, such as rigid frame, coupled shear wall and wall frame structures.

IS 1893 Part 1 Codal Provoisions for Storey Drift Limitations

The storey drift in any storey due to the minimum specified design lateral force, with partial load factor of 1.0, shall not exceed 0.004 times the storey height For the purposes of displacement requirements only, it is permissible to use seismic force obtained from the computed fundamental period (T) of the building without the lower bound limit on design seismic force specified in dynamic analysis.

The result obtained from the analysis models will be discussed and compared as follows:

b) It is observed that

- The maximum storey drift in X-direction occurred at storey 13 th for structure1 in hard ,medium and soft soil.
- The maximum storey drift in X-direction occurred at storey 12 th for structure 2 in hard ,medium and soft soil.
- The maximum storey drift in X-direction occurred at storey 11 th for structure 3 in hard ,medium and soft soil.
- The maximum storey drift in X-direction occurred at storey 11 th for structure 4 in hard ,medium and soft soil.
- The maximum storey drift in X-direction occurred at storey 14 th for structure 5 in hard ,medium and soft soil.

Table 8: Comparation Percentage of Story Drifts in Soft soil of Structures 2,3,4,5 with Structure -1

Story Drifts		Structure -2	Structure -3	Structure -4	Structure -5
Load Case/Combo	Direction	%	%	%	%
DLLLEQXP	X	1%	14%	8%	7%
DLLLEQYP	Y	-20%	-8%	-13%	-11%

Table 9: Comparation Percentage of Story Drifts in medium soil of Structures 2,3,4,5 with Structure -1

Story Drifts		Structure -2	Structure -3	Structure -4	Structure -5
Load Case/Combo	Direction	%	%	%	%
DLLLEQXP	X	1%	14%	13%	7%
DLLLEQYP	Y	-20%	-8%	-7%	-11%

Table 10: Comparation Percentage of Story Drifts in hard soil of Structures 2,3,4,5 with Structure -1

Story Drifts		Structure -2	Structure -3	Structure -4	Structure -5
Load Case/Combo	Direction	%	%	%	%
DLLLEQXP	X	1%	14%	13%	7%
DLLLEQYP	Y	-20%	-8%	-7%	-11%

Table 11: Comparation Percentage of Drifts of medium soil and hard soil with soft soil for Structure -1

Structure -1		SOIL TYPE II	SOIL TYPE III
Load Case/Combo	Direction	%	%
DLLLEQXP	X	26%	39%
DLLLEQYP	Y	26%	39%

Table 12: Comparation Percentage of Drifts of medium soil and hard soil with soft soil for Structure -2

Structure -2		SOIL TYPE II	SOIL TYPE III
Load Case/Combo	Direction	%	%
DLLLEQXP	X	26%	39%
DLLLEQYP	Y	26%	39%

Table 13: Comparation Percentage of Drifts of medium soil and hard soil with soft soil for Structure -3

Structure -3		SOIL TYPE II	SOIL TYPE III
Load Case/Combo	Direction	%	%
DLLLEQXP	X	26%	39%
DLLLEQYP	Y	26%	39%

Table 14: Comparation Percentage of Drifts of medium soil and hard soil with soft soil for Structure -4

Structure -4		SOIL TYPE II	SOIL TYPE III
Load Case/Combo	Direction	%	%
DLLLEQXP	X	30%	42%
DLLLEQYP	Y	30%	42%

Table 15: Comparation Percentage of Drifts of medium soil and hard soil with soft soil for Structure -5

Structure -5		SOIL TYPE II	SOIL TYPE III
Load Case/Combo	Direction	%	%
DLLLEQXP	X	25%	39%
DLLLEQYP	Y	26%	39%

VI. Conclusions

In this paper, reinforced concrete shear wall buildings were analyzed with the procedures laid out in IS codes. Seismic performance of building model is evaluated. In this study, regular shaped structures have been considered. Estimation of drift was carried out for Dual frame system with shear wall structure. This study indicates that the drift on high rise structures has to be considered as it has a notable magnitude. So every tall structure should include the drift due to earthquake load.

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

1. Building with box shape Shear Walls provided at the center core showed better performance in term of maximum storey drifts.
2. From result observed that drift is increased as height of building increased and reduced at top floor.
3. From the comparison of story drift values it can be observed that maximum reduction in drift values is obtained when shear walls are provided at center of the building.
4. As per code, the actual drift is less than permissible drift. The parallel arrangement of shear wall in the center core and outer periphery is giving very good result in controlling drift in both the direction. The better performance for all the structures with soft soil because it has low storey drift.
5. Storey drifts are found within the limit ,As per Indian standard, Criteria for earthquake resistant design of structures, IS 1893 (Part 1) : 2002, the story drift in any story due to service load shall not exceed 0.004 times the story height.
6. The moment resisting frame with shear walls are very good in lateral force such as earthquake and wind force. The shear walls provide lateral load distribution by transferring the wind and earthquake

loads to the foundation. And also impact on the lateral stiffness of the system and also carries gravity loads.

7. For severe lateral loads caused by wind load and or earthquake load, the reinforced shear wall is obvious. Because, it produces less deflection and less bending moment in connecting beams under lateral loads than all others structural system.
8. 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.
9. ETABS is the advanced software which is used for analysing any kind of building structures. By its fast and accuracy it can easily analyses buildings up to 40 floors.
10. ETABS can analyse any building structure with pre-determined load conditions and load combinations for shear walls regarding IS codes.
11. So, for designing of building shear wall structure if we use ETABS software then it analyse the building easily and give the fast results with accurate data.

References Références Referencias

1. Duggal, S.K., "Earthquake Resistant Design of Structures" Oxford University Press, New Delhi 2010
2. Chopra, A.K., "Dynamics of Structures: Theory and Application to Earthquake Engineering", Pearson Education, 4th edition, 2012.
3. Bureau of Indian Standars, IS 456: 2000, "Plain and Reinforced Concrete-Code of practice", New Delhi, India.
4. Bureau of Indian Standards: IS 13920: 1993, "Ductile detailing of reinforced concrete structures subjected to seismic forces-Code of Practice", New Delhi, India.
5. Bureau of Indian Standards: IS 875 (part 1): 1987, "Dead loads on buildings and Structures", New Delhi, India.
6. Bureau of Indian Standards: IS 875 (part 2): 1987, "Live loads on buildings and Structures", New Delhi, India.
7. Bureau of Indian Standards: IS 1893 (part 1): 2002, "Criteria for earthquake resistant design of structures: Part 1 General provisions and buildings", New Delhi, India.
8. Berkeley "ETABS Integrated Building Design Software", Computers and Structure, Inc., California, USA, February 2003.
9. Gary R. scarer and Sigmund A. Freeman" Design drifts requirement for long period structures",13' World conference on earth quake engineering Vancouver, B.C, Canada, Aug 2004 paper no-3292.
10. J.L. Humar and S. Yavari "Design of concrete shear wall buildings for earthquake induced torsion". 4'1" structural conference of the Canadian society for civil engineering June-2002.
11. Mo and Jost, "the seismic response of multistory reinforced concrete framed shear walls using a nonlinear model", Volume 15, Structure Engineering, Issue 3, 1993, Pages 155–166.
12. Paulay, T. & Priestley, M. J. N.. Seismic Design of Reinforced Concrete and Masonry Buildings, JOHN WILEY & SONS, INC, New York. 1992
13. Anand, N. , Mightraj, C. and Prince Arulraj, G. "Seismic behaviour of RCC shear wall under different soil conditions" Indian geotechnical conference, Dec – 2010, pp 119-120.
14. Anshuman, S., Dipendu Bhunia, Bhavin Ramjiyani, "Solution of shear wall location in multistory building", International journal of civil and structural engineering, Vol. 4, Issue 5, pp. 22-32, 2011.
15. Chandiwala, A., "Earthquake Analysis of Building Configuration with Different Position of Shear Wall", International Journal of Emerging Technology and Advanced Engineering ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 2, Issue 12, December 2012
16. Chandurkar, P.P., Dr. Pajgade, P.S., "Seismic analysis of RCC building with and without shear wall", International Journal of Modern Engineering Research. Vol. 3, Issue 3, pp. 1805-1810, 2013.
17. Rahangdale, H., Satone, S.R., "Design and analysis of multi-storied building with effect of shear wall", International journal of engineering research and application", Vol. 3, Issue 3, pp. 223-232, 2013.
18. Agarwal, A.S., and Charkha, S.D., "Effect of change in shear wall location on storey drift of multistorey building subjected to lateral loads", International Journal of Engineering Research and Applications ISSN: 2248-9622 2(3), Vol. 2, Issue 3, May-Jun 2012, pp.1786-1793
19. Shahzad Jamil Sardar and Umesh. N. Karadi, EFFECT OF CHANGE IN SHEAR WALL LOCATION ON STOREY DRIFT OF MULTISTOREY BUILDING SUBJECTED TO LATERAL LOADS, International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization)Vol. 2, Issue 9, September 2013
20. Gaikwad Ujwala Vithal, Effect of Shear Wall on Sesmic Behavior of Unsymmetrical Reinforced Concrete Structure, International Journal of Research and Scientific Innovation (IJRSI) Volume IV, Issue X, October 2017 | ISSN 2321–2705

Global Journal of Researches in Engineering (E) Volume XVIII Issue I Version I Year 2018

21. Mahantesh S Patil 1, Dr. R B Khadiranaikar 2, Dynamic Analysis of High Rise RC Structure with Shear Walls and Coupled Shear Walls, International Journal of Advance Engineering and Research Development Volume 2,Issue 8, August -2015
22. Mayur Sawant1, Prof. G.R. Patil2, Evaluation of Seismic Behaviour of RCC Building Using Coupled Shear wall, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 04 Issue: 08 | Aug -2017 www.irjet.net p-ISSN: 2395-0072
23. C. V. R. Murty, Rupen Goswami, A. R. Vijaya narayanan, Vipul V. Mehta, Some Concepts in Earthquake Behaviour of Buildings, Gujarat State Disaster Management Authority Government of Gujarat, India
24. Professors Durgesh C. Rai, Sudhir K. Jain and C.V.R. Murty, Department of Civil Engineering, IIT Kanpur, short course on “Seismic Design of RC Structures” conducted at Ahmedabad, India during Nov 25-30, 2012.
25. Mariopaz-Structural Dynamics: Theory & computations (Second Edition), CBS Publishers & Distributors-New Delhi, 2004.
26. Makar Nageh “How to Model and Design High Rise Building Using ETABS Program”, Scientific Book House For Publishing and Distributing, Cairo, 2007.
27. Onkar V. Sapate*, Dr. A. M. Pande** Displacement Control of High Rise Structures with the Provision of Shear Wall, International Journal of Engineering Research and Applications, Vol. 1, Issue 4,dec 2011, pp. 1515-1521
28. Himalee Rahangdale *, S.R. Satone** Design And Analysis Of Multi storeied Building With Effect Of Shear Wall International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 3, May-Jun 2013, pp.223-232
29. Abdur Rahman, Saiada Fuadi Fancy, Shamim Ara Bobby, Analysis of drift due to wind loads and earthquake loads on tall structures by programming language c, International Journal of Scientific & Engineering Research, Volume 3, Issue 6, June-2012 1 ISSN 2229-5518
30. Kedavkar, K.D., Kodag, P.B., “Lateral load analysis of RCC building”, Vol.3, Issue.3, pp-1428-1434, ISSN: 2249-6645, International Journal of Modern Engineering Research (IJMER), Vol.3, Issue.3, May-June. 2013 pp-1428-1434
31. M. Ashraf*, Z.A. Siddiqi and M.A. Javed, Configuration Of A Multi storey Building Subjected To Lateral Forces, Asian Journal Of Civil Engineering (Building And Housing) VOL. 9, NO. 5 (2008)PAGES 525-537
32. Mohammed Aejaz Ahmed1 Prof. Dr. Shreenivas Reddy Shahpur2 Prof. Brij Bhushan S3 Prof. Rohan Gurav4 Prof. Shaik Abdull5, Study on Effect of Wind Load and Earthquake Load on Multi storey RC Framed Buildings, IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 10, 2015 | ISSN (online): 2321-0613
33. A. Rahman1, A. A. Masrur Ahmed2* and M. R. Mamun3, Drift analysis due to earthquake load on tall structures, Journal of Civil Engineering and Construction Technology Vol. 4(5), pp. 154-158, May 2012