Study the Effective of Lateral Load on Story Drift in RC Frame Structures

Mahdi Hosseini, Hadi Hosseini, Seyed Amin Ahmadi Olounabadi, Ahmad Hosseini

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. In this study 20 story building with RC shear wall 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 structures were identified in this study, such as rigid frame, coupled shear wall and wall frame structures. 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 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.

Keywords- story drift, wind load, frame structure, Seismic Load, shear wall

I. INTRODUCTION

Lateral loads result from wind or earthquake actions and both can cause a collapse of improperly braced building. The way that wind or earthquake loads act on a building is completely different, but they have the same general effect. These two sources of lateral load are discussed below.

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Wind Load

Wind load is really the result of wind pressures acting on the building surfaces during a wind event. This wind pressure is primarily a function of the wind speed because the pressure or load increases with the square of the wind velocity (i.e., doubling of wind speed results in a four-fold increase in wind load or pressure). Wind load during a hurricane can last hours and a building experiences sustained wind load and short wind impacts (gusts). While the wind pressures are treated as a “static” (do not vary with time) or constant load for purposes of design, the real loads actually fluctuate dramatically with gustiness of wind as well as wind direction. Two fundamental wind effects are of a concern: (1)localized “spikes” in wind pressure that act on small areas of a building to cause damage to items such as roof panels or siding (known as components and cladding wind loads in engineering terms) and (2)averaged wind loads that act on larger areas of the building which the entire structure must resist(known in engineering terms as main wind force resisting system loads).

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 abusive 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: $F = m \times a$, 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.

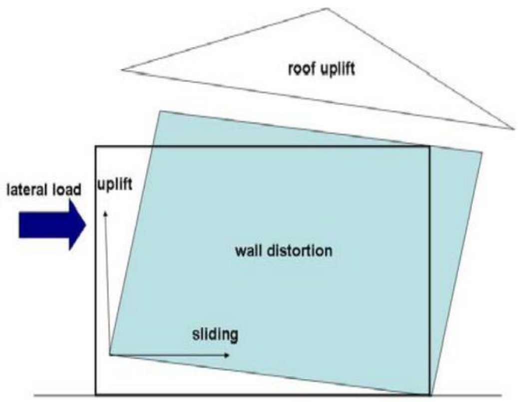

Fig. 1, Schematic of the deformations of the structure due to the lateral loads

II. METHODOLOGY

Semi-Performance-Based Design

The design approach could be considered a "semi-performance-based". The Code Level evaluation aims to have the design meet all prescriptive code requirements with which it is logical that the design comply, without evaluating seismic performance. The MCE (MAXIMUM CREDIBLE EARTHQUAKE) Level Evaluation explicitly considers the performance of the structure at a level for which the structure should not collapse. This evaluation uses state-of-the-art methods of analysis, and structural force and deformation capacities based on expected rather than nominal values. Story drift limitations can be checked at the Code Level, and also at the MCE (MAXIMUM CREDIBLE EARTHQUAKE) Level; for example, using the average of the response-history runs and taking acceptable drift as 1.5 times that in the building code.

All the design philosophies strive for the protection of buildings and may they not completely stop the damage but can lessen the impact. Some of the goals or the minimum objectives of all the design aspects are as listed below.

Minimum Design Objective Recommendations

Traditional code procedures attempt to satisfy implicitly all three objectives by designing to prescriptive rules for a single (design) level of seismic hazard, performance based design of high rise buildings should investigate at least two performance objectives explicitly, they are as follows. Negligible damage in once-in-a-lifetime earthquake shaking demands having a return period of about 50 years (30 years to 72 years depending on jurisdiction and building importance). This objective is achieved by designing for essentially elastic structural response and limiting the story drifts to minimize damage to non-structural components such as cladding and internal walls. Herein, this performance objective is termed the service-level assessment. Collapse prevention under the largest earthquake demands that may occur at the site. This earthquake demand is often taken as that with A return period of approximately 2500 years (sometimes limited by a deterministic cap in regions of high seismicity). Collapse prevention is achieved by demonstrating that are as listed below,

a) Inelastic deformation demands in all the structural elements are smaller than their deformation capacities taking appropriate account of gravity loads, second-order effects and deterioration of stiffness and strength due to cyclic loading.

b) Story deformations are sufficiently small so as to prevent catastrophic damage to non-structural elements. Herein, this design objective is termed the collapse-level assessment.

If the design is accordingly to the above recommendations then the design is said to be the earthquake resistant design. In addition to the above philosophies there is also another design which completely depends on deformation of the structure as a whole.

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Deformation Based Design Philosophy

Deformation is the key parameter in performance-based seismic design rather than force or strength that is used in conventional code design approaches because performance is characterized by the level of damage and damage is related to the degree of elastic and inelastic deformation in components and systems.

Deformations can be classified into three types:

1. Overall building movements
2. Story drifts and other internal relative deformations.
3. Inelastic deformations of structural components and elements. Overall building movement enables a qualitative assessment of building performance only. Although total building deformation can provide some measure of the significance of $P - \Delta$ effects on the response of a building, this is of limited value since peak deflection is transitory.

When a structure vibrating. An earthquake can be resolved in any vibrating. An earthquake can be resolved in any three mutually perpendicular directions-the two horizontal directions (longitudinal and transverse displacement) and the vertical direction (rotation).This motion causes the structure to vibrate or shake in all three directions; the predominant direction of shaking is horizontal. All the structures are designed for the combined effects of gravity loads and seismic loads to verify that adequate vertical and lateral strength and stiffness are achieved to satisfy the structural performance and acceptable deformation levels prescribed in the governing building code. Because of the inherent factor of safety 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.

In general, most earthquake code provisions implicitly require that structures be able to resist:

1. Minor earthquakes without any damage.
2. Moderate earthquakes with negligible structural damage and some non-structural damage.
3. Major earthquakes with some structural and non-structural damage but without collapse.

The structure is expected to undergo fairly large deformations by yielding in some structural members.

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 element or system forces yields to fails, the lateral forces can be redistributed to a secondary system to prevent progressive primary failure.

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.

Equivalent Lateral Force (Seismic Coefficient) Method

This method of finding lateral forces is also known as the static method or the equivalent static method or the seismic coefficient method. The static method is the simplest one and it requires less computational effort and is based on formulae given in the code of practice.

In all the methods of analyzing a multi storey buildings recommended in the code, the structure is treated as discrete system having concentrated masses at floor levels which include the weight of columns and walls in any storey should be equally distributed to the floors above and below the storey. In addition, the appropriate amount of imposed load at this floor is also lumped with it. It is also assumed that the structure flexible and will deflect with respect to the position of foundation the lumped mass system reduces to the solution of a system of second order differential equations. These equations are formed by distribution, of mass and stiffness in a structure, together with its damping characteristics of the ground motion.

Lateral Distribution of Base Shear

The computed base shear is now distributed along the height of the building, the shear force , at any level depends on the mass at that level and deforms shape of the structure . Earth quake forces deflect a structure into number of shapes known as the natural mode shapes. Number of natural mode shapes depends up on the degree of freedom of the system.

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Generally a structure has continuous system with infinite degree of freedom the magnitude of the lateral force at a particular floor (node) depends on the mass of the node , the distribution of stiffness over the height of the structure , and the nodal displacement in the given mode. The actual distribution of base share over the height of the building is obtained as the superposition of all the mode of vibration of the multi - degree of freedom system .

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

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.

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.

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-l):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.

Design Issues

The economic structural design of high-rise buildings is a complex technical challenge, with requirements for lateral stiffness, strength and deformation under wind and earthquakes compounding gravity and constructability issues. In general, as buildings grow taller and more slender, wind loading effects become more significant in comparison to earthquake effects. This is because whilst the wind overturning moment will typically increase as height cubed, the elastic seismic base moment is unlikely to increase at more than height raised to the power 1.25. Accordingly, in regions of moderate seismic hazard, a building structure designed to resist wind effects may require only modest (although vitally important) modifications to meet seismic performance targets. In contrast the design of the lateral force resisting system in a low-rise building at the same site would be entirely governed by seismic requirements.

Critical issues for the design of high-rise buildings in regions prone to significant wind and seismic effects typically include:

- High base overturning moment and foundation design (wind, seismic).

- High shear capacity requirements near base (seismic).
- High gravity stresses in the vertical elements (and use of high-strength materials) to minimize structural sizes for economic structural design and to maximize net floor area.
- Development of ductility in elements at the base of a structure under high
- Compressive gravity stress (seismic).
- Controlling lateral accelerations (wind).
- Controlling storey drift (wind and seismic)
- Controlling damage so as to permit repair (seismic).
- Ensuring ductile energy dissipation mechanisms and preventing brittle failures (seismic).

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 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. NUMERICAL ANALYSES

Structure

G+19 earthquake resistant structure with shear walls

Problems in the Building Due to Earthquake

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.

Geometrical Properties

1.No.of stories of the Building modeal=20
2.Column size=500 mm x 500 mm
3.Beam size= 700 mm x 500 mm
4.Slab thickness=200mm

Loads

1.Live Load=3KN/m2
2.Wall Load=12.4KN/m
3.Floor Finishing =1KN/m2
4. Wind load
Wind coefficients
(i) Wind Speed=50m/s
(ii)Terrain Category =2
(iii) Structure Class=B
(iv) Risk Coefficient(k1)=1
(v)Topography(k3)=1
5.Seismic Loading
(i) Seismic zone factor(Z)=0.36
(ii) Soil Type= Mdeium(II)
(iii) Response Reduction factor(R) =5%
(iv) Storey Range=Base to 20
(v) Important factor(I)=1

Material Properties

(TABLE I) ,materials used in structure and their general properties

Material	Unit weight	Elastic Modulus	Shear Modulus	Poisson Ratio	Thermal expansion coefficient
Text	KN/m3	KN/m2	KN/m2	Unit less	1/C
Concrete	23.563	24855578.28	10356490.95	0.2	0.0000099
Rebar steel	76.973	199947978.8	76903068.77	0.3	0.0000117
Bar steel	76.9730	199947978.8	769030068.77	0.3	0.0000117

Load Combinations

Load combination is the foremost important criteria for designing any structure and more important is the distribution of those loads on to various components of the structure like beams, columns,

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slabs and in our case shears walls and concrete core wall too.There are many kinds of loads existing depending on the location of the where the structure is to be constructed for example in a place where wind is frequent there we have to consider the wind loads and places where rains are heavy rain loads are included and same way all the other loads such as snow loads, earthquake load and etc are included however DEAD LOADS, LIVE LOADS AND IMPOSEDLOADS are always included. Dead loads are all common depending on the structural components and

1. 1.5(DL+ LL)
2. 1.5(DL ± EQXTP)
3. 1.5(DL ± EQYTP)
4. 1.5(DL ± EQXTN)
5. 1.5(DL ± EQYTN)
6. 1.2(DL + LL ± EQXTP)
7. 1.2(DL + LL ± EQYTP)
8. 1.2(DL + LL ± EQXTN)
9. 1.2(DL + LL ± EQYTN)
10. 1.5(DL ± WLX)
11. 1.5(DL ± WLY)
12. 1.2(DL + LL ± WLX)
13. 1.2(DL + LL ± WLY)

DL – Dead Load

LL – Live Load

EQTP–Earthquake load With torsion positive

EQTN–Earthquake load With torsion negative

WL- Wind load

The following Load Combinations have been considered for the Serviceability

1. (DL+ LL)
2. (DL ± EQXTP)
3. (DL ± EQYTP)
4. (DL ± EQXTN)
5. (DL ± EQYTN)
6. (DL + LL ± EQXTP)
7. (DL + LL ± EQYTP)
8. (DL + LL ± EQXTN)
9. (DL + LL ± EQYTN)
10. (DL ± WLX)
11. (DL ± WLY)
12. (DL + LL ± WLX)
13. (DL + LL ± WLY)

DL – Dead Load

LL – Live Load

EQTP–Earthquake load With torsion positive

EQTN–Earthquake load With torsion negative

WL- Wind load

specific gravity of the structure, to get the self weight of the structural component volume or area of the component is multiplied by the specific gravity of the component. Live loads depend on the purpose we are constructing the building. Imposed loads depend on the seismic loads, dead loads and according to are 1893 part 1 percentage of those values is finally considered.

The following Load Combinations have been considered for the design

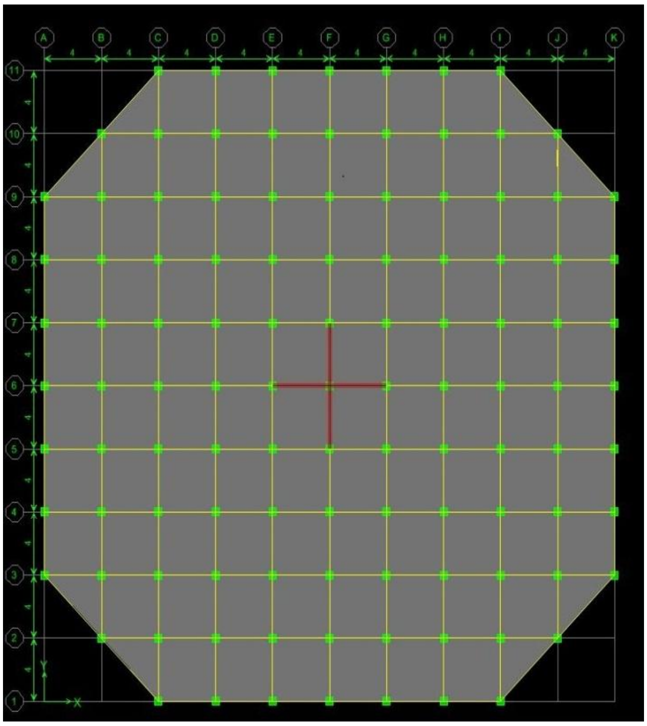


Fig. 2, Basic Plan of the Building

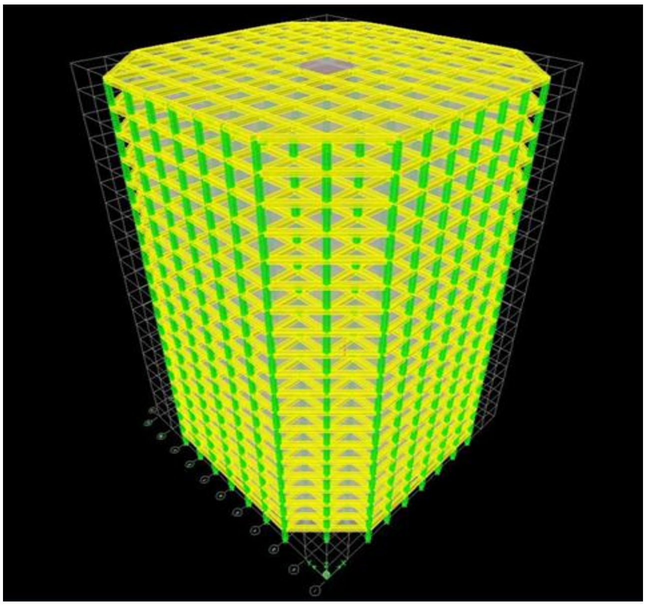


Fig. 3, 3-D modeling

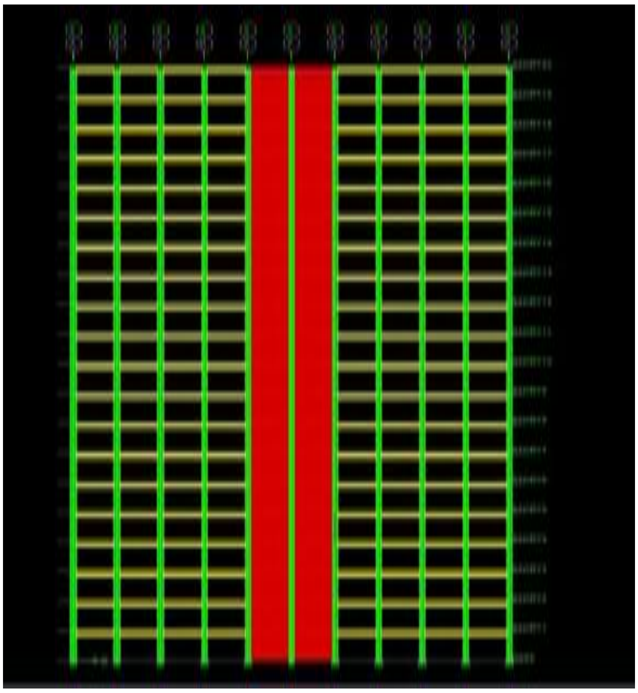


Fig. 4, Elevation of the building

(TABLE III) Story Drift in X and Y Direction

Story	Load	DriftX	DriftY
STORY20	DLLLWLX	0.000032	
STORY20	DLLLWLX		0.000026
STORY19	DLLLWLX	0.000037	
STORY19	DLLLWLX		0.000032
STORY18	DLLLWLX	0.000043	
STORY18	DLLLWLX		0.000038
STORY17	DLLLWLX	0.00005	
STORY17	DLLLWLX		0.000044
STORY16	DLLLWLX	0.000057	
STORY16	DLLLWLX		0.000051
STORY15	DLLLWLX	0.000064	
STORY15	DLLLWLX		0.000058
STORY14	DLLLWLX	0.00007	
STORY14	DLLLWLX		0.000065
STORY13	DLLLWLX	0.000077	
STORY13	DLLLWLX		0.000072
STORY12	DLLLWLX	0.000084	
STORY12	DLLLWLX		0.000079
STORY11	DLLLWLX	0.00009	
STORY11	DLLLWLX		0.000086
STORY10	DLLLWLX	0.000096	
STORY10	DLLLWLX		0.000092
STORY9	DLLLWLX	0.000101	
STORY9	DLLLWLX		0.000098
STORY8	DLLLWLX	0.000106	
STORY8	DLLLWLX		0.000103
STORY7	DLLLWLX	0.000109	
STORY7	DLLLWLX		0.000106
STORY6	DLLLWLX	0.000111	
STORY6	DLLLWLX		0.000109
STORY5	DLLLWLX	0.000111	
STORY5	DLLLWLX		0.000109
STORY4	DLLLWLX	0.000108	
STORY4	DLLLWLX		0.000106
STORY3	DLLLWLX	0.000101	
STORY3	DLLLWLX		0.0001
STORY2	DLLLWLX	0.000088	
STORY2	DLLLWLX		0.000088
STORY1	DLLLWLX	0.000061	
STORY1	DLLLWLX		0.000061

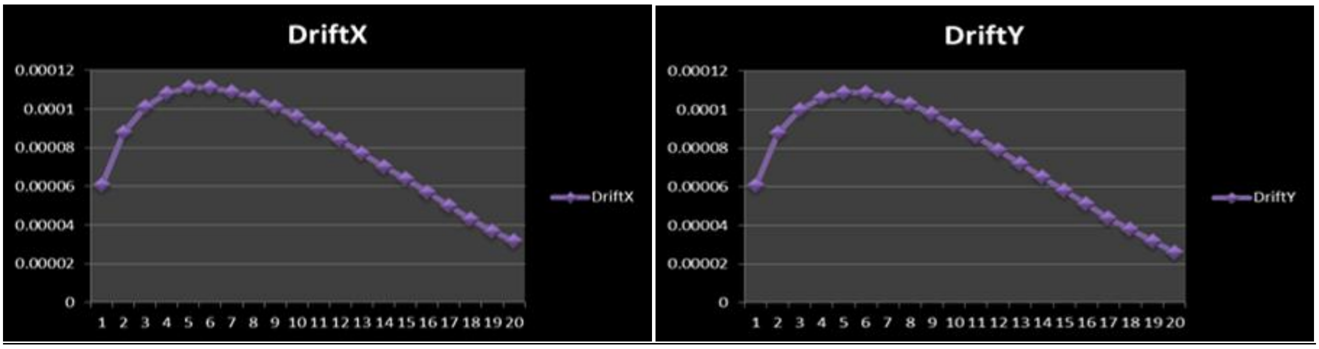


Fig. 5, Story Drift in X&Y Direction

(TABLE IIIII) Story Drift in X and Y Direction

Story	Load	DriftX	DriftY
STORY20	DLLLWLY	0.000032	
STORY20	DLLLWLY		0.000003
STORY19	DLLLWLY	0.000037	
STORY19	DLLLWLY		0.000003
STORY18	DLLLWLY	0.000043	
STORY18	DLLLWLY		0.000003
STORY17	DLLLWLY	0.00005	
STORY17	DLLLWLY		0.000003
STORY16	DLLLWLY	0.000057	
STORY16	DLLLWLY		0.000003
STORY15	DLLLWLY	0.000064	
STORY15	DLLLWLY		0.000003
STORY14	DLLLWLY	0.00007	
STORY14	DLLLWLY		0.000003
STORY13	DLLLWLY	0.000077	
STORY13	DLLLWLY		0.000003
STORY12	DLLLWLY	0.000084	
STORY12	DLLLWLY		0.000003
STORY11	DLLLWLY	0.00009	
STORY11	DLLLWLY		0.000002
STORY10	DLLLWLY	0.000096	
STORY10	DLLLWLY		0.000002
STORY9	DLLLWLY	0.000101	
STORY9	DLLLWLY		0.000002
STORY8	DLLLWLY	0.000106	
STORY8	DLLLWLY		0.000002
STORY7	DLLLWLY	0.000109	
STORY7	DLLLWLY		0.000002
STORY6	DLLLWLY	0.000111	
STORY6	DLLLWLY		0.000001
STORY5	DLLLWLY	0.000111	
STORY5	DLLLWLY		0.000001
STORY4	DLLLWLY	0.000108	
STORY4	DLLLWLY		0.000001
STORY3	DLLLWLY	0.000101	
STORY3	DLLLWLY		0.000001
STORY2	DLLLWLY	0.000088	
STORY2	DLLLWLY		0.000001
STORY1	DLLLWLY	0.000061	
STORY1	DLLLWLY		0

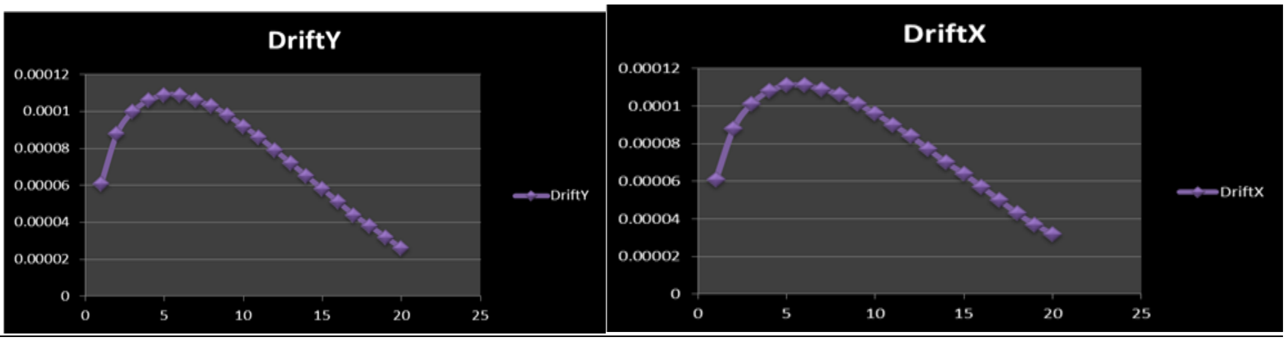
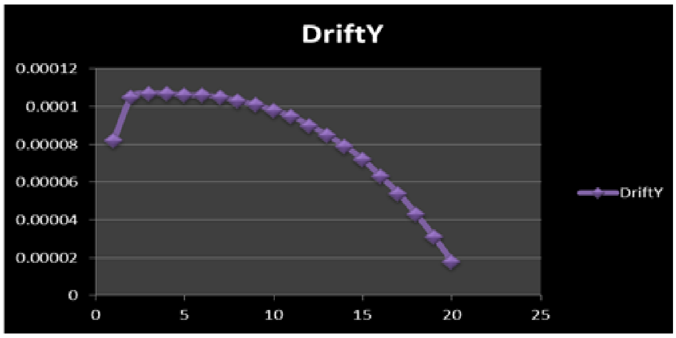


Fig. 6, Story Drift in X&Y Direction

(TABLE IVV) Story Drift in X and Y Direction

Story	Load	DriftX	DriftY
STORY20	DLLLEQX	0.000294	
STORY20	DLLLEQX		0.000018
STORY19	DLLLEQX	0.000356	
STORY19	DLLLEQX		0.000031
STORY18	DLLLEQX	0.000417	
STORY18	DLLLEQX		0.000043
STORY17	DLLLEQX	0.000477	
STORY17	DLLLEQX		0.000054
STORY16	DLLLEQX	0.000534	
STORY16	DLLLEQX		0.000063
STORY15	DLLLEQX	0.000585	
STORY15	DLLLEQX		0.000072
STORY14	DLLLEQX	0.000631	
STORY14	DLLLEQX		0.000079
STORY13	DLLLEQX	0.00067	
STORY13	DLLLEQX		0.000085
STORY12	DLLLEQX	0.000703	
STORY12	DLLLEQX		0.00009
STORY11	DLLLEQX	0.000729	
STORY11	DLLLEQX		0.000095
STORY10	DLLLEQX	0.000748	
STORY10	DLLLEQX		0.000098
STORY9	DLLLEQX	0.00076	
STORY9	DLLLEQX		0.000101
STORY8	DLLLEQX	0.000764	
STORY8	DLLLEQX		0.000103
STORY7	DLLLEQX	0.000761	
STORY7	DLLLEQX		0.000105
STORY6	DLLLEQX	0.000748	
STORY6	DLLLEQX		0.000106
STORY5	DLLLEQX	0.000724	
STORY5	DLLLEQX		0.000106
STORY4	DLLLEQX	0.000685	
STORY4	DLLLEQX		0.000107
STORY3	DLLLEQX	0.000627	
STORY3	DLLLEQX		0.000107
STORY2	DLLLEQX	0.000542	
STORY2	DLLLEQX		0.000105
STORY1	DLLLEQX	0.000371	
STORY1	DLLLEQX		0.000082



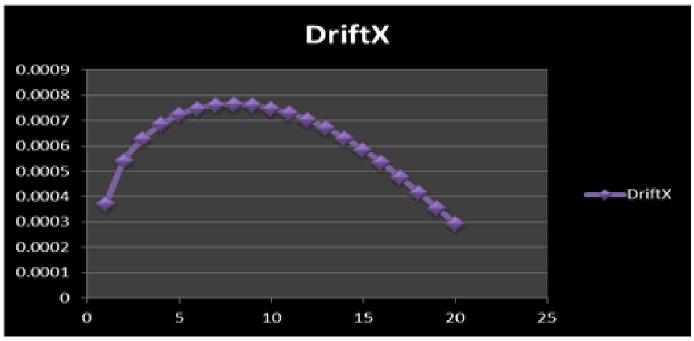
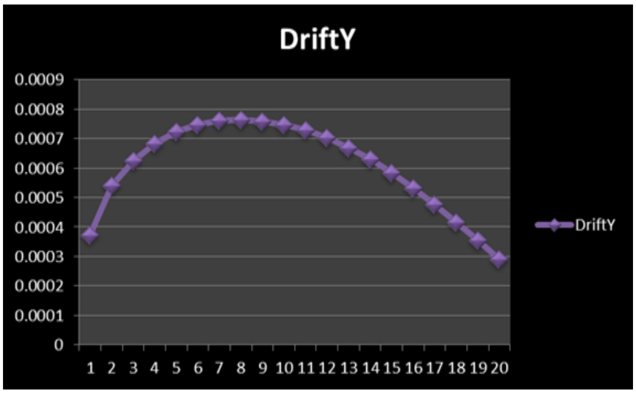


Fig. 7, Story Drift in X&Y Direction

(TABLE V) Story Drift in X and Y Direction

Story	Load	DriftX	DriftY
STORY20	DLLLLEQY	0.000018	
STORY20	DLLLLEQY		0.000292
STORY19	DLLLLEQY	0.000031	
STORY19	DLLLLEQY		0.000355
STORY18	DLLLLEQY	0.000043	
STORY18	DLLLLEQY		0.000416
STORY17	DLLLLEQY	0.000054	
STORY17	DLLLLEQY		0.000476
STORY16	DLLLLEQY	0.000063	
STORY16	DLLLLEQY		0.000532
STORY15	DLLLLEQY	0.000071	
STORY15	DLLLLEQY		0.000584
STORY14	DLLLLEQY	0.000079	
STORY14	DLLLLEQY		0.00063
STORY13	DLLLLEQY	0.000085	
STORY13	DLLLLEQY		0.000669
STORY12	DLLLLEQY	0.000085	
STORY12	DLLLLEQY		0.000702
STORY11	DLLLLEQY	0.000094	
STORY11	DLLLLEQY		0.000728
STORY10	DLLLLEQY	0.000098	
STORY10	DLLLLEQY		0.000747
STORY9	DLLLLEQY	0.000101	
STORY9	DLLLLEQY		0.000759
STORY8	DLLLLEQY	0.000103	
STORY8	DLLLLEQY		0.000763
STORY7	DLLLLEQY	0.000104	
STORY7	DLLLLEQY		0.00076
STORY6	DLLLLEQY	0.000106	
STORY6	DLLLLEQY		0.000747
STORY5	DLLLLEQY	0.000106	
STORY5	DLLLLEQY		0.000723
STORY4	DLLLLEQY	0.000106	
STORY4	DLLLLEQY		0.000684
STORY3	DLLLLEQY	0.000106	
STORY3	DLLLLEQY		0.000626
STORY2	DLLLLEQY	0.000105	
STORY2	DLLLLEQY		0.000541
STORY1	DLLLLEQY	0.000082	
STORY1	DLLLLEQY		0.000371



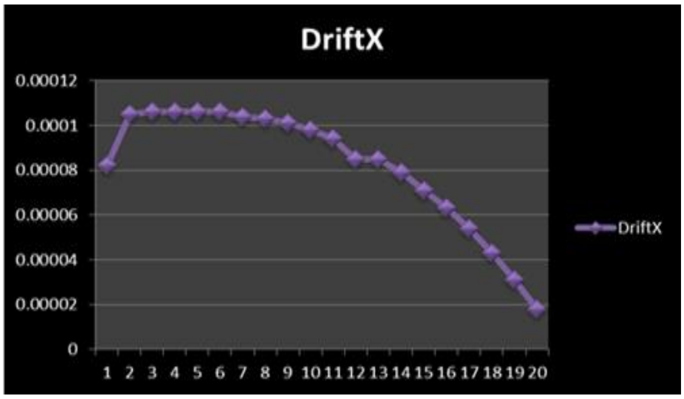


Fig. 8, Story Drift in X &Y Direction

IV. DISCUSSION ON RESULTS

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 centre we need to compare the graphical values of structure with the shear wall and a simple rigid frame structure.

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 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.

V. CONCLUSION

I . It is evident from the observing result that the less value for story drift in all combinations load at story 20 or last story of building.

II. It is evident from the observing result that the value of story drift is very low because of adding shear walls to the building.

III. The story drift for the combination load [DL+LL+WLx]and[DL+LL+WLy] in X&Y direction shown same performance in structure.

IV. The story drift for the combination load

[DL+LL+EQy]and[DL+LL+EQx] in X&Y direction shown different performance in structure .

V. Based on the analysis and discussion, shear wall is very much suitable for resisting earthquake induced lateral forces in multistoried structural systems.

VI. Based on the analysis and discussion ,shear wall are very much suitable for resisting earthquake induced lateral forces in multistoried structural systems .

VII. Shear walls must provide the necessary lateral strength to resist horizontal earthquake forces.

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