ANALYSIS OF MULTISTOREY STRUCTURES IN DIFFERENT ZONES OF INDIA USING ETABS

A PROJECT REPORT

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IN

STRUCTURAL ENGINEERING

Submitted by:

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I **Abhishek**, 2K19/STE/10 student of M. TECH Structural Engineering, hereby declare that the project Dissertation titled **"Analysis Of Multistorey Structures In Different Zones Of India Using Etabs",** which is submitted by me to Department of Civil Engineering, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Technology, in original and not copied for any source without proper citation. This work has not previously formed the basis for the award of any Degree, Diploma Associateship, Fellowship or other similar title or similar recognition.

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CERTIFICATE

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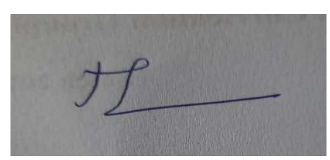

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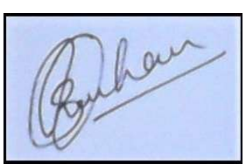

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ABSTRACT

This report deals with the designing and analysis of the muiltistorey structure by using Equivalent Static Analysis/ Pseudo Static Analysis/ Linear Static method. To accomplish this ETABS software has been used. We have to developed to analyze the R.C structure under earthquake and wind loads condition taking into account the IS CODE-1893 (part-1) 2016 [11] and IS CODE 875 (part-3) 2015 [12].The software calculates the base shear that resist the design lateral loads for different load combinations similarly different earthquake zone. It provides to calculation of the center of rigidity and center of mass of the structure. All the results are illustrated with the help of table and graph by the software for better understanding the behavior of structure in different zones and load combination. So we can analysis of load effect on the structure and the comparing with both structure G+10 and G+20 and increment in the force effects and locate the critical situation and points. Various estimations of wind speeds are taken for wind examination and their relating impacts on structure simultaneously with earthquake so which condition is more critical should be consider for more economical aspects.

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1. Introduction

India is seventh largest country in the world with land mass of total area of 3,287,263 km^2 with second highest population after china. And highest growing population in the world. Which causes the major land problems in the cities and needed better infrastructure with well-planned and can occupy the large individual into less area which also can counter the other problems like pollution and provide better way of living to citizens. The urban population is expected to increase in the coming decades. Population growth is an important potential factor for housing and commercial building demand. Which push up the price of renting and buying house and commercial structures. The resulting decline in affordability is a problem. Affordability of these building pushes the real estate into high rise structure. So, these structures should be affordable and profitable also for the construction companies. The profitability for construction companies can erode the quality of these structure, resulting decreasing the life span of the structures and less tolerance or resistance against the natural disaster like earthquake and cyclone etc. To counter these problems the structure should design according to all design criteria which have mention in the Bureau of Indian standard codes.

India is one of the topographically diverse country in the world having mountain range in the north to north east, deserts, plateaus and oceans in all three side. Which have different landscape problems during designing the structures, causes the bad impact on structure life to overcome this Bureau of Indian standard gives the codes to design these structures and efficiency of the structure should not be compromise and structure can perform against worst case scenario like natural disaster.

India is not very lucky when we discuss about the earthquake and suffered many devastated earthquake in history some of them greatest in the world. It is due to seismic activity where the Indian plate is pushing Eurasian plate, at the rate 50mm per year. After Bhuj earthquake on 26th January 2001 in

Gujrat state causes extensive damage and loss of life. The moment magnitude was 7.9. It was the wakeup call for government after this many investigation has been done and identify the location earthquake prone zones all over the India and after that incident of earthquake many examination has been done on the structures to make modern structure more economical and earthquake resistance.
To make earthquake resistance structure the bureau of Indian standard code Recommendations the I.S code 1893 (part-1) 2016 [11] which is 6^{th} revision of code after 2002. And provide better understanding earthquake resistance structure.

Similarly like earthquake wind damage is common in India due the three side cover with the oceans resulting high wind speed in coastal areas sometimes converted cyclones and badly hit the major cities like Mumbai. East coastal areas are more prone compare to the west. States like Odisha, West Bengal, Andhra Pradesh, West Bengal, Tamil Nadu, Maharashtra, Kerala and Gujarat are most effected. These natural hazard causes worst impact on structure due to this the bureau of Indian standard code Recommendations the I.S code 875(part-3) 2015 [12]. And gives understanding on wind load on structure so it resist the wind effect.

ETABS is an engineering software product suitable for the analysis and design of multi-story structures. Modeling tools and templates, code-based load regulations, analysis methods, and solution techniques are coordinated with the unique grid-like geometry of this type of structure. You can use ETABS to evaluate basic or advanced systems under static or dynamic conditions. For complex evaluation of seismic performance, direct and modal integration time history analysis can be combined with P Delta and large displacement effects. Non-linear links and concentrated PMMs or fiber hinges can capture material non-linarites under monotonous or hysterical behavior. Intuitive and built-in functions allow for any complex application. Interoperability with a number of design and documentation platforms makes ETABS a coordinated and efficient design tool suitable for designs ranging from simple 2D frames to complex modern high-rise structures.

2. Literature Review

Dr. K. R. C. Reddy, Sandip A. Tupat (2014)

Introduced a similar investigation of wind and tremor burdens to choose the design load of a multistoried structure. In that multistoried structure is investigated for seismic loads in different zones dependent on IS 1893 and for wind loads IS 875 code is utilized. The wind loads are assessed dependent on the design wind speed of that zone with a -20%or +20%. The wind load so got on the structure have been contrasted compare with seismic load. At long last, it is discovered the wind loads are critical than the seismic effects in the vast majority of the cases.

Mahesh N. Patil, Yogesh N. Sonawane (2015)

Seismic analysis was performed by ETABS software and manually verified according to IS 1893-2002. In manual and software analysis, the lateral force value gradually increases from bottom to top. Calculating earthquake weights using manual analysis and software analysis gives exactly the same results. The basic shear value in manual analysis and software analysis is slightly modified. The basic cutoff obtained by manual analysis is slightly higher than software analysis. The result of the 8-story building comparison is roughly the same mathematical value. This article provides a complete guide for seismic coefficient analysis using ETABS 7.1. A complete design involving multiple parameters is completed, resulting in seismic results, and a 3D perspective view is displayed for easy understanding and use.

Prof. Swapnil B.. Cholekar, Basavalingappa S. M. (2015)

The irregularities of quality were compared with other related details in Composite and R.C.C. structures. In the case of conventional structures, composite structures are often used to produce efficient and economical structures. Here, an idea has been extended to building irregularities to compare Composite and R.C.C. structures. Joint displacement, foundation shear force, floor displacement, shear force, deadweight and time period will help determine which structure is effective. Irregularities are considered in the volume shape in the multi-storey R.C.C. G + 9. And the composite building, and the R.C.C. and composite structures are compared. The equivalent static force and response spectrum method is used to analyze structures in accordance with IS 1893 (Part 1): 2002 using SAP 2000 software. Top the quality of the floor or half is uneven. Research shows that the performance of composite structure with quality irregularities will be better than R.C.C. structure.

K. Rama Raju , M.I. Shereef , Nagesh R Iyer , S. Gopalakrishnan (2013)

The high-rise building design essentially includes conceptual design, rough analysis, preliminary design and optimization to safely transfer to gravity and lateral loads. The design criteria are strength, suitability and human comfort. The goal of Structural Engineer is to propose suitable structural diagrams to meet these standards. In this study, the analysis and design method of the limit state of the 3B + G + high-rise reinforced concrete building under the 3B + G + 40-story wind and seismic load according to the IS practice code are described. The safety of the structure was verified according to the foundation shear force, roof displacement, drift between floors, acceleration specified in practice code and other relevant references in the literature regarding the impact of earthquakes and stress loads. According to the Code of Practice IS , the response of high-rise structures under wind and seismic loads is studied. According to IS 1893 (Part 1): 2002 and IS 875 (Part 3): 1987, the response spectrum seismic analysis method and gust wind load factor analysis were used to analyze the RCC of 40 floors 3B + G + high-rise structures. The building was modeled as a 3D spatial frame using STAAD.Pro software. It is noted that the current analysis of beams and columns using STAAD.Pro found that the force is much greater than the result reported in the INSDAG report.

Balaji.U. , Mr. Selvarasan M.E. (2016)

Use ETABS to conduct seismic loading investigations on G + 13 multi-story residential structures. . Assuming that the material properties are linear static and dynamic, an analysis is performed. These non-linear analyzes were performed considering severe seismic zones to evaluate the behavior of using Class II soil conditions. Different responses are graphed, such as displacements, base shear.

J.Chiranjeevi Yadav, L.Ramaprasad Reddy (2017)

The design criteria for high-rise structures are strength, applicability, stability and comfort. Therefore, the influence of lateral loads such as wind loads and seismic forces has become more and more important. Almost all designers are faced with the problem of providing sufficient resistance and stability to lateral loads. The influence of lateral load on the moment, shear force, axial force, bottom shear force, traction force and maximum floor drift in the structural system is studied, and the results of zone 2 and zone 5 are compared.

A.Pavan Kumar Reddy , R.Master Praveen Kumar (2017)

Through the use of ETABS 9.7.4, the use of lateral load resisting methods in the structural configuration has greatly improved the performance of the structure in earthquakes. The special cases of use of shear walls and bracings for special heights have been worked, and the largest and most important rewards that have been obtained the knowledge is 93.5 m. Modeling is performed to verify the results of special circumstances and seismic parameters (such as foundation shear, lateral displacement, and lateral drift) at a specific height. The acquisition of knowledge has been implemented in IS 1893-2002 for zone IV and V of soil II (medium soil).

Chandrashekar, Varikuppala Krishna, Rajashekar (2015)

This project demonstrates the use of ETABS (Extended Three-dimensional Building Analysis System) for analysis and design of a (parking lot +5) high-rise RCC frame building under the influence of wind and seismic lateral loads. ETABS embeds's main static, dynamic, linear and non-linear analysis engines, etc., and uses this software to analyze and design the building. Due to the facilities provided by the software in the modeling phase, in practice, the building can be modeled according to the configuration of the components of the project. The software treats beams and columns as linear components; floors, ramps/stairs, and walls are like members in the region. Consider the horizontal load effect of wind and seismic forces; in the design of this project, the dynamic load and the static load of and the live load according to the IS code; and almost all project members can use the software to carry out in accordance with the Indian code Analyze and design.

H Eramma, Pulakeshi H L (2015)

The work of the thesis refers to the comparison of the seismic evaluation of RC structures with and without friction damper in IS 1893:2002 (Part 1) specification, and methods are carried out in static equivalent analysis, response spectrum and Pushover. Consider G+5, G+10, and G+15-story structures are analyzed. In this analysis of structures with friction dampers, the dampers are connected at the corners of all structures. The equivalent static method is compared with the response spectrum method, and the finite element software package ETABS 9.7.4 is used for the modeling and analysis of G+5, G+10 and G+15 considering the seismic zone IV. According to IS 1893: 2002 code (part 1). For analysis, several IS codes are referenced. For the gravity load combination IS 456: 2000 and the 0.9, 1.2 and 1.5 seismic load combination reference code (part 1) according to IS 1893: 2002).

Ashok R. Mundhada, Gauri G. Kakpure (2016)

RC structures frame is the most common building type in Indian cities. They are subject to various types of forces during their service life, such as static forces caused by static and live loads and dynamic forces caused by earthquakes. This article reviews previous work done on multi-story structures and seismic analysis. It focuses on the static and dynamic analysis of structures.

3. Basic Aspects of Analysis Seismic Design

To design the earthquake resistance structure Bureau Indian standards recommended is code 1893-(part-1) 2016 [11] “Criteria for Earthquake Resistant Design of Structures”. Which involves the evaluation of seismic loads of various structures and the design of earthquake resistant structures. Basic provisions apply to structures; elevated structures; industrial and stacked structures; bridges; concrete masonry and earth dams; embankments and retaining walls and other structures.

3.1 Some definition and terminology

3.1.1 Importance Factor I

It is multiple factor of base shear to increase or decrease according to the importance of structure.

Table 3.1. – Importance Factors I

Sl. No.	Structure	I
i)	Important service and community structures, such as hospitals; schools; monumental structures; emergency structures like telephone exchange, television stations, radio stations, railway stations, fire station structures; large community halls like cinemas, assembly halls and subway stations,; and power stations.	1.5

ii)	All other structures	1.0

NOTES:

1) The design engineer may choose the importance factor-I of to be greater than the mentioned above.

2) Structures that are not included in the above SI numbers (i) and (ii) may be designed with a higher I value, depending on economic and strategic considerations, such as with multiple residential units.

3) This does not apply to temporary structures, such as excavations, scaffolding, etc. Of short duration.

4)The importance of the industrial structure includes those industrial structures that contain hazardous materials, according to IS: 1893 (Part 4).

The minimum value of the important coefficient I of different building systems should be shown in Table 1.

3.1.2. Response Reduction Factor R

The factor by which the actual foundation shear force must be reduced in order to obtain the design lateral force during the basic design earthquake (DBE) vibration.

The response reduction factor R of different building systems should be shown in Table 3.2.

Redundancy

Structures should have high redundancy resistance to lateral load. Increased redundancy in the fabric will result in increased power dissipation level and excessive current. The building response reduction factor (R) values given in Table 2 are based on the assumption that the building has a sufficient level of redundancy. For structures with low redundancy, for example, only two or three shear walls in a given direction provide resistance to lateral loading. The design engineer can use 0.75 of the value given in Table 2. R value in the range 0.90 times, used for Low Redundancy Structures across a bay frame, etc.

Table 3.2. Response Reduction Factor R, for Building Systems

SI.NO.	**Lateral Load Resisting System**	**‘ R’**
	Building Frame Systems	
1.	Ordinary RC moment resisting frame (OMRF)	3.00
2.	Intermediate RC moment resisting frame	4.00
3.	Special RC moment-resisting frame (SMRF)	5.00
4.	Steel frame with a) Concentric braces b) Eccentric braces	 4.00 5.00
5.	Steel moment resisting frame designed as per SP 6	5.00
	Structures with Shear Walls	
6.	Load bearing masonry wall structures a) Unreinforced masonry without special seismic strengthening b) Unreinforced masonry strengthened with horizontal RC bands and vertical bars at corners of rooms and jambs of openings c) Ordinary reinforced masonry shear wall d) Special reinforced masonry shear wall	 1.50 2.250 3.00 4.00
7.	Ordinary reinforced concrete shear walls	3.00
8.	Ductile shear walls	4.00
	Structures with Dual Systems	

9.	Ordinary shear wall with OMRF	3.00
10.	Ordinary shear wall with SMRF	4.00
11.	Ductile shear wall with OMRF	4.50
12.	Ductile shear wall with SMRF	5.00

3.1.4. Zone Factor (Z)

It is refer to the intensity of earthquake of vibration or shaking, notation refer to Z for zone V .36 means 0.36g.

TABLE 3.3. ZONE FACTOR (Z)

Seismic zone	Zone II	Zone III	Zone IV	Zone V
Z	0.10	0.16	0.24	0.36

3.1.5. Fundamental Natural Period

The empirical expression can be used to estimate the approximate basic natural vibration period (Ta) (in sec) of a flexural frame building without infill of brick pannel:

Ta $= 0.075h^{0.75}$, for RC frame Structure

$= 0.085h^{0.75}$, for steel frame Structure

h = Height of building, (m).

This excludes the basement storeys.

Limitation

Due to the minimum design lateral force specified by, the floor drift of any floor, the load factor of part is 1.0, which must not excee 0.004 times the height of the floor.

Only for the purpose of displacement requirements, it is allowed to use the calculated basic period of seismic force (T) building .There is no lower limit of design seismic force. A single-story building designed to accommodate floor drifts will have no drift limit.

Story Drift: - The lateral displacement of between two floors above and below.

Diaphragm: - Horizontal system which transfer lateral load to vertical system ex: - reinforce cement floor etc.

Base Shear: - Total lateral force at the base of building.

3.2. Different Methods Analysis of the Structures in Earthquake:

1. Linear dynamic Procedure
2. Nonlinear Static Procedure (Pushover analysis)
3. Nonlinear dynamic procedure.
4. Linear Static Procedure
5. Time history method
6. Response Spectrum method

3.2.1. Linear dynamic Procedure: - When the high mode effect is not significant, a static procedure is appropriate. This generally applies to short conventional structures. Therefore, for high-rise structures, structures with torsional irregularities or non-orthogonal systems, dynamic programs are required. In the linear dynamics process, the building is modelled as a multiple degrees of freedom (MDOF) system with a linear elastic stiffness matrix and an equivalent viscous damping matrix. The seismic input is modelled using modal spectrum analysis or time history analysis, but in both cases the internal forces and corresponding displacements are determined using linear elastic analysis. The advantage of these linear dynamic programs over linear static programs is that they can be considered superior modes. However, they are based on a linear elastic response, so the applicability decreases as the non-linear behaviour increases, which is approximated by the overall force reduction factor.

3.2.2. Nonlinear Static Procedure (Pushover analysis): - The linear procedure is applicable when the structure is expected to remain nearly elastic at the level of ground motion, or when the design results in a nearly uniform distribution of the nonlinear response of the entire structure. Since the performance goal of the structure implies a higher inelastic demand, the uncertainty of the linear program increases to the need for highly conservative demand assumptions and acceptance criteria to avoid unexpected performance. Therefore, procedures that incorporate inelastic analysis can reduce uncertainty and conservatism. This method is also called "PUSHOVER" analysis. Force mode is applied to a structural model that contains non-linear properties, and the total force is plotted against the reference displacement to define the capacity curve. It can then be combined with a demand curve. This essentially reduces the problem to a single degree of freedom (SDOF) system.

3.2.3. Nonlinear dynamic procedure:-Non-linear dynamic analysis combines surface movement records with detailed structural models, so it can produce results with low uncertainty. In nonlinear dynamic analysis, the detailed structural model affected by the ground motion record will generate the estimated value of the component strain of each degree of freedom in the model, and use the square root sum of square scheme to combine the modal response. In nonlinear dynamic analysis, the nonlinear characteristics of the structure are regarded as part of the time domain analysis. This method is the most stringent, and some building codes require this method to be used for special configurations or structures of special importance. However, the calculated response may be very sensitive to the characteristics of a single ground motion used as seismic input; therefore, multiple analyses using different ground motion records are required to achieve a reliable estimation of the probability distribution of the structural response. Since the characteristics of the seismic response depend on the intensity or severity of the earthquake, the comprehensive evaluation requires a large number of non-linear dynamic analyzes at different intensity levels to represent different possible earthquake scenarios. This led to the emergence of methods such as incremental dynamic analysis.

Examination should be possible for the structure under the IS code 1893-2016 (part1).

Dynamic analysis will be completed either by Response spectrum method or site explicit Time history technique. Techniques are embraced to do the examination strategy are Equivalent Static Analysis, Response Spectrum Method and Time History Analysis.

3.2.4. Equivalent Static Analysis/ Pseudo Static Analysis/ Linear Static Analysis: -

In this analysis a series of forces acting on the structure to represent the effect of ground movement due to earthquake defined by the seismic design response spectrum. In this we have to assume that the structure responds in its basic mode. So the structure, it should be low in height and should not be significantly distorted when moving on the ground. Given the natural frequency of the structure, read the response in the design response spectrum.

STEPS:

Step 1: Find the lump mass and seismic weight:

Step 2: Calculation of basic natural period:

The approximate fundamental natural period of vibration (T_a) (in sec) of a flexural frame building without infill of brick pannel:

Ta = $0.075 * h^{0.75}$, for RC frame structure

= $0.085 * h^{0.75}$, for steel frame structure

h = Height of building, in m.

The approximate basic natural vibration period (Ta) (in seconds) of a flexural frame building with infill of brick pannel:

$$T_a = \frac{.09h}{\sqrt{d}}$$

h= height of building (m).

This is not includes the basement storeys, where the basement wall is connected to the bottom deck or placed between the pillars of the building. However, it includes basement floors when they are not so connected.

d = the basic size of the structure at the base level (m) in the direction of the lateral force considered.

Step 3: Determination of horizontal earthquake coefficient. Determine A_n:

Step 4: Determination of design base shear:

The total design seismic base shear (V_B) along any principle direction, determine by this formula as following:

$$V_B = A_h W$$

A_h= Use the basic natural period of the considered vibration direction to design the value of the horizontal acceleration spectrum

W= seismic weight of the structure

Step 5: Vertical distribution of base shear

The calculated design foundation shear force (V_B) will be distributed along the height of the building according to the expression,

$$Q_i = V_B \frac{W_i h_j^2}{\sum_{j=1}^{n} W_j h_j^2}$$

Where,

Q_i= design lateral force at a floor (i),

W_i=Seismic weight of the floor (i),

h_i= height of floor (i) from base

n = nos. of storeys in the structure

Step 6: Distribution of lateral forces to different lateral force resisting elements

For the structure of the floor with rigid horizontal diaphragm assuming that the floor has infinite rigidity on the horizontal plane, the total shear force on any horizontal plane is distributed to each vertical element of the resistance system.

For structures where the floor cannot be regarded as a rigid horizontal diaphragms, the lateral cuts on each floor must be distributed to the vertical elements that resist the lateral force. Consider the flexibility of the diaphragms.

If the floor diaphragm is deformed in such a way that the maximum lateral displacement measured from the chord of the deformed shape at any point on the diaphragm is greater than 1.5 times the average displacement of the entire diaphragm, the floor diaphragm will be considered as a flexible monolithic concrete slab. Beam or reinforced floor composed of prefabricated/prefabricated elements, with a reinforced top screed that can be used as a rigid diaphragm.

RIGID DIAPHRAGM ACTION: In this assumption, slab is considered rigid and moves in a straight line in its plane.

NO DIAPHRAGM ACTION

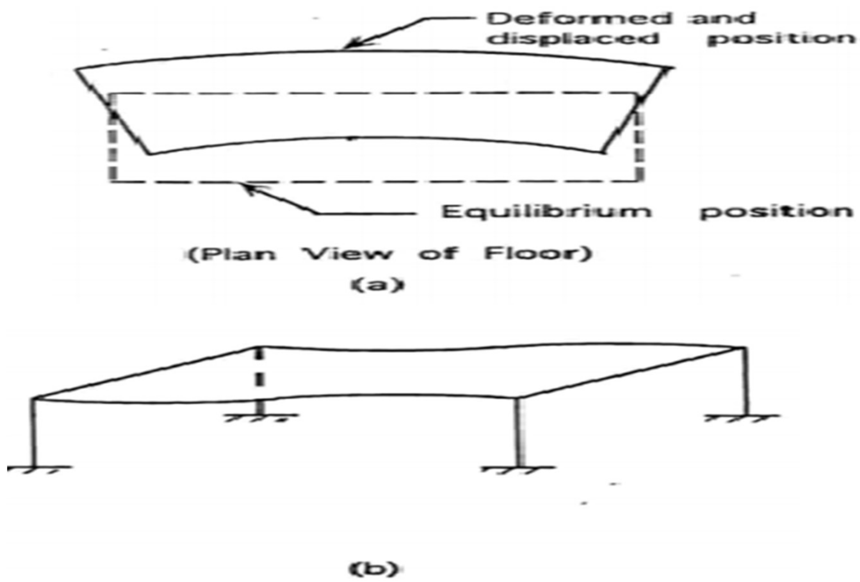

Fig 3.1 (a) In plane floor deformation (b) Out-of plane floor deformation

(Source: Proposed draft provisions and commentary on Indian seismic code IS-1893(part-1))

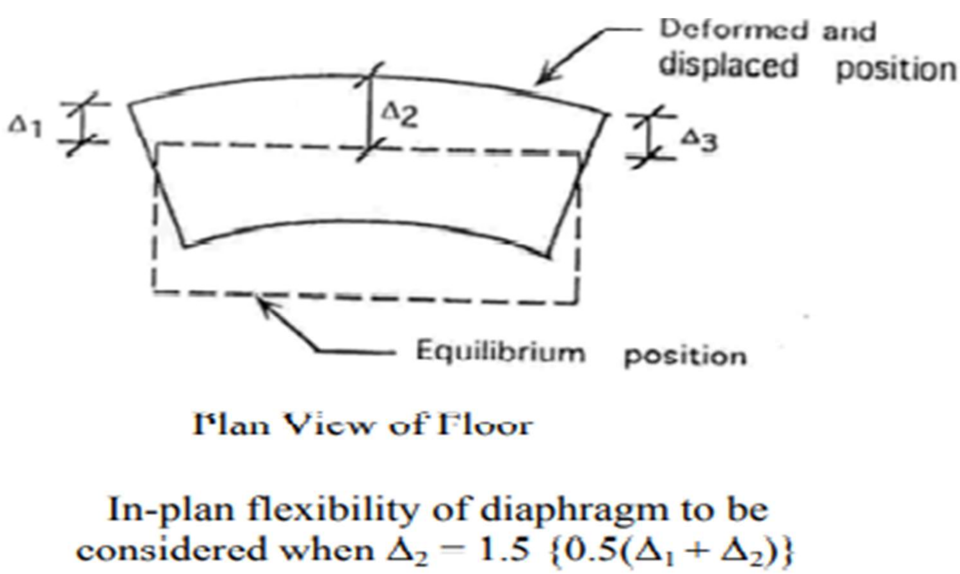

Fig 3.2: Plain view of floor

(Source: Proposed draft provisions and commentary on indian seismic code IS1893 (part-1) [13])

In-plan flexibility of diaphragm to be considered when Δ_2=1.5{.5($\Delta_1 + \Delta_2$)}

Step 7: Apply these lateral forces along the other predetermined forces and calculate the response in the Structure.

3.2.5. Time History Analysis: - Time history analysis is the study of the behavior of structures under past earthquake or wind acceleration data. The structure does not need to be an SDoF system. Time history is a graph of the relationship between amplitude or acceleration and time.

In time history analysis, the structural response is calculated at a few moments later. In other words, the time history of the structural response to a given input is obtained as a result. In response spectrum analysis, the time course of the response cannot be calculated.

3.2.6. Response Spectrum Method: - In the response spectrum method, the maximum response of the structure at the time of the earthquake is obtained directly from the seismic response spectrum or the design spectrum.

Multiple modes of structures response to earthquakes are considered.

In each mode, a design spectrum response is read depending on the modal period. Different mode responses are combined to estimate the total reaction of structures using a complete secondary combination (CQC), a square square root (SRSS), or a mode combinatorial method, such as a total method (ABS). Provide a value.

The response spectrum analysis methods must be performed using a design spectrum or using site-specific design spectra that are prepared specifically for the structure of a particular project site.

3.3. Seismic Zones of India

Based on history analysis, the seismic zone map is reconsidered with just four zones, rather than five. Past Zone I has been converged to Zone II. Subsequently, Zone I doesn't show up in the new drafting; just Zones II, III, IV and V.

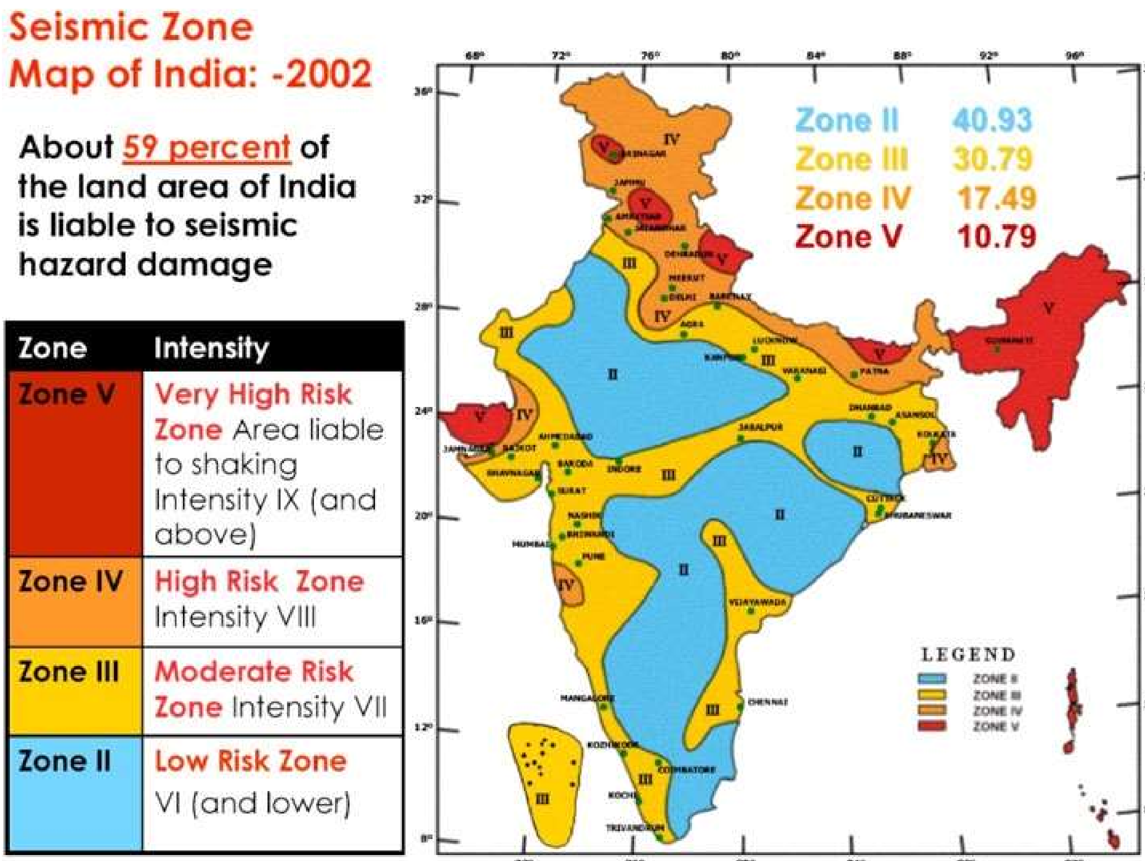

Fig.3.3.seismic zonation and intensity map of India

(IS CODE 1893-2016 [11], SOURCE GOOGLE IMAGE)

4. Wind Analysis

To design the wind resistance structure Bureau Indian standards recommended is code 875(part-3) 2015 [12] “Wind Loads on Structures and Structures”. Which involves what are criteria of wind loads should be consider when designing structures, structures and their components. It depends upon different factors wind pressure, effects of terrain, local topography, size of structures, etc.

Building are divided into two types tall building and low rise building where tall building are when a structure height is more than or equal to 50m or height to smaller dimension is more than 6 and low rise building are structure height less than 20m.

4.1. The Nature of Wind In The Atmosphere

Generally, the wind speed in the atmospheric boundary layer increases with height from zero on the ground to a maximum value at a height called the gradient height. There is usually a slight change in direction (Ekman effect), but this is ignored in the code. The change with altitude mainly depends on the terrain conditions. However, the wind speed at any height will never remain constant, and it has been found convenient to decompose its instantaneous amplitude into the average value or average value and the fluctuation component around the average value.

4.2. Design Wind Speed

The basic wind speed (V_b) for any site shall be obtained IS 875-2015(PART-3) [12] and shall be modified to get the design wind velocity at any height (V_z) for a chosen structure.

$$V_z = V_b * k_1 * k_2 * k_3 * k_4$$

Where,

V_z = design wind speed at any height z in m/s,

V_b = Basic wind speed in m/s,

$\boldsymbol{k_1}$ = probability factor (risk coefficient),

$\boldsymbol{k_2}$ = terrain roughness and height factor

$\boldsymbol{k_3}$= topography factor.

$\boldsymbol{k_4}$= Importance of the cyclone region

The basic wind speed map of India, as applicable at 10 m height above mean ground level for zones of the country selected from the code.

The design wind pressure at any height above mean ground level shall obtained by the following relationship between wind pressure and wind velocity. $\boldsymbol{P_z = 0.6 * V_z^2}$

Where,

$\boldsymbol{P_z}$ = wind pressure in $\frac{\boldsymbol{KN}}{\boldsymbol{m^2}}$ at height z and

$\boldsymbol{V_z}$= design wind speed in m/s at height z.

RISK FACTOR (K1)

Terrain Basic wind speed of category 2, applicable to a height of 10 m. Based on 50-year average return period of. The recommended service life of will be assumed in the design, and for design purposes, the $\boldsymbol{k_1}$ coefficients corresponding to different types of structures. In the design of all structures and structures, the average return period of the basic wind speed in areas is 50 years.

Table 4.1: Risk coefficients for different classes of structures in different wind speed zones

Class of Structure	**Mean Probable design life of structure in years**	**k_1 factor for Basic Wind Speed (m/s) of**					
		33	39	44	47	50	55
All general structures and structures	50	1.0	1.0	1.0	1.0	1.0	1.0
Temporary sheds, structures such as those used during construction operations (for example, formwork and false work), structures during construction stages, and boundary walls	5	0.82	0.76	0.73	0.71	0.70	0.67
Structures and structures presenting a low degree of hazard to life and property in the event of failure, such as isolated towers in wooded areas, farm structures other than residential structures, etc.	25	0.94	0.92	0.91	0.90	0.90	0.89

Important structures and structures such as hospitals, communication structures, towers and power plant structures	100	1.05	1.06	1.07	1.07	1.08	1.08

Table 4.2: $\boldsymbol{k_2}$ factors to obtain design wind speed variation with height in different terrains

Height (z) (m)	Terrain and height multiplier ($\boldsymbol{k_2}$)			
	Terrain Category 1	Terrain Category 2	Terrain Category 3	Terrain Category 4
10	1.05	1.00	0.91	0.80
15	1.09	1.05	0.97	0.80
20	1.12	1.07	1.01	0.80
30	1.15	1.12	1.06	0.97
50	1.20	1.17	1.12	1.10
100	1.26	1.24	1.20	1.20
150	1.30	1.28	1.24	1.24
200	1.32	1.30	1.27	1.27
250	1.34	1.32	1.29	1.28
300	1.35	1.34	1.31	1.30
350	1.37	1.36	1.32	1.31

400	1.38	1.37	1.34	1.32
450	1.39	1.38	1.35	1.33
500	1.40	1.39	1.36	1.34
NOTE: For intermediate values of height z and terrain category, use linear interpolation.				

Terrain and Height Factor (k_1)

Terrain: The choice of terrain category will appropriately consider the impact of obstacles that constitute the roughness of the soil surface. The type of terrain used for structural design may vary depending on the wind direction considered. If there is sufficient wind direction and weather information, the direction of any building or structure can be properly planned.

The land on which the specific structure is located will be assessed as one of the following land categories:

a) Category 1-bare terrain with few or no obstacles, where the average height of any object around the building is less than 1.5 m.

Note-This category includes open ocean coasts and flat treeless plains.

b) Category 2-Open terrain, evenly distributed obstacles, usually 1.5 to 10 m in height.

Note-This is a standard for measuring basic wind speed in areas, including airports, open green areas, urban suburbs, and underdeveloped and underdeveloped suburbs. Due to the roughness of the waves in strong winds, the open terrain adjacent to the coast can also be classified as category 2.

c) Category 3-Terrain with many dense obstacles, the height of the obstacles is up to 10 m, with or without some isolated tall structures.

Note 1 - This category includes fully or partially developed forested areas, shrubs, cities and industrial areas.

NOTE 2 - In most design cases, there is probably no higher category than this, and the stricter category will be chosen with care.

Note 3 - Special attention should be paid to the behavior of obstacles in areas affected by fully developed tropical cyclones. Vegetation is likely to be blown over by wind or fallen leaves, and cannot depend on maintaining Category 3 conditions. If this is the case, you can use an intermediate category with a speed multiplier between the values of category 2 and category 3 in Table 4.2, or select category 2 with due regard to local conditions.

d) Category 4-Terrain with many large and dense obstacles.

Note - This category includes large urban centers, generally with obstacles greater than 25 m and developed industrial parks.

Variation of wind speed with height for different terrains ($\boldsymbol{k_2}$factor)

Table 5 shows the multiplication factor ($\boldsymbol{k_2}$). Multiply the basic wind speed by this factor to obtain wind speeds at different heights in each terrain category. For different wind directions, the ground obstacles in the wind path may be different.

The structure may vary depending on the wind direction considered. With sufficient weather information, the basic wind speed can vary depending on the specific wind direction.

Changes in terrain category: The velocity profile of a given terrain category does not immediately develop to full height with the beginning of the terrain category, but gradually develops to a height (h_x) that increases with fetch or upwind range (x).

a) Fetch and developed height relationship – The relationship between the development height (h_x) and fetch length (x) of wind current in each of the four terrain categories can be shown in Table 6.

b) For structures whose height is greater than the development height (h_x) in Table 4.3, the velocity profile can be determined according to the following formula:

Table 4.3: Fetch and developed height relationship

Fetch (*x*) *(km)*	**Developed Height h_x *(m)***			
	Terrain Category 1	**Terrain Category 2**	**Terrain Category 3**	**Terrain Category 4**
(1)	(2)	(3)	(4)	(5)
0.2	12	20	35	60
0.5	20	30	55	95
1	25	45	80	130
2	35	65	110	190
5	60	100	170	300

10	80	140	250	450
20	120	200	350	500
50	180	300	400	500

Topography (k_3 factor)

The basic wind speed of V_b given in Figure 4.1 takes into account the overall level of the site's altitude of. This does not allow local terrain features, such as hills, valleys, cliffs or ridges, which will significantly affect the wind speed near you. The function of terrain is to accelerate the wind near the top of mountain or cliff top, cliff or ridge, and slow down the wind near the, steep cliff or ridge at the foot of the valley or cliff.

The effect of the topography can be equal to 1.0 if the elevation slope (θ) is greater than about 30 and if the value is lowered. The value of k_3 is trapped in the range of 1.0 to 1.36 due to more than 30 gradients. A method is given to evaluate the value of k_3 for a value greater than 1.0. The value of k_3 is near the soil and at higher levels, and at higher levels. Note. For hillsides higher than 170.

Importance of the cyclone region (K_4)

The ARASHI cyclone usually occurs on the eastern coast of the country, in addition to the coast of the Western Guja thirst. Study of wind speed and damage to structures, and damage to structures and structures, pointing out the fact that the speed given by the basic wind speed map is often exceeded in the cyclone. The impact of cyclone storms feels greatly in a band of about 60 km on the coast. To increase the safety of the area of this area (the width of 60 km on the east coast, the coast of Gujarate), and the importance of structure, the following k_4 values are defined:

Structures of post–cyclone importance	1.30
Industrial structures	1.15
All other structures	1.00

4.2. Basic Wind Speed

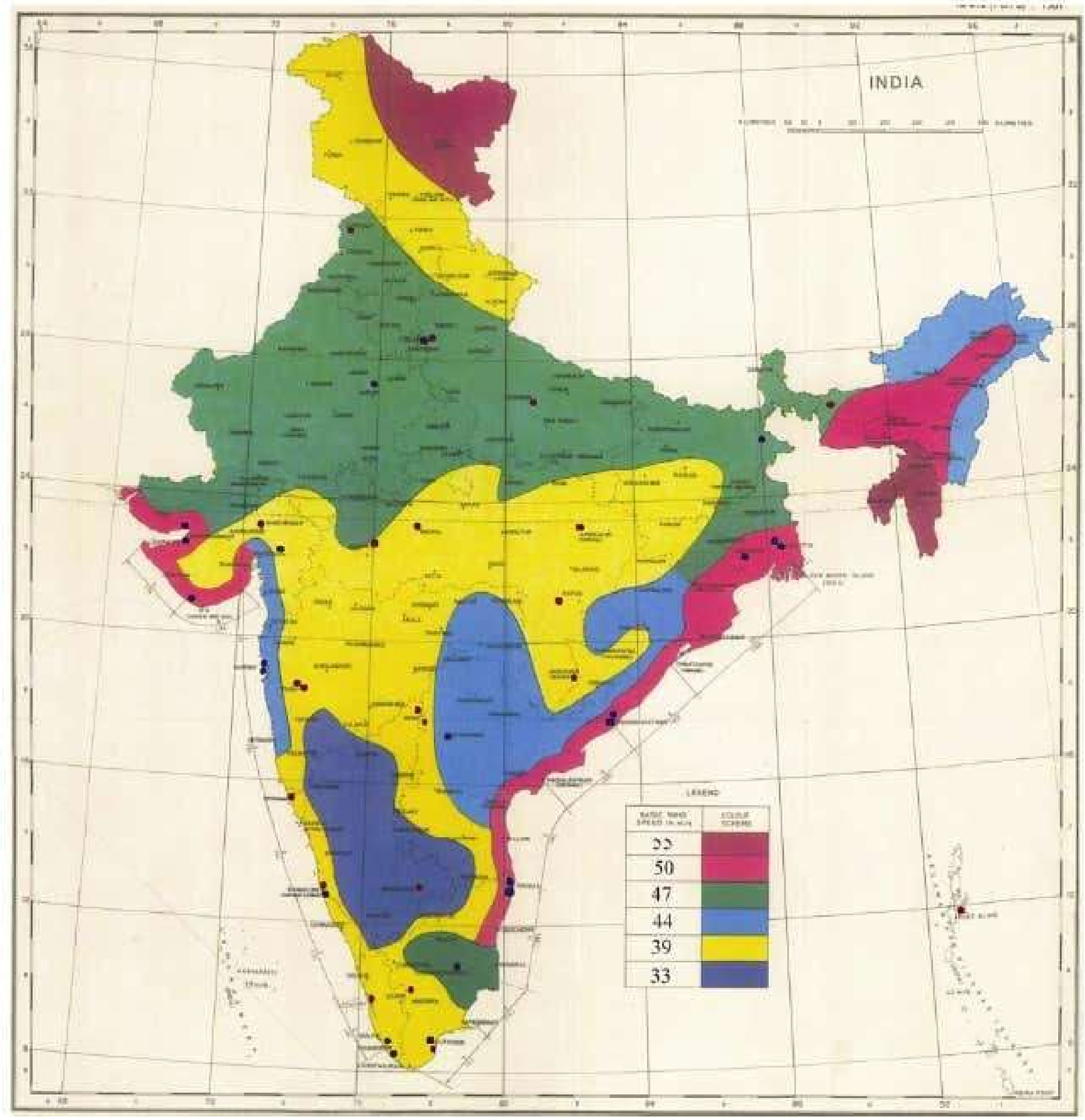

Fig 4.1. MAP SHOWING BASIC WIND SPEED

(IS CODE 875-2015 (PART 3) [12], Source google image)

5. Loads Acting On Building

Loading on tall structures is not the same as low-ascent structures from multiple points of view, for example, enormous gathering of gravity loads on the floors top to bottom, expanded noteworthiness of wind loading and more prominent Importance of dynamic impacts.

Consequently, skyscraper structures need right evaluation of burdens for protected and conservative plan. But dead loads, the evaluation of burdens is impossible precisely. Live loads can be foreseen around from a blend of experience and the past field perceptions. Wind and seimic loads are irregular in nature and it is hard to anticipate them. They are assessed dependent on a probabilistic methodology. The accompanying conversation portrays a portion of the most regular sorts of burdens on high raised structures.

a. Dead loads

The static load can be calculated based on the unit weight of the living material in IS 875 (Part 1). Unless a more accurate calculation is required, plain concrete made of sand and gravel or crushed natural stone and reinforced concrete per unit weight bone The materials are taken at 24 kN/m^3 and 25 kN/m^3.

b. Live loads (or) Imposed Loads =2 kN/m^2

IS code 875 (part 2) deals with live load or dynamic load it is also called temporary load.

c. Wind loads

IS code 875 (part 3) [2] stress applied by wind on the structure.

d. Earthquake loads.

IS code 1893-2016 [1] it is the load pressure on the structure during shaking of earth.

Load Combination to Be Considered

IS 1893 (Part-1) 2016 [11] is used, for limit state design of reinforced and prestressed concrete structure.

a. .9D+1.5EQ
b. 1.2(D+L+EQ)
c. 1.5(D+EQ)
d. .9D+1.5WIN
e. 1.2(D+L+WIN)
f. 1.5(D+WIN)

6. Objectives of the Study

Aim to perform this project:

1. To understand the behavior of structure in different seismic and wind zone.
2. Utilizing ETABS Software comparing the results and analysis of structure in II, III, IV and V zones.
3. Analysis of load effect on the structure and the comparing with both structure G+10 and G+20 and increment in the force effects.
4. Looking for critical situation and points where measures should needed to take.
5. Examine the structure on basis of storey shear, displacement and storey drift and peak values or critical points.

7. Building Details And Modelling:

To study a structures on ETABS software, we have to developed to analyze the R.C structures under wind and earthquake loads condition taking into account the IS CODE-1893 part-1 2016 [11] and IS CODE 875 (part-3) 2015 [12].The software calculates the base shear that resist the design lateral loads for different load combinations similarly different earthquake zone. It provides to calculation of the center of rigidity and center of mass of the structure. All the results are illustrated with the help of table and graph by the software for better understanding.

7.1. Structure Configuration G+10

The structure model in the study has G+10 storeys with same storey height of 3m. Multiple models are used to analyze in three load combination and in different zone of earthquake with equal the number of bays, bay lengths and the bay-width in the two horizontal directions are same for convenience. Applied different values of zone factor in model and their effects on the results. All other details are given in table 7.1:

TABLE 7.1. Model 1:- G+10 shows the different parameter of structure in different zones.

PARAMETER	ZONE-2	ZONE-3	ZONE-4	ZONE-5
FLOOR HEIGHT	3m	3M	3M	3M
LENGTH*WIDTH	22.5m*22.5m	22.5m*22.5m	22.5m*22.5m	22.5m*22.5m
LENGTH OF EACH BAY	7.5m	7.5m	7.5m	7.5m
BEAM	.45m*.25m	.45m*.25m	.45m*.25m	.45m*.25m
COLUMN	.75m*.75m	.75m*.75m	.75m*.75m	.75m*.75m
SLAB THICKNESS	150mm	150mm	150mm	150mm
SUPPORT CONDITION	fixed	fixed	fixed	fixed
GRADE OF CONCRETE	M30	M30	M30	M30
GRADE OF STEEL	Fe415	Fe415	Fe415	Fe415
SEISMIC ZONE FACTOR	.1	.16	.24	.36
BASIC WIND SPEED	44m/s	39m/s	47m/s	50m/s
RESPONSE REDUCTION FACTOR	5	5	5	5
INPORTANCE FACTOR	1	1	1	1
SOIL CONDITION	Medium(2)	Medium(2)	Medium(2)	Medium(2)

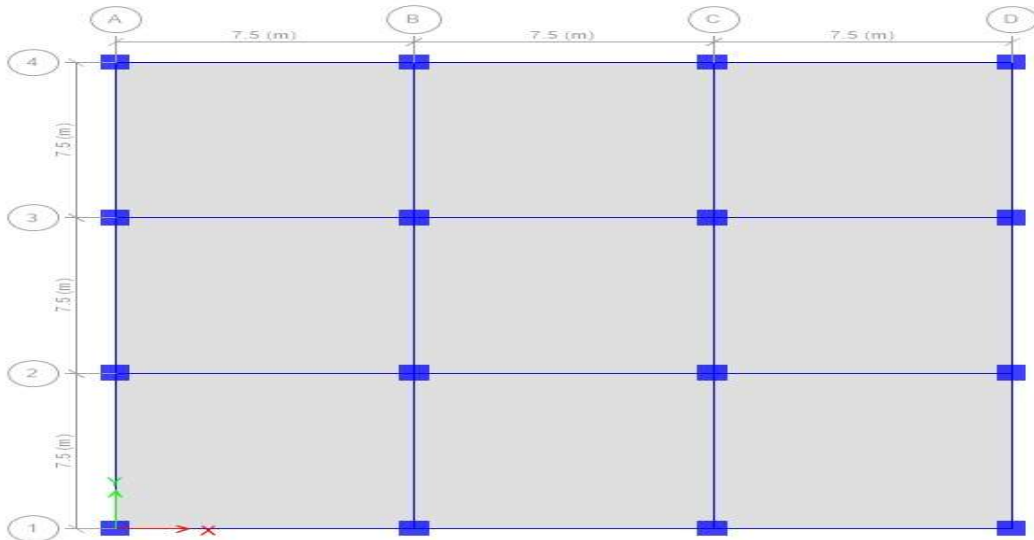

FIG.7.1.1.The plan view G+10 having 3 bay and 7.5m each bay length

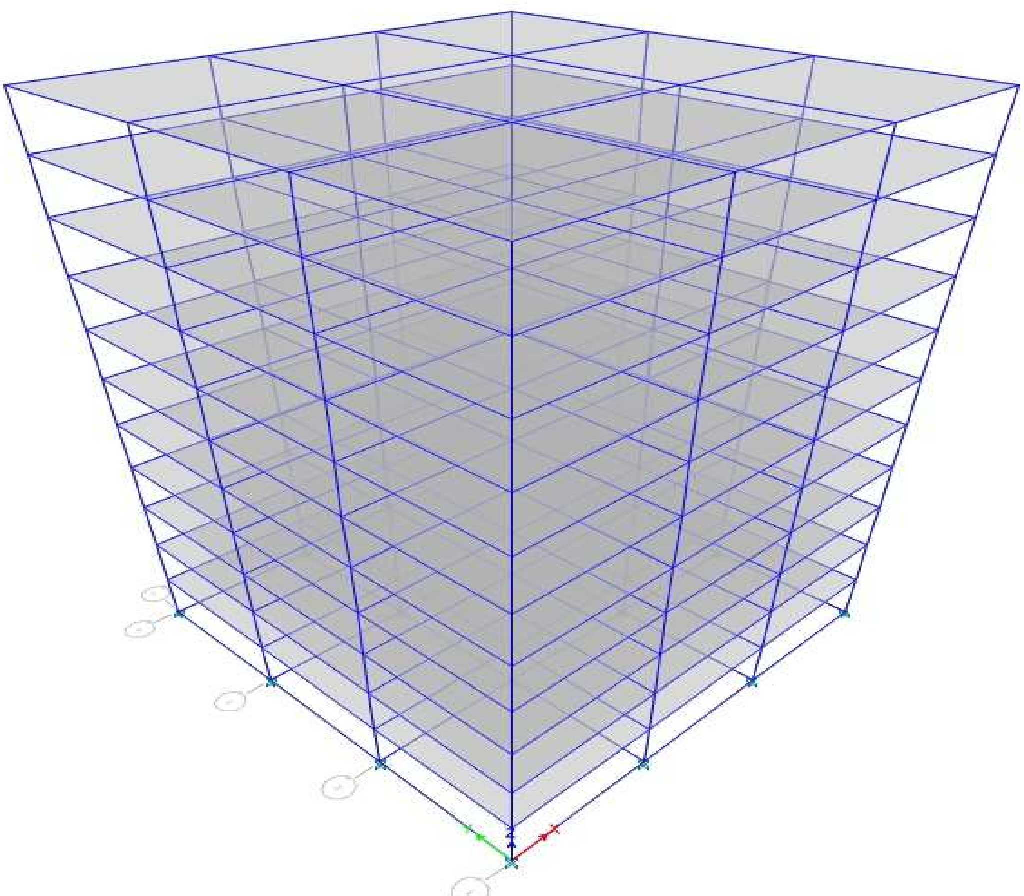

FIG.7.1.2.The 3D view G+10 structure having each floor height is 3m with rigid base.

7.2 Structure Configuration G+20

The structure model in the study has G+20 storeys with same storey height of 3m. Multiple models are used to analyze in three load combination and in different zone of earthquake with equal the number of bay lengths, and width in the two horizontal directions are same for convenience. Applied different values of zone factor in model and their effects on the results. All other details are given in table 7.2.

Table.7.2. Model 2:-G+20 shows the different parameter of structure in different zones.

PARAMETER	ZONE-2	ZONE-3	ZONE-4	ZONE-5
FLOOR HEIGHT	3m	3M	3M	3M
LENGTH*WIDTH	22.50m*22.50m	22.50m*22.50m	22.50m*22.50m	22.50m*22.50m
LENGTH OF EACH BAY	7.50m	7.50m	7.50m	7.50m
BEAM	.45m*.25m	.45m*.25m	.45m*.25m	.45m*.25m
COLUMN	0.75m*0.75m	0.75m*0.75m	0.75m*0.75m	0.75m*0.75m
SLAB THICKNESS	150mm	150mm	150mm	150mm
SUPPORT CONDITION	fixed	fixed	fixed	fixed
GRADE OF CONCRETE	M30	M30	M30	M30
GRADE OF STEEL	Fe415	Fe415	Fe415	Fe415
SEISMIC ZONE FACTOR	.1	.16	.24	.36
BASIC WIND SPEED	44m/s	39m/s	47m/s	50m/s

RESPONSE REDUCTION FACTOR	05	05	05	05
INPORTAN FACTOR	1	1	1	1
SOIL CONDITION	Medium(2)	Medium(2)	Medium(2)	Medium(2)

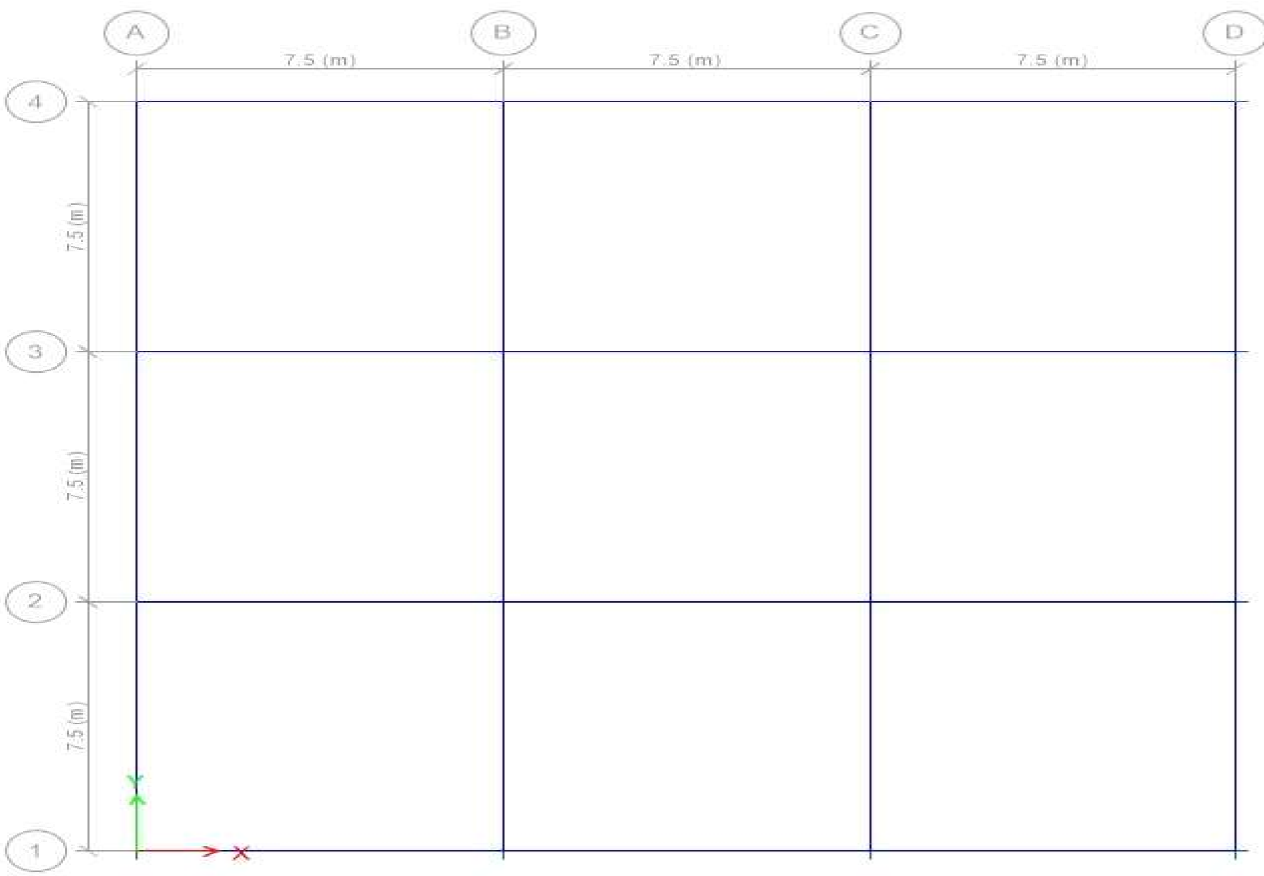

FIG.7.2.1.The PLAN VIEW G+20 having 3 bay and 7.5m each bay length

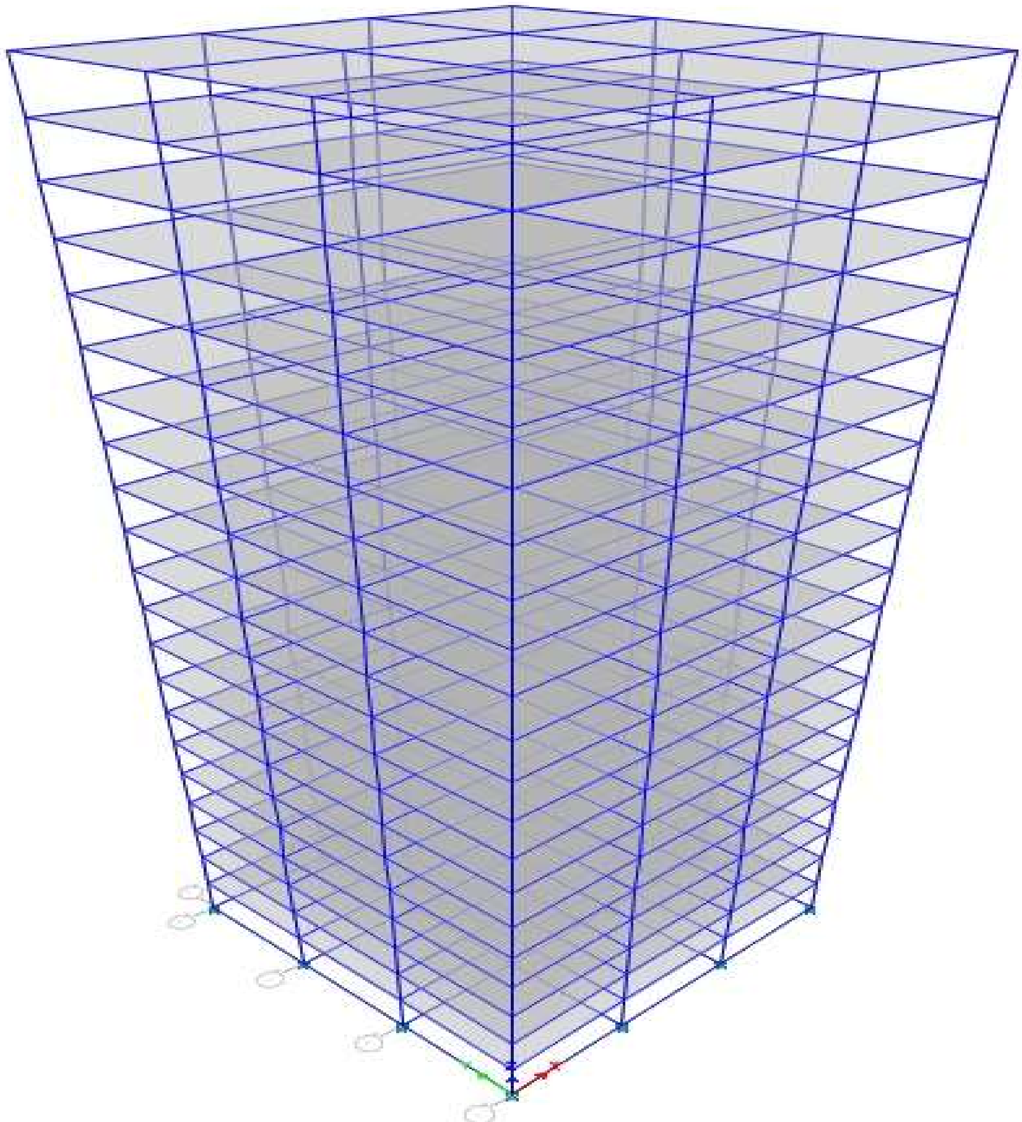

FIG.7.2.1.The 3D view G+20 structure having each floor height is 3m with rigid base

8. Results And Discussion:

8.1 Detailed results of G+10 structure

8.1.1 POINT DISPLACEMENT for EARTH QUAKE LOAD:

Table.8.1.Displacement EQ. (0.9D+1.5EQ) in different zones and the story height.

story	elevation	UNIT=mm			
		zone-5	zone-4	zone-3	zone-2
Story11	33	68.023	45.349	30.232	18.895
Story10	30	64.369	42.912	28.608	17.88
Story9	27	59.768	39.845	26.563	16.602
Story8	24	54.091	36.061	24.041	15.025
Story7	21	47.418	31.612	21.075	13.172
Story6	18	39.935	26.623	17.749	11.093
Story5	15	31.895	21.263	14.175	8.86
Story4	12	23.613	15.742	10.495	6.559
Story3	9	15.498	10.332	6.888	4.305
Story2	6	8.138	5.425	3.617	2.26
Story1	3	2.452	1.635	1.09	0.681
Base	0	0	0	0	0

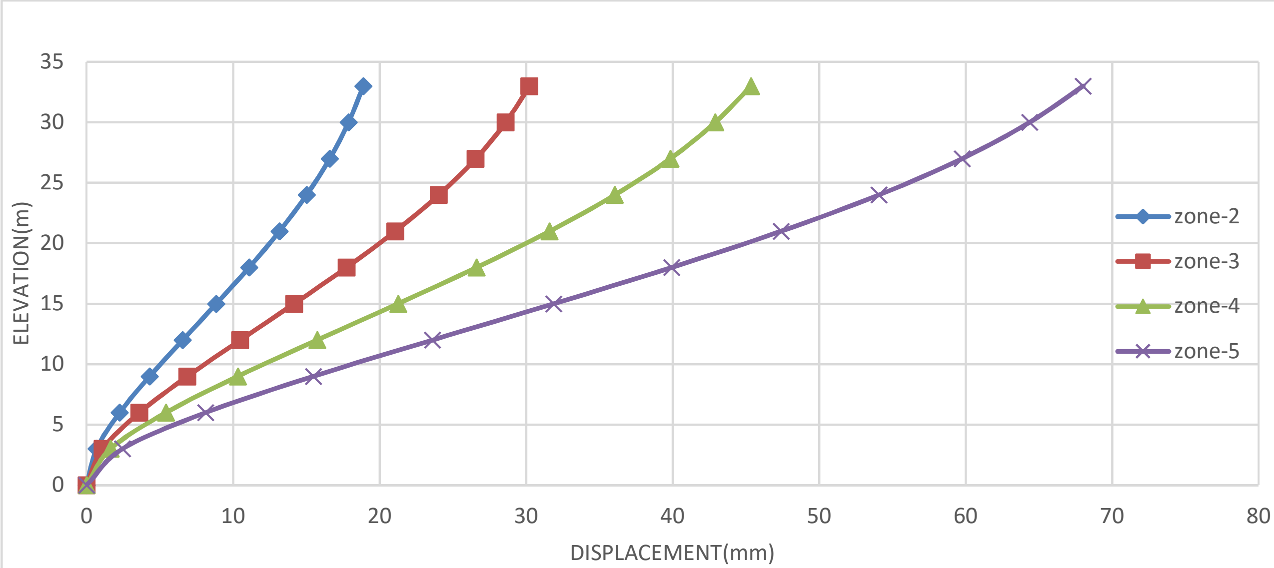

Fig.8.1. displacement curve (.9d+1.5eq)

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 is 68.023mm.whereas the minimum displacement is observed in zone 2 i.e, 18.895mm.

Table.8.2. displacement EQ. 1.2(D+L+EQ) in different zones and the story height

displacement EQ. 1.2(D+L+EQ)					
story	elevation	UNIT= mm			
		zone-5	zone-4	zone-3	zone-2
Story11	33	54.418	36.279	24.186	15.116
Story10	30	51.495	34.33	22.887	14.304
Story9	27	47.814	31.876	21.251	13.282
Story8	24	43.273	28.849	19.232	12.02
Story7	21	37.934	25.29	16.86	10.537
Story6	18	31.948	21.299	14.199	8.874
Story5	15	25.516	17.01	11.34	7.088
Story4	12	18.89	12.593	8.396	5.247
Story3	9	12.399	8.266	5.511	3.444
Story2	6	6.51	4.34	2.893	1.808
Story1	3	1.962	1.308	0.872	0.545
Base	0	0	0	0	0

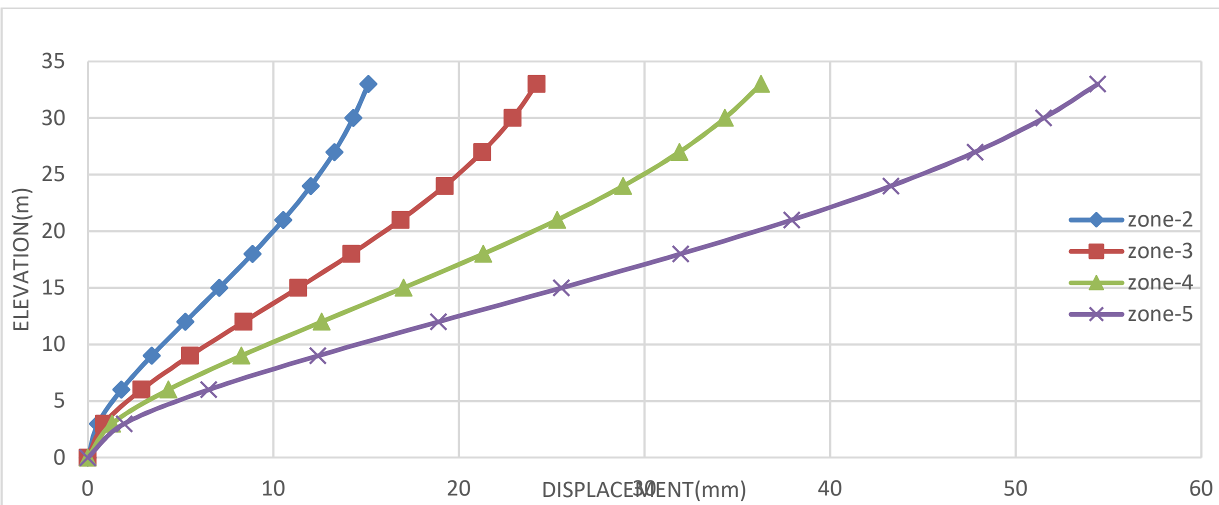

Fig.8.2: displacement curve 1.2(d+L+eq)

From above figure, for the load combination 1.2(d+l+eq) the maximum displacement is observed in zone 5 is 54.418mm.whereas the minimum displacement is observed in zone 2 i.e, 15.116mm.

Table.8.3. displacement EQ. 1.5(D+EQX) in different zones and the story height

displacement EQ. 1.5(D+EQ)					
story	elevation	UNIT=mm			
		zone-5	zone-4	zone-3	zone-2
Story11	33	68.023	45.349	30.232	18.895
Story10	30	64.369	42.912	28.608	17.88
Story9	27	59.768	39.845	26.563	16.602
Story8	24	54.091	36.061	24.041	15.025
Story7	21	47.418	31.612	21.075	13.172
Story6	18	39.935	26.623	17.749	11.093
Story5	15	31.895	21.263	14.175	8.86
Story4	12	23.613	15.742	10.495	6.559
Story3	9	15.498	10.332	6.888	4.305
Story2	6	8.138	5.425	3.617	2.26
Story1	3	2.452	1.635	1.09	0.681
Base	0	0	0	0	0

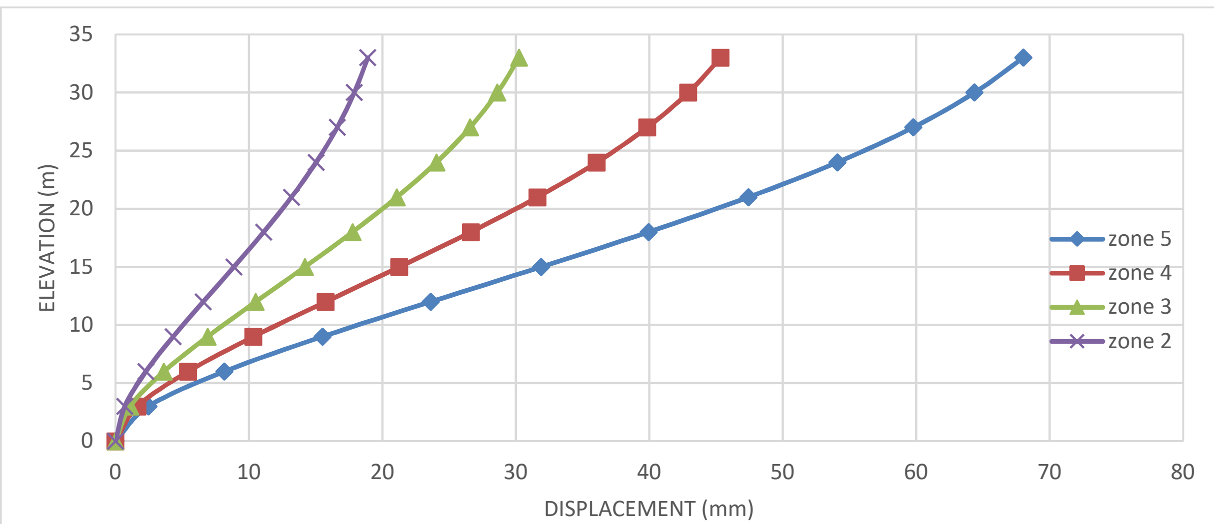

Fig.8.3: displacement curve 1.5(D+EQ)

From above figure, for the load combination 1.5(d+eq) the maximum displacement is observed in zone 5 is 68.023mm.whereas the minimum displacement is observed in zone 2 i.e, 18.895mm.

8.1.2. Point Displacement for Wind Load:

Table.8.4. displacement WIND (.9D+1.5wind) in different wind speed and the story height

story	elevation	UNIT=mm			
		50m/s	47m/s	39m/s	44m/s
Story11	33	69.473	61.386	42.267	53.8
Story10	30	66.979	59.183	40.75	51.869
Story9	27	63.633	56.226	38.714	49.277
Story8	24	59.153	52.267	35.989	45.808
Story7	21	53.429	47.21	32.506	41.375
Story6	18	46.468	41.06	28.271	35.985
Story5	15	38.381	33.913	23.351	29.722
Story4	12	29.403	25.98	17.889	22.769
Story3	9	19.969	17.645	12.149	15.464
Story2	6	10.843	9.581	6.597	8.397
Story1	3	3.378	2.985	2.055	2.616
Base	0	0	0	0	0

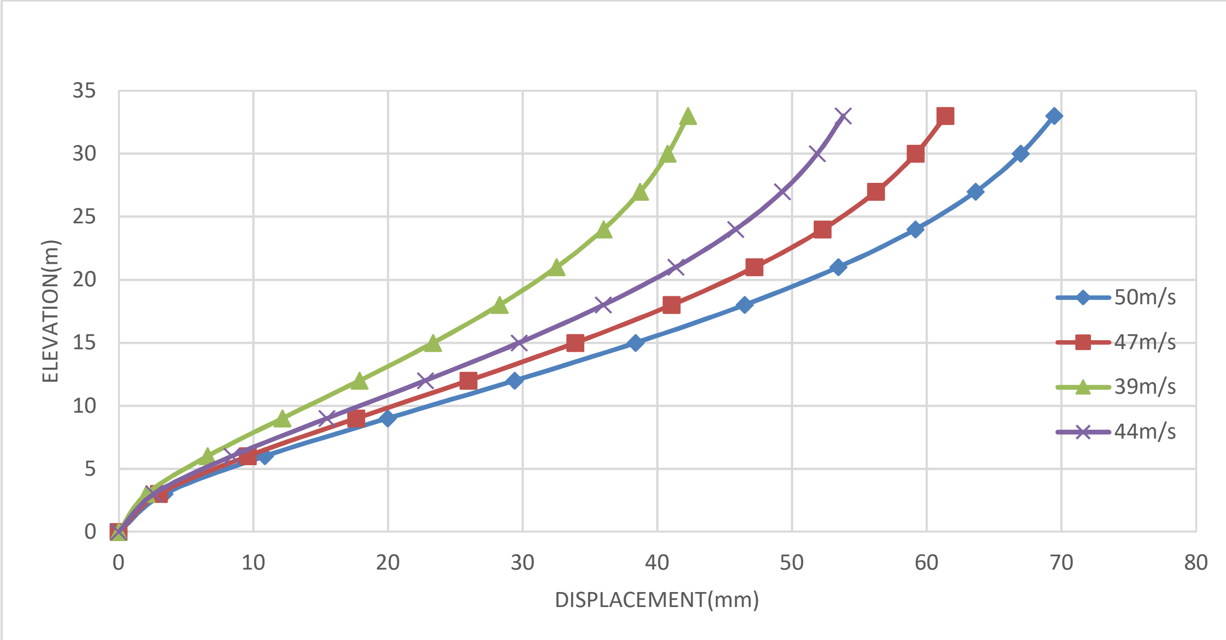

Fig.8.4: displacement curve (.9D+1.5wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 (50m/s) is 69.473mm.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, 42.267mm.

Table. 8.5. Displacement WIND 1.2(D+L+wind) in different wind speed and the story height

displacement WIND 1.2(D+L+wind)					
story	elevation	UNIT=mm			
		50m/s	47m/s	39m/s	44m/s
Story11	33	55.578	49.109	33.814	43.04
Story10	30	53.583	47.346	32.6	41.495
Story9	27	50.906	44.981	30.971	39.422
Story8	24	47.322	41.814	28.791	36.646
Story7	21	42.743	37.768	26.005	33.1
Story6	18	37.175	32.848	22.617	28.788
Story5	15	30.704	27.13	18.681	23.777
Story4	12	23.522	20.784	14.311	18.215
Story3	9	15.975	14.116	9.719	12.371
Story2	6	8.675	7.665	5.278	6.718
Story1	3	2.702	2.388	1.644	2.093
Base	0	0	0	0	0

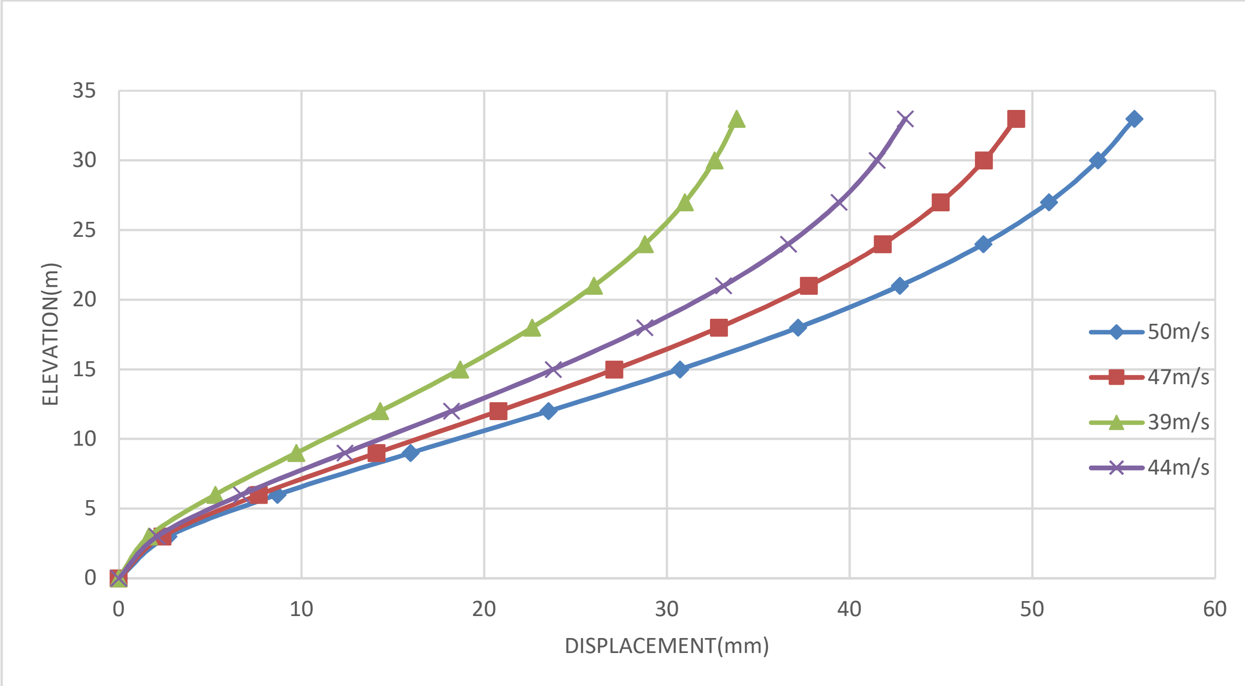

Fig.8.5: displacement curve 1.2(D+L+wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.2(D+L+wind)the maximum displacement is observed in zone 5 (50m/s) is 55.578mm.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, 33.814mm.

Table. 8.6. Displacement WIND 1.5(D+WIND) in different wind speed and the story height

displacement WIND 1.5(D+WIND)					
story	elevation	UNIT=mm			
		50m/s	47m/s	39m/s	44m/s
Story11	33	69.473	61.386	42.267	53.8
Story10	30	66.979	59.183	40.75	51.869
Story9	27	63.633	56.226	38.714	49.277
Story8	24	59.153	52.267	35.989	45.808
Story7	21	53.429	47.21	32.506	41.375
Story6	18	46.468	41.06	28.271	35.985
Story5	15	38.381	33.913	23.351	29.722
Story4	12	29.403	25.98	17.889	22.769
Story3	9	19.969	17.645	12.149	15.464
Story2	6	10.843	9.581	6.597	8.397
Story1	3	3.378	2.985	2.055	2.616
Base	0	0	0	0	0

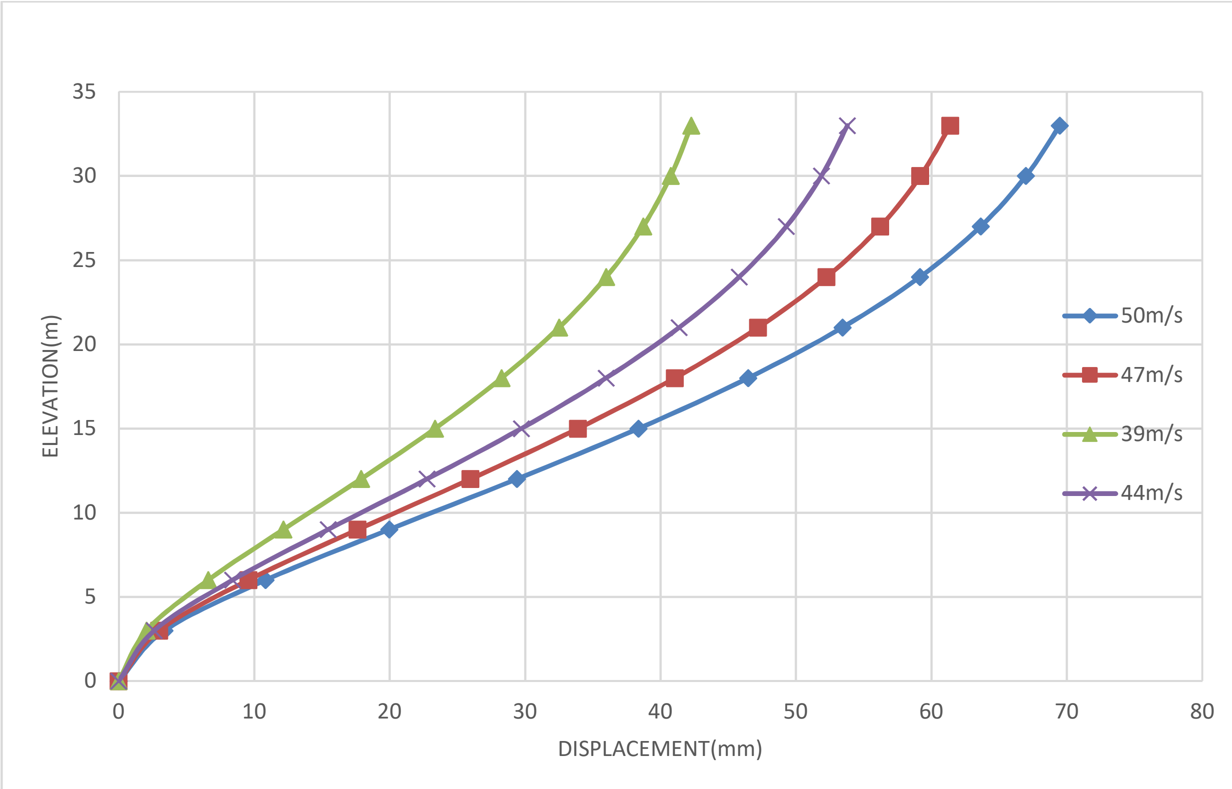

Fig.8.6: displacement curve 1.5(D+WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.5(D+WIND) the maximum displacement is observed in zone 5 (50m/s) is 69.473mm.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, 42.267mm.

8.1.3 Storey Drift for Earth Quake Load:

Table.8.7. STORY DRIFT EQ. (.9D+1.5EQ) in different zones and the story height

STORY DRIFT EQ. (.9D+1.5EQ)					
story	elevation				
		zone-5	zone-4	zone-3	zone-2
Story11	33	0.001218	0.000812	0.000541	0.000338
Story10	30	0.001534	0.001022	0.000682	0.000426
Story9	27	0.001892	0.001261	0.000841	0.000526
Story8	24	0.002224	0.001483	0.000989	0.000618
Story7	21	0.002494	0.001663	0.001109	0.000693
Story6	18	0.00268	0.001787	0.001191	0.000744
Story5	15	0.002761	0.00184	0.001227	0.000767
Story4	12	0.002705	0.001803	0.001202	0.000751
Story3	9	0.002454	0.001636	0.001091	0.000682
Story2	6	0.001895	0.001263	0.000842	0.000526
Story1	3	0.000817	0.000545	0.000363	0.000227
Base	0	0	0	0	0

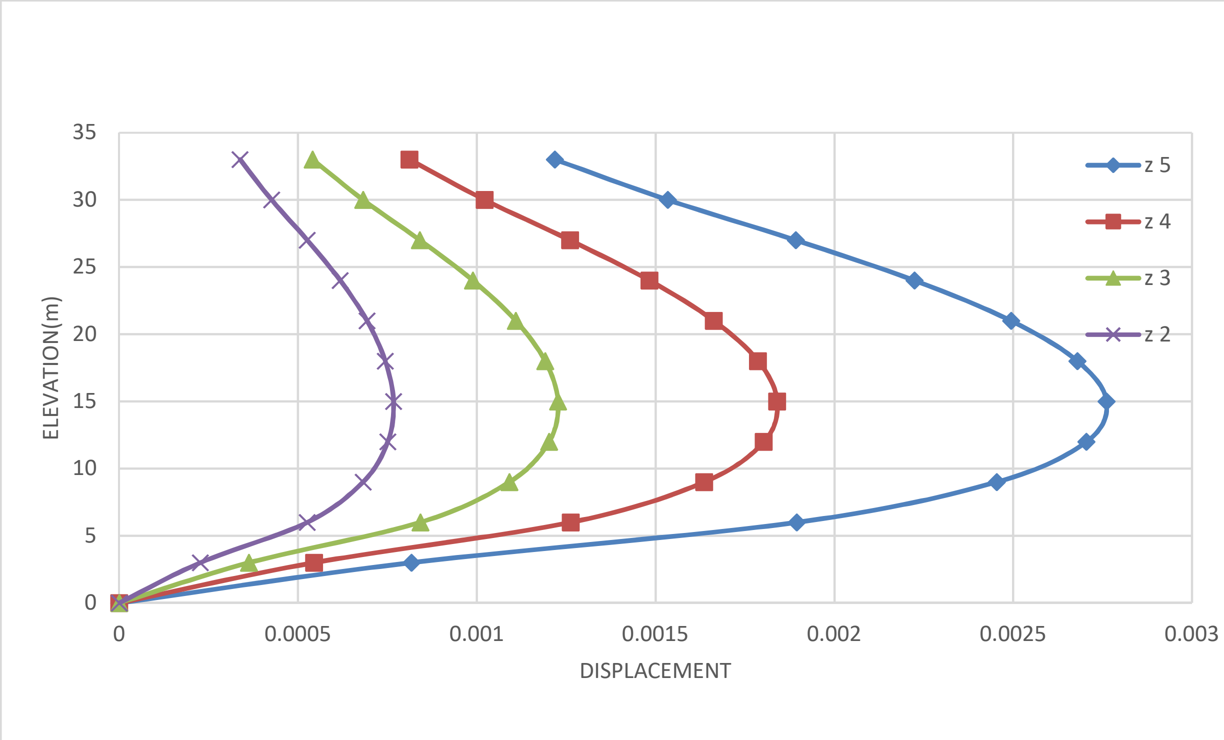

Fig.8.7: displacement curve (.9D+1.5EQ)

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 is .002761 at 15m.whereas the minimum displacement is observed in zone 2 i.e, .000767 at 15m.

Table.8.8. STORY DRIFT EQ. 1.2(D+L+EQ) in different zones and the story height

STORY DRIFT EQ. 1.2(D+L+EQ)					
story	elevation				
		zone-5	zone-4	zone-3	zone-2
Story11	33	0.000974	0.00065	0.000433	0.000271
Story10	30	0.001227	0.000818	0.000545	0.000341
Story9	27	0.001514	0.001009	0.000673	0.00042
Story8	24	0.00178	0.001186	0.000791	0.000494
Story7	21	0.001996	0.00133	0.000887	0.000554
Story6	18	0.002144	0.001429	0.000953	0.000596
Story5	15	0.002209	0.001472	0.000982	0.000613
Story4	12	0.002164	0.001443	0.000962	0.000601
Story3	9	0.001963	0.001309	0.000872	0.000545
Story2	6	0.001516	0.001011	0.000674	0.000421
Story1	3	0.000654	0.000436	0.000291	0.000182
Base	0	0	0	0	0

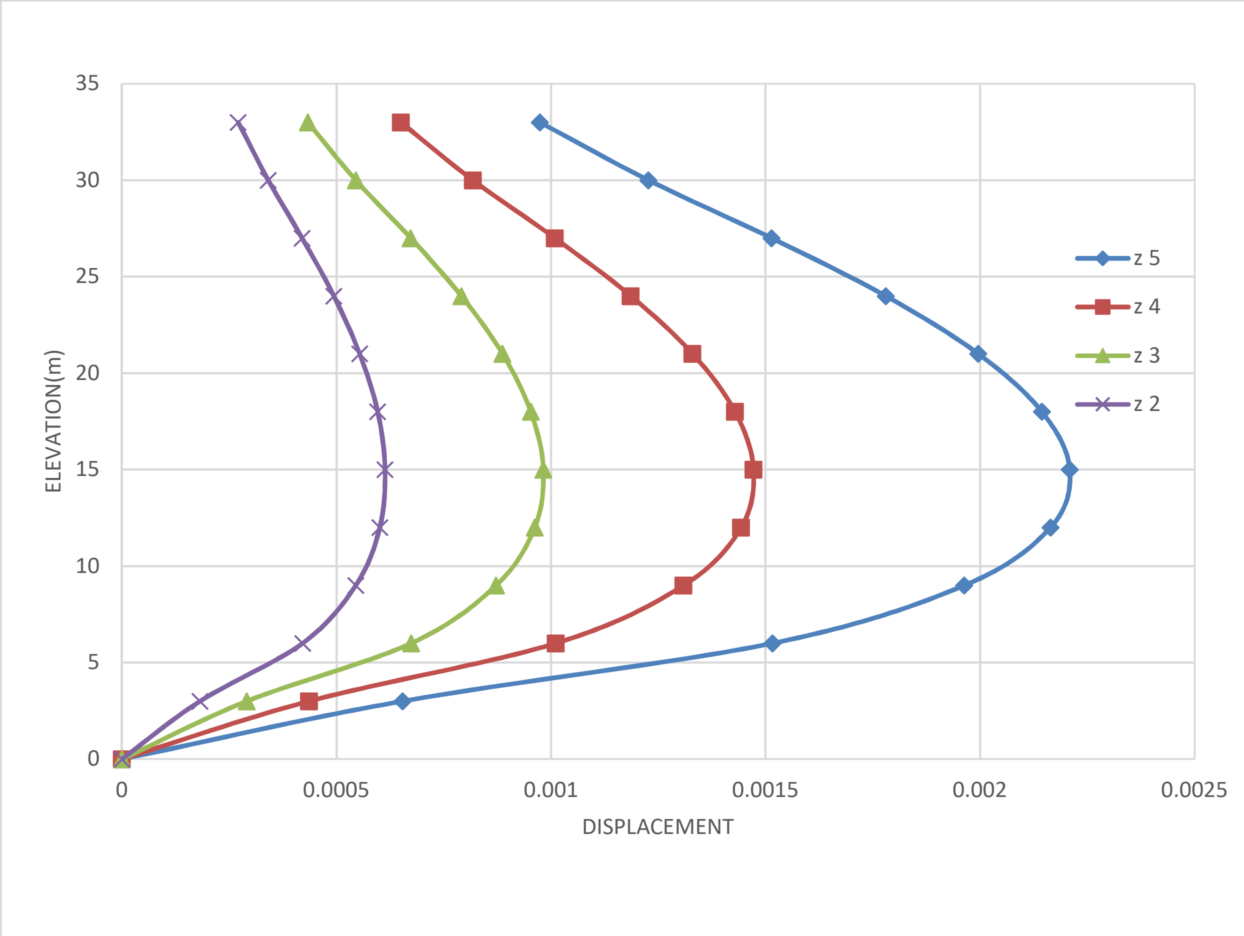

Fig.8.8: displacement curve 1.2(D+L+EQ)

From above figure, for the load combination 1.2(D+L+EQ) the maximum displacement is observed in zone 5 is .002209 at 15m.whereas the minimum displacement is observed in zone 2 i.e, .000613 at 15m.

Table.8.9. STORY DRIFT EQ. 1.5(D+EQ) in different zones and the story height

STORY DRIFT EQ. 1.5(D+EQ)					
story	elevation				
		zone-5	zone-4	zone-3	zone-2
Story11	33	0.001218	0.000812	0.000541	0.000338
Story10	30	0.001534	0.001022	0.000682	0.000426
Story9	27	0.001892	0.001261	0.000841	0.000526
Story8	24	0.002224	0.001483	0.000989	0.000618
Story7	21	0.002494	0.001663	0.001109	0.000693
Story6	18	0.00268	0.001787	0.001191	0.000744
Story5	15	0.002761	0.00184	0.001227	0.000767
Story4	12	0.002705	0.001803	0.001202	0.000751
Story3	9	0.002454	0.001636	0.001091	0.000682
Story2	6	0.001895	0.001263	0.000842	0.000526
Story1	3	0.000817	0.000545	0.000363	0.000227
Base	0	0	0	0	0

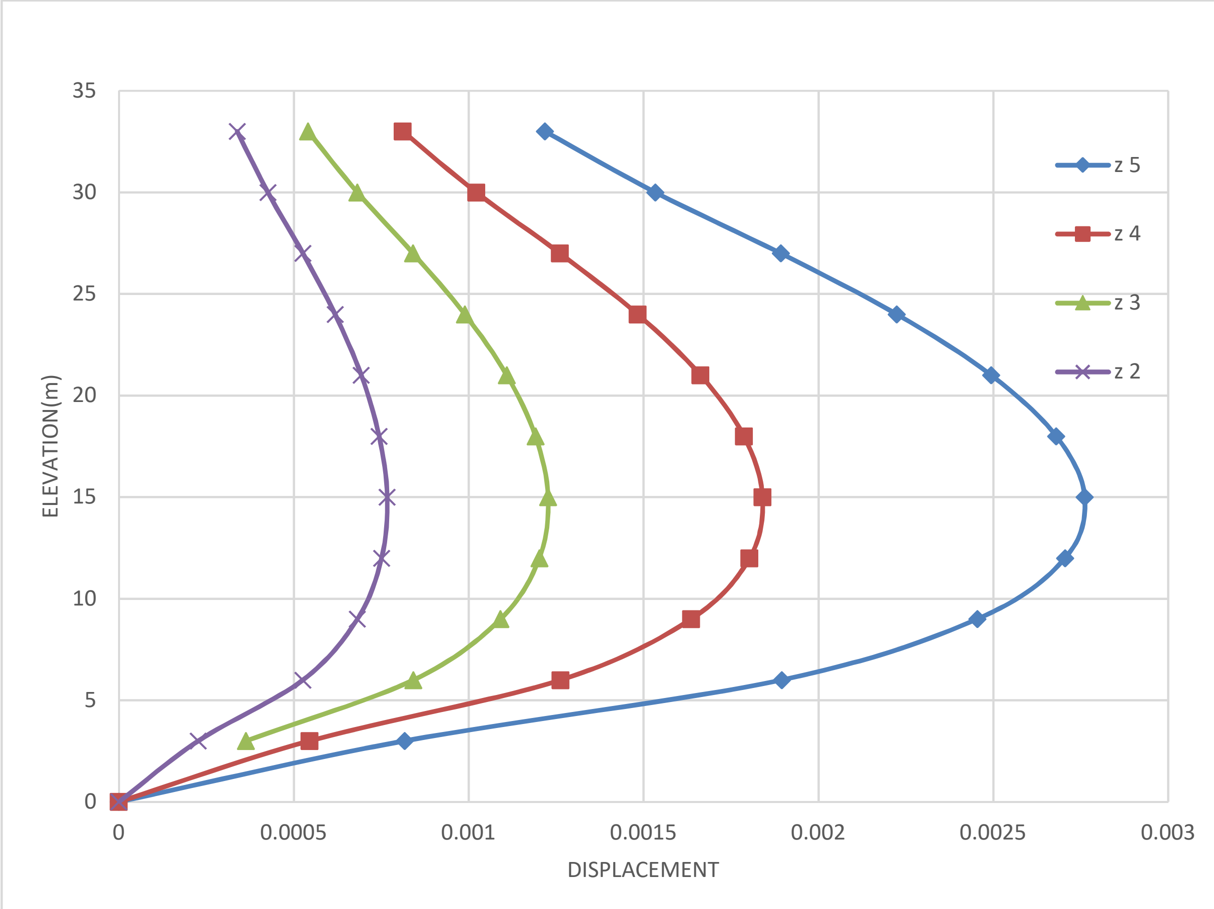

Fig.8.9: displacement curve 1.5(D+EQ)

From above figure, for the load combination 1.5(D+EQ)) the maximum displacement is observed in zone 5 is .002761 at 15m.whereas the minimum displacement is observed in zone 2 i.e, .000767at 15m.

8.1.4 Storey Drift for Wind Load:

Table.8.10. STORY DRIFT WIND (.9D+1.5wind) in different wind speed and the story height

STORY DRIFT WIND (.9D+1.5wind)					
story	elevation				
		50m/s	47m/s	39m/s	44m/s
Story11	33	0.000831	0.000735	0.000506	0.000644
Story10	30	0.001115	0.000986	0.000679	0.000864
Story9	27	0.001493	0.00132	0.000909	0.001156
Story8	24	0.001908	0.001686	0.001161	0.001477
Story7	21	0.00232	0.00205	0.001412	0.001797
Story6	18	0.002696	0.002382	0.00164	0.002088
Story5	15	0.002993	0.002644	0.001821	0.002317
Story4	12	0.003145	0.002779	0.001913	0.002435
Story3	9	0.003042	0.002688	0.001851	0.002356
Story2	6	0.002488	0.002199	0.001514	0.001927
Story1	3	0.001126	0.000995	0.000685	0.000872
Base	0	0	0	0	0

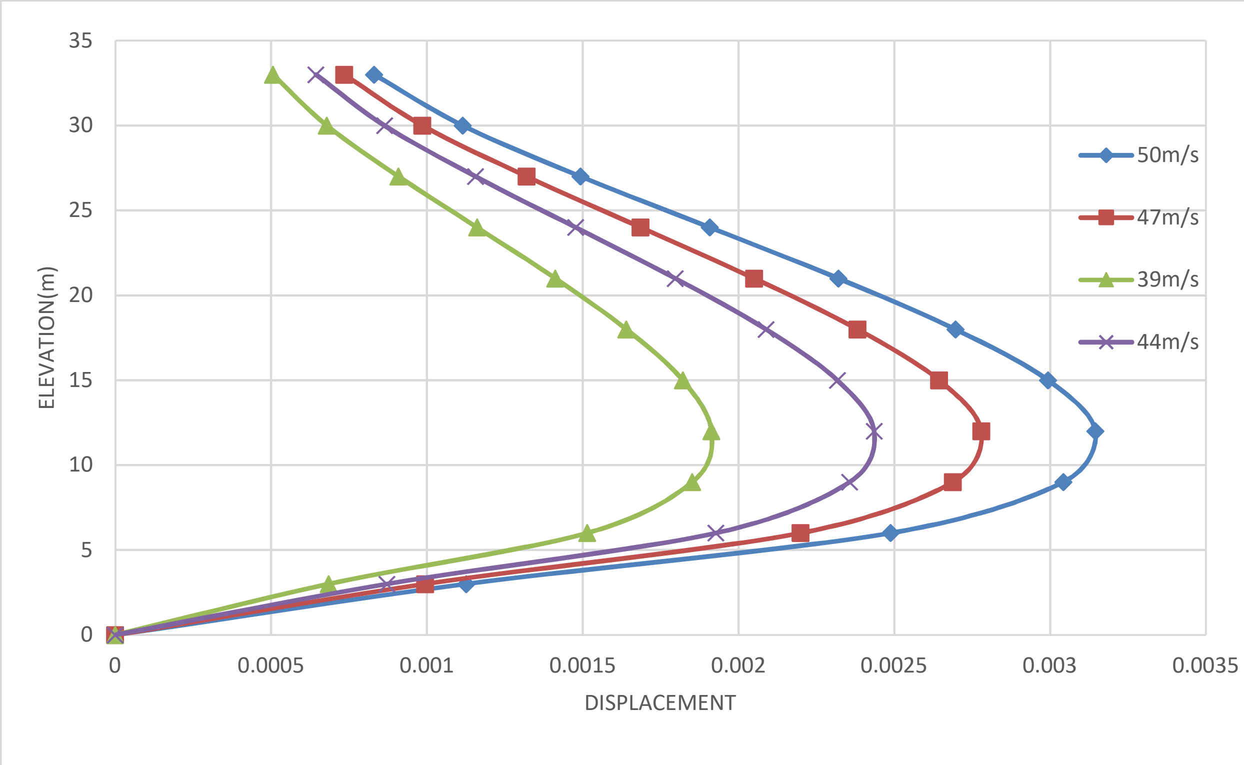

Fig.8.10: displacement curve (.9D+1.5WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s)).

From above figure, for the load combination (.9d+1.5wind) the maximum displacement is observed in zone 5 (50m/s) is .003145 at 12m.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, .001913 at 12m.

Table. 8.11. STORY DRIFT WIND 1.2(D+L+wind) in different wind speed and the story height

STORY DRIFT WIND 1.2(D+L+wind)					
story	elevation				
		50m/s	47m/s	39m/s	44m/s
Story11	33	0.000665	0.000588	0.000405	0.000515
Story10	30	0.000892	0.000788	0.000543	0.000691
Story9	27	0.001195	0.001056	0.000727	0.000925
Story8	24	0.001526	0.001349	0.000929	0.001182
Story7	21	0.001856	0.00164	0.001129	0.001437
Story6	18	0.002157	0.001906	0.001312	0.00167
Story5	15	0.002394	0.002115	0.001457	0.001854
Story4	12	0.002516	0.002223	0.001531	0.001948
Story3	9	0.002434	0.00215	0.001481	0.001885
Story2	6	0.001991	0.001759	0.001211	0.001542
Story1	3	0.000901	0.000796	0.000548	0.000698
Base	0	0	0	0	0

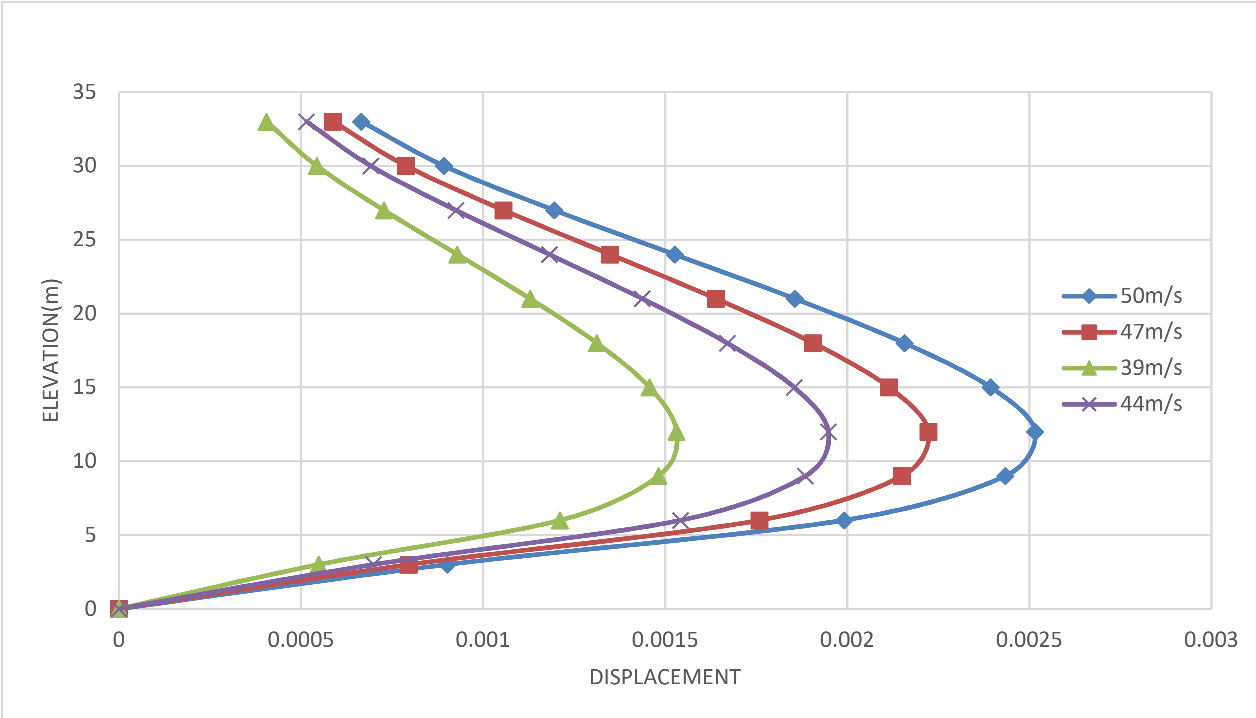

Fig.8.11: displacement curve 1.2(D+L+wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.2(D+L+wind)the maximum displacement is observed in zone 5 (50m/s) is .002516 at 12m.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, .001531 at 12m.

Table. 8.12. STORY DRIFT WIND 1.5(D+WIND) in different wind speed and the story height

STORY DRIFT WIND 1.5(D+WIND)					
story	elevation				
		50m/s	47m/s	39m/s	44m/s
Story11	33	0.000831	0.000735	0.000506	0.000644
Story10	30	0.001115	0.000986	0.000679	0.000864
Story9	27	0.001493	0.00132	0.000909	0.001156
Story8	24	0.001908	0.001686	0.001161	0.001477
Story7	21	0.00232	0.00205	0.001412	0.001797
Story6	18	0.002696	0.002382	0.00164	0.002088
Story5	15	0.002993	0.002644	0.001821	0.002317
Story4	12	0.003145	0.002779	0.001913	0.002435
Story3	9	0.003042	0.002688	0.001851	0.002356
Story2	6	0.002488	0.002199	0.001514	0.001927
Story1	3	0.001126	0.000995	0.000685	0.000872
Base	0	0	0	0	0

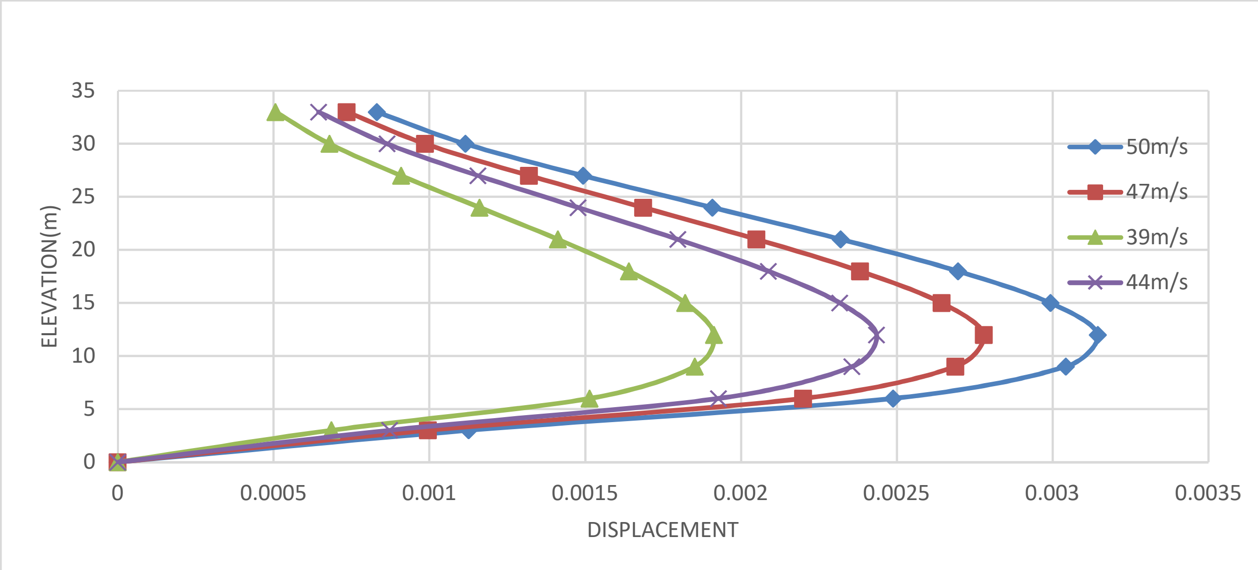

Fig.8.12: displacement curve 1.5(D+WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.5(D+WIND) the maximum displacement is observed in zone 5 (50m/s) is .003145 at 12m.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, .001913 at 12m.

8.1.5 Storey Shear for Earth Quake Load:

Table.8.13. STORY SHEAR EQ. (.9D+1.5EQ) in different zones and the story height

STORY SHEAR EQ. (.9D+1.5EQ)						
story	elevation		UNIT=KN			
			zone-5	zone-4	zone-3	zone-2
Story11	33	Top	-317.5013	-211.6675	-141.1117	-88.1948
		Bottom	-317.5013	-211.6675	-141.1117	-88.1948
Story10	30	Top	-609.9726	-406.6484	-271.0989	-169.4368
		Bottom	-609.9726	-406.6484	-271.0989	-169.4368
Story9	27	Top	-846.8743	-564.5829	-376.3886	-235.2429
		Bottom	-846.8743	-564.5829	-376.3886	-235.2429
Story8	24	Top	-1034.0559	-689.3706	-459.5804	-287.2378
		Bottom	-1034.0559	-689.3706	-459.5804	-287.2378
Story7	21	Top	-1177.3669	-784.9112	-523.2742	-327.0464
		Bottom	-1177.3669	-784.9112	-523.2742	-327.0464
Story6	18	Top	-1282.6565	-855.1043	-570.0696	-356.2935
		Bottom	-1282.6565	-855.1043	-570.0696	-356.2935
Story5	15	Top	-1355.7743	-903.8496	-602.5664	-376.604
		Bottom	-1355.7743	-903.8496	-602.5664	-376.604
Story4	12	Top	-1402.5697	-935.0465	-623.3643	-389.6027
		Bottom	-1402.5697	-935.0465	-623.3643	-389.6027
Story3	9	Top	-1428.8922	-952.5948	-635.0632	-396.9145
		Bottom	-1428.8922	-952.5948	-635.0632	-396.9145
Story2	6	Top	-1440.591	-960.394	-640.2627	-400.1642
		Bottom	-1440.591	-960.394	-640.2627	-400.1642
Story1	3	Top	-1443.5157	-962.3438	-641.5625	-400.9766
		Bottom	-1443.5157	-962.3438	-641.5625	-400.9766
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

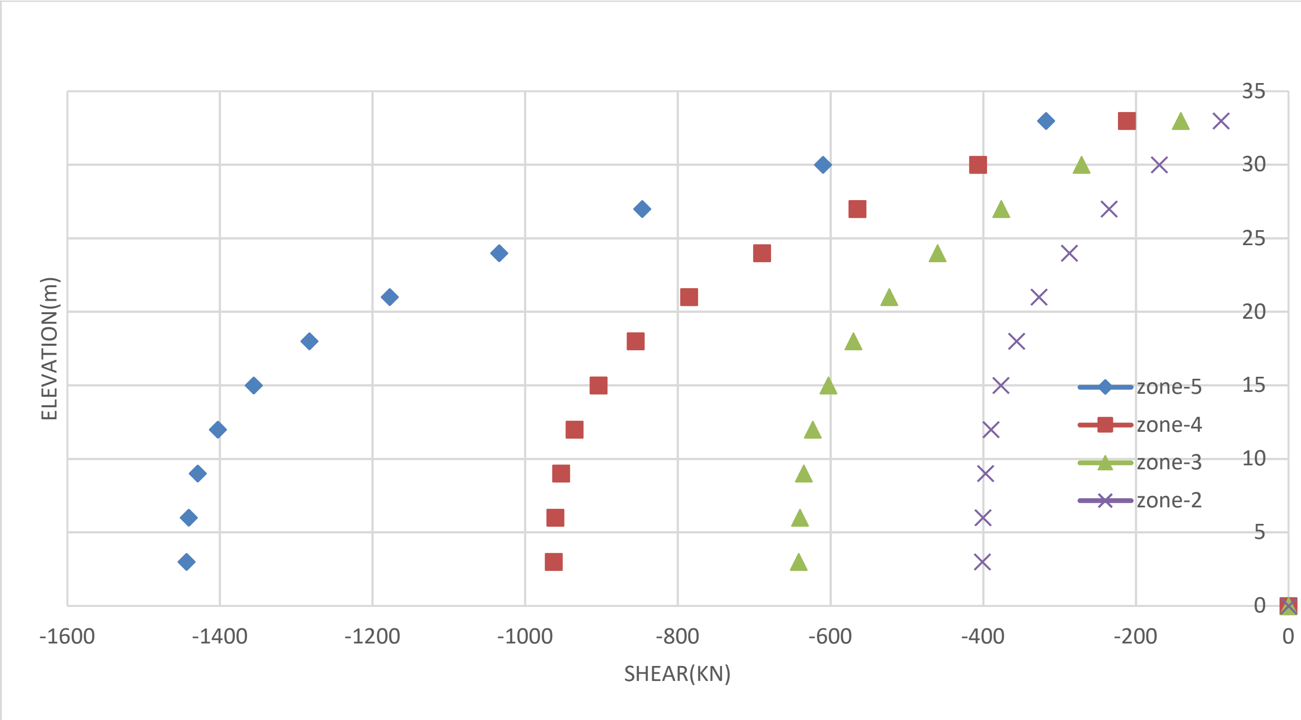

Fig.8.13.Story Shear Curve (.9D+1.5EQ)

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 is -1443.157KN.whereas the minimum displacement is observed in zone 2 i.e, -400.9766KN.

Table. 8.14. STORY SHEAR EQ. 1.2(D+L+EQ) in different zones and the story height

STORY SHEAR EQ. 1.2(D+L+EQ)						
story	elevation	UNIT=KN				
			zone-5	zone-4	zone-3	zone-2
Story11	33	Top	-254.0011	-169.334	-112.8894	-70.5558
		Bottom	-254.0011	-169.334	-112.8894	-70.5558
Story10	30	Top	-487.9781	-325.3187	-216.8791	-135.5495
		Bottom	-487.9781	-325.3187	-216.8791	-135.5495
Story9	27	Top	-677.4995	-451.6663	-301.1109	-188.1943
		Bottom	-677.4995	-451.6663	-301.1109	-188.1943
Story8	24	Top	-827.2448	-551.4965	-367.6643	-229.7902
		Bottom	-827.2448	-551.4965	-367.6643	-229.7902
Story7	21	Top	-941.8935	-627.929	-418.6193	-261.6371
		Bottom	-941.8935	-627.929	-418.6193	-261.6371
Story6	18	Top	-1026.1252	-684.0835	-456.0557	-285.0348
		Bottom	-1026.1252	-684.0835	-456.0557	-285.0348
Story5	15	Top	-1084.6195	-723.0796	-482.0531	-301.2832
		Bottom	-1084.6195	-723.0796	-482.0531	-301.2832
Story4	12	Top	-1122.0558	-748.0372	-498.6915	-311.6822
		Bottom	-1122.0558	-748.0372	-498.6915	-311.6822
Story3	9	Top	-1143.1137	-762.0758	-508.0505	-317.5316
		Bottom	-1143.1137	-762.0758	-508.0505	-317.5316
Story2	6	Top	-1152.4728	-768.3152	-512.2101	-320.1313
		Bottom	-1152.4728	-768.3152	-512.2101	-320.1313
Story1	3	Top	-1154.8126	-769.875	-513.25	-320.7813
		Bottom	-1154.8126	-769.875	-513.25	-320.7813
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

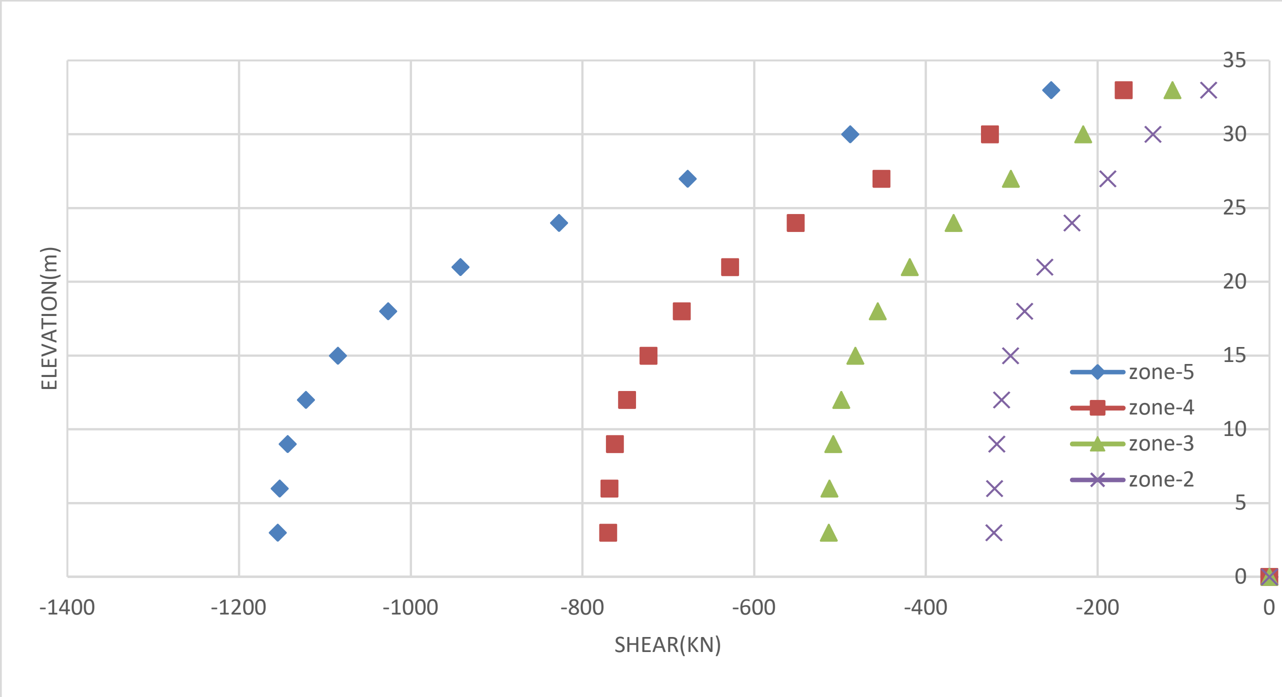

Fig.8.14.Story Shear Curve 1.2(D+L+EQ)

From above figure, for the load combination 1.2(D+L+EQ)the maximum displacement is observed in zone 5 is -1154.8126KN.whereas the minimum displacement is observed in zone 2 i.e, -320.7813KN.

Table. 8.15. STORY SHEAR EQ. 1.5(D+EQ) in different zones and the story height

STORY SHEAR EQ. 1.5(D+EQ)						
story	elevation		UNIT=KN			
			zone-5	zone-4	zone-3	zone-2
Story11	33	Top	-317.5013	-211.6675	-141.1117	-88.1948
		Bottom	-317.5013	-211.6675	-141.1117	-88.1948
Story10	30	Top	-609.9726	-406.6484	-271.0989	-169.4368
		Bottom	-609.9726	-406.6484	-271.0989	-169.4368
Story9	27	Top	-846.8743	-564.5829	-376.3886	-235.2429
		Bottom	-846.8743	-564.5829	-376.3886	-235.2429
Story8	24	Top	-1034.0559	-689.3706	-459.5804	-287.2378
		Bottom	-1034.0559	-689.3706	-459.5804	-287.2378
Story7	21	Top	-1177.3669	-784.9112	-523.2742	-327.0464
		Bottom	-1177.3669	-784.9112	-523.2742	-327.0464
Story6	18	Top	-1282.6565	-855.1043	-570.0696	-356.2935
		Bottom	-1282.6565	-855.1043	-570.0696	-356.2935
Story5	15	Top	-1355.7743	-903.8496	-602.5664	-376.604
		Bottom	-1355.7743	-903.8496	-602.5664	-376.604
Story4	12	Top	-1402.5697	-935.0465	-623.3643	-389.6027
		Bottom	-1402.5697	-935.0465	-623.3643	-389.6027
Story3	9	Top	-1428.8922	-952.5948	-635.0632	-396.9145
		Bottom	-1428.8922	-952.5948	-635.0632	-396.9145
Story2	6	Top	-1440.591	-960.394	-640.2627	-400.1642
		Bottom	-1440.591	-960.394	-640.2627	-400.1642
Story1	3	Top	-1443.5157	-962.3438	-641.5625	-400.9766
		Bottom	-1443.5157	-962.3438	-641.5625	-400.9766
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

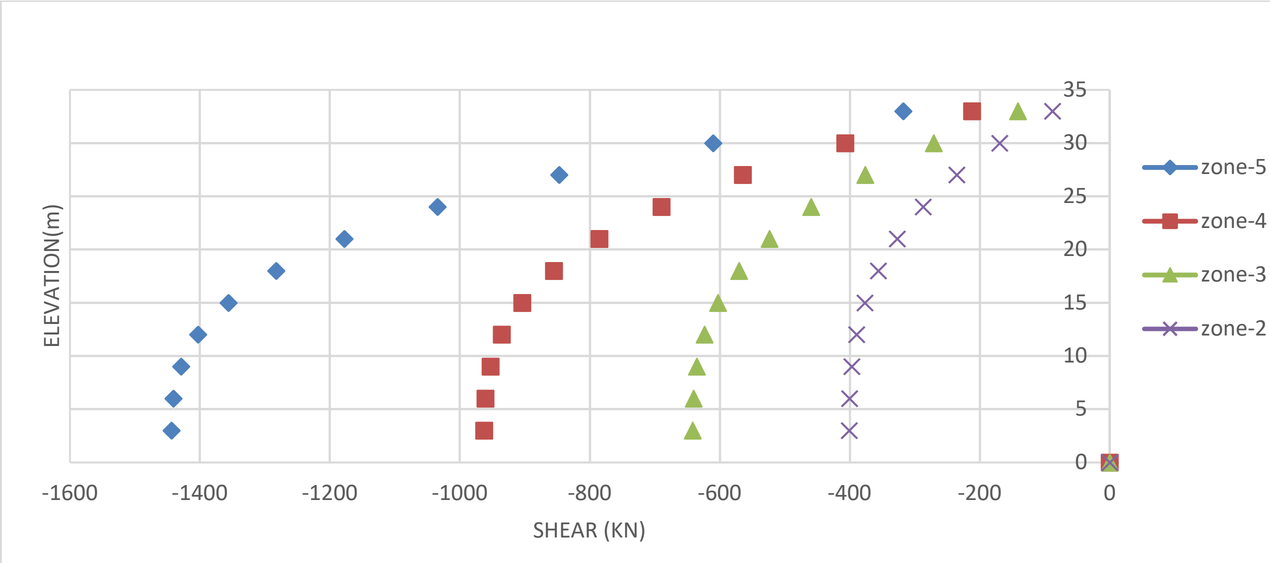

Fig.8.15.Story Shear Curve 1.5(D+EQ)

From above figure, for the load combination 1.5(D+EQ) the maximum displacement is observed in zone 5 is -1443.157KN.whereas the minimum displacement is observed in zone 2 i.e, -400.9766KN.

8.1.6 Storey Shear For Wind Load:

Table. 8.16. STORY SHEAR EQ. (.9D+1.5EQ) in different wind speed and the story height

STORY SHEAR EQ. (.9D+1.5EQ)						
story	elevation		UNIT=KN			
			50m/s	47m/s	39m/s	44m/s
Story11	33	Top	-124.9405	-110.3975	-76.0138	-96.7539
		Bottom	-124.9405	-110.3975	-76.0138	-96.7539
Story10	30	Top	-372.0572	-328.7498	-226.3596	-288.1211
		Bottom	-372.0572	-328.7498	-226.3596	-288.1211
Story9	27	Top	-613.1408	-541.7712	-373.0349	-474.8162
		Bottom	-613.1408	-541.7712	-373.0349	-474.8162
Story8	24	Top	-847.7237	-749.0487	-515.7551	-656.4772
		Bottom	-847.7237	-749.0487	-515.7551	-656.4772
Story7	21	Top	-1075.9572	-950.7158	-654.6124	-833.2213
		Bottom	-1075.9572	-950.7158	-654.6124	-833.2213
Story6	18	Top	-1298.6485	-1147.4858	-790.0978	-1005.6734
		Bottom	-1298.6485	-1147.4858	-790.0978	-1005.6734
Story5	15	Top	-1515.0952	-1338.7381	-921.7839	-1173.2897
		Bottom	-1515.0952	-1338.7381	-921.7839	-1173.2897
Story4	12	Top	-1720.612	-1520.3328	-1046.8204	-1332.4419
		Bottom	-1720.612	-1520.3328	-1046.8204	-1332.4419
Story3	9	Top	-1918.638	-1695.3085	-1167.2993	-1485.7932
		Bottom	-1918.638	-1695.3085	-1167.2993	-1485.7932
Story2	6	Top	-2116.0755	-1869.7643	-1287.4203	-1638.6888
		Bottom	-2116.0755	-1869.7643	-1287.4203	-1638.6888
Story1	3	Top	-2313.513	-2044.2201	-1407.5413	-1791.5844
		Bottom	-2313.513	-2044.2201	-1407.5413	-1791.5844
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

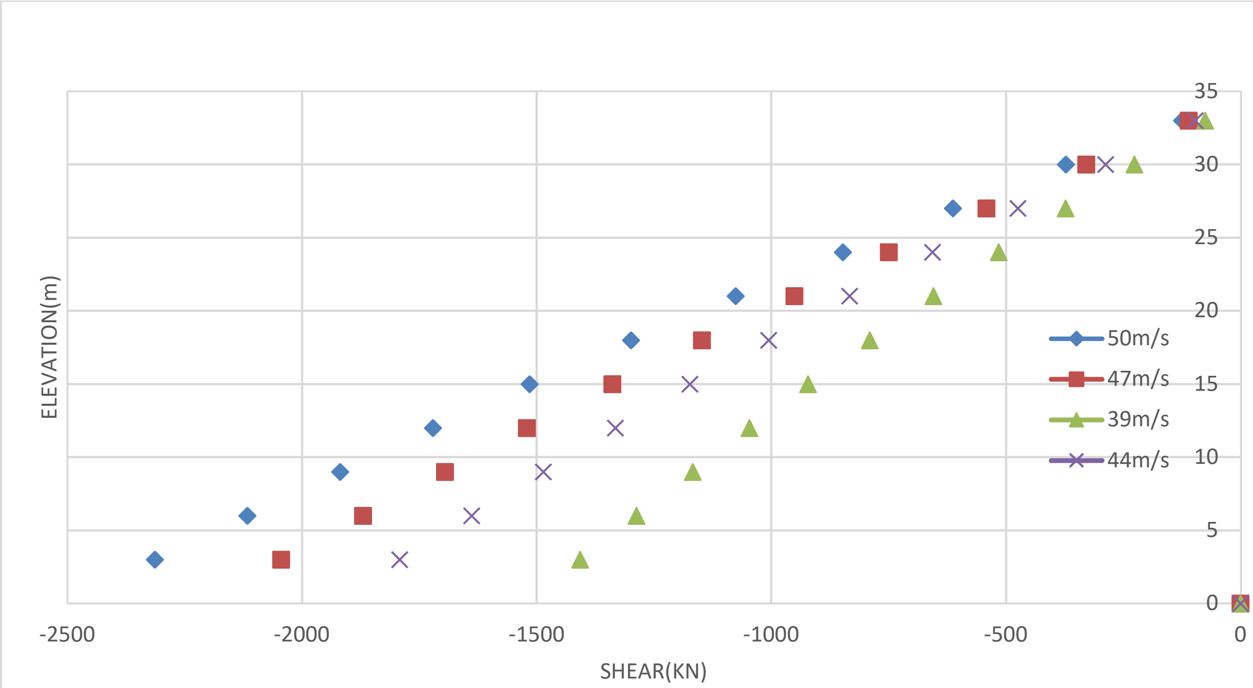

Fig.8.16.Story Shear Curve (.9d+1.5wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 (50m/s) is -2313.513KN.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, -1407.5413KN.

Table 8.17.STORY SHEAR WIND 1.2(D+L+wind) in different wind speed and the story height

STORY SHEAR WIND 1.2(D+L+wind)						
story	elevation		UNIT=KN			
			50m/s	47m/s	39m/s	44m/s
Story11	33	Top	-99.9524	-88.318	-60.8111	-77.4032
		Bottom	-99.9524	-88.318	-60.8111	-77.4032
Story10	30	Top	-297.6458	-262.9998	-181.0877	-230.4969
		Bottom	-297.6458	-262.9998	-181.0877	-230.4969
Story9	27	Top	-490.5126	-433.417	-298.4279	-379.853
		Bottom	-490.5126	-433.417	-298.4279	-379.853
Story8	24	Top	-678.179	-599.2389	-412.6041	-525.1818
		Bottom	-678.179	-599.2389	-412.6041	-525.1818
Story7	21	Top	-860.7658	-760.5726	-523.6899	-666.577
		Bottom	-860.7658	-760.5726	-523.6899	-666.577
Story6	18	Top	-1038.9188	-917.9887	-632.0782	-804.5387
		Bottom	-1038.9188	-917.9887	-632.0782	-804.5387
Story5	15	Top	-1212.0761	-1070.9905	-737.4271	-938.6317
		Bottom	-1212.0761	-1070.9905	-737.4271	-938.6317
Story4	12	Top	-1376.4896	-1216.2662	-837.4563	-1065.9536
		Bottom	-1376.4896	-1216.2662	-837.4563	-1065.9536
Story3	9	Top	-1534.9104	-1356.2468	-933.8395	-1188.6346
		Bottom	-1534.9104	-1356.2468	-933.8395	-1188.6346
Story2	6	Top	-1692.8604	-1495.8114	-1029.9363	-1310.9511
		Bottom	-1692.8604	-1495.8114	-1029.9363	-1310.9511
Story1	3	Top	-1850.8104	-1635.3761	-1126.033	-1433.2676
		Bottom	-1850.8104	-1635.3761	-1126.033	-1433.2676
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

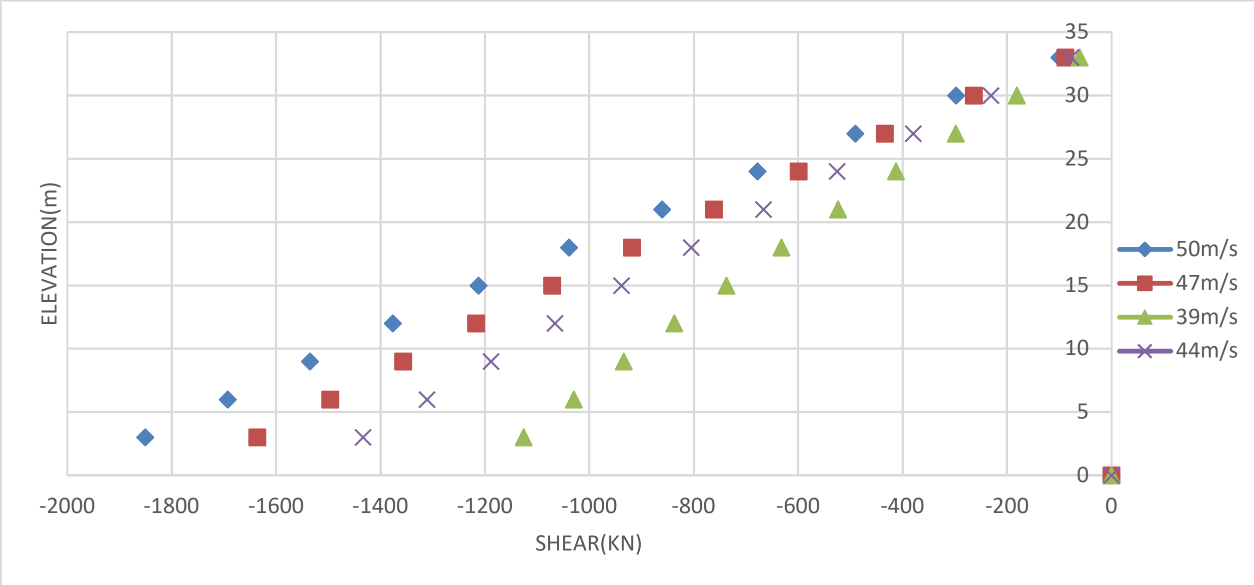

Fig.8.17.Story Shear Curve 1.2(D+L+wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.2(D+L+wind) the maximum displacement is observed in zone 5 (50m/s) is -1850.8104KN.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, -1126.00KN.

Table. 8.18. STORY SHEAR WIND 1.5(D+WIND) in different wind speed and the story height

STORY SHEAR WIND 1.5(D+WIND)						
story	elevation		UNIT=KN			
			50m/s	47m/s	39m/s	44m/s
Story11	33	Top	-124.9405	-110.3975	-76.0138	-96.7539
		Bottom	-124.9405	-110.3975	-76.0138	-96.7539
Story10	30	Top	-372.0572	-328.7498	-226.3596	-288.1211
		Bottom	-372.0572	-328.7498	-226.3596	-288.1211
Story9	27	Top	-613.1408	-541.7712	-373.0349	-474.8162
		Bottom	-613.1408	-541.7712	-373.0349	-474.8162
Story8	24	Top	-847.7237	-749.0487	-515.7551	-656.4772
		Bottom	-847.7237	-749.0487	-515.7551	-656.4772
Story7	21	Top	-1075.9572	-950.7158	-654.6124	-833.2213
		Bottom	-1075.9572	-950.7158	-654.6124	-833.2213
Story6	18	Top	-1298.6485	-1147.4858	-790.0978	-1005.6734
		Bottom	-1298.6485	-1147.4858	-790.0978	-1005.6734
Story5	15	Top	-1515.0952	-1338.7381	-921.7839	-1173.2897
		Bottom	-1515.0952	-1338.7381	-921.7839	-1173.2897
Story4	12	Top	-1720.612	-1520.3328	-1046.8204	-1332.4419
		Bottom	-1720.612	-1520.3328	-1046.8204	-1332.4419
Story3	9	Top	-1918.638	-1695.3085	-1167.2993	-1485.7932
		Bottom	-1918.638	-1695.3085	-1167.2993	-1485.7932
Story2	6	Top	-2116.0755	-1869.7643	-1287.4203	-1638.6888
		Bottom	-2116.0755	-1869.7643	-1287.4203	-1638.6888
Story1	3	Top	-2313.513	-2044.2201	-1407.5413	-1791.5844
		Bottom	-2313.513	-2044.2201	-1407.5413	-1791.5844
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

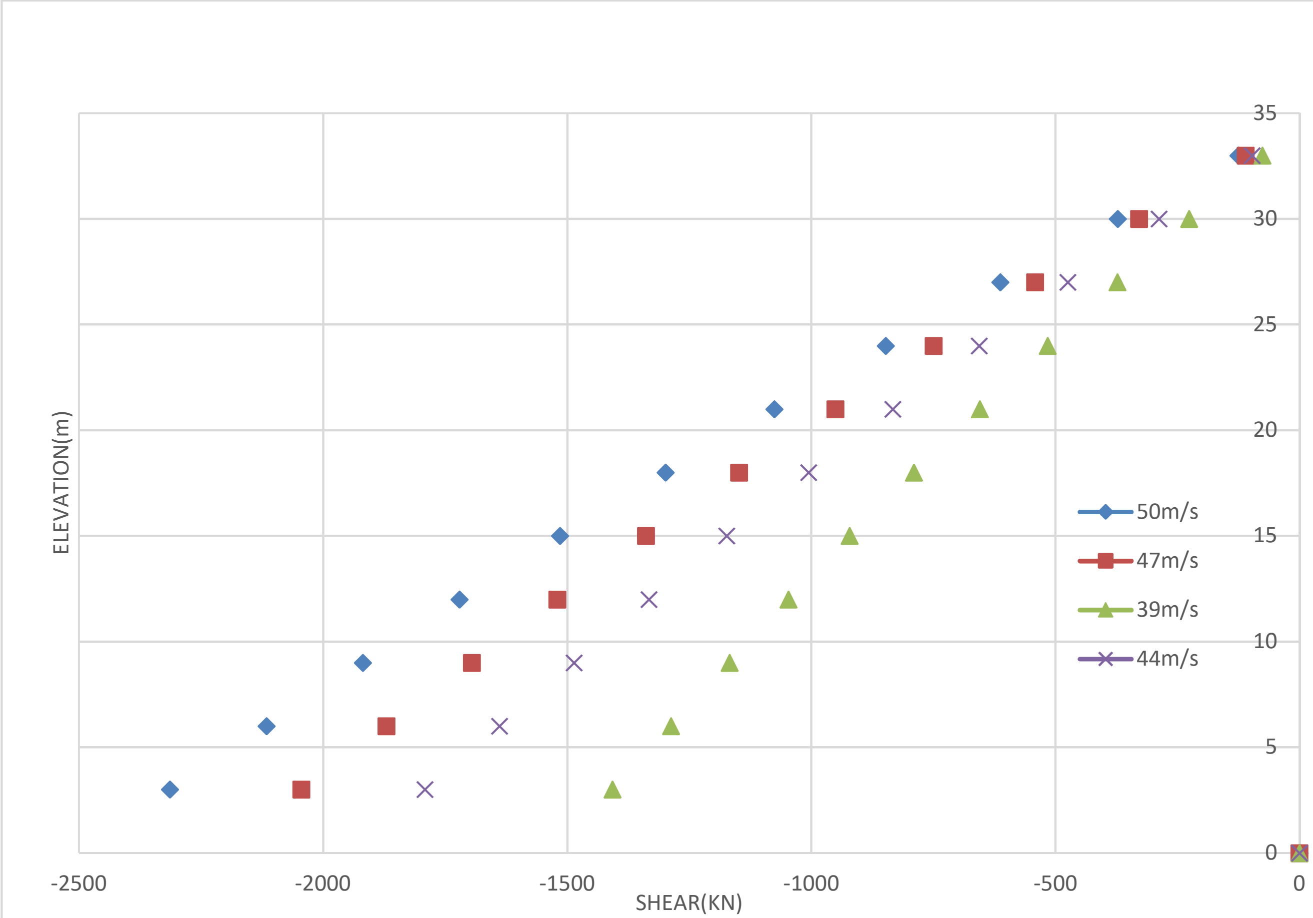

Fig. 8.18. STORY SHEAR WIND 1.5(D+WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.5(D+WIND) the maximum displacement is observed in zone 5 (50m/s) is -2313.513KN.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, -1407.5413KN.

8.2 Detailed results of G+20 structure

8.2.1 Point Displacement for Earth Quake Load:

Table.8.19. Displacement EQ. (0.9D+1.5EQ) in different zones and the story height

displacement EQ. (.9D+1.5EQ)					
story	elevation	UNIT=mm			
		zone-5	zone-4	zone-3	zone-2
Story21	63	137.167	91.445	60.963	38.102
Story20	60	134.812	89.874	59.916	37.448
Story19	57	131.867	87.911	58.607	36.63
Story18	54	128.191	85.461	56.974	35.609
Story17	51	123.753	82.502	55.001	34.376
Story16	48	118.575	79.05	52.7	32.937
Story15	45	112.71	75.14	50.094	31.308
Story14	42	106.226	70.817	47.211	29.507
Story13	39	99.193	66.128	44.086	27.553
Story12	36	91.683	61.122	40.748	25.468
Story11	33	83.768	55.846	37.23	23.269
Story10	30	75.517	50.345	33.563	20.977
Story9	27	66.997	44.665	29.776	18.61
Story8	24	58.275	38.85	25.9	16.187
Story7	21	49.422	32.948	21.966	13.728
Story6	18	40.524	27.016	18.011	11.257
Story5	15	31.691	21.127	14.085	8.803
Story4	12	23.085	15.39	10.26	6.413
Story3	9	14.969	9.98	6.653	4.158
Story2	6	7.79	5.193	3.462	2.164
Story1	3	2.333	1.555	1.037	0.648
Base	0	0	0	0	0

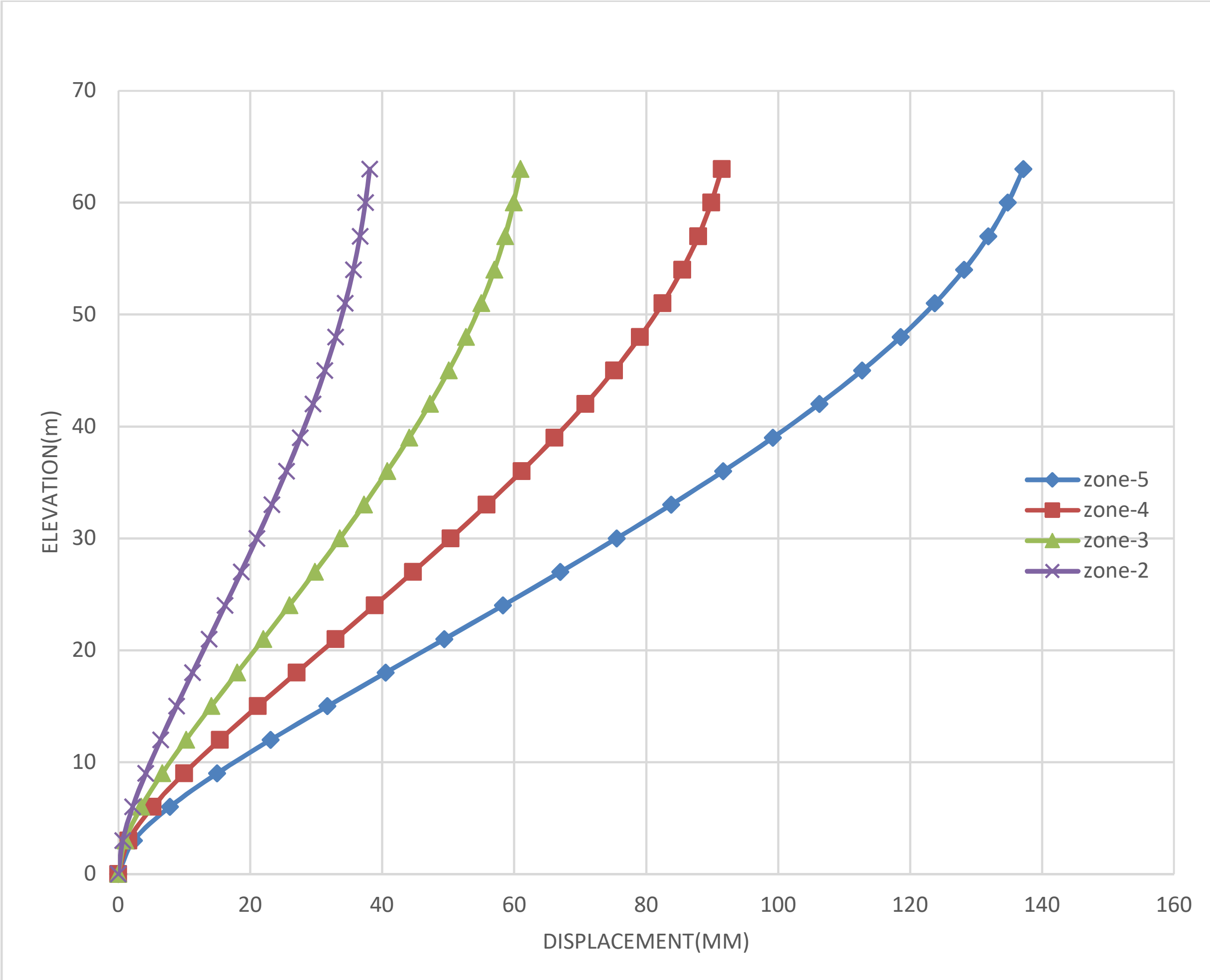

FIG.8.19.dispacement Curve (.9D+1.5EQ)

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 is 137.16mm.whereas the minimum displacement is observed in zone 2 i.e, 38.102mm.

Table.8.20. displacement EQ. 1.2(D+L+EQ) in different zones and the story height

displacement EQ. 1.2(D+L+EQ)					
story	elevation	UNIT=mm			
		zone-5	zone-4	zone-3	zone-2
Story21	63	109.734	73.156	48.771	30.482
Story20	60	107.849	71.9	47.933	29.958
Story19	57	105.493	70.329	46.886	29.304
Story18	54	102.553	68.369	45.579	28.487
Story17	51	99.002	66.001	44.001	27.501
Story16	48	94.86	63.24	42.16	26.35
Story15	45	90.168	60.112	40.075	25.047
Story14	42	84.981	56.654	37.769	23.606
Story13	39	79.354	52.903	35.268	22.043
Story12	36	73.346	48.898	32.598	20.374
Story11	33	67.015	44.677	29.784	18.615
Story10	30	60.414	40.276	26.851	16.782
Story9	27	53.598	35.732	23.821	14.888
Story8	24	46.62	31.08	20.72	12.95
Story7	21	39.538	26.359	17.572	10.983
Story6	18	32.42	21.613	14.409	9.005
Story5	15	25.353	16.902	11.268	7.042
Story4	12	18.468	12.312	8.208	5.13
Story3	9	11.976	7.984	5.322	3.327
Story2	6	6.232	4.155	2.77	1.731
Story1	3	1.866	1.244	0.829	0.518
Base	0	0	0	0	0

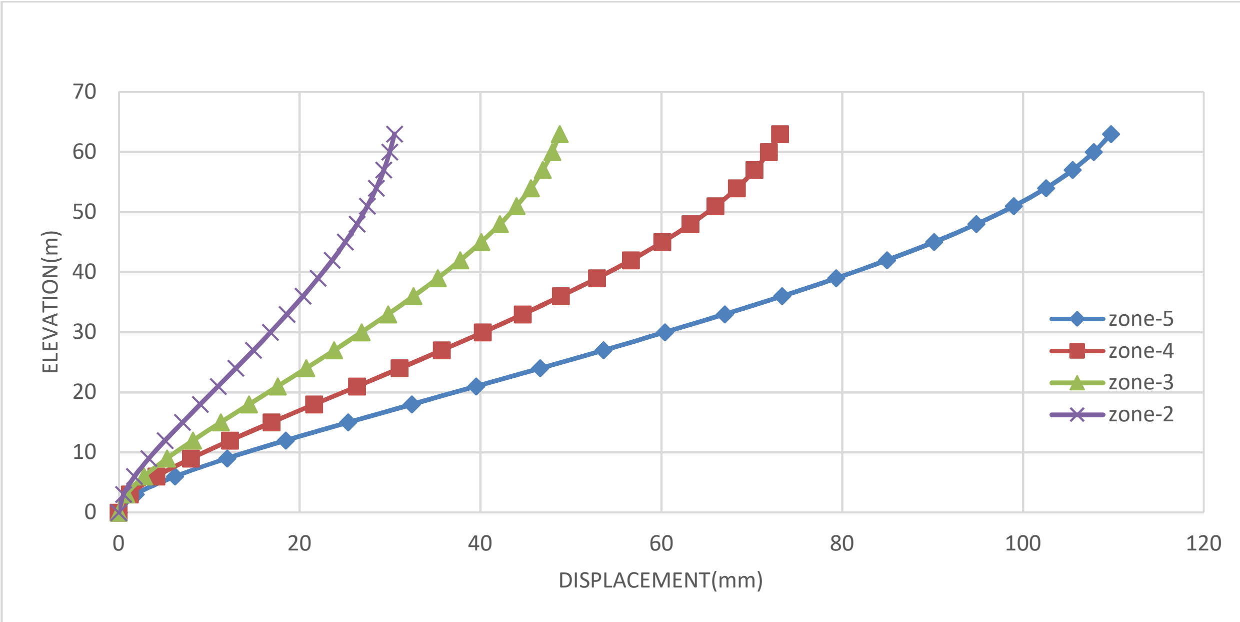

FIG.8.20.dispacement curve 1.2(D+L+EQ)

From above figure, for the load combination 1.2(D+L+EQ) the maximum displacement is observed in zone 5 is 109.734mm.whereas the minimum displacement is observed in zone 2 i.e, 30.482mm.

Table.8.21. displacement EQ. 1.5(D+EQ) in different zones and the story height

displacement EQ. 1.5(D+EQ)					
story	elevation	UNIT=mm			
		zone-5	zone-4	zone-3	zone-2
Story21	63	137.167	91.445	60.963	38.102
Story20	60	134.812	89.874	59.916	37.448
Story19	57	131.867	87.911	58.607	36.63
Story18	54	128.191	85.461	56.974	35.609
Story17	51	123.753	82.502	55.001	34.376
Story16	48	118.575	79.05	52.7	32.937
Story15	45	112.71	75.14	50.094	31.308
Story14	42	106.226	70.817	47.211	29.507
Story13	39	99.193	66.128	44.086	27.553
Story12	36	91.683	61.122	40.748	25.468
Story11	33	83.768	55.846	37.23	23.269
Story10	30	75.517	50.345	33.563	20.977
Story9	27	66.997	44.665	29.776	18.61
Story8	24	58.275	38.85	25.9	16.187
Story7	21	49.422	32.948	21.966	13.728
Story6	18	40.524	27.016	18.011	11.257
Story5	15	31.691	21.127	14.085	8.803
Story4	12	23.085	15.39	10.26	6.413
Story3	9	14.969	9.98	6.653	4.158
Story2	6	7.79	5.193	3.462	2.164
Story1	3	2.333	1.555	1.037	0.648
Base	0	0	0	0	0

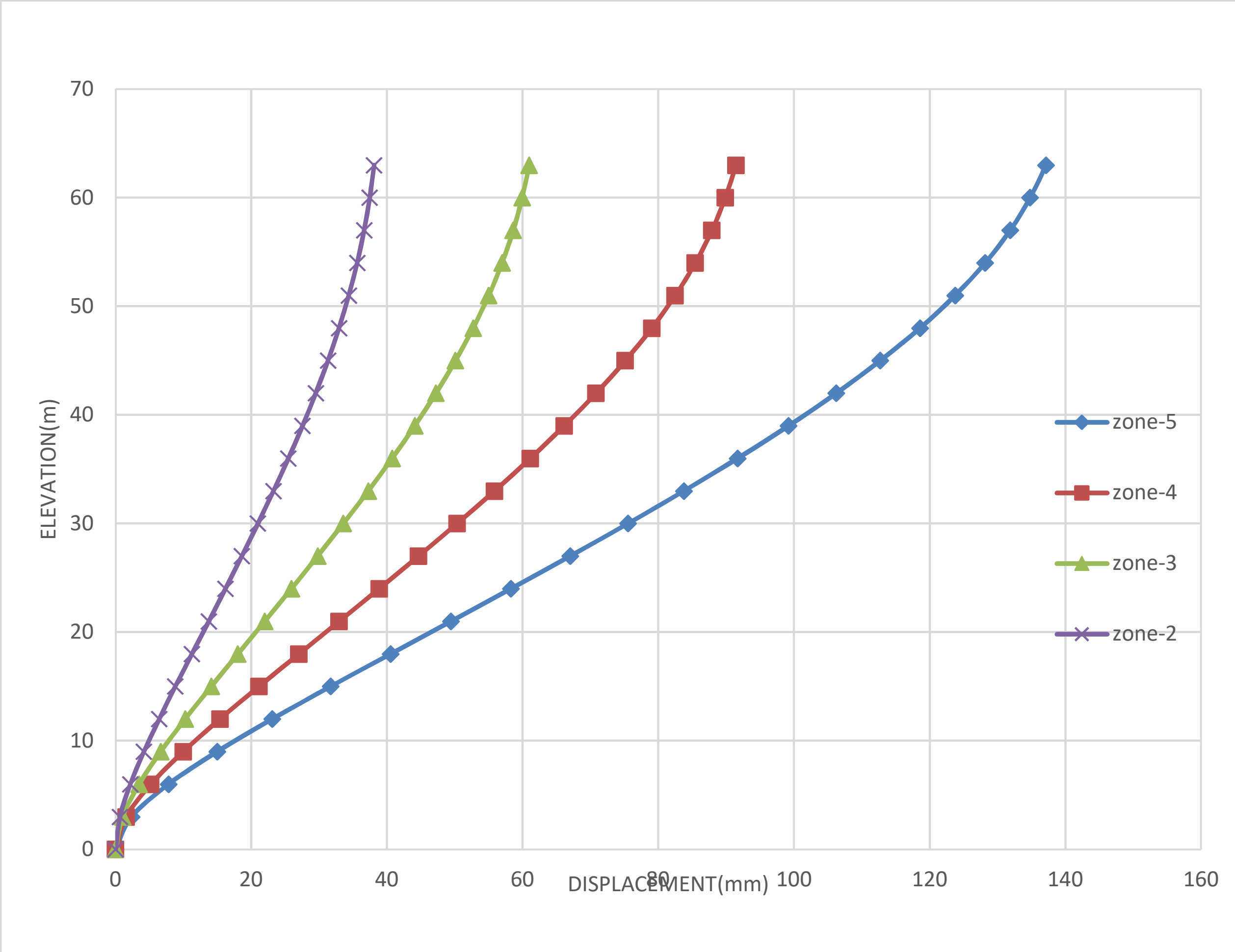

FIG.8.21.dispacement curve 1.5(D+EQ)

From above figure, for the load combination 1.5(D+EQ) the maximum displacement is observed in zone 5 is 137.16mm.whereas the minimum displacement is observed in zone 2 i.e, 38.102mm.

8.2.2. Point Displacement for Wind Load:

Table.8.22. displacement WIND (.9D+1.5wind) in different wind speed and the story height

displacement WIND (.9D+1.5wind)					
story	elevation	UNIT=mm			
		50m/s	47m/s	39m/s	44m/s
Story21	63	336.049	296.933	204.452	260.236
Story20	60	332.564	293.853	202.332	257.537
Story19	57	328.079	289.891	199.603	254.065
Story18	54	322.231	284.724	196.046	249.536
Story17	51	314.828	278.182	191.541	243.803
Story16	48	305.771	270.179	186.031	236.789
Story15	45	295.02	260.679	179.49	228.463
Story14	42	282.562	249.672	171.911	218.816
Story13	39	268.407	237.164	163.299	207.854
Story12	36	252.574	223.174	153.666	195.593
Story11	33	235.093	207.728	143.03	182.056
Story10	30	216.006	190.862	131.418	167.275
Story9	27	195.37	172.629	118.863	151.294
Story8	24	173.269	153.1	105.417	134.179
Story7	21	149.826	132.386	91.154	116.025
Story6	18	125.23	110.653	76.19	96.978
Story5	15	99.791	88.175	60.713	77.278
Story4	12	74.03	65.413	45.04	57.329
Story3	9	48.853	43.166	29.722	37.832
Story2	6	25.853	22.844	15.729	20.021
Story1	3	7.868	6.952	4.787	6.093
Base	0	0	0	0	0

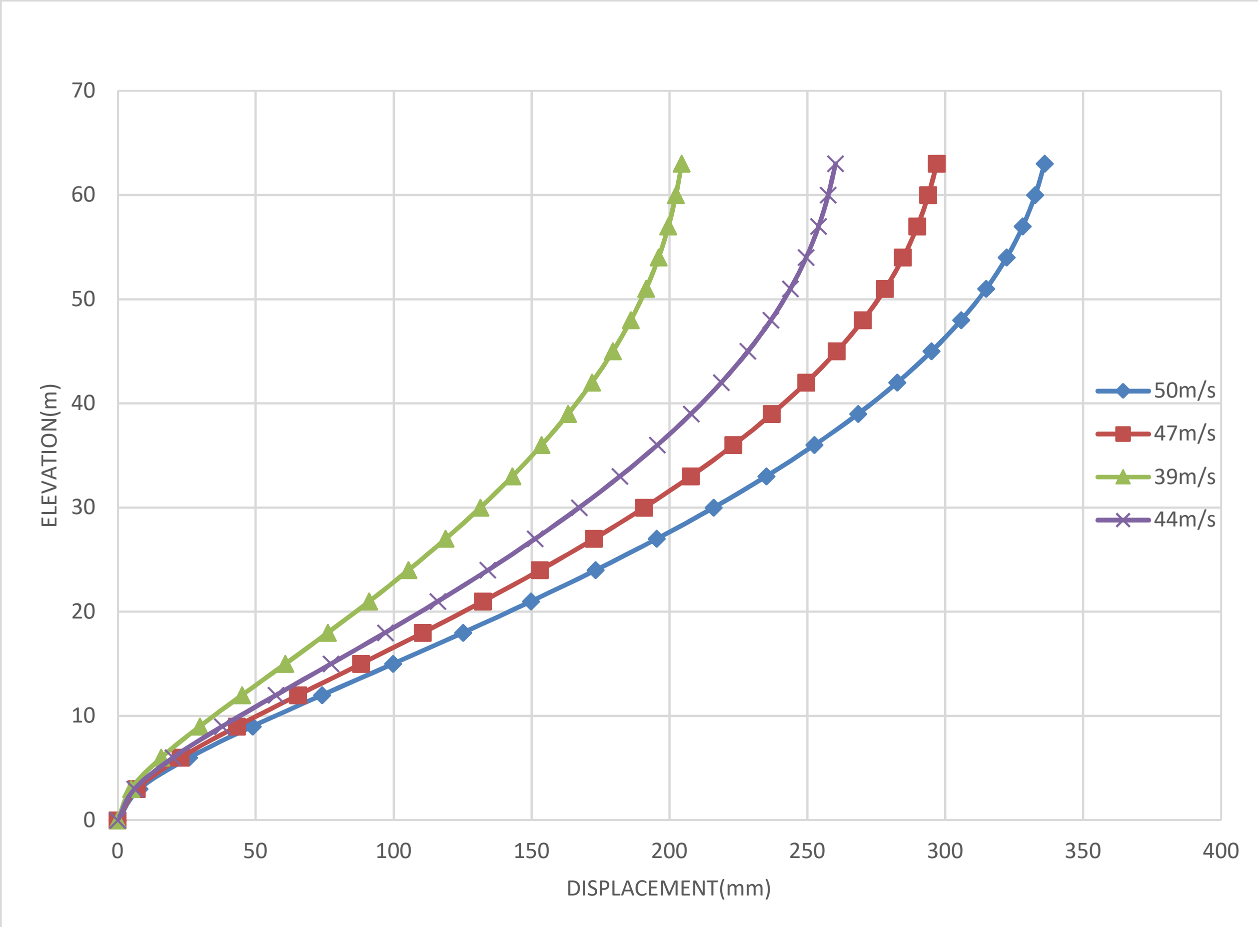

Fig.8.22.dispacement curve (.9D+1.5wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 (50m/s) is 336.049mm.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, 204.452mm.

Table. 8.23. Displacement WIND 1.2(D+L+wind) in different wind speed and the story height

displacement WIND 1.2(D+L+wind)					
story	elevation	UNIT=mm			
		50m/s	47m/s	39m/s	44m/s
Story21	63	268.839	237.546	163.562	208.189
Story20	60	266.051	235.083	161.866	206.03
Story19	57	262.463	231.913	159.683	203.252
Story18	54	257.785	227.779	156.836	199.629
Story17	51	251.862	222.545	153.233	195.042
Story16	48	244.617	216.143	148.825	189.431
Story15	45	236.016	208.543	143.592	182.77
Story14	42	226.05	199.737	137.529	175.053
Story13	39	214.725	189.731	130.639	166.283
Story12	36	202.059	178.539	122.933	156.474
Story11	33	188.074	166.182	114.424	145.645
Story10	30	172.804	152.69	105.134	133.82
Story9	27	156.296	138.103	95.09	121.035
Story8	24	138.615	122.48	84.333	107.343
Story7	21	119.86	105.909	72.923	92.82
Story6	18	100.184	88.523	60.952	77.583
Story5	15	79.833	70.54	48.57	61.822
Story4	12	59.224	52.33	36.032	45.863
Story3	9	39.082	34.533	23.778	30.265
Story2	6	20.683	18.275	12.583	16.017
Story1	3	6.294	5.562	3.829	4.874
Base	0	0	0	0	0

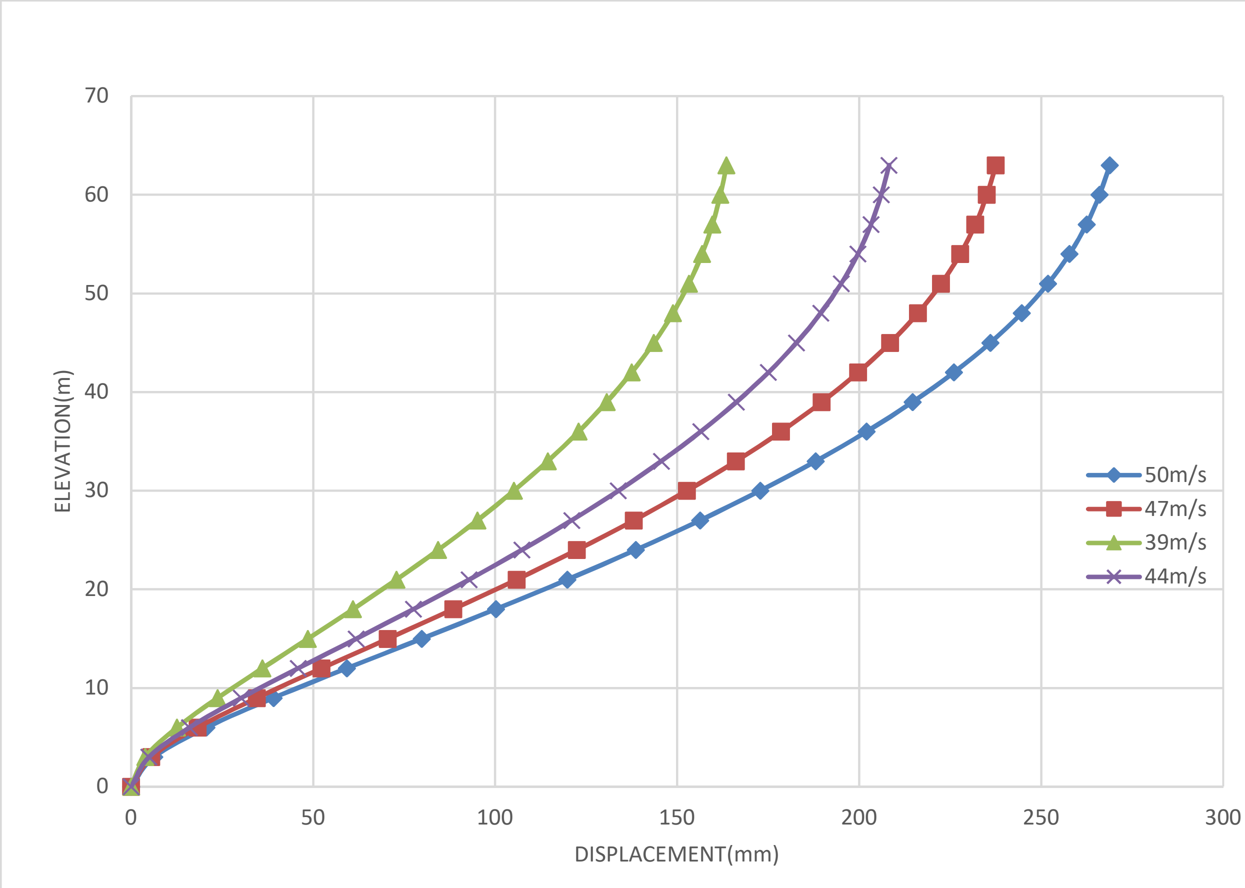

Fig.8.23.dispacement curve 1.2(D+L+wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.2(D+L+wind) the maximum displacement is observed in zone 5 (50m/s) is 268.839mm.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, 163.562mm.

Table. 8.24. Displacement WIND 1.5(D+WIND) in different wind speed and the story height

displacement WIND 1.5(D+WIND)					
story	elevation	UNIT=mm			
		50m/s	47m/s	39m/s	44m/s
Story21	63	336.049	296.933	204.452	260.236
Story20	60	332.564	293.853	202.332	257.537
Story19	57	328.079	289.891	199.603	254.065
Story18	54	322.231	284.724	196.046	249.536
Story17	51	314.828	278.182	191.541	243.803
Story16	48	305.771	270.179	186.031	236.789
Story15	45	295.02	260.679	179.49	228.463
Story14	42	282.562	249.672	171.911	218.816
Story13	39	268.407	237.164	163.299	207.854
Story12	36	252.574	223.174	153.666	195.593
Story11	33	235.093	207.728	143.03	182.056
Story10	30	216.006	190.862	131.418	167.275
Story9	27	195.37	172.629	118.863	151.294
Story8	24	173.269	153.1	105.417	134.179
Story7	21	149.826	132.386	91.154	116.025
Story6	18	125.23	110.653	76.19	96.978
Story5	15	99.791	88.175	60.713	77.278
Story4	12	74.03	65.413	45.04	57.329
Story3	9	48.853	43.166	29.722	37.832
Story2	6	25.853	22.844	15.729	20.021
Story1	3	7.868	6.952	4.787	6.093
Base	0	0	0	0	0

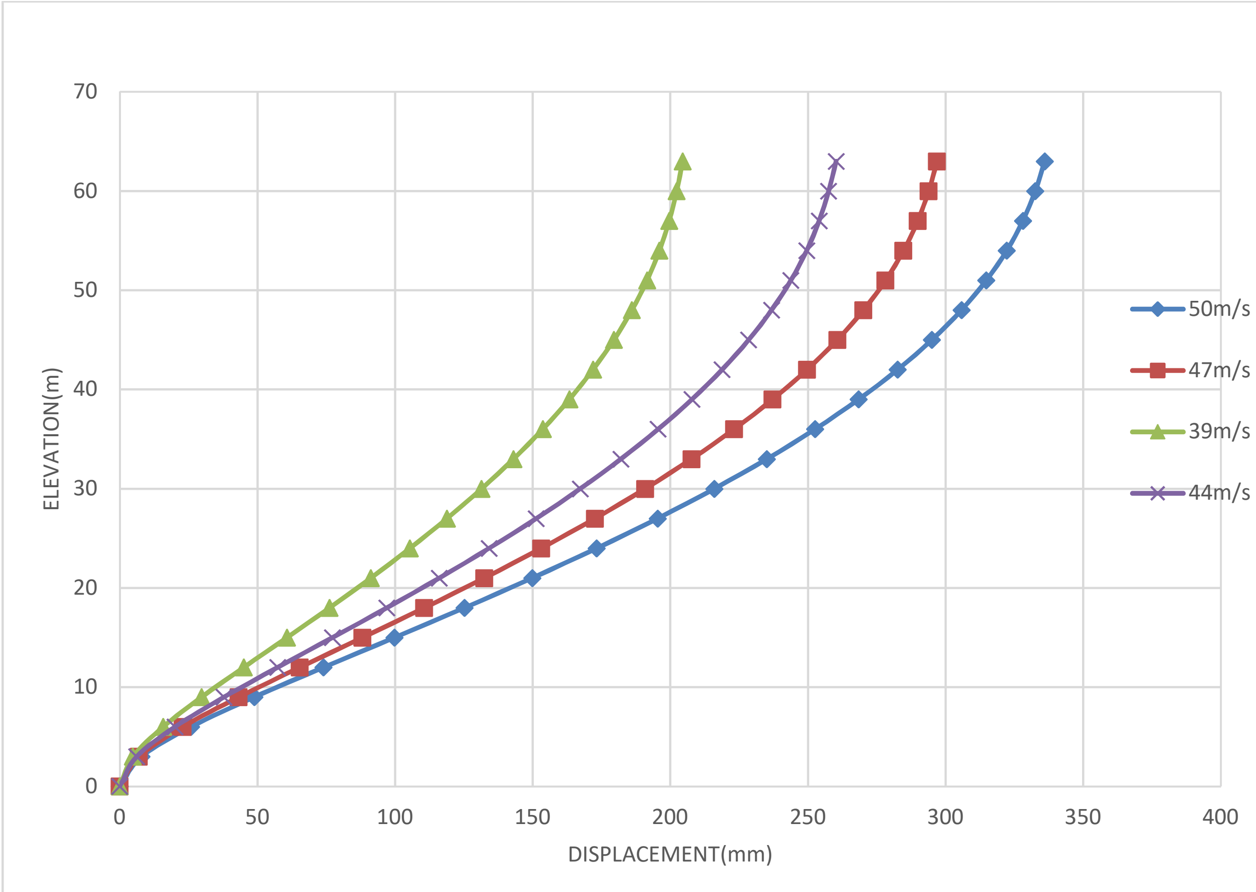

Fig.8.24.dispacement curve 1.5(D+WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.5(D+WIND) the maximum displacement is observed in zone 5 (50m/s) is 336.049mm.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, 204.452mm.

8.2.3 Storey Drift for Earth Quake Load:

Table.8.25. STORY DRIFT EQ. (.9D+1.5EQ) in different zones and the story height

STORY DRIFT EQ. (.9D+1.5EQ)					
story	elevation				
		zone-5	zone-4	zone-3	zone-2
Story21	63	0.000785	0.000523	0.000349	0.000218
Story20	60	0.000982	0.000654	0.000436	0.000273
Story19	57	0.001225	0.000817	0.000544	0.00034
Story18	54	0.001479	0.000986	0.000658	0.000411
Story17	51	0.001726	0.001151	0.000767	0.000479
Story16	48	0.001955	0.001303	0.000869	0.000543
Story15	45	0.002162	0.001441	0.000961	0.0006
Story14	42	0.002344	0.001563	0.001042	0.000651
Story13	39	0.002503	0.001669	0.001113	0.000695
Story12	36	0.002638	0.001759	0.001173	0.000733
Story11	33	0.00275	0.001834	0.001222	0.000764
Story10	30	0.00284	0.001893	0.001262	0.000789
Story9	27	0.002907	0.001938	0.001292	0.000808
Story8	24	0.002951	0.001967	0.001311	0.00082
Story7	21	0.002966	0.001977	0.001318	0.000824
Story6	18	0.002944	0.001963	0.001309	0.000818
Story5	15	0.002869	0.001912	0.001275	0.000797
Story4	12	0.002705	0.001804	0.001202	0.000751
Story3	9	0.002393	0.001595	0.001064	0.000665
Story2	6	0.001819	0.001213	0.000809	0.000505
Story1	3	0.000778	0.000518	0.000346	0.000216
Base	0	0	0	0	0

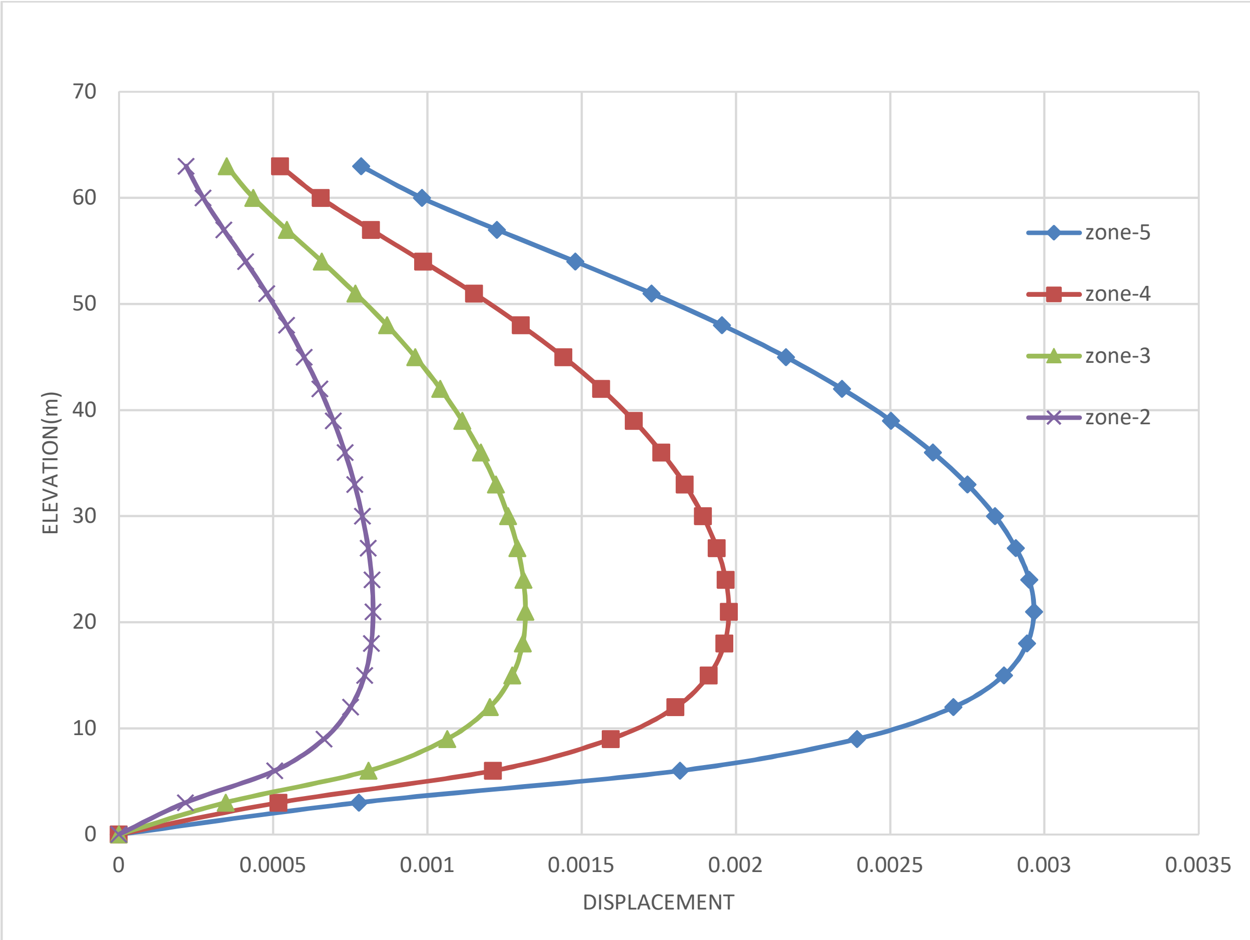

FIG.8.25.dispacement curve (.9D+1.5EQ)

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 is .00296 at 21m.whereas the minimum displacement is observed in zone 2 i.e, .000824 at 21m.

Table.8.26. STORY DRIFT EQ. 1.2(D+L+EQ) in different zones and the story height

STORY DRIFT EQ. 1.2(D+L+EQ)					
story	elevation				
		zone-5	zone-4	zone-3	zone-2
Story21	63	0.000628	0.000419	0.000279	0.000174
Story20	60	0.000785	0.000524	0.000349	0.000218
Story19	57	0.00098	0.000653	0.000436	0.000272
Story18	54	0.001184	0.000789	0.000526	0.000329
Story17	51	0.001381	0.000921	0.000614	0.000384
Story16	48	0.001564	0.001043	0.000695	0.000434
Story15	45	0.001729	0.001153	0.000769	0.00048
Story14	42	0.001876	0.00125	0.000834	0.000521
Story13	39	0.002003	0.001335	0.00089	0.000556
Story12	36	0.002111	0.001407	0.000938	0.000586
Story11	33	0.0022	0.001467	0.000978	0.000611
Story10	30	0.002272	0.001515	0.00101	0.000631
Story9	27	0.002326	0.001551	0.001034	0.000646
Story8	24	0.002361	0.001574	0.001049	0.000656
Story7	21	0.002373	0.001582	0.001055	0.000659
Story6	18	0.002356	0.00157	0.001047	0.000654
Story5	15	0.002295	0.00153	0.00102	0.000637
Story4	12	0.002164	0.001443	0.000962	0.000601
Story3	9	0.001914	0.001276	0.000851	0.000532
Story2	6	0.001455	0.00097	0.000647	0.000404
Story1	3	0.000622	0.000415	0.000276	0.000173
Base	0	0	0	0	0

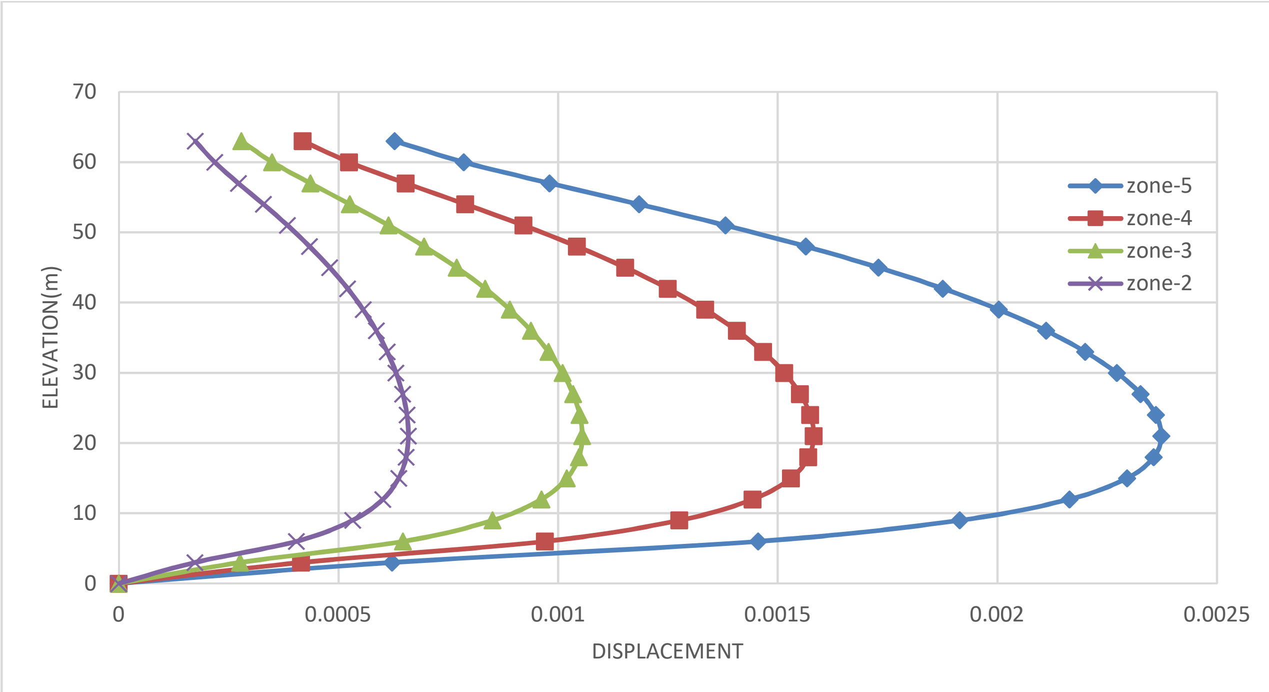

FIG.8.26.dispacement curve 1.2(D+L+EQ)

From above figure, for the load combination 1.2(D+L+EQ) the maximum displacement is observed in zone 5 is .002373 at 21m.whereas the minimum displacement is observed in zone 2 i.e, .000659 at 21m.

Table.8.27. STORY DRIFT EQ. 1.5(D+EQ) in different zones and the story height

STORY DRIFT EQ. 1.5(D+EQ)					
story	elevation				
		zone-5	zone-4	zone-3	zone-2
Story21	63	0.000785	0.000523	0.000349	0.000218
Story20	60	0.000982	0.000654	0.000436	0.000273
Story19	57	0.001225	0.000817	0.000544	0.00034
Story18	54	0.001479	0.000986	0.000658	0.000411
Story17	51	0.001726	0.001151	0.000767	0.000479
Story16	48	0.001955	0.001303	0.000869	0.000543
Story15	45	0.002162	0.001441	0.000961	0.0006
Story14	42	0.002344	0.001563	0.001042	0.000651
Story13	39	0.002503	0.001669	0.001113	0.000695
Story12	36	0.002638	0.001759	0.001173	0.000733
Story11	33	0.00275	0.001834	0.001222	0.000764
Story10	30	0.00284	0.001893	0.001262	0.000789
Story9	27	0.002907	0.001938	0.001292	0.000808
Story8	24	0.002951	0.001967	0.001311	0.00082
Story7	21	0.002966	0.001977	0.001318	0.000824
Story6	18	0.002944	0.001963	0.001309	0.000818
Story5	15	0.002869	0.001912	0.001275	0.000797
Story4	12	0.002705	0.001804	0.001202	0.000751
Story3	9	0.002393	0.001595	0.001064	0.000665
Story2	6	0.001819	0.001213	0.000809	0.000505
Story1	3	0.000778	0.000518	0.000346	0.000216
Base	0	0	0	0	0

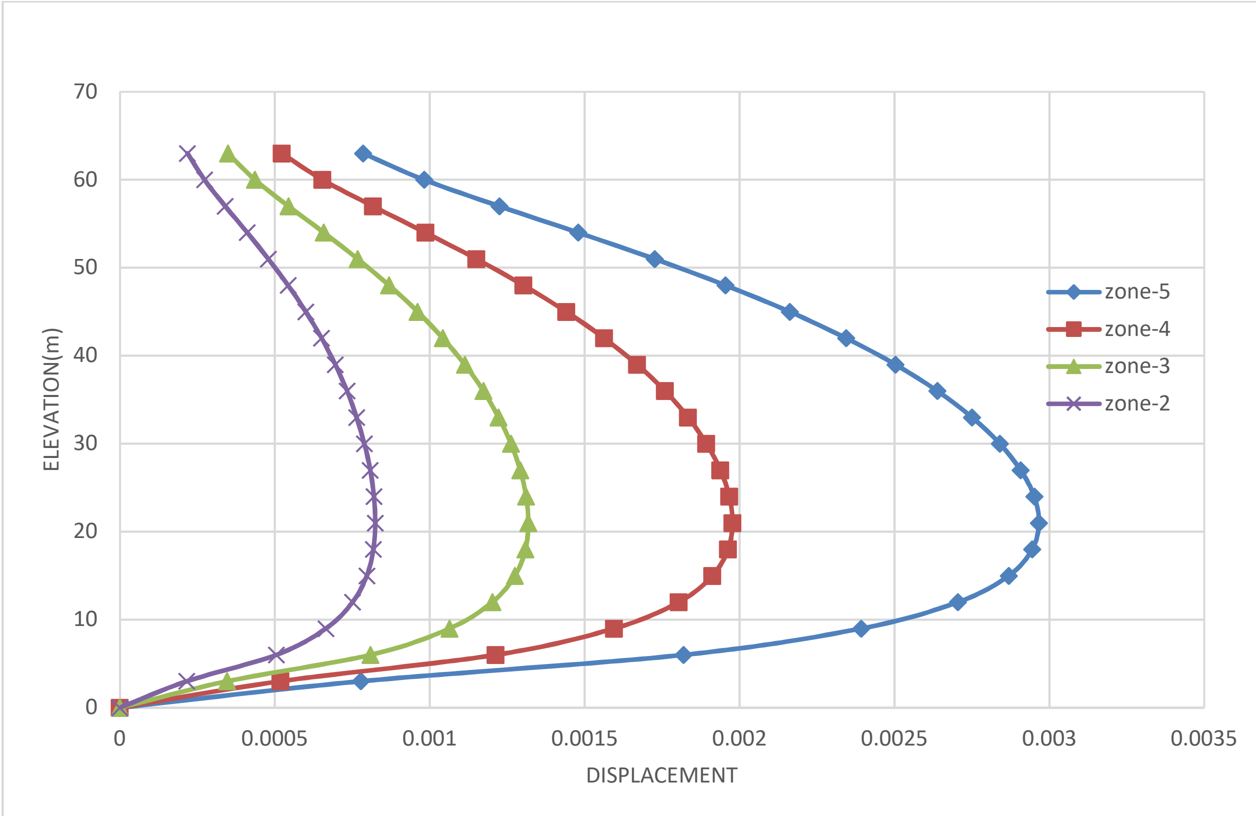

FIG.8.27.dispacement curve 1.5 (D+EQ)

From above figure, for the load combination 1.5 (D+EQ) the maximum displacement is observed in zone 5 is .002966 at 21m.whereas the minimum displacement is observed in zone 2 i.e, .000824 at 21m.

8.2.4 Storey Drift for Wind Load:

Table.8.28. STORY DRIFT WIND (.9D+1.5wind) in different wind speed and the story height

STORY DRIFT WIND (.9D+1.5wind)					
story	elevation				
		50m/s	47m/s	39m/s	44m/s
Story21	63	0.001162	0.001026	0.000707	0.0009
Story20	60	0.001495	0.001321	0.000909	0.001158
Story19	57	0.001949	0.001722	0.001186	0.00151
Story18	54	0.002468	0.002181	0.001501	0.001911
Story17	51	0.003019	0.002667	0.001837	0.002338
Story16	48	0.003584	0.003167	0.00218	0.002775
Story15	45	0.004152	0.003669	0.002526	0.003216
Story14	42	0.004718	0.004169	0.002871	0.003654
Story13	39	0.005278	0.004663	0.003211	0.004087
Story12	36	0.005827	0.005149	0.003545	0.004512
Story11	33	0.006362	0.005622	0.003871	0.004927
Story10	30	0.006879	0.006078	0.004185	0.005327
Story9	27	0.007367	0.006509	0.004482	0.005705
Story8	24	0.007814	0.006905	0.004754	0.006051
Story7	21	0.008198	0.007244	0.004988	0.006349
Story6	18	0.00848	0.007493	0.005159	0.006567
Story5	15	0.008587	0.007588	0.005224	0.00665
Story4	12	0.008392	0.007415	0.005106	0.006499
Story3	9	0.007667	0.006774	0.004664	0.005937
Story2	6	0.005995	0.005297	0.003647	0.004643
Story1	3	0.002623	0.002317	0.001596	0.002031
Base	0	0	0	0	0

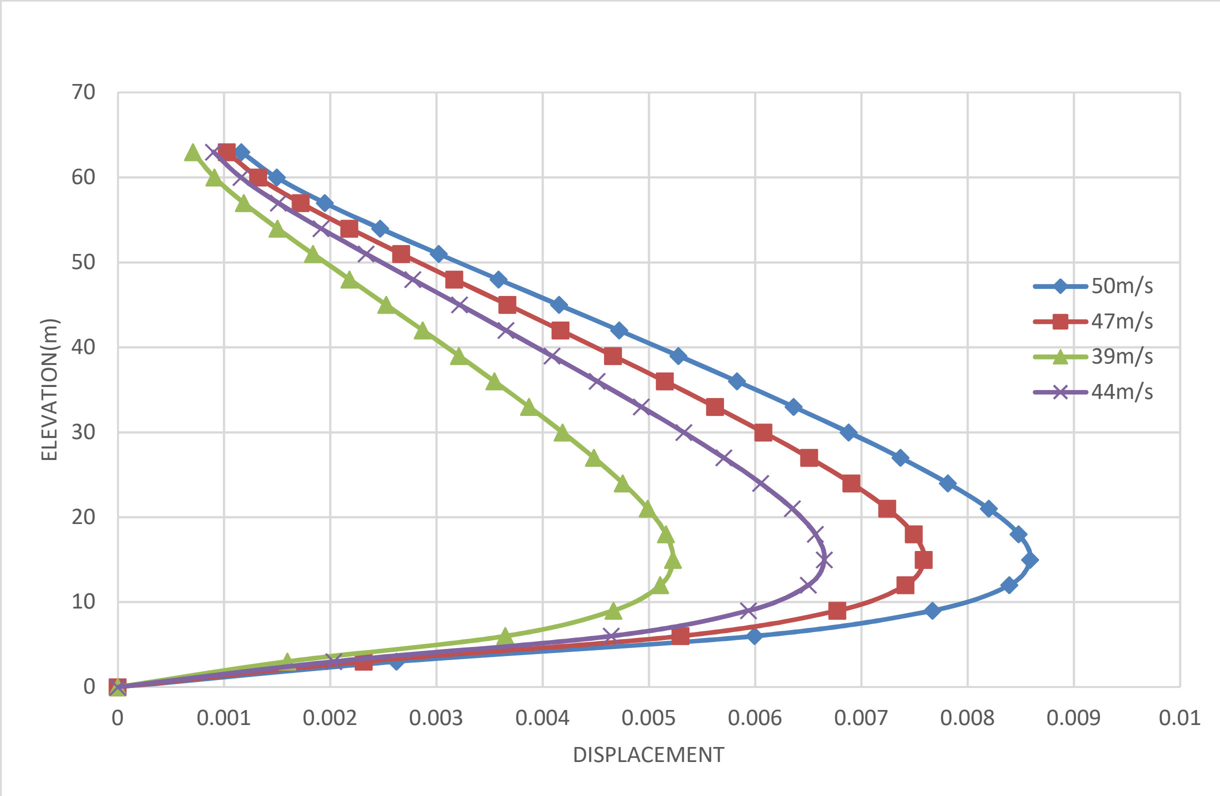

Fig.8.28.dispacement curve (.9D+1.5wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 (50m/s) is .008587 at 15m.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, .005224 at 15m.

Table. 8.29. STORY DRIFT WIND 1.2(D+L+wind) in different wind speed and the story height

STORY DRIFT WIND 1.2(D+L+wind)					
story	elevation				
		50m/s	47m/s	39m/s	44m/s
Story21	63	0.000929	0.000821	0.000565	0.00072
Story20	60	0.001196	0.001057	0.000728	0.000926
Story19	57	0.001559	0.001378	0.000949	0.001208
Story18	54	0.001974	0.001745	0.001201	0.001529
Story17	51	0.002415	0.002134	0.001469	0.00187
Story16	48	0.002867	0.002533	0.001744	0.00222
Story15	45	0.003322	0.002935	0.002021	0.002573
Story14	42	0.003775	0.003335	0.002297	0.002923
Story13	39	0.004222	0.003731	0.002569	0.00327
Story12	36	0.004662	0.004119	0.002836	0.00361
Story11	33	0.00509	0.004497	0.003097	0.003942
Story10	30	0.005503	0.004862	0.003348	0.004261
Story9	27	0.005894	0.005208	0.003586	0.004564
Story8	24	0.006252	0.005524	0.003803	0.004841
Story7	21	0.006559	0.005795	0.00399	0.005079
Story6	18	0.006784	0.005994	0.004127	0.005253
Story5	15	0.00687	0.00607	0.004179	0.00532
Story4	12	0.006714	0.005932	0.004085	0.005199
Story3	9	0.006133	0.005419	0.003731	0.00475
Story2	6	0.004796	0.004238	0.002918	0.003714
Story1	3	0.002098	0.001854	0.001276	0.001625
Base	0	0	0	0	0

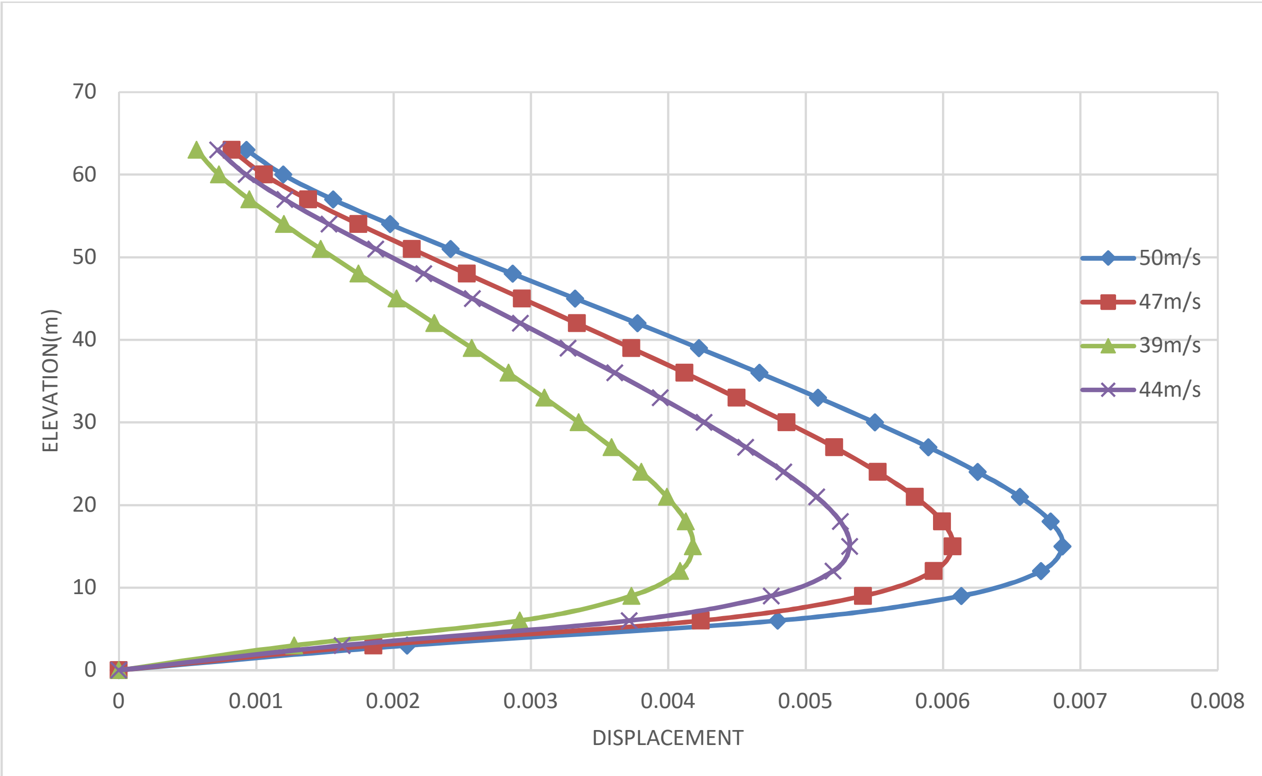

Fig.8.29.dispacement curve 1.2(d+l+wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.2(d+l+wind) the maximum displacement is observed in zone 5 (50m/s) is .00687 at 15m.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, .004179 at 15m.

Table.8.30. STORY DRIFT WIND 1.5(D+WIND) in different wind speed and the story height

STORY DRIFT WIND 1.5(D+WIND)					
story	elevation				
		50m/s	47m/s	39m/s	44m/s
Story21	63	0.001162	0.001026	0.000707	0.0009
Story20	60	0.001495	0.001321	0.000909	0.001158
Story19	57	0.001949	0.001722	0.001186	0.00151
Story18	54	0.002468	0.002181	0.001501	0.001911
Story17	51	0.003019	0.002667	0.001837	0.002338
Story16	48	0.003584	0.003167	0.00218	0.002775
Story15	45	0.004152	0.003669	0.002526	0.003216
Story14	42	0.004718	0.004169	0.002871	0.003654
Story13	39	0.005278	0.004663	0.003211	0.004087
Story12	36	0.005827	0.005149	0.003545	0.004512
Story11	33	0.006362	0.005622	0.003871	0.004927
Story10	30	0.006879	0.006078	0.004185	0.005327
Story9	27	0.007367	0.006509	0.004482	0.005705
Story8	24	0.007814	0.006905	0.004754	0.006051
Story7	21	0.008198	0.007244	0.004988	0.006349
Story6	18	0.00848	0.007493	0.005159	0.006567
Story5	15	0.008587	0.007588	0.005224	0.00665
Story4	12	0.008392	0.007415	0.005106	0.006499
Story3	9	0.007667	0.006774	0.004664	0.005937
Story2	6	0.005995	0.005297	0.003647	0.004643
Story1	3	0.002623	0.002317	0.001596	0.002031
Base	0	0	0	0	0

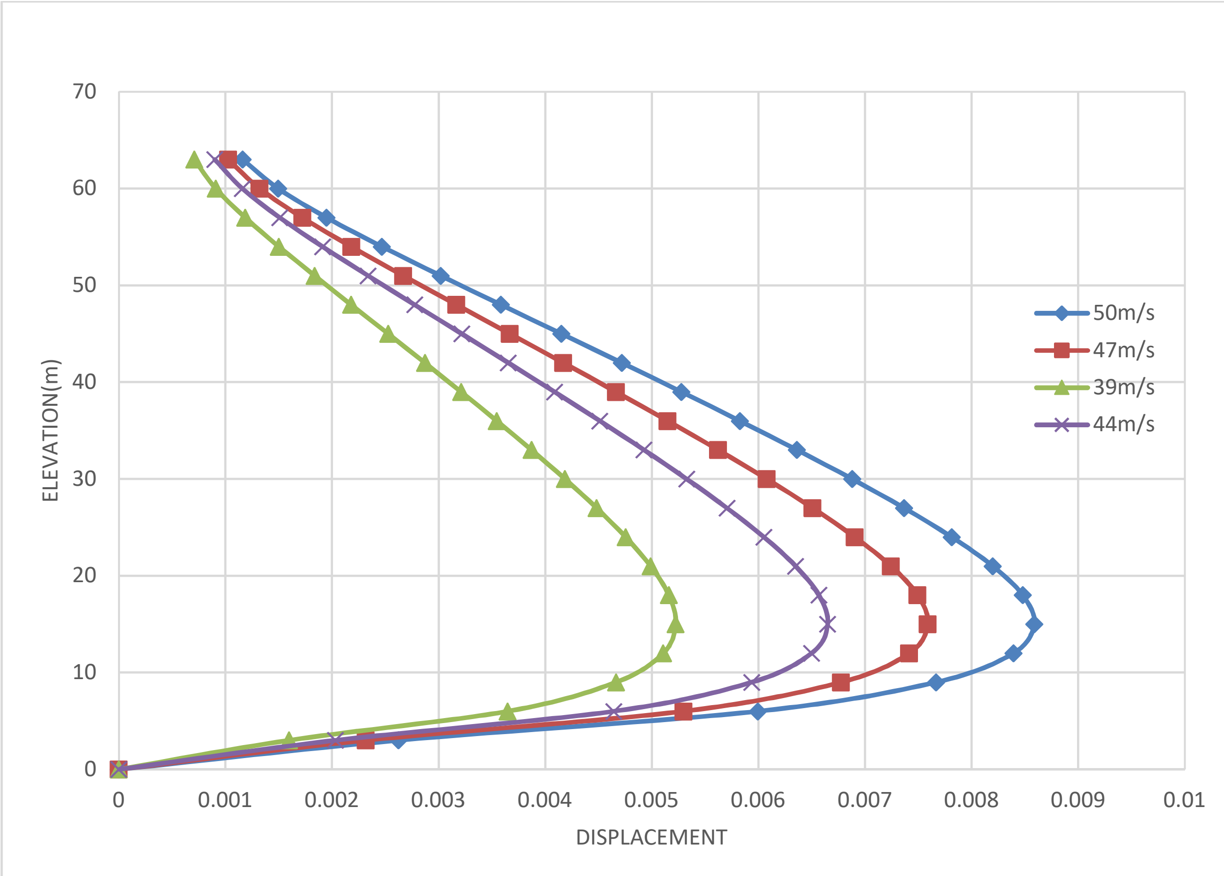

Fig.8.30.dispacement curve 1.5(D+WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.5(D+WIND) the maximum displacement is observed in zone 5 (50m/s) is .008587 at 15m.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, .005224 at 15m.

8.2.5 Storey Shear for Wind Load:

Table.8.31. STORY SHEAR WIN. (.9D+1.5WIN) in different zones and the story height

STORY SHEAR WIND (.9D+1.5WIN)						
story	elevation		UNIT=KN			
			50m/s	47m/s	39m/s	44m/s
Story21	63	Top	-139.0445	-122.8597	-84.5947	-107.676
		Bottom	-139.0445	-122.8597	-84.5947	-107.676
Story20	60	Top	-415.824	-367.4221	-252.9873	-322.0141
		Bottom	-415.824	-367.4221	-252.9873	-322.0141
Story19	57	Top	-690.6434	-610.2525	-420.1874	-534.8342
		Bottom	-690.6434	-610.2525	-420.1874	-534.8342
Story18	54	Top	-963.5096	-851.3571	-586.1992	-746.1418
		Bottom	-963.5096	-851.3571	-586.1992	-746.1418
Story17	51	Top	-1234.3543	-1090.6755	-750.9812	-955.884
		Bottom	-1234.3543	-1090.6755	-750.9812	-955.884
Story16	48	Top	-1502.3138	-1327.4445	-914.0077	-1163.3918
		Bottom	-1502.3138	-1327.4445	-914.0077	-1163.3918
Story15	45	Top	-1766.8437	-1561.1831	-1074.9477	-1368.2437
		Bottom	-1766.8437	-1561.1831	-1074.9477	-1368.2437
Story14	42	Top	-2027.9566	-1791.9025	-1233.8088	-1570.4496
		Bottom	-2027.9566	-1791.9025	-1233.8088	-1570.4496
Story13	39	Top	-2285.6749	-2019.6223	-1390.6046	-1770.0266
		Bottom	-2285.6749	-2019.6223	-1390.6046	-1770.0266
Story12	36	Top	-2540.0206	-2244.3622	-1545.3486	-1966.992
		Bottom	-2540.0206	-2244.3622	-1545.3486	-1966.992
Story11	33	Top	-2791.0161	-2466.1419	-1698.0542	-2161.3629
		Bottom	-2791.0161	-2466.1419	-1698.0542	-2161.3629
Story10	30	Top	-3038.1329	-2684.4942	-1848.4	-2352.7301
		Bottom	-3038.1329	-2684.4942	-1848.4	-2352.7301
Story9	27	Top	-3279.2164	-2897.5156	-1995.0753	-2539.4252
		Bottom	-3279.2164	-2897.5156	-1995.0753	-2539.4252
Story8	24	Top	-3513.7993	-3104.7931	-2137.7955	-2721.0862
		Bottom	-3513.7993	-3104.7931	-2137.7955	-2721.0862
Story7	21	Top	-3742.0328	-3306.4602	-2276.6528	-2897.8302
		Bottom	-3742.0328	-3306.4602	-2276.6528	-2897.8302
Story6	18	Top	-3964.7241	-3503.2302	-2412.1382	-3070.2824
		Bottom	-3964.7241	-3503.2302	-2412.1382	-3070.2824
Story5	15	Top	-4181.1708	-3694.4825	-2543.8243	-3237.8986
		Bottom	-4181.1708	-3694.4825	-2543.8243	-3237.8986
Story4	12	Top	-4386.6876	-3876.0772	-2668.8608	-3397.0509
		Bottom	-4386.6876	-3876.0772	-2668.8608	-3397.0509
Story3	9	Top	-4584.7136	-4051.0529	-2789.3397	-3550.4022
		Bottom	-4584.7136	-4051.0529	-2789.3397	-3550.4022
Story2	6	Top	-4782.1511	-4225.5087	-2909.4607	-3703.2978
		Bottom	-4782.1511	-4225.5087	-2909.4607	-3703.2978
Story1	3	Top	-4979.5886	-4399.9645	-3029.5817	-3856.1934

		Bottom	-4979.5886	-4399.9645	-3029.5817	-3856.1934
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

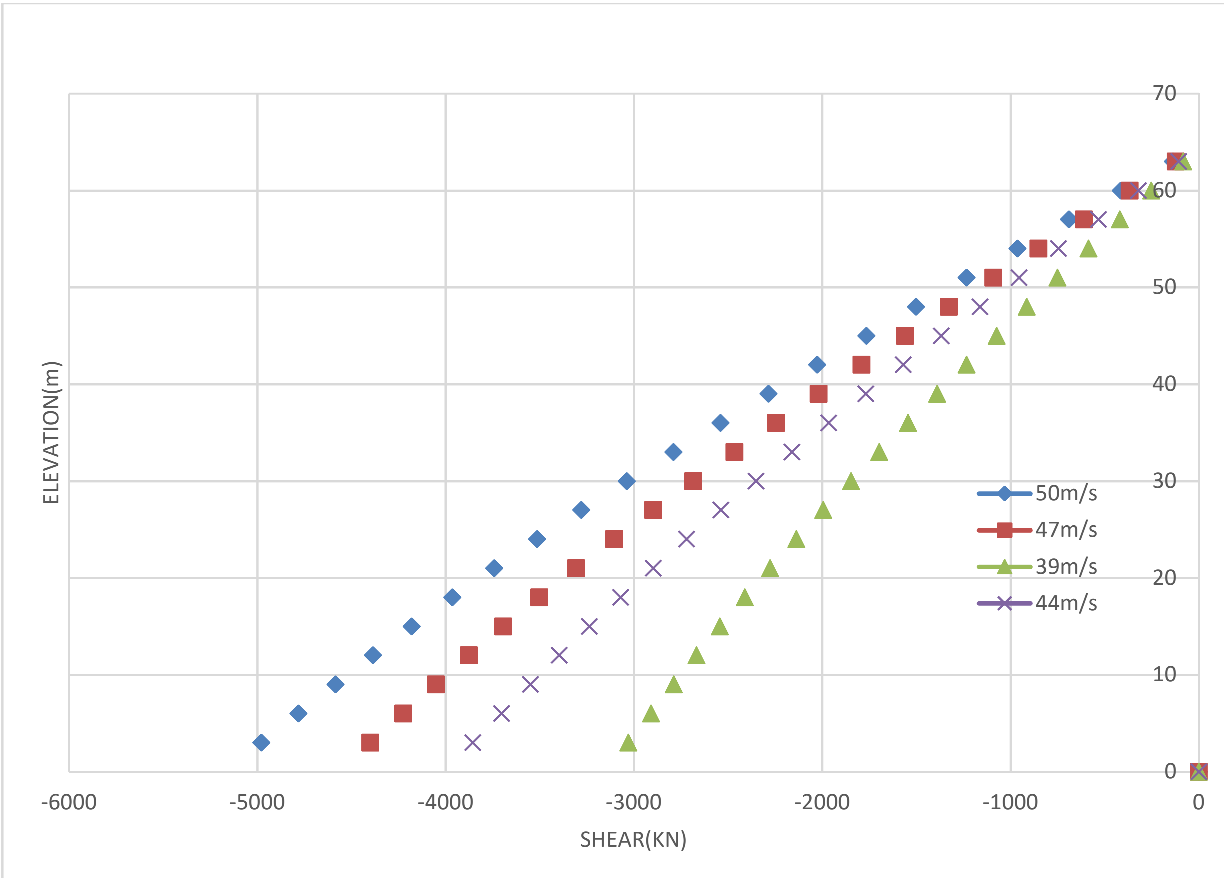

Fig.8.32. story shear curve (.9d+1.5win) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 (50m/s) is -4979.886KN.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, -3029.5817KN.

Table. 8.33. STORY SHEAR WIN. 1.2(D+L+WIN) in different zones and the story height

STORY SHEAR WIND 1.2(D+L+wind)						
story	elevation		UNIT=KN			
			50m/s	47m/s	39m/s	44m/s
Story21	63	Top	-111.2356	-98.2878	-67.6757	-86.1408
		Bottom	-111.2356	-98.2878	-67.6757	-86.1408
Story20	60	Top	-332.6592	-293.9377	-202.3899	-257.6113
		Bottom	-332.6592	-293.9377	-202.3899	-257.6113
Story19	57	Top	-552.5147	-488.202	-336.1499	-427.8674
		Bottom	-552.5147	-488.202	-336.1499	-427.8674
Story18	54	Top	-770.8077	-681.0856	-468.9594	-596.9134
		Bottom	-770.8077	-681.0856	-468.9594	-596.9134
Story17	51	Top	-987.4834	-872.5404	-600.7849	-764.7072
		Bottom	-987.4834	-872.5404	-600.7849	-764.7072
Story16	48	Top	-1201.851	-1061.9556	-731.2062	-930.7134
		Bottom	-1201.851	-1061.9556	-731.2062	-930.7134
Story15	45	Top	-1413.4749	-1248.9464	-859.9581	-1094.595
		Bottom	-1413.4749	-1248.9464	-859.9581	-1094.595
Story14	42	Top	-1622.3653	-1433.522	-987.047	-1256.3597
		Bottom	-1622.3653	-1433.522	-987.047	-1256.3597
Story13	39	Top	-1828.5399	-1615.6978	-1112.4837	-1416.0213
		Bottom	-1828.5399	-1615.6978	-1112.4837	-1416.0213
Story12	36	Top	-2032.0165	-1795.4898	-1236.2788	-1573.5936
		Bottom	-2032.0165	-1795.4898	-1236.2788	-1573.5936
Story11	33	Top	-2232.8129	-1972.9135	-1358.4434	-1729.0903
		Bottom	-2232.8129	-1972.9135	-1358.4434	-1729.0903
Story10	30	Top	-2430.5063	-2147.5954	-1478.72	-1882.1841
		Bottom	-2430.5063	-2147.5954	-1478.72	-1882.1841
Story9	27	Top	-2623.3731	-2318.0125	-1596.0602	-2031.5401
		Bottom	-2623.3731	-2318.0125	-1596.0602	-2031.5401
Story8	24	Top	-2811.0394	-2483.8345	-1710.2364	-2176.8689
		Bottom	-2811.0394	-2483.8345	-1710.2364	-2176.8689
Story7	21	Top	-2993.6263	-2645.1682	-1821.3222	-2318.2642
		Bottom	-2993.6263	-2645.1682	-1821.3222	-2318.2642
Story6	18	Top	-3171.7793	-2802.5842	-1929.7105	-2456.2259
		Bottom	-3171.7793	-2802.5842	-1929.7105	-2456.2259
Story5	15	Top	-3344.9366	-2955.586	-2035.0594	-2590.3189
		Bottom	-3344.9366	-2955.586	-2035.0594	-2590.3189

Story4	12	Top	-3509.3501	-3100.8618	-2135.0886	-2717.6407
		Bottom	-3509.3501	-3100.8618	-2135.0886	-2717.6407
Story3	9	Top	-3667.7709	-3240.8423	-2231.4718	-2840.3218
		Bottom	-3667.7709	-3240.8423	-2231.4718	-2840.3218
Story2	6	Top	-3825.7209	-3380.407	-2327.5686	-2962.6382
		Bottom	-3825.7209	-3380.407	-2327.5686	-2962.6382
Story1	3	Top	-3983.6709	-3519.9716	-2423.6654	-3084.9547
		Bottom	-3983.6709	-3519.9716	-2423.6654	-3084.9547
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

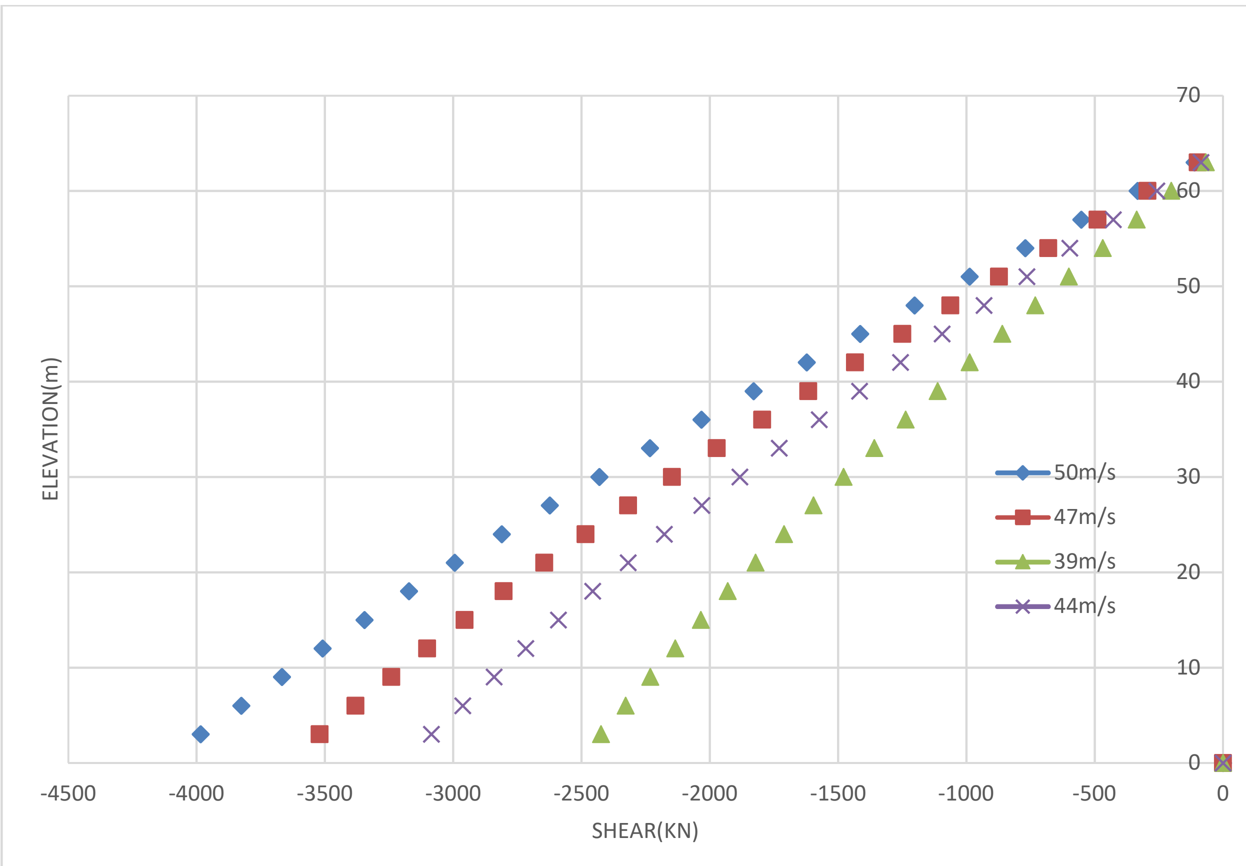

Fig.8.32. story shear curve 1.2(D+L+wind) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.2(D+L+wind) the maximum displacement is observed in zone 5 (50m/s) is -3983.6709KN.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, -2423.6654KN.

Table. 8.33. STORY SHEAR WIN. 1.5(D+WIN) in different zones and the story height

STORY SHEAR WIND 1.5(D+WIND)						
story	elevation		UNIT=KN			
			50m/s	47m/s	39m/s	44m/s
Story21	63	Top	-139.0445	-122.8597	-84.5947	-107.676
		Bottom	-139.0445	-122.8597	-84.5947	-107.676
Story20	60	Top	-415.824	-367.4221	-252.9873	-322.0141
		Bottom	-415.824	-367.4221	-252.9873	-322.0141
Story19	57	Top	-690.6434	-610.2525	-420.1874	-534.8342
		Bottom	-690.6434	-610.2525	-420.1874	-534.8342
Story18	54	Top	-963.5096	-851.3571	-586.1992	-746.1418
		Bottom	-963.5096	-851.3571	-586.1992	-746.1418
Story17	51	Top	-1234.3543	-1090.6755	-750.9812	-955.884
		Bottom	-1234.3543	-1090.6755	-750.9812	-955.884
Story16	48	Top	-1502.3138	-1327.4445	-914.0077	-1163.3918
		Bottom	-1502.3138	-1327.4445	-914.0077	-1163.3918
Story15	45	Top	-1766.8437	-1561.1831	-1074.9477	-1368.2437
		Bottom	-1766.8437	-1561.1831	-1074.9477	-1368.2437
Story14	42	Top	-2027.9566	-1791.9025	-1233.8088	-1570.4496
		Bottom	-2027.9566	-1791.9025	-1233.8088	-1570.4496
Story13	39	Top	-2285.6749	-2019.6223	-1390.6046	-1770.0266
		Bottom	-2285.6749	-2019.6223	-1390.6046	-1770.0266
Story12	36	Top	-2540.0206	-2244.3622	-1545.3486	-1966.992
		Bottom	-2540.0206	-2244.3622	-1545.3486	-1966.992
Story11	33	Top	-2791.0161	-2466.1419	-1698.0542	-2161.3629
		Bottom	-2791.0161	-2466.1419	-1698.0542	-2161.3629
Story10	30	Top	-3038.1329	-2684.4942	-1848.4	-2352.7301
		Bottom	-3038.1329	-2684.4942	-1848.4	-2352.7301
Story9	27	Top	-3279.2164	-2897.5156	-1995.0753	-2539.4252
		Bottom	-3279.2164	-2897.5156	-1995.0753	-2539.4252
Story8	24	Top	-3513.7993	-3104.7931	-2137.7955	-2721.0862
		Bottom	-3513.7993	-3104.7931	-2137.7955	-2721.0862
Story7	21	Top	-3742.0328	-3306.4602	-2276.6528	-2897.8302
		Bottom	-3742.0328	-3306.4602	-2276.6528	-2897.8302
Story6	18	Top	-3964.7241	-3503.2302	-2412.1382	-3070.2824
		Bottom	-3964.7241	-3503.2302	-2412.1382	-3070.2824
Story5	15	Top	-4181.1708	-3694.4825	-2543.8243	-3237.8986
		Bottom	-4181.1708	-3694.4825	-2543.8243	-3237.8986

Story4	12	Top	-4386.6876	-3876.0772	-2668.8608	-3397.0509
		Bottom	-4386.6876	-3876.0772	-2668.8608	-3397.0509
Story3	9	Top	-4584.7136	-4051.0529	-2789.3397	-3550.4022
		Bottom	-4584.7136	-4051.0529	-2789.3397	-3550.4022
Story2	6	Top	-4782.1511	-4225.5087	-2909.4607	-3703.2978
		Bottom	-4782.1511	-4225.5087	-2909.4607	-3703.2978
Story1	3	Top	-4979.5886	-4399.9645	-3029.5817	-3856.1934
		Bottom	-4979.5886	-4399.9645	-3029.5817	-3856.1934
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

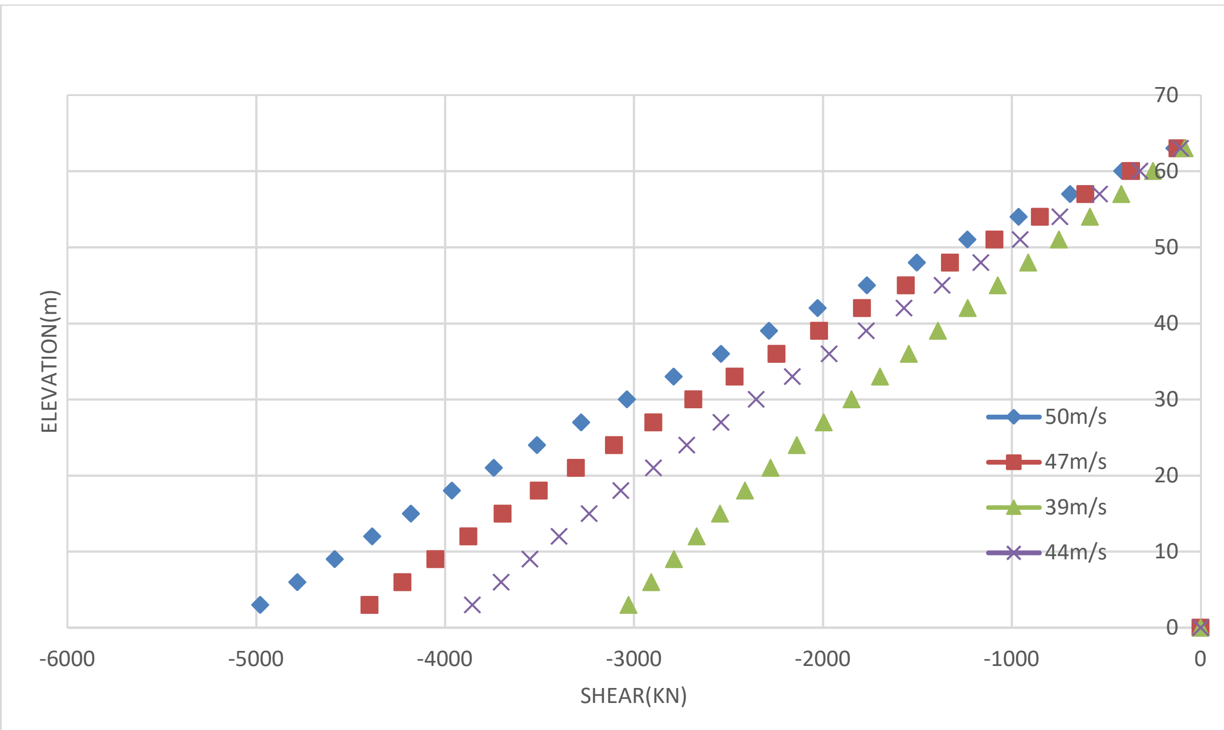

Fig.8.33. story shear curve 1.5(D+WIND) (Zone 2 (44m/s); Zone 3 (39m/s); Zone 4 (47m/s); Zone 5 (50m/s))

From above figure, for the load combination 1.5(D+WIND) the maximum displacement is observed in zone 5 (50m/s) is -4979.886KN.whereas the minimum displacement is observed in zone 3 (39m/s) i.e, -3029.5817KN.

8.2.6 Storey Shear for Earthquake Load:

Table. 8.34. STORY SHEAR EQ. (.9D+1.5EQX) in different wind speed and the story height

STORY SHEAR EQ. (.9D+1.5EQ)						
story	elevation		UNIT=KN			
			zone-5	zone-4	zone-3	zone-2
Story21	63	Top	-162.534	-108.356	-72.2375	-45.1484
		Bottom	-162.534	-108.356	-72.2375	-45.1484
Story20	60	Top	-326.854	-217.903	-145.268	-90.7928
		Bottom	-326.854	-217.903	-145.268	-90.7928
Story19	57	Top	-475.153	-316.768	-211.179	-131.987
		Bottom	-475.153	-316.768	-211.179	-131.987
Story18	54	Top	-608.251	-405.501	-270.334	-168.959
		Bottom	-608.251	-405.501	-270.334	-168.959
Story17	51	Top	-726.972	-484.648	-323.099	-201.937
		Bottom	-726.972	-484.648	-323.099	-201.937
Story16	48	Top	-832.137	-554.758	-369.839	-231.149
		Bottom	-832.137	-554.758	-369.839	-231.149
Story15	45	Top	-924.567	-616.378	-410.919	-256.824
		Bottom	-924.567	-616.378	-410.919	-256.824
Story14	42	Top	-1005.08	-670.056	-446.704	-279.19
		Bottom	-1005.08	-670.056	-446.704	-279.19
Story13	39	Top	-1074.51	-716.339	-477.559	-298.475
		Bottom	-1074.51	-716.339	-477.559	-298.475
Story12	36	Top	-1133.66	-755.776	-503.85	-314.907
		Bottom	-1133.66	-755.776	-503.85	-314.907
Story11	33	Top	-1183.37	-788.913	-525.942	-328.714
		Bottom	-1183.37	-788.913	-525.942	-328.714
Story10	30	Top	-1224.45	-816.3	-544.2	-340.125
		Bottom	-1224.45	-816.3	-544.2	-340.125
Story9	27	Top	-1257.72	-838.483	-558.989	-349.368
		Bottom	-1257.72	-838.483	-558.989	-349.368
Story8	24	Top	-1284.02	-856.011	-570.674	-356.671
		Bottom	-1284.02	-856.011	-570.674	-356.671
Story7	21	Top	-1304.15	-869.43	-579.62	-362.263
		Bottom	-1304.15	-869.43	-579.62	-362.263
Story6	18	Top	-1318.93	-879.289	-586.193	-366.371
		Bottom	-1318.93	-879.289	-586.193	-366.371
Story5	15	Top	-1329.2	-886.136	-590.757	-369.223
		Bottom	-1329.2	-886.136	-590.757	-369.223
Story4	12	Top	-1335.78	-890.518	-593.679	-371.049
		Bottom	-1335.78	-890.518	-593.679	-371.049
Story3	9	Top	-1339.47	-892.983	-595.322	-372.076
		Bottom	-1339.47	-892.983	-595.322	-372.076

Story2	6	Top	-1341.12	-894.078	-596.052	-372.533
		Bottom	-1341.12	-894.078	-596.052	-372.533
Story1	3	Top	-1341.53	-894.352	-596.235	-372.647
		Bottom	-1341.53	-894.352	-596.235	-372.647
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

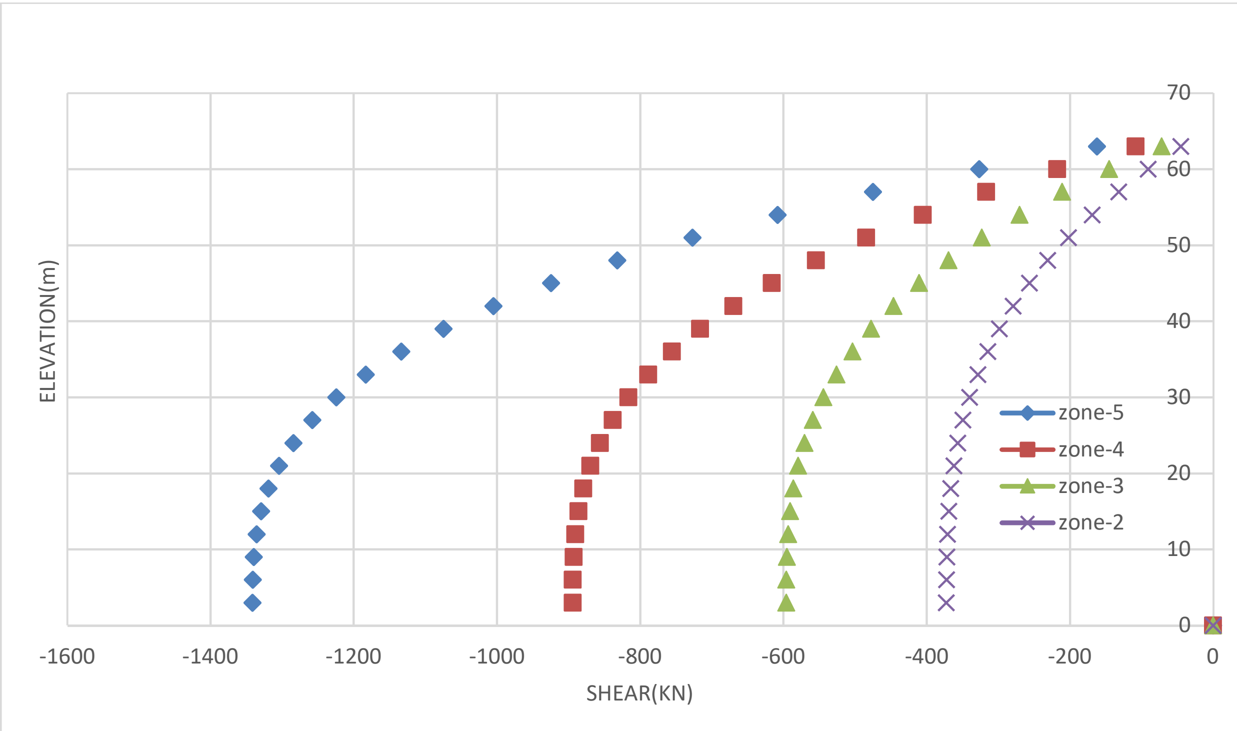

FIG.8.34. story shear curve (.9D+1.5EQ)

From above figure, for the load combination (.9d+1.5eq) the maximum displacement is observed in zone 5 is -1341.5278KN.whereas the minimum displacement is observed in zone 2 i.e, -372.6466KN.

Table 8.35. STORY SHEAR EQ 1.2(D+L+EQX) in different wind speed and the story height

STORY SHEAR EQ. 1.2(D+L+EQX)						
story	elevation		UNIT=KN			
			zone-5	zone-4	zone-3	zone-2
Story21	63	Top	-130.0275	-86.685	-57.79	-36.1187
		Bottom	-130.0275	-86.685	-57.79	-36.1187
Story20	60	Top	-261.4832	-174.3221	-116.2147	-72.6342
		Bottom	-261.4832	-174.3221	-116.2147	-72.6342
Story19	57	Top	-380.122	-253.4146	-168.9431	-105.5894
		Bottom	-380.122	-253.4146	-168.9431	-105.5894
Story18	54	Top	-486.6011	-324.4007	-216.2672	-135.167
		Bottom	-486.6011	-324.4007	-216.2672	-135.167
Story17	51	Top	-581.5779	-387.7186	-258.479	-161.5494
		Bottom	-581.5779	-387.7186	-258.479	-161.5494
Story16	48	Top	-665.7095	-443.8063	-295.8709	-184.9193
		Bottom	-665.7095	-443.8063	-295.8709	-184.9193
Story15	45	Top	-739.6534	-493.1022	-328.7348	-205.4593
		Bottom	-739.6534	-493.1022	-328.7348	-205.4593
Story14	42	Top	-804.0667	-536.0444	-357.363	-223.3519
		Bottom	-804.0667	-536.0444	-357.363	-223.3519
Story13	39	Top	-859.6067	-573.0711	-382.0474	-238.7796
		Bottom	-859.6067	-573.0711	-382.0474	-238.7796
Story12	36	Top	-906.9308	-604.6205	-403.0803	-251.9252
		Bottom	-906.9308	-604.6205	-403.0803	-251.9252
Story11	33	Top	-946.6961	-631.1308	-420.7538	-262.9711
		Bottom	-946.6961	-631.1308	-420.7538	-262.9711
Story10	30	Top	-979.5601	-653.04	-435.36	-272.1
		Bottom	-979.5601	-653.04	-435.36	-272.1
Story9	27	Top	-1006.1798	-670.7866	-447.191	-279.4944
		Bottom	-1006.1798	-670.7866	-447.191	-279.4944
Story8	24	Top	-1027.2128	-684.8085	-456.539	-285.3369
		Bottom	-1027.2128	-684.8085	-456.539	-285.3369
Story7	21	Top	-1043.3161	-695.5441	-463.696	-289.81
		Bottom	-1043.3161	-695.5441	-463.696	-289.81
Story6	18	Top	-1055.1471	-703.4314	-468.9543	-293.0964
		Bottom	-1055.1471	-703.4314	-468.9543	-293.0964
Story5	15	Top	-1063.3631	-708.9087	-472.6058	-295.3786
		Bottom	-1063.3631	-708.9087	-472.6058	-295.3786
Story4	12	Top	-1068.6213	-712.4142	-474.9428	-296.8393

		Bottom	-1068.6213	-712.4142	-474.9428	-296.8393
Story3	9	Top	-1071.5791	-714.386	-476.2574	-297.6609
		Bottom	-1071.5791	-714.386	-476.2574	-297.6609
Story2	6	Top	-1072.8936	-715.2624	-476.8416	-298.026
		Bottom	-1072.8936	-715.2624	-476.8416	-298.026
Story1	3	Top	-1073.2223	-715.4815	-476.9877	-298.1173
		Bottom	-1073.2223	-715.4815	-476.9877	-298.1173
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

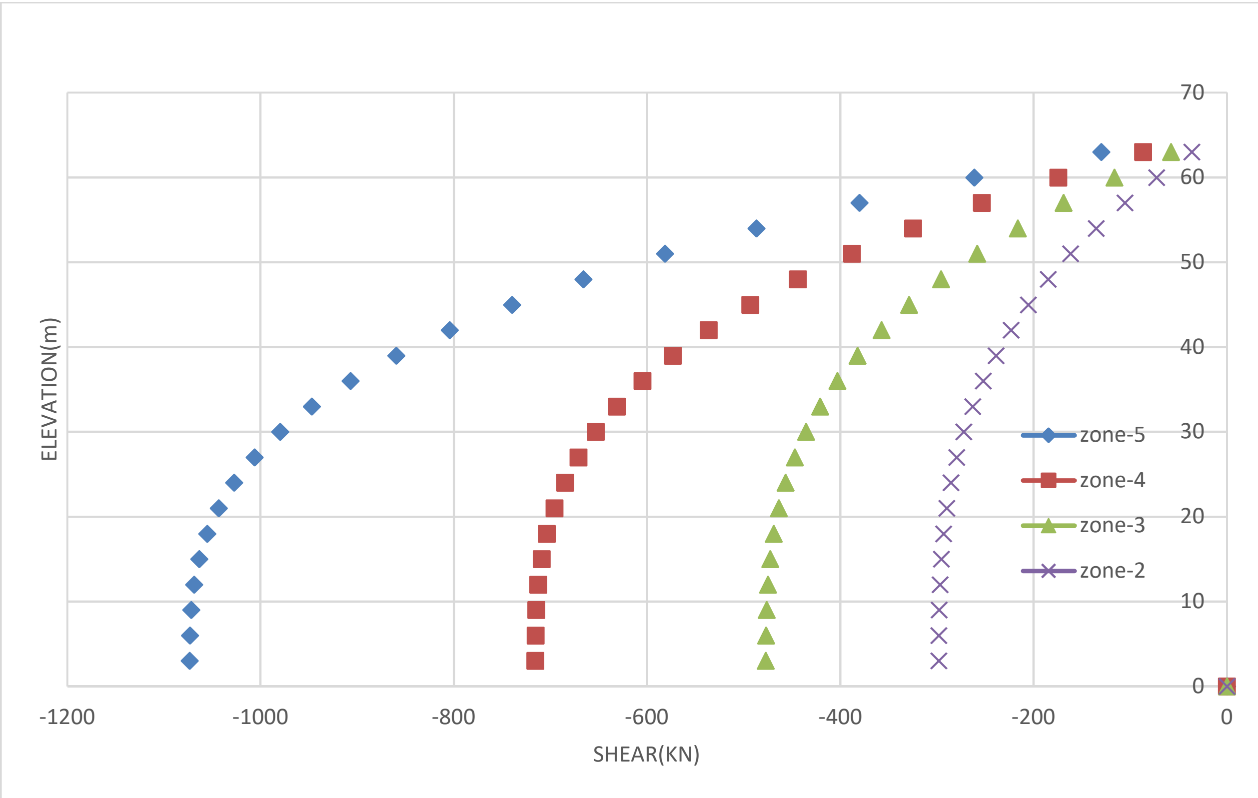

Fig.8.35.Story Shear Curve 1.2(D+L+Eq)

From above figure, for the load combination 1.2(D+L+EQ)the maximum displacement is observed in zone 5 is -1073.2223KN.whereas the minimum displacement is observed in zone 2 i.e, -298.1173KN.

Table. 8.36. STORY SHEAR EQ 1.5(D+EQX) in different wind speed and the story height

STORY SHEAR EQ. 1.5(D+EQX)						
story	elevation		UNIT=KN			
			zone-5	zone-4	zone-3	zone-2
Story21	63	Top	-162.5343	-108.3562	-72.2375	-45.1484
		Bottom	-162.5343	-108.3562	-72.2375	-45.1484
Story20	60	Top	-326.854	-217.9026	-145.2684	-90.7928
		Bottom	-326.854	-217.9026	-145.2684	-90.7928
Story19	57	Top	-475.1525	-316.7683	-211.1789	-131.9868
		Bottom	-475.1525	-316.7683	-211.1789	-131.9868
Story18	54	Top	-608.2514	-405.5009	-270.3339	-168.9587
		Bottom	-608.2514	-405.5009	-270.3339	-168.9587
Story17	51	Top	-726.9723	-484.6482	-323.0988	-201.9368
		Bottom	-726.9723	-484.6482	-323.0988	-201.9368
Story16	48	Top	-832.1369	-554.7579	-369.8386	-231.1491
		Bottom	-832.1369	-554.7579	-369.8386	-231.1491
Story15	45	Top	-924.5667	-616.3778	-410.9185	-256.8241
		Bottom	-924.5667	-616.3778	-410.9185	-256.8241
Story14	42	Top	-1005.0833	-670.0556	-446.7037	-279.1898
		Bottom	-1005.0833	-670.0556	-446.7037	-279.1898
Story13	39	Top	-1074.5084	-716.3389	-477.5593	-298.4746
		Bottom	-1074.5084	-716.3389	-477.5593	-298.4746
Story12	36	Top	-1133.6635	-755.7756	-503.8504	-314.9065
		Bottom	-1133.6635	-755.7756	-503.8504	-314.9065
Story11	33	Top	-1183.3702	-788.9134	-525.9423	-328.7139
		Bottom	-1183.3702	-788.9134	-525.9423	-328.7139
Story10	30	Top	-1224.4501	-816.3001	-544.2	-340.125
		Bottom	-1224.4501	-816.3001	-544.2	-340.125
Story9	27	Top	-1257.7248	-838.4832	-558.9888	-349.368
		Bottom	-1257.7248	-838.4832	-558.9888	-349.368
Story8	24	Top	-1284.016	-856.0106	-570.6738	-356.6711
		Bottom	-1284.016	-856.0106	-570.6738	-356.6711
Story7	21	Top	-1304.1451	-869.4301	-579.62	-362.2625
		Bottom	-1304.1451	-869.4301	-579.62	-362.2625
Story6	18	Top	-1318.9339	-879.2893	-586.1928	-366.3705
		Bottom	-1318.9339	-879.2893	-586.1928	-366.3705
Story5	15	Top	-1329.2039	-886.1359	-590.7573	-369.2233
		Bottom	-1329.2039	-886.1359	-590.7573	-369.2233
Story4	12	Top	-1335.7766	-890.5178	-593.6785	-371.0491
		Bottom	-1335.7766	-890.5178	-593.6785	-371.0491

Story3	9	Top	-1339.4738	-892.9826	-595.3217	-372.0761
		Bottom	-1339.4738	-892.9826	-595.3217	-372.0761
Story2	6	Top	-1341.117	-894.078	-596.052	-372.5325
		Bottom	-1341.117	-894.078	-596.052	-372.5325
Story1	3	Top	-1341.5278	-894.3519	-596.2346	-372.6466
		Bottom	-1341.5278	-894.3519	-596.2346	-372.6466
Base	0	Top	0	0	0	0
		Bottom	0	0	0	0

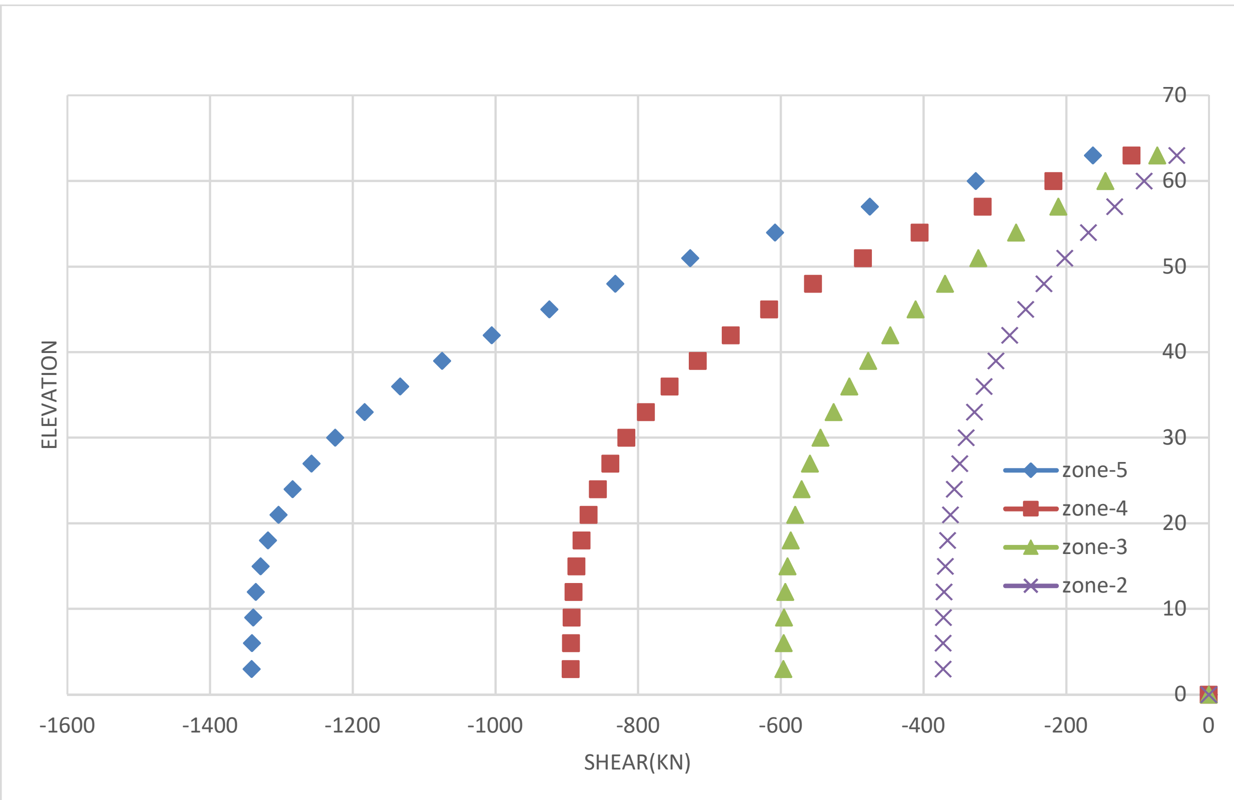

FIG.8.36.Story Shear Curve 1.5(D+EQX)

From above figure, for the load combination 1.5(D+EQX)the maximum displacement is observed in zone 5 is -1341.5278KN.whereas the minimum displacement is observed in zone 2 i.e, -372.6466KN.

9. CONCLUSIONS

1. Structure is more critical in wind load compare to earthquake load.

2. Compare to earthquake zone 3, earthquake zone 2 is more critical in wind load because at zone 2 wind speed is 44m/s whereas in zone 3 is 39m/s.

3. With increasing in seismic zone, the displacement of the structure also increases. The displacement is peak at high level where very low at the bottom of structure. The displacement of zone 2 in G10 structure is 18.895mm where in zone 5 is 68.023mm. Which is around 260% increment. Similarly, for G20 structure displacement in zone2 is 38.102mm and in zone5 is 137.167mm. Which is around 260% increment.
   If we are going with the height, the increment with the height in zone 2 between G10 and G20 is 105.84% and zone 3 is 101.64%, zone 4 is 101.64% and zone 5 is 101.64%.

4. With increasing in wind pressure, the displacement of the structure also increases. The wind displacement is peak at high level where very low at the bottom of structure. The displacement of wind speed 39m/s in G10 structure is 42.267mm where in wind speed 50m/s is 69.473mm. Which is around 64.36% increment. Similarly, for G20 structure displacement in wind speed 39m/s is 204.452mm and in wind speed 50m/s is 336.049mm which is around 64.36% increment.
   If we are going with the height, the increment with the height the displacement in wind speed 39m/s between G10 and G20 is 383.715% and wind speed 44m/s is 383.71%. Wind speed 47m/s is 383.71% and wind speed 50m/s is 383.71%.

5. With increasing in seismic zone, the story drift of the structure also increases. The story drift is peak at somewhere in mid-section of structure. The story drift in zone 5 in G10 structure is .002781mm which is maximum value at 5th floor (15m) where in zone 2 is .000767mm at same floor, which is around 262.58% increment. Similarly, for G20 structure story drift in zone 5 is .002966mm which a maximum value at 7th floor (21m) and in zone 2 is .000824mm which is around 260% increment.
   If we are going with the height, the increment with the height the story drift in zone 2 between G10 and G20 is 7.43% and zone 3 is 7.416%. Zone 4 is 7.44% and zone 5 is 6.65%.

6. With increasing in wind pressure, the story drift of the structure also increases. The wind displacement is peak at somewhere in mid- section of structure. The displacement of wind speed 50m/s in G10 structure is .003145mm which is maximum value at 12m floor where in wind speed 39m/s is .001913mm same floor. Which is around 64.4% increment. Similarly, for G20 structure displacement in wind speed 39m/s is .005224mm and in wind speed 50m/s is .00315mm which is around 64.4% increment.

If we are going with the height, the increment with the height the displacement in wind speed 39m/s between G10 and G20 is 173% and wind speed 44m/s is 173%. Wind speed 47m/s is 173% and wind speed 50m/s is 173%.

7. With increasing in seismic zone, the story shear displacement of the structure also increases. The displacement is low at high level where very peak at the bottom of structure. The displacement of zone2 in G10 structure is -400.9766KN where in zone 5 is -1443.5157KN which is around 260% increment. Similarly, for G20 structure displacement in zone2 is -372.6466KN and in zone5 is -1341.5278KN which around 260% increment.
   If we are going with the height to G10 to G 20, the increment with the height in zone 2 between G10 and G20 is 760.23% and zone 3 760%. Zone 4 is 760% and zone 5 is 760%.

8. With increasing in wind pressure, the story shear of the structure also increases. The wind displacement is peak at low level where very high at the bottom of structure. The displacement of wind speed 39m/s in G10 structure is -1407.543KN where in wind speed 50m/s is -2313.513KN which is around 64.36% increment. Similarly, for G20 structure displacement in wind speed 39m/s is -596.2396KN and in wind speed 50m/s is -1341.5278KN which is around 125% increment.
   If we are going with the height, the increment with the height the displacement in wind speed 39m/s between G10 and G20 is 136% and wind speed 44m/s is 380.74%. Wind speed 47m/s is 1284% and wind speed 50m/s is 72.45%.

9. In the analysis load combination .9D+1.5EQX and 1.5(D+EQX) giving the same value and more critical value comparing 1.2(D+L+EQX).
   Similarly In the analysis load combination .9D+1.5WINX and 1.5(D+WINX) giving the same value and more critical value comparing 1.2(D+L+WINX).

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