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"Seismic Performance Of Bracing And Shear Wall In High Rise Building Along With Different Types Of Soil''

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Abstract*:* Lateral load effects on high rise buildings are quite significant and increase rapidly with increase in height. In high rise structures, the behavior of the structure is greatly influenced by the type of lateral system provided and the selection of appropriate. The selection is dependent on many aspects such as structural behavior of the system economic feasibility and availability of materials. The structural performance of high-rise buildings is critically influenced by lateral load-resisting systems, especially under seismic loading conditions. This study investigates the dynamic behavior of a high-rise building equipped with bracings and shear walls when subjected to response spectrum analysis. The primary objective is to evaluate the efficiency of combined structural systems in enhancing the seismic resistance and overall stability of tall structures. A comparative analysis is conducted using structural modeling software to assess parameters such as lateral displacement, inter-storey drift, base shear, and modal behavior. The incorporation of bracings and shear walls is found to significantly reduce seismic response, demonstrating improved stiffness and energy dissipation capacity. The results underscore the importance of integrated lateral load- resisting systems in modern high-rise design, ensuring safety, serviceability, and code compliance under dynamic earthquake loading.

In the design of high-rise buildings, ensuring structural stability and safety under seismic loads is a critical concern. This thesis presents a detailed analytical study on the seismic performance of a high-rise building incorporating both bracings and shear walls as lateral load-resisting systems. The building is analyzed using the Response Spectrum Method as per relevant seismic codes to assess its behavior under dynamic earthquake loading.

The objective of this study is to evaluate the effectiveness of bracing systems and shear walls— individually and in combination—in controlling lateral displacements, inter-storey drift, and base shear. A comparative analysis is carried out using structural analysis software, focusing on different configurations of bracing and shear wall placements. This research highlights the importance of hybrid structural systems in optimizing high-rise building responses to seismic excitations and provides valuable insights for engineers and designers aiming to develop safe, economical, and code-compliant structures in seismic-prone regions.

Key Words : Base Shear, Storey Displacement, Storey Drift, Seismic zone, Bracings

1.1 Introduction

Recent trend of growth in population and scarcity of land has evolved an era of modern urbanization which indeed has led to the vertical growth of buildings and gave us the new trend setting structures named as High Rise Structures or Multi-Storeyed Structures as shown in fig1.1. These structures are need of time due to scarceness of land, greater demand for business and residential space, economical emergence, technical advancements, innovations in structural systems and desire for aesthetics in urban area. Although there is no precise definition that is universally accepted, various bodies have tried to define what 'high-rise' means. The new shorter oxford english dictionary defines high-rise as "a building having many stories". The international conference on fire safety in high-rise buildings defined a high-rise as "any structure where the height can have a serious impact on evacuation". displacement, storey acceleration, modal time period, storey drift and performance point were analyzed with the help of software.

1.2 NEED FOR THE PRESENT STUDY

High Rise Buildings being an unavoidable feature in recent architectural venture, the analysis of High Rise Structures using different structural system is of importance and its precise design should be given. This will give the practicing designers scope to analyze and design any building where lateral load is predominant with best adoptable structural system.

1.3 OBJECTIE AND SCOPE OF THE STUDY

The main objective of the present work is to carryout analysis of High Rise Structures and findout which structural system can be
best suitable for High Rise Structures and Low Rise Structures. This study is important as its need of time for buildings to
expand vertically and if not properly analyzed or designed will lead to massive failure of structure. Thus analysis of 10,15 and 20
storey buildings is carried out using different structural systems such as Shear-wall System, Framed System and Bracing System
From this study we can clearly get an idea of best suitable Structural systems for Low Rise Structures and High Rise Structures.
Linear seismic analysis is carried out for study.

2.1 LITERATURE SURVEY

S.T.B. College of Engineering, Tuljapur, Maharashtra (2014): This study analyzes high-rise buildings using STAAD.Pro under various lateral stiffness conditions, including bare frames, brace frames, and shear wall frames. The RSA method is employed to assess the impact of higher vibration modes and force distribution within the elastic range. Key parameters such as base shear, story drift, and deflections are evaluated to determine the most effective lateral load-resisting system.

Apurva Arjun Gaikwad & Atul B. Pujari (2019) : worked on Optimal Design of Tube-in-Tube Systems. Primary objectives of this study were to investigate effects of varying design parameters on the tube action and shear lag behavior of a typical reinforced concrete tube-in-tube building & proposed optimal design approaches for similar tube-in-tube structures. Parametric study was conducted with selected key design variables on the performance

Fasil Mohi ud din (2017) : his study explores the efficiency of various bracing systems in multi-story steel frames using RSA. It evaluates how different steel profiles and bracing arrangements impact lateral displacement and overall structural performance during seismic events

Kamani Kanchan, Pankaj Kumar (2024) : The research compares several bracing systems in a 15- story reinforced concrete structure. It assesses maximum story displacement and base shear under seismic loading, providing insights into the effectiveness of different bracing configurations of a 40 story building. The design variables considered for parametric study included column & beam depth, interior walls of the moment frames. Performance of each model was assessed in terms of overall and critical (maximum) story drifts, and shear lag behavior. Overall effects of column depth on the tube action and shear lag behavior more prominent than the other member dimensions.

Nimmy (2015) studied the seismic performance of tube-in-tube structures. Three different models were developed in SAP2000 software by varying location of the inner tubes. Structures were analyzed using continuum approach in which the horizontal slabs and beams connecting vertical elements were assumed as continuous connecting medium having equivalent distributed stiffness properties. Equivalent static, Response spectrum analysis and Time-history analysis was done and the output of three models were evaluated to compare their seismic performance. It was concluded that time-history analysis predicts structural response more accurately than equivalent static analysis. It was seen that for a regular structure with seismic loading, the model with core located at the corners yielded better results. Large displacements were seen in which positioning of the inner cores were not exactly at middle nor at corner. Hence this type of arrangement was least recommended.

Yogendra (2015) studied Lateral load Resisting Systems for Multi-Storey Building. Structural system can be visualized as consisting of two components 1) Horizontal Framing consisting of Slab and Beams which is primarily responsible for transfer of vertical load to the Vertical framing system and 2) Vertical Framing System consisting of Beams and Column which is primarily responsible for transfer of Lateral load to Foundation. Framed, Shear-Wall, Frame-Shear wall system, Framed Tube System, Tube in Tube System and Modular Systems were compared.

Navin R Amin et.al studied the Design of Multiple Framed Tube High Rise Steel Structure in Seismic Region carried out analysis and design of Multiple tube for governing load cases and finally concluded that the Multiple Framed Tube concept can be effectively utilized in seismic region. Also proper proportioning of framed members will result in good consistent in terms of strength, stiffness etc.

Khanetal discussed the analysis and design of framed tube structures for tall concrete buildings. The behavior of framed tube structures was discussed from an overall structural system point of view. The influence of various structural parameters was emphasized for achieving better tubular behaviors. Also the concept of the equivalent reduced plane frame modeling technique was used for developing a series of influence curves for the preliminary analysis and design.

A.M. Chandler suggested the application of strut and- tie method on outrigger braced core wall buildings. This is to enhance practicing engineers to understand the general structural behavior of outrigger braced core wall system.

B.N.Sarath strut and-tie method is applied to analyze the whole lateral structural system. The complete load transfer mechanism between the outrigger brace and the core wall is displayed. Many practical concerns in design including the structural behaviors of different configuration of our triggers, the effect of openings through the core wall adjacent to the outrigger brace, the arrangement of shear studs on outrigger brace and the shear link arrangement in core wall are briefly discussed.

Jiemin Ding introduced the design and research for a tall building of concrete filled square steel tube. The braced - frame system was adopted to reduce the torsion effect brought by architectural irregularities of plan and elevation. The modal analysis, response spectrum analysis and time history analysis was carried out by several software. The period, displacement and story shearing force etc. were obtained and compared with each other.

3.1 GRAVITY LOAD PATH

Gravity load is the vertical load acting on a building structure, including dead load and live load due to occupancy or snow. Gravity load on the floor and roof slabs is transferred to the columns or walls, down to the foundations, and then to the supporting soil beneath. Figure 3.7 shows an isometric view of a concrete Structure and a gravity load path. The vertical gravity load acts on a slab (1), which transfers the load to the beams (2), which in turn transfer the load to the columns (3) and then down to the foundations (4). The gravity load path depends on the type of floor slab, that is, whether a slab is a one way or a two-way system. In the one-way system in Figure 3.8(a), the effect of external loads is transferred primarily in one direction, shown with an arrow. The slab-beam and-girder floor is an example of a one-way system. The gravity load acting on this system is transferred from the slab (1) to the beams (2) and then to the girders (3). Finally, the girders transfer the load to the columns (4).

The load path in a two-way The vertical gravity load acts on a slab (1), which transfers the load to the beams (2), which in turn transfer the load to the columns (3) and then down to the foundations (4). The gravity load path depends on the type of floor slab, that is, whether a slab is a one way or a two-way system. In the one-way system in Figure 3.8(a), the effect of external loads is transferred primarily in one direction, shown with an arrow. The slab-beam and-girder floor is an example of a one-way system. The gravity load acting on this system is transferred from the slab (1) to the beams (2) and then to the girders (3). Finally, the girders transfer the load to the columns (4).

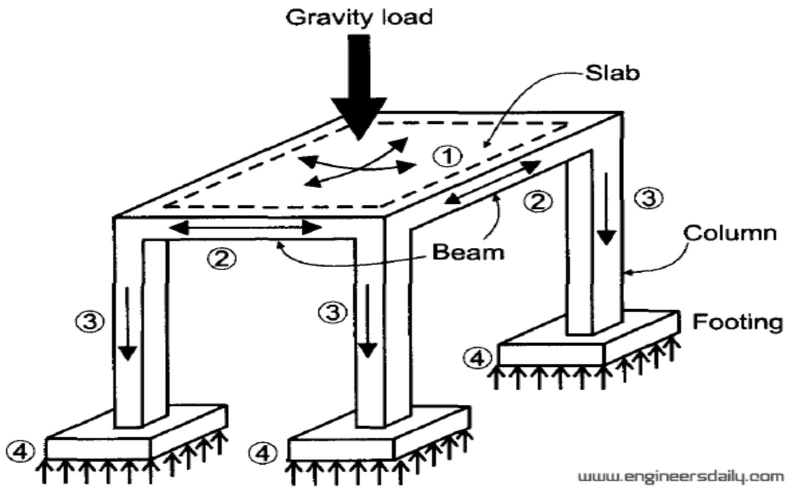


Figure No 1: An isometric view of a concrete structure showing a gravity load path.

The load path in a two-way system is not as clearly defined. The slab transfers gravity load in two perpendicular directions; however, the amount carried in each direction depends on the ratio of span lengths in the two directions, the type of end supports, and other factors. For example, in the slab with beams system shown in Figure 3.8(b), the load is transferred from the slab (l) to the beams aligned in the two directions (2) and then tothe columns (3).

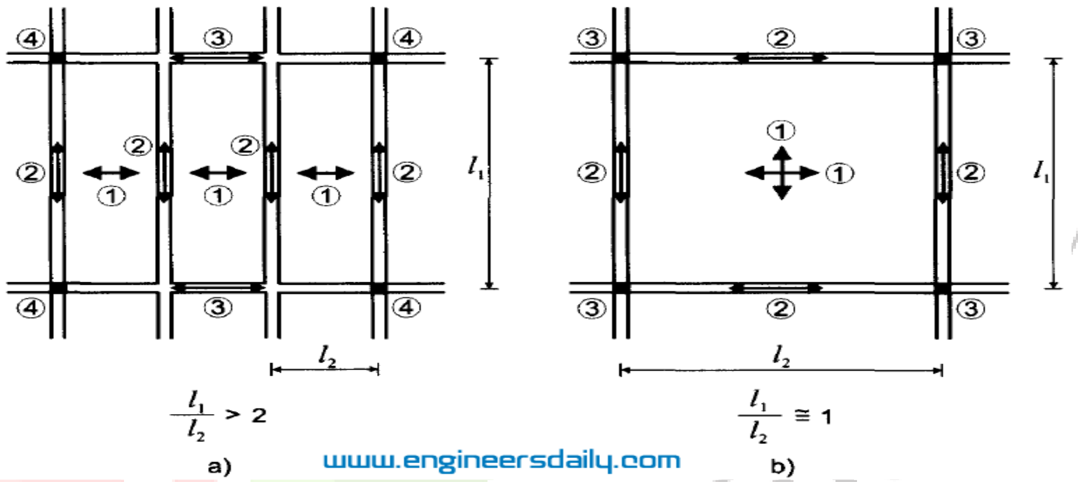


Figure No 2: Gravity load path in a floor slab: a) one-way system; b) two-way system.

3.2 LATERAL LOAD PATH

The lateral load path is the way lateral loads (mainly due to wind and earthquakes) are transferred through a building. The primary elements of a lateral load path are as follows:

1) Vertical components: shear walls and frames;

2) **Horizontal components: roof, floors, and foundations.**

A reinforced concrete structure and the elements constituting the lateral load path: roof and floor systems (I) transfer the load to the walls (2), which in turn transfer the load to the foundations
(3). Roof and floor systems (also called diaphragms) take horizontal forces from the storeys at or above their level and transfer them to walls or frames in the storey immediately below. Shear walls and frames are the primary lateral-load resisting elements; however, these members also carry gravity loads. Shear walls receive lateral forces from diaphragms and transmit them to the foundations. Foundations form the final link in the load path by collecting the lateral forces from all storeys and transmitting them to the ground.

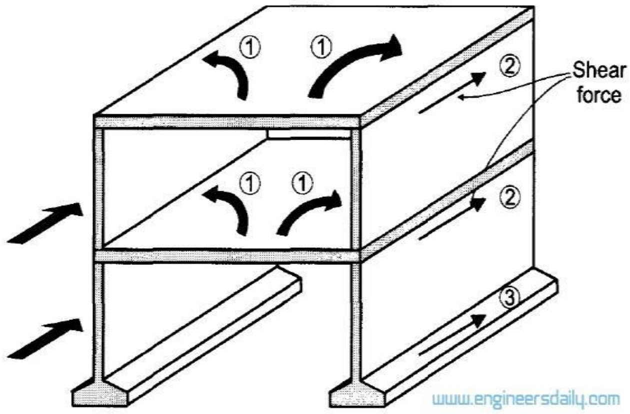


Figure No 3: Lateral load resisting path

3.3 EARTHQUAKE RESISTANCE DESIGN CRITERIA

3.3.1 Seismic Zones in India

The varying geology at different locations in the country implies that the like hood of damaging earthquakes taking place at different locations is different. Thus, a seismic zone map is required so that buildings and other structures located in different regions can be designed to withstand different level of ground shaking. At present the zone map has four seismic zones – II, III, IV, and V. Seismic zone II and zone III are major zones, covering more percentage of land area in India. Geographical statistics of India show that almost 54% of the land is vulnerable to earthquakes. Eastern India has higher seismic intensity hence falls under zone V and North-East India falls under zone IV. Figure 3.12 show the Map for various seismic zones in India.

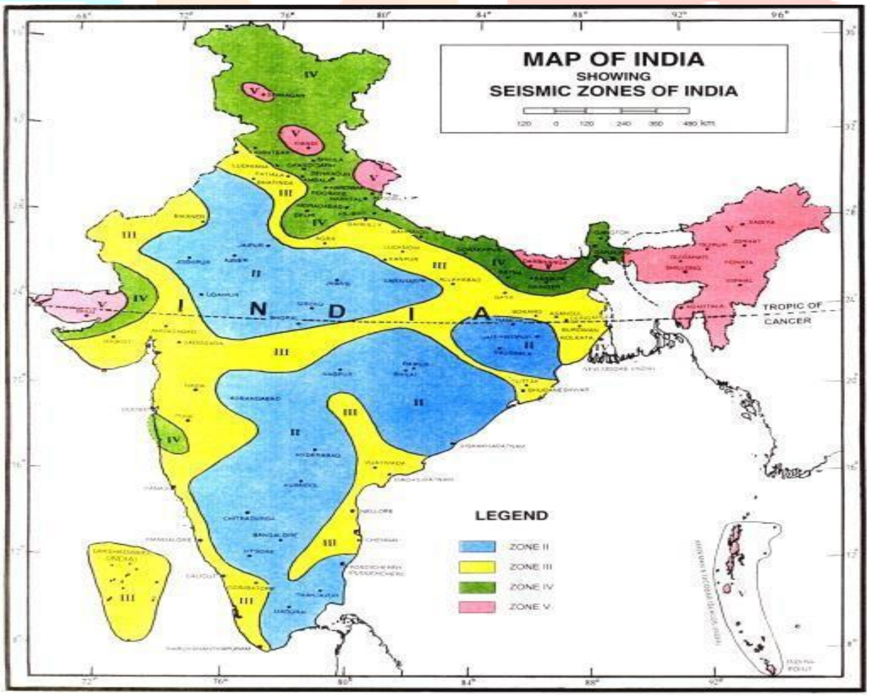


Figure No 4: Map showing various seismic zones of India

3.3.1.1 Zone Factor (Z)

Seismic Zone	II	III	IV	V
Seismic Intensity	Low	Moderate	Severe	Very Severe
Zone Factor	0.10	0.16	0.24	0.36

Table 1: Zone Factor (Z) as per IS 1893 (Part 1): 2016

3.3.2 Response Reduction Factor (R)

Lateral load-resisting system	Response Reduction Factor (R)
Ordinary RC moment resisting frame (OMRF)	3.0
Special RC moment resisting frame (SMRF)	5.0

Table 2: Response reduction factors (R) as per IS 1893 (Part 1): 2002

3.4 LOAD COMBINATIONS CONSIDERED

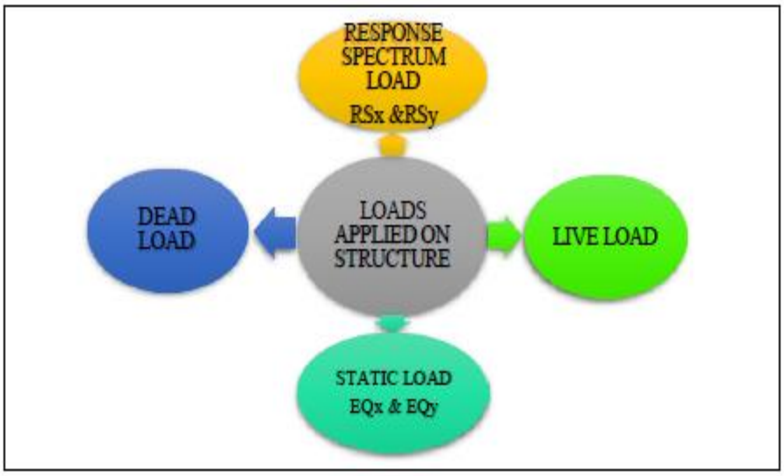


Figure 5: Types of Load

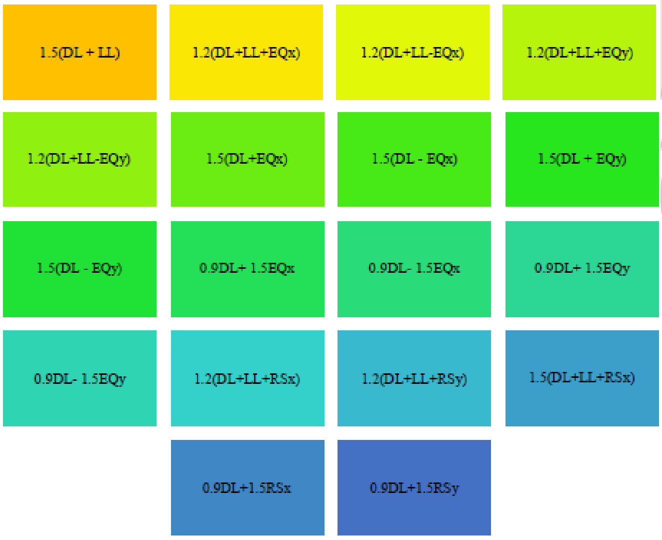


Figure 6: Load Combinations

Model No	Name of Structural System
I	Bare Frame
II	Frame with corner Bracing
III	Frame with 5% Shear Wall
IV	Frame with 10% Shear Wall
V	Frame with 15% Shear Wall

Table No 3: Description of Models with different Structural Systems.

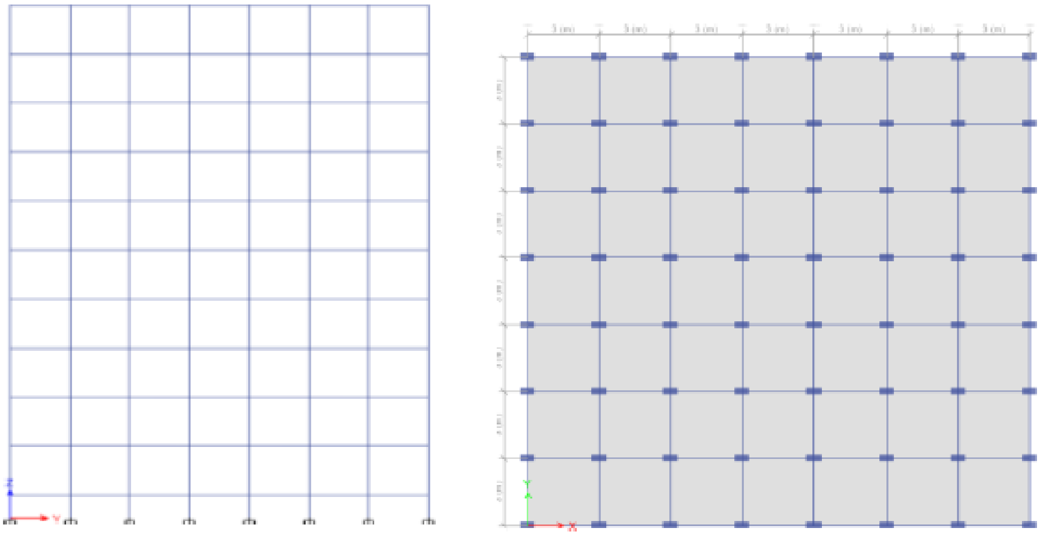


Figure No 7: Typical Plan and Elevation Structure (M-1)

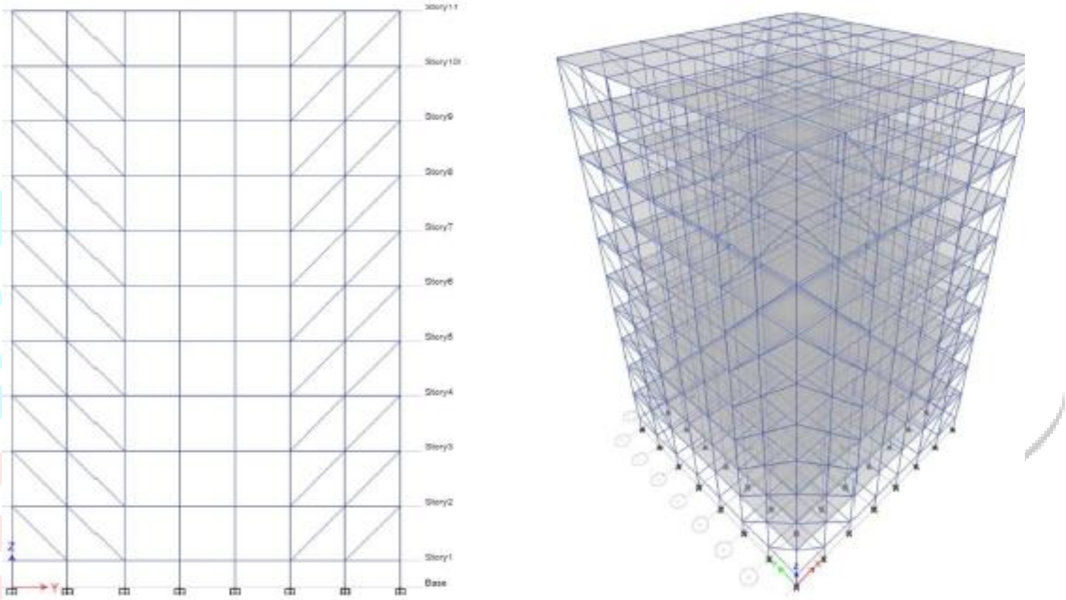


Figure No 8: Elevation and 3D view Corner Braced Framed Structure (M-II)

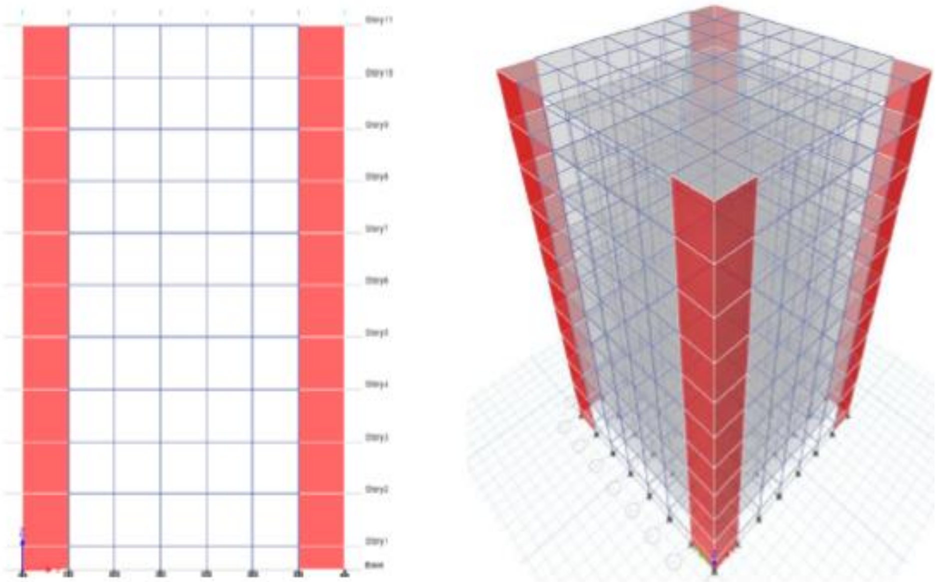


Figure No 9: Elevation and 3D view Framed Structure with Corner Shear Wall (5%)-((M-III)

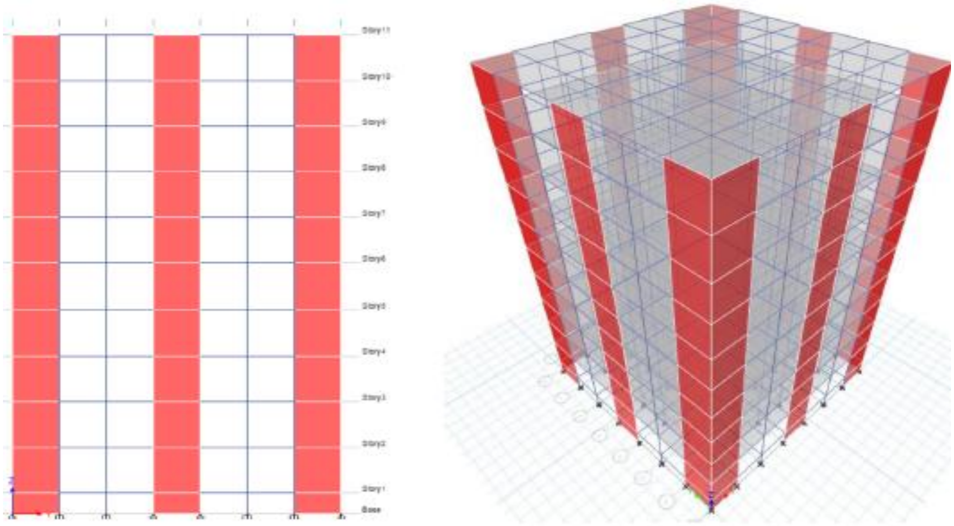


Figure No 10: Elevation and 3D view Framed Structure with Corner Shear Wall (10%)-((M-IV)

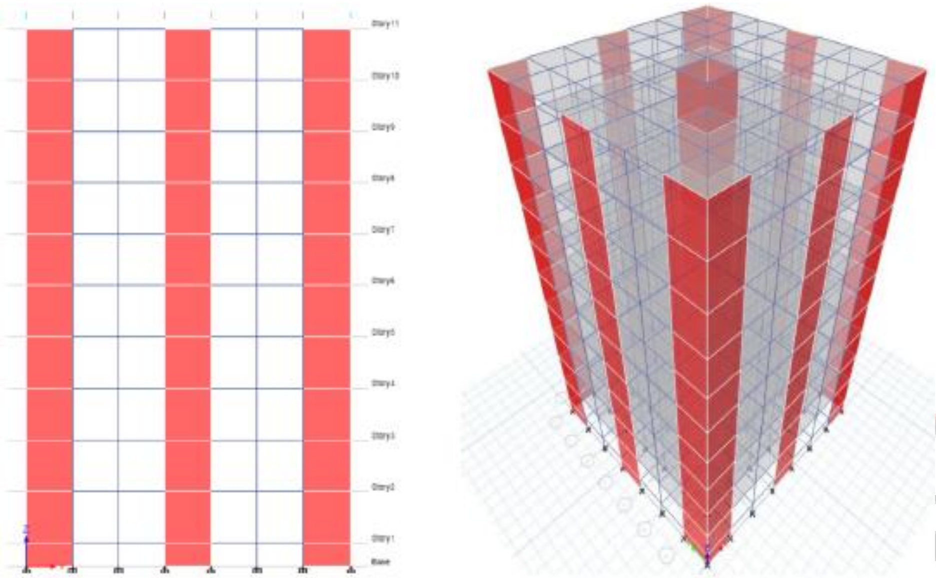


Figure No 11: Elevation and 3D view Framed Structure with Corner Shear Wall (15%)-((M-V)

Table No 4: Detailed Specifications Required for the Structures

Sr.No	Structural Element	Dimension
1	Plan Dimensions	21 X 21 m
2	Spacing in X-Direction	3 m
3	Spacing in Y-Direction	3 m
4	Number of Bays in X-Direction	7
5	Number of Bays in Y-Direction	7
6	Number Stories	10, 15 and 20
7	Grade of Concrete	M25
8	Grade of Steel	Fe500
9	Support Conditions	Fixed
10	Typical Storey Height	3.2 m
11	Bottom Storey Height	2 m
12	Total Height of Structure	37.2m,53.2m &69.2m
13	Thickness of Slab	0.15 m
14	Thickness of Wall	0.230 m

Table No 5: Detail Description of Loads Applied on Structure

Sr. No	Type of Load	Intensity
1	**Dead Load** Self-Weight of Slab Self-Weight of Beam Self-Weight of Column Floor Finish	1 kN/m2
2	Live Load	2.5 kN/m2
3	Wall Load	(Height of Wall – Depth of beam) x Density of Masonary x Thickness of Wall Eg : (3.2 -0.45) x 20 x 0.23 =12.65 KN/m

Table No 6: Detailed Specifications for Seismic Analysis

DETAILED SPECIFICATIONS FOR SEISMIC ANALYSIS (ACC TO IS 1893- 2002)		
1	Zone	V
2	Zone Factor **(Z)**	0.
3	Importance Factor **(I)**	1
4	Response Reduction Factor **(R)**	5
5	Soil Type	I, II and III
6	Method of Analysis	Response Spectrum Analysis

4.1 ANALYSIS RESULTS FOR MODULE – 01 (HARD SOIL CATEGORY)-TYPE I

4.1.1 BASE SHEAR COMPARISON

Structure	Bare Frame		Bracing System		Shear Wall					
					5%		10%		15%	
	VBx	VBy	VBx	VBy	VBx	VBy	VBx	VBy	VBx	VBy
10	13288	10216	13181	12952	1718	15310	17848	16171	19815	17991
15	19566	15283	21988	18920	24106	20506	26130	23333	28722	23513
20	25395	19952	28432	24179	31678	27698	33200	29443	35950	32626

Table 7: Base Shear in X & Y direction for Different height of structure and structural provisions

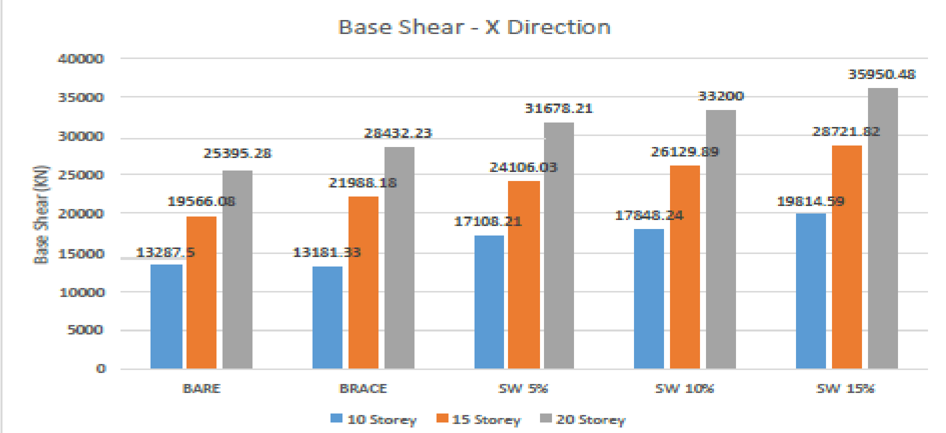


Chart 1: Base Shear in X direction for Different height of structure and structural provisions

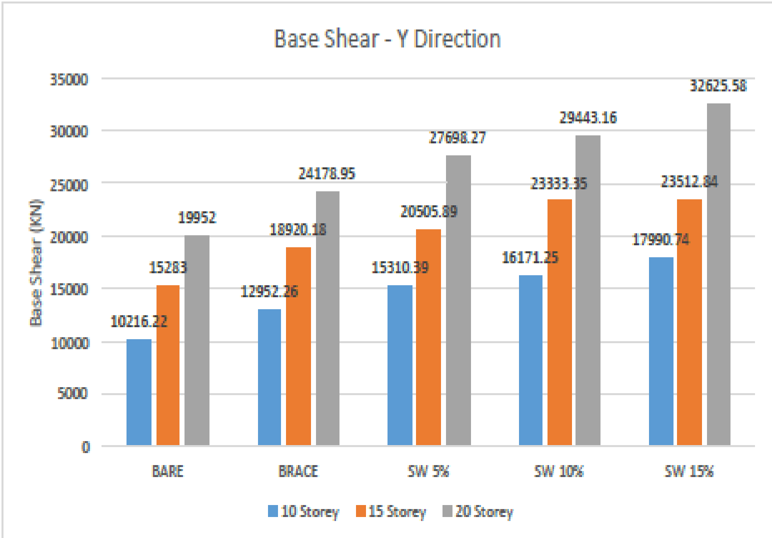
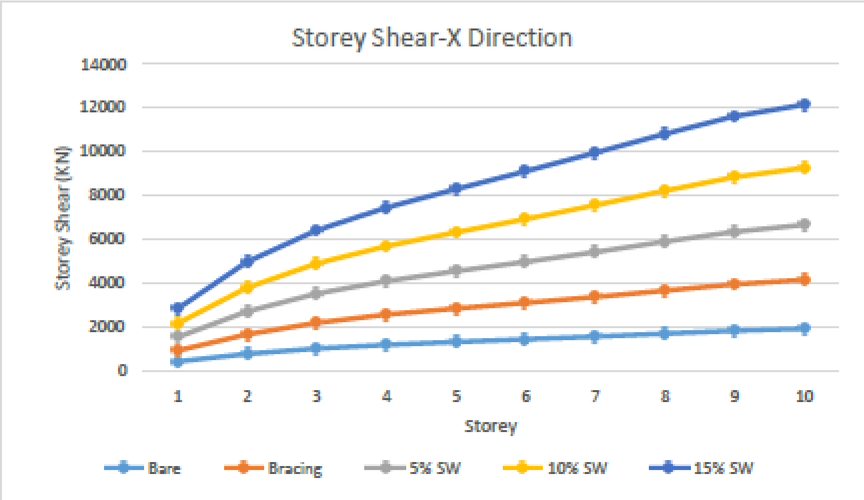


Chart 2: Base Shear in Y direction for Different height of structure and structural provisions

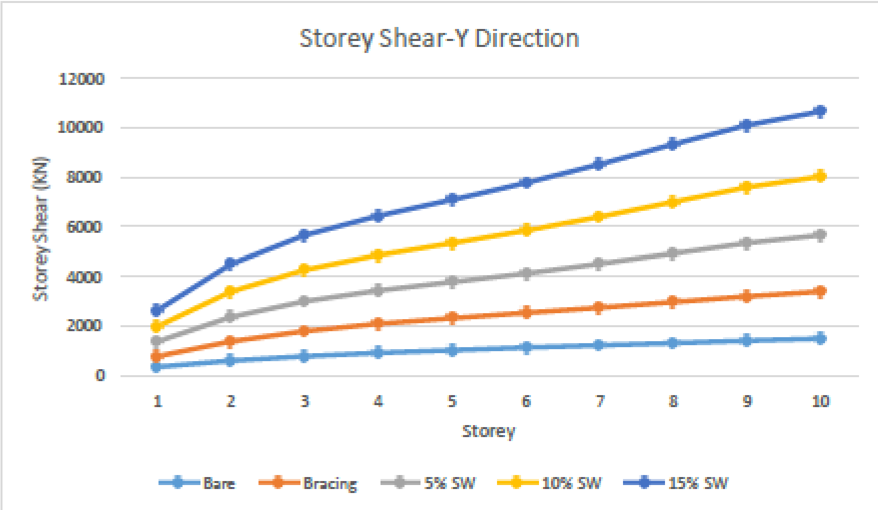
4.1.2 STOREY SHEAR COMPARISON

Storey	Bare Frame		Bracing System		Shear Wall					
					5%		10%		15%	
	Qx	Qy	Qx	Qy	Qx	Qy	Qx	Qy	Qx	Qy
10	444	345	495	431	612	599	620	608	670	650
9	785	602	889	776	1048	991	1070	1019	1170	1109
8	1027	778	1171	1013	1326	1210	1365	1262	1504	1387
7	1200	910	1370	1175	1523	1344	1580	1423	1751	1579
6	1332	1024	1520	1296	1690	1457	1764	1561	1966	1748
5	1450	1126	1655	1403	1857	1593	1943	1713	2173	1927
4	1573	1221	1798	1519	2036	1764	2129	1889	2380	2124
3	1705	1313	1955	1650	2221	1956	2314	2078	2581	2328
2	1836	1407	2107	1788	2387	2136	2478	2252	2755	2510
1	1934	1491	2211	1901	2499	2260	2585	2367	2865	2629

Table No 8:Storey shear comparison for 10 Storey



Graph 1: Storey Shear in X direction for Different height of structure and structural provisions



Graph 2: Storey Shear in Y direction for Different height of structure and structural provisions

4.1.3 STOREY DISPLACEMENT COMPARISON

Storey	Bare Frame		Bracing System		Shear Wall					
					5%		10%		15%	
	δx	δy	δx	δy	δx	δy	δx	δy	δx	δy
10	35	44.88	31.2	37.1	30.27	35.97	28.76	33.45	27.06	30.66
15	43.61	55.48	39.38	47.39	37.16	44.09	35	40.78	33.33	37.87
20	60.35	75.41	55.67	65.7	52.42	62.63	49.63	57.4	47.47	53.9

Table 9: Storey Displacement in X & Y direction for Different height of structure

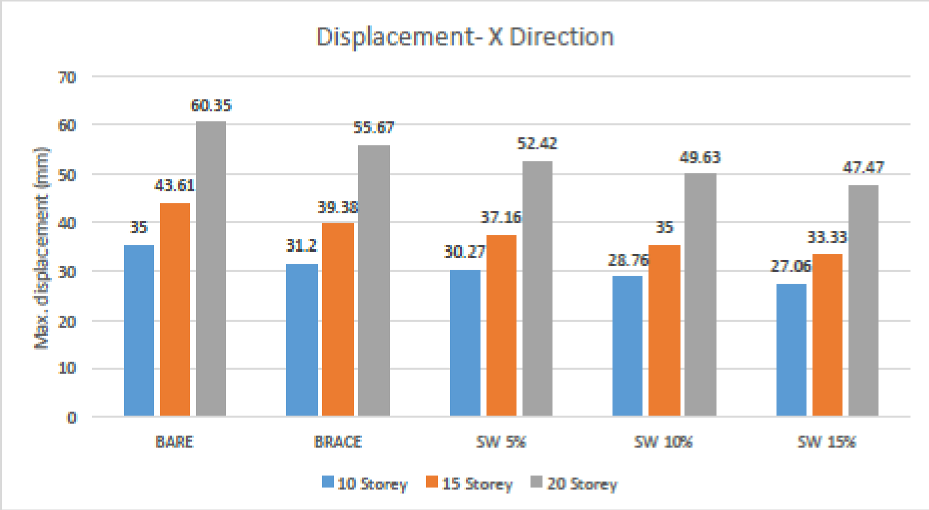
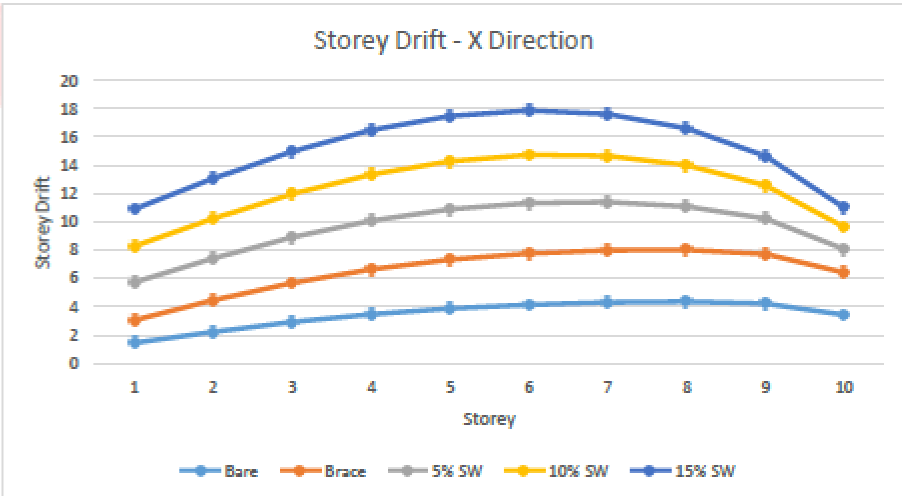


Chart 3: Maximum Storey Displacement in X direction different height of buildings with different structural provision

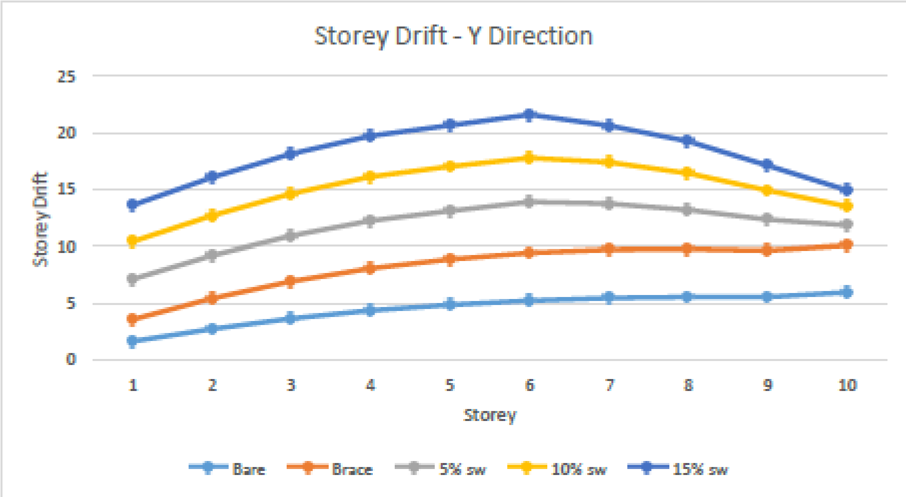
4.1.4 STOREY DRIFT COMPARISONFOR 10 STORIED STRUCTURE

Storey	Bare Frame		Bracing System		Shear Wall					
					5%		10%		15%	
	δx	δy	δx	δy	δx	δy	δx	δy	δx	δy
10	1.46	1.65	1.6	1.92	2.68	3.56	2.55	3.28	2.62	3.21
9	2.23	2.74	2.24	2.68	2.96	3.79	2.81	3.49	2.82	3.36
8	2.93	3.65	2.77	3.28	3.22	4	3.06	3.71	3	3.51
7	3.47	4.36	3.17	3.72	3.44	4.17	3.27	3.87	3.14	3.61
6	3.88	4.87	3.45	4	3.56	4.23	3.39	3.94	3.19	3.62
5	4.15	5.23	3.62	4.21	3.56	4.47	3.4	3.88	3.14	3.82
4	4.31	5.46	3.68	4.26	3.41	4.03	3.25	3.65	2.96	3.25
3	4.37	5.556	3.65	4.21	3.06	3.44	2.92	3.23	2.61	2.83
2	4.23	5.56	3.51	4.07	2.49	2.73	2.36	2.56	2.07	2.21
1	3.43	5.97	3	4.12	1.65	1.77	1.57	1.66	1.36	1.42

Table 10: Storey Drift in X & Y direction for Different height of structure with shear wall and bracing system provision For 10 Storied structure



Graph 3: Storey Drift in X direction different height of buildings with different structural provisions



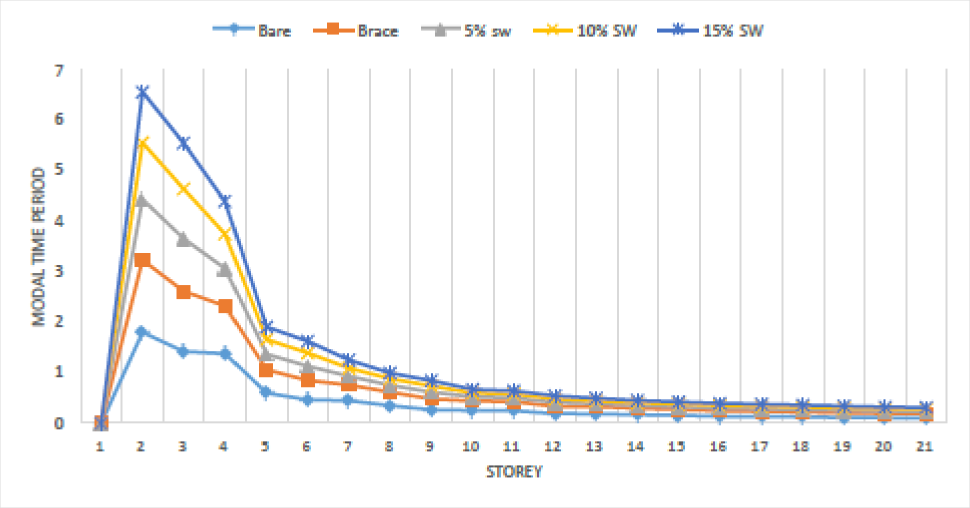
Graph 4: Storey Drift in Y direction different height of buildings with different structural provisions

4.1.5 MODAL TIME PERIOD OF THE STRUCTURE

For current study the Response Spectrum Approach for the Dynamic Analysis is used. As per IS 1893:2016, total number of modes to be considered should be such that total sum of modal masses considered should be atleast 90% of the total seismic mass. For the present study, first 20 modes are considered for the 10, 15 and 20 storied building which satisfied the 90% criteria.

Mode	Bare Frame	Bracing System	Shear Wall		
			5%	10%	15%
1	1.798	1.429	1.2	1.118	1.005
2	1.417	1.196	1.037	0.985	0.904
3	1.378	0.94	0.741	0.684	0.645
4	0.594	0.464	0.31	0.289	0.247
5	0.464	0.382	0.281	0.265	0.232
6	0.445	0.313	0.172	0.162	0.158
7	0.349	0.264	0.14	0.13	0.108
8	0.268	0.214	0.131	0.123	0.105
9	0.252	0.187	0.084	0.077	0.07
10	0.246	0.179	0.079	0.073	0.064
11	0.189	0.146	0.076	0.071	0.062
12	0.184	0.145	0.059	0.055	0.051
13	0.17	0.126	0.055	0.052	0.05
14	0.153	0.119	0.052	0.052	0.046
15	0.137	0.109	0.051	0.05	0.046
16	0.13	0.102	0.05	0.05	0.044
17	0.124	0.097	0.048	0.049	0.043
18	0.114	0.091	0.046	0.046	0.042
19	0.107	0.085	0.046	0.046	0.034
20	0.104	0.084	0.046	0.043	0.033

Table 11: Modal time period of 10 storey structure



Graph 5: Modal time period for different height of buildings with different structural provisions-10 storey

5.1 SUMMARY OF WORK AND COMMON OBSERVATIONS FROM MODULE-I, MODULE-II AND MODULE-III

Following are the observations that drawn from the present study. Here we have considered 10, 15 and 20 storey buildings. The different structural elements like Bare frame (M-1), Bracing at the corner bays(M-II) and Shear walls with variation in percentage ie. 5% (M-III), 10%(M-IV) and 15%(M-V) of planbay area.The bracing (Tube 132x132x4.8) is used with the boundary condition as Rigid Joint. The shear wallpercentage is decided with respect to total number of bays in plan area ie. in plan total 49 number of baysare there. 5% of 49 number of bays will be around 4: means we provided shear wall in between fourcorner bays. Likewise calculated in the same way for 10% and 15%.The models that is created has been examined for the three types of soil. Type-I (Hard), Type-II (Medium)and Type-III (Soft). The Tables and charts mentioned above and the common observation are mentionedin next point:

1. Base shear observed to be more for bracing sytem and shear wall system compare to bare frame system.
2. Base shear is 11% more for bracing system, 18% more for shear wall with 5% shear wall (M-III) provision, 21% more for 10% shear wall (M-IV) provision and 28% more for 15% (M-V) shear wall provision.
3. Same trend of base shear variation is observed for all category of structure. But, for all height of structure Type-II soil shows 20% more and Type-III soil shows 25% more base shear than Type- I Soil.
4. Eeping structural elements constant, the 15 storey structure shows 25% to 30% more base shear and for 20 storey structure it shows 40% to 45% more base shear as compared to 10 storey structure.
5. Hike in storey shear by 18% to 25% for Type-II soil and 25% to 40% hike for Type-III soil a compared to Type-I soil.
6. Provision of bracing (M-II) leads to increase in storey shear by 12%. With provision of 5% (MIII), 10% (M-IV) and 15% (M-V) shear wall leads to increase in storey shear by 22%, 25% and 30% respectively compared to Bare Frame System (M-I).
   This trend variation is observed to be same for all types of soil
7. For all types of soil the peak displacement get reduced by 11% for Bracing system(M-II), reduced by 14% for Shear wall with 5% provision (M-III), reduced by 19% for shear wall with 10% provision (M-IV) and reduced by 23% for shear wall with 15% provision (M-V) compared to Bare frame system (M-I)
8. Peak displacement observed to be 25% more and 65% more in case of 15 storey and 20 storey structure respectively compared to peak displacement for 10 storey building.

9. It is observed that peak storey drift took place at middle set of stories. Letter on the drift goes on in reducing order and same trend is observed for all height of structures.
10. Storey drift varies gradually for 10 storey building. Whereas non uniform drift for 15 and 20 storey building is observed.
11. It is observed that modal time period reduced by 16% for M-II, for 25% M-III, for 30% M-IV and for 38% M-V compared to M-I.
12. No major changes observed in Modal Time Period for variation in soil type.

6.1 CONCLUSION

In the present study, the evaluation of structural response of structures with various structural arrangements are examined. This study has comprehensively analyzed the seismic performance of a highrise building using the Response Spectrum Method, in accordance with established seismic design codes IS 1893:2016. The objective was to assess the dynamic response of the structure in terms of displacement**,** base shear**,** storey shear**,** and storey drift considering various types of soil conditions which are critical indicators of seismic behavior and structural resilience. Following are some of the conclusions drawn from the study:

1. The analysis revealed that the building exhibits a well-distributed and code-compliant response under seismic loading. The lateral displacements increased gradually with height, and the maximum displacement at the roof level remained within acceptable serviceability limits. The base shear, calculated using modal combination techniques, was observed to be lower than that of the equivalent static method, confirming the efficiency and accuracy of the response spectrum approach in representing real dynamic behavior, especially for flexible and tall structures.
2. Storey shear distribution demonstrated a typical tapering pattern, with the highest forces concentrated near the base, tapering off towards the top. Additionally, localized peaks in intermediate storeys highlighted the influence of higher modes, which are particularly significant in tall structures.
3. For hard soil it will be efficient to adopt bracing system or shear wall with covering its maximum 5% of bays at the corner. For soft soil shear wall with covering its atleast 10% of bays will make efficient in terms of lateral deformation.

4. As observed in the analysis, the fundamental (first mode) time period increases with the height, flexibility, and mass of the structure. For the high-rise building considered in this project, the first mode time period was relatively high, indicating a flexible structure with dominant displacement response in the lower frequency range of the response spectrum. Higher mode time periods were shorter and associated with more localized vibration effects, especially affecting mid to upper stories in terms of storey shear and drift**.** So, it makes an important to consider higher modes also for the evaluation with consideration as an important one.

REFERANCES:

1) Hojat Allah Ghasemi**,** (2016), "Evaluation of Seismic Behavior of Irregular Tube Buildings in Tube Systems", *Advances in Science and technology Research Journal*, Vol 10, No 29.
2) Abbas Ali Ibrahim**,** (2015), "A Comparative Study between the use of Framed Shear Wall System and Framed Tube System in Tall Buildings", *International Journal & Maganize of Engineering Technology, Management and Research*, ISSN No: 2348-4845.
3) Nimmy Dileep et.al, (2015), "Analytical Investigation on the Performance of Tube-in-Tube Structures subjected to Lateral Load", *International Journal of Technical Research and Application*, Vol 3, Issue 4 , ISSN No: 2320-8163.
4) Hamid Mirza Hosseini**,** (2015), "Optimal Design of Tube in Tube System", *Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231 – 6345 Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/03/jls.htm 2015 Vol. 5 (S3).*
5) B.N.Sarath et.al (2015), "Comparative Seismic Analysis of an Irregular Building with a Shear Wall

and Frame Tube System of Various Sizes" *International Journal of Engineering and Computer Science ISSN: 2319-7242 Volume 4 Issue 4.*

6) Er. NishantRana (2014), "Structural Forms Systems for Tall Building Structures" *SSRG International Journal of Civil Engineering (SSRG-IJCE) volume1 Issue 4.*

7) M.L.Gambhir, (2014), "Earthquake Resistance of Structural Systems for tall buildings".

8) Kang-Kun Lee (2014), "Simple Analysis Of Framed-Tube Structures With Multiple Internal Tubes".

9) M. R. Jahanshahi, R. Rahgozar, M. Malekinejad (2012) " A simple approach to static analysis of tall buildings with a combined tube-in tube and outrigger-belt truss system subjected to lateral loading",*Ije Transactions A: Basics* Vol. 25, No. 3.

10) Murty C.V.R.(2009) Earthquake tips-IITK. Building Materials and Technology Promotion, NICEE.

11) Mir M. Ali (2007), "Structural Developments in Tall Buildings Current Trends and Future Prospects" *Architectural Science Review Volume 50.*

12) Richard and David (2003), "Construction History of Composite Framed Tube Structural System", *First International Congress on Construction History*.

13) Ali (2001), "The art of Skyscraper-Genius of Fazlur Khan", *Rizzoli International Publication.*

14) Peter C. Chang, "Analytical modeling of tube-in-tube structure", ASCE *Journal of Structural Engineering*, Vol. I 11, No. 6.

15) J. J, Connor and C. C. Pouangare (1991), "Simple model for design of framed-tube " ASCE *Journal of Structural Engineering,* Vol. 117, No. 12.

16) Yogendra Singh "Lateral load resisting system for Multi-Storey Buildings" *IIT Roorkee.*

17) Coull A and Ahmed AA (1978)**, "**Deflections of framed-tube structures", *Journal of Structural Engineering, ASCE* 104(5).

18) Wolfgaug (1998), "High Rise Building Structures".

19) IS 1893(Part 1): 2002, "Criteria for earthquake resistant design of structure", general provisions and building, Fifth revision, Bureau of Indian standards, New Delhi.

20) IS 875 (Part lll) 1987 Wind loads on Building.

21) Shrikhande Agarwal., "Earthquake resistant design of building structures".

22) Housur V., "Earthquake resistant design of building structures", WILEY Publication, 1st Edition, 125-174, 197-230.

23) Design of Steel structure by Ramchandra 9th edition Volume-2.

24) Design of Steel structure by Duggal.