Analysis and Design of High Rise Residential Building by Using ETABS

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Abstract— From the ancient time we know earthquake is a disaster causing occasion. Up to date days constructions are fitting increasingly narrow and extra inclined to sway and consequently detrimental within the earthquake. Researchers and engineers have worked out within the past to make the constructions as earthquake resistant. After many functional reports it has proven that use of lateral load resisting methods in the constructing configuration has drastically increased the performance of the structure. In the present analysis, a residential building is analyzed with columns, columns with inverted v Bracings for G+14 building. The building is analyzed in both static & dynamic analysis and the results of Displacement, Storey shear, Moment, Base moment, Base shear were compared for different load combinations in static & dynamic analysis, results of critical load combination are noted. In dynamic analysis response spectrum method is carried out for the building. The building is analyzed in condition i.e,, in ZONE- 4 & 5 in three soils and the results of different heights are noted as stated above. A commercial package of ETABS 2013 has been utilized for analyzing residential building. The result has been compared using tables & graph to find out the most optimized solution. Concluding remark has been made on the basis of this analysis & comparison tables.

Keywords: ETABS, residential building, inverted v bracings, combination

I. INTRODUCTION

From a structural engineer's factor of view the tall constructing or high upward thrust constructing (HRB) may be outlined in concert that, with the inside the structural type. Tall constructions have involved grouping from the beginning of civilization. Such structures were made for safeguard and to indicate pleasure. The system of urbanization that began with the age of industrialization remains to be ongoing in setting up nations like India. Industrialization motives migration of contributors to urban centers wherever job opportunities are critical. The land accessible for structures to accommodate this migration is changing into scarce, main too fast expand inside the cost of land. The growth in latest multi storeyed constructing development, which began in late nineteenth century, is meant for essentially the most part for industrial and residential features. Tall buildings are the fundamental evolved engineered structures considering there are a few conflicting necessities and problematic constructing techniques to integrate. In these day's tall constructions are getting extra and additional slim ensuing in the hazard of further sway as compared with earlier high-rise structures.

For that reason the influence of wind and seismic forces performing on them turns into an awfully foremost facet of the seam. Rising the structural techniques of tall structures will management their dynamic response. A tall building can be outlined as a constructing whose design is dominated via the lateral forces prompted given that of wind and earthquake. On the ways aspect ten experiences, the lateral flow begins dominant the seam, the stiffness rather of force turns into the dominant problem. Fully distinctive structural forms of tall structures could also be accustomed strengthen the lateral stiffness and to decrease the waft index. Many Lateral resisting systems (comparable to introduction of body-wall, framed tube, belt truss with stabilizer, tube in tube and bundled tube programs) may be accustomed withstand the lateral plenty functioning on the constitution. This be taught seeks to understand the more than a few lateral techniques that have emerged and its associated structural behavior for soil kind three (i.e., smooth soil form) all advised 4 zones. The more than a few types of bracings discipline unit presented in RCC constructing mannequin at regular location to understand the suitableness of the programs with relevance the seismic motions whereas alternative properties of the structural individuals within the building are stay constants love the scale of the columns,. The most important purpose is to appraise the lateral displacements, go with the flow, Base shear and stiffness occurs by means of due to the fact the better than

A. Principles of Planning and Design

A notion of 24.14m×20.627m plan is taken into idea having 16×12 bays on each the sides. The excessive rise constructing (HRB) of 30 stories inside which flooring to flooring top is taken as 3m and ground to ground peak is 3.5m for all of the models. These building items area unit analyzed, mistreatment ETABS 2013 program process using Response Spectrum method as per IS 1893 (part I): 2002.

In this be taught a 30 storey building having equal plan in distinctive kind of zones (as per IS 1893 (part I): 2002) and extraordinary type of soils is taken. The tall constructing with distinctive types of braces introduce in the primary region in two bays is remember to learn the effect of lateral deflection, base shear, bending second, shear force and axial force triggered as a result of lateral load . As a result of earth quake load (each static and dynamic loads)

The place of the constructing is believed to be at distinct zones and extraordinary varieties of soils. An elevation and plan view of a natural constitution. The ETABS software is used to develop 3D model and to carry out the analysis. The lateral loads to be applied on the buildings are based on the Indian standards. The study is performed for seismic zone IV & V as per IS 456 (Dead load, Live Load) IS 1893:2002 (Earthquake load), IS875: 1987(Wind Load).

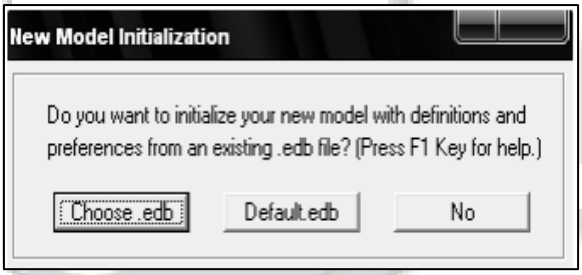
Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

B. Modeling in ETABS

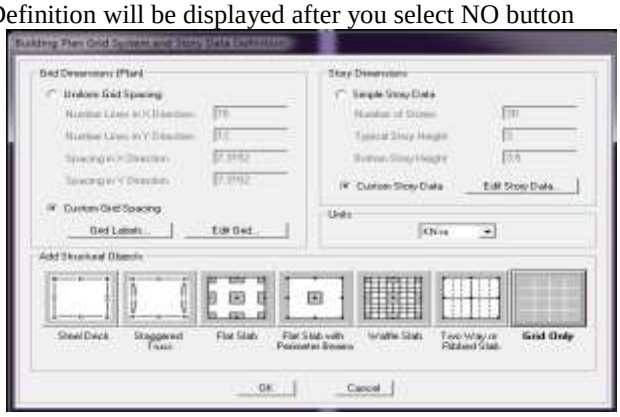
This research and investigation has opened a vast scenario for future studies. The proposed formulae can be used in future research and applied to models for further study. In this subject, extensive explorations can be conducted with a wide range of variables and characteristics. Further studies may be carried out by adding the following variations to the research prototypes;

- Varied stiffness on varied building levels.
- Introduction of a soft storey in model.
- Different loadings on different levels of buildings.
- Placement on 1/4th, 3/4th, 4/5th, 3/5th etc. building height. These can be placed individually or in combination;
- Providing outriggers in one direction and maintaining the stability by RCC core in the other direction.
- Open ETABS program.
- Check the units of the model in the drop-down box in the lower right-hand corner of the ETABS window click the drop-down box to set units to KN-m.

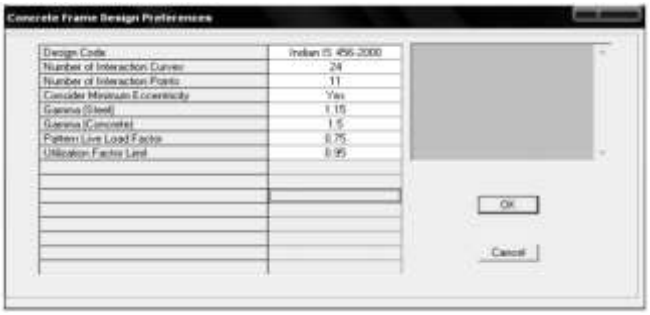
1) Click the File menu > New model command



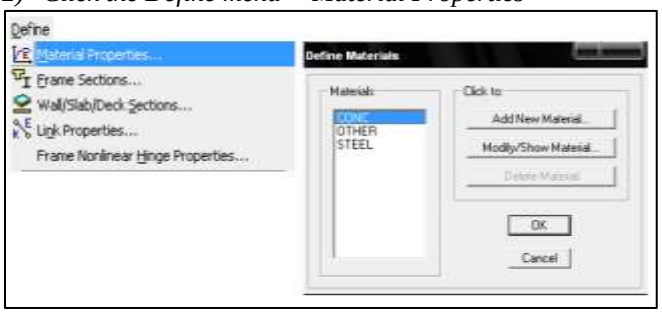
The next form of Building Plan Grid System and Story Data Definition will be displayed after you select NO button



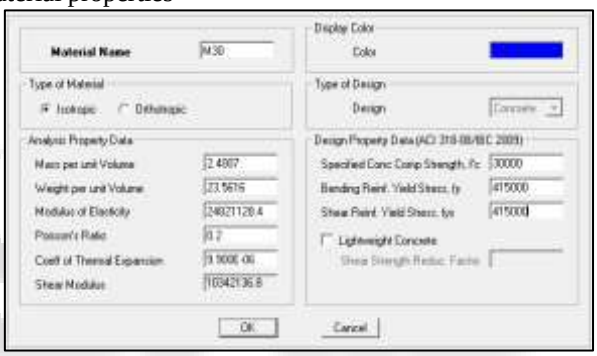
This will Display the Concrete Frame Design Preference form as shown in the figure.



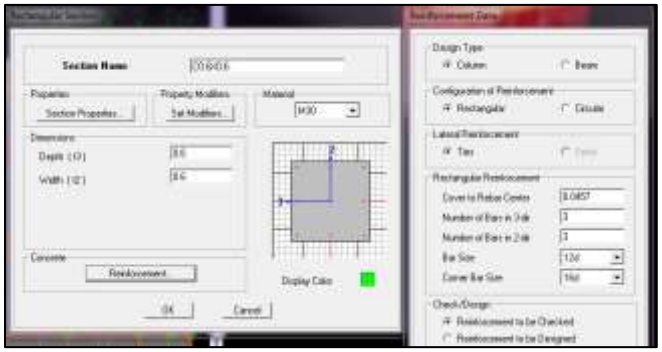
2) Click the Define menu > Material Properties



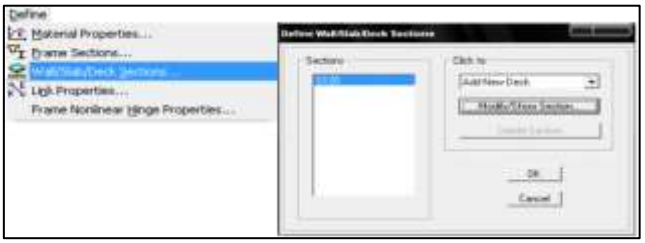
Add New Material or Modify/Show Material used to define material properties



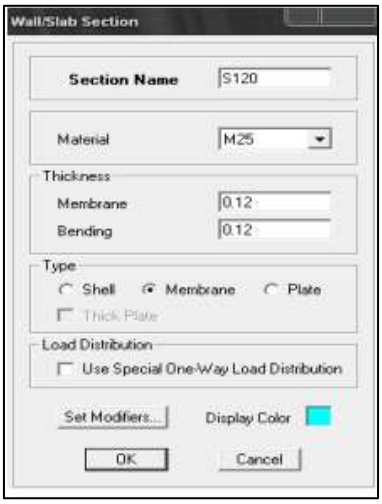
Define section columns and beams using Define > Frame section



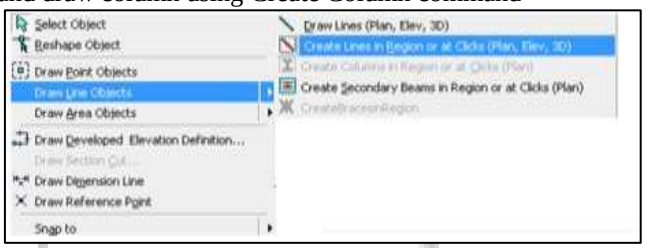
Define wall/slab



To define a slab as membrane element and one way slab define using special one way load distribution



Generate the model Draw beam using Create Line Command and draw column using Create Column command



Above creating option used to generate the model as shown in below figures

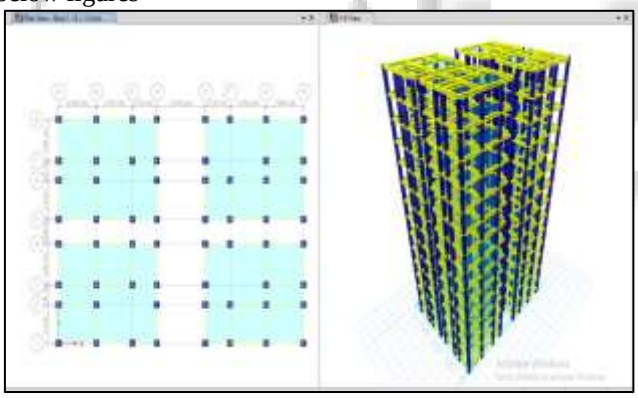


Fig. 2.1: Model showing plan 3d view of high rise building without bracings in linear analysis

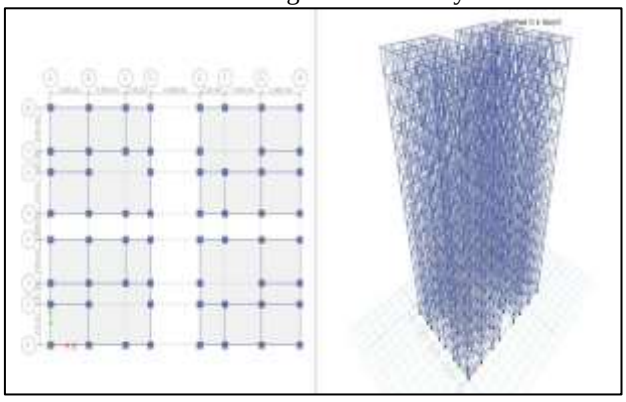


Fig. 2.2: Model showing plan 3d view of high rise building with bracings in linear analysis

Define various loads (Dead load, live load, wind load, Earthquake load)

C. Dead Loads

Dead loads are permanent or stationary loads which are transferred to the structure throughout their life span. Dead loads mainly due to self-weight of structural members, permanent partitions, fixed equipment's and fittings. These loads shall be calculated by estimating the quality of each material and then multiplying it with the unit weight. The unit weight of various material used in building construction are given in the code IS: 875(PART-1)-1987.The unit weight of commonly used building material are given below

D. Live Loads

These are the loads that changes with respect to the time. Live loads or imposed loads include loads due to the people occupying the floor, weight of the movable partitions, weight furniture and materials. The live loads to be taken in design of building have been given in IS: 875(Part-2)-1987.Some of the common live loads used in the design of building are given in table

E. Lateral loads

No of stories	without bracings	with bracing
15	26.9	11.7
14	25.6	10.7
13	23.9	9.7
12	21.7	8.7
11	19.3	7.6
10	17.1	6.6
9	15.3	5.6
8	13.4	4.6
7	11.5	3.7
6	9.6	2.8
5	7.7	2.1
4	5.9	1.4
3	4.1	0.8
2	2.4	0.4
1	0.8	0.1

Earthquake and its prevalence and measurements, its vibration affect and structural response are incessantly studied for several years in earthquake historical past and utterly documented in literature. Considering then the structural engineers have tried hard to appear at the approach, with an intention to counter the developed dynamic impact of seismically triggered forces in structures, for arising with of earthquake resistant constructions in the course of a refined and simple method. Linear static evaluation or identical static evaluation will solely be used for normal buildings with limited peak. Linear dynamic analysis is also carried out in 2 methods that either by way of mode superposition technique or response spectrum procedure and elastic time history technique. This evaluation can turn out the impact of the

higher modes of vibration and in addition the precise distribution of forces inside the elastic factor an improved way. They represent an improvement over linear static evaluation. Important choices of seismic process of research supported Indian natural 1893 (phase I): 2002 subject unit delineated as follows as Response spectrometry. This paper offers a comprehensive comparative study of the Dynamic hundreds and their results on tall buildings mistreatment Response spectrum method. The Structural responses on diverse parameters like building flow, Structural lateral displacements, Base shear, Stiffness for typical constructing and thoroughly exclusive Load resisting methods area unit analyzed

F. Wind Loads

Wind is perceptible common movement of air; its glide can also be suave like a zephyr or will also be haphazard and tempestuous. Structural engineering translates wind as a typical phenomenon that puts forward an obvious drive on constructions. Air glide is three-dimensional; it has one vertical and two horizontal accessories. In multi-storey building design, vertical air glide is of less value than horizontal air flow. The vertical air pressure is counteracted by the load of a constructing and hence just isn't a peril. As a result, the phrases wind action, wind force, wind load, wind velocity, wind velocity and wind stress all correspond to the horizontal element of air float

II. RESULTS

No of stories	without bracings	with bracing
15	20.1	10
14	19.1	9.2
13	17.8	8.3
12	16.2	7.4
11	14.5	6.5
10	12.8	5.6
9	11.4	4.8
8	10	3.9
7	8.6	3.1
6	7.2	2.4
5	5.8	1.7
4	4.4	1.2
3	3	0.7
2	1.8	0.3
1	0.6	0.1
Base	0	0

Table 3.1: Comparative values of displacement in linear static analysis along zone-4, soil-1 with bracings & without bracings.

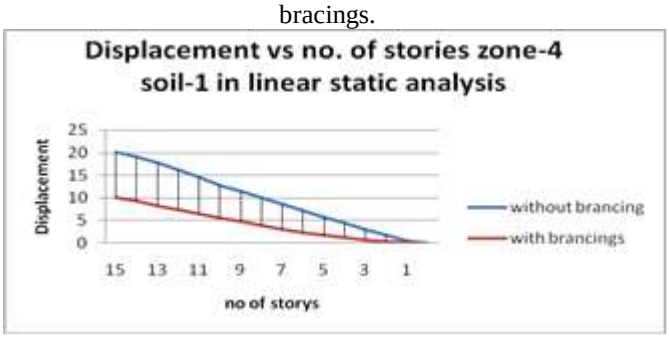


Fig. 3.1: Variation of displacement with bracings & without bracings in linear static analysis along Zone 4 soil-1

No of stories	without bracings	with bracing
15	26.9	11.7
14	25.6	10.7
13	23.9	9.7
12	21.7	8.7
11	19.3	7.6
10	17.1	6.6
9	15.3	5.6
8	13.4	4.6
7	11.5	3.7
6	9.6	2.8
5	7.7	2.1
4	5.9	1.4
3	4.1	0.8
2	2.4	0.4
1	0.8	0.1

Table 3.2: Comparative values of displacement in linear static analysis along zone-4, soil-2 with bracings & without bracings

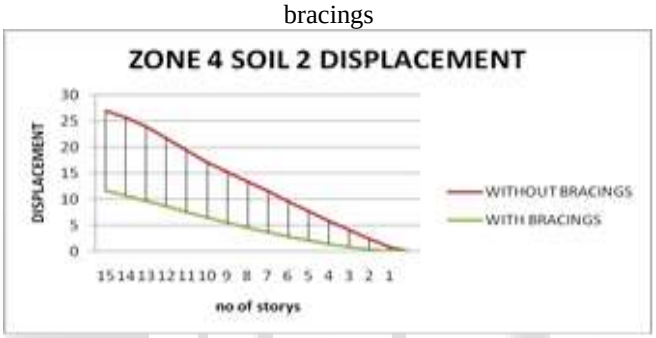


Fig. 3.2: Variation of displacement with bracings & without bracings in linear static analysis along Zone 4 soil-2.

No of stories	without bracings	with bracing
15	0.9	0.5
14	0.8	0.5
13	0.7	0.4
12	0.7	0.4
11	0.6	0.3
10	0.5	0.3
9	0.4	0.2
8	0.3	0.2
7	0.2	0.1
6	0.2	0.1
5	0.1	0.1
4	0.1	0.03972
3	0.04454	0.02325
2	0.01956	0.01259
1	0.004903	0.007983

Table 3.3: Comparative values of displacement force in Linear static analysis along zone-4, soil-3 with bracings & without bracings

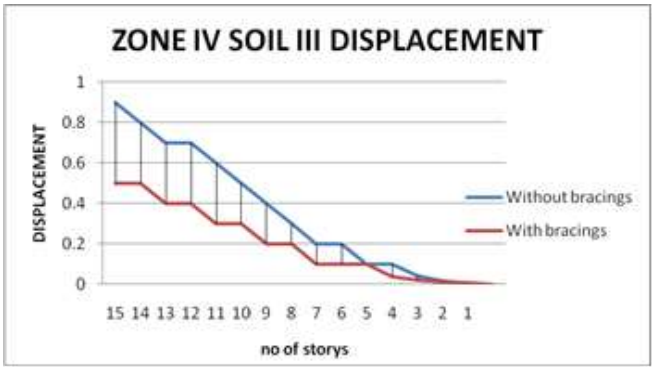


Fig. 3.3: Variation of displacement with bracings & without bracings in linear static analysis along Zone 4 soil-3.

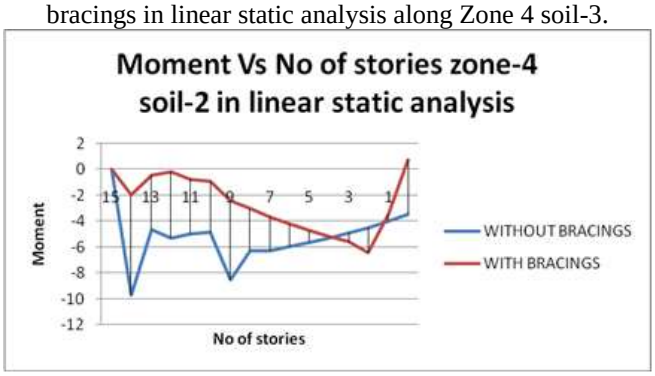


Fig. 3.4: Variation of moment with bracings & without bracings in linear static analysis along Zone 4 soil-4

No of stories	with out bracings	with bracing
15	0	0
14	-9.6867	-1.9812
13	-4.6195	-0.4492
12	-5.2753	-0.1853
11	-4.9834	-0.7851
10	-4.8566	-0.9563
9	-8.4895	-2.4698
8	-6.2533	-3.0398
7	-6.2962	-3.6656
6	-5.9413	-4.2256
5	-5.6314	-4.7436
4	-5.285	-5.2256
3	-4.9076	-5.5896
2	-4.4901	-6.451
1	-4.0027	-3.519
base	-3.4739	0.7189

Table 3.4 Comparative values of moment in Linear static analysis along zone-4, soil-2 with bracings & without bracings.

No of stories	without bracings	with bracing
15	-11.13	-2.69
14	-5.1	-0.34
13	-6.07	0
12	-5.7	-1.29
11	-5.5	-2.86
10	-5.41	-4.49
9	-5.23	-6.19
8	-5.04	-7.94
7	-4.85	-9.73
6	-4.63	-11.55
5	-4.41	-13.39
4	-4.16	-15.24
3	-3.89	-16.88
2	-3.56	-20.18
1	-3.3	-13.24
base	0	0

Table 3.5: Comparative values of moment in linear static analysis along zone-4, soil-3 with bracings & without bracings

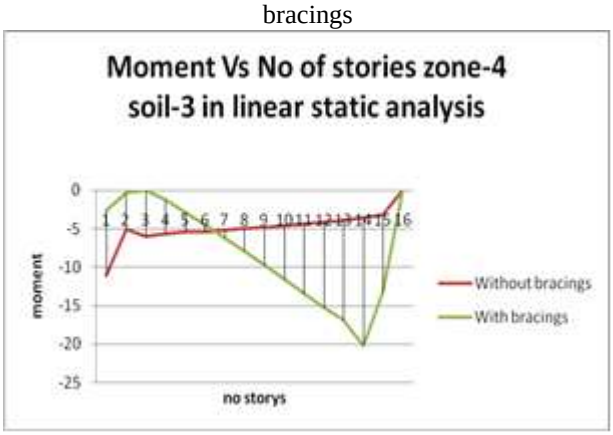


Fig. 3.5: Variation of moment with bracings & without bracings in linear static analysis along Zone 4 soil-3.

III. CONCLUSIONS

From the above research the following conclusions were made

The Behavior of high rise structure for both the scheme is studied in present project. The graph clearly shows the story moment and displacement. It is also observed that the results are more conservative in Static analysis.

1) Displacement is compared for all the 12 models in zone IV and zone V in static analysis and it is observed that displacement increases with increase in height, it is noted that a displacement of 40% is reduced when lateral load is resisting systems are provided on each elevation.
2) Moment is also compared for all the 12 models in zone IV and zone V in static analysis and it is observed that shear value increase from top to bottom ,and I it is noted that maximum shear value is occuris at the bottom of the story
3) Moment is also compared for all the 12 models in zone IV and zone V in dynamic analysis and it is observed that shear value increase from top to bottom ,and I it is noted that maximum shear value is occurs at the bottom of the story
4) By providing that load resisting system stiffness of the structure is also improved

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