3-D Analysis of Building Frame using STAAD-PRO

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Abstract: **In these modern days the Buildings are made to fulfill our basic aspects and better Serviceability. It is not an issue to construct a Building any how its, important to construct an efficient building which will serve for many years without showing any failure. The Project titled "3-D ANALYSIS OF BUILDING FRAME USING STAAD-PRO", aims in finding Better technique for creating Geometry, Defining the cross sections for column and beam etc, Creating specification and supports (to define a support weather it is fixed or pinned),then the Loads are defined. After that the model is analyzed by 'run analysis'. Then reviewing (whether beam column passed in loads or failed) results. Then the design is performed. In 21st century due to huge population the no of areas in units are decreasing day by day. Few years back the populations were not so vast so they used to stay in Horizontal system(due to large area available per person).But now a day's people preferring Vertical System(high rise building due to shortage of area).In high rise buildings we should concern about all the forces that act on a building ,its own weight as well as the soil bearing capacity .For external forces that act on the building the beam, column and reinforcement should be good enough to counteract these forces successfully. And the soil should be good enough to pass the load successfully to the foundation. For loose soil we preferred deep foundation (pile).If we will do so much calculation for a high rise building manually then it will take more time as well as human errors can be occurred. So the use of STAAD-PRO will make it easy. STAAD-PRO can solve typical problem like Static analysis, Seismic analysis and Natural frequency. These type of problem can be solved by STAAD-PRO along with IS-CODE. Moreover STAAD-PRO has a greater advantage than the manual technique as it gives more accurate and precise result than the manual technique. STAAD-PRO was born giant. It is the most popular software used now a days.Basically it is performing design works. There are four steps using STAAD-PRO to reach the goal.**

- **Prepare the input file.**
- **Analyze the input file.**
- **Watch the results and verify them.**
- **Send the analysis result to steel design or concrete design engines for designing purpose.**

I. INTRODUCTION

ind load is one of the important design loads for civil engineering structures. For long span bridges, tall buildings and high towers or mast structures, wind load may be taken as a critical loading, and complicated dynamic wind load effects control the structural design of the structure. Therefore knowledge of the dynamic characteristics of an important structure under wind loading becomes a requirement in engineering design and in academic study. In the ongoing research project on tall buildings, the study of wind-induced demands is categorized as: along-wind and crosswind responses. These demands are caused by different mechanisms. Moving along the wind-induced is due to the effects of turbulence impact while the perpendicular component is related to the effects of windstorm. On the other hand the effect of wind load on tall structures not only distributed over the wider surface but also it has higher intensity. Furthermore, in high risk seismic zone the seismic performance of structures are considered as the primary importance which influence other hand in seismic zones, may be the effect of impact forces resulting from earth movement greater than the forces caused by wind loads and consequently, Seismic loading determines form and final design of the structure (with this assumption that with respect to the all international codes and standards, wind and earthquake loads never simultaneously

II CALCULATION OF LOADS

1. DEAD LOAD CALCULATION:

MAIN WALL LOAD (From above plinth area to below the Roof) should be the cross sectional area of the wall multiplied by unit weight of the brick. (unit weight of brick is taken as 19.2 kn/m3). According to the IS-CODE PLINTH LOAD should be half of the MAIN WALL LOAD.Internl PLINTH LOAD should be half of the PLINTH LOAD. PARAPATE LOAD should be the cross sectional is multiplied by unit weight. SLAB LOAD should be combination of slab load plus floor finishes. SLAB LOAD can be calculated as the thickness of slab multiplied by unit weight of concrete (according to IS-CODE unit weight of concrete is taken as 25 kn/m^3).and FLOOR FINISHES taken as .5-.6 kn/m2.

2. LIVE LOAD CALCULATION:

LIVE LOAD is applied all over the super structure except the plinth .Generally LIVE LOAD varies according to the types of building. For Residential building LIVE LOAD is taken as ----2kn/m2 on each floor and -1.5kn/m2 on roof.Negetive sign indicates its acting on downward direction.

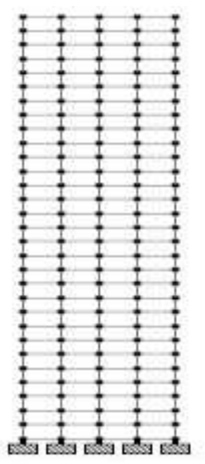
3. WIND LOAD CALCULATION:

According to IS CODE (875 PART 3), $V_z = V_b \times K_1 \times K_2 \times K_3$
Where Vz=design wind speed at a height z meter in m/s.
Vb=basic design wind speed at 10m height. For example Vb is 50 m/s for cities like Cuttack and Bhubaneswar and 39 m/s for Rourkela.K1, K2, K3 can be calculated from the IS-CODE(875 part3).

III COMPARISION OF TWO 30-STOREY BUILDING

After the basic work is done then it was made with two different load combination.1st 30-storey building was made with the combination of seismic load, live load and dead load. And 2nd 30-storey building was made with the combination of wind load, live load and dead load .The Beam and column size of both buildings are same. Internal column size are (0.8m×0.8m).External column size was taken as (.75m×.75m).The beam size was taken as (.45m×.3m).More internal size was taken because it always taken more load than the external. If greater size will not provide then it will fail in compression.

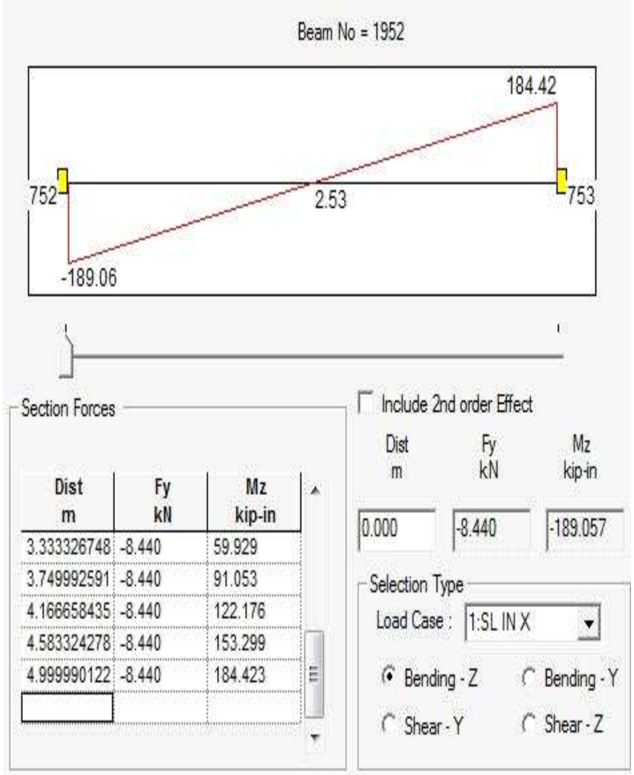
FOLLOWINGS ARE THE INPUT DATA , CONCRETE DESIGN,DEFLECTION AND SHEAR BENDING OF A 30 STOREY BUILDIG USING DEAD LOAD,SEISMIC LOAD AND WIND LOAD COMBINATION…



(A 30 storey building under seismic, live and dead load combination)

DATA REQUIRED FOR THE ANALYSIS OF THEFRAME..

- Type of structure --> multi-storey fixed jointed plane frame.
- Seismic zone II (IS 1893 (part 1):2002)
- Number of stories 30, (G+29)
- Floor height 3.5 m
- No of bays and bay length 4nos,5 m each.
- Imposed load 2 kn/m2 on each floor and 1.5 kn/m2 on roof.
- Materials Concrete (M 35) and Reinforcement (Fe500).
- Size of column .8m×.8m internal column size,.75m×.75m external column size.
- Size of beam .45m×.45m
- Depth of slab 125 mm thick
- Specific weight of RCC 25kn/m3.
- Specific weight of infill 19.2 kn/m3
- Type of soil Medium soil.
- Response spectra As per IS 1893.



IV Conclusion

From the above comparison between two 30-storey building taking same beam and column size using different load combination it was clearly visible that the top beams of a building in seismic load combination required more reinforcement than the building under wind load combination (for example beam no 1952 required 7 no of 12 mmØ and 6 no of 12 mmØ bars whereas for wind load combination it required 5 nos of 12 mmØ and 4nos of 12 mmØ).but the deflection and shear bending is more in wind load combination compare to seismic. But in lower beams more reinforcement is required for wind load combination. For column the area of steel and percentage of steel always greater required for wind load combination than the seismic load combination. (example column no 79 Ast required for WL combination is 5850 mm2 and percentage of steel is 1.04 where as for the SL combination Ast required is 5400 mm2 and percentage of steel is .98) .The deflection value is more in WL combination than the SL combination.

REFERENCES

1. IS 875 (Part III for wind load design).
2. IS 456.
3. IS 1893 (for seismic analysis).
4. STAAD-Pro user guide.
5. Earthquake Resistant Design Of Structures By Pankaj Agarwal.