SEISMIC ANALYSIS OF BUILDING WITHOUT INFILLED WALLS

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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 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.

GENRAL INTRODUCTION

In present century population is increasing day by day and due to large population, the no of areas are decreasing day by day. Years back the populations were not so vast/ large. 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). Today we have only high rise building, In high rise buildings we should know about all the forces that act on a building, i.e., its own weight (Self weight) as well as the soil bearing capacity .For external forces that act on the buildings such as : beam and column. Reinforcement should be good enough to counteract these forces successfully. Soil should be good enough to bear the load successfully from super-structure (above the ground level) to sub-structure (foundation) to the soil or hard strata. For loose soil we preferred deep foundation (Pile Foundation). If we calculate calculations manually for a high rise building then it will take more time as well as human errors will also be there or can be occurred. So the use of STAAD-PRO will make it easy and fast without errors. STAAD-PRO can solve typical problem like Static analysis, Seismic analysis and Natural frequency. These types of problems can be solved by STAAD-PRO along with IS-CODES. Moreover STAAD-PRO has a greater advantage than the manual technique as it gives more accurate results and graphs (bending moment, shear force) than the manual technique.

STAAD-PRO was born giant. It is the most popular software commonly used in these days. Basically it is performing design works. There are four steps using STAAD-PRO to reach the goal.

1)Prepare the input file.

2) Analyze the input file.

3) Watch the results and verify them.

Send the analysis result to steel design or concrete design engines for designing purpose.

1. Prepare the input file-

First of all we described the structure. In description part we include geometry, the materials, cross sections, the support conditions (fixed, Hinged, Roller).

2. Analyze the input file-

We should sure that we are using STAAD-PRO syntax. Else it may have error. We should sure that all that we are inputting that will generate a stable structure .Else it will show error.

At last we should verify our output data to make sure that the input data was given correctly.

Watch the results and verify them.

Reading the result take place in POST PROCESSING Mode.

First we choose the output file that we want to analyze (like various loads or load combination) .Then it will show the results.

Send the analysis result to steel design or concrete design engines for designing purpose.

If someone wants to do design after analysis then he can ask STAAD-PRO to take the analysis results to be designed as design

The data like Fy main,Fc will assign to the view

Then adding design beam and design column. Running the analysis it will show the full design structure.

TYPES OF LOAD USED

DEAD LOAD (DL):-DEAD LOAD or STATIC LOAD is defined as the load on a structure due to its own weight (self-weight). It also added other loads if som permanent structure is added to that structure.

LIVE LOAD (LL):-LIVE LOAD Or IMPOSED LOAD is defined as the load on the structure due to moving load/weight. The LIVE LOAD varies according to the type of building. For example generally for a Residential Building the LIVE LOAD is taken as 2KN/m^2.

WIND LOAD (WL):-WIND LOAD is defined as the load on a structure due to wind intensities. Generally wind intensity vary from time to time. So it is suggested to take maximum probable wind intensities calculation for a structure for which damage can be avoided.

SEISMIC LOAD (SL):-SEISMIC LOAD or EARTHQUAKE LOAD can be calculated taking the view of acceleration response of the ground to the super structure. Earthquake intensity may be low or high/sever at any time so that according to intensity of earthquake they are divided into 4 zones.

Zone I and II are combined as zone II.

Zone III.

Zone IV.

Zone V

CALCULATION OF LOADS

1. DEAD LOAD CALCULATIONS:

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/m^3).

According to the IS-CODE PLINTH LOAD should be half of the MAIN WALL LOAD. Internal 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/$m^{2.}$

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/m^2on each floor and -1.5KN/m^2on roof. Negative sign indicates its acting on downward direction.

3. WIND LOAD CALCULATION:

According to IS CODE (875 PART 3),

$Vz = Vb \times K1 \times K2 \times K3$

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).

Pz=Design wind pressure at a height z meter

$Pz=0.6\ Vz^2$

SEISMIC LOAD CALCULATION:

According to the IS-CODE 1893(part 1) the horizontal Seismic coefficient Ah for a structure can be formulated by the following expression

$Ah=ZISa/2RG$

Z=Zone factor depending upon the zone the structure belongs to. For Zone II (z=0.1) For Zone III (Z=0.16) For Zone IV (Z=0.24) For Zone V (Z=.36) I=Importance factor. For important building like hospital it is taken as 1.5 and other for other building it is taken as 1. R=Response reduction factor.

Sa/g=Average Response Acceleration coefficient.

However it should be notice that the ratio of I and R should not be greater than 1.

LOAD COMBINTION

For seismic load analysis of a building the code refers following load combination.

1.5(DL + IL)

1.2(DL + IL ± EL)

1.5(DL ± EL)

0.9 DL ± 1.5 EL

For wind load analysis of a building the code refers following load combination.

DL +LL

DL+WL

DL+0.8LL+0.8WL

Both WL and EL are applied in X and Z direction. These loads are also applied further in negative X and Z direction.

So for Seismic analysis there are 18 load combinations and for Wind load analysis there are 11 load combinations.

ANALYSIS OF 35-STOREY BUILDING

The basic work is done, After the basic work, it was made with 35 (G+34) storey building with the different load combination. In 35-storey building was made with the combination of seismic load, live load and dead load and wind load. As firstly we provide the seismic load otherwise it will give us error. After providing seismic load we can apply the dead load, live load and wind load.

At the ground floor we provide the circular column at the base. The size of the column at ground floor is 0.5m. The ground floor is for parking areas. For rest of the 34 floors the size of the column is (0.3m×0.3m) and is rectangular in shape. The beam size was taken as (.45m×.3m). More internal size was taken because it always taken more load than the external.

DATA REQUIRED FOR THE ANALYSIS OF THE FRAME

Type of structure --> multi-storey fixed jointed plane frame.

Seismic zone II (IS 1893 (part 1):2002)

Number of stories 35, (G+34)

Floor height 4 m

No of bays and bay length 3.2m each.

Imposed load 10KN/m^2 on each floor and 1.5 KN/m^2 on roof.

Materials Concrete (M 35) and Reinforcement (Fe500).

Size of column .3m×.3m column size.

Size of beam .45m×.3m

Depth of slab 125 mm thick

Specific weight of RCC 25kn/m^3.

Specific weight of infill 19.2 KN/m^3

Type of soil Medium soil.

Response spectra As per IS 1893.

FROM ABOVE DATA ANALYSIS OF THE BUILDING IS DONE:

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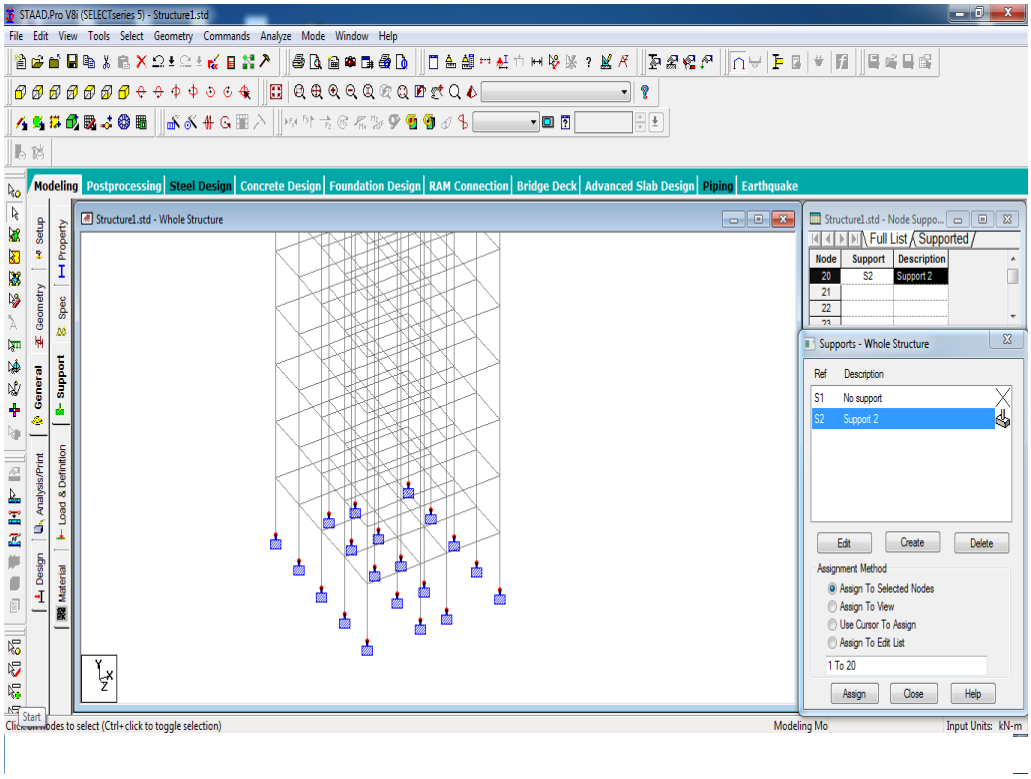
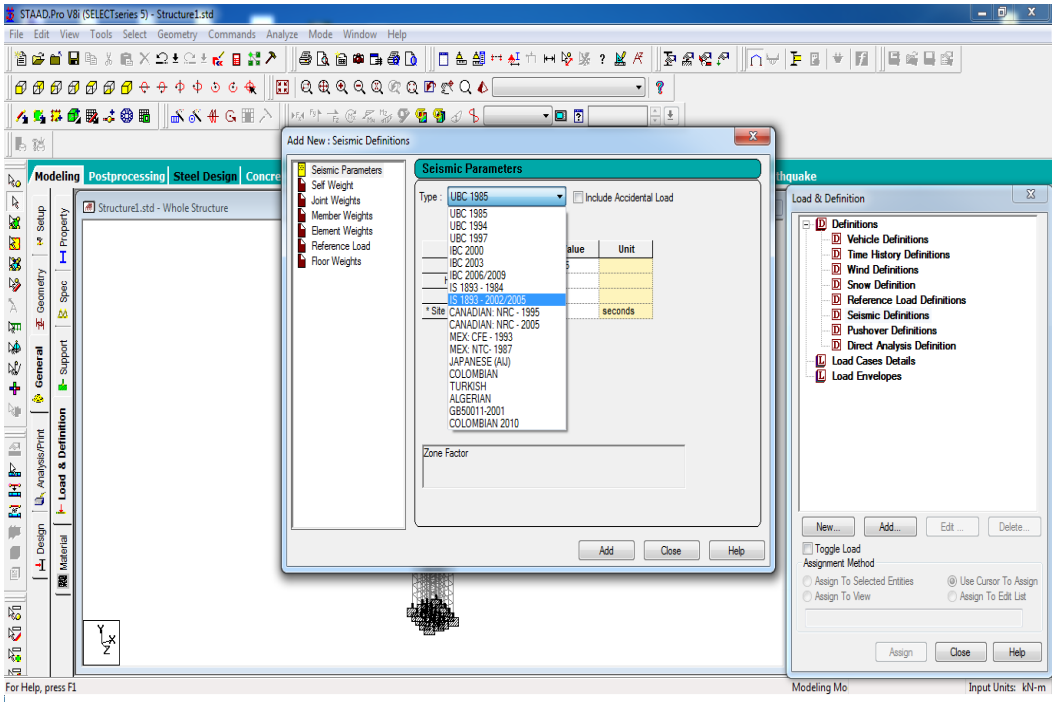
FOLLOWINGS ARE THE INPUT DATA,

CONCRETE DESIGN, DEFLECTION AND SHEAR BENDING OF A 35 STOREY BUILDING USING DEAD LOAD, SEISMIC LOAD AND WIND LOAD COMBINATION…

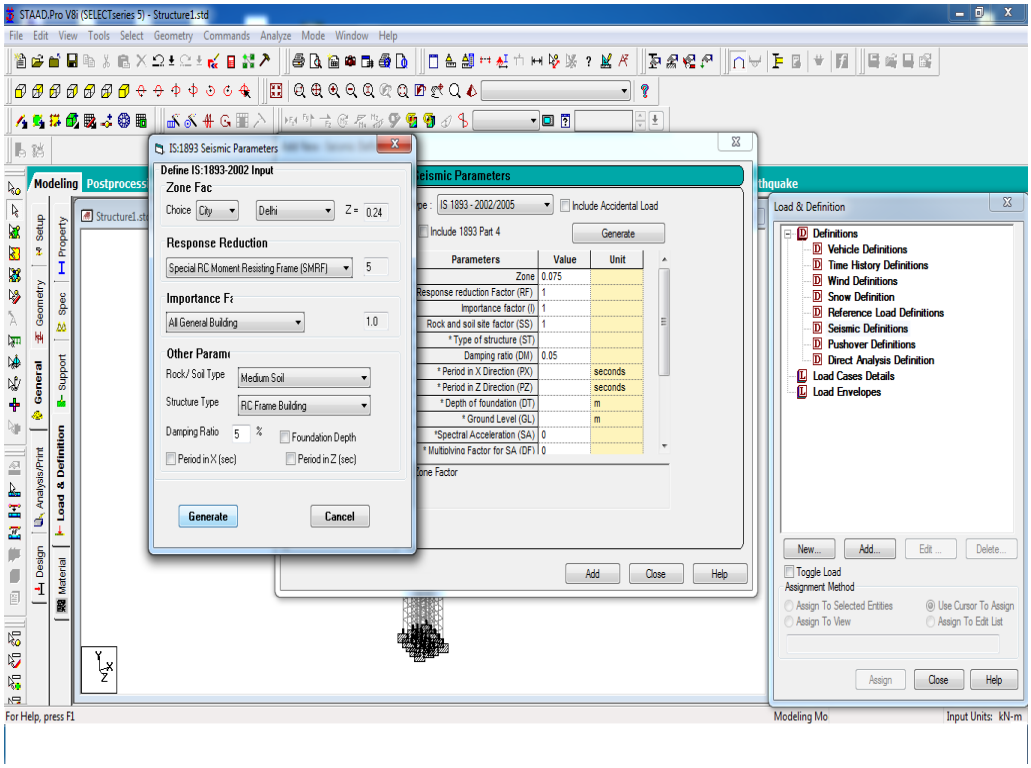
Model design with fixed end supports



Seismic parameters according to IS:1893-2002/2005

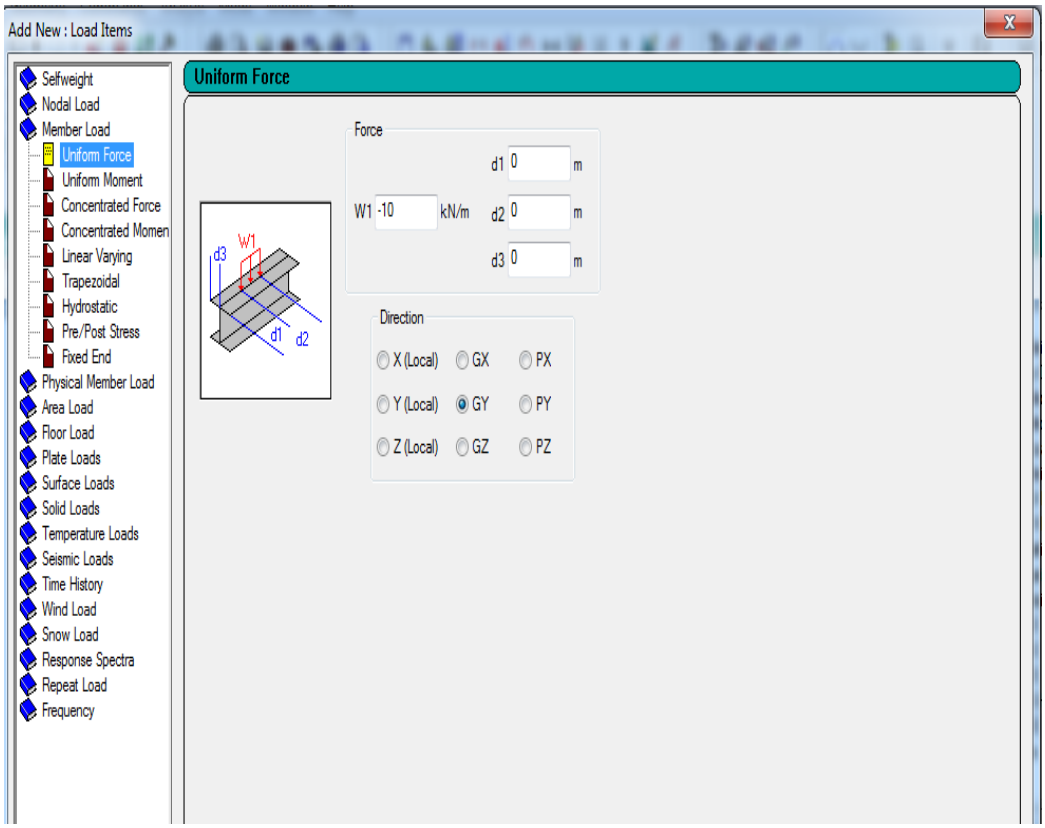


Zones with soil type and importance factor with damping ratio required for seismic force in building



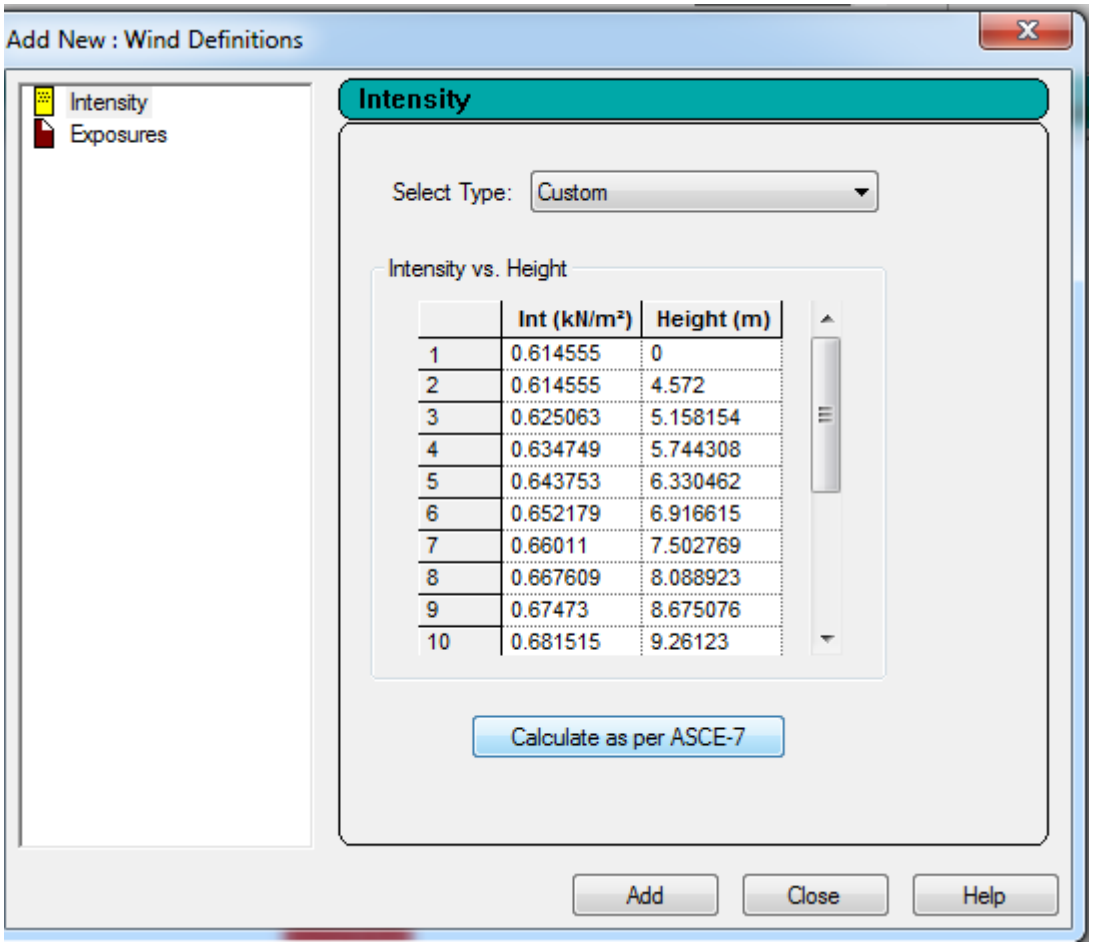
We will generate the seismic force and analysis will be done for the building, That it is stable or not. After generate the seismic force, we apply the dead load and live load and wind load.

After generation of all forces we will analyses the building.



We will calculate the wind load for every floor of the building thus we will analyze the building can carry the wind load or fail due to wind load.

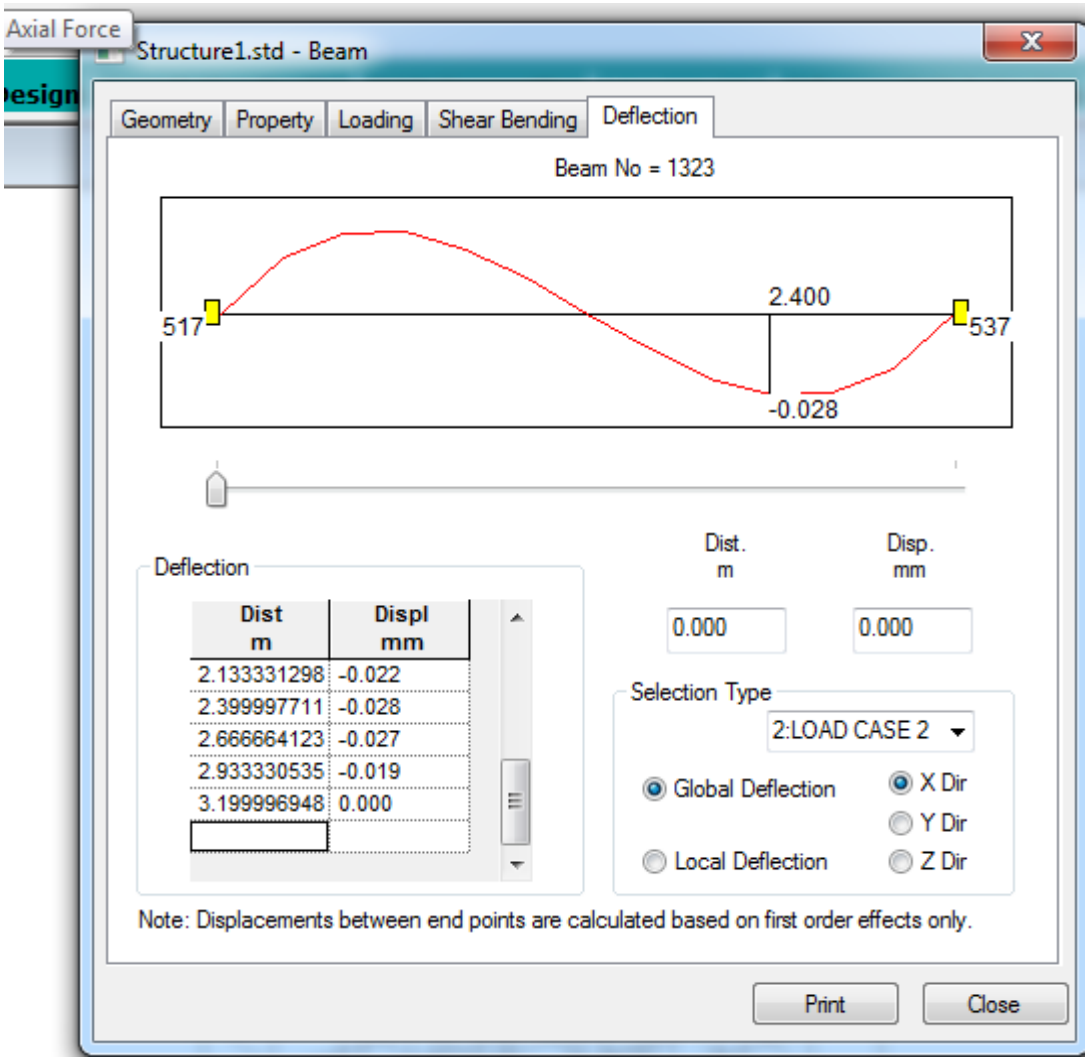
Intensity of wind load as per floor wise is calculated as per ASCE-7



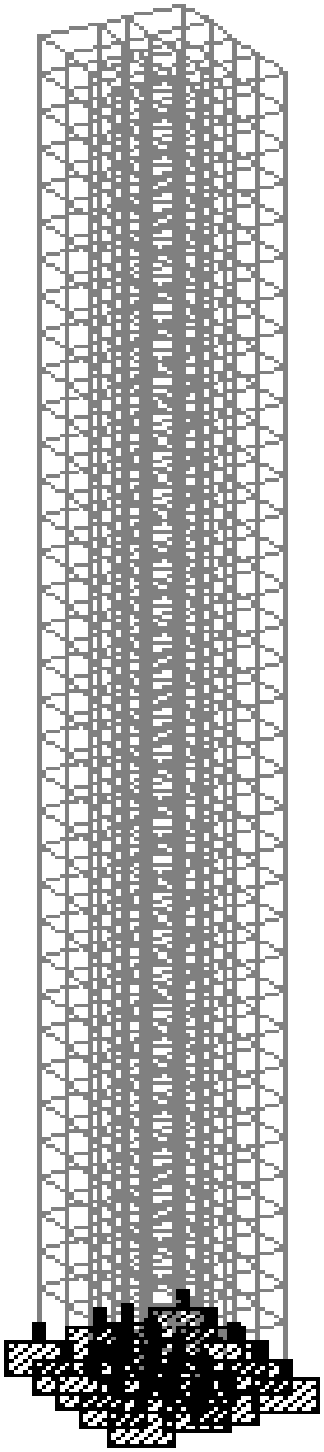
Wind intensity on 35- storey building.

Wind intensity is regular and in x –axis direction and way be opposite to it.

For the same beam we can also find the deflection in the beam. It is very easy to calculate the beam shear bending and deflection of beams and columns, for every storey.



The model structure of the 35-storey building after analysis.



CONCLUSION

From the above analysis of 35-storey building taking size of the beam and column by 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. 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. The deflection value is more in WL combination than the SL combination.

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