IJMTARC – VOLUME – IX – ISSUE – 38, APR - JUN, 2022 ISSN: 2320-1363

DESIGN AND ANALYSIS OF COMMERCIAL BUILDING (C+G+5) UNDER WIND LOAD ANAYSIS USING STAAD PRO

Mohd Imran Ahmed, Likmabam Nickson Singh, Mohd Moinuddin Osamah, Mohammed Afzal Mohiuddin, Dr. Aftab Tanveer

Dept. of Civil Engineering, SVITS, Mahbubnagar, Telangana, India.

Abstract: *In order to compete in the ever growing competent market it is very important for a structural engineer to save time. As a sequel to this an attempt is made to analyze and design a multistoried building by using a software package staad pro. For analyzing a multi storied building one has to consider all the possible loadings and see that the structure is safe against all possible loading conditions.The present project deals with the analysis of a commercial multi storeyed building of C+G+5 floors and the analysis is done for wind loads in staad pro with all the design parameters included. The dead load & live loads are applied and the design for beams, columns and slabs is obtained from STAAD Pro with its new features surpassed its predecessors and compotators with its data sharing capabilities with other major software like AutoCAD.The analysis and design of the entire structure has been completed using STAAD pro. The results include the various forces acting on various members as well various schedules for various members like shear forces, Displacements, Bending Moments in reference with Wind forces in all lateral directions. Also using the software we got the concrete take-off as well as the weight of the various reinforcement bars thus easing the load of cost estimation with reference to steel quantities.*

We conclude that staad pro is a very powerful tool which can save much time and is very accurate in Designs. Thus it is concluded that staad pro package is suitable for the design of a multistoried building.

I- INTRODUCTION

Building construction is the engineering deals with the construction of building such as residential houses. In a simple building can be define as an enclose space by walls with roof, food, cloth and the basic needs of human beings. In the early ancient times humans lived in caves, over trees or under trees, to protect themselves from wild animals, rain, sun, etc. as the times passed as humans being started living in huts made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. Rich people live in sophisticated condition houses.

Buildings are the important indicator of social progress of the county. Every human has desire to own comfortable homes on an average generally one spends his two-third life times in the houses. The security civic sense of the responsibility. These are the few reasons which are responsible that the person do utmost effort and spend hard earned saving in owning houses.

Nowadays the house building is major work of the social progress of the county. Daily new techniques are being developed for the construction of houses economically, quickly and fulfilling the requirements of the community engineers and architects do the design work, planning and layout, etc, of the buildings. Draughtsman are responsible for doing the drawing works of building as for the direction of engineers and architects. The draughtsman must know his job and should be able to follow the instruction of the engineer and should be able to draw the required drawing of the building, site plans and layout plans etc, as for the requirements.

A building frame consists of number of bays and storey. A multi-storey, multi-paneled frame is a complicated statically intermediate structure. A design of R.C building of C+G+5 storey frame work is taken up. The building in plan (30m x 15m) and (6.25x 10) consists of columns built monolithically forming a network. The numbers of columns are 28. It is commercial structure

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1.1 OBJECTIVES OF THE PROJECT

The objectives of the project are mentioned below:

1. Draft the Layout of the proposed building using AutoCAD
2. Analyze the building on STAAD Pro V8i
3. Design and Plan the Project Schedule using staad pro
4. Calculate the effect of wind loads on the structure and then estimate the quantity of steel i.e. reinforcement.

1.2 EFFECT OF WIND LOAD ON MULTISTORY BUILDING

The wind sensitivity of buildings and structures depends on several factors, the most important of which are the meteorological properties of the wind, type of exposure, and the aerodynamic and mechanical characteristics of the structure.

For tall buildings, average wind speed increases with height, and the gustiness, or different combinations of eddies (circular movement of wind), decreases with height. Wind forces can break the building's load path or punch a hole in the building envelope. Sometimes the actual force of high winds can cause a door or window to break open. Other times nearby debris can be picked up in the wind and projected against the building envelope.

Wind effects on structures continue to pose danger that continues to attract the attention of scientist round the globe. This is because of its trend of effect that changes with time, a dynamic problem, and inadequate information on the response of structures to wind action (Zhang et al., 1993). Wind loading competes with seismic loading as the dominant environmental loading for structures. They have produced roughly equal amounts of damage over a long time period, although large damaging earthquakes have tended to occur less often than severe windstorms (Douald, 1988).

The direction of wind is horizontal relative to the surface of earth. The primary generating force behind wind is the constant rotational movement of earth and terrestrial radiations of varying intensity. The radiation results in the convection currents in two directions either upwards or downwards. The nature of wind is very unpredictable, even for the same locality the wind speeds are extremely different and one may experience the effect of gusts lasting for few seconds. The effect of wind on a structure thus depends on many factors like its geographical location and obstructions near the structure which may cause any variation in air flow and also the characteristics of the structure itself.

II - LITERATURE REVIEW

Arvind Y. Vyavahare1, Godbole. P.N2, Trupti Nikose3, 2012, As author study that Tall buildings are slender flexible structures in nature and require to be examine to settle on the significance of wind speed induced excitation along and across the path of wind in specific zone . The Indian codal provision of practice for wind load on any buildings and structures (code IS-875 Part-3 1987) gives a procedure to determine along wind response of tall structures, while the across wind response and intervention effect are not included in the code at present. A article ‘Review of Indian Wind Code IS 875 (Part 3) 1987’ has been set by IIT Kanpur under GSDMA project gives recommendations to gain across wind reaction of tall buildings and structure as per process given in Australian/New Zealand standard ‘Structural Design Actions – Part 2 Wind Action (AS/NZS 1170-2 : 2002)

Shaikh Muffassir [1],L.G. Kalurkar [2], 2016, This

N. Lakshmanan, S. Gomathinayagam*, P. Harikrishna, A. Abraham and S. Chitra Ganapathi, 2009, Long-term data on hourly wind speed from 70 meteorological centres of India Meteorological Department have been collected. The daily gust wind data have been processed for annual upper limit wind speed (in kmph) for each

ISSN: 2320-1363

site. Using the Gumbel probability paper approach the intense value quantiles have been derived. A design basis wind speed for each site for a return period of 50 years has also been evaluated. The site specific changes in the design wind speeds in the contemporary wind zone map for the design of buildings/structures are highlighted and revision to the map is suggested.

Tharaka Gunawardena1*, Shiromal Fernando 2, Priyan Mendis 1, Bhathiya Waduge 2, Dilina Hettiarachchi 2, 2017, Urban habitats around the world are becoming more congested with rising populations and the need for tall buildings is as high as ever. Sri Lanka is experiencing this reality at present as Colombo's skyline expands rapidly with a large number of upcoming complex high-rise buildings. The response of tall buildings to wind forces is a critical design criterion and it requires both conventional force based designs as well as performance based solutions. This paper discusses these challenges and the engineering solutions that they require to successfully design a tall building which is not only stable, safe and strong under wind loads but also performs excellently providing usable and highly functional design.

Umakant Arya1, Aslam Hussain2, Waseem Khan3. (2014), In this study paper, the investigative result of wind speed and structural response of building frame on sloping ground has been studied and analyze. Considering various frame geometries and slope of grounds. Combination of static and wind loads are considered. There is many type of sloping ground. For combination, 60 cases in different wind zones and three different heights of building frames are analyzed. STAAD-Pro software has been used for analysis purpose. Results are collected in terms of Storey wise drift, Shear force, moment, axial force, support reaction, and Displacement which are critically analyzed to count the effects of a variety of slope of ground.

III - LAYOUT OF C+G+5 STRUCTURE USING AUTOCAD

3.1 GENERAL

AutoCAD or Computer Aided Design is a very helpful tool in drafting and designing any structure. AutoCAD uses a Graphical User Interface for the purpose of drafting and designing any structure. The software has various inbuilt tools for complex drafting. Also AutoCAD can be used for 2D, 3D and for perspective design.

With the help of AutoCAD all the drafting for the project has been done.

3.2 DETAILS OF THE PROJECT:

The plot size for the project is (30m x 15m) and (6.25m x 10m) SQ mts accordingly the building has been laid in the centre of the plot leaving ample space on all the sides for landscaping and pathways for cars and for visitors parking.

The complete structure is of 600 sqyards and the numbers of floors are C+G+5 with column orientation, beam placements and slabs as per different floors.

3.3 LAYOUT USING AUTOCAD

The layout has been mostly completed using the Line command. The unit for the layout is metres with accuracy of "0.000". Below is a screen shot of the line diagram showing the centre line for beam and column layout.

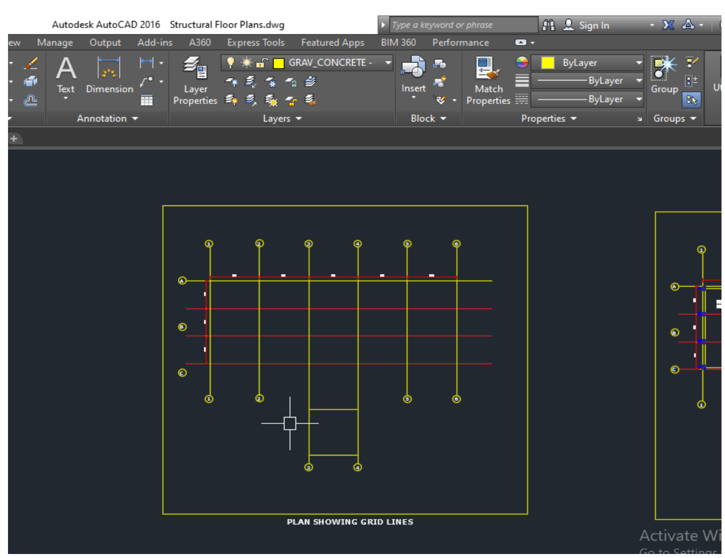

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Fig 1 Shows grid lines of the building

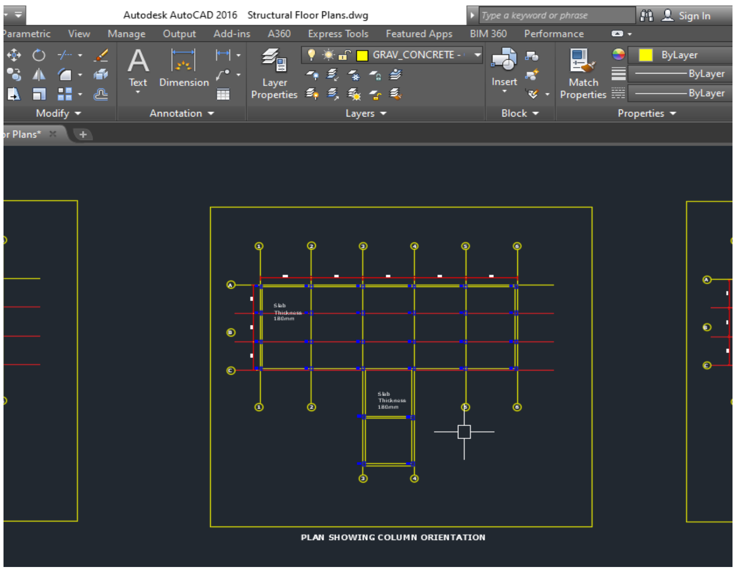

Fig 2 shows the column orientation of the building

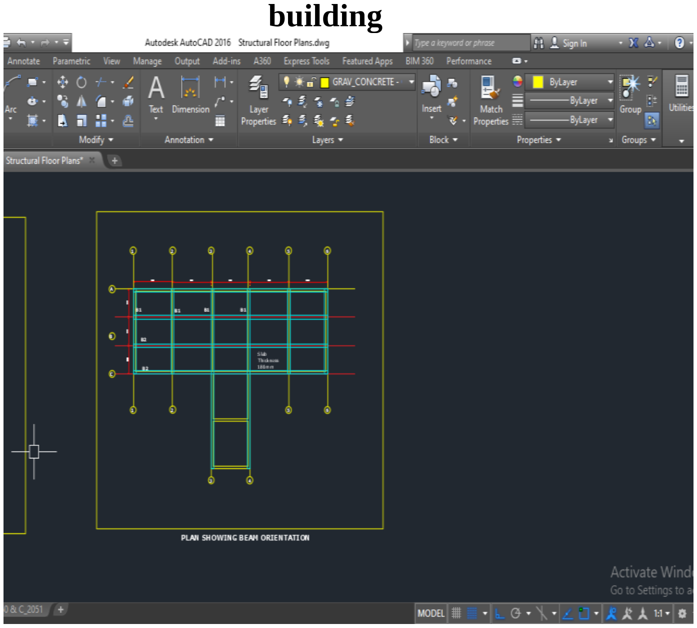

Fig 3 shows the beam orientation of the structure.

IV - DESIGN PARAMETERS

4.1 STAAD PRO INPUTS

Concrete Grade = M25
Clear Cover = 25mm
Fc = 25mpa
Fy main = 500mpa
Fy Section/ Stirrups = 500mpa
Density of Concrete = 23.5Kn/m^3

Loading Considerations for elements

Consider Finishes of 75mm with 20 Kn/m^3 Density of concrete
Brick wall/Partition walls Moderate Grade = 20 Kn/m^3
Live Load = 2.0Kn/m^2 & 2.50Kn/m^2 for commercial

4.2 PROPERTIES OF ELEMENTS

a). Beam Sizes

300 mm × 400 mm C+ G.F to 2nd Floor
250 mm × 350 mm 3rd to 4th Floor
225 mm × 300 mm Roof Beam Size

b). Column Sizes

250 mm × 400 mm C+G.F to 2nd Floor
230 mm × 400 mm 3rd to 4th Floor
230 mm × 350 mm Secondary Columns

c). Slabs Thickness

Floors C+G.F to 2nd = 200mm
Floors 3rd to 4th Slab = 150mm
Roof Slab = 115mm

d). Wall Thickness

Partition wall = 115mm
Outer Main wall = 230mm
Parapet wall = 75mm thick / Height= 1.2m

V - WIND LOADS DESIGN PARAMETERS AS PER IS 875 PART 3

The wind load pressure calculation for a building is done by using the formula mentioned below in 5.3 i.e design wind speed as per the code

IJMTARC – VOLUME – IX – ISSUE – 38, APR - JUN, 2022

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5.2 Basic Wind Speed — Figure 1 gives basic wind speed map of India, as applicable to 10 m height above mean ground level for different zones of the country. Basic wind speed is based on peak gust velocity averaged over a short time interval of about 3 seconds and corresponds to mean heights above ground level in an open terrain (Category 2). Basic wind speeds presented in Fig. 1 have been worked out for a 50 year return period. Basic wind speed for some important cities/towns is also given in Appendix A.

5.3 Design Wind Speed (V_z) — The basic wind speed (V_b) for any site shall be obtained from Fig. 1 and shall be modified to include the following effects to get design wind velocity at any height (V_z) for the chosen structure:

a) Risk level;

b) Terrain roughness, height and size of structure; and

c) Local topography.

It can be mathematically expressed as follows:

$$V_z = V_b \, k_1 \, k_2 \, k_3$$

where

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

k_1 = probability factor (risk coefficient) (*see* **5.3.1**);

k_2 = terrain, height and structure size factor (*see* **5.3.2**); and

k_3 = topography factor (*see* **5.3.3**).

NOTE — Design wind speep up to 10 m height from mean ground level shall be considered constant.

Fig. 4.0 showing design wind speed

a) In the above code reference we can see we need the 3 factors i.e k1, k2 and k3 where k1 is probability factor, k2 is terrain factor and k3 is the topography factor. Below we can further see how all these values are taken and then inserted in staad pro for analysis of the structure for wind loads.

5.3.1 *Risk Coefficient* (k_1 *Factor*) — Figure 1 gives basic wind speeds for terrain Category 2 as applicable at 10 m above ground level based on 50 years mean return period. The suggested life period to be assumed in design and the corresponding k_1 factors for different class of structures for the purpose of design is given in Table 1. In the design of all buildings and structures, a regional basic wind speed having a mean return period of 50 years shall be used except as specified in the note of Table 1.

5.3.2 *Terrain, Height and Structure Size Factor* (k_2 *Factor*)

5.3.2.1 *Terrain* — Selection of terrain categories shall be made with due regard to the effect

Fig. 5.0 terrain Factors

b).Categories of terrain factor where we have take category 3 as per the building design considerations.

c) *Category 3* — Terrain with numerous closely spaced obstructions having the size of building-structures up to 10 m in height with or without a few isolated tall structures.

NOTE 1 — This category includes well wooded areas, and shrubs, towns and industrial areas full or partially developed.

NOTE 2 — It is likely that the next higher category than this will not exist in most design situations and that selection of a more severe category will be deliberate.

NOTE 3 — Particular attention must be given to performance of obstructions in areas affected by fully developed tropical cyclones. Vegetation which is likely to be blown down or defoliated cannot be relied upon to maintain Category 3 conditions. Where such situation may exist, either an intermediate category with velocity multipliers midway between the values for Category 2 and 3 given in Table 2, or Category 2 should be selected having due regard to local conditions.

d) *Category 4* — Terrain with numerous large high closely spaced obstructions.

NOTE — This category includes large city centres, generally with obstructions above 25 m and well developed industrial complexes.

Fig 6.0 shows category of terrain structures

TABLE 1 RISK COEFFICIENTS FOR DIFFERENT CLASSES OF STRUCTURES DIFFERENT WIND SPEED ZONES

(*Clause* 5.3.1)

CLASS OF STRUCTURE	MEAN PROBABLE DESIGN LIFE OF STRUCTURE IN YEARS	k_1 FACTOR FOR BASIC WIN (m/s) OF			
		33	39	44	47
All general buildings and structures	50	1·0	1·0	1·0	1·0
Temporary sheds, structures such as those used during construction operations (for example, formwork and falsework), structures during construction stages and boundary walls	5	0·82	0·76	0·73	0·71
Buildings 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 buildings other than residential buildings	25	0·94	0·92	0·91	0·90
Important buildings and structures such as hospitals communication buildings / towers, power plant structures	100	1·05	1·06	1·07	1·07

Fig 7 showing classes of wind speed

TABLE 2 k_1 FACTORS TO OBTAIN DESIGN WIND SPEED VARIATION WITH HEIGHT IN DIFFERENT TERRAINS FOR DIFFERENT CLASSES OF BUILDINGS/STRUCTURES

(*Clause* 5.3.2.2)

Height	Terrain Category 1 Class			Terrain Category 2 Class			Terrain Category 3 Class			Terrain Category 4 Class		
m	*A*	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
10	1·05	1·03	0·99	1·00	0·98	0·93	0·91	0·88	0·82	0·80	0·76	0·67
15	1·09	1·07	1·03	1·05	1·02	0·97	0·97	0·94	0·87	0·80	0·76	0·67
20	1·12	1·10	1·06	1·07	1·05	1·00	1·01	0·98	0·91	0·80	0·76	0·67
30	1·15	1·13	1·09	1·12	1·10	1·04	1·06	1·03	0·96	0·97	0·93	0·83
50	1·20	1·18	1·14	1·17	1·15	1·10	1·12	1·09	1·02	1·10	1·05	0·95
100	1·26	1·24	1·20	1·24	1·22	1·17	1·20	1·17	1·10	1·20	1·15	1·05
150	1·30	1·28	1·24	1·28	1·25	1·21	1·24	1·21	1·15	1·24	1·20	1·10
200	1·32	1·30	1·26	1·30	1·28	1·24	1·27	1·24	1·18	1·27	1·22	1·13
250	1·34	1·32	1·28	1·32	1·31	1·26	1·29	1·26	1·20	1·28	1·24	1·16
300	1·35	1·34	1·30	1·34	1 32	1·28	1·31	1·28	1·22	1·30	1·26	1·17
350	1·37	1·35	1·31	1·36	1·34	1·29	1·32	1·30	1·24	1·31	1·27	1·19
400	1·38	1·36	1·32	1·37	1·35	1·30	1·34	1·31	1·25	1·32	1·28	1·20
450	1·39	1·37	1·33	1·38	1·36	1·31	1·35	1·32	1·26	1 33	1·29	1·21
500	1·40	1·38	1·34	1·39	1·37	1·32	1·36	1·33	1·28	1·34	1·30	1·22

NOTE 1 — *See* 5.3.2.2 for definitions of Class A, Class B and Class C structures.

NOTE 2 — Intermediate values may be obtained by linear interpolation, if desired. It is permissible to assume constant wind speed between 2 heights for simplicity.

Fig 8 showing classes of wind speed variations as per the terrain category

APPENDIX A

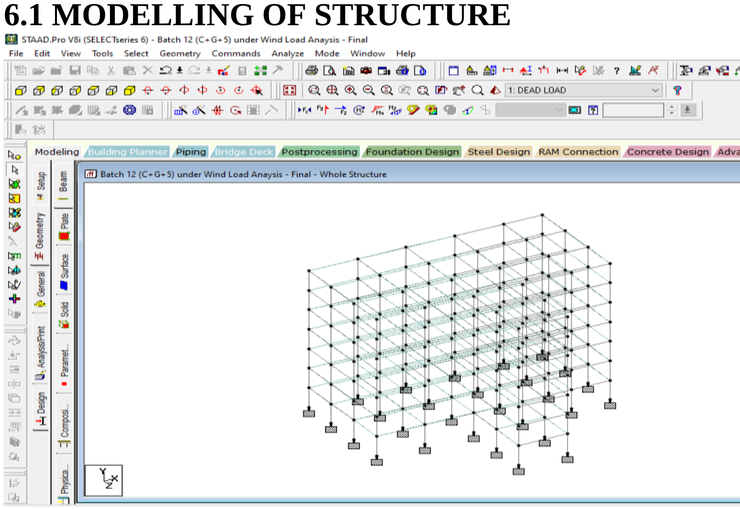
(*Clause* 5.2)

BASIC WIND SPEED AT 10 m HEIGHT FOR SOME IMPORTANT CITIES/TOWNS

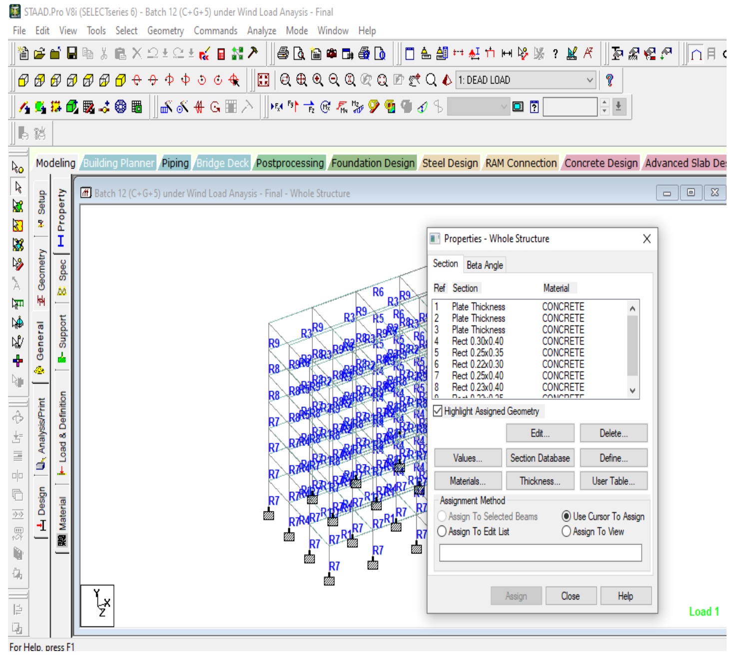
City/Town	*Basic Wind Speed (m/s)*	*City/Town*	*Basic Wind Speed (m/s*
Agra	47	Jhansi	47
Ahmadabad	39	Jodhpur	47
Ajmer	47	Kanpur	47
Almora	47	Kohima	44
Amritsar	47	Kurnool	39
Asansol	47	Lakshadweep	39
Aurangabad	39	Lucknow	47
Bahraich	47	Ludhiana	47
Bangalore	33	Madras	50
Barauni	47	Madurai	39
Bareilly	47	Mandi	39
Bhatinda	47	Mangalore	39
Bhilai	39	Moradabad	47
Bhopal	39	Mysore	33
Bhubaneshwar	50	Nagpur	44
Bhuj	50	Nainital	47
Bikaner	47	Nasik	39
Bokaro	47	Nellore	50
Bombay	44	Panjim	39

VI - ANALYSIS OF STRUCTURE

6.1 MODELLING OF STRUCTURE



6.2 MEMBER PROPERTY ASSIGNING TO THE STRUCTURAL ELEMENTS



6.3 ASSIGNING OF LOADS

- Dead Load
- Live Load
- Wind Loads in X & Z Directions
- Floor Finishes
- Brick Wall Load
- Inner Partition Wall Loads
- Roof Loads

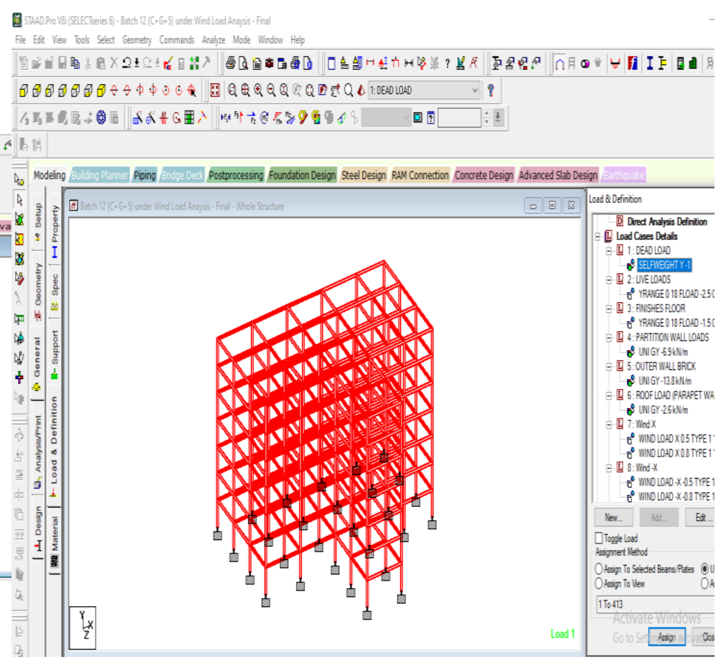
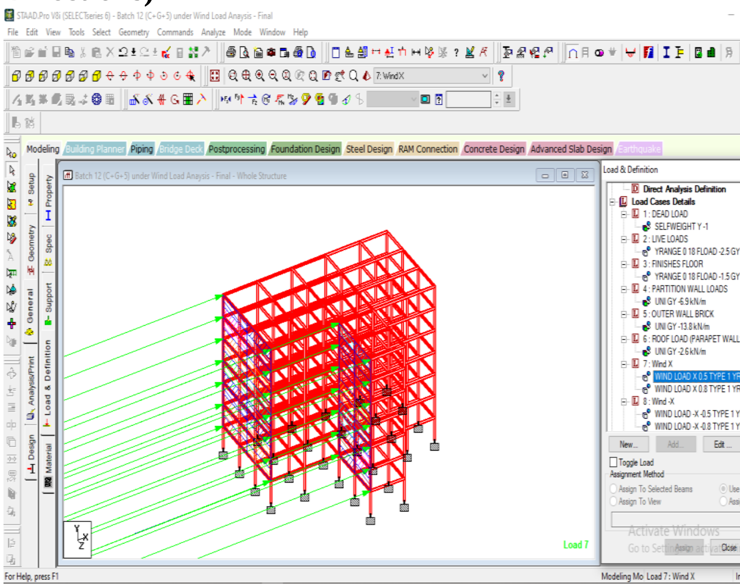
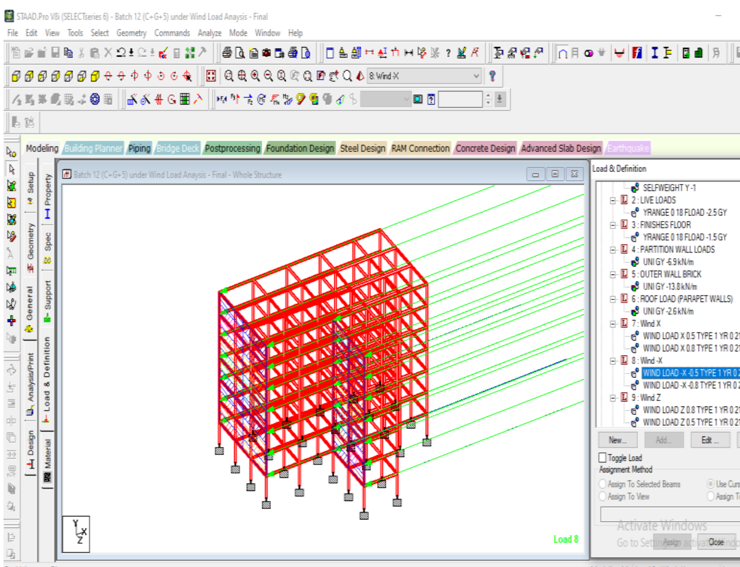
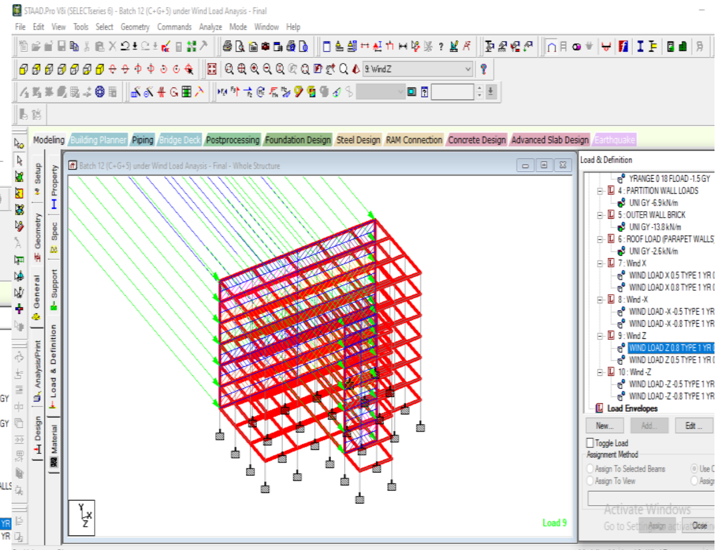


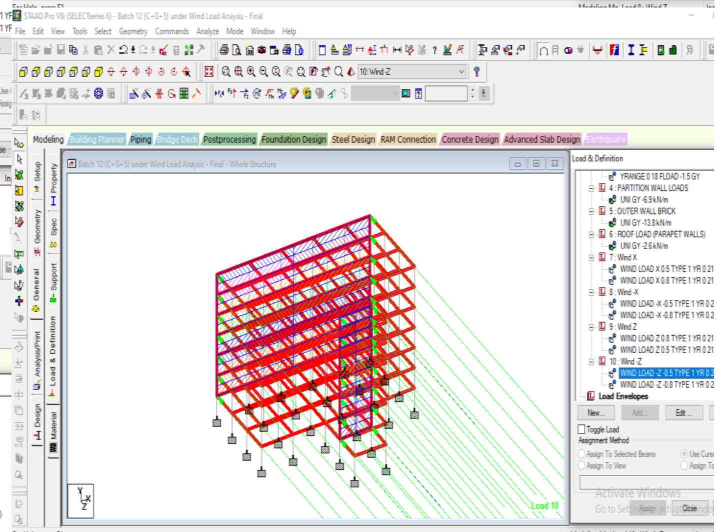
Fig 9 shows the assigned self weight

6.4 ASSIGN OF WIND LOADS (X & Z Directions)

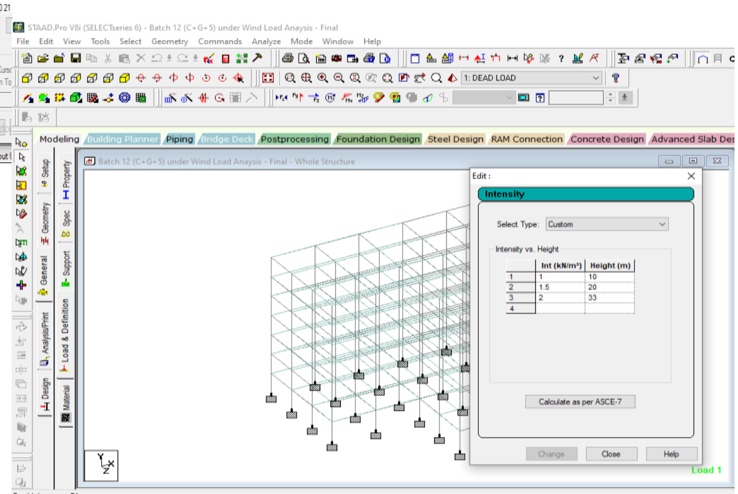






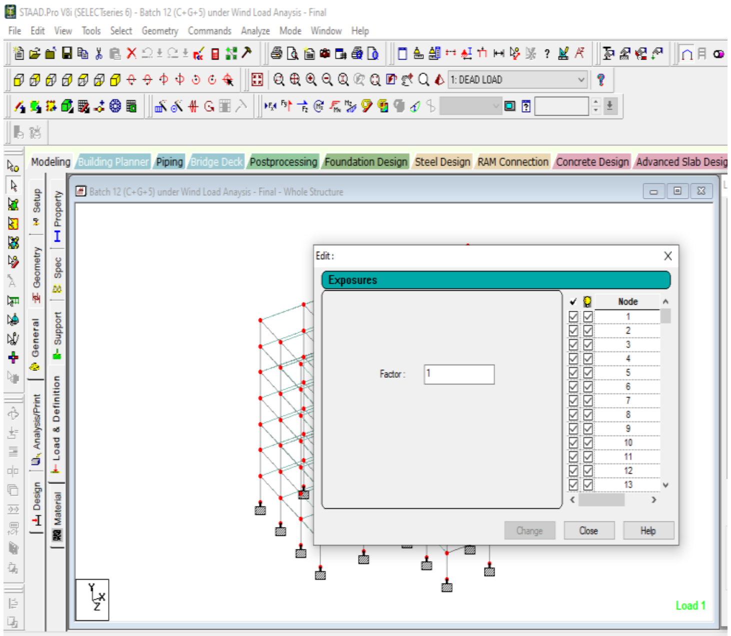


6.5 ASSIGNING OF WIND INTENSITY



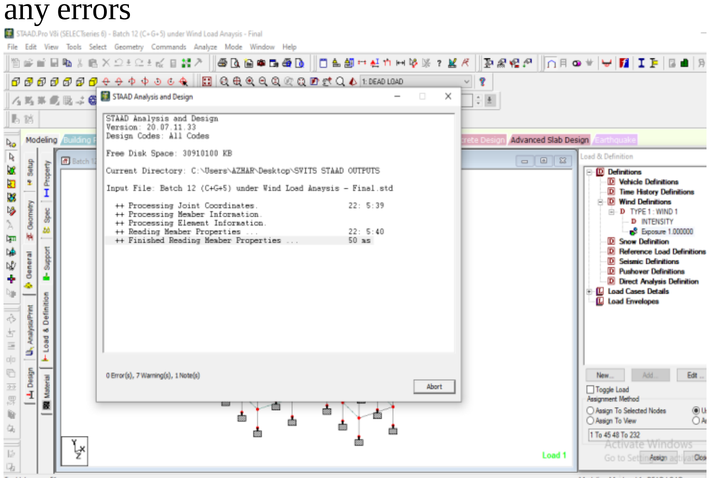
IJMTARC – VOLUME – IX – ISSUE – 38, APR - JUN, 2022

ISSN: 2320-1363

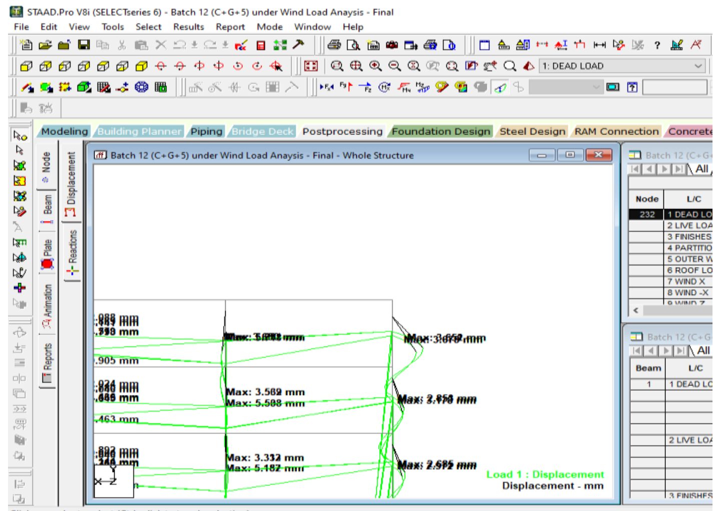


VII- STAAD RESULT OUTPUT.

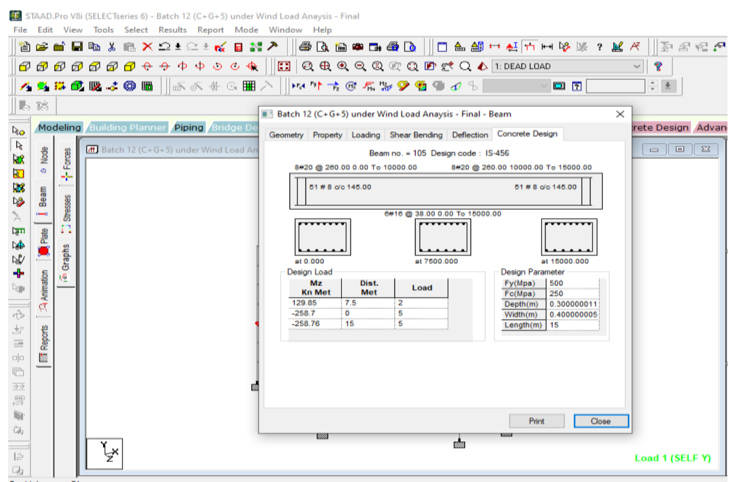
The analysis done from considering all the above parameters state that the structure is safe without any errors



7.1 STRUCTURE DISPLACEMENTS OUTPUTS



7.2 DESIGN REINFORCEMENT OUTPUTS



7.3 SHEAR FORCE & BENDING MOMENTS OUTPUT RESULTS

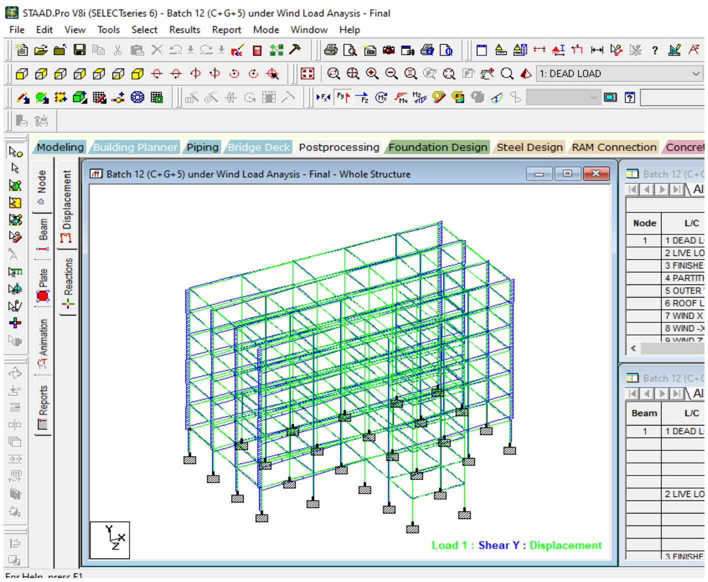


Fig 10 Shear force output

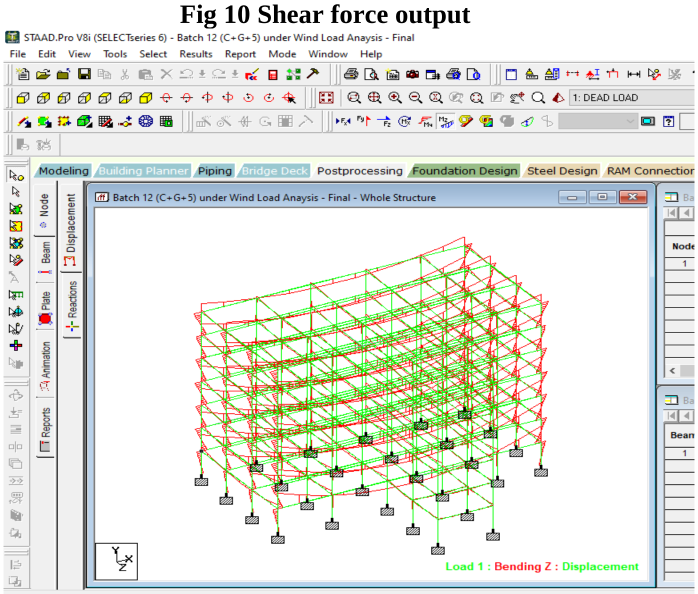


Fig 17 Bending Moment Output

7.4 DESIGN RESULTS OF BEAMS AND COLUMNS REINFORCEMENT

Due to huge output data, output of a sample beam is shown below.

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B E A M N O.19 D E S I G N R E S U L T S

M25 Fe500 (Main) Fe500 (Sec.)

LENGTH: 3000.0 mm SIZE: 400.0 mm X 250.0 mm COVER: 30.0 mm

DESIGN LOAD SUMMARY (KN MET)

SECTION |FLEXURE (Maxm. Sagging/Hogging moments)| SHEAR
(in mm) | P MZ MX Load Case | VY MX Load Case

0.0 | 0.00 35.89 -0.02 2 | -22.35 0.32 8
| 0.00 -31.40 -0.32 7 |
250.0 | 0.00 31.46 -0.02 2 | -22.35 0.32 8
| 0.00 -25.81 -0.32 7 |
500.0 | 0.00 27.03 -0.02 2 | -22.35 0.32 8
| 0.00 -0.05 0.05 10 |
750.0 | 0.00 22.60 -0.02 2 | -22.35 0.32 8
| 0.00 -0.07 -0.00 4 |
1000.0 | 0.00 10.90 -0.01 3 | -22.35 0.32 8
| 0.00 -9.04 -0.32 7 |
1250.0 | 0.00 13.74 -0.02 2 | -22.35 0.32 8
| 0.00 -0.04 -0.00 4 |
1500.0 | 0.00 7.73 -0.01 5 | -22.35 0.32 8
| 0.00 -2.13 0.32 8 |
1750.0 | 0.00 7.72 -0.32 7 | -22.35 0.32 8
| 0.00 -7.72 0.32 8 |
2000.0 | 0.00 0.38 -0.01 5 | -22.35 0.32 8
| 0.00 0.00 0.00 1 |
2250.0 | 0.00 18.89 -0.32 7 | -22.35 0.32 8
| 0.00 -18.89 0.32 8 |
2500.0 | 0.00 24.48 -0.32 7 | -22.35 0.32 8
| 0.00 -24.48 0.32 8 |
2750.0 | 0.00 30.07 -0.32 7 | -22.35 0.32 8
| 0.00 -30.07 0.32 8 |
3000.0 | 0.00 35.66 -0.32 7 | -22.35 0.32 8
| 0.00 -35.66 0.32 8 |

SUMMARY OF REINF. AREA (Sq.mm)

SECTION | TOP | BOTTOM | STIRRUPS

(in mm) | Reqd./Provided reinf. | Reqd./Provided reinf. | (2 legged)

SECTION (in mm)	TOP Reqd./Provided reinf.	BOTTOM Reqd./Provided reinf.	STIRRUPS (2 legged)
0.0	346.77/ 603.19(3-16í)	393.26/ 603.19(3-16í)	8í @ 135 mm
250.0	285.23/ 603.19(3-16í)	344.33/ 603.19(3-16í)	8í @ 135 mm
500.0	144.16/ 603.19(3-16í)	295.51/ 603.19(3-16í)	8í @ 135 mm
750.0	144.16/ 603.19(3-16í)	246.80/ 603.19(3-16í)	8í @ 135 mm
1000.0	144.16/ 603.19(3-16í)	144.16/ 603.19(3-16í)	8í @ 135 mm
1250.0	144.16/ 603.19(3-16í)	149.73/ 603.19(3-16í)	8í @ 135 mm
1500.0	144.16/ 603.19(3-16í)	144.16/ 603.19(3-16í)	8í @ 135 mm
1750.0	144.16/ 603.19(3-16í)	144.16/ 603.19(3-16í)	8í @ 135 mm
2000.0	0.00/ 402.12(2-16í)	144.16/ 603.19(3-16í)	8í @ 135 mm
2250.0	209.34/ 603.19(3-16í)	209.34/ 603.19(3-16í)	8í @ 135 mm
2500.0	270.66/ 603.19(3-16í)	270.66/ 603.19(3-16í)	8í @ 135 mm
2750.0	332.16/ 603.19(3-16í)	332.16/ 603.19(3-16í)	8í @ 135 mm
3000.0	393.84/ 603.19(3-16í)	393.84/ 603.19(3-16í)	8í @ 135 mm

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C O L U M N N O. 25 D E S I G N R E S U L T S

M25 Fe500 (Main) Fe500 (Sec.)

LENGTH: 3000.0 mm CROSS SECTION: 400.0 mm X 250.0 mm COVER: 40.0 mm

**** GUIDING LOAD CASE: 10 END JOINT: 45 TENSION COLUMN**

DESIGN FORCES (KNS-MET)

DESIGN AXIAL FORCE (Pu) : -144.74

	About Z	About Y
INITIAL MOMENTS :	1.04	63.39
MOMENTS DUE TO MINIMUM ECC. :	2.89	2.89
SLENDERNESS RATIOS :	-	-
MOMENTS DUE TO SLENDERNESS EFFECT :	-	-
MOMENT REDUCTION FACTORS :	-	-
ADDITION MOMENTS (Maz and May) :	-	-
TOTAL DESIGN MOMENTS :	2.89	63.39

REQD. STEEL AREA : 1200.00 Sq.mm.

REQD. CONCRETE AREA: 98800.00 Sq.mm.

MAIN REINFORCEMENT : Provide 4 - 20 dia. (1.26%, 1256.64 Sq.mm.)

TIE REINFORCEMENT : Provide 8 mm dia. rectangular ties @ 250 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)

Puz : 11565.00 Muz1 : 45.48 Muy1 : 72.77

INTERACTION RATIO: 0.93 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)

WORST LOAD CASE: 8

END JOINT: 45 Puz : 11579.87 Muz : 60.29 Muy : 96.47 IR: 0.83

VIII - CONCLUSION

IJMTARC – VOLUME – IX – ISSUE – 38, APR - JUN, 2022 ISSN: 2320-1363

This project includes the layout of C+G+5 commercial building using AutoCAD, Analysis and Design using STAAD Pro. The analysis and design of the entire structure has been completed using STAAD pro. The results include the various forces acting on various members as well various schedules for various members in addition to wind loads in all lateral directions i.e. X, -X, Z & -Z coordinates. Also using the software we got the concrete take-off as well as the weight of the various reinforcement bars thus easing the load of cost estimation and we also got the output of steel reinforcement that is to be provided for every structural element.
After designing the structure against wind loads the analysis of the structure is considered safe against the forces as per the wind zones of the particular area in consideration with basic wind speed.

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AUTHOR PROFILE

Mohd Imran Ahmed B.Tech student in the Civil Engineering from Sree Visvesvaraya institute of technology and science, MBNR.
Likmabam Nickson Singh B.Tech student in the Civil Engineering from Sree Visvesvaraya institute of technology and science, MBNR
Mohd Moinuddin Osamah B.Tech student in the Civil Engineering from Sree Visvesvaraya institute of technology and science, MBNR.
Mohammed Afzal Mohiuddin B.Tech student in the Civil Engineering from Sree Visvesvaraya institute of technology and science, MBNR.
Dr. Aftab Tanveer, PROFESSOR & HOD Civil Engineering from Sree Visvesvaraya institute of technology and science, MBNR