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SPACE UTILISATION AND STRUCTURAL DESIGN OF WAREHOUSE USING STAADPRO

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Abstract *: Warehouse design is done based on the deliberations and requisite. All the load factors, foundation parameters were inspected during the design. The different types of loads were featured and were assigned to the beams. We made use of slighter steel that meets the economic conditions. The desperate need of the warehouse is advanced in societies where the trade outstretched a critical mass necessitate storage at some point in the allowed swapping process. The warehouses may be of concrete walls, brick masonry or any sheet wrapping material. Always the walls are very satisfactory to withstand all the wind forces as the warehouse constructed will be at higher heights. If the warehouse was made with steel, it can be easy to use even after the demolition, and it can be also shifted to other location in future if needed. The main objective of the project is that at most safety is fortified, can be constructed inexpensive which can withstand all the wind loads, and most preferable for throughputs, can also be constructed using the conventional steel or either with pipe sections.*

Index Terms **– Pipe sections, Load factors, Wind forces.**

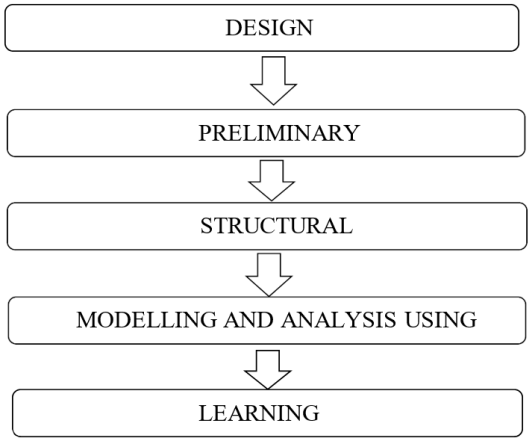
I. INTRODUCTION

Warehouse is a place where different materials and goods are stored for industrial use. Warehouse design is the new concept that deals with the requirements for the construction of a warehouse. It always gives an at most safety and also security to all the materials and goods from all the environmental factors. Always the thought of designing a warehouse requires a check on storage capacity, delivery equipment's and also about the throughputs. We are emphasizing the design, utilities of warehouse where the real engineering comes into play and we are using the STAAD PRO software as our validation tool. There are different warehouses classified based on the wholesalers, distributors choices and economic conditions.

Warehouse design is done based on the deliberations and requisite. All the load factors, foundation parameters were inspected during the design. The different types of loads were featured and were assigned to the beams. We made use of slighter steel that meets the economic conditions. The desperate need of the warehouse is advanced in societies where the trade outstretched a critical mass necessitate storage at some point in the allowed swapping process. The warehouses may be of concrete walls, brick masonry or any sheet wrapping material. Always the walls are very satisfactory to withstand all the wind forces as the warehouse constructed will be at higher heights. If the warehouse was made with steel, it can be easy to use even after the demolition, and it can be also shifted to other location in future if needed. If we are going to design warehouse with steel sections, then the different combinations like cold-formed, hot-rolled and steel rods along with wrapped sheets can also be used in practice. Always choosing a warehouse near the industries will be ponderable, because it does not take much time to load and reload the goods. The main objective of the project is that at most safety is fortified, can be constructed inexpensive which can withstand all the wind loads, and most preferable for throughputs, can also be constructed using the conventional steel or either with pipe sections.

II. METHODOLOGY

The unique methodology we are going to adopt is discussed. First, we are going to look into the design considerations which will be detailed, then preliminary design, structural design. After the structural design we will analyze the structure in staad pro.



3.DESIGN

3.1Design Considerations:

First one is design consideration. here we look into all type of requirements and needs like throughputs- as the warehouse must be very suitable for throughputs, location- this is one of the important criteria for construction of warehouse and endurance time- as the warehouse we are going to design should remain active for a long period of time as well as it should be able to resist, withstand all the wind forces.

***3.2** Preliminary Design:*

The further important one is preliminary design. Here we are very specified about the human and warehouse interaction which means the space utilization and arrangement of lane and lane depth. For example: if we have lanes at the northeast and entrance is at southwest, then it will be very difficult for the workers to load and unload the goods. These all comes under preliminary design. According to the considerations, we have designed with two entrances and both will be designed in opposite to each other. The lanes are placed in such a way that they can be moved to front so that their succeeding lane can be loaded or reloaded. This pattern is followed throughout the warehouse. There is a office room at the front left corner. The lanes can be placed at the starting right corner while loading or unloading. Thus all the considerations were taken and analyzed for further process.

3.3 Structural Design:

The next step is structural design. Here we will design the structure for all the different types of loads and also the forces are considered. We will also have a look on bending moment and shear force. Once done with the structural part, we will model the structure and then analyze it in staadpro for different conditions. Thus, if all the conditions are satisfied in first attempt, it will be well and good or else we will start again from preliminary design.

Loadings: We have considered the location as Warangal and it has a wind speed of 11km/hr. There are three different types in which the wind forces can be taken into deliberation on the roof surface. The figure below shows the propagation of wind towards the roof. From those we have considered the first case that satisfies our design and loading criteria.

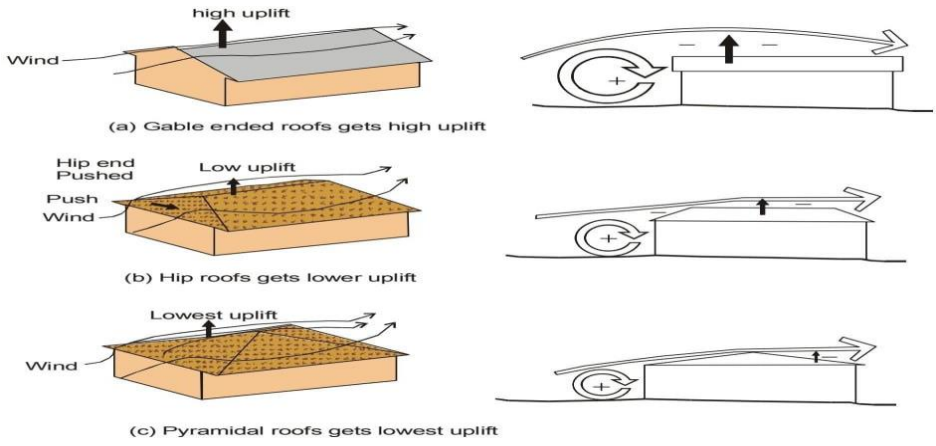


Fig 2: Uplift wind forces

The area of warehouse is 21780m^2. The length and width of the warehouse is 56.89 and 28.44. The height is 15mts. The pressure coefficients based on the dimensions both internal and external pressures were referred from IS 875:1987(Part 3). The values are taken for external pressure coefficient and for internal coefficient.

Next the stagnation pressure was calculated using the wind velocity. From the above obtained stagnation pressure, design pressure is determined. The force that a roof can carry is obtained and analyzed from design pressure. The same process is followed for calculation of pressure induced in walls. We have referred table 4 from IS 875:1987(Part 3) for determining the external pressure coefficients of wall.

Considerations: The main consideration is that the deflection should be less than 5mm.

The pressure is calculated by the formula

$P=1/2\ ev^2$

The highest wind speed in telangana is 98kmph. By calculation we get the

pressure $P = 281.67$pa.

The wind force on individual member is calculated by the formula

$$F= (Cpe - Cpi)A\ Pd$$

The height of the warehouse is 10m along the wall without considering the roof.

The height to width ratio is 0.35. In order to have low lift on roof, the roof angle is taken to be 30deg. Thus Cpe= 0

Therefore the load from calculations obtained w= 3.997KN/m.

The number of members to be placed is 7 and distance between each other is 5m.

4.MODELLING

As all the values are obtained, loads are calculated, now those are analyzed using the software STAADPRO. First the distances should be located, so that the members can be assigned easily. After giving the distances the top view of the structure is analyzed. Thus as per calculations, more 7 members should be added. That gives the structural view with respect to walls. The fixed supports should be assigned for each member.

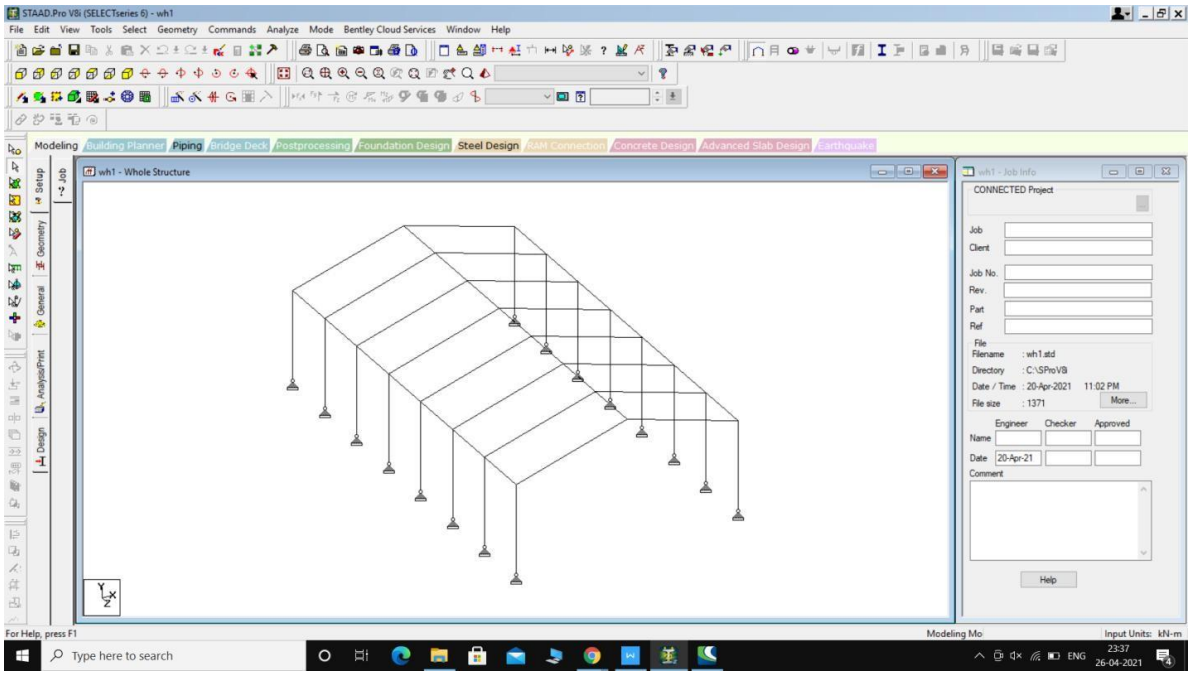


Fig 4: Analysis of TRUSS

Now the same method is followed for roof portion. The loads are calculated and supports are placed. The distance between each member is 5m. The members placed are 6. All the parameters are taken into account which also includes stresses in the roof portion. Due to stresses, there may be a slight variation in the structures. So that is avoided.

Thus the structure is analyzed in STAADPRO. As all the load calculations, support reactions are satisfied in first trail, there is no need of going for learnings, which again begins from preliminary design. Therefore the structure of warehouse is designed using STAADPRO.

5.**RESULTS**

After completion of design and analysis of warehouse required results like displacements, reactions, shear force and bending moments are obtained from the software. The area taken for consideration will be appreciable if the length to width ratio is 1:2.Always the wind speed in a required location need to be considered. Deflection must be taken less than 5mm. Space optimization need to be estimated for a efficient and effective design of a warehouse. The stagnation pressure was calculated using the wind velocity. From the above obtained stagnation pressure, design pressure is determined. obtained and analyzed from design pressure. The same process is followed for calculation of pressure induced in walls. Always less thickness of steel is recommended for the roof portion. The inclined bars should be placed based on the stresses developed in the truss member. The load obtained is 3.997KN/m and the number of members used are 7. 20% of the area should be left for any future inconvenience regarding the load and reload of the goods or products.

6.**CONCLUSIONS**

From the design and results obtained it can conclude that the structure designed is safe with the given loads and dimensions. Deflection of beams is 20mm which is in the required limit. Required steel area are given in detail in output of software. Software gives detail description of results of each and every member of the structure. If any failure occurs in the structure, software shows error and it can be modified easily. Accurate results are given by the software and less time is required for the design compared to manual calculations.

REFERENCES

[1] Shankaranand, Rahul Patange, Megha S P, Deepa C K, Renuka G M (2020), "Design and analysis of industrial warehouse using STAAD PRO", pg no: 223-254.

[2] Shahab Derhami, Kevin R. Gue (2016), "Optimizing Space Utilization in Block Stacking Warehouses", pg no: 2-6.

[3] Prof. G. S. Patil, Dr. Prof. M. B. Chougule (2020), "Warehouse Design", pg no: 805- 807.

[4] Srikanth Boga, Ashok Kankuntla, Pradeep Dara, Praveen Mamdyal (2018)," Optimum Design of an Industrial Warehouse Using Staad pro", pg no: 749-752.

[5] Abhilash Joy, Stuba Engineering Consultancy, Palarivattom, Ernaklulam, India, Analysis and design of Industrial Building, International Journal of Engineering Research & Technology (IJERT), ISSN:2278-0181, Vol.4 Issue 03, March-2015.

[6] Anisha Goswami, Pre-Engineered Building Design of an Industrial Warehouse, International Research Journal of Engineering and Technology (IRJET).

[7] K.Prabin Kumar, U.G.Scholar, Planning Analysis and Design of Industrial Building Using STAAD-PRO, International Journal of Pure and Applied Mathematics, Volume 119 No.17 2018, 131-137.

[8] Viren Chandanshive, Design of Industrial Warehouse, International Journal of Engineering Research & Technology (IJERT),ISSN:2278-0181, Vol.7 Issue 02, February- 2018.