

DESIGN AND ANALYSIS OF STEEL STRUCTURE (WAREHOUSE) USING CYPE SOFTWARE

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ABSTRACT: *Permanent and temporary steel frame buildings are commonly used as sport facilities, exhibition halls, leisure facilities and warehouses. This Project is a study of Structural Design and Analysis of a Steel structure Warehouse. The Design has been processed using CYPE Software and Analyzed using CYPE Software, and the drawings are generated using AUTOCADD. Structural Building concept is a new conception of multi-storied industrial building construction, especially for warehouses. The methodology is very versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction. The concept includes the technique of providing the best possible section according to the optimum requirement.*

Keyword: *CYPE software, Warehouse, Pre-designing, Prefabrication...Etc*

I. INTRODUCTION

1.1 GENERAL

Buildings & houses are one of the oldest construction activities of human beings. The construction technology has advanced since the beginning from primitive construction technology to the present concept of modern house buildings. The present construction methodology for buildings calls for the best aesthetic look, high quality & fast construction, cost effective & innovative touch.

1.2 CLASSIFICATION OF BUILDINGS

A healthy trend in the form of growth in demand for construction works in residential, Commercial, Institutional, industrial and infrastructure sectors are being seen over the past decade. Modern Structures are much more complex and sophisticated as compared to earlier period. One of the major changes which are being felt by all is that the present structures are taller and thinner. Modern day requirement of structures is that these should be lighter yet not compromising on functionality. Civil engineering construction has seen a continual economic competition between steel, concrete and other construction materials. The different types of buildings are as follows,

- Reinforced cement concrete buildings
- Timber buildings
- Steel buildings

1.3 STEEL BUILDINGS

Steel is the material of choice for design because it is inherently ductile and flexible. It flexes under extreme loads rather than crushing and crumbling. Structural steel's low cost, strength, durability, design flexibility, adaptability and recyclability continue to make it the material of choice in building construction. Today's structural steel framing is

bringing grace, art and function together in almost limitless ways and is offering new solutions and opportunities to create challenging structures, which were once thought impossible. Steel structures have reserve strength. Simple "stick" design in the steel framings allows construction to proceed rapidly from the start of erection. A steel building is a metal structure fabricated with steel for the internal support and for exterior cladding, as opposed to steel framed buildings which generally use other materials for floors, walls, and external envelope. Steel buildings are used for a variety of purposes including storage, work spaces and living accommodation.

1.4 APPLICATION OF STEEL

- Houses & Living Shelters
- Factories
- Warehouses
- Sport Halls (Indoor and Outdoor)
- Aircraft Hangers
- Supermarkets
- Workshops
- Office Buildings
- Labor Camps
- Petrol Pumps/Service Buildings
- Schools
- Community centre's
- Railway Stations
- Equipment housing/shelters.

There is a great possibility of improving the aesthetic quality with a choice of roofing elements, exterior finishes, weather-sheds, color system and variations in planning as well as massing.

1.5 SCOPE OF THE PROJECT

- RCC building in which excess materials and time are utilized can be avoided with steel structure.
- Steel buildings are more economical and aesthetically pleasing.
- The span length can be sufficiently without any additional structure, provided in RCC.
- Components are manufactured in factory and assembled on site.
- Steel structure material can be recovered and reused.

1.6 OBJECTIVE OF THE PROJECT

The following are objective of the project and a detailed report on design and analysis of the Steel structure Warehouse is discussed in the upcoming chapters.

- To Study Steel Structures Building.
- To Prepare a Design of steel Structure.

- To Analyze Structure Using CYPE.
- To Design Sections, Connections etc.

II. LITERATURE SURVEY

2.1 GENERAL

In this chapter the literature review of Steel structure warehouse designs is carried out from various books, reference, journals, and from several websites .the brief discussion of the concept is presented below in this project.

2.1.1 L. M .C SIMOES (1997) described a computer based method for the optimum design of steel frameworks accounting for the behavior of semi rigid connections. The described optimization procedure provides an effective means to account for the cost of both members and connections in the design of steel building frameworks. it was concluded that the semi- rigid behavior of connections results in designs that are less costly than when, as is usually done, the connections are idealized as being fully rigid.

2.1.2 TREMBLAY ET AL., (ASCE) 0733-9445 (2003) Tremblay et al. performs an experimental study on the seismic performance of concentrically braced steel frames with cold-formed rectangular tubular bracing system. Analysis is performed on X bracing and single diagonal bracing system.

2.1.3 SEISMIC RESPONSE ASSESSMENT OF CONCENTRICALLY BRACED STEEL FRAME BUILDINGS (THE 14TH WORLD CONFERENCE ON EARTHQUAKE ENGINEERING OCTOBER 12-17, 2008, BEIJING, CHINA) Improvement of performance based design and analysis procedure for better understanding of conventionally used concentrically braced frame and buckling restrained braced frames is discussed.

2.1.4 A.JAYARAMAN work on the structural design to be satisfactory, generally four major objectives utility, safety, economical and elegance must be fulfilled. This paper presents a study on behavior and economical of roof trusses and Purlins by comparison of limit state and working stress method. Roof trusses and Purlins are therefore an integral part of an industrial building and the like for supporting the roofing system. The specimens are designed under uniformly distributed loading with simply supported condition. The research project aims to provide which method is economical, high bending strength, more load carrying capacity and high flexural strength.

2.1.5 K.JARMAI, J.FARKAS, Y.KUROBANE (2006) studied about Optimum seismic design of a multi-storey steel frame. An interior three-storey frame structure with a column and 4 beams in each floor was investigated. The welded box columns and rolled I-section beams were designed for minimum weight and cost.

III. METHODLOGY

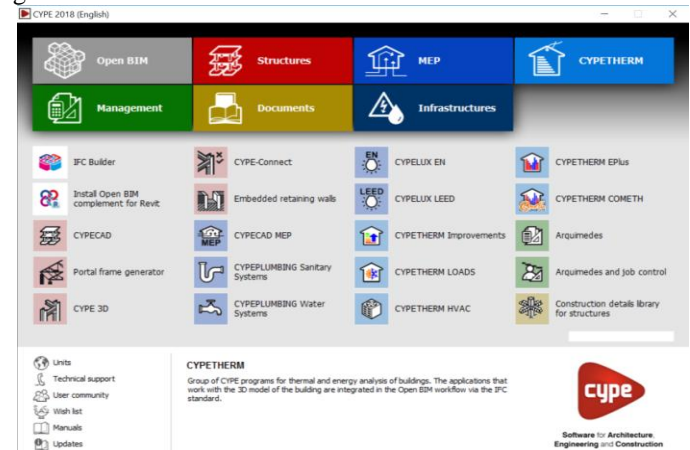
3.1 GENERAL

- Estimation of probable loads, based on the plan and elevation and the soil data from the geotechnical engineer
- Arrival of the structural system.
- Structural analysis (with the aid of computer and software)

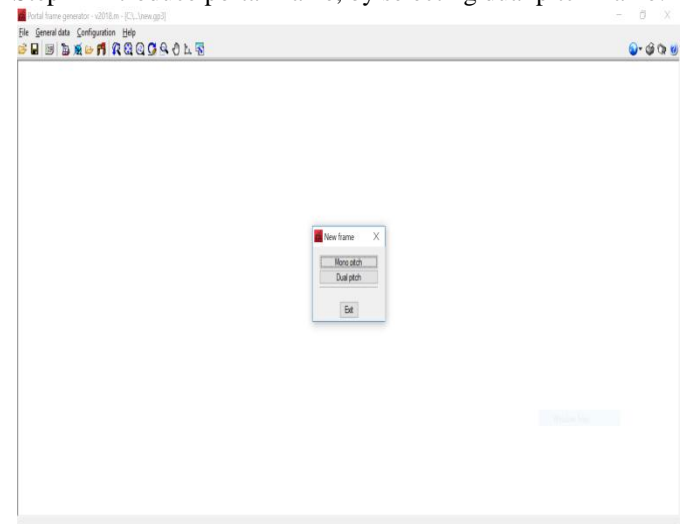
- Design of various elements based on codal provisions

3.2 STEPS INVOLVED IN METHODOLOGY

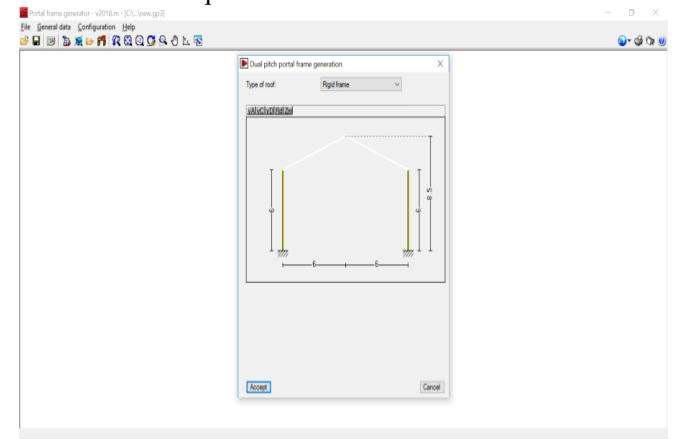
Step 1- Open CYPE software and select portal frame generator.



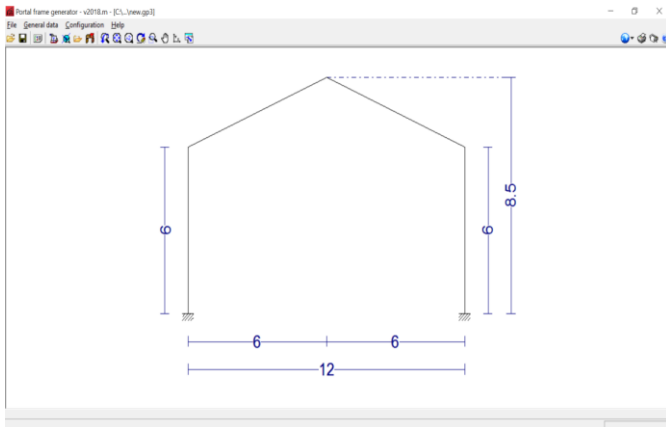
Step 2- Introduce portal frame, by selecting dual pitch frame.



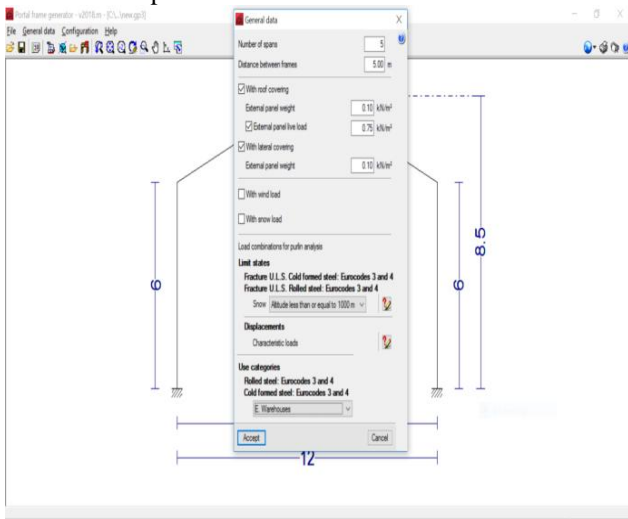
STEP 3-Now select the type of roof, from various option scrolled down.In this project we introduced Rigid frame.Once after the selection of frame assign the dimensions as required.



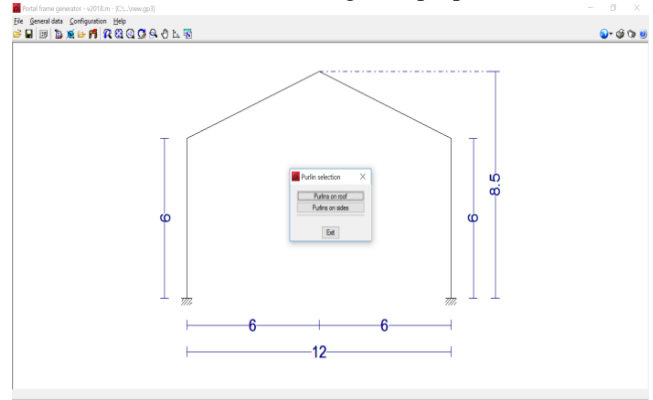
STEP 4-After the introduction of dimension, we get the below diagram.



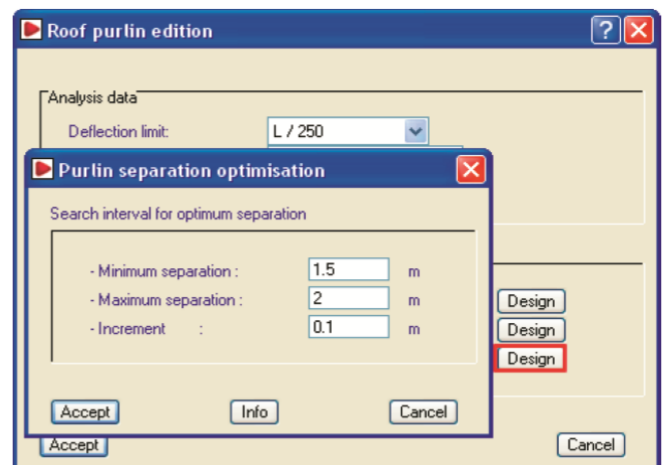
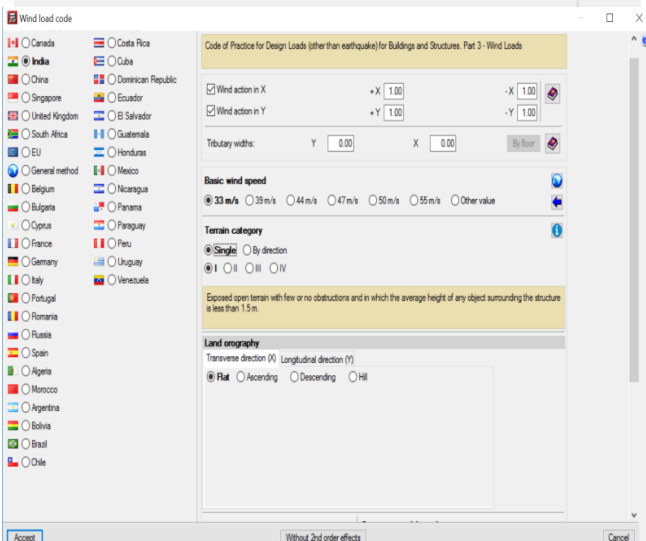
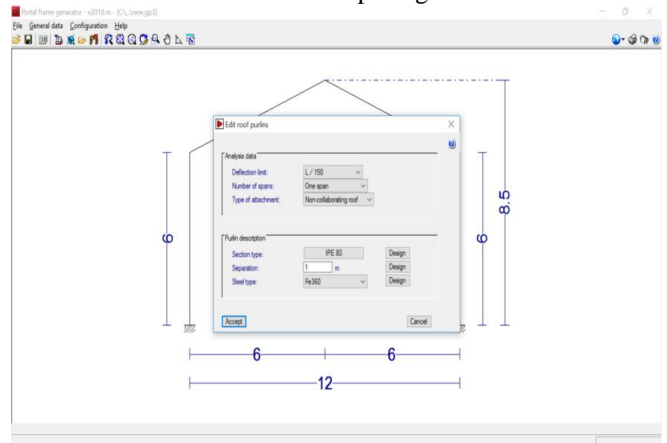
STEP 5- Select General data from the toolbar, and assign the Number of span required, with specified distance between the frames. Also assign the loads for Roof covering with external panel weight as 0.10KN/m², and a live load of 0.75KN/m² as per Codal provisions. Introduce lateral covering with GI sheets of panel weight 0.10kn/m². Assign the wind load to the specified region by considering the basic wind speed of the region, terrain category, Design life of warehouse, Structure class. Also assign the Use categories as Warehouse. And click Accept.

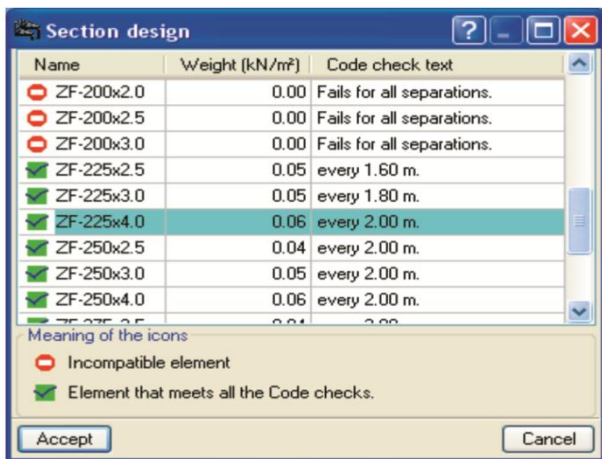


STEP 6- Select General data aand Purlin selection. Now Select the Purlins on roof to assign the properties of Purlins.

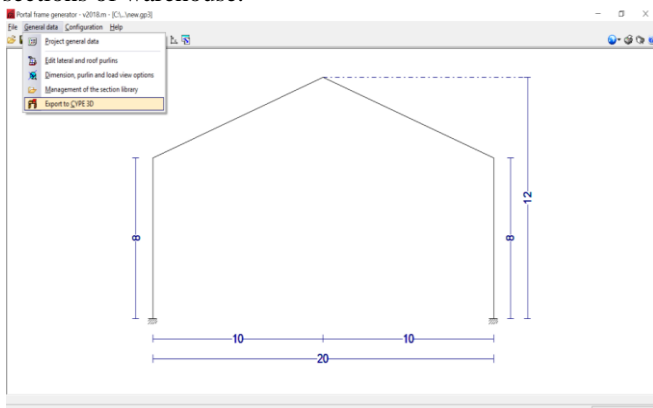


STEP 7- Edit the roof Purlins by assigning the deflection limit, number of spans, and default type of attachment for non-collaborating roof. In Purlins description select the section type, separation of the Purlins, steel type. After selection we need to run the design and check for the safer section selection. The advantage of this software is it takes the section given by the user and compares, with all the other sections in steel Table and gives the best possible output with the maximum percentage efficiency. This software also checks for best and economical spacing between the Purlins.

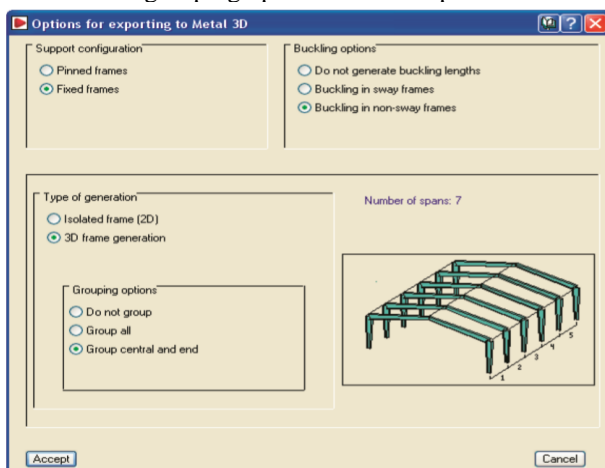




STEP 8- After the completion of assigning the data of loads and Purlins, export to CYPE 3D for the analyzing the sections of warehouse.



STEP 9- Before exporting to CYPE 3D the software asks for the support configuration, Buckling option, type of generation and grouping options. And accept.



STEP 10 –
The main steps that now have to be carried out in CYPE 3D is:

- Describe the sections
- Describe the nodes
- Check for economical and safer section by running the analysis.
- Assign the connections

- Describe the Foundation
- Generate the reports

3.3 DESIGN CODES

Many countries have their own structural design codes, codes of practice or technical documents which perform a similar function. It is necessary for a designer to become familiar with local requirements or recommendations in regard to correct practice. In this chapter some examples are given, occasionally in a simplified form, in order to demonstrate procedures. They should not be assumed to apply to all areas or situations.

- IS: 800-2007: General Construction in Steel - Code of practice
- IS: 875 (Part 1): - 1987 Code of Practice for Design Dead Loads
- IS: 875 (Part 2): - 1987 Code of Practice for Design Imposed Loads
- IS: 875 (Part 3): - 1987 Code of Practice for Design Wind Loads
- Steel Tables Manual

IV. CONCLUSIONS

Steel is such a versatile material that every object we see in our daily life has used steel directly or indirectly. There is no viable substitute to steel in construction activities. Steel remains and will continue to remain logical and wide choice for construction purpose, environmentally also, as much of the steel used is recycled. Steel building offers more design and architectural flexibility for unique or conventional styling. Its strength and large clear spans mean the design is not constrained by the need for intermediate support walls. As your requirements changes over the years, you can reuse, relocate, & modify the structure. Using of Steel structures instead of RCC may be reducing the material quantity and thus reducing the construction cost and Reduction in the steel quantity definitely reducing the dead load. Reduction in the dead load reducing the size of Foundation. And reduction is all but not the performance and life span is the unique property of Steel structures and using Steel increase the Aesthetic view of structures.

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