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Design Detailing of Steel Structure by Using BOCAD Software

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Abstract— **This project explores the application of BoCad software for the precise detailing of steel structures, emphasizing its capabilities in generating 3D models, shop drawings, assembly diagrams, and bills of materials (BOM). The study evaluates BoCad's effectiveness in enhancing accuracy, optimizing fabrication workflows, and streamlining project execution.**

Key aspects include load-bearing analysis, connection design, and erection planning, ensuring compliance with industry standards. The interoperability of BoCad with BIM platforms is also assessed to demonstrate seamless collaboration across disciplines. Comparative analysis highlights the software's efficiency over traditional detailing methods in terms of time and cost.

The outcomes aim to validate BoCad's role in improving detailing accuracy, reducing material waste, and accelerating project delivery, offering practical insights for structural engineering applications.

I. INTRODUCTION

Steel structures are assemblies of interconnected members designed to withstand axial forces, bending, torsion, or their combinations, depending on member orientation. They are widely used in industrial facilities, commercial warehouses, public buildings like stadiums and transport terminals, railway bridges, and towers. Structural design involves determining member sizes, shapes, and connections using three key design approaches: Working State Method (WSM), Ultimate Load Method (ULM), and Limit State Method (LSM).

Pre-engineered steel buildings (PEBs) have become prevalent due to their rapid construction and cost efficiency. Manufactured components, including built-up, hot-rolled, and cold-formed sections, are assembled on-site, creating airtight, energy-efficient structures with optimized material use.

Accurate steel detailing is essential for ensuring structural integrity and safety. Advanced software like BoCad has revolutionized this process by providing precise 3D modeling, automated shop drawings, and bill of materials (BOM) generation. BoCad's intuitive interface and extensive functionalities enhance detailing accuracy, reduce errors, and streamline fabrication workflows.

This project investigates BoCad's capabilities by applying its features to detail a specific steel structure. Challenges faced and corresponding solutions will be analyzed to demonstrate BoCad's adaptability in complex configurations. The study aims to highlight how the software enhances accuracy, optimizes material use, and reduces project timelines, serving as a valuable resource for civil engineering professionals and students in advanced structural detailing.

II. OBJECTIVES

- To develop the design sheets by using advanced Excel
- To validate the design sheets developed with the manual calculation.
- To do detailed analysis of the steel structure by using BoCad software

III. METHODOLOGY

In this project we are Designing the steel structure that is truss.

- Definition of Truss:

A truss is a structural framework made up of straight members connected at their ends to form a stable structure. These members are usually arranged in interconnected triangles, which provide rigidity and efficiently transfer loads. Trusses

are commonly used in bridges, roofs, towers, and other structures to support loads over a span.

Types of Truss:-

Trusses can be classified based on their shape and application. Common types include:

1. Based on Geometry:

a. Pratt Truss
b. Howe Truss
c. Warren Truss
d. King Post truss
e. Queen Post Truss

2. Based on Application:

a. Roof Trusses
b. Bridge Trusses

We are Designing the truss by using bocad software and it is howe truss. The dimensions are the
L= 40m W= 20m H= 10m

And Design various components like purlins, long chord, bottom chord, sling, strut etc we are using manual calculation according to load we calculate various force and strength according to member. We design the various components and then we formalized that manual calculation. In excel and generate the format for better use and accurate results and then by using this calculation. In Bocad software we generate the model.

1. Model Creation

Input Geometry: Define the structural geometry including beams, columns, trusses, and bracings. Material and Section Properties: Assign steel grades and cross-sectional profiles (e.g., I-beams, channels). Load Application: Apply dead loads, live loads, wind, seismic, and other relevant load combinations.

2. Structural Analysis

Finite Element Analysis (FEA): BOCDA uses FEA to compute internal forces, moments, displacements, and reactions. Load Combinations: Perform analysis under multiple load cases as per design codes (e.g., IS 800, AISC, Eurocode).

3. Design Checks

Code Compliance: Perform limit state design checks including strength, stability, and serviceability. Member Verification: Check sections for axial forces, bending moments, shear, and combined actions.

4. Connection Design

Bolted/Welded Joints: Design of connections including gusset plates, base plates, and stiffeners. Detailing Standards: Follow standards for edge distances, hole diameters, and weld sizes.

5. Detailing and Drafting

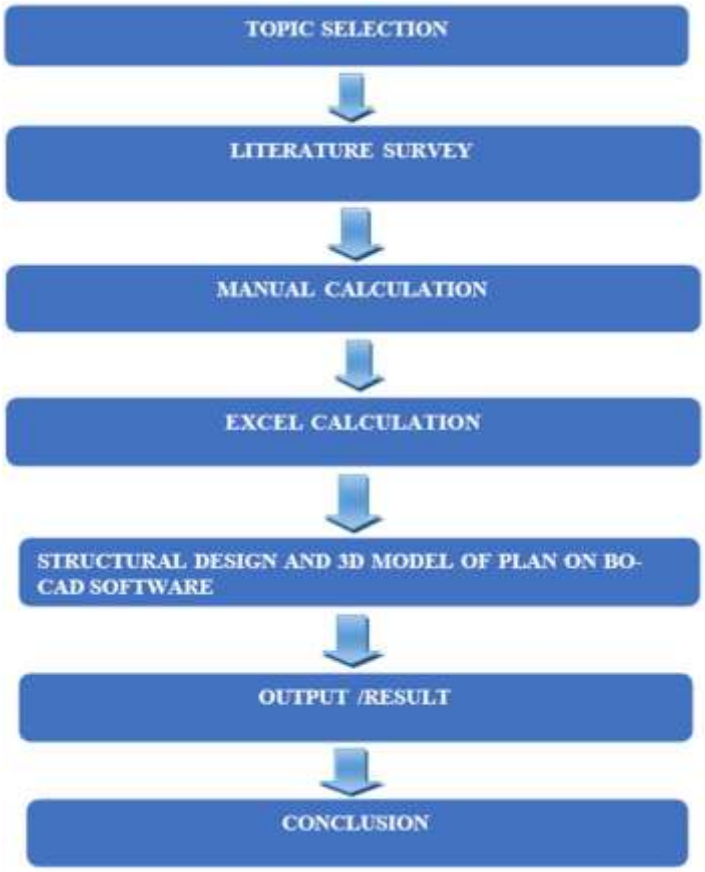
Shop Drawings: Auto-generate detailed drawings with dimensions, sections, and fabrication notes. BOM Generation: Produce Bill of Materials (BOM) including weights, lengths, and material types.

6. Reporting and Documentation

Design Reports: Generate calculation reports and structural verification outputs. Revisions: Easily update models and regenerate drawings upon changes.

Summary
BOCDA streamlines the entire steel structure workflow from modeling to detailing, ensuring compliance with design codes, improving accuracy, and reducing drafting time with its automated features.

WORKFLOW

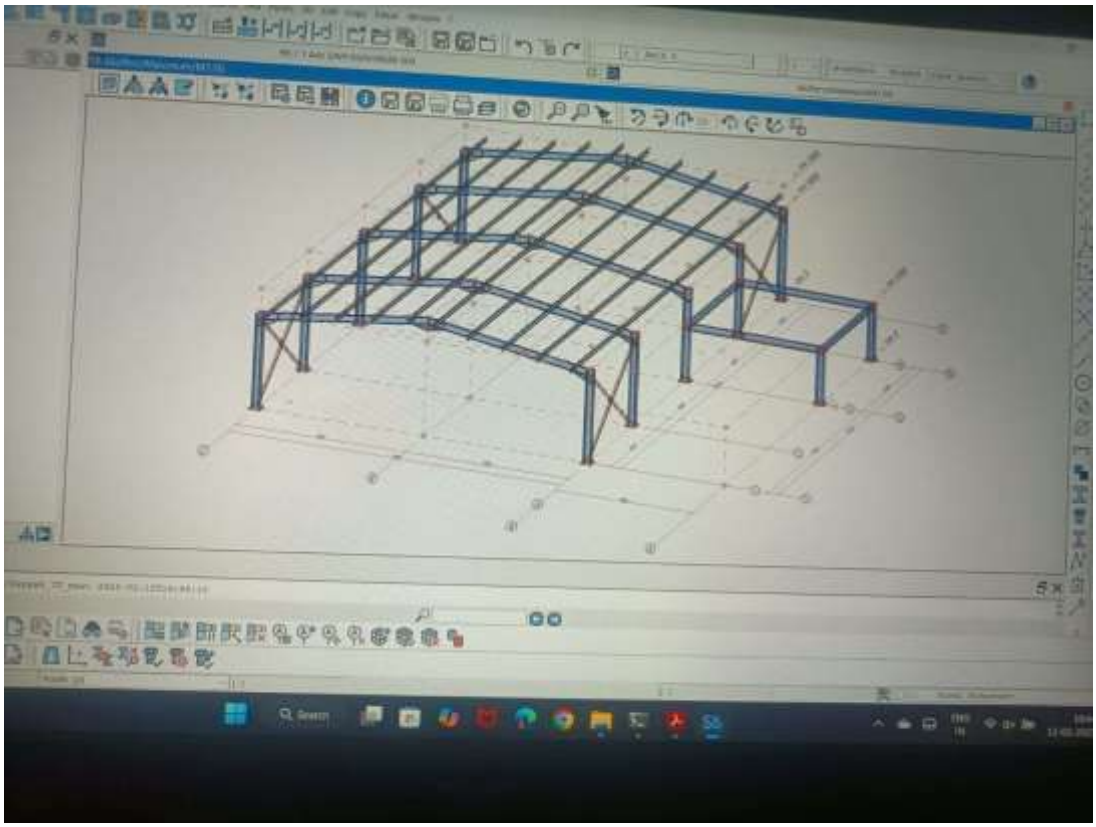


IV. ANALYSIS

Sr.No.	Name Of Member	Values
1	Top chord	Ag Req =568mm^2
		Ag provided =568mm^2
		Length of weld=121.622mm
		Tdg=129.09 KN
		Tdn =162.783KN
		Tdb=184.312KN
		Ag req=571.978mm^2
		Ag Pro=575mm^2
		Design comopressive strengrth pd=105.225KN
		Length of weld L1=41.135mm L2=94.475mm
		Tdg=130.68KN

2	Bottom chord	Tdn=160.273KN
		Tdb=177.53KN
3.	Design of slings	Ag req=485.386mm^2
		Ag pro=626mm^2
		Fcd=68.5909N\mm^2
		Pd=42.937KN
		Lw=65.096mm
		Tdg=142.172KN
		Tdn=165.918KN
		Tdb=141.567KN
3	Design of Struts	Ag req=98.9714mm^2
		Ag pro=447mm^2
		Lw=37.708mm
		Tdg=101.590KN
		Tdn=119.636KN
		Tdb=93.105KN
		Fcd=47.665N\mm^2
		Pd=21.306KN
4	Design of Purlin Load combination 1	LL= 0.4188 kn/m^2
		DL= 0.180 kn/m^2
		WL= 1.115 kn/m^2
		Wz= 1.2573 kn/m
		Wy= 0.286 kn/m
		Mz= 1.9252 kn/m
		My= 0.9624 kn/m
		Zpz(req)= 17.645x$10^3$$mm^3$
		Zpz prov=58.71x10^3 mm^3
		Vdz=52.486x10^3n
		Vdy=141.7 kn
5	Design of Purlin Load combination 2	Mdz=13.31x10^6n\mm
		Mdy=4.68Knm
		DL=0.27kn\m^2
		WL=2.615 KN/m
		Wz=-2.2396KN\m
		Wy=0.1889 KN\m
		Mz=-3.4294 KN\m
		My=0.2892KN\m
		Mdy=7.048x10^6Nmm
		Mdz=2.472x10^6Nmm
		Delta1=5.33mm
		Delta2=8.497mm

V. RESULTS



VI. CONCLUSIONS

This project evaluates the effectiveness of BoCad Software in structural detailing of steel structures, emphasizing its advanced modeling and detailing capabilities. BoCad's 3D modeling, automated connection detailing, and fabrication integration enabled the creation of precise drawings, minimizing fabrication and assembly errors.

The software's visualization and simulation features facilitated early detection and resolution of design issues, ensuring robust structural solutions. By enhancing accuracy and reducing detailing time, BoCad optimized overall project workflows.

The study highlights the critical role of accurate detailing in structural integrity and safety. BoCad's implementation streamlined the design-to-construction transition, contributing to efficient project delivery and cost management. With the industry's increasing adoption of digital solutions, mastering BoCad is essential for engineers to meet modern demands for accuracy, speed, and sustainability in infrastructure projects.

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