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Design And Estimation Of Led Billboard Using Tekla Software

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Abstract- This project focuses on the design and estimation of an LED billboard using Tekla Structures software. LED billboards are widely used for digital advertising due to their high visibility, energy efficiency, and long service life. The study involves the structural design of the billboard using steel components such as columns, beams, bracings, and base connections to ensure strength, stability, and safety under various loading conditions. Tekla software is used for 3D modeling, detailing, quantity estimation, and preparation of fabrication drawings. The project also includes estimation of construction materials such as steel, concrete, bolts, and foundation requirements to determine the overall project cost. By using BIM technology, manual errors are reduced and project accuracy and efficiency are improved. The proposed design ensures durability, economical construction, and effective structural performance for modern advertising applications. Different loads acting on the structure are considered to ensure safety and durability. Tekla software helps to reduce manual errors and improves accuracy in design and estimation. The main objective of this project is to create a safe, economical, and efficient LED billboard structure using modern BIM technology.

Keywords— LED Billboard, Steel Structure, BIM, Estimation, Structural Design, Tekla Structures Software.

I. INTRODUCTION

LED billboards have become one of the most popular methods of digital advertising in modern cities and highways. Compared to traditional advertisement boards, LED billboards provide better visibility, bright display quality, low power consumption, and longer service life. These billboards are widely used in commercial areas, transportation hubs, shopping malls, and public places for displaying advertisements, announcements, and promotional content. Due to their large size and outdoor installation, proper structural design is necessary to ensure safety, stability, and durability under different environmental conditions.

The design of LED billboard structures mainly involves the use of steel components such as columns, beams, bracings, and base connections. These structural elements must be capable of withstanding various loads including dead load, wind load, and live load. In this project, Tekla Structures software is used for creating accurate 3D models of the billboard structure. The software helps engineers to prepare detailed drawings, connections, and fabrication details with high precision. It also reduces manual drafting errors and improves the overall efficiency of structural planning and execution.

Estimation is another important part of billboard construction because it determines the quantity of materials and the overall project cost. The project includes estimation of steel quantity, concrete foundation, bolts, and other construction materials required for fabrication and installation. By using Tekla software, quantity take-off and cost estimation can be completed quickly accurately. The main objective of this project is to design a safe, economical, and efficient LED billboard structure using modern BIM technology and advanced structural modeling techniques.

II. MATERIALPROPERTIESM AND MIX DESIGN

General

LED billboards are widely used for dynamic advertising and public displays, requiring strong and efficient structural support systems. Proper design and estimation are crucial to ensure safety, durability, and cost-effectiveness. This project focuses on the design and estimation of an LED billboard structure using Tekla Structures, a leading Building Information Modeling (BIM) software. Tekla enables accurate 3D modeling, detailing, and material takeoff, reducing manual errors and improving project efficiency. By utilizing Tekla, this study aims to demonstrate a streamlined approach to structural design and cost estimation, enhancing the planning and execution of billboard installation projects.

III. PLANNING

INTRODUCTIONOF BIM

Traditional In the modern era, visual communication plays a crucial role in advertising, information sharing, and urban aesthetics. Among various mediums, LED billboards have emerged as one of the most effective and widely adopted platforms for digital advertising due to their high visibility, energy efficiency, and dynamic display capabilities. Unlike traditional billboards, LED-based structures demand careful consideration not only in terms of electrical design but also in terms of structural stability, durability, and cost- effectiveness.

TEKLASTEELSTRUCTURES

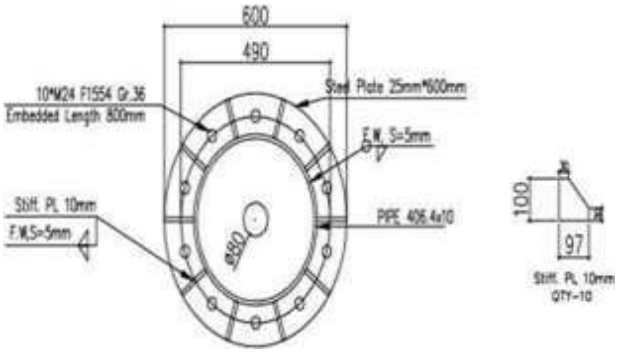
Tekla Structures is an advanced Building Information Modeling (BIM) software developed by Trimble, widely used in structural engineering, construction, and steel detailing. It enables engineers to create accurate 3D models of concrete and steel structures, perform clash detection, generate shop drawings, and prepare precise quantity take-offs for cost estimation. Tekla supports the entire project lifecycle— from design and detailing to fabrication and erection—enhancing accuracy and efficiency.

Input of Frame Structure

The design and estimation of an LED billboard using Tekla Software involves creating a detailed 3D model of the supporting frame structure, including columns, beams, plates, and connections. Key inputs include billboard dimensions, panel load, wind pressure, support type, and material specifications. Tekla enables accurate modeling of members, connections, and assemblies, ensuring structural stability and code compliance.

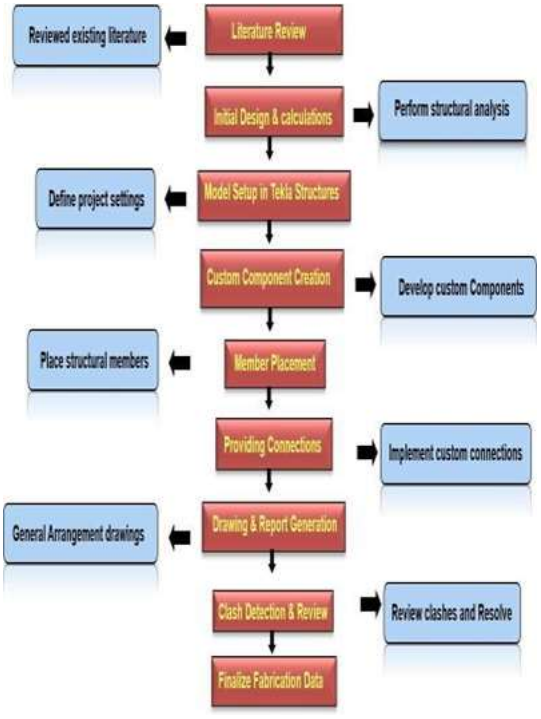
Baseplate Arrangement

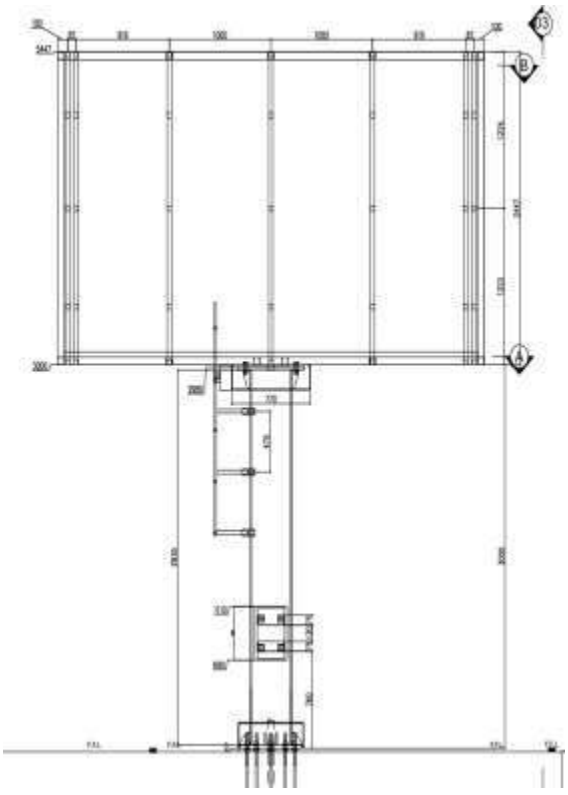
The baseplate arrangement is a crucial component in the design of an LED billboard frame structure, as it connects the supporting column to the foundation while ensuring the safe transfer of loads. A baseplate is generally fabricated from a thick steel plate, rectangular or square in shape, and welded to the bottom of the column. The plate rests on the concrete pedestal and is anchored using high-strength bolts embedded into the foundation. Its dimensions, thickness, and bolt layout are determined based on the magnitude of axial loads, bending moments due to wind pressure, and shear forces acting on the structure. To enhance rigidity, stiffener plates are often welded between the column and the baseplate, preventing local buckling and distributing stress uniformly.



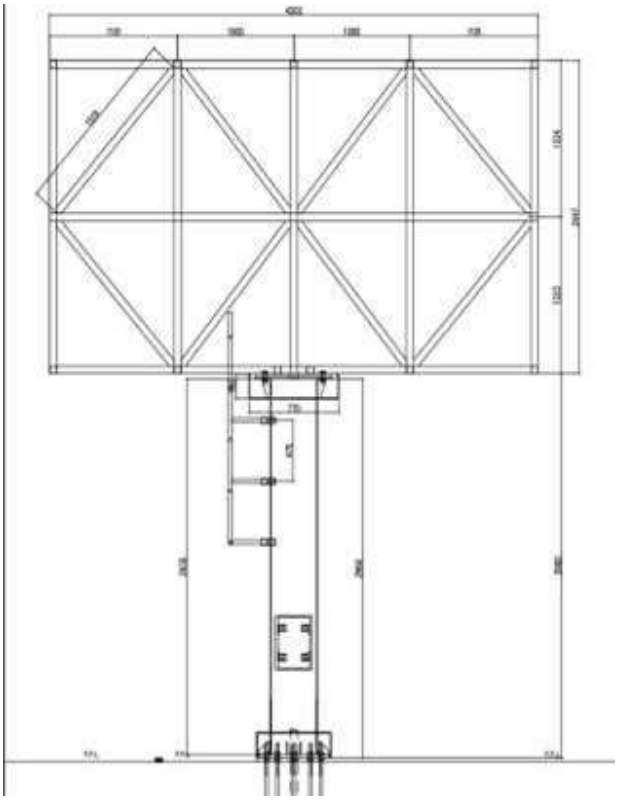
Baseplate Arrangement

IV. METHODOLOGY



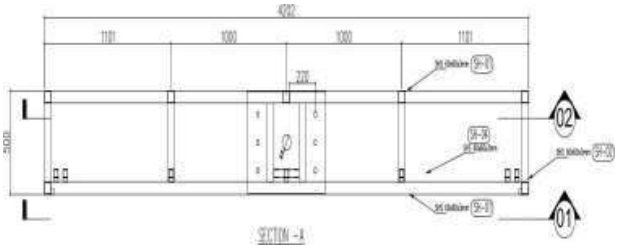


Frontside View of LED Billboard

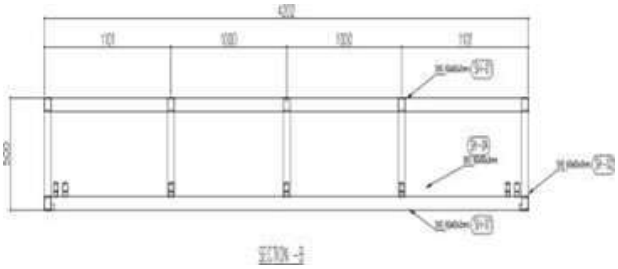


Backside View of LED Billboard

Sectional views



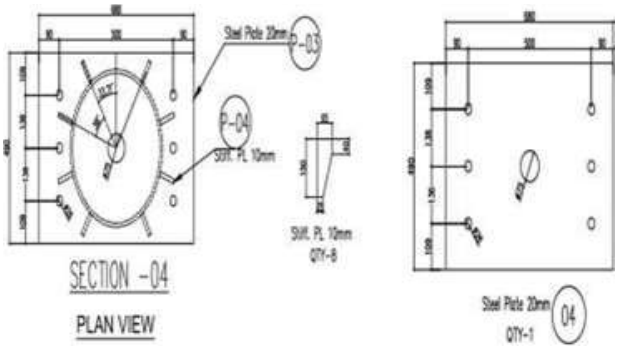
Section A



Section B

Seating Plate Arrangement

The Seating Plate Arrangement in Tekla for Billboard Structures is designed to provide a stable and secure connection between the vertical supporting columns and the foundation. In Tekla, seating plates are modeled with accurate thickness, dimensions, bolt holes, and weld details to ensure proper load transfer from the billboard frame to the base. The arrangement typically includes anchor bolts, stiffeners, and gusset plates for additional strength and stability. By using Tekla's detailing features, designers can visualize clashes, optimize fabrication, and ensure accurate placement on-site. This enhances structural reliability, ease of installation, and long-term durability of the billboard support system



Seating Plate Arrangement PROJECT

V. IMPLEMENTATION INPUT OF DATA

The Designand Estimation of LED Billboard using Tekla Software involves creating a 3D structural model with accurate member sizes, seating plates, baseplates, anchor bolts, and stiffeners. Tekla enables detailed modeling of the billboard frame, LED panel supports, and electrical box holders.

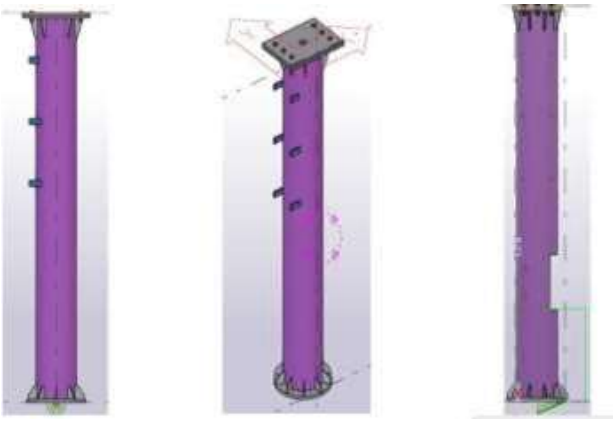
Grid Properties

Grid properties in Tekla Structures define the reference framework used for positioning and aligning structural elements in a model. They consist of horizontal and vertical grid lines that form a 3D coordinate system. Grid properties include details like grid spacing, labels, coordinates, and extensions, helping ensure accurate placement, modeling, and coordination of structural components throughout the project.

Grid Properties

Column Assembly

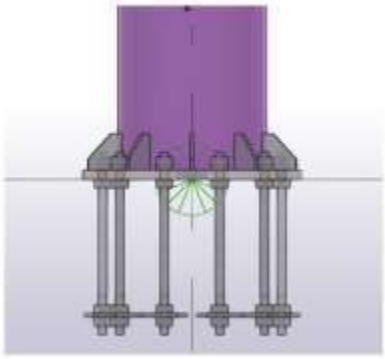
A column assembly in Tekla Structures refers to a complete fabricated unit consisting of a main column member along with all its attached components such as base plates, stiffeners, cleats, end plates, and bolts. It represents how the column will be manufactured and assembled in the workshop before erection on-site.



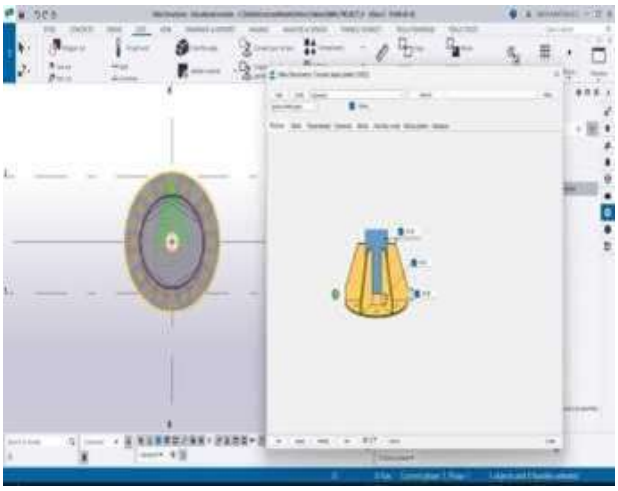
Column Assembly Anchor Rods

Anchor rods are steel rods used to connect structural elements, such as columns or base plates, securely to concrete foundations. They transfer loads from the steel structure to the concrete base, providing

stability, alignment,and resistanceagainstupliftorshear forces.



AnchorRods



Baseplate Placement

Sectional views

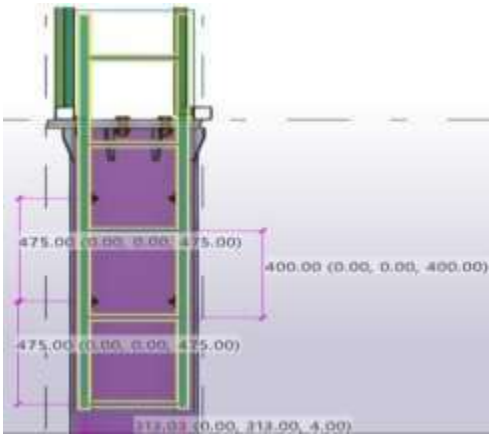
Sectional views are technical drawings that show the interior details of an object or structure by cutting through it along a chosen plane. In Tekla Structures (and general drafting), sectional views help reveal hidden parts, such as reinforcements, welds, or internal connections, that are not visible in standard views.

Section A

Section B

Ladder Assembly

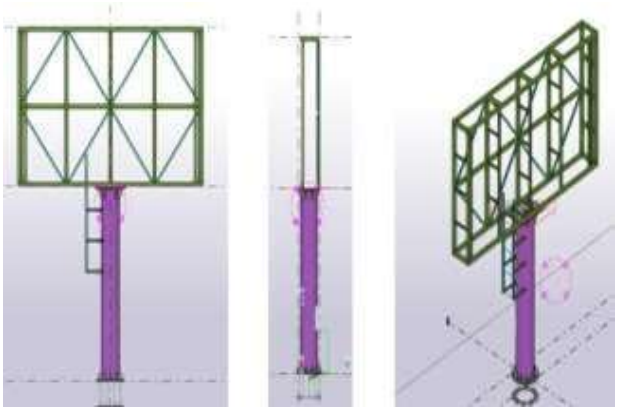
ladder assembly in Tekla Structures is a complete modeled unit that includes the main stringers (side rails), rungs (steps), and support brackets or hoops. It represents the fabricated ladder as it will be built and installed on the structure. Ladder assemblies are used to provide safe access to platforms, roofs, or maintenance areas and are detailed in assembly drawings.



Ladder Assembly

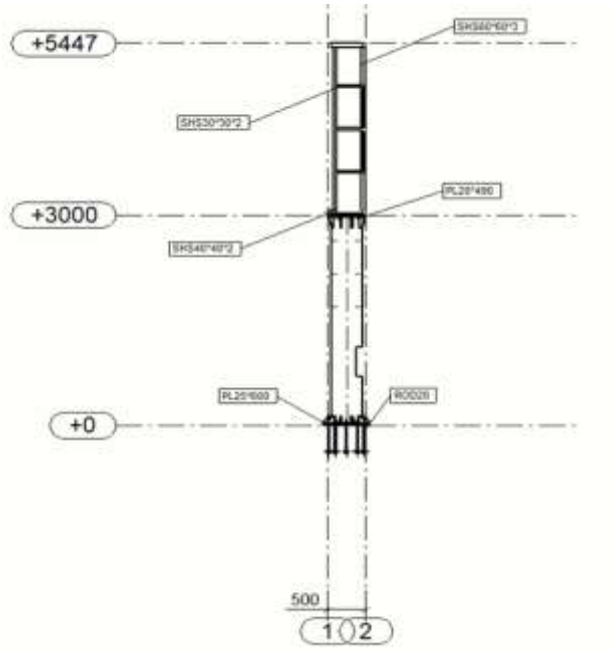
LED Billboard

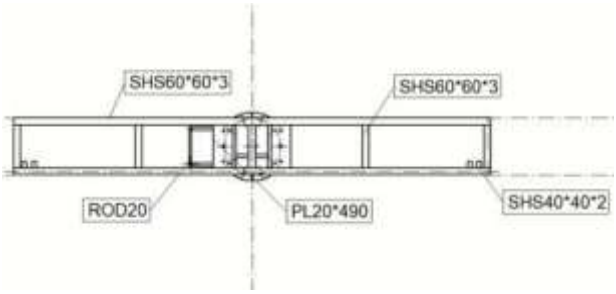
The Final Output 3D view of the LED Billboard as per all the inputs given above



VI. GENERAL ARRANGEMENT DRAWINGS

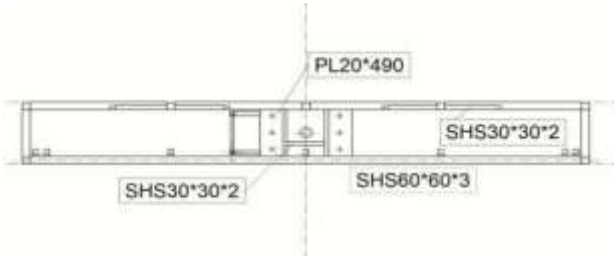
1. Detailing at Grid B





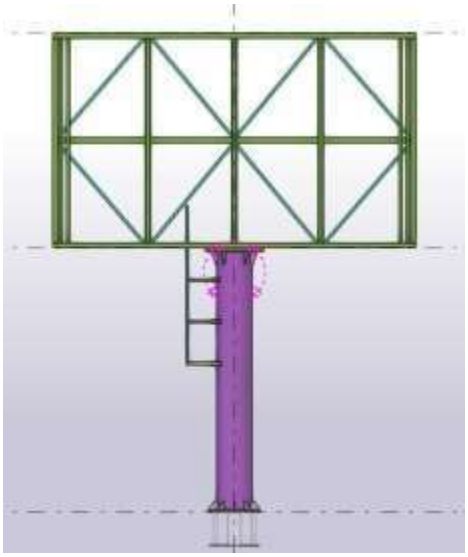
Top View

Detailing at Plan +3m



@ Plan +3m

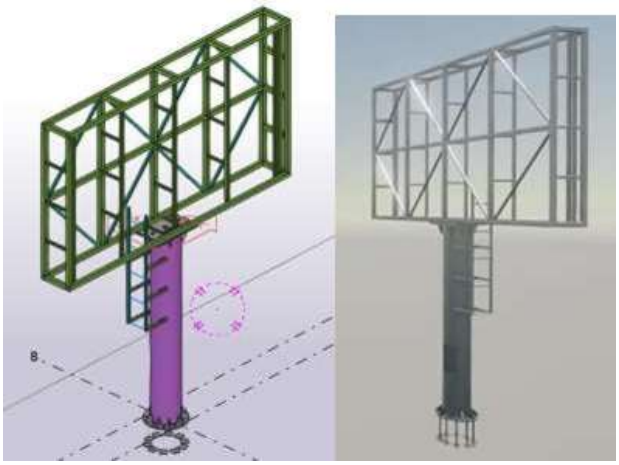
REALTIME IMPLEMENTATION



Front View

Visualized View

3D View



3D View

VII. CONCLUSION

The design and estimation of an LED billboard using Tekla Software provides a comprehensive and efficient approach to developing safe, economical, and durable structures. By creating a precise 3D model, the frame structure, including columns, beams, baseplates, stiffeners, and connections, can be accurately represented. Tekla not only helps in visualizing the complete structure but also ensures that the design meets structural stability and code requirements under loads such as self-weight, wind pressure, and panel weight. The software further enables the generation of detailed fabrication drawings, material take-offs, and estimation reports, which include steel weight, bolt quantities, weld lengths, and surface areas for finishing.

This integrated workflow reduces errors that may arise in manual calculations, minimizes material wastage, and ensures clarity in fabrication and erection. The ability to link design with estimation provides cost-effective solutions and facilitates smooth execution from planning to construction. Moreover, Tekla's detailed output enhances communication among designers, fabricators, and contractors. Overall, using Tekla Software for LED billboard design and estimation improves accuracy, saves time, and ensures safety, making it an effective tool for modern structural engineering applications.

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7. Trimble Solutions Corporation (2024) – Tekla Structures User Assistance
This official guide provides practical instructions on modeling, detailing, and estimation within Tekla. It is highly relevantfor learning baseplate connections, seating plate arrangements, and the use of custom components.
8. IS 800:2007 – General Construction in Steel
This Indian Standard code governs the design of steel structures, covering limit state and working stress methods. For LED billboards, it helps in selecting safe column, beam, and bracing sections.
9. IS 875 (Part 3): 2015 – Wind Loads on Buildings and Structures Since billboards face significant wind pressure, this code is crucial for load calculation and structural stability. It defines design wind speed, terrain categories, and pressure coefficients.

10. IS 456:2000 – Plain and Reinforced Concrete
This standard ensures safe design of the billboard foundation
and anchor bolt embedment in reinforced concrete bases.

11. AISC Steel Construction

Manual (15th Edition) A widely used international reference providing design tables, connection details, and guidelines for structural steel members. It supplements IS codes for advanced analysis.

12. Eurocode 3 (EN 1993-1-1:2005) – Design of Steel Structures Provides European standards for steel design, focusing on strength, stability, and serviceability. Useful for comparative studies or when designing billboards for global practices.

13. Eurocode 1 (EN 1991) – Actions on Structures Defines actions like wind, snow, and temperature loads. For billboards, Eurocode 1 guides load combinations and safety checks.