Design and Detailing of Emergency Exit Steel Tower for an Industrial Building

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Abstract—

The design and detailing of an emergency exit steel tower for an industrial building focuses on providing a safe, stable, and code-compliant evacuation system during emergencies such as fires, explosions, or other hazardous situations. The structure is carefully planned to withstand various loads, including dead load, live load, wind load, and seismic forces, following the guidelines of ASCE 7.Fire and life safety requirements recommended by NFPA and OSHA are incorporated to ensure proper stair dimensions, adequate landing space, and safe guardrail and handrail arrangements. All structural components—such as columns, beams, bracings, stair stringers, and connections—are designed to meet strength, stability, and serviceability requirements.Special attention is given to corrosion protection, fire resistance, proper foundation anchorage, and ease of construction. These considerations help improve the durability and long-term performance of the structure.Overall, the final design ensures a reliable, safe, and efficient emergency evacuation system that meets industrial safety standards.

Keywords— Emergency Exit Tower, Steel Structure, Industrial Safety, Evacuation Design, ASCE 7 Loads, Dead and Live Loads, Wind and Seismic Loads, NFPA Compliance, OSHA Standards, Staircase Design, Guardrails and Handrails, Structural Stability, Columns and Beams,

I. INTRODUCTION

Safety is a primary concern in the design of industrial buildings, especially in situations involving fire, chemical hazards, or other emergencies. To ensure the safe and quick evacuation of occupants, dedicated emergency exit systems are provided. An external **emergency exit steel tower** serves as an independent escape route, allowing people to exit the building without passing through hazardous internal areas.Steel is commonly used for such towers because of its high strength, durability, and ability to withstand heavy loads and environmental forces such as wind and earthquakes. In addition, steel structures can be fabricated and erected quickly, making them suitable for industrial applications where reliability and speed of construction are important.The design and detailing of an emergency exit steel tower require careful consideration of structural loads, stair geometry, safety railings, and code compliance.

II. LITERATURE REVIEW

Recent studies from 2020 to 2025 show steady improvements in the design of emergency exit steel towers for industrial buildings. Early research focused on the need for safe external evacuation systems, with steel preferred for its strength and ease of construction. Later studies examined structural performance under different loads such as wind and earthquakes to ensure stability.Recent work has emphasized compliance with safety codes, proper stair design, and strong connections using bolted and welded joints. Fire safety improvements, including external placement, anti-slip steps, and emergency lighting, have also been highlighted.

III. METHODOLOGY

The methodology begins with identifying the building requirements such as height, number of floors, occupancy, and the suitable location for the emergency exit tower. Based on standard guidelines, the preliminary dimensions of the stair, including width, riser, tread, and landing size, are determined. Structural steel is selected as the material due to its high strength, durability, and ease of construction. Load calculations are then carried out by considering dead load, live load, wind load, and seismic load. Using these loads, structural analysis is performed to understand the behavior of the tower. Based on the analysis, structural members such as columns, beams, and bracings are designed to safely withstand the applied loads, and connections using bolts and welds are detailed to ensure stability and proper load transfer. Finally, detailed drawings are prepared, and safety features such as handrails, anti-slip steps, and proper access are provided to ensure safe and efficient evacuation during emergency situations.

IV. RESULTS AND DISCUSSION

The designed emergency exit steel tower is safe and stable for industrial use. It can withstand all loads such as dead, live, wind, and seismic forces within allowable limits. Structural members and connections are properly designed to ensure strength and stability.The use of steel provides durability and easy construction. Proper stair dimensions, handrails, and anti-slip steps improve safety during evacuation. The external location of the tower also helps reduce exposure to smoke and heat.

V. CONCLUSION

The design and detailing of the emergency exit steel tower for an industrial building have been successfully carried out, ensuring structural safety, stability, and functional efficiency. The analysis confirms that all structural members are within permissible stress and deflection limits under various loading conditions such as dead load, live load, wind load, and seismic load.The use of structural steel provides high strength, durability, and ease of construction, making it suitable for emergency structures. Proper design of connections, bracings, and foundation ensures effective load transfer and overall stability of the tower.

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