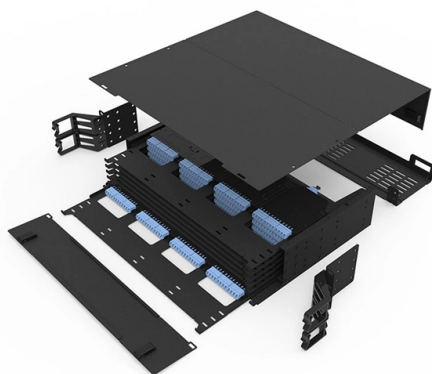


Bridge-type tension frame



Overview

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Key Takeaways

Bridge-type tension frames are structural elements in bridges, such as truss members or cross frames, designed to resist axial tension and provide lateral stability to the superstructure. Overview of Tension Frames in Bridges

In steel bridges, tension frames are critical for maintaining structural integrity under live loads, dead loads, and environmental forces. These frames are typically part of truss bridges, where members are arranged to carry either axial tension or compression depending on their position and the type of truss used. The top chords of a truss generally carry compression, while the bottom chords carry tension. Diagonal and vertical web members may carry tension, compression, or both, depending on the truss configuration.

Common Truss Types and Tension Members

- Pratt Truss: Diagonal members face inward and are primarily in tension, while verticals carry compression. This configuration is efficient for uniform loads and medium spans.
- Warren Truss: Diagonals alternate in direction, carrying tension and compression alternately along the span. Vertical members may be added to reduce panel size and handle point loads.

- Howe Truss: Diagonals lean outward and are in compression, while verticals are in tension, making it less suitable for long-span steel bridges .
- K-Truss: Features a K-shaped arrangement of verticals and diagonals, splitting diagonal forces and shortening the effective buckling length of compression members, while tension members stabilize the structure .

Cross Frames and Lateral Stability

In addition to trusses, cross frames are used to provide lateral stability to steel girder bridges. Common layouts include X-type, K-type, and Z-type cross frames. These members are designed to resist lateral forces, prevent buckling of girders, and transfer loads between adjacent girders . X-type and K-type cross frames are widely used in practice, while Z-type frames are under research for specialized applications. Cross-frame members are sized according to slenderness limits for tension and compression, ensuring both strength and stiffness .

Function and Design Considerations

Bridge-type tension frames serve several purposes:

- Resist axial tension in chords and diagonals under live and dead loads.
- Provide lateral stability to prevent buckling of compression members.
- Distribute loads across the bridge superstructure to adjacent members and supports.
- Enhance structural redundancy, allowing the bridge to remain stable even if some members are overloaded or fail . Materials for tension frames are typically rolled H-sections, square hollow sections, or fabricated box sections, depending on span length and load requirements . Proper design ensures that tension members are slender yet strong enough to carry axial forces without excessive deformation.

Summary

Bridge-type tension frames are essential components in truss and girder bridges, designed to carry axial tension, stabilize compression members, and distribute loads efficiently. Their configuration depends on the truss type, span, and load conditions, with cross frames providing additional lateral support. Understanding the role of tension members is crucial for safe and economical bridge design .

Article Content

Bridge Types Explained: Beam, Arch, Suspension, and Cable-Stayed

Each bridge form solves the span problem in a different way. This guide compares the structural mechanics, material

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