Bridge frame left and right bend construction

Article Overview

Bridge frames with left and right bends are constructed using bent columns and caps that transfer vertical and lateral loads from the superstructure to the foundation, with careful attention to geometry, reinforcement, and load distribution.

Frame Bridge Overview

Frame bridges are structural systems where vertical and horizontal members act together to transfer loads, similar to arches, and are particularly effective for smaller spans or grade separations. In bridges with bends, the frame action must account for curvature-induced forces, including torsion and lateral bending, in addition to vertical loads. Orthogonal or trapezoidal frames are commonly used for such configurations, while composite steel or concrete frames may be employed for longer spans due to cost and construction efficiency considerations .

Bent and Pier Design

Bents are intermediate supports consisting of columns and a bent cap beam that transfer loads from the superstructure to the foundation. For bridges with left and right bends, asymmetric bent configurations may be required to accommodate the curvature. Columns can be single, double, or multi-column, and may include web walls for additional stability. Hollow or integral piers are often used to reduce dead load and improve ductility, especially in seismic regions .

Bent Cap Considerations

o Drop Bent Cap: Supports girders directly on top; may use pinned or fixed connections to the superstructure .
o Integral Bent Cap: Integrally connected to the superstructure, providing a rigid frame action that resists bending and torsion from curved alignments .
o Reinforcement: Vertical and horizontal reinforcement must be designed to resist torsion, bending, and shear induced by the curvature. Columns on the inside of the bend may require heavier reinforcement due to higher compressive forces, while outside columns may experience tension or bending .

Construction Techniques
o Geometry Layout: Accurate survey and layout are critical to ensure the left and right bends align with the design curvature. Templates or formwork may be used for curved bent caps.
o Column Construction: Columns can be cast-in-place or precast, with post-tensioning applied if necessary to improve structural continuity and reduce cracking. Hollow or segmented columns may be used for ease of transport and assembly .

o Bent Cap Placement: Bent caps are typically cast-in-place or precast and connected to columns using shear keys, high-strength rods, or post-tensioning to ensure load transfer and frame action .
o Superstructure Integration: Girders or slabs are placed on the bent caps, with connections designed to accommodate curvature-induced torsion and lateral forces. Temporary falsework may be required for stability during construction, especially for inclined or curved frames .

Key Considerations for Curved Frames

o Load Distribution: Curved frames introduce torsional moments; design must account for uneven load distribution across columns.
o Reinforcement Detailing: Columns and caps must be reinforced to resist combined bending, shear, and torsion.
o Construction Sequencing: Proper sequencing ensures stability; often, bents are constructed first, followed by superstructure placement.
o Material Selection: Concrete is common for bent frames, with steel reinforcement; composite steel-concrete frames may be used for longer spans .

By carefully designing bent caps, columns, and reinforcement, and by following precise construction sequencing, bridge frames with left and right bends can achieve structural stability, durability, and efficient load transfer.

The left side is in Dutch is framed as a dekbalkgebint (roof beam bent) and the right side is an ankerbalkgebint (anchor beam bent).

Research on the critical technique of synchronous rotation construction with large angle for T-shape curve rigid frame bridge

Design considerations for the drop bent cap, the integral bent cap, and inverted tee bent cap are presented. Two design examples

FOREWORD Heat straightening and heat curving have been effectively and routinely used for decades to fabricate steel bridge

A simple explanation of how bridges work, including descriptions of the many different

Wind loads, overhang construction, and stability bracing loads are commonly determined by simple hand calculation methods. The

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The "fit" or "fit condition" of an I-girder bridge refers to the deflected girder geometry associated with a specific load

The component of a bridge which supports the deck or riding surface of the bridge. The superstructure consists of the components

For the curved bridge example here, the tributary width is simply taken as the cross-frame spacing measured along the bridge

A rigid-frame bridge is a bridge in which the superstructure and substructure are rigidly connected to act as a continuous unit.

Similarly, a rigid-frame bridge integrates the superstructure and substructure (in other words, the deck, supports, and

The staged construction of composite bridges usually demands more extensive bracing, to stabilise the primary members before the

Cross frames in the 8th Edition Recent code changes have a significant effect on cross frame design for beam and girder bridges

Bridge Geometry Manual Publication No. FHWA-HIF-22-034 Infrastructure O ffice of Bridges and Structures

Skew bridges It is often not possible to arrange that a bridge spans square to the feature that it crosses, particularly where it is

The superstructure girders are framed into the bent cap and are supported indirectly by the bent cap. This type of the bent cap is

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