45-degree bridge structure at the bend



Overview

Main bent cap top reinforcement may be bundled vertically or horizontally wider than bent cap section. Vertical bundles should be avoided in post-tensioned/prestressed girder bridges.

Key Takeaways

A 45-degree bend in a bridge can be constructed using inclined cantilever posts, mitered connections, or segmented reinforced concrete elements to ensure stability, clear force transmission, and efficient load distribution.

Cantilever Reinforced Concrete Approach

One effective method is to use a 45-degree inclined cantilever reinforced concrete structure. In this approach: Outer cantilever batter posts are inclined outward at 45 degrees relative to vertical frame posts. The bottom of the inclined post is fixed to a vertical frame post, forming a stable triangular load path.

The top of the inclined post is connected to the front end of a top frame beam, while the bottom intersection is connected to a two-layer frame beam for additional support. A frame batter post is fixed on the opposite side to connect the rear end of the top frame beam, completing the structural loop. This configuration provides clear force transmission, reasonable stress distribution, and stability, while allowing for prefabrication and on-site splicing, reducing construction time and cost.



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Mitered Segment Method

For steel or precast concrete bridges, a miter bend can be used: The bend is created by cutting and welding multiple straight segments (called gores) at angles that sum to 45 degrees. Typically, a 4-piece miter bend includes two end segments and two middle segments, joined in a plane bisecting the bend angle. The number of segments and cuts depends on the bridge material, load, and pressure requirements.

This method allows for precise alignment and smooth directional change while maintaining structural integrity.

Geometric and Anchor Considerations

Accurate geometric layout is essential; bridge geometry manuals recommend detailed drawings and alignment checks to ensure the bend integrates with the overall bridge plan. For reinforced concrete elements, anchor design may follow the 45-degree cone method, which assumes a conical failure surface in concrete and ensures proper load transfer from the inclined elements to the foundation or adjacent structural members. Embedment depth, edge distance, and anchor group effects must be considered to prevent concrete fracture and ensure safety.

Practical Recommendations

Choose the method based on material: cantilever posts for reinforced concrete, mitered segments for steel or precast elements. Ensure proper alignment using detailed geometric drawings and temporary supports during construction. Use prefabricated components where possible to reduce on-site labor and improve quality control.

Check load paths and stress distribution to avoid excessive deflection or cracking. Incorporate anchors and connections designed according to the 45-degree cone or CCD method for reinforced concrete elements. By combining these approaches, engineers can construct a safe, stable, and economical 45-degree bend in bridge structures while maintaining structural performance and ease of construction.

Article Content

Thrust Block Design for 45° Bend

It details calculating forces on the block, sizing the block at 4.5m x 4.5m x 0.6m, checking bearing pressure and passive earth resistance, and determining that sliding and moment criteria are satisfied

15-19 Bridges With Skewed Supports

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For bridges on straight alignments with support skews exceeding 60 degrees and for curved concrete bridges with support skews exceeding 45 degrees, the designer should use a full three-dimensional

BDD Chapter 7 Bent

Main bent cap top reinforcement may be bundled vertically or horizontally wider than bent cap section. Vertical bundles should be avoided in post-tensioned/prestressed girder bridges.

Piping Elbows

In a piping structure without adequately support fluid flow and internal pressure may create intolerable forces and tensions. The resultant force - or required support force - on a thrust block - or an anchor -

Special girder bridges

The introduction of torsion, bending moments and shear forces at skew girder ends is outlined on the following slides, using equilibrium models (→ provide minimum reinforcement in all elements to

Bridge Geometry Manual

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

Bridge Inspection: Piers and Bents (BIRM)

A pier or bent is an intermediate substructure unit located between the ends of a bridge. Its function is to support the bridge at intermediate intervals with minimal obstruction to the flow of traffic or water

751.5 Structural Detailing Guidelines

The horizontal component is unitary for slopes greater than 45 degrees and the vertical component is unitary for slopes less than 45 degrees. The components in a slope ratio must be of

Special girder bridges

Bridges crossing obstacles at a right angle in plan are more economical than skew crossings (shorter bridge). Orthogonal crossings are usually also aesthetically preferable, particularly in case of river

90 mm pipe 45 deg | PDF

This document analyzes the thrust block parameters for a 90mm diameter pipe bent at 45 degrees. It calculates thrust values, soil and concrete weights, buoyancy forces, and passive soil resistance.

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Comprehensive Guide to Bend 45 Degree Pipe Fittings: Applications ...

Explore the essential role of bend 45 degree fittings in industrial and infrastructure systems worldwide. Learn about materials, applications, advantages, leading suppliers, and future trends.

Bend 45 degrees

The Bend 45 is a Silent Plus SWR pipe fitting connecting two sewage pipes or pipes with fittings in the plumbing system. It is a connection fitting with a specific

BDD Chapter 7 Bent

Length of ELEVATION should match the length along the layout line at centerline of bent (NOTE: For skewed structures, the skewed length is longer than the width of the bridge normal to the bridge

A Complete Guide On Bends in Pipes

A 45-degree bend provides a gentler change in direction compared to a 90-degree bend. It is often used when a smoother transition is required, reducing the potential for turbulence and pressure loss in

If the center bend of a 3-bend saddle is bent to 45 degrees ...

Understanding the Total Angle: In a structure with three bends, the total of those angles must sum up to 180 degrees, which represents a straight line. Identifying the Center Bend: We know

Bridge Geometry Manual

to specific geometric on presents terminology m governing characteristics It is highway noted that related to roadway is interchangeable are presented the clarity where variability geometry and bridge

What is the strongest angle in a bridge?

What angles are the strongest? 45 degrees is the strongest brace angle for a right-angle triangle, but the absolutely strongest is an equilateral triangle with three 60 degree angles.

Stainless steel bends welded type 5D 45°

45° bend type 5D (r=2,5xD) welded DIN EN 10253 Welded bend 45° - Single weld version acc. to DIN EN 10253 Part 4 (with special test requirements)2 welded half ...

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