

Design

Article C9.4.1 of AASHTO's LRFD Code states, "composite action is recommended to enhance stiffness and economy of structures." That general recommendation is applied specifically to Grid Reinforced Decks in Article 9.8.2.3.1: "Filled and partially filled grids shall be attached to supporting components by welding or by shear studs to transfer shear between the two surfaces." Best current practice is for deck attachment through the use of headed shear studs.

In designing the deck to be composite with supports, provisions for calculating effective width of slab shall be as described in Article 4.6.2.6.1. Field testing has verified that when the "12t" rule is used, t = the overall deck thickness from bottom of steel grid to top of concrete overfill for both fully and partially filled Grid Reinforced Decks.

Code provisions covering design of shear connectors is contained in Article 6.10.7.4. A practical accommodation must be made by a designer, in recognizing that a specified shear stud spacing must be consistent with the spacing of the grid members. For example, if shear stud design requires studs spaced at 18" c/c for use with a grid design whose components are spaced 8" c/c, an erector must necessarily place shear studs at 16" centers because of the grid bar spacing.

Construction

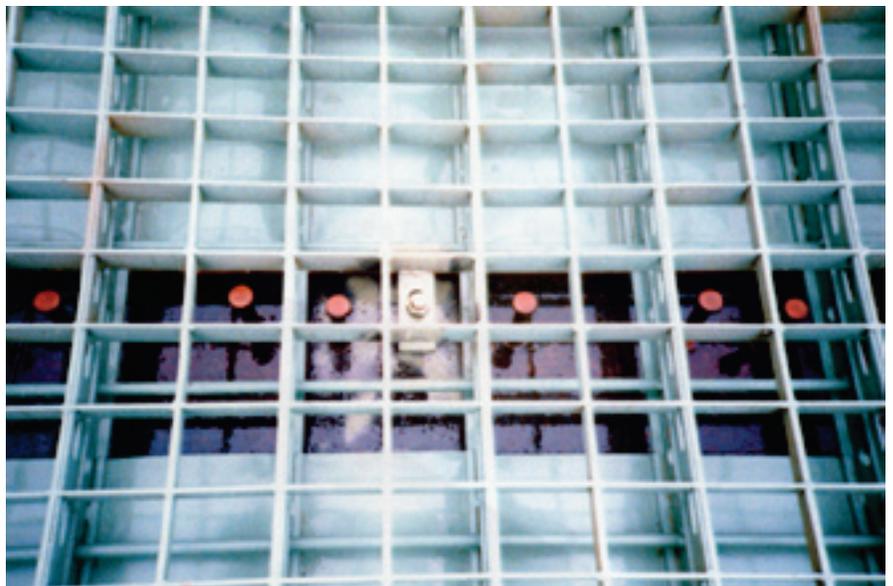
The use of headed shear studs eliminates the need to weld grid bars directly to bridge framing members, thus reducing concerns about the quality of field welds.

On rehabilitation projects which retain existing bridge girders/stringers, achieving an improved cross slope is often a project parameter, and is greatly simplified through the use of shear studs, since grid panels need not bear directly on those girders. (Various deck elevation adjustment methods have been used in this situation; see Foster Technical Data Sheet "Grid Reinforced Concrete Deck Attachment.")

Studs are attached using automated equipment; they may be welded to bridge girders either before or after grid panel placement (see photos). If studs are placed after grid panels are erected, there is sufficient space between grid bars to insert the automatic welding equipment. Some more closely spaced grid designs do not allow the conventional stud bend test

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Composite Design of Grid Reinforced Concrete Bridge Decks



spacing must accommodate grid component spacing. Placing studs is accomplished through the use of automatic equipment, and can take place before or after grid panel erection.

References

L. B. Foster Technical Data Sheet “Grid Reinforced Concrete Deck Attachment.”

AASHTO LRFD Bridge Design Specifications, 2nd Edition, 1998

“Effective Flange Width and Live Load Distribution Factor for Concrete Filled Steel Grid Deck”, IBC Paper 94-26, Ahmadi, Ahmad, Ph.D., PE

“Full Scale Test of Half Depth Grid on Upper Buckeye Bridge to Determine Effective Flange Width, Live Load Distribution and Grid Deck Stresses”, BGFMA Test Report, Ahmadi, Ahmad, Ph.D., PE, May 1996



after they have been attached to the girders. In this situation, periodic weld equipment calibration and testing conducted on separate plates insures weld quality.

Summary

Composite behavior of Grid Reinforced Concrete Bridge Decks with bridge framing elements is reliably achieved through the use of headed shear studs, and is described in appropriate AASHTO Articles. Specified shear stud

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