GRIDLINE

Newsletter of The Bridge Grid Flooring Manufacturers Association

BGFMA
www.bgfma.org

Gridline, Issue #6
December 2011

A Message from the Executive Director

It has been an eventful 2011 for the **BGFMA** as several large bridges, such as the **Walt Whitman** (pictured), **Brooklyn** (approach spans) and **Arrigoni Bridges** are currently in the process of being rehabilitated with new grid reinforced concrete bridge decks. The Walt Whitman and Arrigoni structures were originally constructed with grid reinforced concrete decks that have been in service for over 50 years and therefore offer clear proof that grid deck systems are a durable long-term solution.

We would also like to welcome **Clearspan Construction Products** as the BGFMA's newest member. Clearspan Construction Products manufactures high quality construction products for the transportation infrastructure market. In addition to **steel grid decks**, the company also fabricates **transit products**, **metal deck forms**, **Polyspan Polymer Deck**, **steel railings**, and their patented **No-Weld Installation System** and **Metal Stay in Place Diaphragm System**.

Mark Kaczinski, P.E.
BGFMA Executive Director

LRFD Code Revision Update

In June, 2010, the BGFMA released Tech-Line Issue #3, **"Design of Filled Grid Deck Systems to Meet AASHTO LRFD Criteria"** which outlined the shortcomings of the AASHTO LRFD code and summarized the subsequent research by **Professor Chris Higgins** in his report, **"Calibration of AASHTO LRFD Section 4.6.2.1.8 with Historical Performance of Filled, Partially Filled, Unfilled Composite Grid Decks"**. The AASHTO Bridge Subcommittee met in spring of 2011 to vote on two proposed code revision ballot items presented by the BGFMA as a result of this research. Both ballot items passed and revisions to the AASHTO LRFD Bridge Design Specification will be incorporated in the next release of the code or interims.

The first revision is to Article 4.6.2.1.8 updating the reduction factor used to determine the fatigue moment from the design moment. This was simply an omission when the code was previously updated to incorporate new fatigue limit states.

The second revision will require fully-filled and partially-filled grid reinforced concrete decks to be checked for fatigue in the positive moment region only assuming the deck configuration is simple span (C=1.0) regardless of the actual span configuration. Strength, deflection and fatigue resistances in the positive moment region will allow fully-filled and partially-filled grid reinforced concrete decks to be designed for span lengths consistent with historical limits.

History Preserved

Originally opened in 1874 to carry horse-driven vehicles and pedestrians on the top deck, as well as freight and passenger railroad traffic on the bottom deck, the **Eads Bridge in St. Louis, MO was the first major bridge to cross the Mississippi River!** In addition to being the first major crossing of the Mississippi River, the structure was also the largest arch bridge in the world at the time of construction and the first to be constructed using cantilevered erection techniques. Along with the Gateway Arch, the Eads Bridge is an iconic structure in St. Louis and symbolizes westward expansion of the United States. A protected National Historic Landmark, the bridge is occasionally closed to vehicular traffic and used as a gathering place during festivities and celebrations.

Sadly enough, the top deck of the structure was closed to vehicular traffic for over 10 years in the 1990's before being replaced in 2003 allowing the bridge to be reopened to traffic. The consultant and bridge owner selected a lightweight **Exodermic™** deck to revitalize the upper roadway of the structure and increase the load rating to HS20 for the four lanes of traffic. The new configuration permitted the stringers to be removed and the cast-in-place Exodermic™ deck to span longitudinally between floorbeams spaced at over 12 feet. This change saved additional weight that was necessary to achieve the load ratings needed, and the Exodermic™ deck resulted in a system that is roughly 40% lighter than a conventional reinforced slab.

Exodermic™ Install, Eads Bridge

Beyond the Tables

Maximum design span tables for grid reinforced concrete deck systems are established and published as a ready reference for engineers to select the appropriate deck system to satisfy the design parameters. Deck configurations and spans are provided for standard concrete filled grid systems and Exodermic™ deck using WT4x5, WT5x6, and WT6x7 main bearing bars and generally accommodate most span requirements. But what if an engineer needs a grid reinforced concrete deck system to span beyond the published spans in the design tables?

Fortunately, Exodermic™ deck systems are not limited to the three WT main bearing bars used to generate the spans shown in the brochure. Heavier and taller WT main bearing bars have been used on projects in which the span and/or design load required the additional strength of an unpublished bar.

In 1997, WT8x15.5 structural tees were used to span 30' between supports as a slab bridge near Soldier Field in Chicago. In 2005, WT10.5x22 main bearing bars were used in a 26' clear span 58° skew precast slab bridge to support an HS 36.2 design vehicle on the Elbert #2 Bridge over Sandlick Creek in McDowell County, WV. Most recently in 2009, the replacement of the Bronx approach of the Bronx-Whitestone Bridge utilized WT8x13 main bearing bars in conjunction with structural channels to span up to 24' 6" between floor beams for temporary (continued next page)

precast panels at the median replacement.

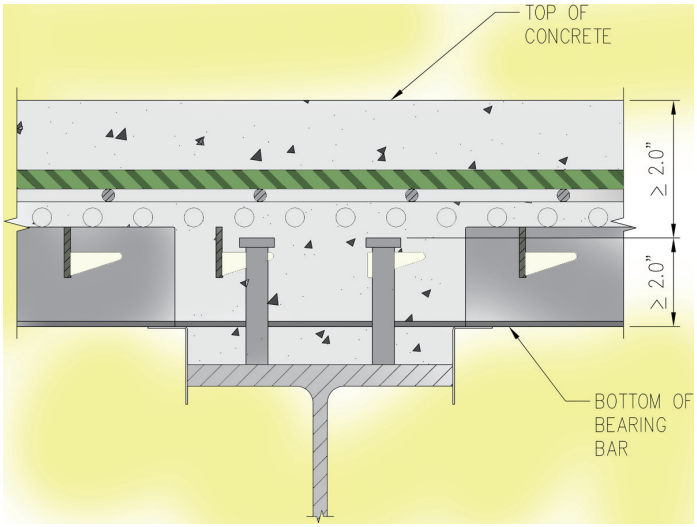
The three examples above demonstrate how non-standard WT main bearing bars can be utilized to achieve capacity beyond published data. In addition to the extended span lengths accommodated, both the Chicago and West Virginia projects benefited from a reduced superstructure depth and weight which allowed for the re-use of existing abutments. Contact the BGFMA for designs that can be used beyond the tables.

Additional Information/Photographs from the Grand Island Bridge Rehabilitation

In November 2010 we published Gridline #4 which included an article on the Northbound, South Grand Island Bridge that recently underwent rehabilitation. Part of the rehabilitation project involved replacing the bridge deck with a lightweight precast Exodermic™ deck system. **Mark Horschel** of **Bergmann Associates** (Rochester, NY) gave an excellent presentation on this project at the 2011 International Bridge Conference in Pittsburgh, PA. With consent from the New York State Thruway Authority, Mark was kind enough to share the PowerPoint presentation which can be downloaded on the BGFMA website in the *News Scroll* and *Projects* sections.

Grid Facts

By attachment of the grid reinforced concrete bridge deck to the supporting elements via headed shear studs, the deck will by nature act **compositely** with the superstructure to a certain degree. The BGFMA recommends at least one 0.75" diameter stud, at 8 to 12 inch spacing along the supporting element, located between main bearing bars for any deck. If the design is composite however, the designer must specify the required diameter and number of studs. However, it is important to make the shear stud spacing consistent with the grid main bar spacing.



In accordance with AASHTO LRFD Bridge Design Specifications, Section 6.10.10.1.4, shear connectors shall penetrate at least 2.0 inches into the concrete deck and have at least 2.0 inches of concrete cover over the tops for all composite decks. AASHTO does not clearly define deck thickness for composite action on grid decks. The BGFMA recommends that for all grid reinforced concrete decks, the head of the stud must be at least 2.0 inches above the bottom of the grid main bearing bar.

More Information

If you would like to receive more information about the features and benefits of grid deck systems, please contact us at **1-877-257-5499** or **bgfma@bgfma.org**. We are also available to make presentations at your office and can offer continuing education credits for professional engineers as a registered provider in New York and Florida.

BGFMA Tradeshow Schedule

Please visit BGFMA members at our exhibit booth during the following upcoming bridge engineering conferences:

NASCC Conference (AISC/NSBA)	**April 18-21**	**Dallas, TX**
International Bridge Conference (IBC)	**June 10-13**	**Pittsburgh, PA**
Heavy Movable Structures Symposium (HMS)	**Oct. 22-25**	**Orlando, FL**

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