



# Standard Specification for Steel Grid Bridge Flooring<sup>1</sup>

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## 1. Scope

1.1 This specification covers the requirements for steel grid bridge flooring systems, including design and material specifications, coatings, fabrication, and installation practices. This specification includes open (Type I), concrete filled (Type II), and unfilled composite grid (exodermic) (Type III).

## 2. Referenced Documents

### 2.1 ASTM Standards:

A 123/A 123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products<sup>2</sup>

A 366/A 366M Specification for Commercial Steel (CS) sheet, Carbon (0.15 Maximum Percent) Cold Rolled<sup>3</sup>

A 569/A 569M Specification for Steel, Carbon (0.15 Maximum Percent) Hot-Rolled Sheet, and Strip Commercial<sup>3</sup>

A 615/A 615M Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement<sup>4</sup>

A 709/A 709M Specification for Carbon and High-Strength Low Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges<sup>4</sup>

A 780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings<sup>2</sup>

C 94/C 94M Specification for Ready-Mixed Concrete<sup>5</sup>

D 448 Classification for Sizes of Aggregate for Road and Bridge Construction<sup>6</sup>

D 3963/D 3963M Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars<sup>6</sup>

D 6275 Practice for Laboratory Testing of Bridge Decks<sup>6</sup>

### 2.2 Other Standards:

Bridge Grid Flooring Manufacturers Association Design

and Specification Data<sup>7</sup>

Exodermic Bridge Deck Inc Design and Specification Data<sup>8</sup>

ANSI/AASHTO/AWS Bridge Welding Code AWS D1.5<sup>9</sup>

AASHTO Standard Specifications for Highway Bridges<sup>10</sup>

## 3. Classification

3.1 *Type I—Open Steel Grid System*—Consists of an open steel grid for carrying vehicular traffic with or without a roughened (serrated) surface. Other methods of improving skid resistance may be acceptable, but regardless of the method, it is imperative that a maintainable skid resistant surface be furnished for Type I decks. Design options to obtain acceptable fatigue life of this type of grid must be investigated.

### 3.2 *Type II—Concrete Filled System*

3.2.1 *Grade 1*—Consists of a steel grid that will be filled with concrete to the full depth of the grid. The concrete may be finished flush with the top of the grid and made ready for traffic, or an additional thickness of concrete or other wearing surface may be placed at the option of the designer (see Note 1 and Note 3).

NOTE 1—If an additional surface course is placed, adequate provision must be made to obtain dependable bonding at the top of the filled grid.

3.2.2 *Grade 2*—Consists of a steel grid that will be partially filled with concrete by constructing the grid in the fabrication plant with a pan form at some design depth but never more than midpoint from the bottom, except that the grid must be filled full depth over all supporting floor system flanges (see Note 1, Note 2, and Note 3).

NOTE 2—The use of this system by the designer may be more beneficial than Grade 1 if dead load is a consideration.

NOTE 3—A minimum 1 $\frac{3}{4}$ -in. overlay on all Type II flooring systems is

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.06.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 04.03.

<sup>7</sup> Available from Bridge Grid Flooring Manufacturers Association, 231 South Church St., Mt. Pleasant, PA 15666.

<sup>8</sup> Available from Exodermic Bridge Deck Inc., 60 Long Pond Road, Lakeville, CT 06039.

<sup>9</sup> Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

<sup>10</sup> Available from the American Association of State Highway and Transportation Officials, 444 N. Capitol St., NW, Washington, DC 20001.

required for dependable bonding (Note 1). In the absence of such overlay, options to obtain acceptable design life must be investigated.

### 3.3 Type III—Unfilled Composite System (Exodermic)<sup>11</sup>—

3.3.1 Type A consists of an open steel grid fitted with tertiary bars and studs (for shear connection) composite with a reinforced concrete slab. Concrete is kept on top of the grid and excluded from filling it by placing expanded metal lath or sheet metal strips between the tertiary bars (or filling the grid with lightweight or removable material) before placing the reinforced concrete.

3.3.2 Type B consists of an open steel grid fabricated to be composite with a reinforced concrete slab. Concrete is kept on top of the grid and excluded from filling it by placing sheet metal strips between the main bars and on top of the distribution bars before placing the reinforced concrete. The top 1 in. of the main bars is embedded in the reinforced concrete and has a row of 3/4 in. diameter holes to ensure composite behavior.

## 4. Ordering Information

4.1 Orders for material under this specification shall include the following information, as required, to describe the material adequately:

4.1.1 ASTM Specification number and date of issue,

4.1.2 Steel, ASTM Specification A 709/A 709M, Grade 36, 50, or 50W,

4.1.3 Concrete, Class C (AE) in accordance with Table Number 8.2, Div. II of AASHTO Standard Specifications for Highway Bridges.

4.1.4 Steel grid Type (I, II Grade 1, II Grade 2, or III Type A, or III Type B), dimensions and spacings of main bars, distribution bars, and tertiary bars if specified.

4.1.5 Special requirements, including paint, galvanizing, or epoxy coating.

## 5. Materials and Manufacture

5.1 Unless otherwise specified, the steel shall meet the requirements of Specification A 709/A 709M, Grade 36.

5.1.1 The concrete to be placed in the grid for Type II, or the reinforced concrete component for Type III, shall be ready-mixed concrete meeting the requirements of Specification C 94/C 94M, and these specifications.

<sup>11</sup> The unfilled composite grid (Exodermic) is covered by several patents held by Exodermic Bridge Deck Inc., 60 Long Pond Road Lakeville CT 06039. Interested parties are invited to submit information regarding the identification of acceptable alternatives to this patented item to the Committee on Standards, ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

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5.1.2 All welding shall meet the requirements of the latest AWS Bridge Welding Code, both at the fabrication and erection sites.

## 6. Other Requirements

6.1 The unit shall be designed in accordance with the latest AASHTO Standard Specifications for Highway Bridges. Shop drawings and assembly details shall be submitted to the purchaser for review prior to the start of any work.

6.2 *Fabrication*—Arrangement of sections, tolerances after fabrication, details of distribution bar splicing (if required), camber, and joint details shall be as required by the contract documents and as shown on shop drawings after approval.

6.3 *Erection*—Type I grid shall be shimmed before welding to supporting framing. Forced deflection of the grid in excess of 1/4 in. over a 4 ft distance to obtain the desired cross-section and profile shall not be permitted. Type II grid and Type III grid should not be welded to supporting framing; headed studs welded to the beam supports and embedded with the concrete shall be used to provide this connection. The spacing of the welded headed studs embedded in haunch concrete shall be adequate to transfer full horizontal shear forces. Welding grid to supporting framing is permitted by AASHTO.

6.4 *Coating*—Unless otherwise specified, all steel specified to be galvanized shall be in accordance with Specification A 123/A 123M and shall have an average coating of not less than 2 oz/ft<sup>2</sup> (610 g/m<sup>2</sup>). Any damage to the coating during installation will be repaired in accordance with Practice A 780 (see Note 4).

NOTE 4—The purchaser may specify a fusion bonded epoxy coating conforming to the portions of Specification D 3963/D 3963M which are applicable to grid, painted with a specified coating system, or furnished with uncoated Specification A 709/A 709M Grade 50W steel, instead of galvanization.

6.5 The Portland cement concrete to be placed in the grid for Type II, or the reinforced concrete component for Type III, shall be in accordance with 4.1.3 (see Note 5).

NOTE 5—The purchaser may consider the use of a polymer modified concrete instead of Portland cement concrete. If so, the design should conform to recommendations of the polymer manufacturer.

## 7. Keywords

7.1 bridge deck; bridge flooring; Exodermic; grid deck; prefabricated bridge deck