

**ITEM 01557.40 M - EXODERMIC BRIDGE DECK USING LIGHTWEIGHT HIGH PERFORMANCE CONCRETE**

**DESCRIPTION.**

Furnish and install steel grid panels, epoxy coated reinforcing steel, metal forms and cast-in-place lightweight high-performance concrete as shown in the contract plans. Produce steel grid panels according to Manufacturer's recommendations. Purchase the steel grid panels for the patented Exodermic deck from:

L. B. Foster Company 1016 Greentree Road Pittsburgh, PA 15220 TEL: (412) 928-7820 FAX: (412) 928-3514	or	IKG Greulich P.O. Box 295 Route 910 Cheswick, PA 15024 TEL: (412) 828-2223 FAX: (412) 828-4103
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or other licensed Exodermic deck steel grid panel Manufacturers. (All royalty payments are paid by licensed Manufacturers.) Licensing status and other information can be obtained from:

Exodermic Bridge Deck , Inc. 60 Long Pond Road Lakeville, CT 06039 TEL: 860-435-0300 or toll free: 888-EXODERM (396-3376) FAX: 860-435-4868 e-mail: info@exodermic.com
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Notify the Engineer of the name, address, telephone number, and contact person of the steel grid panel Manufacturer.

**MATERIAL REQUIREMENTS.**

**Steel Grid Panels:**

Structural Steel - (ASTM A36M with a minimum 0.20% copper content, unless the plans show otherwise.)	§715-01
Galvanized Coatings and Repair Methods	§719-01
Leveling Bolts	ASTM F568M, Class 4.6
Nuts	ASTM A563M

Use deformed reinforcement bars conforming to §709-01, or round bars conforming to ASTM A36M for the tertiary bar studs.

Use galvanized steel, sheet metal conforming to ASTM A653M for the forms.

**Cast-In-Place Lightweight High-Performance Concrete:**

All materials for superstructure slabs and structural approach slabs	§557-2
Stud Shear Connectors	§709-05

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Manufacture lightweight high-performance according to §501, and the following modifications:

1. Design a lightweight high-performance concrete mixture, proportioned according to the American Concrete Institute Manual of Concrete Practice, ACI 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete. Produce a homogeneous mixture of cement, fly ash, microsilica, fine aggregate, lightweight coarse aggregate, air entraining agent, normal range set-retarding water-reducing admixture, and water as designed.
2. Use Type 2 cement with a minimum cement content of 400 kg/m<sup>3</sup>.
3. Use lightweight coarse aggregate conforming to §703-10, with a gradation in the 10 mm to 2.36 mm size designation in Table 1, ASTM C330.
4. Construct lightweight aggregate stockpile(s) so as to maintain uniform moisture throughout the pile. Continuously and uniformly sprinkle the stockpile(s) with water for a minimum of 24 hours using a sprinkler system approved by the Materials Engineer. If a steady rain of comparable intensity occurs, turn off the sprinkler system at the direction of the Materials Engineer, until the rain ceases. At the end of the wetting period, or after the rain ceases, allow stockpiles to drain for 12 to 15 hours immediately prior to use, unless otherwise directed by the Materials Engineer.
5. Supply either a densified powder or slurry form of microsilica admixture whose brand name appears on the Department's Approved List. Use only one brand for any structural element. Provide written certification from the Supplier that the microsilica meets the requirements of the Materials Bureau. Include the following data: fineness, silica content, total chloride ion content, solids content for slurries, and moisture content for densified powders.

Agitate the slurry as necessary to prevent separation. Remove and replace slurry that reaches a temperature less than 0°C., at no cost to the Department.

The Materials Engineer will take a ½ - 1 liter microsilica sample directly from the storage container, for each days placement, for testing by the Department.

If densified powder is used, and added independently - weigh cumulatively in the following order: cement, fly ash and microsilica. Base the batching tolerance of ±½% on the total mass of cementitious material, for each material draw mass.

If densified powder is used as part of a blended cement - weigh cumulatively in the following order: blended cement and fly ash. Base the batching tolerance of ±1% on the total mass of cementitious material, for each material draw mass.

If microsilica slurry is used - use proportioning equipment approved by the Materials Engineer. Add through an existing automation system or a two stop, off-line automated, batching system meeting the following requirements:

- Delivery accuracy - ±1% (by volume)
- Program quantity - liters (nearest tenth)
- Batching tolerance - ±2.0% (by volume)
- System interlocks

Print requirements:

- a. Date and time
- b. Truck number (or alternate method relating microsilica to batch ticket)
- c. Delivered quantity (liters, nearest tenth)

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Locate the control box/printer for a two stop, off-line batching system at the batch plant operator's work station unless otherwise approved by the Materials Engineer.

Calibrate in accordance with procedures approved by the Materials Engineer. Recalibrate the entire system if part or all of the off-line system is moved.

6. After the materials have been accepted for this work, determine the proportions for concrete and equivalent batch masses based on trials made with materials to be used in the work.
  - a. Determine the cement content for each trial batch by means of a yield test according to ASTM C138.
  - b. At least 1 week prior to concrete placement provide the Materials Engineer with a copy of the trial mix design with the following data.
    - i. Fine and coarse aggregate (saturated surface dry condition) content in  $\text{kg/m}^3$ .
    - ii. Cement content in  $\text{kg/m}^3$ .
    - iii. Water content in  $\text{kg/m}^3$ .
    - iv. Dry unit mass in accordance with ASTM C567.
    - v. 28 day compressive strengths.
    - vi. Batch masses.

The Materials Engineer will approve the batch weights prior to use. Use these values to manufacture all lightweight concrete for this project, and periodically correct the batch masses to account for changes in the fine aggregate fineness modulus and aggregate moisture contents.

7. Achieve an average compression strength of 25.00 MPa, or greater, with no individual cylinder compressive strength less than 21.00 MPa.
8. Produce concrete with an average dry unit mass ranging from 1750 to 1850  $\text{kg/m}^3$  when tested in accordance with ASTM C567.

**CONSTRUCTION DETAILS.**

**Steel Grid Panel Manufacturing Details:**

**Prior to steel grid panel manufacture, check the proposed panel layout and verify all shop drawing dimensions and cross-slopes in the field for accuracy.**

Manufacture the steel grid panels with the properties and to the dimensions shown on the plans, shop drawings, and in accordance with Section 564 - Structural Steel, and the New York State Steel Construction Manual. Before steel grid panel assembly, weld the vertical studs to the tertiary bars. If using round studs, weld them 5° - 20° off-vertical to provide uplift resistance.

Gas Metal Arc Welding (MIG) may be used for steel grid panel manufacture. Prior to welding, an approved Procedure Qualification Record (PQR) and Welding Procedure Specification (WPS) are required in accordance with the New York State Steel Construction Manual.

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Use the Bridge Grid Flooring Manufacturers Association current standards for dimension tolerances.

After the attachment of all edge bars, leveling devices (with clearance for on-top field adjustment), and other components, galvanize the grid according to §719-01 Type I. Repair defects in galvanizing as specified in §719-01.

Identify each steel grid panel for correct placement on the structure. Support the steel grid panels with wood or similar blocks to avoid distortion or other damage during transportation and storage.

**Steel Grid Panel Installation:**

1. When rehabilitating a structure, and prior to steel grid panel installation, blastclean the top surface of beam flanges, and the surfaces of concrete or reinforcing that will be in contact with new concrete, according to §584-3.04A. and B.
2. Check the steel grid panels for defects and identification. Repair or replace steel grid panels or metal forms damaged during shipment and site storage to the satisfaction of the Engineer.
3. Position steel grid panels on the steel beams and align with adjacent panels. Measure from fixed points to avoid cumulative error. Adjust elevations with the attached leveling devices and square-up as necessary.
4. After sheet metal form and miscellaneous form installation, attach the shear studs through openings in the steel grid panels as per §556-3.03. With precise layout, and the Engineer's permission, shear studs may be welded in place prior to placing the steel grid panels.
5. Break the ceramic ferrules around the welded studs, and remove all debris.

**Lightweight High-Performance Concrete Placement:**

Apply the provisions of §557-3.01 and the following modifications:

1. Install epoxy coated reinforcing steel in accordance with Section 556 - Reinforcing Steel for Concrete Structures. Position the top rebars, which run in the same direction as the tertiary bars with the vertical studs, a minimum 25 mm away from the tertiary bars.
2. Add the following to §557-3.01, Concrete Manufacturing and Transporting:
  - a. Use slump and air tests as a control measure to maintain a suitable consistency. Perform slump and air tests according to NYSDOT Materials Method 9.2. Determine air content by the volumetric method described in ASTM C173. Air content and slump placement limits are:

	<u>Minimum</u>	<u>Desired</u>	<u>Maximum</u>
Air Content (Roll-A Meter)	5.0%	6.5%	8.0%
Slump (mm)	----	65-90	100

- b. Introduce lightweight coarse aggregate, along with approximately 2/3 of the total mixing water, into the mixer and mix for a minimum of 10 minutes. Add the fine aggregate, admixtures, cement, fly ash, microsilica, and remaining mixing water and mix completely.

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c. Have the lightweight aggregate manufacturer supply a service representative at the site for the first two days of lightweight concrete placement operations to assist in the control of lightweight concrete mixing and placement operations.

3. Handle and place concrete according to §557-3.06, Handling and Placing, except that pumping is not permitted. No waivers will be granted. Insert concrete vibrators deeper at the haunch and full depth areas between panels.

During concrete placement, wash off any mortar that leaks through the steel grid panels and drips onto any structural steel.

Test the concrete according to written Department procedural directives. Fabricate and cure cylinders for compressive strength testing according to NYSDOT Materials Method 9.2 procedures. The Engineer will cast cylinders, in sets of 2 individual cylinders, at a frequency of 1 set for each 50 m<sup>3</sup>, or fraction thereof actually placed. A minimum of 1 set will represent each day's concrete placement.

4. Cure concrete according to §557-3.12, Curing, except that only continuous wetting is allowed.
5. Make any repairs as per the provisions of §557-3.13, Damaged or Defective Concrete. In addition, the Engineer will reject any concrete represented by a cylinder set with an average compressive strength less than 25.00 MPa, or an individual cylinder with a compressive strength less than 21.00 MPa. Proposed repairs require Deputy Chief Engineer, Structures approval.
6. The loading limitations of §557-3.14 apply, except that concrete cylinder sets designated for early loading must attain an average compression strength of 25.00 MPa, or greater, with no individual cylinder less than 21.00 MPa.

**METHOD OF MEASUREMENT.**

Payment will be made at the unit price bid per square meter for the number of square meters of Exodermic deck stated in the Estimate of Quantities shown on the contract plans.

**BASIS OF PAYMENT.**

Include the cost of all labor, materials and equipment necessary to complete the work in the square meter bid price.

Make progress payments on a per span basis as follows:

1. 40 percent of the estimate area after all steel grid panels and reinforcing is properly placed.
2. 40 percent of the estimate area after concrete placement, and curing initiated.
3. Pay the remainder after curing is complete.

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
01557.40M	Exodermic Bridge Deck using Lightweight High-Performance Concrete	Square Meter