

ITEM 11557.40 M - PRE-CAST EXODERMIC BRIDGE DECK WITH CLASS DP CONCRETE

DESCRIPTION:

This work shall consist of fabricating, furnishing, delivering to the job site and installing steel grid panels, epoxy coated reinforcing steel, metal forms and precast concrete as shown in the contract plans and in accordance with the Manufacturer's recommendations. The Contractor shall purchase the steel grid panels for the patented Exodermic deck from one (1) of the following designated manufacturers.

MATERIAL REQUIREMENTS:

Obtain 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
K.G. 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. 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

Notify the Engineer of the name, address, telephone number, and contact person of the steel grid panel manufacturer within seven days of contract award.

Exodermic Panels:

Structural Steel - (ASTM A36M with a minimum 0.20% copper content, unless the plans show otherwise.)	§715-01
Stud Shear Connectors	§709-05
Galvanized Coatings and Repair Methods	§719-01
Leveling Bolts	ASTM F568M, Class 4.6
Nuts	ASTM A563M
Bar Reinforcement (Epoxy Coated)	§709-04
Concrete Repair Material	§701-04
Mechanical Connectors for Reinforcing Bar Splices	§709-10
Membrane Curing Compound	§711-05
Water	§712-01
Fine Aggregate	§703-01

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Course Aggregate

§703-02

Use 20 gauge (minimum) galvanized steel sheet metal conforming to ASTM A653M for the forms. Use ASTM A366M for sheet metal that is installed prior to galvanizing the panels.

Fasteners shall conform to §715-14 and shall be galvanized as per §719-01.

Field Placed Concrete:

This material will be used to fill in shear-keys and to secure panels in the field. The maximum allowable total chloride content in the concrete shall not exceed 0.10 percent by weight of cement.

Develop a mix design using a Accelerated Cement, with an approved fine aggregate (§703-01) and coarse aggregate (§703-02). The mix shall meet the specified properties of Table 1. The proposed mix design must be submitted to the Director Materials Bureau for review. All materials used are subject to the approval of the Director Materials Bureau. Final approval will be based on the results of the trial batch.

A mix design must be finalized at least 30 days prior to the begining of the work.

TABLE 1 - Mix Design Requirements	
6 Hour Strength	18 MPa
28 Day Strength	42 MPa
Minimum Set Time	15 min.
Maximum Coarse Aggregate Size	10 mm
Shrinkage	0.0 %
Capable of being retarded when necessary.	
Provide a working time which allows for placement in a continuous operation without cold joints.	
Be flowable such that the mix pours into and completely fills the shear keys.	
Match the color and texture of the surrounding concrete.	
Provide a durable, crack free final product.	

Trial Batches:

Prepare a trial batch using the same (1) materials and (2) mixing, transporting, and discharging methods as those to be used on the project. Demonstrate the mix's ability to achieve the specified properties to the Regional Materials Engineer. Determine the required time to achieve the specified strengths. Changes other than minor fluctuations in admixture dosage rates will require a new mix design and trial batch as determined by the Regional Materials Engineer. The Engineer may halt material placement and order

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new trial batches whenever the specified properties are not achieved.

Using material from the trial batch, construct a 280 mm wide by 102 mm thick by 2 m long (min.), test panel in order to determine the mix's crack susceptibility. Also test the mix's pourability by placing the concrete in a simulated shear-key, 300 mm (min.) in length, which matches the dimensions of the shear-key shown on the project plans.

Precast DP Concrete:

The Class DP Portland cement concrete shall conform to the requirements of the PCCM Section 400 and 500, unless otherwise specified hereinafter. Use a Water-Reducing and Retarding Admixture (§711-08) to delay setting until after final concrete placement and finishing, and produce the desired slump without exceeding the maximum water-cementitious material ratio.

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MIX CRITERIA TABLE - CLASS DP CONCRETE	
Cement (kg/m ³)	318
Fly ash (kg/m ³)	86
Microsilica (kg/m ³)	26
Sand - % of total aggregate (solid volume)	45.8
Maximum water/cementitious material ratio (430 kg total)	0.40
Desired air (%)	7.5
Allowable air (%)	6.0 - 9.0
Desired slump (mm)	100
Allowable slump (mm)	50 - 125
Aggregate gradation	CA 1
See note on the following page	
NOTE: Criteria given for design information is based on a fine aggregate fineness modulus of 2.80. Determine the mixture proportions by using actual fineness modulus and bulk specific gravities (saturated surface dry for aggregate). Compute proportions according to Department written instructions.	

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

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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 Regional 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 $\pm 1/2\%$ 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 $\pm 1\%$ on the total mass of cementitious material, for each material draw mass.

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 Regional Materials Engineer.

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

Shop, working and erection drawings shall be required and shall be in accordance with the NYSSCM, the PCCM and shall include the following information as a minimum:

- a. Plan layout, including length, width, skew angle and orientation;
- b. Concrete mix design including admixtures;
- c. Concrete surface finish;
- d. Structural steel type and grade, degree of steel cleanliness and galvanizing procedures;
- e. Fabrication and curing procedures;
- f. Lifting details;
- g. Cross-sections showing structural depths and reinforcement;
 - a. Fastener type, strength and location of use;
 - b. Reinforcement schedule;
 - c. Tolerances. Use the Bridge Grid Flooring Manufacturers Association current standards for dimension tolerances.

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UNDER NO CIRCUMSTANCES SHALL FABRICATION OF UNITS COMMENCE PRIOR TO APPROVAL OF THE SHOP, WORKING AND ERECTION DRAWINGS AND THE INSPECTOR HAS RECEIVED PRINTS MADE FROM THE ORIGINAL DRAWINGS.

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EQUIPMENT:

Mobile Concrete Mixing Unit: Meeting the requirements of §501 Portland Cement Concrete - General.

Vibrators. Hand held pencil vibrators having a maximum diameter of 25 mm and capable of operating through a frequency range of 6000 - 9000 vibrations per minute.

CONSTRUCTION DETAILS:

Grid Manufacturing Details:

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

The steel members and steel grating shall be fabricated to the dimensions and properties as shown on the plans and in accordance with Section 564 as well as the requirements of the New York State Steel Construction Manual. It shall be the Contractor's responsibility to field verify all dimensions in order to make necessary changes prior to fabrication. Due consideration shall be given to the placement of leveling devices to provide adequate clearance for their field adjustment from above using a socket wrench. The panel layout shown in the Contract Plans is suggested. The fabricator shall develop the layout and detail it on the shop and working drawings. After the attachment of all edge bars, leveling devices, horizontal shear studs and other components, the steel and grating shall be galvanized according to §719-01 Type 1. Steel members and grating shall be fabricated to proper roadway cross slopes prior to galvanizing.

After the steel members and grating have been galvanized, they shall be inspected for defects in the galvanized coating. Any defects shall be repaired as specified in §719-01 as well as the requirements of the New York State Steel Construction Manual.

Gas Metal Arc Welding (MIG) may not 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.

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.

Pre-Casting:

Casting beds conforming to the dimensions of the various types of panels shall be constructed by the manufacturer. The materials used for the casting beds shall be sound and durable so as to permit their re-

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use throughout the casting operation. If the panels are cast upside down (at the election of the manufacturer) the bottom of the form, which will produce the finished top surface of the concrete deck, shall be textured so that the finished concrete deck will have a fine surface as specified in §502-3.09D, unless otherwise shown on the Contract Plans. If the panels are cast right side up, a fine finish shall be applied as specified in §502-3.09D, unless otherwise shown on the Contract Plans.

Concrete inserts and mechanical connectors for reinforcing bar splicing, as shown on the drawings or as required by the manufacturer, shall be casted in the pre-fabricated deck panels. The number and locations of the inserts or mechanical connectors shall be as detailed on the Shop Drawings.

Tolerances for the pre-cast panel shall be in accordance with the requirements of PCCM Section 600, Para. 630.1, "Precasting" except for the following:

Depth (overall): $\pm 3\text{mm}$.

Forms shall meet the requirements of PCCM Para. 530, "Concrete Forms."

DP Concrete Placement:

Apply the provisions of PCCM Section 500 with the following modifications:

1. Position the top reinforcing bars, which run in the same direction as the main grid bars, a minimum of 25mm away from the web of the main bars.
2. Insert concrete vibrators deeper at the shear key areas.
3. If the manufacturer elects to cast upside down, the steel members and grating shall be placed upside down into the concrete mix already in place in the forms. The bar reinforcement shall have been placed in the forms prior to placing the concrete. The reinforcing bars shall be supported on approved bar chairs at the proper depth in the forms. The bar chairs shall have plastic protectors where they contact the forms. The concrete shall have a slump within the specified range shown in the Mix Criteria Table, yet allow the steel members or grating to be placed in the wet concrete mix to the proper depth without excessive force being exerted on the member. The use of vibrators attached to the forms or placement of the forms on vibrating shock tables will be permitted provided excessive vibration causing segregation of the aggregate in the concrete mix does not occur. The fabricator may use equipment which would apply steady, even downward pressure to the member to embed the steel member or grating to the proper depth in the forms.
4. Test cylinders shall be prepared and the average of any three (3) break tests shall exceed:
 - 24.1 MPa prior to allowing the panels to be lifted from the forms.

Cylinders shall be stored at the ambient temperature of the structure where the pour was made.

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- Cylinders shall be cast from each truck-load of ready-mix concrete or from each batch of ten (10) cubic yards of concrete, if mixed at a manufacturing plant. Failure of the cylinder breaks to meet the minimum compressive strengths at the required intervals will result in the removal and replacement of the poured concrete by the Contractor at no additional cost to the state.
5. The panels shall not be removed from the forms until they have attained the minimum strength specified. Steam-curing will only be permitted with the approval of the Inspector. Accelerated curing methods will NOT be allowed nor considered for approval. The final curing phase shall not be less than seven (7) days. After curing, all form release material adhering to the concrete shall be removed.
 6. Minor honeycomb areas less than 0.01 m² where reinforcing steel is not exposed shall be repaired with an approved concrete repair material. Units that have honeycombed areas where reinforcing is exposed and/or units are cracked or damaged may be rejected at the Inspector's discretion. Rejected units shall be repaired or replaced in accordance with a written repair procedure approved by the Inspector.
 7. The completed panels shall be marked with their proper identification number and marked at either end with the adjoining panel number for proper orientation in the field. No more than three panels will be permitted to stack upon each other during storage or shipment. Panels shall be stored and shipped right side up, and wood lagging shall be used to prevent concrete or galvanized coating damage. Proper support shall be provided at all changes in panel cross section, or grade during storage and transportation.
 8. The pre-fabricated panel shall be delivered to the job site free from any defects and bearing the proper identifying marks. The Contractor shall store the deck panels at the project on elevated supports and provide for the proper bearing of the panel above ground.
 9. All ground surface preparations, timber blocking or slimming for stacking the panels, concrete construction barrier as required for protection, and all necessary precautions for safe storage shall be included in the amount paid for under this item.

Pre-Cast Panel Installation:

Apply the provisions of PCCM Section 700 with the following modifications:

1. When rehabilitating a structure, and prior to steel grid panel installation, blast clean 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. Form haunches, if required, with closure angles or install adhesive backed foam on the supporting steel beams as indicated on the plans, position steel grid panels on the steel beams and align with

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- 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 stud shear connectors through openings in the steel grid panels as per §556-3.03. With precise layout, and the Engineer's permission, stud shear connectors 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.
6. Place Field Placed Concrete where shown on the Contract Plans and conforming to the following requirements:
- a) Concrete shall be batched in a mobile mixer. No hand mixing will be allowed.
 - b) Place concrete only within an ambient temperature range of 10°C to 25°C. If temperatures are expected to fall below 10°C, cold weather concreting procedures, in accordance to §555-3.06 Provisions for Concreting in Cold Weather, must be followed. If temperatures are expected to go above 25°C, contact the Material's Bureau for appropriate placement procedures. Do not expose fresh concrete to direct rainfall.
 - c) Blastclean all surfaces to be in contact with fresh concrete prior to installation. Remove grease, dirt and all other contaminants. Protect the galvanized grid and epoxy rebar from damage due to the blastcleaning operation.
 - d) Prior to the placement of fresh concrete, thoroughly wet all surfaces to be in contact with fresh concrete for as long as possible. Remove all standing water with oil-free compressed air, and protect the existing concrete from drying, so it remains in a surface-saturated-dry condition.
 - e) A representative of the cement producer shall be on site to verify field conditions and placement procedures for at least the initial placement.
 - f) Firmly work fresh concrete into place and consolidate with pencil vibrators in accordance to PCCM Para. 545 "Placing Concrete", to minimize voids.
 - g) Hand screed fresh concrete to the level of the surrounding concrete, do not over work or apply additional water to the surface.
 - h) Cure the concrete with wet burlap for as long as possible. Do not allow the burlap to dry. Prior to opening to traffic, apply a membrane curing compound.
 - i) Do not open to traffic until the concrete has achieved a minimum compressive strength of 18 MPa. The time required to reach this strength should be determined through the trial batches.

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METHOD OF MEASUREMENT:

The work will be measured as the number of square meters of pre-fabricated exodermic panels. Measurement will be taken as the horizontal plane projection of the top of the pre-fabricated panels. Measurement will be taken from outside edge to outside edge of the top surface. No deduction will be made for joint or chamfers.

BASIS OF PAYMENT:

The square meter bid price shall include the cost of all labor, materials and equipment necessary to complete the work, including the furnishing and installation of all Exodermic grid panels, the cost of transporting, storing and protecting the deck panels from damage, the furnishing and installation of closures, forms, backer rods, stud shear connectors, field placed concrete and additional epoxy coated reinforcement.

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