MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**EXODERMIC BRIDGE DECK SYSTEM**

BRG:JST 1 of 6 APPR:MJF:SCK:12-28-23

**a. Description.** This work consists of furnishing, delivering, and installing an Exodermic bridge deck system on the bascule leaf span as shown on the plans. The Exodermic bridge deck system consists of a series of fabricated steel grid panels that support and are made composite with a reinforced concrete slab. The Exodermic deck steel grid panels consist of a series of main bars, a series of rolled steel distribution bars, and a series of steel sheet metal form pans. Steel reinforcing bars are embedded within the concrete slab. Cast-in-place concrete and rebar is paid for separately.

1. Design Code*. AASHTO LRFD Design Bridge Design Specifications*.

2. Basic Bridge Design Parameters.

A. Exodermic Deck Span Length. 4½ feet center to center of stringers.

B. Deck Continuity. Continuous span across multiple intermediate supports.

C. Deck Span/Main Bar Direction. Perpendicular to traffic.

D. Deck Concrete Placement Method. Cast-in-place construction.

E. Deck Composite Behavior. Deck considered non-composite with supporting steel framing members.

3. Deck Components.

A. Main Bars. Wide Flange Tee (WT) 4x5 rolled steel members spaced at 12 inches on center.

B. Primary Direction Reinforcing Steel. #4 bars spaced at 4 inches on center.

C. Secondary Reinforcing Steel. #4 bars spaced at 4 inches on center.

D. Distribution/Crossbar Bars. 1½ inches by 1/4 inch rolled steel bars spaced at 6 inches on center.

4. Deck Profile.

A. Total Concrete Thickness. 4¼ inches.

B. Total Deck Height. 7¼ inches.

5. Deck Material Parameters.

A. Steel Modulus of Elasticity. 29,000 ksi.

B. Structural Steel Yield Strength. 50 ksi.

C. Assumed Concrete Weight. 144 pcf.

D. Steel Sheet Metal Form Pans. 20 gauge.

**b. Materials.** Furnish products and materials meeting the following requirements.

1. Within 10 days of the contract award, notify the Engineer of the name, address, telephone number, and contact person for the Exodermic deck panel fabricator. Purchase Exodermic deck steel grid panels from a licensed Manufacturer that is a participating member of the Bridge Grid Flooring Manufacturer’s Association (BGFMA). Further information may be obtained from:

BGFMA

Attn: Mike Riley

(724) 355-1878

2. Structural Steel. Furnish and fabricate structural steel for the steel grid panels in accordance with sections 707 and 906 of the Standard Specifications for Construction, except as specified herein or noted on the plans. Fabricate steel grid panels in accordance with the details, configuration, material properties, and unit weight listed herein and as shown on the plans.

WT Main Bearing Bars: *ASTM A992/A992M*

Distribution Bar and Miscellaneous Plates: *ASTM A572/A572M* and *ASTM* *A709/A709M* Grade 50

Furnish high strength bolts, hardened washers, and nuts meeting subsection 906.07 of the Standard Specifications for Construction.

Hot-dip galvanize steel grid panels after all fabrication and welding is complete, and in accordance with *ASTM A123/A123M*. Hot-dip galvanize all bolting hardware in accordance with subsection 906.07 of the Standard Specifications for Construction. Repair damaged galvanized coatings in accordance with subsection 716.03.E of the Standard Specifications for Construction.

3. Form Pans. Furnish galvanized steel sheet metal forms for support of cast-in-place concrete in accordance with *ASTM A653/A653M,* Designation SS Grade 50 Class 1, 2, or 3, Coating Designation G210. Ensure that the field installed forms are protected during shipment and site storage to retain their shape until installation.

4. Shims. Furnish galvanized steel shim packs in accordance with *ASTM A123/A123M* for the bolted connections between steel grid panels at the crown and bolted connections between steel grid panels and the supporting steel framing.

Acceptance of the fabricated steel grid panel will be based on “Fabrication Inspection” per the *MQAP Manual*. Acceptance of high strength bolts will be based on “Test” per the *MQAP* *Manual*.

**c. Construction.** Fabricate and construct structural steel for the panels in accordance with section 707 of the Standard Specifications for Construction. Perform fabrication using a Fabricator that possess a valid *AISC* certification for Bridge Component QMS Certification (CPT). Perform welding, weld inspection and testing in accordance with subsection 707.03.D.10 of the Standard Specifications for Construction, except as specified by 20SP-707A - Structural Steel and Aluminum Construction. Perform steel grid panel welding in accordance with the *AWS/AASHTO D1.5*.

Shop drawings and shop inspection are required. Ensure shop drawings and shop inspection are in accordance with subsections 707.03.A and 707.03.B, respectively, of the Standard Specifications for Construction. Prepare shop drawings that include outlines of supporting bascule leaf structural steel and joint assemblies including locations of bolts and welded headed studs to identify potential conflicts. Furnish shop drawings for each steel grid deck panel. Show the panel layout relative to the steel framing for each bascule leaf.

1. Exodermic Deck Fabrication. Fabricate and deliver the panels to the job site free from any defects. Repair or replace deck panels including steel sheet metal forms damaged during shipment and storage to the satisfaction of the Engineer. Label each panel with a unique identifying mark and location to establish the panel orientation relative to the bascule leaf steel framing. Inspect the panels for defects.

Weld the distribution bars to the main bars at all intersections. Submit weld details including sizes and lengths, welding sequences and welding procedure specifications (including supporting procedure qualification records when applicable) for review and approval. Implement welding sequences that minimize panel distortions of the completed deck system after fabrication and galvanizing.

Furnish steel grid panels with connection plates with corresponding fill plates and shim packs to achieve uniform bearing of the steel grid panels on the supporting steel framing members. Develop connection details to avoid excessive deformation and at the connections between panels at the crown for uniform connection.

Fabricate the Exodermic deck steel grid panels within the tolerances shown in Table 1:

**Table 1: Panel Fabrication Tolerances**

|  |  |
| --- | --- |
| Panel Length | ±1/4 inch |
| Panel Width | +0 inch, -1/8 inch |
| Panel Squareness | ±1/2 inch measured diagonally |
| Transverse Camber (Width) | 0.004 by width |
| Longitudinal Camber (Length) | 0.003 by length |
| Side Bow (Sweep) | ±1/4 inch per 10 lineal feet |
| Main Bar Verticality | ±5/32 inch |
| Distribution Bar Verticality | ±5/32 inch |
| Main Bar Spacing | ±1/8 inch |
| Distribution Bar Spacing | ±1/8 inch |

Fabricate the Exodermic deck on a level solid surface. Monitor the flatness of the panels during the fabrication process. Accurately weigh the new Exodermic deck panels after fabrication and galvanizing for use in preparing the final bascule bridge span balance calculations.

2. Exodermic Deck Shop Assembly and Field Erection. Shop assemble and field erect the steel grid panels in accordance with applicable general requirements and section 707 of the Standard Specifications for Construction except as specified herein or as shown on the plans.

Splice the steel grid panels to each other at the crown and connect the grid panels to the supporting steel framing by field bolting per the details shown on the plans, including attachment plates welded to the main bearing bars and corresponding fill plates and shim packs for adjustment.

During field erection, deliver the Exodermic deck steel grid panels to the field, and accurately erect and align them onto the stringers in the relative positions on the bascule span, both transversely and longitudinally, with the main bearing bars at right angles to the stringers and curbs, making use of the longitudinal bolted splice located at the crown. After field alignment is achieved and approved, field drill bolt holes for the connections to the stringers. Achieve installation tolerances noted herein.

Exercise care to place each panel in its proper position, measuring in all cases from the same reference point to avoid cumulative errors in spacing. Submit proposed corrections to fit up errors for approval of the Engineer. Obtain the Engineer’s approval prior to any field trimming. Any cost of materials and labor will be borne by the Contractor, including application of zinc rich primer to cut or welded surfaces. Splice the panels together along the ends at the crown, as shown on the plans.

Prior to erection of the steel grid panels, ensure that the stringers are at specified grades and spacing within tolerance. Install and align the deck panels onto the steel framing. Ensure the alignment of the steel grid panels prior to drilling holes for hold-down connections. Inspect the erected steel grid panels and the stringers for overall fit up. Use templates as required to accurately locate bolt holes where holes in the steel grid panel connection plates cannot be used as a guide for drilling. Inspect the interface between the main bars and stringers for uniform bearing before installation of the temporary hold down fasteners and re-verify that the main bars are in full bearing after tensioning the bolts. Adjust the fill plates and shim packs below the connection plates as required so that the main bars are drawn tight against the stringers.

Lift, handle, support and secure the steel grid panels in a manner that prevents permanent distortion. Use adequate support beneath the ends and at intermediate points along the length of the panels during transport and storage. Lift the panels using devices located at similar points as the end and intermediate supports. Locate intermediate support points at a spacing of no more than twice the stringer spacing. Panels may be stacked upon each other provided that support, as described, is provided between panels. Secure the steel grid panels during transport with nylon straps wrapped over the panels and tightened in a manner that avoids distortion to the main bars, distribution bars or steel sheet metal form pans. After transport and storage, ensure that the panels are undamaged and within allowable flatness tolerances. Store panels in an elevated position above the ground. Submit details of the support and lifting locations in the shop drawings.

Erect and support the steel grid panels in a manner that avoids distortion induced stress. Do not apply external force to the panel to achieve proper fit-up, except as required to close a gap between the panels and stringers equal to the maximum allowable camber. The high strength connections may be used to draw the panels tight against the stringers. Furnish adequate thread length as required.

Remove and replace steel grid panels that do not meet the requirements of this special provision with new panels at no additional cost to the contract.

Do not place construction equipment on the steel grid panels after erection and prior to placing and curing the deck concrete. Ensure that the steel grid panels at the tip end of adjacent bascule leaves are aligned to each other with both bascule leaves in the fully lowered position. Adjust the vertical alignment with fill plates and/or shims as required.

3. Concrete Placement. Place, screed, consolidate, and finish the deck concrete in accordance with section 706 of the Standard Specifications for Construction, except as specified herein.

Seal the gaps between the steel sheet metal form pans and the main bars and trim bars using an approved silicone caulking material to minimize leakage during concrete placement. Install additional temporary formwork as required.

Install and secure deck reinforcing steel to the steel grid panels with tie wires through the series of closely spaced holes in the main bars.

Install and align screed rails. Verify screed alignment to the steel grid panels to demonstrate that the screed achieves uniform deck slab thickness and concrete cover to the specified values within tolerance. Uniform deck thickness takes priority over a specified profile grade to control bascule leaf weight.

Ensure that forms and steel grid panels are clean and dry at the time of concrete placement. Consolidate the concrete using mechanical vibrators (rubber coated head), approved by the Engineer. Remove wet concrete spilled onto the structural steel before it hardens.

Perform the deck concrete placement, screeding, finishing, and curing with the bascule leaf in the fully lowered position and supported at the counterweight and center of roll, while the other bascule leaf is in the fully raised position. Place the deck concrete continuously from the tip of the bascule leaf while working towards the bascule piers. Do not raise the bascule leaf until after the concrete has achieved the required 7-day flexural or compressive strength. Furnish temporary counterweight support to accommodate any imbalance condition during deck placement.

4. Navigation Restrictions. Coordinate with the United States Coast Guard for navigation restrictions during Exodermic deck construction including grid deck panel erection, reinforcing steel installation, screed rail installation, and concrete placement, screeding, finishing, and curing. See Special Provision for Maintaining Navigation.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

**Pay Item Pay Unit**

Exodermic Deck, 4 inch Square Foot

**Exodermic Deck, 4 inch** is to be measured as the horizontal plan area between the out-to-out dimensions shown on the plans. Work includes preparation of shop and working drawings, fabrication, shipping, storage and erection of the Exodermic deck hot-dip galvanized steel grid panels, including stay-in-place steel sheet metal form pans, connection plates, bolting hardware, welded studs, fill plates and shim packs as shown on the plans. No separate payment will be made for galvanizing, required testing, shop or field bolting, leveling/aligning panels, or shims. The steel reinforcement and cast in place concrete are measured and paid for separately.