MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**CULVERT, ALUMINUM MULTI-PLATE PIPE ARCH, 12 FOOT 11 INCH BY 7 FOOT 6 INCH**

BRG:KAH 1 of 4 APPR:DMG:NAP:03-15-22

**a. Description.** This work consists of designing, load rating, manufacturing, furnishing, erecting, and installing an aluminum multi-plate pipe arch culvert, headwalls, wingwalls and appurtenances, providing dewatering, and maintaining water flow during all construction stages. Conduct all work in accordance with section 401 of the Standard Specifications for Construction, as shown on the plans and as specified herein.

**b. Materials.** Furnish granular material, Class II in accordance with section 902 of the Standard Specifications for Construction.

Furnish the culvert, headwalls and wingwalls in accordance with *AASHTO M219* as appropriate. The culvert, headwalls and wingwalls consist of all plates, ribs, and appurtenant items to provide a complete structure as shown on the plans.

Furnish bolts and nuts in accordance with *ASTM B746/B746M* or *AASHTO M219*.

Acceptance of fabricated elements will be based on fabrication inspection in accordance with subsection 2.3 of the *Structural Fabrication Quality Manual.*

If Grade A325 fasteners are used ensure they are in accordance with *ASTM F3125/F3125M* and will be accepted based on general certification.

**c. Design.**

1. Design. Design the aluminum multi-plate pipe arch culvert based on 1.2 times the current *AASHTO LRFD Bridge Design Specifications HL-93 Loading* with the exception that the design tandem portion of the *HL-93* loading definition is to be replaced by a single 60-kip axle load before application of the 1.2 factor. The resulting load is designated *HL-93 Mod*. Live load plus dynamic load allowance deflection cannot exceed 1/800 of the span length. A maximum internal angle of friction of 30 degrees for backfill soil is to be used in design of the multi-plate pipe arch culvert and wingwalls.

2. Load Rating. Prior to manufacture, perform load ratings on the aluminum multi-plate pipe arch culvert in accordance with the *AASHTO Manual of Bridge Evaluation, Section 6, Part A*, the *Michigan Bridge Analysis Guide* and the *Michigan Structure Inventory and Appraisal Guide*. Calculate the following ratings:

A. The Inventory Rating, National Bridge Inventory (NBI) Item 66;

B. The Operating Rating, NBI Item 64;

C. The Michigan Operating Rating, MDOT Item 64M; and

D. The Michigan Overload Class, MDOT Item 193.

3. Perform the above load ratings using as-designed conditions and deliver to the Engineer in PDF for each load rating case that includes the following:

A. Assumption Sheet

B. Program or Calculation Input and Output

C. Summary Sheet

Furnish load ratings signed and sealed by a Professional Engineer licensed in the State of Michigan.

**d. Fabrication.** Shop inspection and prefabrication meeting requirements will be in accordance with subsection 707.03.B of the Standard Specifications for Construction.

The fabricator must document procedures for verifying and maintaining material identity of plates and fasteners, dimensional tolerances of plates thickness, corrugations, and cross-sectional dimensions in accordance with *AASHTO M219* or *ASTM B746/B746M*.

Furnish shop drawings of the culvert, headwalls and wingwalls for approval in accordance with subsection 104.02 of the Standard Specifications for Construction. Ensure shop drawings are signed and sealed by a Professional Engineer licensed in the State of Michigan. Furnish the culvert from a fabricator that has a minimum of two licensed Professional Engineers on staff that are dedicated to the design of these types of structures. Furnish the names, engineer license numbers, and positions held to the Engineer. Furnish evidence of a similar type of culvert or metal culvert by the fabricator that was successfully installed in Michigan in accordance with the *AASHTO LRFD Bridge Construction Specifications* or *ASTM B789/B789M*. Include the name of the project and site location with the shop drawing submittal.

Include in the shop drawings the details of the physical dimensions, material specifications, method of manufacture, method of joining adjacent culvert elements and corresponding headwall and wingwall components, recommended installation procedures, design assumptions, compliance and application of the design live loads, and design calculations. Submit shop drawings to the Engineer for review at least 30 calendar days prior to fabrication. Do not begin fabrication until written approval of the shop drawings has been received from the Engineer.

If welding is specified on the design of the culvert or appurtenances and approved by the Engineer, ensure welding personnel (i.e., welders, welding operators and tack welders) are qualified in accordance with AWS D1.2:2003 (as modified by 20SP-707A - Structural Steel and Aluminum Construction), hereafter referred to as AWS D1.2. The Department will require additional performance testing in accordance with the *MDOT Welder Qualification Program* under the supervision of the QAI. The Engineer will not accept welding performance endorsements from other agencies.

The period of effectiveness for shop welding personnel endorsed through *MDOT’s Welder Qualification Program* is 3 years unless welding personnel are not engaged in a welding process for at least 3 months, or a specific reason exists to question the welder's ability. The Engineer may require a confirming performance test, at no cost to the contract, during the progress of the work.

**e. Construction.** Assemble and install the culvert in accordance with *ASTM B789/B789M*. Hold a preconstruction meeting with the Fabricator and Engineer prior to beginning any culvert work to discuss the installation process. Furnish an on-site technical representative from the Fabricator, as necessary or as requested by the Engineer, during the culvert installation to assist the Contractor and Engineer. Furnish the Engineer with a copy of the Fabricator’s construction manual prior to erection.

1. Unloading and Handling. Unload and handle all material as recommended by the fabricator. Do not use hooks, chain, wire rope or other types of materials that will damage the aluminum plate sections and accessories.

2. Assembly. Construct culvert, headwalls and wingwalls and all appurtenant items as shown on the plans and in accordance with the installation notes for the method of backfill, compaction around the structure and placement of the culvert bedding. The fabricator of the culvert must furnish qualified staff for on-site construction assistance during the entire assembly of the culvert, headwalls, wingwalls, and placement of the culvert bedding and backfill.

Install the culvert in accordance with the plans and specifications, the fabricator’s recommendations, and the standard specifications.

Perform backfill operations to minimize deflection of the structural walls when subjected to backfill loads. Perform backfill operations evenly on both sides of the structure to ensure a uniform stress distribution. Place and compact backfill material in 6 inch layers to at least 95 percent of the maximum unit weight.

When flowable fill is used, provide counterweight and/or restraints to secure the culvert from movement due to the buoyant effects of the flowable fill.

Protect the culvert from damage caused by adjacent work or related activities. Any damage to the culvert, headwalls, wingwalls or appurtenant items will be repaired or replaced at the direction of the Engineer at no cost to the contract. Do not operate heavy equipment over or near the structure without full depth of cover and complete backfilling.

**f. 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**

Culv, Alum Multi-Plate Pipe Arch, 12 foot 11 inch by 7 foot 6 inch Foot

**Culv, Alum Multi-Plate Pipe Arch, 12 foot 11 inch by 7 foot 6 inch** will be measured along the transverse centerline of the culvert from outside face of headwall to outside face of headwall. **Culv, Alum Multi-Plate Pipe Arch, 12 foot 11 inch by 7 foot 6 inch** includes testing and water control measures as described in this special provision and as shown on the plans. The culvert, headwalls, wingwalls and appurtenances are included in the payment for this item of work.

Excavation, structure backfill, flowable fill, and culvert bedding will be paid for separately.

All costs associated with shop or field welder endorsement to the *MDOT Welder Qualification Program* testing including, but not limited to providing the specimen test plates, performing endorsement testing, and submittal of qualification specimens are included in this pay item. The Department will perform testing (cut, machine, test, and report out) of specimens at no cost to the Contractor for the first test; however, the Contractor is responsible for the cost of performing re-testing if the first test specimen fails for a specific test.