PROJECT REQUIREMENTS

BOOK 2

Little Rapids Habitat Restoration
Roadway Reconstruction
Design-Build Project

1 ½ Mile Road
Chippewa County Road Commission

Addendum 2 Addendum 3
June 10 June 16, 2015
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• Pier Scour Analysis:
  o The Design-Builder shall evaluate total pier scour based on a maximum velocity of 9 feet per second, and a contraction scour of 4 feet and 3.5 feet for a Waterway Clear Opening of 400 feet and 500 feet or 3 feet for a Waterway Clear Opening of 600 feet and 700 feet.

• Abutment Scour Analysis:
  o Preliminary calculations indicate a significant potential for abutment scour. In lieu of abutment scour calculations, the Design-Builder shall provide armor protection for abutments to prevent scour. The armor protection shall be designed using FHWA’s HEC-23 Design Guide 8 using a velocity of 9 feet per second.

• Culvert Scour Analysis
  o The Design-Builder shall evaluate culvert scour and provide scour protection. It is anticipated that the 2’ river bottom liner will combat scour on the upstream and downstream ends of a box culvert structure, but the Design-Builder shall confirm this with their final design and provide scour protection as necessary.

• Plot of the scour depths relative to the bridge structure units
• Riprap and armor protection design and calculations (per FHWA’s HEC-23 Design Guide 8)
  o If armoring material other than riprap is proposed, the Design-Builder shall submit design calculations from the manufacturer for review by CCRC.
• Soil boring information (sieve analysis) used to determine variables
• Scour calculations shall be based on the substrate material sizes indicated in Book 2 Section 13.2.2.1.

The Design-Builder shall submit two (2) copies to the CCRC Project Manager (each containing one CD with electronic files in their original format of the Drainage Design Report) for a preliminary review by CCRC. The electronic files shall include the files used to perform calculations. CCRC will respond with comments or approval within ten (10) Working Days. The Design-Builder will make necessary changes requested by CCRC and resubmit the report with written response to all comments. CCRC will have an additional ten (10) Working Days to provide comment or Acceptance. This review time will be required for each submittal until the comments are addressed to CCRC’s satisfaction.

12.5.1.4 Hydrologic Report
The Hydrologic Report will be submitted prior to or with the roadway base plans and shall include:
• Executive Summary
• Introduction: Location, purpose, and scope of Work
• Basis of Design: List of standards followed
• Hydraulic evaluation of Existing Drainage System: Calculation results
• Proposed recommendations
• Appendices:
  o Drainage area maps for design
  o Hydrologic and hydraulic calculations
  o Document results (summary tables, etc.)
  o Computer input and output on CD in their original format
The Design-Builder shall obtain CCRC Acceptance of the report before initiating the Drainage Design Report.

**12.5.1.5 Drainage Design Report**

The Design-Builder shall develop a Drainage Design Report, submitted prior to or with the roadway preliminary plans, that shall include a record set of all drainage computations, both hydrologic and hydraulic, and all support data. The Drainage Design Report will include information specific to storm sewer and culverts, and shall include:

- Executive Summary
- Introduction: Location, purpose, objectives, and scope of Work
- Basis of Design: List of standards followed
- Evaluation of Existing Drainage: Results of drainage sizing calculations
- Evaluation of Proposed Drainage: Results of proposed sewer calculations
- Appendices:
  - Drainage area maps for design
  - Enclosed storm sewer and calculations, if applicable
  - Hydrologic and hydraulic calculations
  - Document results
  - Computer input and output (native format) on CD
  - Drainage and permitting correspondence

The Design-Builder shall submit two (2) copies to the CCRC project manager (each containing one CD with electronic files in their original format of the Drainage Design Report) for a preliminary review. The electronic files shall include the files used to perform calculations. CCRC will respond with comments or no objection within ten (10) Working Days. The Design-Builder will make necessary changes requested by CCRC and resubmit the report with written response to all comments. CCRC will have an additional ten (10) Working Days to provide comment or no objection. This review time will be required for each submittal until the comments are addressed to CCRC’s satisfaction.

When the comments are addressed to CCRC’s satisfaction, the Design-Builder will, if necessary, forward two (2) additional copies of the Drainage Design Report to CCRC to include in their permit application to the MDEQ/USACE. The MDEQ has up to 90 days to review a complete application. The review times must be accounted for in the Project schedule. The Design-Builder shall obtain CCRC and MDEQ/USACE Acceptance prior to construction within a floodplain.

**12.5.2 Video Inspections**

Not used.
13.2.2 Design Parameters

13.2.2.1 Geometrics

The lane layout, shoulder width, clear roadway width, and fishing area shall be in accordance with Exhibit 2-11-B (Proposed Laneage and Cross Slopes).

Shoulder cross slopes must match lane cross slopes.

The bottom of the superstructure (i.e. the bottom face of the culvert top slab for box culverts or the bottom of the beams for bridges) shall be at a minimum elevation of 583.70 (IGLD 85 Datum).

For box culvert structures, the top face of the culvert bottom slab shall be at a maximum elevation of 571.70 (IGLD 85 Datum). There shall be at least 6 inches of clean washed stone covering the bottom slab of box culverts. The river bottom within the Project limits, but outside the box culvert limits, shall be lined with natural river stone or gravel materials that are consistent with the substrate material found upstream and downstream of the causeway. The existing substrate material appears to be roughly 3 inch to 16 inch stone with a D50 of 8 inches. River bottom lining shall be a minimum of 2 feet thick. Use of existing causeway material is acceptable if it meets or exceeds the requirements for substrate material as described in this Section 13.2.2.1.

For bridge structures, the river bottom/proposed ground line shall be determined using straight line grading from upstream to downstream through the causeway at multiple locations. Natural stone or gravel materials that are consistent with the substrate material upstream and downstream shall be used to shape the river bottom/proposed ground line. There shall be no obstructions between the bottom of the superstructure and the river bottom/proposed ground line adjacent to bridge piers. The existing substrate material appears to be roughly 3 inch to 16 inch stone with a D50 of 8 inches. River bottom lining shall be a minimum of 2 feet thick. Use of existing causeway material is acceptable if it meets or exceeds the requirements for substrate material as described in this Section 13.2.2.1.

The limits of river bottom lining for both box culvert structures and bridge structures shall be the Project limits, defined by all areas impacted by construction activities and the area between these impacts, and in accordance with permit requirements. The existing river bottom may meet the requirements for substrate material in its current form, however, the Design-Builder shall investigate the substrate material to determine if the existing substrate material is acceptable and provide additional material as necessary. The river bottom/proposed ground line is defined as the top of the river bottom lining.

The river bottom/proposed ground line elevation for both box culvert structures and bridge structures shall be determined by straight line grading between 2 points at multiple locations. The first point shall be located 100’ upstream and the second point shall be located 100’ downstream of the centerline of the proposed structure alignment. The elevations of these points shall be determined by averaging the elevations of the existing river bottom at 60, 80, and 100 foot offsets upstream and downstream from the centerline of the proposed structure alignment at each pier, respectively.

Broken concrete shall not be used as surface material for any part of the Project, including but not limited to river bottom lining, culvert lining, or armoring.

See Exhibit 2-13-A for details. In order for a span to be counted towards the Waterway Clear Opening, it must completely satisfy the above requirements from the upstream face of the structure to the downstream face of the structure.

13.2.2.2 Loads and Forces

For a proposed box culvert structure, loads and forces must conform to section 406.03 of the MDOT Standard Specifications for Construction, the AASHTO LRFD Bridge Design Specifications, and MDOT standards. Design box culverts for HL-93 live loading. Designing box culverts for HL-93 Modified live loading is not required.
For a proposed bridge structure, apply live loading according to the AASHTO LRFD Bridge Design Specifications, except use HL-93-Modified live loading according to the MDOT Bridge Design Manual.

Apply pedestrian live loading to the fishing area according to the AASHTO LRFD Bridge Design Specifications.

Design components, other than box culverts, including, but not limited to, headwalls, wing walls, foundations and connections, according to the AASHTO LRFD Bridge Design Specifications, the MDOT Bridge Design Manual, MDOT Bridge Design Guides, MDOT Road Design Manual and MDOT Standard Plans.

The Design-Builder shall not design a bridge with fracture-critical components. A non-redundant bridge is prohibited.

The temperature range used to determine thermal forces and movements shall be in conformance with the AASHTO LRFD Bridge Design Specifications Article 3.12 for cold climate temperature range. The type of structure used in determining the temperature range shall be defined by the material of the main supporting members of the superstructure or substructure being considered. Thermal movements and any resulting forces must be taken into account in the design of the structure.

Apply Load Modifiers according to Article 1.3 of the AASHTO LRFD Bridge Design Specifications except as specified herein. Use the following Load Modifiers:

\[ \eta_D = 1.0 \]
\[ \eta_R = 1.0 \]
\[ \eta_I = 1.05 \]

**13.2.2.3 Load Rating**

For box culvert structures, the Design-Builder shall perform a load rating according to subsection 406.03.C of the MDOT Standard Specifications for Construction.

For bridges, the structure must meet all Michigan legal loads and unrestricted Class A overloads. The Design-Builder shall use the Load Rating procedures according to the MDOT Bridge Analysis Guide, AASHTO Manual for Bridge Evaluation, and the MDOT Michigan Structure Inventory and Appraisal Coding Guide. The following Load Ratings shall be calculated:

- The Inventory Rating, National Bridge Inventory (NBI) Item 66
- The Operating Rating, NBI Item 64
- The Michigan Operating Rating, MDOT Item 64M
- The Michigan Overload Class, MDOT Item 193

Perform the above Load Rating using as-designed conditions and assuming the future wearing surface has been placed. Calculations shall be submitted for review prior to Acceptance of RFC documents for the bridge. These calculations shall include at minimum program calculation input and output and the Bridge Analysis Assumptions and Summary forms found at the following website. If the Design-Builder wishes to submit the latter information in a different format, that will be acceptable as long as all of the information requested on these forms is furnished.

[http://www.michigan.gov/mdot/0,4616,7-151-9625_24768_59520---,00.html](http://www.michigan.gov/mdot/0,4616,7-151-9625_24768_59520---,00.html)

Calculations shall be submitted for CCRC review prior to Acceptance of RFC Documents for the bridge. The Design-Builder shall rate the bridge using the AASHTOWare™ Bridge Rating software or an approved equal. The bridges shall be modeled using the “Girder System” method. If the bridge structure cannot be modeled using the Bridge Rating software due to limitations of the software, the Design-Builder shall rate...
the structure using hand calculations or other software as approved by CCRC. The bridge deck shall be analyzed using hand calculations.

If the Design-Builder does not currently have the Bridge Rating software, they shall obtain it from AASHTO.

http://www.aashtoware.org/Pages/default.aspx

Any assumptions made in the analysis (material properties, section losses, etc.) shall be listed in an Assumption Sheet. The Design-Builder shall submit any hand calculations, spreadsheets, etc. used to determine input into the Bridge Rating software. If formulas are hidden, a brief description of the procedure shall be included. When other programs are used instead of the Bridge Rating software, load and capacity information shall be provided at locations of interest, including but not limited to 10th points of the spans. The Bridge Analysis Assumptions and Summary forms shall be submitted as a *.pdf. These forms shall be marked with the design engineering firm’s logo or letterhead.

All Load Ratings shall be sealed by a Professional Engineer licensed in the State of Michigan.

13.2.2.4 Cast-in-place Concrete Design

For box culvert structures, design concrete components including, but not limited to, headwalls and wingwalls according to the AASHTO LRFD Bridge Design Specifications.

For bridges, concrete deck over prestressed concrete beams shall be cast continuous over pier(s).

The barrier railing shall not be considered as a structural part of the cross-section for design.

The Design-Builder shall apply low-temperature protection of concrete when required according to the Standard Specifications. The Design-Builder shall provide a 7 day wet cure on all permanently exposed surfaces of the bridge deck. Forms can remain on the fascias or the underside of the bridge deck for seven days in lieu of the wet cure for these two surfaces.

13.2.2.5 Precast Concrete Beam Design

Design prestressed concrete beams as simple span beams for all dead load and live load. Design the bridge deck continuous over piers for live loads and superimposed dead loads. The connection details between beams at the continuity diaphragm shall be per the MDOT Bridge Design Guides.

A bridge design with side–by–side concrete box beams is prohibited.

13.2.2.6 Steel Beam Design

Steel beams are not allowed for this Project.

13.2.2.7 Slope Stability

The Design-Builder shall check the overall stability of earth slopes near all structures, including the box culvert structure ends or bridge abutments. Overall stability includes internal, external, compound, and global. The factor of safety for slope stability shall be meet the requirements of AASHTO LRFD sections 10.5.2.3 and 11.6.2.3. The steepest permanent slope allowed will be 1:2 (V:H).

13.2.2.8 Drainage

For box culvert structures, one (1) 2-inch weep hole shall be provided in the headwalls at the north and south ends of each concrete box culvert channel to promote drainage of the fill section above the concrete box culverts. 6-inch outlets shall be provided at underdrain outlet locations as defined in Book 2, Section 11.

For bridges, deck drains may be used to provide positive deck drainage.

13.2.2.9 Signs, Lighting, Signals and Utilities

Conduits shall not be placed on the outboard side of fascia girders. Conduits shall be supported by beams.
13.2.2.10 Bridge Bearings
The elastomeric bearings shall be laminated steel-reinforced elastomeric bearings. The bearings shall be designed according to AASHTO LRFD Method A as described in AASHTO LRFD Bridge Design Specifications section 14.7.6.

13.2.2.11 Bridge Deck Joints
The Design-Builder shall not use open transverse joints or open longitudinal joints in the bridge decks.

Expansion joint devices shall be utilized between the approach slab and the sleeper slab. No expansion joints or expansion joint devices shall be located on the bridge deck.

13.2.2.12 Bridge Railings

The pedestrian railing (located at the south face of the structure) need not be crash-worthy if vehicular traffic is prevented from impacting the pedestrian railing by a separate crash-worthy barrier, railing or guardrail. The pedestrian railing must be 42” tall and be constructed of hot-dip galvanized steel. The pedestrian railing must satisfy the requirements contained in the AASHTO LRFD Bridge Design Specifications.

13.2.2.13 Approach Slabs
The Design-Builder shall disregard AASHTO LRFD section 3.11.6.5 for the purpose of designing the abutment.

The Design-Builder shall provide an approach slab and sleeper slab at each end of a bridge according to MDOT Bridge Design Guide 6.20.03A. The Design-Builder shall provide an underdrain system beneath all approach slabs and around all slab edges according to the MDOT Bridge Design Guides, to reduce water in embankment fills at bridge abutments.

13.2.2.14 Abutments
The Design-Builder shall apply a penetrating water repellant treatment to the vertical face of the abutment and back-wall above the bridge seats and apply Substructure Horizontal Surface Sealer to the top horizontal surfaces of all abutment bridge seats. Integral and semi-integral abutments are prohibited.

13.2.2.15 Piers
Hammer head piers, steel pier caps, and non-redundant, fracture critical-pier caps will not be allowed. Cap and column type piers are prohibited.

Pier walls shall extend continuously to the lowest existing river bottom elevation encountered within 100’ upstream and 100’ downstream from the centerline of the proposed structure alignment at each proposed pier. Proposed ground line elevation encountered within the footprint of a proposed pier. The river bottom/proposed ground line elevation shall be determined by straight line grading between the elevations of the existing river bottom at a point 100’ upstream to a point 100’ downstream of the centerline of each pier.

Pier Noses shall be provided on the upstream and downstream end of all piers. A metal ice breaker shall be utilized on the upstream end of all piers. See MDOT Bridge Design Guide 5.21.01 for nosing and ice breaker details.

13.2.2.16 Foundation and Foundation Piling
The Design-Builder shall not use timber piles as foundations for permanent structures.

The Design-Builder shall not use spread footings as foundations for permanent structures.
13.2.2.17 Bridge Deck
The Design-Builder shall provide a minimum 2-inch thick HMA wearing surface on top of the concrete bridge deck. An approved preformed deck waterproofing membrane shall be placed, according to subsection 710.03.C of the MDOT Specifications for Construction, between the HMA wearing surface and the concrete bridge deck. Barrier and / or railing shall be used interchangeably for the term “curb” in Section 710.03.C. The pavement section for the HMA wearing surface shall match the Top Course requirements in Book 2, Section 11.2.2.3.

13.2.3 Aesthetic Treatment
Not used.

13.2.3.1 Painting Requirements
Not used.

13.2.3.2 Concrete Surface Coating Requirements
Not used.

13.2.3.3 Bridge Railing
The steel railing shall be hot-dip galvanized.

13.2.4 Materials
All bridge materials shall be in accordance with the 2012 MDOT Standard Specifications for Construction and MDOT Materials Source Guide.

The Design-Builder shall not use steel sheet piling, masonry, timber, or aluminum as load bearing supports for permanent superstructures or substructures. The use of steel sheet piling will be allowed for earth retainage.

13.2.4.1 Cast-in-place Concrete
The Design-Builder shall not use lightweight concrete for structural members. The Design-Builder shall comply with the 2012 MDOT Standard Specifications for Construction pertaining to concrete mix design requirements.

13.2.4.2 Reinforcing Steel
All reinforcement except reinforcement entirely embedded in the prestressed concrete beams shall be epoxy coated.

The Design-Builder shall use laps or mechanical splices as required to facilitate continuation of reinforcement. Welded splices shall not be used.

13.2.4.3 Precast Concrete
The release and final strengths shall be determined by the Design-Builder and shall not exceed the values in the MDOT Bridge Design Manual Section 7.01.03 LRFD.

13.3 Construction Requirements
All necessary permanent and temporary structures including excavation, slopes and embankment shall be within CCRC ROW and within areas identified on state or federal permits included within this RFP. Temporary structures may be constructed outside of the ROW if written permission is obtained from the land owner.

The attachment of temporary concrete barrier (TCB) to the proposed bridge deck during construction staging is prohibited.

Waterproof all joints in concrete against earth per the MDOT Standard Specifications for Construction.
Longitudinal bridge deck construction used to facilitate part-width construction must be located along a permanent lane line.

**Box Culvert Waterproofing**

All joints in concrete against earth material shall be waterproofed per the MDOT *Standard Specifications for Construction*. This is including, but not limited to, all parallel and transverse joints on the top surface of the concrete box culverts. These joints shall be treated with cold applied culvert joint sealer per Section 406.03 of the MDOT *Standard Specifications for Construction*.

All concrete surfaces, not treated with cold applied culvert joint sealer, in contact with earth material and located above the OHWM, as defined in Book 2, Section 1, shall be waterproofed per the MDOT Special Provision for Substructure Horizontal Surface Sealer. At a minimum, this includes the top of all concrete box culverts and the inside faces of concrete headwalls. Concrete surfaces near joints that will receive cold applied culvert joint sealer shall be free of waterproofing sealer.

**Eye Bolts**

The Design-Builder shall furnish and install galvanized or stainless steel eye bolts spaced every 25 feet along the downstream face of the proposed structure for Sea Lamprey monitoring for the entire length of the structure. The eyebolts shall meet the following requirements:

- The bolt diameter shall be a minimum of 1”
- The inside hole diameter shall be a minimum of 2”
- The embedded length shall be a minimum of 6” if cast in concrete
- The Eye Bolts shall be adhesive anchored according to the manufacturers recommendations if installed after the concrete is cast.

**13.3.1 Removal of Existing Structure**

Not used.

**13.3.2 Field and Shop Painting of Structural Steel**

Not used.

**13.3.3 Structural Metals**

Not used.

**13.3.4 Bracing and Steel Sheet Piling**

The Design-Builder shall provide temporary and/or permanent bracing required during construction per the Design-Builder’s design.

**13.4 Deliverables**

See Book 2, Section 2.5.