PROJECT REQUIREMENTS

BOOK 2

Little Rapids Habitat Restoration
Roadway Reconstruction
Design-Build Project

1 ½ Mile Road
Chippewa County Road Commission

Addendum 1
Addendum 2
June 5
June 10, 2015
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<th>Structure and/or Foundation Support Type</th>
<th>Minimum Number of Foundation Borings per Substructure</th>
<th>Boring Locations</th>
<th>Minimum Boring Depth</th>
<th>Required Investigation Method</th>
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<tr>
<td>Bridge - Pile foundation</td>
<td>One, unless highly variable conditions exist or bridge is 100 ft wide or larger, then add one additional boring per substructure.</td>
<td>As required per standards, subject to CCRC Approval</td>
<td>Borings shall be extended to sufficient depth below shallow or deep foundation elements to allow for comprehensive settlement analysis of foundation systems, with due consideration of the compressibility of the subsurface soils underlying the project. As a minimum, borings should extend at least 50 ft below the base of shallow foundation elements, and at least 20 ft below the tip of deep foundation elements. Piles bearing on rock, 10 ft rock core required. 50 ft below proposed bottom of foundation or per standards, whichever is deeper. Piles bearing on rock, 10 ft rock core required.</td>
<td>Rotary or hollow stem auger borings in soil and rock, rock coring. SPT’s, Shelby tubes.</td>
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<tr>
<td>Retaining walls</td>
<td>Wall length (in feet) divided by 200. Two if 50 ft &lt; wall length &lt; 200 ft. One if wall length &lt; 100 ft. Anchored, tieback, or soil nail walls, require borings in tieback/anchored zone every 200 ft</td>
<td>Space approx 200 ft. Space at 1/3 points if 200 &gt; wall length &gt; 50 ft. For anchored, tieback, soil nail walls, offset borings every 200 ft in this zone of support.</td>
<td>Twice the wall height below the bottom of the wall or auger refusal, whichever is shallower. 10 ft rock core if wall bears on or slightly above bedrock.</td>
<td>Rotary or hollow stem auger borings in soil and rock, rock coring. SPT’s, Shelby tubes.</td>
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<tr>
<td>Roadway – Cuts and Fills</td>
<td>Variable</td>
<td>200 ft (erratic conditions) to 400 ft (uniform conditions)</td>
<td>As required per standards. In larger fills and cuts (&gt;10ft), boring depth should be sufficient to address overall stability. If rock present, core 5 ft beyond planned cut depth</td>
<td>Rotary, hollow stem auger borings, rock coring. SPT’s, Shelby tubes.</td>
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<td>Culverts greater than 30 inch span or diameter</td>
<td>Culvert Length (in feet) divided by 100. Two if length &lt; 100 ft</td>
<td>Along alignment and at headwall/aprons or as needed to define subsurface condition</td>
<td>As required per standards</td>
<td>Rotary or hollow stem auger borings, hand augers, SPT’s req’d for culverts≥60 in or box/slab culverts ≥ 48 in</td>
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shall develop lateral earth pressure calculations including parameters for \( P-y \) curve development for structures subject to horizontal loads. Lateral pile resistance shall be calculated using L-Pile. The Design-Builder shall provide minimum tip elevations, prebore and casing requirements, and estimates of overdrive. Static analysis shall not be used to certify the resistance of piles unless approved by the MDOT Geotechnical Services Section. The maximum nominal pile resistance for the proposed pile sections shall not exceed values given in the MDOT Bridge Design Manual - Chapter 7: LRFD.

- For drilled shafts, nominal resistance graphs that show the resistance in relation to tip elevation for both compression and tension. In addition, the Design-Builder shall calculate and consider downdrag and lateral squeeze. The Design-Builder shall develop lateral earth pressure calculations including parameters for \( P-y \) curve development for structures subject to horizontal loads. Lateral pile resistance shall be calculated using L-Pile. The Design-Builder shall provide minimum tip elevations and casing requirements.

- The Design-Builder shall design all foundation elements to account for losses in lateral and axial capacities resulting from calculated design scour depths which are unmitigated.

- The Design-Builder shall analyze structures supported on rock or tied to rock formations. This includes analyses for areas such as rock bolts and rock cuts.

- The Design Builder shall design excavations and temporary earth retention systems needed for construction in accordance with MDOT special provisions.

### 8.2.3 Roadway Analysis and Design

#### 8.2.3.1 Roadway Design Criteria

The Design-Builder shall provide the pavement sections specified in Book 2, Section 11. Compaction shall follow the compaction requirements in the MDOT Standard Specifications for Construction.

For embankments with fill heights greater than or equal to 10 feet, the Design-Builder shall perform a global stability analysis.

Subsurface drainage outlets shall not cross roadways. Left and right side subsurface drainage systems shall not use a common outlet pipe.

Differential settlement across approach slabs shall not exceed 0.50 inches in 25 feet. The Design-Builder shall implement ground improvement techniques to the approach embankment subgrade, if necessary, to meet this requirement.

Differential settlement between adjacent culverts shall not exceed 0.50 inches.

The Design-Builder shall provide granular treatments for culverts in accordance with MDOT Standard Plan R-82 Series.

#### 8.2.3.2 Excavations and Embankments

For proposed embankments with fill heights greater than or equal to 10 feet, the Design-Builder shall perform a global stability analysis using Slope software. Proposed embankment includes both temporary and permanent embankments (i.e. temporary roads, construction access roads, modified portions of the causeway due to roadway reconstruction, etc.). Staged construction of proposed embankments is required unless the Design-Builder furnishes calculations/analyses demonstrating the proposed embankment is stable without the use of staged construction. The Design-Builder shall submit design calculations to CCRC for review.

Organic deposits within the influence of roadbed support shall be removed. Minimum limits for deep excavations to remove organic deposits shall be in accordance with MDOT Standard Specifications for Construction, Section 205 and MDOT Standard Plans R-103 Series.
All new embankment and embankment-widening material shall be suitable grading material or borrow that meets the requirements of the Standard Specifications and must be constructed in accordance with Standard Specification Section 205, which requires the in-place embankment foreslopes to be notched before widening.

8.2.3.3 Detention Ponds and Infiltration Zones

If detention ponds or infiltration zones are part of the Project, the Design-Builder shall prepare slope stability analyses on pond side slopes and berms, and settlement analyses on berms. The Design-Builder shall prepare geotechnical recommendations for infiltration zones. The Design-Builder shall perform all detention pond and infiltration zone analyses in accordance with the requirements of Section 12.

8.2.3.4 Alternative Designs

The following are unacceptable alternatives for pavement design (See Book 2, Section 11.2.2 for pavement design requirements):

- Change in surface type (bituminous or concrete) for any pavements.
- Alternatives that result in a decrease in the depth of non-frost susceptible material.
- Decreases in thickness relative to minimum structural requirements. This applies to individual layer thicknesses, as well as the total minimum structural requirements.
- Decreases in granular equivalent (GE) relative to minimum structural requirements. This applies to individual layer GE, as well as the total minimum GE structural requirement.

8.2.4 Geotechnical Instrumentation and Monitoring Plan

The Design-Builder shall determine what geotechnical instrumentation is required to monitor the impact of construction or demolition activities to protect the Project area and verify the stability of the proposed Work. The Design-Builder shall develop, implement, and maintain a documented Geotechnical Instrumentation and Monitoring Plan. All geotechnical instruments shall be installed and monitored by the Design-Builder. Any instruments that are damaged during construction and require removal and/or recalibration shall be replaced and/or recalibrated by the Design-Builder.

Prior to deploying geotechnical instrumentation and beginning monitoring, the Design-Builder shall identify and submit in writing to CCRC the recommended instrument types, locations, installation requirements, zones of influence, critical readings, and frequency of readings. An action plan shall be presented that protects the nearby structures, utilities, or other element if defined vibration thresholds or defined settlement limits are exceeded.

Depending on the Design-Builder’s approach to the work, the plan shall include instrumentation to provide information to help protect adjacent structures, pavements, utilities, slopes or other elements. The Geotechnical Instrumentation and Monitoring Plan may include such parameters as:

- Settlement and settlement rates of embankments
- Pore water pressures
- Groundwater levels
- Stability of bridges, walls and slopes
- Stability of existing and new pavements
- Stability of Utilities

The Design-Builder shall pay particular attention to construction methods that may induce settlement or vibrations (pile driving, steel sheet installation, etc.) and deploy monitoring instrumentation accordingly. The Design-Builder shall at minimum meet the requirements of the MDOT Special Provision for Monitoring Vibrations.
8.2.5 **Foundation Analysis and Design Report**

The Design-Builder shall use the subsurface investigation information provided along with any supplemental information necessary to produce a Foundation Engineering Report for each structure on the Project. The report shall be in accordance with the MDOT Geotechnical Investigation and Analysis for Structures. Each report shall include a letter that contains a Project reference, a brief description of the proposed design, the number of borings taken by the Design-Builder, which borings were used for design that were provided by CCRC, a brief description of the soils and groundwater conditions encountered, and if required, conclusions of an engineering analysis and design recommendations.

8.2.5.1 **Presentation of Foundations Investigation**

The plotted borings used to show the generalized geotechnical profile may be abbreviated, but shall include soil and rock classifications, Standard Penetration Test values, unconfined compression test results, and where soils become saturated or where groundwater conditions are encountered, all plotted with depth. The Design-Builder shall make all plots on tabloid-size (11-inch by 17-inch) paper and plotted to an engineering scale.

8.2.5.2 **Subsurface Investigation Summary**

The Foundation Analysis and Design Report shall contain a separate section labeled “Subsurface Investigation Summary.” This section shall include information about the borings taken for the Project, a brief description of the foundation soil and rock conditions, a summary of the water level measurements taken, and an interpretation of the static water level. Also included in this section shall be a list of borings provided by CCRC that were used by the Design-Builder.

8.2.5.3 **Foundation Analysis**

The Foundation Analysis and Design Report shall contain a separate section labeled “Foundation Analysis.” For this section, the Design-Builder shall summarize the results of a detailed foundation analysis to identify critical design elements and provide a basis for foundation recommendations. At a minimum, the Design-Builder shall address the following:

- The foundation analyses listed in Section 8.2.2.3
- A summary of the design assumptions, including information about embankment fill heights, unit weights of fill, side slope and end slope angles, bridge loading information (both axial and horizontal), retaining wall loading information, design methodologies, and other pertinent information
- An evaluation of CCRC borings used by the Design-Builder and the assumptions and design completed from these borings
- Construction considerations such as design of temporary slopes and shoring limits
- Subcut recommendations and backfill requirements (including details prepared by the Design-Builder for the Project)
- Construction staging requirements, where applicable

8.2.5.4 **Foundation Recommendations**

The Foundation Analysis and Design Report shall include a section labeled “Foundation Recommendations.” The report shall be sealed by a Geotechnical Professional Engineer Licensed in the State of Michigan. This section shall include definitive recommendations listed as follows:

- Nominal bearing capacities and associated resistance factors for the recommended foundation type
- Recommended design soil parameters (e.g., coefficient of friction, lateral earth pressure coefficients, etc.)
- Recommended footing sizes and embedment depths
- Recommended pile section, minimum pile tip elevation, and estimated pile tip elevation
- Recommended drilled shaft dimensions and construction methods
8.3 Construction Requirements

8.3.1 Foundation Load Testing
Driven foundation piling shall be load tested according to the MDOT Standard Specifications for Construction Section 705, and Special Provision for Static Load Test, if required by the Design-Builder’s design. Load testing by other methods must be approved by the project manager prior to construction.

Lateral load testing on driven piles will be allowed and shall follow ASTM D3966-07.

8.3.2 Driven Foundation Pile Requirements
Field testing in accordance with MDOT Standard Specifications for Construction shall be performed for driven foundations to evaluate foundation capacity and integrity, to verify design assumptions, to determine foundation installation characteristics, to evaluate the pile-driving system performance, and to establish foundation depths. The driven foundation testing and monitoring shall include all necessary quality control testing, including test piles, dynamic testing, and static load testing.

8.3.3 Driven Foundation Limitations
The Design-Builder shall consider susceptibility to settlement of footing, roadways, utilities, and other elements due to the driving of foundation elements such as pile. If settlement is an issue, mitigation shall be provided.

8.3.4 Temporary Earth Retainage Limitations
Temporary earth retainage such as steel sheet piling or soldier piles near or adjacent to existing and proposed roadways, utilities, and other elements susceptible to settlement shall be installed without vibratory methods and left in place. Other requirements or limitations within the section may be more stringent. The more stringent requirements or limitations will apply.

8.3.5 Geotechnical Instrumentation and Monitoring
Instrumentation and monitoring shall be performed according to the Design-Builder’s Design Lead Geotechnical Engineer and the Approved Geotechnical Instrumentation and Monitoring Plan. Minimum construction requirements are outlined in the Special Provision for Monitoring Vibrations.

8.3.6 Density Requirements
At a minimum, the Design-Builder shall provide density control that meets the requirements set forth in the following:
8.3.7 Subgrade Improvements
Underdrains shall be according to Book 2, Section 11.2.2.
Peat excavation and swamp backfill shall be according to Book 2, Section 8.2.3.2.

8.4 Deliverables
8.4.1 Supplemental Subsurface Investigation
8.4.1.1 Subsurface Investigation Plan
The Design-Builder shall submit for Approval in electronic format a Subsurface Investigation Plan for supplemental subsurface investigation(s) the Design-Builder plan(s) to perform for bridge foundations or roadways.
8.4.1.2 Foundation Boring Field Logs
The Design-Builder shall submit to CCRC one electronic copy of the field log for each foundation boring performed as part of the supplemental subsurface investigation.
8.4.1.3 Foundation Boring Final Logs
The Design-Builder shall submit to CCRC one electronic copy of the final log for each foundation boring performed as part of the supplemental subsurface investigation.
8.4.1.4 Roadway Boring Final Logs
The Design-Builder shall submit to CCRC one electronic copy of all final boring logs performed as part of the supplemental subsurface investigation.
8.4.1.5 Lab Testing Data
The Design-Builder shall submit to CCRC one electronic copy of the lab test data completed as part of the supplemental subsurface investigation.
8.4.2 Foundation Analysis and Design Report
The Design-Builder shall submit one electronic copy of each Foundation Analysis and Design Report for Acceptance by CCRC. CCRC will respond within 10 Working Days of receipt of each Foundation Analysis and Design Report.

The Design-Builder shall submit the results of the supplemental foundations investigation, incorporating the geotechnical information provided in the RFP, for each structure in the form of plotted borings on proposed plans and profiles and cross-sections.
8.4.3 Geotechnical Instrumentation and Monitoring Plan
The Design-Builder shall submit to CCRC for Approval one electronic copy of the Geotechnical Instrumentation and Monitoring Plan. The minimum plan and reporting requirements are outlined in the Special Provision for Monitoring Vibrations. The Design-Builder shall submit monthly action and progress reports as readings become available and actions are taken. These reports should be included in the required monthly progress reports outlined in Book 2, Section 2. An exception to the monthly reporting requirements are that daily reports for vibration monitoring shall be made available to CCRC field personnel on a daily basis and submitted electronically weekly.
8.4.4 Settlement Monitoring Plan and Reports
The Design-Builder shall submit for Approval one electronic copy of the Settlement Monitoring Plan if the Geotechnical Instrumentation and Monitoring Plan requires settlement instrumentation. The Design-Builder shall submit monitoring reports monthly as readings become available.
--- MDOT Level 2 Scour Analysis Worksheet (Drainage Manual 6-D)

- **Pier Scour Analysis:**
  - 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 for a Waterway Clear Opening of 400 feet or 3 feet for a Waterway Clear Opening of 600 feet.

- **Abutment Scour Analysis:**
  - 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.

--- Scour calculations, done by hand, for the 100 year (1% chance) and 500 year (0.2% chance) events

- 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)
  - If armoring material other than riprap is proposed, the Design-Builder shall submit design calculations from the manufacturer for review by CCRC.

--- HEC-RAS output report highlighting values used in the calculations

- 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:**
  - Drainage area maps for design
  - Hydrologic and hydraulic calculations
  - Document results (summary tables, etc.)
  - 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.

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 armorin.

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 Bride 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

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.

Bridge elements shall be designed by the Design-Builder to accommodate the forces and moments resulting from loads (e.g., dead, wind, and ice) applied to any attached signs, lighting, signals, and utilities.

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-Build shall disregard AASHTO LRFD section 3.11.6.5 for the purpose of designing the abutment.

The Design-Build 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-Build 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-Build 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 pier caps, steel pier caps, and non-redundant, fracture critical-pier caps will not be allowed. Cap and column type piers are prohibited.

Pier caps walls shall extend continuously to the lowest river bottom/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. Cap and column type piers are prohibited.

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-Build shall not use timber piles as foundations for permanent structures.

The Design-Build shall not use spread footings as foundations for permanent structures.

13.2.2.17 Bridge Deck
The Design-Build 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-Builders 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-Builders shall provide temporary and/or permanent bracing required during construction per the Design-Builders’s design.

13.4 Deliverables
See Book 2, Section 2.5.