MASON COUNTY
ROAD COMMISSION

Board of Commissioners
Bill Schwass, Chairman
Douglas Robidoux, Vice-Chairman
Nick Matiash, Member
Wayne A. Schoonover, P.E., Manager/Director

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November 18, 2016

REQUEST FOR PROPOSAL
FOR
DESIGN ENGINEERING & CONSTRUCTION SERVICES

Replacement of:
SN 6682,
Darr Road over North Branch Lincoln River, Sherman Township, Mason County

The Mason County Road Commission (MCRC) is seeking proposals for the cost of design engineering and all or some construction engineering and services for removal of the existing bridge and construction of a new bridge/structure with related approach work. The design must be in accordance with Federal Highway Administration (FHWA) and Michigan Department of Transportation (MDOT) standards and specifications and AASHTO LRFD Bridge Design Specifications incorporating HL-93 modified live loading. The proposal must include all necessary work for plan and proposal acceptance by the MCRC and MDOT.

LOCATION:

> Darr Road Bridge over North Branch Lincoln River is located in Sections 17 and 18, T19N, R16W, south of Fountain Road, 1 mile east of US-31, 4 miles west of the Village of Fountain, Sherman Township, Mason County.

The original single span structure was built in 1900 and reconstructed in 1979 as a single span steel I-beam thru-truss superstructure with steel decking and hot mix asphalt surface. The bridge railing is steel beam guardrail bolted to the thru-truss. The abutments are vertical concrete walls. The bridge has a structure length of 35.8 feet (span of 35.5 feet) and an outside width of 16.1 (rail-to-rail 14.1 feet). The structure is currently closed and two residences to the south are accessed via temporary access across private property to the east and accessing Ordway Rd, a seasonal road.

This bridge is not on the eligible historic bridge listing.

This project has been approved for the 2018 fiscal year Local Bridge Program after a study and report was generated to consider alternatives for the proposed crossing and to provide a recommended option. A copy of this report is included.

This project will be financed with a combination of Federal and Michigan Local Bridge Program Funds and Local Funds. Participation in engineering costs is not included and will be the responsibility of the MCRC. The MCRC and MDOT will be involved in final approval of plans, etc., and acceptance of completed construction.

At a minimum the following items must be considered and included in the proposal:

1. The plans and specifications shall be developed using the English system and the most current edition of the Michigan Standard Specifications for Construction.

2. Determine in cooperation with the MCRC and MDOT, appropriate design criteria that will govern all design elements for the approach and bridge replacement; including DHV, percentage of trucks, directional distribution of traffic and design speed.

3. Surveys and field investigation including, but not limited to, surveys for the design, road alignment, property lines of adjacent riparian owners, river and flood plain cross sections necessary to develop hydraulics for MDEQ permit, topography, establish section line alignments and any other needed information to apply for and obtain any information needed for environmental studies, permits, etc. Northing and Easting coordinates shall be in NAD83 Michigan StatePlane Central – International Feet. NAVD88 elevations shall be used. It shall also include the location and staking of all horizontal and vertical control points for construction staking, i.e., benchmarks, POT's, PC's, PT's, PI's, section and 1/4 section corners with witnesses, etc. Report all control points with Northing, Easting, Elevation, Station and Offset.

4. Soil borings and associated traffic control, will be the full responsibility of the consultant and shall be included in the proposal. Soil borings shall be included on the plans and include any gradation test results, shear tests, etc. Soil borings shall be made for each substructure location.

5. Perform necessary hydraulic analysis to determine the required waterway opening. Perform necessary scour analysis. Obtain any necessary permit from the MDEQ.

6. The Preliminary Design shall utilize the Report generated by Northwest Design Group and summarized Type, Size, and Location Options and the AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT < 400).

7. The consultant shall prepare and submit any and all MDOT & FHWA program applications, design exceptions (if required), all other applications, permits, and reports for environmental, hydraulic analysis, archaeological studies if required, assessments, reviews, etc. as may be required by FHWA, MDOT, Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Corps of Engineers, SHPO, County Drain Commissioner, or any other Federal, State, or Local Agency involved in the project.

8. Prepare and submit type, size and location (TS&L) plans using the most current MDOT TS&L requirements list, specifications and an estimate of probable construction costs to the MCRC and MDOT for review, comment and approval. Attend the TS&L meeting, if one is necessary.

9. Prepare Preliminary Plans including engineer's opinion of cost, special provisions and additional information required by MDOT. Submit to the MCRC and MDOT for approval. Determine additional right-of-way requirements for the MCRC and prepare property descriptions and documents for any needed grading permits, easements or property acquisition. Provide any necessary staking required for ROW permits, easements or acquisitions. The MCRC will be responsible for appraisals, grading permits, easements and acquisitions of additional ROW.

10. Attend the grade inspection meeting.

11. Prepare Final Design plans, estimate (including electronic MERL) and special provisions in accordance with the MCRC, MDOT and FHWA recommendations and requirements. Final plans shall be submitted electronically to the MCRC and MDOT for approval. Final plans shall be complete with all necessary information and quantities ready for bid letting by MDOT.

12. Shop drawing review and minor phone consultation during construction is included.

13. If any public hearing is held for the project, the Consultant is expected to prepare any required information; attend and participate in the hearing.

14. Contact, coordinate with, and inform all utilities. MCRC will provide consultant a list of utilities and contact information.

15. The proposal shall include: proposed bridge/structure type assumptions estimated construction cost; and a detailed breakdown of the estimated hours and hourly rates for the various design stages for each proposed bridge/structure type.

Construction Engineering and services provided under a separate estimate, to be used in full or partial by the MCRC, shall include at the minimum the following:

1. Construction staking – control and as needed staking

2. Inspection including storm water and soil erosion and sedimentation control, testing, and pay estimates using Field Manager or approved MDOT software

3. Construction Engineering – if applicable: pile driving calculations; shop drawing review; new inspection, load rating, scour analysis and updating of MiBRIDGE; and additional as-needed services.

4. Submit electronic As-Built Plans in PDF file format on thumb/jump drive to the MCRC with read-write capabilities for documentation and file history.

Any proposed cost increases for engineering shall be approved by the Road Commission before the costs are incurred.

Sealed proposals (2 copies) will be received until 2 p.m. on Wednesday, December 21, 2016 at 510 E. State Street, P.O. Box 247, Scottville, Michigan, 49454. Telephone: (231) 757-2882. Faxed proposals will not be accepted.

A decision as to whether to make award of the contract will not be made until the Board of County Road Commissioners meet and decide upon further action. This may require approximately one-to-two months before award.

Proposed Letting Date for the Bridge Construction Contract is January 2018.

Professional liability insurance is required.

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MASON COUNTY, MICHIGAN

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PDF copies of this RFP, most recent Structure Inventory and Appraisal Form 1717A, Bridge Safety Inspection Report Form P2502, and NDG Report are available on our website at www.masoncountyroads.com under the "BIDS" tab. Old plans of the superstructure are available at the MCRC office for viewing. For additional information, please contact Wayne A. Schoonover, P.E., Manager/Director, by phone at (231) 757-2882, or by email at wayneschoonover@masoncountyroads.com.

MICHIGAN DEPARTMENT OF TRANSPORTATION

STR 6682 — STRUCTURE INVENTORY AND APPRAISAL

Facility	Latitude / Longitude	MDOT Structure ID	Structure Condition
DARR ROAD	44.0465 / -86.2607	53313H00016B020	Critical Condition(2)
Feature	**Length / Width**	**Owner**	
N BR LINCOLN RIVER	35.8 / 16.1	County: Mason(53)	
Location	**Built / Recon. / Paint / Ovly.**	**TSC**	**Operational Status**
4 MI W OF FOUNTAIN	1900 / 1979 / /	Muskegon(21)	K Closed to all traffic(K)
Region / County	**Material / Design**	**Last NBI Inspection**	**Scour Evaluation**
Grand(3) / Mason(53)	3 Steel / 10 Truss-Thru	06/02/2016 / Q0RP	U Unknown Scour

Bridge History, Type, Materials

27 - Year Built	1900	
106 - Year Reconstructed	1979	
202 - Year Painted		
203 - Year Overlay		
43 - Main Span Bridge Type	3	10
44 - Appr Span Bridge Type		
77 - Steel Type	1	
78 - Paint Type	9	
79 - Rail Type	0	
80 - Post Type		
107 - Deck Type	8	
108A - Wearing Surface	7	
108B - Membrane	0	
108C - Deck Protection	0	

Structure Dimensions

34 - Skew	0
35 - Struct Flared	0
45 - Num Main Spans	1
46 - Num Apprs Spans	0
48 - Max Span Length	35.8
49 - Structure Length	35.8
50A - Width Left Curb/SW	0
50B - Width Right Curb/SW	0
33 - Median	0
51 - Width Curb to Curb	14.1
52 - Width Out to Out	16.1
112 - NBIS Length	Y

Inspection Data

90 - Inspection Date	06/02/2016	
91 - Inspection Freq	12	
92A - Frac Crit Req/Freq	Y	24
93A - Frac Crit Insp Date	10/29/2015	
92B - Und Water Req/Freq	N	
93B - Und Water Insp Date		
92C - Oth Spec Insp Req/Freq	N	
93C - Oth Spec Insp Date		
92D - Fatigue Req/Freq	N	
93D - Fatigue Insp Date		
176A - Und Water Insp Method	1	
58 - Deck Rating	5	
58A/B - Deck Surface/Bottom		6
59 - Superstructure Rating	2	
59A - Paint Rating	4	
60 - Substructure Rating	3	
61 - Channel Rating	4	
62 - Culvert Rating	N	

Navigation Data

38 - Navigation Control	0
39 - Vertical Clearance	0
40 - Horizontal Clearance	0
111 - Pier Protection	
116 - Lift Brdg Vert Clear	

Route Carried By Structure(ON Record)

5A - Record Type	1	
5B - Route Signing	4	
5C - Level of Service	0	
5D - Route Number	00000	
5E - Direction Suffix	0	
10L - Best 3m Unclr-Lt	0	0
10R - Best 3m Unclr-Rt	99	99
PR Number		
Control Section		
11 - Mile Point		
12 - Base Highway Network	0	
13 - LRS Route-Subroute	0000002205 02	
19 - Detour Length	5	
20 - Toll Facility	3	
26 - Functional Class	09	
28A - Lanes On	2	
29 - ADT	30	
30 - Year of ADT	1997	
32 - Appr Roadway Width	24.9	
32A/B - Ap Pvt Type/Width	2	24.93
42A - Service Type On	1	
47L - Left Horizontal Clear	0.0	
47R - Right Horizontal Clear	15.8	
53 - Min Vert Clr Ov Deck	99	99
100 - STRAHNET	0	
102 - Traffic Direct	3	
109 - Truck %	5	
110 - Truck Network	0	
114 - Future ADT	30	
115 - Year Future ADT	2017	
Freeway	0	

Structure Appraisal

36A - Bridge Railing	0
36B - Rail Transition	0
36C - Approach Rail	0
36D - Rail Termination	0
67 - Structure Evaluation	2
68 - Deck Geometry	6
69 - Underclearance	N
71 - Waterway Adequacy	3
72 - Approach Alignment	5
103 - Temporary Structure	
113 - Scour Criticality	U

Miscellaneous

37 - Historical Significance	5
98A - Border Bridge State	
98B - Border Bridge %	
101 - Parallel Structure	N
EPA ID	
Stay in Place Forms	9
143 - Pin & Hanger Code	
148 - No. of Pin & Hangers	-1

Route Under Structure (UNDER Record)

5A - Record Type		
5B - Route Signing		
5C - Level of Service		
5D - Route Number		
5E - Direction Suffix		
10L - Best 3m Unclr-Lt		
10R - Best 3m Unclr-Rt		
PR Number		
Control Section		
11 - Mile Point		
12 - Base Highway Network		
13 - LRS Route-Subroute		
19 - Detour Length		
20 - Toll Facility		
26 - Functional Class		
28B - Lanes Under		
29 - ADT		
30 - Year of ADT		
42B - Service Type Under	5	
47L - Left Horizontal Clear		
47R - Right Horizontal Clear		
54A - Left Feature		
54B - Left Underclearance	99	99
54C - Right Feature		
54D - Right Clearance	99	99
Under Clearance Year	-1	
55A - Reference Feature	N	
55B - Right Horiz Clearance	99.9	
56 - Left Horiz Clearance	0	
100 - STRAHNET		
102 - Traffic Direct		
109 - Truck %		
110 - Truck Network		
114 - Future ADT		
115 - Year Future ADT		
Freeway		

Proposed Improvements

75 - Type of Work	35	2
76 - Length of Improvement	100.1	
94 - Bridge Cost	10	
95 - Roadway Cost	1	
96 - Total Cost	11	
97 - Year of Cost Estimate	1991	

Load Rating and Posting

31 - Design Load	6
41 - Open, Posted, Closed	K
63 - Fed Oper Rtg Method	2
64F - Fed Oper Rtg Load	30.1
64MA - Mich Oper Rtg Method	2
64MB - Mich Oper Rtg	44
64MC - Mich Oper Truck	17
65 - Inv Rtg Method	2
66 - Inventory Load	20.1
70 - Posting	3
141 - Posted Loading	03NNNN
193 - Overload Class	

MICHIGAN DEPARTMENT OF TRANSPORTATION

STR 6682 BRIDGE SAFETY INSPECTION REPORT

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NBI INSPECTION Q0RP

Inspector Name	Agency / Company Name	Insp. Freq.	Insp. Date
James Nordlund	Nordlund and Associates, Inc	12	06/02/2016

GENERAL NOTES

Bridge Closed - Bridge closed Signs in place.

Posting Signs in Place YES

DECK

	12/14	06/15	06/16	
1. Surface (SIA-58A)	5	5		Bitt on galv steel deck (06/16) (06/15) Bitt on Galvanized steel deck. (12/14)
2. Expansion Joints	N	N	N	(06/16) (06/15) (12/14)
3. Other Joints	N	2	2	Joint at east abutment has settled up to 9". (06/16) Joint at east abutment has settled up to 9". (06/15) (12/14)
4. Railings	5	5	5	(06/16) (06/15) No conventional guardrail is present on the bridge. The sides of the bridge have a couple of small channels welded to the pony trusses that act as railings (12/14)
5. Sidewalks or Curbs	N	N	N	(06/16) (06/15) (12/14)
6. Deck Bottom Surface (SIA-58B)	6	6	6	(06/16) (06/15) Galvanized steel deck (12/14)
7. Deck (SIA-58)	6	5	5	(06/16) (06/15) A bituminous surface obscures the condition of the deck from the top - however, the deck was recently replaced and is in good condition from the bottom (12/14)
8. Drainage				(06/16) (06/15) (12/14)

SUPERSTRUCTURE

	12/14	06/15	06/16

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9. Stringer (SIA-59)	2	2	2	BRIDGE CLOSED The conditions observed in previous inspections continued to worsen... (Checked the ends of the truss near the bearing and found up to 80% of the gusset plates attaching the bottom chord to the end diagonals has been lost to corrosion. Stringers... E1 stringer 5% loss, E2 ~20% loss of section. E3 ~30% loss of section north end & 30% section loss South end. E4 large area of holes at north end w& small area of holes over north floor beam. up to 60% loss of section, bottom flange of beam is gone. E5 40% loss of section, both flanges pitted . E6 north half ~10% loss of section and south half up to 40% loss of section. T Flange - knife edge. E7 - Fair condition. Floor Beams - two are present. Each have been repaired with plates installed on bottom flange at mid span. North floor beam top plate @ stringers # 3 4 & 5 60& loss. South floor beam 50% loss a stringer #5. East end of the south Floor Beam connection has perforated the web of the beam. Connections very rusty. Overall loss of section ~40%. Sag rods are very loose at the south end. Above the bridge deck - the structure is in fair condition. Steel plated riveted to top member is perforated - but this is not a structural part. Angles under the plate are in fair condition with a minimal loss of section (less than 5%). The north floor beam appears to be lower than the south floor beam and the north abutment (06/16) BRIDGE CLOSED The conditions observed in previous inspections continued to worsen... (Checked the ends of the truss near the bearing and found up to 80% of the gusset plates attaching the bottom chord to the end diagonals has been lost to corrosion. Stringers... E1 stringer 5% loss, E2 ~20% loss of section. E3 ~30% loss of section north end & 30% section loss South end. E4 large area of holes at north end w& small area of holes over north floor beam. up to 60% loss of section, bottom flange of beam is gone. E5 40% loss of section, both flanges pitted . E6 north half ~10% loss of section and south half up to 40% loss of section. T Flange - knife edge. E7 - Fair condition. Floor Beams - two are present. Each have been repaired with plates installed on bottom flange at mid span. North floor beam top plate @ stringers # 3 4 & 5 60& loss. South floor beam 50% loss a stringer #5. East end of the south Floor Beam connection has perforated the web of the beam. Connections very rusty. Overall loss of section ~40%. Sag rods are very loose at the south end. Above the bridge deck - the structure is in fair condition. Steel plated riveted to top member is perforated - but this is not a structural part. Angles under the plate are in fair condition with a minimal loss of section (less than 5%). The north floor beam appears to be lower than the south floor beam and the north abutment (06/15) The conditions observed in previous inspections continued to worsen... (Checked the ends of the truss near the bearing and found up to 80% of the gusset plates attaching the bottom chord to the end diagonals has been lost to corrosion. Stringers... E1 stringer 5% loss, E2 ~20% loss of section. E3 ~30% loss of section north end & 30% section loss South end. E4 large area of holes at north end w& small area of holes over north floor beam. up to 60% loss of section, bottom flange of beam is gone. E5 40% loss of section, both flanges pitted . E6 north half ~10% loss of section and south half up to 40% loss of section. T Flange - knife edge. E7 - Fair condition. Floor Beams - two are present. Each have been repaired with plates installed on bottom flange at mid span. North floor beam top plate @ stringers # 3 4 & 5 60& loss. South floor beam 50% loss a stringer #5. East end of the south Floor Beam connection has perforated the web of the beam. Connections very rusty. Overall loss of section ~40%. Sag rods are very loose at the south end. Above the bridge deck - the structure is in fair condition. Steel plated riveted to top member is perforated - but this is not a structural part. Angles under the plate are in fair condition with a minimal loss of section (less than 5%). The north floor beam appears to be lower than the south floor beam and the north abutment (12/14)
10. Paint (SIA-59A)	4	4	4	More than 35% of the paint is gone. (06/16) More than 35% of the paint is gone. (06/15) More than 35% of the paint is gone. (12/14)
11. Section Loss	0	0	0	Stringers are rusted through and have considerable ection loss. (06/16) Stringers are rusted through and have considerable ection loss. (06/15) (12/14)

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12. Bearings	3	3	4	Bearings consist of the ends of the pony truss supports and the ends of the seven (7) stringers. Bearings are steel plates anchored to the concrete. Very rusty and dirty. The west 1/2 of the north abutment has settled and is no longer supporting the ends of the stringers or the pony truss in a proper manner. (06/16) Bearings consist of the ends of the pony truss supports and the ends of the seven (7) stringers. Bearings are steel plates anchored to the concrete. Very rusty and dirty. The west 1/2 of the north abutment has settled and is no longer supporting the ends of the stringers or the pony truss in a proper manner. (06/15) Bearings consist of the ends of the pony truss supports and the ends of the seven (7) stringers. Bearings are steel plates anchored to the concrete. Very rusty and dirty. The west 1/2 of the north abutment has settled and is no longer supporting the ends of the stringers or the pony truss in a proper manner. (12/14)

SUBSTRUCTURE

	12/14	06/15	06/16	
13. Abutments (SIA-60)	1	1	3	The north abutment has two significant cracks. At the northeast corner the abutment has cracked and dropped about 3-1/2". This area supports the truss bearing. There is a large vertical crack at this location that varies from 2" to 5" wide. The other crack is at the middle of the abutment. The west half of the North abutment has moved south ~6" and dropped about 3.5". This is about somewhat more than the last inspection. Also the northeast wingwall has settled and pulled away from the abutment and settled approximately 4". The crack at this location is approximately 4" wide varying from 3" to 4 1/2". The cracks go through the abutment and there is fill being lost at this location. The south abutment is not cracked, what appears to be a serious settlement is the effect that a concrete repair makes it look like the abutment has settled. The Pony Truss connection to the abutment has settled with the abutment. The settlement and movement of the north abut has caused the north portion of the bridge to rest on a structure that is in danger of collapsing. There has been an attempt to force the flow of water away from behind the north abutment through the use of vertical lumber. This effort has been partialy successful. (06/16) The north abutment has two significant cracks. At the northeast corner the abutment has cracked and dropped about 3-1/2". This area supports the truss bearing. There is a large vertical crack at this location that varies from 2" to 5" wide. The other crack is at the middle of the abutment. The west half of the North abutment has moved south ~6" and dropped about 3.5". This is about somewhat more than the last inspection. Also the northeast wingwall has settled and pulled away from the abutment and settled approximately 4". The crack at this location is approximately 4" wide varying from 3" to 4 1/2". The cracks go through the abutment and there is fill being lost at this location. The south abutment is not cracked, what appears to be a serious settlement is the effect that a concrete repair makes it look like the abutment has settled. The Pony Truss connection to the abutment has settled with the abutment. The settlement and movement of the north abut has caused the north bridge to rest on a structure that is in danger of collapsing. (06/15) The north abutment has two significant cracks. At the northeast corner the abutment has cracked and dropped about 3-1/2". This area supports the truss bearing. There is a large vertical crack at this location that varies from 2" to 5" wide. The other crack is at the middle of the abutment. The west half of the North abutment has moved south ~6" and dropped about 3.5". This is about somewhat more than the last inspection. Also the northeast wingwall has settled and pulled away from the abutment and settled approximately 4". The crack at this location is approximately 4" wide varying from 3" to 4 1/2". The cracks go through the abutment and there is fill being lost at this location. The south abutment is not cracked, what appears to be a serious settlement is the effect that a concrete repair makes it look like the abutment has settled. The Pony Truss connection to the abutment has settled with the abutment. The settlement and movement of the north abut has caused the north bridge to rest on a structure that is in danger of collapsing. (12/14)
14. Piers (SIA-60)	N	N	N	(06/16) (06/15) (12/14)

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15. Slope Protection	N	N	N	(06/16) (06/15) (12/14)
16. Channel (SIA-61)	4	5	4	The bridge has debris in the superstructure. The flow is directed to the north abutment where it has undermined the north abutment. (06/16) (06/15) The bridge is to small for the waterway. Evidence of debris on the truss bottom (12/14)
17. Scour Inspection			3	The flow has undermined the north abutment where there is a large scour hole. (06/16) (06/15) (12/14)

APPROACH

	12/14	06/15	06/16	
18. Approach Pavement	4	4	4	Settlement at north end with large bitt patch on the east half of the roadway at the north end. This indicates loss of fill from behind the abutment. The area has settled further than the last inspection. (06/16) Settlement at north end with large bitt patch on the east half of the roadway at the north end. This indicates loss of fill from behind the abutment. The area has settled further than the last inspection. (06/15) Settlement at north end with large bitt patch on the east half of the roadway at the north end. This indicates loss of fill from behind the abutment. The area has settled further than the last inspection. (12/14)
19. Approach Shoulders Sidewalks	5	5	5	(06/16) (06/15) Shoulder are narrow - and only about 2' higher than the flood plain (12/14)
20. Approach Slopes				(06/16) (06/15) (12/14)
21. Utilities				(06/16) (06/15) (12/14)
22. Drainage Culverts				(06/16) (06/15) (12/14)

MISCELLANEOUS

Guard Rail

Item	Rating
36A. Bridge Railings	0
36B. Transitions	0
36C. Approach Guardrail	0
36D. Approach Guardrail Ends	0

Other Items

Item	Rating
71. Water Adequacy	3
72. Approach Alignment	5
Temporary Support	0 No Temporary Supports
High Load Hit (M)	No
Special Insp. Equipment	2
Underwater Insp. Method	1

False Decking (Timber) Removed to Complete Inspection N/A - No False Decking

Critical Feature Inspections (SIA-92)

	Freq	Date
92A. Fracture Critical	24	10/29/2015
92B. Underwater		

STR 6682 BRIDGE SAFETY INSPECTION REPORT

Facility	Latitude / Longitude	MDOT Structure ID	Structure Condition
DARR ROAD	44.0465 / -86.2607	53313H00016B020	Critical Condition(2)
Feature	**Length / Width**	**Owner**	
N BR LINCOLN RIVER	35.8 / 16.1	County: Mason(53)	
Location	**Built / Recon. / Paint / Ovly.**	**TSC**	**Operational Status**
4 MI W OF FOUNTAIN	1900 / 1979 / /	Muskegon(21)	K Closed to all traffic(K)
Region / County	**Material / Design**	**Last NBI Inspection**	**Scour Evaluation**
Grand(3) / Mason(53)	3 Steel / 10 Truss-Thru	06/02/2016 / Q0RP	U Unknown Scour

92C. Other Special

92D. Fatigue Sensitive

Northwest Design Group
CONSULTING ENGINEERS

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REPORT

Darr Road over North Branch Lincoln River

September 2016

Prepared for:

Mr. Wayne Schoonover
Mason County Road Commission
510 East State Street
PO Box 247
Scottville, Michigan 49454

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

This report summarizes Northwest Design Group's (NDG's) preliminary scoping/type, size, and location study for this proposed bridge replacement. The purpose of this study was to consider alternatives for the proposed crossing and to provide our recommended option.

1.2 Project Description and Scope

The crossing is in Sherman Township, Sections 17 and 18, T19N, R16W in Mason County, as shown in Figure 1. The existing bridge is in poor condition and is currently closed. It is a low-volume bridge serving only two homes.

(Image source: Mason County Road Commission)

Figure 1 – Vicinity Map

The purpose of the study was to provide innovative ideas and alternatives analysis for replacing this low-volume crossing serving limited users. Alternatives were expected to include: single lane crossing, no bridge/access from south, culvert option(s), bridge option(s) including GRS-IBS abutments. We expect that this report will be used to negotiate conditions for funding with the Local Bridge Program/North Region Bridge Council.

NDG's scope of work, as described in our agreement, included:

- Gathering readily available data and information;
- Visiting the site to review field conditions and take measurements;
- Discuss the project with regulators to determine constraints;
- Review geometric requirements;
- Develop alternatives;
- Estimate planning-level costs for the alternatives; and
- Prepare this report.

2.0 SITE CONDITIONS

2.1 Route and Users

The crossing is located on North Darr Road, about 1/8 mile south of its intersection with Fountain Road. The northern 1/2 mile is shown on Mason County Road Commission maps as "unimproved/trail", though we understand it is currently classified as "Local Improved".. The 1 mile portion south of this segment, to Mavis Road, is shown as seasonal. It is classified as "NFC Local" on the MDOT National Functional Classification map.

The area is rural with agricultural and undeveloped, forested properties. The existing approaches on either side are relatively straight horizontally and flat vertically.

Darr Road near this crossing is 14 to 19 feet wide with a gravel surface. About ¼ mile south of the bridge, the road becomes an unimproved dirt trail, which crosses a drain via an impassable structure.

Figure 2 – View from approach

Two houses are located south of the Darr Road over North Branch Lincoln River crossing and rely on it to access Fountain Road. Other undeveloped properties can be accessed by this road segment, utilizing the bridge.

While traffic count data is unavailable, we expect the average daily traffic is less than 10 vehicles per day. The majority of the traffic is expected to be passenger vehicles, with occasional commercial (garbage, propane/fuel delivery, etc.) and agricultural traffic.

2.2 Existing Bridge Conditions

The bridge is Structure #6682. According to its latest Bridge Safety Inspection Report (June, 2016), the bridge was constructed in 1900 and reconditioned in 1979. It is about 36 feet long with a width of 16 feet. It consists of bituminous paving on a steel deck, with a through-truss superstructure supported on concrete abutments. The Bridge Safety Inspection Report indicates the bridge is in very poor condition. Significant items of note include severe corrosion and section loss of stringers, gusset plates, and floor beams. The north abutment has significant cracks, leading to loss of ground behind the abutment. A significant scour hole has undermined a portion of the north abutment, which has moved and settled. The bridge is currently closed to traffic.

Figure 3 – View of abutment

During our site visit, debris was noted in the superstructure, suggesting that high flows reach the elevation of the bridge.

2.3 Other Site Conditions

The bankfull width upstream of the bridge was observed to be about 30 feet, and about 44 feet downstream. The water surface on the day of our field visit was about 5 ½ feet below the top of the bridge deck. The channel appears to be comprised predominately of sand. Discharge information from the MDEQ Flood Discharge Database indicates a contributing drainage area of about 39 square miles and the following flows:

Event	Discharge
10%	370 cfs
2%	500 cfs
1%	550 cfs
0.5%	600 cfs
0.2%	700 cfs

The Quaternary Geology of Michigan maps the surficial deposits in the vicinity of the site as “lacustrine sand and gravel” with nearby areas mapped as “dune sand”. The NRCS classifies the immediate site of the crossing as Kerston-Carlisle-Glendora complex, consisting of muck and sand. Nearby areas are mapped as Grattan sand, which is predominately sand.

Nearby well logs from the MDEQ water well database show 10 to 35 feet of sand over clay.

3.0 REQUIREMENTS

3.1 Geometrics

AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT < 400) provides the following guidance:

- Widths of existing roads need not be modified.
- An existing bridge can be replaced with the same width as the existing structure.
- For new bridges, a single lane bridge can be used if the ADT < 100 vehicles per day.
- Single lane bridges should have a width of at least 15 feet, but widths greater than 16 feet should be avoided.

Vertically, the approaches can likely allow for raising plan grade 1 to 2 feet. Horizontal alignment of the roadway is straight in the vicinity of the crossing.

3.2 Loading

AASHTO LRFD Bridge Design Specifications require HL93 loading, consisting of an HS20 design truck and a 640 plf lane load. The commentary states that the live load model was developed to represent effects produced by a group of vehicles routinely permitted on highways of various states under exceptions to weight laws. MDOT's Bridge Design Manual requires "HL93 modified" loading, 120% of HL93 loading, for design of bridges for interstates, trunklines, and primary roads. Local roads and streets are to be design according to city or county standards.

Note that the MDOT Bridge Design Manual specifies designing for an H10 design truck load for pedestrian and nonmotorized bridges greater than 10 feet in width. Also, AASHTO's A Policy on the Geometric Design of Highways and Streets and MDOT 3R Guidelines require vehicular bridges to have capacity for at least an H15 design vehicle. If allowed by county road commission standards, we recommend designing for an H20 or HS 20 vehicle, without the lane load. The bridge would require load limit posting.

3.3 Hydraulic and Environmental

Based on a preliminary site review on August 15, 2016, Jeff Silagy of the Michigan Department of Environmental Quality indicated that the new bridge should allow for a stream width of at least 33 feet at bankfull elevation and that the clear span should be at least 36 feet for flows up to the 1% (100-year) event.

Jeff Silagy also indicated that wetlands will make permitting improvements to the seasonal portion of the road south of the bridge unlikely.

4.0 TYPE, SIZE, AND LOCATION OPTIONS

4.1 Removal/No-Build

Instead of replacing the bridge, the existing bridge could be removed, the crossing abandoned and restored to a natural state, and the seasonal road from the south improved to meet county standards (two 11-foot lanes and two 5-foot shoulders). This option would require clearing, subgrade undercut, subbase,

and new pavement structure. As discussed above, this option would involve extensive impact to wetlands and would likely not be permittable. In addition, to provide access to the residences, another crossing would be required to pass the existing county drain.

4.1 Location

The current location of the existing bridge is the most practical location for its replacement. There is not other crossing location or angle within the road right-of-way, or in the immediate vicinity, that would allow for a shorter span or other improved condition. Therefore, we recommend that the new bridge be located at the same location as the existing.

The underclearance should be maintained, or preferably increased, to allow passage of high flows, either by raising the plane grade or decreasing the structure depth.

4.2 Size

The existing 36-foot span appears undersized for the crossing and does not span bankfull width. As indicated by the MDEQ, to accommodate frequent high flows and allow for natural stream function, the steam should be sized to match a 33-foot bankfull width, and to provide a clear span of at least that of the existing (36 feet). Although out of the scope of our current study, hydraulic analyses should be performed to confirm that this span passes flood flows.

We recommend a single, 16-foot wide lane for this crossing, given its low-volume and existing size.

4.3 Type

4.3.1 Superstructure

Potential superstructure types are based on the following considerations:

- Proposed span;
- Maximized underclearance;
- Economical;

We considered the following superstructure types:

- Timber;
- Steel through-truss;
- Steel stringer; and
- Prestressed concrete deck.

Timber bridges are often a cost-efficient choice for low-volume, short-span bridges. The proposed 36-foot span is feasible with a spike-laminated or stress-laminated deck and would result in a relatively thin structure. This option is conducive to installation by road commission crews or a contractor. Estimated cost for the bridge and installation is $119,000.

A *pre-engineered steel through-truss* structure is a cost-effective option that lends itself well to this scenario. These are typically constructed of weathering steel, for a relatively low-maintenance and aesthetic structure. Estimated installed cost is $109,000.

Another steel superstructure option for this span and site is a *simple steel stringer bridge* with a cast in place concrete deck. Estimated cost would be about $100,000.

A *prestressed/post-tenstioned concrete deck* superstructure is a durable option that also minimizes structure depth. We expect 17-inch deep side-by-side box beams to be utilized. Cost for this option is expected to be about $73,000.

4.3.2 Substructure

Substructure type depends on loads, soils, and scour potential. Because of the relatively short span, loads will be modest. Soil conditions are currently not known, though we expect generally sandy soils. The sandy soils and potential for high flows, as well as the observed scour hole, suggest high scour potential. Several foundation options were considered:

Timber pile abutment: Most appropriate for supporting a timber superstructure, a timber pile abutment would generally consist of four to six bearing piles per abutment, supporting a timber pile cap, and four to six wing wall pile. Timber planking supported by the piles would provide soil retention. Cost for this option is expected to be about $38,000.

Pile-supported concrete abutment: This option would consist of a concrete abutment wall supported by piles. The piles would provide support even if significant scour occurred, and also would be the most practical option if site soils prove to be very soft or loose. Steel piles (either concrete-filled shells or H-section, depending on the soil conditions) would be typical. A stub abutment on a single row of piles could be used considering the low abutment height. Cost for this option would be about $63,000. If scour depth is expected to be significant or high lateral earth pressures need to be supported, a concrete curtain wall abutment could be used, which is a more substantial structure on two rows of piles. Cost for this option is estimated to be $84,000.

Sheet pile abutment: For modest loads when competent bearing strata are relatively shallow, sheet piling can be used for both the earth-retaining function of the abutment as well as the axial loads component. This system precludes the use of a separate cofferdam and provides resistance to scour. This cost would be about $59,000.

Shallow concrete footings: Where soil conditions are suitable, the superstructure can be supported on shallow concrete footings. These would be subject to loss of support by scour, so this option is not expected to be feasible here without significant costly scour countermeasures. Cost for this option would be about $24,000.

GRS-IBS: Geosynthetic Reinforced Soil Integrated Bridge System utilizes closely-spaced geotextile or geogrid within lifts of compacted backfill to support the bridge. A facing (usually concrete masonry units) is used to protect the reinforced soil and provide an aesthetic component. This option is readily accomplished by public agency crews or a contractor. Cost for this option could be as low as about $16,000. However, like shallow concrete footings, it is at risk of scour, without countermeasures. Sheet piling facing could be used in lieu of the CMU block to provide scour protection. A GRS abutment system with sheet pile facing would be about $41,000.

Note that the above costs are concept-level only and make assumptions regarding bearing and scour depth. Actual costs will depend on several additional factors and would also need to include approach work. We expect approach work construction costs to be about $130,000.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the several options presented above, assuming moderate depth to bearing and significant scour potential, and comparing costs, we expect that the most cost effective option would be to utilize a prestressed concrete deck on a sheet pile-protected GRS abutment. This option should prove to be durable and cost effective. The bridge should have a 36-foot clear span and be 16 feet wide with a single lane. We recommend designing for an HS20 truck load. We recommend planning for $305,000 for construction of the project, plus engineering costs.

We appreciate the opportunity to be of service. If you have any questions concerning this report or require additional information, please do not hesitate to contact us.

Respectfully submitted,

NORTHWEST DESIGN GROUP, LLC

NILS W. LINDWALL, P.E.
Civil Engineer/Geotechnical Section Manager

LUCAS C. PORATH, P.E.
Regional Manager

APPENDIX A:
CONCEPT COST ESTIMATES

File: Estimate

TS&L Cost Comparisons — Estimate Date: 9/14/2016

Mason County Road Commission — NDG Project No.: N3113.030
Darr Road over North Branch Lincoln River

Mason County, Michigan

Prepared By: Nils Lindwall, P.E.
Northwest Design Group, LLC
Petoskey, Michigan

This Estimate Includes:
36-foot clear span x 16-foot wide bridge. Various superstructure and substructure options.

Timber Superstructure

Item No.	Description	Units	Qty	Unit Price	Amount
	Krenn 38- x 17-foot Timber Bridge (furnish)	LS	1	$ 93,472.22	$ 93,472.22
	Installation	LS	1	$ 25,000.00	$ 25,000.00
				TOTAL:	**$ 118,472.22**

Steel Truss Superstructure

Item No.	Description	Units	Qty	Unit Price	Amount
	Contech Steadfast Vehicular Truss Bridge (furnish)	LS	1	$ 84,000.00	$ 84,000.00
	Installation	LS	1	$ 25,000.00	$ 25,000.00
				TOTAL:	**$ 109,000.00**

Steel Stringer Superstructure

Item No.	Description	Units	Qty	Unit Price	Amount
	Contech Simple Span Beam Bridge (furnish)	SFT	684	$ 85.00	$ 58,140.00
	Installation	LS	1	$ 25,000.00	$ 25,000.00
	Concrete Deck	SFT	684	$ 25.00	$ 17,100.00
				TOTAL:	**$ 100,240.00**

Prestressed Concrete Deck

Item No.	Description	Units	Qty	Unit Price	Amount
	Prestessed Concrete Deck (furnish & install)	SFT	684	$ 70.00	$ 47,880.00
	Post Tensioning	LS	1	$ 5,000.00	$ 5,000.00
	Rail	FT	76	$ 150.00	$ 11,400.00
	Waterproof Membrene & Surface Coating	LS	1	$ 8,000.00	$ 8,000.00
				TOTAL:	**$ 72,280.00**

NOTE: Actual construction costs may vary significantly depending upon the timing of construction, market conditions, and other factors beyond our control.

TS&L Cost Comparisons

Estimate Date: 9/14/2016

Mason County Road Commission
Darr Road over North Branch Lincoln River

NDG Project No.: N3113.030

Mason County, Michigan

Prepared By: Nils Lindwall, P.E.
Northwest Design Group, LLC
Petoskey, Michigan

This Estimate Includes:
36-foot clear span x 16-foot wide bridge. Various superstructure and substructure options.

Timber Piles

Item No.	Description	Units	Qty	Unit Price	Amount
	Earth Excavation	CYD	70	$ 15.00	$ 1,050.00
	Structure Backfill	CYD	70	$ 25.00	$ 1,750.00
	Pile Driving Equipment	LS	1	$ 10,000.00	$ 10,000.00
	Timber Pile, Furnish	FT	630	$ 15.00	$ 9,450.00
	Timber Pile, Install	FT	540	$ 12.00	$ 6,480.00
	Test Pile	EA	2	$ 2,000.00	$ 4,000.00
	Pile Cap	TBF	0.6	$ 3,000.00	$ 1,800.00
	Abutment Planks	TBF	1.1	$ 3,000.00	$ 3,300.00
				TOTAL:	**$ 37,830.00**

Pile Supported Concrete Abutment (Stub Abutment)

Item No.	Description	Units	Qty	Unit Price	Amount
	Earth Excavation	CYD	125	$ 15.00	$ 1,875.00
	Structure Backfill	CYD	125	$ 25.00	$ 3,125.00
	Pile Driving Equipment	LS	1	$ 10,000.00	$ 10,000.00
	Piles, 12 inch CIP	FT	540	$ 45.00	$ 24,300.00
	Test Piles	EA	2	$ 2,500.00	$ 5,000.00
	Substructure Concrete	CYD	30	$ 600.00	$ 18,000.00
				TOTAL:	**$ 62,300.00**

Pile Supported Concrete Abutment (Curtain Wall Abutment)

Item No.	Description	Units	Qty	Unit Price	Amount
	Earth Excavation	CYD	155	$ 15.00	$ 2,325.00
	Structure Backfill	CYD	155	$ 25.00	$ 3,875.00
	Pile Driving Equipment	LS	1	$ 10,000.00	$ 10,000.00
	Piles, 12 inch CIP	FT	780	$ 45.00	$ 35,100.00
	Test Piles	EA	2	$ 2,500.00	$ 5,000.00
	Substructure Concrete	CYD	45	$ 600.00	$ 27,000.00
				TOTAL:	**$ 83,300.00**

Sheet Pile Abutment

Item No.	Description	Units	Qty	Unit Price	Amount
	Pile Driving Equipment	LS	1	$ 5,000.00	$ 5,000.00
	Steel Sheet Piling	SFT	1700	$ 30.00	$ 51,000.00
	Structural Steel (Pile Cap)	LB	1360	$ 2.00	$ 2,720.00
				TOTAL:	**$ 58,720.00**

Shallow Concrete Footing

Item No.	Description	Units	Qty	Unit Price	Amount
	Earth Excavation	CYD	155	$ 15.00	$ 2,325.00
	Structure Backfill	CYD	155	$ 25.00	$ 3,875.00
	Substructure Concrete	CYD	30	$ 600.00	$ 18,000.00
				TOTAL:	**$ 24,200.00**

GRS-IBS (CMU Facing)

Item No.	Description	Units	Qty	Unit Price	Amount
	Earth Excavation	CYD	200	$ 15.00	$ 3,000.00
	Structure Backfill	CYD	200	$ 30.00	$ 6,000.00
	Stabilization Geotextile	SYD	900	$ 2.50	$ 2,250.00
	CMU Facing	SFT	410	$ 12.00	$ 4,920.00
				TOTAL:	**$ 16,170.00**

GRS-IBS (Sheet Pile Facing)

Item No.	Description	Units	Qty	Unit Price	Amount
	Earth Excavation	CYD	200	$ 15.00	$ 3,000.00
	Structure Backfill	CYD	200	$ 30.00	$ 6,000.00
	Stabilization Geotextile	SYD	900	$ 2.50	$ 2,250.00
	Pile Driving Equipment	LS	1	$ 5,000.00	$ 5,000.00
	Steel Sheet Piling	SFT	820	$ 30.00	$ 24,600.00
				TOTAL:	**$ 40,850.00**

NOTE: Actual construction costs may vary significantly depending upon the timing of construction, market conditions, and other factors beyond our control.

Engineer's Opinion of Costs

Project Number: N3113.030
Estimate Number: 1: Darr Road over North Branch Lincoln River
Project Type: Bridge Construction
Location: Darr Rd.
Mason County
Description:

Project Engineer: Nils Lindwall, P.E.
Date Created: 9/2/2016
Date Edited: 9/14/2016
Fed/State #:
Fed Item:
Control Section:

Line	Pay Item	Description	Quantity	Units	Unit Price	Total
Category: 0001		**Road Approach Work**				
0001	1500001	Mobilization, Max. ____	1.000	LSUM	$20,000.00	$20,000.00
0002	2010001	Clearing	0.100	Acre	$20,000.00	$2,000.00
0003	2040060	Structures, Rem	1.000	LSUM	$10,000.00	$10,000.00
0004	2050010	Embankment, CIP	200.000	Cyd	$15.00	$3,000.00
0005	2080036	Erosion Control, Silt Fence	400.000	Ft	$2.50	$1,000.00
0006	3010002	Subbase, CIP	200.000	Cyd	$20.00	$4,000.00
0007	3020016	Aggregate Base, 6 inch	550.000	Syd	$15.00	$8,250.00
0008	5010005	HMA Surface, Rem	550.000	Syd	$5.00	$2,750.00
0009	5010703	HMA, LVSP	150.000	Ton	$110.00	$16,500.00
0010	8070000	Guardrail, Type B	200.000	Ft	$25.00	$5,000.00
0011	8070040	Guardrail Approach Terminal, Type 1B	4.000	Ea	$2,500.00	$10,000.00
0012	8110231	Pavt Mrkg, Waterborne, 4 inch, White	250.000	Ft	$1.00	$250.00
0013	8110232	Pavt Mrkg, Waterborne, 4 inch, Yellow	250.000	Ft	$1.00	$250.00
0014	8120020	Barricade, Type III, High Intensity, Furn	4.000	Ea	$100.00	$400.00
0015	8120021	Barricade, Type III, High Intensity, Oper	4.000	Ea	$10.00	$40.00
0016	8120170	Minor Traf Devices	1.000	LSUM	$30,000.00	$30,000.00
0017	8120260	Plastic Drum, High Intensity, Lighted, Furn	20.000	Ea	$35.00	$700.00
0018	8120261	Plastic Drum, High Intensity, Lighted, Oper	20.000	Ea	$2.00	$40.00
0019	8120350	Sign, Type B, Temp, Prismatic, Furn	520.000	Sft	$8.00	$4,160.00
0020	8120351	Sign, Type B, Temp, Prismatic, Oper	520.000	Sft	$5.00	$2,600.00
0021	8130010	Riprap, Plain	50.000	Syd	$80.00	$4,000.00
0022	8160020	Fertilizer, Chemical Nutrient, Cl A	10.000	Lb	$5.00	$50.00
0023	8160025	Mulch	300.000	Syd	$1.00	$300.00

Line	Pay Item	Description	Quantity	Units	Unit Price	Total
0024	8160026	Mulch Anchoring	300.000	Syd	$0.50	$150.00
0025	8160027	Mulch Blanket	150.000	Syd	$2.50	$375.00
0026	8160037	Seeding, Mixture TDS	10.000	Lb	$10.00	$100.00
0027	8160061	Topsoil Surface, Furn, 3 inch	300.000	Syd	$10.00	$3,000.00
					Category 0001 Total:	**$128,915.00**
Category: 0002		**Bridge Work**				
0028	2050016	Excavation, Earth	200.000	Cyd	$15.00	$3,000.00
0029	2060002	Backfill, Structure, CIP	200.000	Cyd	$30.00	$6,000.00
0030	3080010	Geotextile, Stabilization	900.000	Syd	$2.50	$2,250.00
0031	7040001	Steel Sheet Piling, Permanent	820.000	Sft	$30.00	$24,600.00
0032	7050002	Pile Driving Equipment, Furn	1.000	LSUM	$5,000.00	$5,000.00
0033	7080015	Post Tensioning	1.000	LSUM	$5,000.00	$5,000.00
0034	7087010	_ Prestressed Concrete Deck	684.000	Sft	$70.00	$47,880.00
0035	7107051	_ Waterproof Membrane & Surface Coating	1.000	LSUM	$8,000.00	$8,000.00
0036	7117001	_ Bridge Railing	76.000	Ft	$150.00	$11,400.00
					Category 0002 Total:	**$113,130.00**
Category: 0003		**Engineering and Contingency**				
0037	1047051	_ Contingency	1.000	LSUM	$60,000.00	$60,000.00
					Category 0003 Total:	**$60,000.00**
					Estimate Total:	**$302,045.00**