Lac Qui Parle Bridge 5380: Section 106 Evaluation of Rehabilitation Alternatives

State Project Numbers
SP 1209-22; 3701-23

TH 40 Bridge Rehabilitation Study:
Lac Qui Parle Bridge 5380

Prepared for
Minnesota Department of Transportation

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1. Introduction

The Lac Qui Parle Bridge (Bridge 5380) carries Trunk Highway (TH) 40 over a widening in the Minnesota River known as Lac Qui Parle Lake. Built in 1938, the bridge is significant as a contributing property to the Lac Qui Parle Flood Control Historic District, which has been determined eligible for the National Register of Historic Places (National Register).[1] As such, the bridge is subject to review under Section 106 of the National Historic Preservation Act (Section 106) and Section 4(f) regulatory requirements. Initiated in 1933, the Flood Control Project was completed by the Works Project Administration (WPA) as a major federal relief project during the New Deal era. Bridge 5380 is the only metal truss bridge in the historic district. It replaced an earlier metal truss bridge at the same crossing.

The Minnesota Department of Transportation (Mn/DOT) proposes a transportation action to provide a long-lasting structure that is not load-restricted and that will provide safe, unrestricted access that serves traffic needs and aids Mn/DOT in meeting its bridge maintenance goals, all within the context of the history of the bridge and the surrounding area. These goals are described in the Purpose and Need Statement prepared by Mn/DOT District 8 (see Appendix B). This study is designed to evaluate any proposed rehabilitation plans for compliance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (Secretary's Standards) and to avoid, to the maximum extent possible, adverse effects under Section 106 of the Historic Preservation Act of 1966 as amended.

Bridge 5380 has a sufficiency rating of 39.3. The bridge is structurally deficient and is load-posted at 40 tons. According to the most recent Mn/DOT report, the "2010 Routine and Fracture Critical Bridge Inspection Report (January 10, 2011), structural deficiencies contribute to the low sufficiency rating and the need to load-post the structure. These structural deficiencies include corrosion in the steel stringers and floor beams, deterioration in the concrete deck, and pack rust in some of the gusset plate connections. The monolithic, cast-in-place, concrete slabs and integral beams within the U-shaped abutments are deteriorated with some loss of structural capacity and are primarily responsible for the load posting of the bridge. The overall low load rating of the floor beams is a result of the original design load for the bridge being less than today's design load, as well as the structural yield stress assumed to be 30 ksi. The condition of the gusset plates also factors into the low ratings, but the controlling gusset plate L4 has an operating rating of HS 26, controlled by flexure. Subsequent guidance from the Federal Highway Administration (FHWA) recently has indicated that the flexure check is not required to apply to gusset plates. The paint system on the bridge is failing and the bridge needs to be re-painted.

In this memorandum, Mead & Hunt, Inc. (Mead & Hunt) provides the results of a study that developed four rehabilitation alternatives to meet the purpose and need. As part of the process of evaluating rehabilitation strategies for Bridge 5380, Mead & Hunt initially considered alternatives to widen the bridge to accommodate an increased roadway width and alternatives to provide a multi-use trail crossing connected to, or adjacent to, a rehabilitated bridge. Both these previous sets of alternatives, outlined briefly below, were subsequently eliminated from consideration for the project by Mn/DOT. In addition,

[1] Heidemann, Mary A., Minnesota State Historic Preservation Office, letter to Jackie Sluss, Minnesota Department of Transportation Cultural Resources Unit, 19 October 2010.

the possibility of providing internally or externally redundant structural systems for the bridge was eliminated from consideration by Mn/DOT.

Preservation values are factored into the development of each of the four rehabilitation alternatives. Following the presentation below of the four rehabilitation alternatives, as a requirement of the Section 106 process, this report identifies and assesses the effects of the planned activities of each alternative on the historic resource. More specifically, this report weighs the consistency of each alternative with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (Secretary's Standards). Estimated costs for each of the four alternatives are presented in Section 3.C of this memorandum.

2. Rehabilitation Strategies Evaluated and Eliminated

Between the commencement of this project and the present, several approaches to rehabilitation have been analyzed and/or otherwise considered and subsequently eliminated for further consideration for reasons of feasibility, cost, or non-compliance with the Secretary's Standards in the Section 106 process. These approaches are described below.

A. Redundant structural systems

The consultant's original scope of work for this project, as requested by Mn/DOT, required a description of the methods and feasibility of providing both internally and externally redundant structural systems in accordance with Minnesota Statute 165, commonly termed Chapter 152, the section's previous title. Since then, the Mn/DOT Bridge Office has determined that alterations to this through-truss design to add load path redundancy are likely to have visual impacts that would change the character of this historic structure. Therefore the Mn/DOT Bridge Office has concluded not to pursue adding external redundancy in this case.[2]

B. Widening existing truss

The existing bridge has 12-foot traffic lanes and 1.5-foot shoulders for a roadway width of 27 feet. Current Mn/DOT bridge width standards for existing and forecasted traffic volumes on TH 40 call for 12-foot lanes and a minimum of six-foot shoulders, or a roadway minimum width of 36 feet. In 2009 Mead & Hunt provided design concepts for widening the existing truss superstructure and abutments to achieve a 36-foot roadway between curbs (see Appendix C). A Section 106 preliminary review of the widening concepts by the State Historic Preservation Office (SHPO) determined that widening the truss superstructure would constitute an adverse effect to the historic structure.[3] The work required for this concept would also entail extraordinary measures to carry out rehabilitation and construction operations. For these reasons, consideration of widening the bridge was removed from the project.

Even though widening the bridge for a 36-foot roadway was removed from consideration, the Mn/DOT Bridge Office expressed a preference to conform to improvement standards, which consist of 12-foot lanes with three-foot shoulders, or a 30-foot minimum clear roadway width, which is three feet wider than the existing structure. The FHWA expressed the opinion that an attempt to eliminate rehabilitation solely because of a statewide policy to meet improvement standards for bridge widths less than 30 feet would eliminate further consideration of the project from a National Environmental Policy Act (NEPA)/Federal-

[2] Duane R. Hill, Acting State Bridge Engineer, email to Nancy Daubenberger, James Lilly, Kevin Western, Jacqueline Sluss, and Susann Karnowski, December 15, 2010.

[3] Jackie Sluss, Mn/DOT CRU, letter to Kelly Gragg-Johnson, 25 November 2009, submitting two options: Option A, Rehabilitate without widening, and Option B, Rehabilitate with widening to 30-foot roadway, with attached Exhibits A-E. This letter followed a meeting on 12 November 2009 wherein Options A and B and Exhibits A-E were presented to the SHPO Historical Architect. See Gragg-Johnson, letter to Sluss, 18 December, 2010, stating that "Option B does not meet the Secretary of the Interior's Standards and is clearly an adverse effect," and "Option A can be developed into a project that does meet the Standards. We strongly recommend this option."

aid project process perspective.[4] That is, under the NEPA of 1969 as implemented through FHWA (23 CFR 771.105), a project restriction as proposed would not be in compliance with NEPA. Due to the eligibility of the bridge for the National Register, a design exception may be pursued and development of rehabilitation alternatives may be considered for the structure with an existing clear roadway width of 27 feet.

C. Multi-use trail options

The Minnesota River State Trail is proposed to cross Bridge 5380, as listed in the draft Minnesota River State Trail Master Plan.[5] Because the sidewalks on the bridge are narrow (approximately three feet wide), bicyclists and pedestrians using the trail that wish to continue on to the state park must move to the roadway shoulder to cross the bridge. In April 2010 Mead & Hunt provided to Mn/DOT a memorandum on concept-level analysis to provide a multi-use trail structure across the Minnesota River at the existing site of the bridge (see Appendix D). This multi-use trail would be used by pedestrians, bicyclists, and those who would want to fish from the bridge and would have a minimum clear width of 12 feet. Three alternative concepts were developed and analyzed. Each alternative was considered either not-feasible, not cost-effective, or both. At the same time, Mn/DOT District 8 was continuing to develop the Purpose and Need Statement for the project. As the statement was refined, the multi-use trail option was eliminated from further consideration and concepts were not submitted to SHPO for review.

[4] See Minutes for Mn/DOT Conference Call, September 27, 2010, Discussion Topic 4, statement by Phil Forst, FHWA; see also email, Phil Forst, FHWA, to Bob Frame, Mead & Hunt, and Jennie Ross and Susann Karnowski, Mn/DOT.

[5] Minnesota Department of Natural Resources, Division of Trails Waterways, "Minnesota River State Trail Master Plan, DRAFT, June 2007. Available at *http://files.dnr.state.mn.us/input/mgmtplans/trails/mnrivst_plan_a.pdf*

3. Alternatives for Rehabilitation

A. Introduction

Following the elimination from consideration of the rehabilitation concepts and approaches outlined in Section 2, one approach remained viable for analysis: rehabilitation of the bridge at the current clear roadway width of 27 feet, with no load restriction and no additional pedestrian/bicycle sidewalk accommodation, and with an estimated additional service life of at least 25 to 30 years. Based on preliminary rehabilitation analysis by Mead & Hunt in February 2010 and updated in June 2012, this rehabilitation alternative would cost an estimated $1,087,000.

In a meeting on September 27, 2010, and in subsequent communications, MnDOT instructed Mead & Hunt to proceed with a consideration of this alternative.[6] Several rehabilitation versions of this alternative were to be considered, including options with fewer or different elements that would have lower estimated costs and might require load restrictions. In analyzing the alternatives, however, Mead & Hunt determined that it was not practical nor reasonable to consider rehabilitation alternatives that would result in a bridge still having load restrictions. Therefore, the goal of the rehabilitation is to achieve a bridge with a minimum inventory load rating of HS-18 and a minimum operating factor of 1.15 for all agricultural trucks in the region, thereby removing the weight restrictions (i.e. load posting). Since the load rating is governed by the truss span deck and floor system and concrete slabs and beams in the abutments, there is no "minimal" or "lesser" level of repair and replacement available. These components are either replaced/repaired entirely (thus achieving the minimum inventory load rating of HS-18 and a minimum operating factor of 1.15), or they are not replaced/repaired at all. A partial replacement/repair to achieve a lower cost with a subsequent load-posting would not be considered a cost-effective approach from a project engineering perspective. As a result, the four alternatives presented below will bring the inventory load rating of the bridge up to a minimum of HS-18 and a minimum operating factor of 1.15. Lower-cost rehabilitation alternatives are achieved through the selective postponement of other items than those governing the load rating, such as painting.

B. Four rehabilitation alternatives:

The critical repairs needed in order to increase the load rating are: removal and replacement of the concrete deck with a new cast-in-place reinforced concrete deck; removal and replacement of all steel stringers; removal and replacement of all steel floor beams; and removal and replacement of the monolithic, cast-in-place, concrete slabs and integral beams within the U-shaped abutments with new cast-in-place reinforced concrete beams and slabs (see Appendix A, Photographs, Figure 2, Figure 5, and Figure 6). All stringers for the bridge deck and sidewalk support would be replaced with similar size stringers of Grade 36 steel. All floor beams would be replaced with similar size floor beams of Grade 50 steel. Miscellaneous repairs would be performed on deteriorated ends of vertical members within the lower chord panel point connections. Miscellaneous repairs would also include removal and replacement of deteriorated horizontal gusset plates for lower lateral bracing connections. These repairs would be done with Grade 36 steel.

[6] See Minutes for Mn/DOT Conference Call, September 27, 2010, Discussion Topic 5, Next Steps & Action Items.

Each of the rehabilitation alternatives includes those critical repairs. Specific repair items are noted in the cost spreadsheets presented in Section 3.C. Cost estimates are presented in summer 2012 dollars.

(1) Alternative 1

Alternative 1 is the "Full Rehabilitation" alternative and includes the critical repairs noted above. In addition, this alternative includes lead substance collection & removal, sandblasting, cleaning, and painting of the entire structure, including all main truss members and secondary bracing members. The estimated cost for this alternative is $1,087,000.

(2) Alternative 2

Alternative 2 is similar to Alternative 1, but with sandblasting, cleaning, and painting extending only to four feet above the top of the roadway (splash zone) instead of painting the entire bridge. The estimated initial cost for this alternative is $976,000, excluding future maintenance costs.

(3) Alternative 3

Alternative 3 is similar to Alternative 2, but with repairs and painting of the bridge pedestrian railing in-place instead of removing, repairing, painting, and reinstalling the pedestrian railing. The estimated initial cost of this alternative is $952,000, excluding future maintenance costs.

(4) Alternative 4

Alternative 4 is similar to Alternative 3, but with no surface repairs on the abutments. The estimated initial cost of this alternative is $930,000, excluding future maintenance costs.

C. Costs

Table 1. Cost for Alternative 1 – Full Rehabilitation

Item	Quantity	Unit	Unit Cost	Total
Remove Old Structure (Truss Span Deck & Stringers)	1	LS	$30,000.00	$30,000
Remove Floor Beams	9	EA	$3,000.00	$27,000
Remove Old Structure (Abutment Approach Slabs)	1	LS	$25,000.00	$25,000
Structural Steel - Sidewalk Stringers (Grade 36)	14,000	LB	$2.50	$35,000
Structural Steel - Roadway Stringers (Grade 36)	69,000	LB	$2.50	$172,500
Structural Steel - Floor Beams (Grade 50) & Connections	44,000	LB	$4.00	$176,000
Repair Truss Elements (Gusset Plates; Verticals)	10,000	LB	$4.00	$40,000
Sandblast, Clean and Paint Structure, incl. Lead Substance Collection & Removal (Entire Truss Span)	1	LS	$200,000.00	$200,000
New Concrete Deck (Truss Span, incl. Rebars)	112	CY	$600.00	$67,200
New Concrete Slab and Beams (Abutment Slabs)	113	CY	$600.00	$67,800
Clean, Repair & Reposition Expansion Bearings (2)	2	EA	$10,000.00	$20,000
Remove, Clean & Reinstall Pedestrian Railing	440	LF	$150.00	$66,000
Expansion/Compression Joint Replacement	60	LF	$150.00	$9,000
Repair Concrete Abutments (Surface)	200	SF	$100.00	$20,000

Table 1. Cost for Alternative 1 – Full Rehabilitation

Item	Quantity	Unit	Unit Cost	Total
Approach Beam Guard & End Treatments	1	LS	$15,000.00	$15,000
Bituminous Roadway Approaches	1	LS	$10,000.00	$10,000
Finishing Roadway (Shoulders, Grading)	1	LS	$5,000.00	$5,000
Item Subtotal				$985,500
Miscellaneous			5.00%	$49,275
Mobilization			5.00%	$51,739
TOTAL				**$1,086,514**
			Round to:	**$1,087,000**

Table 2. Cost for Alternative 2 – Painting Only to Four Feet Above Top of Roadway (Splash Zone)

Item	Quantity	Unit	Unit Cost	Total
Remove Old Structure (Truss Span Deck & Stringers)	1	LS	$30,000.00	$30,000
Remove Floor Beams	9	EA	$3,000.00	$27,000
Remove Old Structure (Abutment Approach Slabs)	1	LS	$25,000.00	$25,000
Structural Steel - Sidewalk Stringers (Grade 36)	14,000	LB	$2.50	$35,000
Structural Steel - Roadway Stringers (Grade 36)	69,000	LB	$2.50	$172,500
Structural Steel - Floor Beams (Grade 50) & Connections	44,000	LB	$4.00	$176,000
Repair Truss Elements (Gusset Plates; Verticals)	10,000	LB	$4.00	$40,000
Sandblast, Clean and Paint Structure, incl. Lead Substance Collection & Removal 4' Above Roadway Only)	1	LS	$100,000.00	$100,000
New Concrete Deck (Truss Span, incl. Rebars)	112	CY	$600.00	$67,200
New Concrete Slab and Beams (Abutment Slabs)	113	CY	$600.00	$67,800
Clean, Repair & Reposition Expansion Bearings (2)	2	EA	$10,000.00	$20,000
Remove, Clean & Reinstall Pedestrian Railing	440	LF	$150.00	$66,000
Expansion/Compression Joint Replacement	60	LF	$150.00	$9,000
Repair Concrete Abutments (Surface)	200	SF	$100.00	$20,000
Approach Beam Guard & End Treatments	1	LS	$15,000.00	$15,000
Bituminous Roadway Approaches	1	LS	$10,000.00	$10,000
Finishing Roadway (Shoulders, Grading)	1	LS	$5,000.00	$5,000
Item Subtotal				$885,500
Miscellaneous			5.00%	$44,275
Mobilization			5.00%	$46,489
TOTAL				**$976,264**
			Round to:	**$976,000**

Table 3. Cost for Alternative 3 – Painting Only to Four Feet Above Top of Roadway (Splash Zone); Repair and Paint Railing in Place

Item	Quantity	Unit	Unit Cost	Total
Remove Old Structure (Truss Span Deck & Stringers)	1	LS	$30,000.00	$30,000
Remove Floor Beams	9	EA	$3,000.00	$27,000
Remove Old Structure (Abutment Approach Slabs)	1	LS	$25,000.00	$25,000
Structural Steel - Sidewalk Stringers (Grade 36)	14,000	LB	$2.50	$35,000
Structural Steel - Roadway Stringers (Grade 36)	69,000	LB	$2.50	$172,500
Structural Steel - Floor Beams (Grade 50) & Connections	44,000	LB	$4.00	$176,000
Repair Truss Elements (Gusset Plates; Verticals)	10,000	LB	$4.00	$40,000
Sandblast, Clean and Paint Structure, incl. Lead Substance Collection & Removal (4' Above Roadway Only)	1	LS	$100,000.00	$100,000
New Concrete Deck (Truss Span, incl. Rebars)	112	CY	$600.00	$67,200
New Concrete Slab and Beams (Abutment Slabs)	113	CY	$600.00	$67,800
Clean, Repair & Reposition Expansion Bearings (2)	2	EA	$10,000.00	$20,000
Repair & Paint Pedestrian Railing in Place	440	LF	$100.00	$44,000
Expansion/Compression Joint Replacement	60	LF	$150.00	$9,000
Repair Concrete Abutments (Surface)	200	SF	$100.00	$20,000
Approach Beam Guard & End Treatments	1	LS	$15,000.00	$15,000
Bituminous Roadway Approaches	1	LS	$10,000.00	$10,000
Finishing Roadway (Shoulders, Grading)	1	LS	$5,000.00	$5,000
Item Subtotal				$863,500
Miscellaneous			5.00%	$43,175
Mobilization			5.00%	$45,334
TOTAL				**$952,009**
			Round to:	**$952,000**

Table 4. Cost for Alternative 4 – Painting Only to Four Feet Above Top of Roadway (Splash Zone) Repair and Paint Railing in Place; No Surface Repair on Abutments

Item	Quantity	Unit	Unit Cost	Total
Remove Old Structure (Truss Span Deck & Stringers)	1	LS	$30,000.00	$30,000
Remove Floor Beams	9	EA	$3,000.00	$27,000
Remove Old Structure (Abutment Approach Slabs)	1	LS	$25,000.00	$25,000
Structural Steel - Sidewalk Stringers (Grade 36)	14,000	LB	$2.50	$35,000
Structural Steel - Roadway Stringers (Grade 36)	69,000	LB	$2.50	$172,500
Structural Steel - Floor Beams (Grade 50) & Connections	44,000	LB	$4.00	$176,000
Repair Truss Elements (Gusset Plates; Verticals)	10,000	LB	$4.00	$40,000
Sandblast, Clean and Paint Structure, incl. Lead Substance Collection & Removal (4' Above Roadway Only)	1	LS	$100,000.00	$100,000

Table 4. Cost for Alternative 4 – Painting Only to Four Feet Above Top of Roadway (Splash Zone) Repair and Paint Railing in Place; No Surface Repair on Abutments

Item	Quantity	Unit	Unit Cost	Total
New Concrete Deck (Truss Span, incl. Rebars)	112	CY	$600.00	$67,200
New Concrete Slab and Beams (Abutment Slabs)	113	CY	$600.00	$67,800
Clean, Repair & Reposition Expansion Bearings (2)	2	EA	$10,000.00	$20,000
Repair & Paint Pedestrian Railing in Place	440	LF	$100.00	$44,000
Expansion/Compression Joint Replacement	60	LF	$150.00	$9,000
Repair Concrete Abutments (Surface)	0	SF	$100.00	$0
Approach Beam Guard & End Treatments	1	LS	$15,000.00	$15,000
Bituminous Roadway Approaches	1	LS	$10,000.00	$10,000
Finishing Roadway (Shoulders, Grading)	1	LS	$5,000.00	$5,000
Item Subtotal				$843,500
Miscellaneous			5.00%	$42,175
Mobilization			5.00%	$44,284
TOTAL				**$929,959**
			Round to:	**$930,000**

D. Impacts to long-term maintenance and inspections

The rehabilitation alternative will not change the needs for bridge inspection. Bridge 5380 will continue to require an inspection annually, a fracture-critical inspection bi-annually, and a scour inspection and analysis performed every 10 years at minimum.

Impacts to long-term maintenance (next 25-30 years) for each of the alternatives are summarized as follows:

Table 5. Impacts to Long-Term Maintenance for Each Alternative

Alternative	Maintenance	Additional long-term maintenance (as deferred in rehabilitation alternative)	Total present-value cost estimate
1	Minimal maintenance	none	
2	Same as Alt. 1, plus ->	Painting of upper portion of truss superstructure in 5 to 10 years	$111,000
3	Same as Alt. 2, plus ->	Additional spot repairs and repainting of bridge railing in 10 to 15 years	$135,000
4	Same as Alt. 3, plus ->	With deferral of surface repairs to abutments for 5 to 10 years	$157,000

The maintenance items listed for Alternatives 2, 3, and 4 are deferred items that are not performed initially as part of Alternative 1. These deferred items could increase in cost, depending on the bridge condition at the estimated time for the needed rehabilitation.

4. Rehabilitation, Historic Significance, and Consistency with Secretary's Standards

The planned activities in each of the four alternatives presented in Section 3 were individually reviewed and analyzed for consistency with the Secretary's Standards and for a determination of effect under Section 106. As part of the process of historical analysis, the alternatives were evaluated for their impact on the bridge's character-defining features as follows (see Appendix A, Photographs, for character-defining features):

1. The Parker truss design and construction (see Figure 1)
2. The two sidewalks with brackets and railings (see Figure 2)
3. Architectural detailing on the railings and abutments (see Figure 3)
4. The WPA stone masonry in the areas around the abutments (see Figure 4)

The effect of the alternatives on the overall integrity of the historic bridge was evaluated to determine the consistency with the Secretary's Standards. Lack of consistency with the Secretary's Standards would cause the proposed alternative to be considered an adverse effect on the historic property. An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

As presented in Section 3, the four alternatives involve replacement of the bridge floor system (i.e., replacement of floor beams and replacement of the steel stringers), replacement of the concrete deck, and replacement of the concrete slabs and integral beams at the approaches. These components are not character-defining features. The only historic-fabric components of importance that may be involved are the steel floor beams. Replacement of the floor beams would not constitute an adverse effect because they are not a character-defining feature and would be replaced with similar materials and design. In the case of the deteriorated steel stringers and concrete approach-slabs and beams, replacement would not constitute an adverse effect because these are not character-defining features and typically are replaced with similar materials and design.

The historical analysis of the alternatives is summarized in Table 6. Based on that analysis, it was determined that:

- The character-defining features would remain unaltered under each of the alternatives.
- The overall integrity of the historic bridge would not be affected by any of the alternatives.
- The bridge would continue to retain National Register eligibility under each of the alternatives.
- Each of the alternatives is consistent with the Secretary's Standards.
- Each of the alternatives would present no adverse effect under Section 106.

Therefore, following historical analysis it is recommended that each of the alternatives would constitute acceptable and appropriate rehabilitation treatment for Bridge 5380.

Table 6. Historical Analysis of Alternatives for Consistency with Secretary's Standards

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Character-defining features	**Parker truss design and construction**	Unaltered	Unaltered	Unaltered	Unaltered
	Sidewalks, brackets & railings	Unaltered	Unaltered	Unaltered	Unaltered
	Architectural detailing	Unaltered	Unaltered	Unaltered	Unaltered
	WPA masonry	Unaltered	Unaltered	Unaltered	Unaltered
Consistent with Secretary's Standards		Consistent	Consistent	Consistent	Consistent
Section 106		No adverse effect	No adverse effect	No adverse effect	No adverse effect

5. Recommendation

As a result of the analysis completed for this study, the recommended alternative is Alternative 1 – Full rehabilitation. This alternative:

- Will provide a bridge with a minimum inventory load rating of HS-18 and a minimum operating factor of 1.15 for all agricultural trucks in the region, thereby removing the load posting.

- Is consistent with the Secretary's Standards and will have no adverse effect under Section 106.

- Will provide a bridge with minimum maintenance for the next 25 to 30 years.

Appendix A. Photographs

Figure 1. Perspective view of south side of Bridge 5380. This view illustrates Character Defining Feature 1: Parker truss design and construction.

Figure 2. Deck view of Bridge 5380 looking west from east abutment. This view illustrates Character Defining Feature 2: the two sidewalks with brackets and railings.

Figure 3. South side of east abutment of Bridge 5380. This view illustrates Character Defining Feature 3: architectural detailing on the railings and abutments.

Figure 4. View of area on northeast side of Bridge 5380, facing east. This view illustrates Character Defining Feature 4: WPA stone masonry in the areas around the abutments.

Figure 5. General view of floor system and underside of deck on the truss span.

Figure 6. Deck view of concrete U-shaped west abutment. This view shows the deck (beneath the orange cone), which is the top of the concrete slab to be replaced. The concrete beams (not visible here) are integral with the bottom of the slab and run longitudinally, from left to right.

Figure 7. General view of Bridge 5380 looking east from west abutment. Note lower portion of steel superstructure (splash zone), which has been painted previously.

Appendix B. Purpose and Need Statement

S.P. 1209-22 TH 40 Br 5380 Purpose & Need

Purpose

The purpose of the project is to provide a structurally sound bridge structure that is not load restricted, and that provides unrestricted access that serves the traffic and aids Mn/DOT in meeting its bridge maintenance goals, all within the context of the history of the bridge and surrounding area.

Problems that Need to be Addressed

- **Structural Concerns**

  There are structural issues with Bridge 5380. The bridge, which was constructed in 1938, has a sufficiency rating of 38.9. The bridge is structurally deficient and is posted at 40 tons. The bridge has been in service for more than 70 years and has gone through numerous fatigue cycles. Based on its age and the overall condition of the structure, the bridge is nearing the end of its design life, thereby increasing the risk to the traveling public. The bridge condition indicates that it has severe structural problems that need remedy. According to the most recent bridge condition survey, conducted in September 2010, these structural problems include corrosion in the stringers and floor beams, deterioration in the concrete deck, and pack rust in some of the bridge gusset plates. In addition, the rocker bearings are frozen which prevent the bridge from expanding and contracting. And, the concrete slabs over the u-shaped abutments are deteriorated and primarily responsible for the load posting of the bridge.

- **Local Traffic Use Concerns**

  Trunk Highway (TH) 40 serves as primarily a farm to market route. Local farmers travel along TH 40 to Milan and destinations to the east. The bridge is posted at 40 tons maximum load because the structural factor of safety is decreased due to the bridge structural condition described previously, and the chance of a heavy load damaging the bridge has increased. Due to the structural concerns, no overweight vehicles (which would otherwise be allowed by permit) are allowed on TH 40 because of the bridge restrictions. The next nearest bridge crossing (which is not posted) is approximately 5.5 miles upstream. Forty tons is the legal limit on most roadways, with an increase of 10% in winter. Providing a non-posted bridge would ensure that local products can travel from farm to market in the most direct manner.

  If the bridge would need to be closed due to structural concerns or construction due to rehabilitation or replacement, the detour route would add approximately 9 miles, affecting emergency service providers, school bus routing, farm commercial traffic and others. Lac Qui Parle Valley middle and high school is located approximately 8 miles west of Bridge 5380 and serves the communities of Madison, Appleton and Milan. Students from the Milan area would need to take alternate routes, potentially increasing operating costs for the school district.

Other Issues to be Addressed/Considered

- **Geometric Deficiencies**

  Bridge 5380 is functionally obsolete. It does not meet current Mn/DOT bridge width standards for existing and forecasted traffic volumes on TH 40. Based on current standards and traffic volumes, the roadway on the bridge should have 12 foot lanes and a minimum of 6 foot shoulders, compared to the existing bridge with 12 foot lanes and 1.5 foot shoulders. Based on Mn/DOT's Bridge Preservation, Improvement and Replacement Guidelines, the minimum bridge width required to meet improvement standards consists of 12 ft lanes with 3 ft shoulders. The crossing of Bridge 5380 is the narrowest portion of TH 40. In order to keep the current bridge width, a design exception would need to be recommended by the Mn/DOT Bridge Office. The Mn/DOT Bridge Office has indicated that they would not support a design exception to allow a substandard roadway width of 27 ft on Bridge 5380 due to the safety risks that are inherent in a substandard design. In addition, TH 40 and Bridge 5380 are set in a largely agricultural area, and the narrow bridge limits the largest farm equipment from crossing the river at this point.

  Because the bridge is an overhead truss design, vertical clearance is limited. While there is no history of the overhead members of Bridge 5380 being hit, other truss bridges of similar design have been hit by over-height vehicles and the possibility exists of this occurring here in the future as well. The vertical clearance also limits tall agricultural equipment from crossing Bridge 5380.

  There are four accesses directly to the east of the bridge that serve a parking area, a business and a private residence. Due to the proximity of these accesses to the bridge, the bridge truss and railing partially block the view for vehicles entering TH 40 from these driveways. There have been no reported accidents in the last 10 years that are attributed to this limited sight distance, but the visual obstruction does increase the risk of accidents in this area. The speed limit on TH 40 in the area of the bridge has been lowered because of the turning traffic and limited sight distance.

- **Increasing Maintenance Costs**

  Maintenance costs on Bridge 5380 are rising. Numerous deck repairs have been made and more are needed. There are numerous transverse cracks and minor spalls with exposed rebar. The bridge has peeling lead paint that will continue to flake off and fall into the Minnesota River if nothing is done, exposing the bridge to further rusting and potential contamination of the river. District 8 is currently struggling to meet established bridge maintenance targets and expectations of management, the state legislature and administration. Truss bridges require additional maintenance beyond that of other bridge types, and special maintenance that might be needed to maintain this truss bridge, given its age and structural problems described previously, is increasingly difficult to achieve. Bridge maintenance personnel spent over 200 hours on deck repair in 2008 alone. Additional work is needed in the upcoming years to repair and maintain the bridge. With limited resources, focusing on one structure while ignoring or delaying needed work on other structures is not the most effective use of Mn/DOT staff time and materials and is not the most prudent use of public funds.

- **State of Minnesota Statute 165.14 desire for a redundant structure**

  Minnesota Statute 165.14 Subdivision 4 (formerly Chapter 152) classifies Bridge 5380 as a Tier 2 bridge. Tier 1 bridges consist of any bridge that has an average daily traffic count that is above 1,000 and has a sufficiency rating that is at or below 50. Tier 2 bridges consist of any bridge that is not a Tier 1 bridge and is classified as fracture-critical, or has a sufficiency rating at or below 80. Bridge 5380 has a sufficiency rating less than 80 and is fracture-critical, but has an average daily traffic of 610, and therefore falls into the Tier 2 category. This same Minnesota statute requires that "By June 30, 2018, all tier 1 and tier 2 bridges originally included in the program must be under contract for repair or replacement with a new bridge that contains a load-path-redundant design, except that a specific bridge may remain in continued service if the reasons are documented in the report." While the Federal Highway Administration has no federal requirement to remove fracture critical bridges, a rehabilitation or replacement bridge that is load path redundant would fulfill Minnesota Statue 165.

- **Conflicting Pedestrian-Vehicular Use**

  The bridge and surrounding area is a popular recreational area. There is a Minnesota Department of Natural Resources (DNR) fishing pier and parking area on the southeast side of the bridge and a boat launch in northeast quadrant of the bridge. Also located in the northeast quadrant is the Milan Beach Resort, which has a restaurant and bait shop. These amenities attract many tourists to the area. The public that uses these amenities must cross the highway to travel from the fishing pier and parking area to the boat launch. While there is no record of accidents between pedestrians and vehicles, the mixed-use nature in this area increases the chance of conflicts between pedestrians and vehicles passing through the area. Due to the popularity of this area as a fishing spot, the DNR has indicated an interest in making enhancements to the bridge and surrounding area to improve fishing and boating and improve the safety of this area for all users. The deepest area of Lac Qui Parle Lake is near Bridge 5380, making it one of the most desirable spots for fishing.

  The Minnesota River State Trail is designated to cross Bridge 5380, as listed in the draft Minnesota River State Trail Master Plan. It connects the cities of Milan and Appleton with Lac Qui Parle State Park. A trail parallels TH 40 east of the bridge to the city of Milan. Because the sidewalks on the bridge are narrow (approximately 3 ft wide), bikes and pedestrians using the trail that wish to continue on to the state park must move to the roadway shoulder to cross the bridge. The narrow shoulder does not provide enough safe space for multi-modal use.

  The sidewalk was specifically built on Bridge 5380 because of the popularity of the area for recreation. The need to accommodate pedestrians and bicyclists on the bridge is consistent with today's use and the intended use of the bridge when it was originally constructed.

- **ADA Requirements**

  The Americans with Disabilities Act (ADA) recognizes and protects the civil rights of people with disabilities. The ADA establishes accessibility requirements for State and local government facilities, places of public accommodation, and commercial facilities. State and local governments must ensure that the facilities they build or alter are accessible to people with disabilities.

  Mn/DOT has adopted the Access Board's Draft Public Rights of Way Accessibility Guidelines (PROWAG) 2005. Any alteration project must provide accessibility to the maximum extent feasible. On Bridge 5380, the existing sidewalk is only three feet wide. ADA requires a four foot wide sidewalk with passing zones placed every 200 feet. Because pedestrians also fish from the bridge, additional width is required to maintain a four foot clear distance. There are no pedestrian ramps leading to the sidewalk.

- **Historical Nature of Bridge**

  Bridge 5380 carries TH 40 over a widening in the Minnesota River known as Lac Qui Parle Lake. The lake itself is an artifact of a water conservation and flood control project initiated in 1933 during the Great Depression. It was largely constructed by laborers provided by the New Deal Works Project Administration (WPA), under the sponsorship of the Minnesota Department of Conservation. In addition to creating Lac Qui Parle State Park, the project created a 40-mile-long reservoir on the Minnesota River with the construction of dams, control works, and a diversion channel. The undertaking also required the construction of new roads and bridges, including Bridge 5380 on TH 40. Bridge 5380 is the only truss bridge built in the flood control district and replaced an earlier truss. The character defining features of the bridge include the Parker truss design (with sidewalks on both sides of the bridge, including brackets and railings), the architectural details on the concrete approach spans (including metal railing panels), and the WPA grouted stone slope protection on both approaches, which includes the terraces and steps adjacent to the bridge on the northeast side. The Lac Qui Parle Flood Control project is considered a historical district, and has been recommended eligible for the National Register. Bridge 5380 is a contributing element to this historical district. Any potential impacts to the bridge, including rehabilitation or replacement, need to be considered consistent with federal Section 106 and Section 4(f) regulatory requirements.

Appendix C. Widening Existing Truss: Concept Renderings (2009 Exhibits)

Exhibit A. Rendering Widened Bridge
Exhibit B. Cross Section
Exhibit C. Top Lateral Bracing
Exhibit D. Abutment Widening
Exhibit E. Top Lateral Bracing, Reuse Existing

Exhibit A
10/13/09

Rendering: Existing Bridge Widened 9’-0”
(Looking East)

ONE HALF TRAFFIC LANES PER TRUSS WITH REDUCTION AS PER A.A.S.H.O. SPECIFICATIONS DATED 1935.

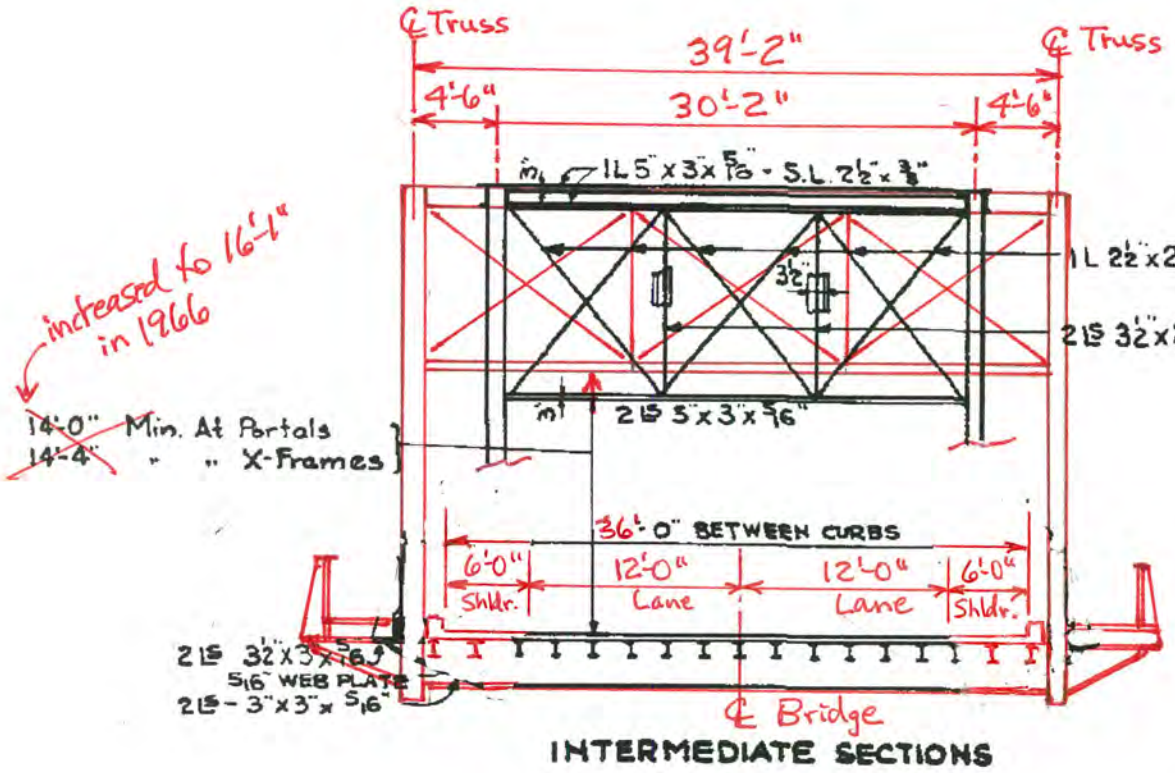
IMPACT :- FIGURED ACCORDING TO A.A.S.H.O. SPECIFICATIONS DATED 1935

SIDEWALK LIVE LOAD :- A.A.S.H.O. SPECIFICATIONS DATED 1935 . LOADED WIDTH OF SIDEWALK = 5'-3" (ASSUMED)

DESIGN LIVE LOAD : H-15 (original bridge)

by DJB 10/8/69

Exhibit B



INTERMEDIATE SECTIONS

Needed:

1) New Floor Beams (existing are CB 38"@125#)
2) New Stringers with 4 add'l lines of stringers (existing are CB 12"@28#)
3) New concrete deck w/curbs
4) New guardrail
5) New bottom lateral bracing
6) New bearings at each end of bridge (4 total)
7) New bracing ea. panel

SCHEDULE OF OPERATIONS FOR POURING FLOOR SLAB AND SIDEWALKS ON SPAN & ABUTMENTS.

1. Place floor slab by beginning at Panel Point "C" and extending to Panel Point "C'."
2. Place balance of Floor slab between abutments and panel points "C" & "C'."
3. Place sidewalks on the span. Before placing sidewalk slab, railing shall be erected, lined up horizontally and shimmed vertically as may be necessary, using metal shims for this purpose. Sidewalk stringers shall not be riveted until they have been properly shimmed so as to secure a truly horizontal curb line from end to end of steel span.
4. Place roadway slab on abutments.
5. Place sidewalk slabs on abutments.
6. Erect railing and place railing posts on abutments.

CONSTRUCTION NOTES

FABRICATOR SECURING CONTRACT FOR FABRICATION OF STEEL SHALL SUBMIT PRINTS OF DETAIL DRAWINGS, INCLUDING A COMPLETE ERECTION DIAGRAM TO THE HIGHWAY DEP'T. AND OBTAIN APPROVAL BEFORE ANY WORK IS DONE IN SHOP. PRINTS SHALL BE MADE FROM CHECKED DRAWINGS MADE WITH INDIA INK ON TRACING CLOTH. FABRICATOR MUST SECURE, TYPICAL LAYOUTS OF TRUSS JOINTS FROM THE HIGHWAY DEP'T. BEFORE MAKING DRAWINGS.

WHILE MANY DETAILED DIMENSIONS FOR THE STEEL STRUCTURE ARE GIVEN ON THE PLANS AND LAYOUTS, FABRICATOR SHALL ASSUME FULL RESPONSIBILITY FOR THE ACCURATE FITTING OF ALL MEMBERS.

ALL PAINT SHALL COMPLY WITH SECTION 219.01 OF REVISED PAINT SPECIFICATIONS DATED MARCH 15, 1937.

SHOP PAINT FOR STRUCTURAL SHALL SHALL BE ONE COAT OF RED LEAD BRIDGE PAINT. PAINT ALL CONTACT SURFACES.

FIELD PAINT SHALL CONSIST OF A FIRST COAT OF BROWN PAINT AND A FINAL COAT OF BLACK PAINT EXCEPT RAILING, PORTALS AND END POST COVER PLATES AS NOTED BELOW.

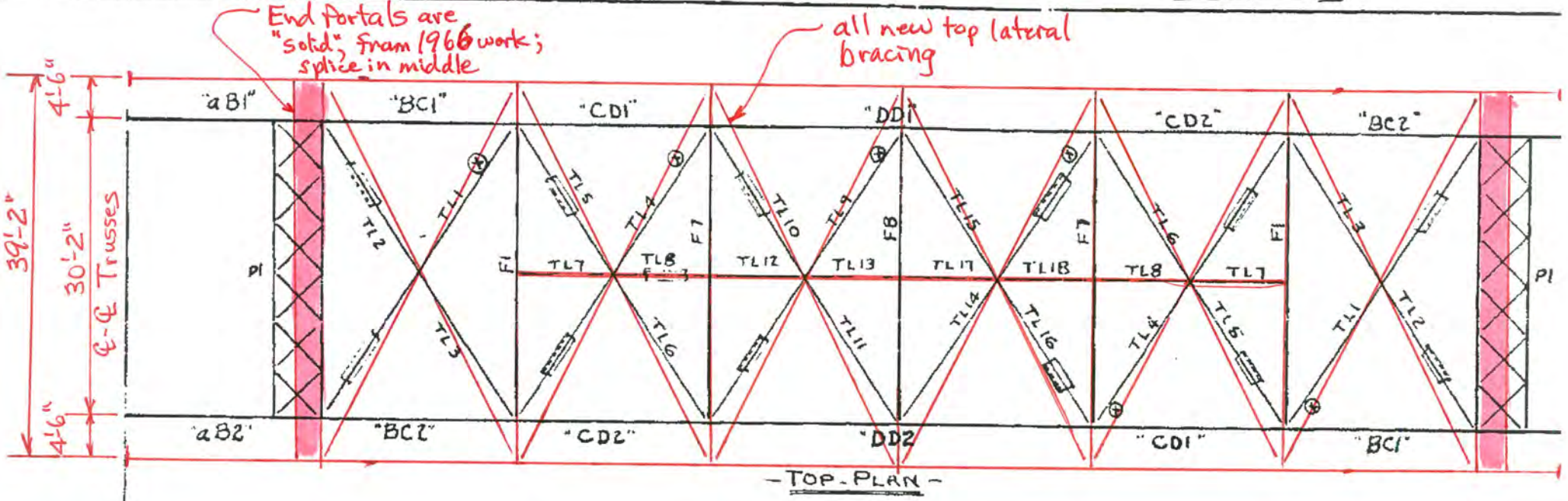
OUTSIDE FACE OF END FLOOR BEAMS, BOTTOM OF EXPANSION DEVICE AND ALL PARTS INACCESSIBLE FOR PAINTING AFTER ERECTION ARE TO RECEIVE THEIR TWO COATS OF FIELD PAINT AND ALLOWED TO DRY BEFORE ERECTION

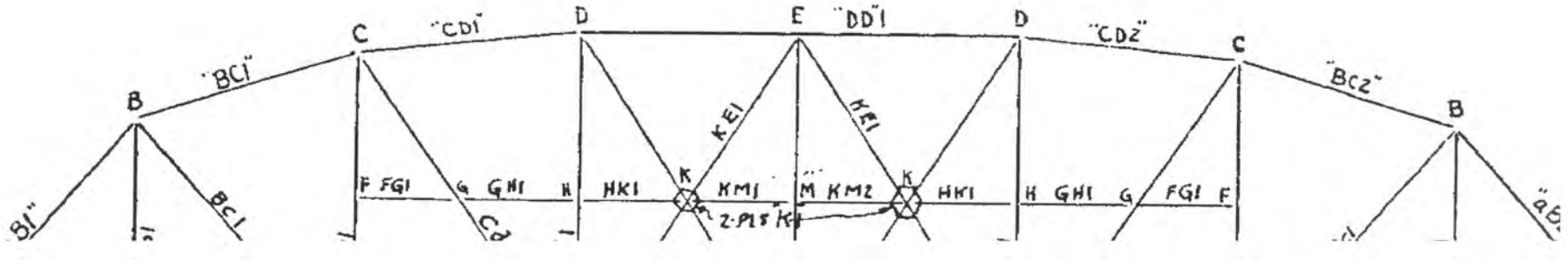
widen bridge by 9'-0", 4'-6" each direction

by DJB
10/8/09

Sheet 1 of 2

Exhibit C





by DJB 10/8/09

Exhibit D

Abutments to be widened 4'6" each way

DETAIL OF DEPRESSED PANELS IN SIDEWALLS
1" = 1'-0"

DETAIL OF PLATE CAPS FOR PILES

Note: Place Caps As Shown After Piles Have Reached Their Required Resistance And Been Burned Off If Required.

SIDE ELEVATION
1/4" = 1'-0"

FRONT ELEVATION
1/4" = 1'-0"

DETAIL OF ℄ MARKER
1/4" = 1"

DETAIL OF CONSTRUCTION JOINT
1/2" = 1'-0"

4'-6"

4'-6"

4'-6"

4'-6"

HALF PLAN OF FOOTING - EAST ABUTMENT
SHOWING PILING
1/4" = 1'-0"

HALF PLAN OF FOOTING - WEST ABUTMENT
SHOWING PILING
1/4" = 1'-0"

HALF PLAN
FOOTING NOT SHOWN

HALF PLAN
RAIL, SIDEWALK, ROADWAY SLAB & FOOTING NOT SHOWN
1/4" = 1'-0"

total reconstruction of roadway slab required

widening not shown here

REVISED 12-20-37

STATE OF MINNESOTA
DEPARTMENT OF HIGHWAYS
DETAILS OF ABUTMENTS
BRIDGE No 5380
APPROVED: SEPT. 27, 1937

BRIDGE ENGR. CHIEF ENGR.

NOTE - ALL ELEVATIONS ARE U.S.C. & G.S. 1915 DATUM.

LAC QUI PARLE FLOOD CONTROL PROJECT
BRIDGE 5380 ON T.H. 40 NEAR MILAN, MINN.
DETAILS OF ABUTMENTS
WORKS PROGRESS ADMINISTRATION
EMERGENCY RELIEF ADMINISTRATION
STATE DEPARTMENT OF CONSERVATION
STATE OF MINNESOTA
COOPERATING

DESIGN: STATE HWY. DEPT.	APPROVED	SHEET
DRAWN: S.A.F.		LH-20
DATE: 1-20-37	CONSULTANT	
REVISED:		

S.P. 40=145-21-1 F.A.S. No 11-A (1938)

SHEET 6 OF 10 SHEETS 5380

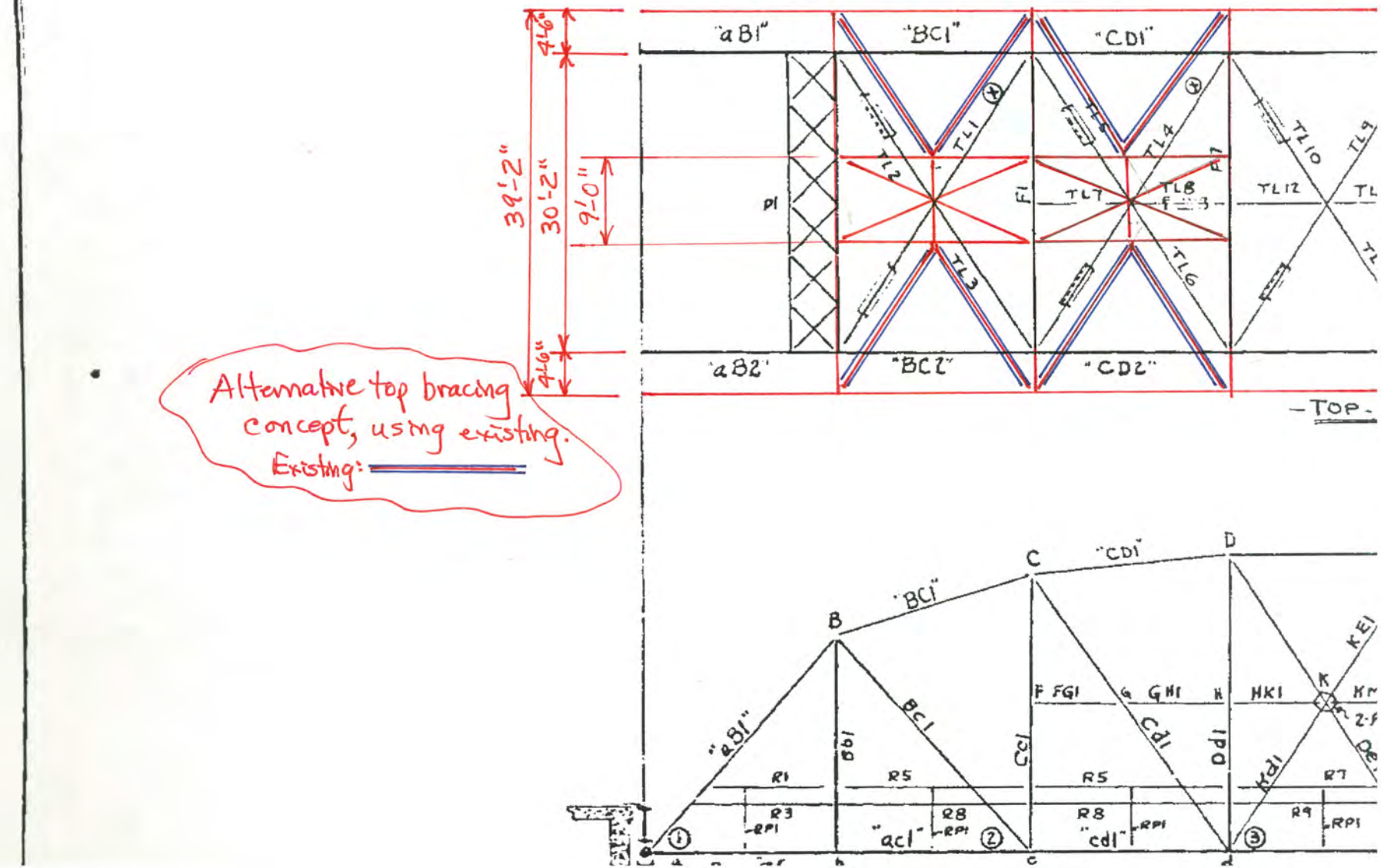
Foundation widening with steel piling.

Foundation widening w/ steel piling; concern for mixing steel piling with timber piling.

Exhibit E

Alternative top lateral bracing concept, using existing bracing

by DJB
10/8/09



Appendix D. Multi-Use Trail Crossing Concept Level Analysis (2010 Report)

Lac Qui Parle Bridge
Multi-Use Trail Crossing
Concept Level Analysis

Mn/DOT Bridge No. 5380

Prepared for
Minnesota Department of Transportation

Prepared by

Mead & Hunt, Inc.

Draft 4-30-10

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Figures

1. Introduction

The Lac Qui Parle Bridge 5380 carries Trunk Highway (TH) 40 over a widening in the Minnesota River known as Lac Qui Parle Lake (see *Figures 1 and 2*). The bridge, built in 1938, is significant as a contributing property to the Lac Qui Parle Flood Control Historic District, which as been determined eligible for the National Register of Historic Places. As such, the bridge is subject to review under Section 106 and Section 4(f) regulatory requirements. Initiated in 1933, the Flood Control Project was completed by the Works Project Administration (WPA) as a major federal relief project during the New Deal era. Bridge 5380 is the only metal truss bridge in the historic district. It replaced an earlier metal truss bridge at the same crossing (see *Figure 3*).

Alternatives for multi-use trail structure

This report summarizes a concept-level analysis to provide a multi-use trail structure across the Minnesota River at the existing site of Bridge 5380. This multi-use trail would be used by pedestrians, bicyclists and those who would want to fish from the bridge. The proposed multi-use trail structure would have a minimum clear width of 12 feet, as confirmed with the Mn/DOT Bridge Office. This structure would be located on the north side of the existing bridge, because a trail parallels TH 40 on the north side, east of the bridge to the city of Milan. The multi-use trail structure would need to be designed for a live load of 85 pounds per square foot (psf) in accordance with current AASHTO bridge design criteria. It is noted that the repairs and rehabilitation of the existing bridge as identified in the Mead & Hunt February 11, 2010 letter report would still need to be completed in association with any of the multi-use trail alternatives analyzed. As identified in the letter, the cost estimate for the repairs and rehabilitation is $857,000.

Three multi-use trail structure alternatives were analyzed at a concept level:

1. A structure on the existing bridge with cantilever support.
2. A structure employing a support system separate from the existing bridge.
3. A separate structure parallel to the existing bridge.

2. Analysis and Recommendation

A. Alternative 1: A structure on the existing bridge with cantilever support (*Figure 4*)

- Remove existing 3-foot concrete sidewalk, cantilever steel brackets and metal railing.
- Construct new cantilever steel brackets with a new timber deck to provide a 12-foot walkway.
- Refurbish and reinstall existing metal railing on new cantilevered walkway on bridge and abutments.
- Reinforce existing concrete walls, add new support brackets.

Structural analysis: Additional loading from the wider cantilever would increase the dead load, live load, and torsional loading on the existing bridge, including additional loads on the bearings at the abutments. The bearings might need to be replaced as a result of the additional loading from the cantilevered walkway. Ice loading on the cantilever would need to be a design requirement.

Historical analysis: This alternative would include the removal of the original north sidewalk with supporting brackets and replacing it with a new and different structure. Architectural details on the existing concrete abutments and railing would be altered. The WPA masonry work adjacent to the abutments would be altered. The changes and new additional would not be compliant with the Secretary of the Interior's Standards and would constitute an adverse effect under Section 106.

Recommendation: Not recommended for continued analysis and consideration due to lack of structural feasibility and non-compliance with Secretary of the Interior's Standards.

Cost estimate: N/A

B. Alternative 2: A structure employing a support system separate from the existing bridge (*Figure 5*)

- Remove existing 3-foot concrete sidewalk, cantilever steel brackets and metal railing.
- Install new 160-foot prefabricated, painted steel truss to support outside edge of proposed 12-foot walkway.
- Add new stringers and floor beams to connect existing truss with new truss.
- Construct 30-foot girder approach spans at each end of the main span, adjacent to the existing abutments.
- Construct two new piers and two new abutments to support the new truss and approach spans.
- Existing railing not reused because new steel truss would be equipped with necessary railing elements.

Structural analysis: Extensive modifications would be necessary for the walkway attachments to the existing bridge, including existing truss gusset plates. Differential movements from the vehicular truss transferred to the pedestrian walkway could result in deflections along the walkway outside the limits of current design criteria for pedestrian bridges. Additional loads on the existing bearings at the abutments are a concern, and would result in the need to remove and replace the bearings.

Historical analysis: This alternative would include the removal of the original north sidewalk with supporting brackets and replacing it with a new and different structure. Architectural details on the existing concrete abutments and railing would be altered. The WPA masonry work adjacent to the abutments would be altered. The changes and new additional would not be compliant with the Secretary of the Interior's Standards and would constitute an adverse effect under Section 106.

Recommendation: Not recommended for continued analysis and consideration due to lack of structural feasibility and non-compliance with Secretary of the Interior's Standards.

Cost estimate: N/A

C. Alternative 3: A separate structure parallel to the existing bridge (*Figures 6 and 7*)

- Construct new prefabricated pedestrian bridge about 60 feet north of the existing bridge, to include three prefabricated truss spans, two piers constructed in the waterway, and two abutments.
- Trusses to be 12-foot clear width, prefabricated weathering steel trusses designed for pedestrian loading. See *Figures 8 and 9* for examples of prefabricated weathering steel trusses.
- Modify existing riprap and boat launch area to accommodate new multi-use trail piers, abutments and embankment.
- Allows economical solution to the project requirements for a trail crossing at the location with the least impact on the existing historic bridge and approach areas.

Structural analysis: Provides a completely independent structure for the multi-use trail functions, and is not connected to the existing bridge. No additional loads would be imposed on the existing bridge. Differential movement would not be a concern because the vehicle and pedestrian bridges are not structurally connected. The existing sidewalk and metal railing on the north side of the bridge would remain. The elevation of this new bridge would be set to be slightly higher than the lowest member of the existing bridge, thereby not affecting the waterway opening at the bridge site.

Historical analysis: This alternative does not affect the character-defining features of the historic bridge structure. There may be some alteration to the WPA masonry, depending on the design and location of the abutments and approaches, but the intention of this alternative is to avoid the masonry as much as possible while keeping all work within the project right-of-way.

Recommendation: Determined to be feasible with minimal impact on historic resources and compliance with Secretary of the Interior's Standards and is recommended for continued analysis and consideration.

Cost estimate: $739,200 (calculations below)

- Bridge length = 480 feet; bridge width = 14 feet (centerline to centerline of trusses, 12 feet clear width).
- Area = 6,720 square feet.
- Unit cost = $110 per square foot.
- Bridge estimated cost = $739,200.
- This cost is for the bridge structure only and does not include cost for the trail extension or cost for widening the roadway embankment on the west side.

Table 1. Analysis of Alternatives for Trail Structure

		Alternative 1 (cantilever support)	Alternative 2 (separate support)	Alternative 3 (separate structure)
Character-defining features	**Parker truss design and construction**	Unaltered	Unaltered	Unaltered
	Sidewalks, brackets & railings	North sidewalk removed, replaced with different structure; railing reused.	North sidewalk removed, replaced with different structure; railing not reused.	Unaltered
	Architectural detailing	Architectural elements of concrete abutments and approach railings altered or removed	Architectural elements of concrete abutments and approach railings altered or removed	Unaltered
	WPA masonry	Elements altered or removed	Elements altered or removed	Some alteration to masonry
Compliance with Secretary's Standards		Alterations & new construction not compliant	Alterations & new construction not compliant	Compliant with Standards; minimal alteration to setting
Section 106		Adverse effect	Adverse effect	No adverse effect
Cost estimate		N/A	N/A	$739,200 (bridge only)

Figure 1. Lac Qui Parle Bridge 5380

South truss, facing north, 2009

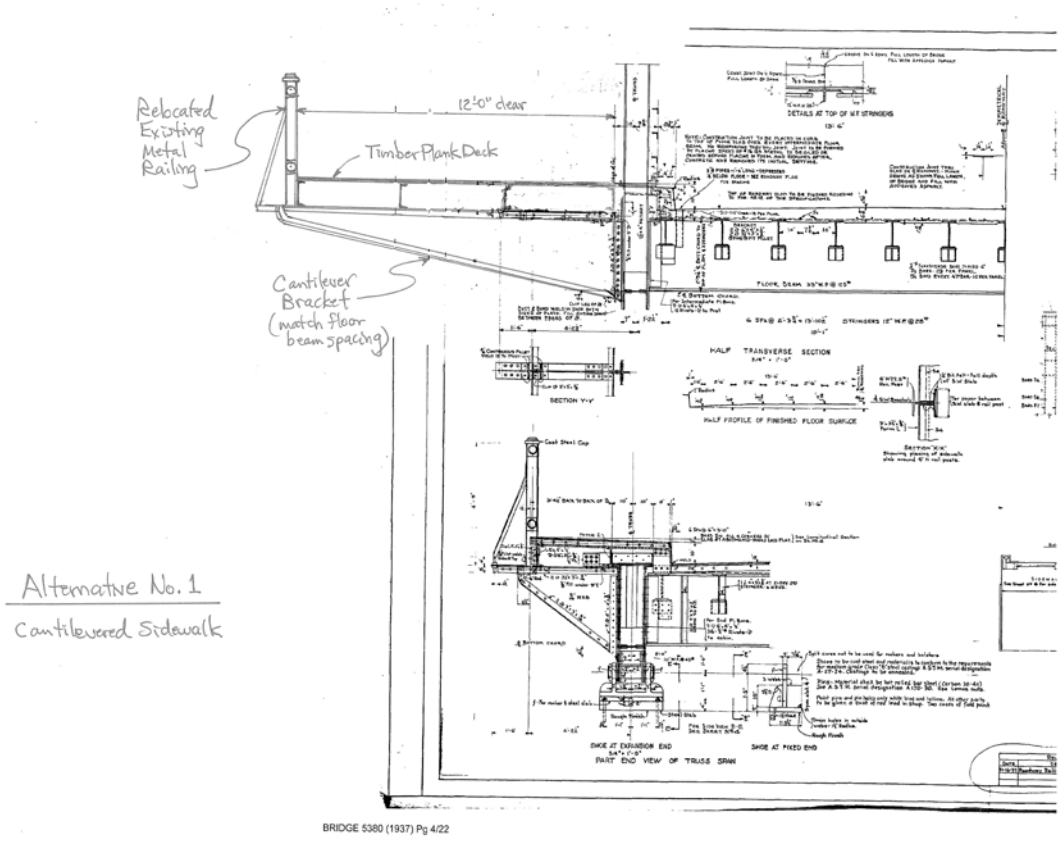
Figure 2. Lac Qui Parle Bridge 5380

North truss, facing southwest, 2009

Figure 3. Historic Photo of Bridge 5380

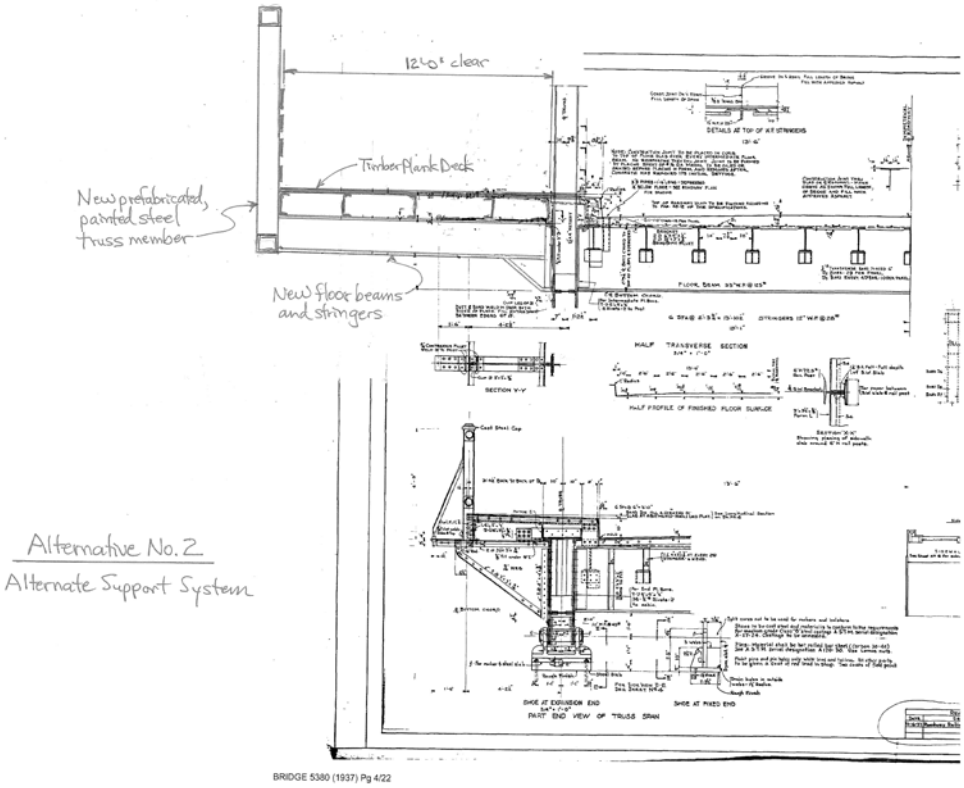
With predecessor truss, facing southwest, c.1938

Figure 4. Alternative 1, concept sketch.



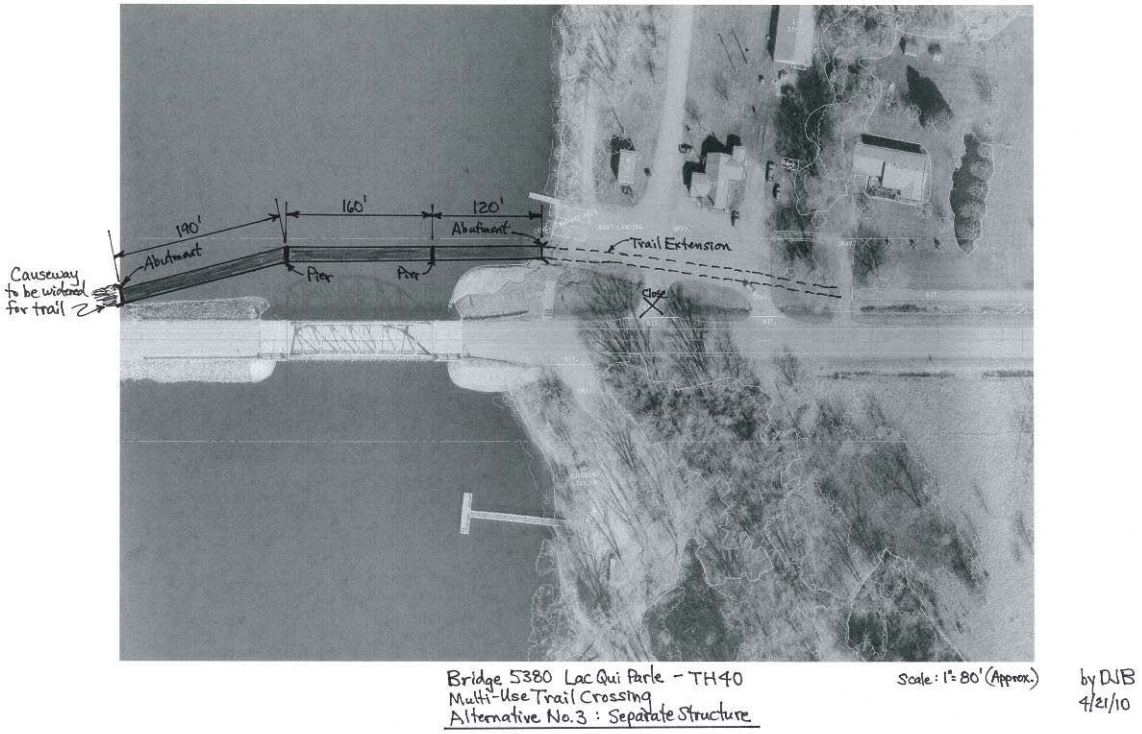
Cantilevered Sidewalk

Figure 5. Alternative 2, concept sketch.



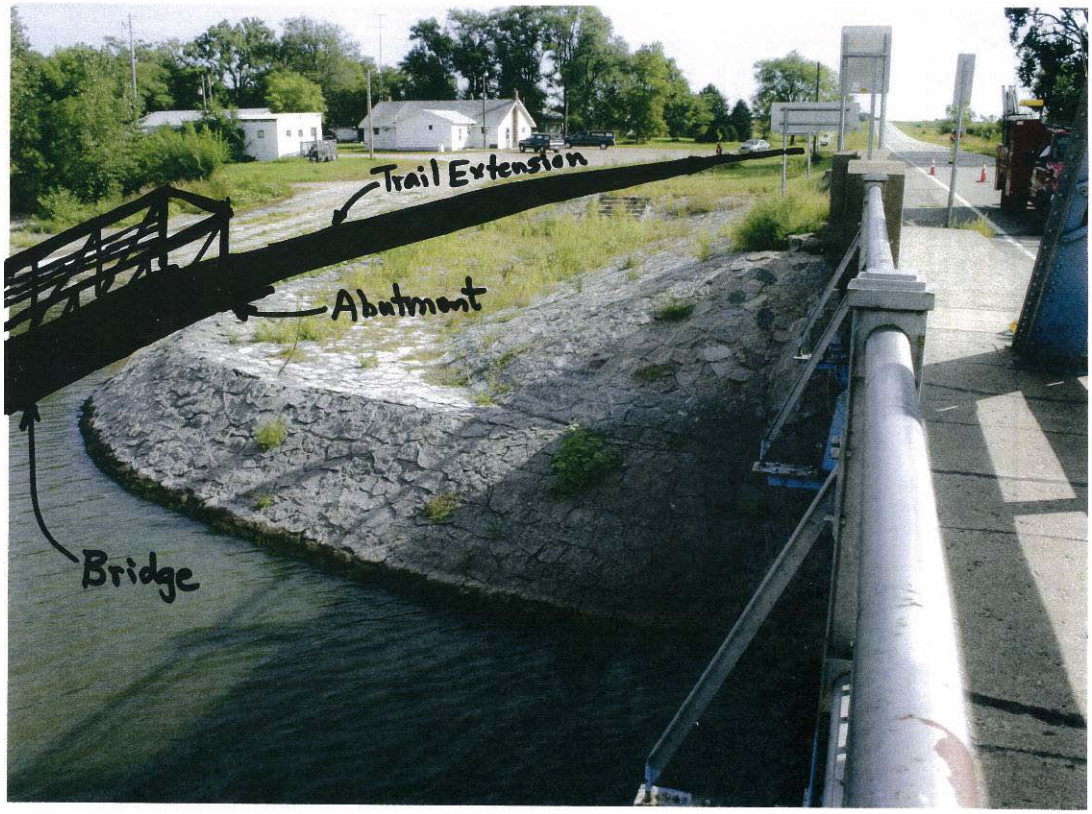
Alternate Support System

Figure 6. Alternative 3, concept plan view.



Separate Structure

Figure 7. Alternative 3, concept sketch



Separate Structure

Figure 8. Prefabricated truss, example from Agassiz Recreational Trail, Fertile, Minnesota. Continental Bridge, Contech, Construction Products Inc.

Agassiz Recreational Trail Bridge

Fertile, Minnesota

Knowledge. Solutions. Service.

Parks & Recreation

Project Team Members:

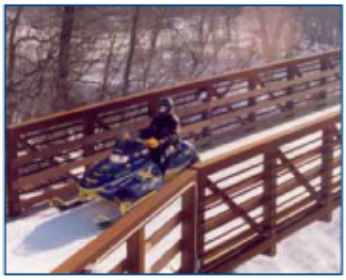
Owner:
Sand Hill Snowcruisers

Contractor:
Larum Construction

Technical Description:

• Width:	12 ft
• Span:	170 ft
• Style:	Connector®
• Finish:	Weathering Steel
• Decking:	Douglas fir, plywood

Installation Date: January 2005



After years of planning and fund raising, a new bridge over the Sand Hill River is open to recreational traffic. The new Continental® bridge was made possible through the fund raising efforts of the Sand Hill Snowcruisers, a local snowmobile club, and a grant from the Minnesota Department of National Resources. Norman County Soil and Water Conservation District was also instrumental in helping secure the grant.

With the installation of the new bridge, snowmobilers and outdoor enthusiasts alike can safely cross over the scenic Sand Hill River, which is 40' below the bridge. Club officials are excited about the new bridge, which replaces an abandoned railroad bridge. They believe its installation will make the Agassiz Recreation Trail System more appealing and have a positive year round impact on the local economy, something that is important to this rural community of 900 people.

Site preparation was handled by Ferguson Brodher Excavating, Inc. The 170' x 12' bridge was delivered to the site in two sections. This allowed the contractor to use a smaller crane when moving the bridge sections into position for splicing. The splicing was done in mid-air. The crane positioned one section and then drove around to the other side of the river to set the final piece. This phase of the project was accomplished in just two days.

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CONTINENTAL BRIDGE

Figure 9. Prefabricated truss, example from Colorado Riverway, Moab, Utah. Continental Bridge, Contech, Construction Products Inc.

Colorado Riverway Bridge

Moab, Utah

Knowledge. Solutions. Service.

Parks & Recreation

Project Team Members:

Owner:
Grand County

Engineer:
Horrocks Engineers

Contractor:
Ralph L. Wadsworth Construction

Technical Description:

- Width: 11 ft (3)
- Span: 618 ft (3-206 ft spans)
- Style: Capstone®
- Finish: Weathering Steel
- Decking: Concrete
- Installation Date: January 2008

In 2001, an amendment was proposed for the Colorado River Recreation Management Plan to analyze the construction of a new pedestrian bridge to span the Colorado River and extend the bike path along the first three miles of State Highway 128. After many years of conceptualization, the bicycle and pedestrian bridge opened in May 2008.

The Continental® pedestrian truss bridge crosses the Colorado River at one of its widest and deepest points. Installation of the Capstone structure occurred in winter of 2007 when the river was at its lowest levels. Sections of the bridge were cantilevered and set with a crane to minimize environmental impact.

"In addition, we had to build a temporary bridge out into the river before construction of the new bridge could begin," states Brandon Squire, P.E., Project Manager of Ralph L. Wadsworth Construction, the contractor on this project. "We were limited as to how far out we could construct this temporary bridge so we had to utilize 100 ton Hilman Rollers to launch the last truss section towards the other side of the river until the 550 ton crane on the other side could pick up half the weight of the truss."

A weathering steel finish was selected to blend in with the natural beauty of the canyon landscape. It was designed to weather the elements and grow in beauty as it becomes part of its surroundings. Additionally, Keystone® modular block retaining walls were utilized to line access ramps to the bridge. The aesthetic rust color of the blocks was chosen to match the red rocks of the trail.

The Colorado Riverway Bridge is a key element of the North Moab Recreation Area's alternative transportation system. The community envisions the ability to travel from Moab City to all of the surrounding state parks within the next five years. The trails are safe, alternative transportation methods that promote health and fitness and reduce the use of fuel.

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CONTINENTAL BRIDGE