

# Memorandum

**Date:** 11/11/2016

**To:** Wade Salyards, MDT

**Copy to:** Russ Lay, Steve Grabill, Brady Lassila

**From:** Kathy Harris

**RE:** Swan River - Bridge St (Bigfork) UPN 9020000 STPB 9015 (126): Bridge Memo 2, Planning-Level Risk Assessment and Cost Development

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## Purpose of Memorandum

The second bridge memorandum provides a conceptual project risk management analysis and provides further cost estimates for the seven options previously developed.

## Background

The Swan River Bridge does not meet current design standards, is functionally obsolete and is structurally deficient. Without treatment of ongoing corrosion and deterioration, bridge closure is imminent. The owner (Flathead County), MDT and the project Steering Committee concur that, due to the unique nature and historic appearance of this bridge to the community of Bigfork, some current design standards do not need to be met.

Previous memos detailed the project goals and defined seven options deemed feasible for maintaining this crossing of the Swan River. The seven options include one no-build option, one rehabilitation option and five replacement options. Bridge Memo #1 then evaluated the seven options using qualitative screening criteria, specific to each of the three project goals established by the Steering Committee. The options that did not meet the minimal criteria (defined as "required criteria") were:

- Option 1 (No Build) did not meet structural loading or maintenance criterion
- Option 4 (New Concrete Girder) did not meet the historical appearance criteria

The general public was invited to review and provide comments at an informational meeting on August 16, 2016. Of the 38 public comments received, 78% supported Options 3, 5 and 7, in that order. Two comments requested a two-lane bridge (Option 6) be considered which was in opposition to the majority of public comments. No comments were received that voted or prioritized support for options 1, 2, 4, or 6.

## Risk Management

The Montana Department of Transportation (MDT) has created a formal process for identifying, assessing and managing potential project risks. This formal process utilizes a spreadsheet to identify risks and to assess if these risks can be managed throughout a project. Because of the planning nature of this study, a qualitative analysis is considered appropriate.

### Risk Analysis

The Swan River bridge project was originally identified as a medium-risk project, typical for bridge rehabilitation or bridge replacement. The medium level of risk was confirmed for Options 2-7 within MDT's spreadsheet. Option 1, No-Build, is not considered a project and therefore, is not included in the risk management discussions.

Individual Risk Management Plan (RMP) worksheets for bridge Options 2-7 identified risks and developed management strategies for high risk items. Risk levels and management strategies were discussed with KLJ and MDT on November 2, 2016. Table 1 identifies the risks that are common to all options and are deemed usual and manageable. The completed risk management spreadsheets are available upon request.

*Table 1: Risks Common to All Options 2-7*

Risk Group	Description (Risk Number from Spreadsheet)
Environmental	Mitigation measures need to be defined for NRHP listing (#2)
Engineering	Contaminated soils & hazardous materials (on bridge) (#3)
Stakeholders	County Project Agreements and County need to request funding (#4)
Unforeseen	Bridge design challenges due to existing abutments and bridge (#8)
Utility	Relocate gas line and electrical lines (#9)

Table 2 presents the risks that vary between bridge options and highlights which options have an increased risk potential.

*Table 2: Risks that Vary between Options*

Risk Group	Level of Risk per Option *			Description (Risk Number from Spreadsheet)
	Options #2, 3, 4, 7 Replacement	Option #5, Rehabilitation	Option #6, 2-Lane	
<b>Right-of-Way</b>	Low Cost Low Sched.	Very Low Cost Very Low Sched.	High Cost Medium Sched.	Obtain Right-of-Way (permits or acquisition) (#1)
<b>Environmental</b>	+	Low Cost Low Sched.	+	Option #5 risks a <u>possible</u> loss of NRHP eligibility based upon SHPO determination (#2)
<b>Stakeholders</b>	Medium Sched.	Medium Sched.	High Sched.	Public opposition (#5)
<b>Engineering</b>	Low Cost Low Sched.	Medium Cost Medium Sched.	Medium Cost Low Sched.	Unknown geotechnical conditions at abutments (#6)
<b>Engineering</b>	Low Cost Very Low Sched.	Medium Cost Very Low Sched.	Low Cost Very Low Sched.	Risk varies for bridge design on infrequently-designed project (Option #5)
<b>Engineering</b>	N/A	Medium Cost Low Schedule	N/A	Construction Administration (CE) experience (#10)

\* Risk as determined by the RMP worksheet.

+ This risk is unique to Option 5 as all other options will result in the loss of NRHP listing. The risk is unlikely to affect project cost or schedule & is therefore eliminated from further consideration.

Abbreviations:

N/A Risk is Not Applicable for this option

Sched. Schedule

Table 2 results can also be shown as a rating matrix, similar to previous matrices presented to the public. Table 3 shows the risks that vary between options but with screening ratings rather than the low/medium/high comparison used in MDT’s spreadsheet and in Table 2. Table 3 also provides a “combined” risk factor which presents one, cumulative rating showing the potential project risk for each build option.

*Table 3: Screening Ratings for Risks that Vary between Options*

#	Description	Screening Criteria					Combined Risk Comparison
		R/W	Stakeholders	Engineering: Geotech Unknowns	Engineering: Uncommon Bridge Design	Engineering: Uncommon CE	Combination of Known Project Risks
2	New, 1-Lane, Pony Truss	●	◐	●	●	N/A	●
3	New, 1-Lane, Steel Girder w/ Arch Truss	●	◐	●	●	N/A	●
4	New, 1-Lane, Concrete Girder	●	◐	●	●	N/A	●
5	Rehab, w/ Integral Walkway	●	◐	◐	○	○	○
6	New, 2-Lane, Concrete Girder w/ Arch Truss	●	◐	○	●	N/A	◐
7	New, 1-Lane, Through Truss	●	◐	●	●	N/A	●

Legend:

- Low or Very Low
- ◐ Medium
- Medium Cost, Low Schedule
- ◑ High
- High Costs, Medium Schedule
- N/A No project risk applicable

Similar to public and Steering Committee input, Table 3 shows that Option #6 has the highest project risk and Option #5 has a higher project risk than other options. These higher risks will be utilized in applying a range of project cost contingencies in the next section.

## Additional Cost Analysis of Bridge Options

Table 4 summarizes conceptual cost estimates for Options 2-7. Option 1 is not a construction project and therefore is not included below. Due to the uncertainty of when construction funding may be available, costs reflect 2016 prices with no inflation. To reflect the higher risks associated with some options, different contingency percentages were applied to both the right-of-way (R/W) and construction costs. R/W costs include minor construction permits (for Options 2, 3, 4, 5, and 7) and assume acquisition for Option 6 as the two-lane plus sidewalk footprint is not anticipated to fit within the current county easement. Contingencies for R/W reflect the potential for very expensive acquisition. Construction cost contingencies range from 10 to 45% based upon risk assessment and engineering judgement. Typical for MDT projects, standard percentages were applied to the construction cost to include engineering design (12%), construction administration (12%) and indirect cost capture (11%) and are reflected in the total project cost.

The right column of Table 4 shows the costs with qualitative comparison rather than dollars, similar to previous information presented to the public.

*Table 4: Conceptual Project Costs*

#	Description	Costs (in millions of 2016 dollars)		Qualitative Comparison
		R/W Cost Range	Total Project Cost Range (Engineering, R/W, and all Construction Costs)	
2	New, 1-Lane, Pony Truss	\$ 0.00	\$ 1.40 to 2.00	\$\$
3	New, 1-Lane, Steel Girder w/ Arch Truss	\$ 0.00	\$ 1.50 to 2.20	\$\$
4	New, 1-Lane, Concrete Girder	\$ 0.00	\$ 1.20 to 1.70	\$
5	Rehab, w/ Integral Walkway	\$ 0.00	\$ 1.50 to 2.70	\$\$\$
6	New, 2-Lane, Concrete Girder w/ Arch Truss	\$ 0.05 to 1.00	\$ 2.70 to 3.60	\$\$\$\$
7	New, 1-Lane, Through Truss	\$ 0.00	\$ 1.60 to 2.40	\$\$

## Summary

The memorandum identified that Options 5 and 6 have greater project risk than other options. This risk was carried forward into the project cost comparisons by using variable contingency percentages.

If a project proceeds from the feasibility study, MDT's risk management tool should be applied at multiple design phases to reduce and manage project risks.