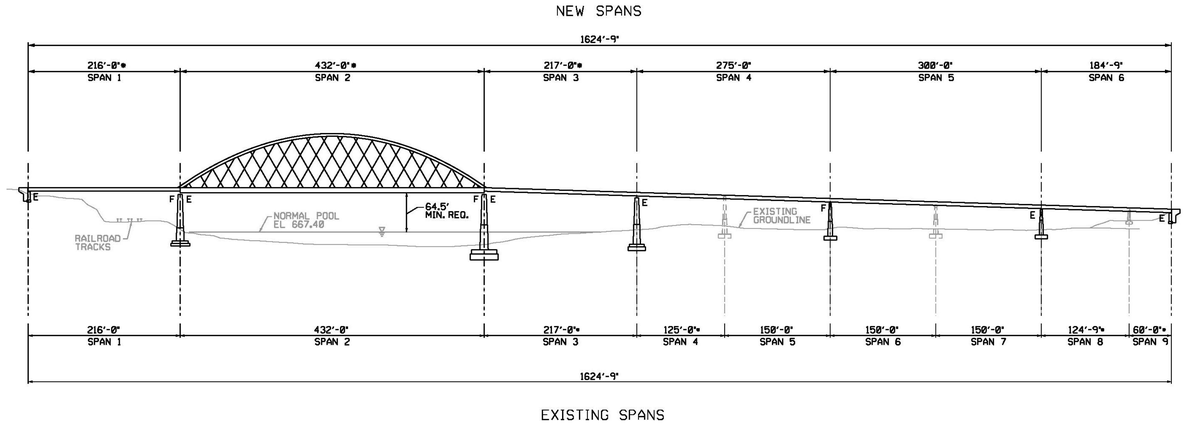
Red Wing Bridge Alternates

Alternate 1 | Tied Arch

Alternate 1 Design Drawing



Similar Bridge Design to Alternate 1

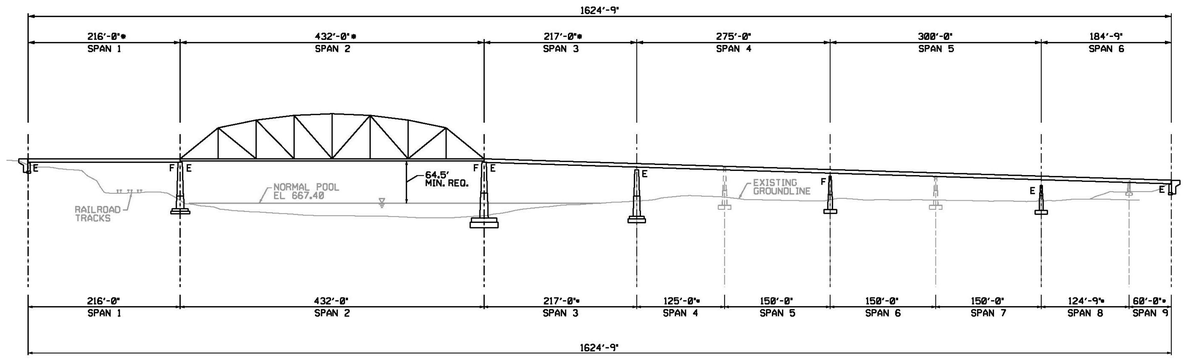
Evaluation Matrix for Alternate 1

Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
Low	**Medium**	**Low**	**Medium**	**Medium**	**Medium**	**Medium**
2 to 5 ft	Requires future painting. Inspection will require special expertise.	Looks somewhat similar to existing bridge. (Similar to new Hastings bridge).	Bridge could be built in pieces using temp supports, or built off-site and moved into place.	Tie girder will require special design similar to Hastings Bridge.	Original design would have to account for future addition of third arch.	

The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Alternate 2 | Simple Span Truss

Alternate 2 Design Drawing



Similar Bridge Design to Alternate 2

Evaluation Matrix for Alternate 2

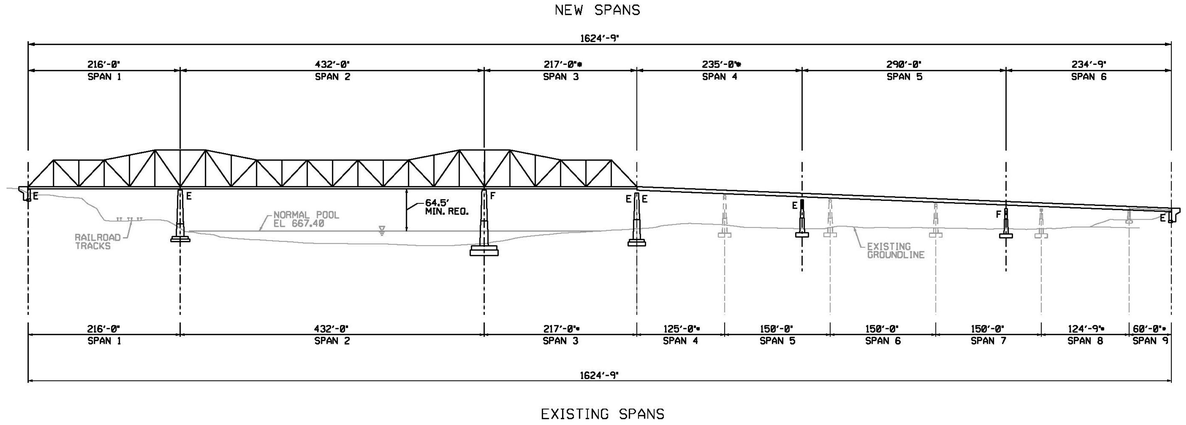
Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
Low	**High**	**Low**	**Medium**	**High**	**Medium**	**Medium**
2 to 5 ft	Requires future painting. Inspection will be costly.	Looks similar to existing bridge.	Bridge could be built in pieces using temp supports, or built off-site and moved into place.	Lower chord, tension diagonals and verticals will require special design.	Original design would have to account for future addition of third truss.	

The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Red Wing Bridge Alternates

Alternate 3 | Three-Span Continuous Truss

Alternate 3 Design Drawing



Similar Bridge Design to Alternate 3

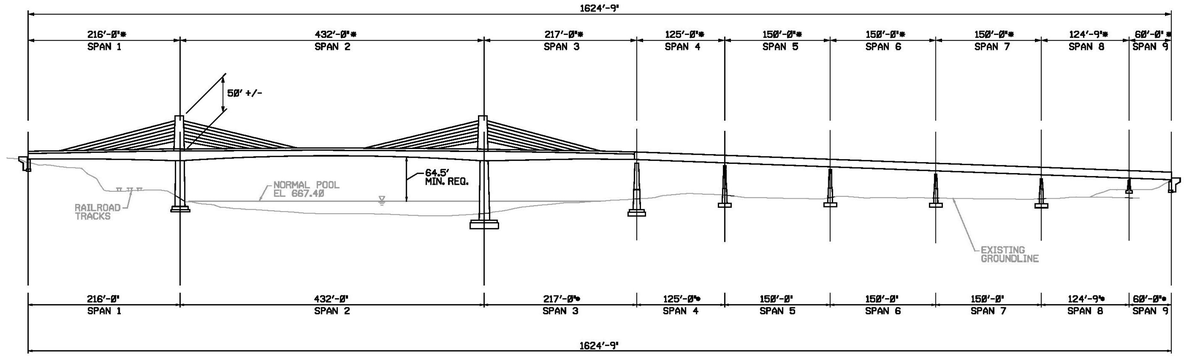
Evaluation Matrix for Alternate 3

Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
Low	**High**	**Low**	**Medium**	**Medium/High**	**Medium**	**Medium/High**
2 to 5 ft	Requires future painting. Inspection will be costly.	Looks most like existing bridge.	Balanced cantilever construction of fairly light pieces.	Will be similar to Simple Span Truss but continuous spans will provide some additional load paths.	Original design would have to account for future addition of third truss.	

The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Alternate 4 | Extradosed Bridge

Alternate 4 Design Drawing



Similar Bridge Design to Alternate 4

Evaluation Matrix for Alternate 4

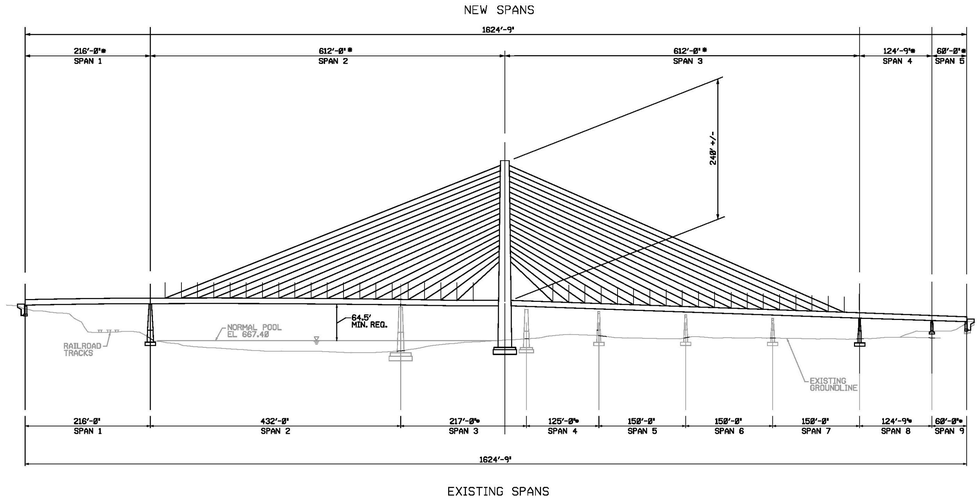
Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
Medium/High	**Medium**	**High**	**High**	**Low**	**Medium/High**	**High**
10 ft	Inspection of cables and anchorages will require some special expertise.	Towers and grade raise will have visual impact. More modern appearance.	Least common structure type. Only one extradosed currently in US. Staging challenges with the required grade raise.	Concrete segments are precompressed and cables are redundant at each location.	Original design would have to account for future addition of a third tower.	

The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Red Wing Bridge Alternates

Alternate 5 | Cable-Stayed Bridge

Alternate 5 Design Drawing



Similar Bridge Design to Alternate 5

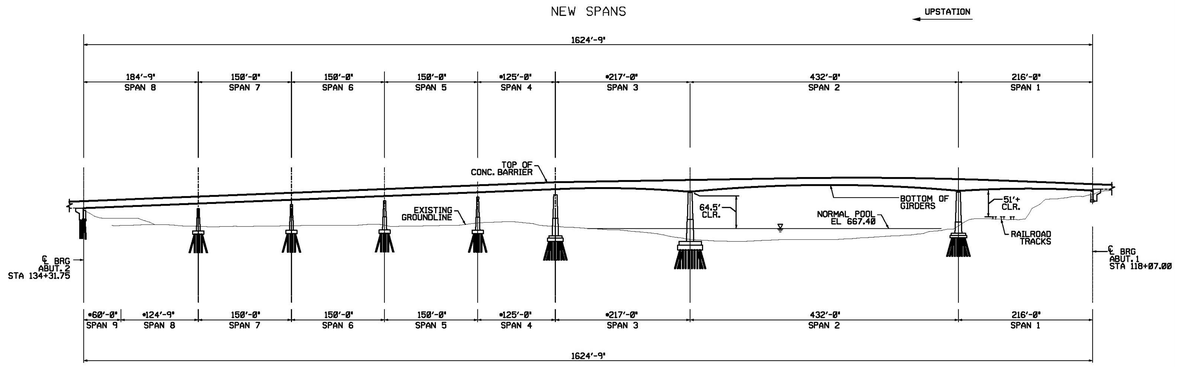
Evaluation Matrix for Alternate 5

Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
Low	Medium	High	High	Low	High	High
1 to 6 ft	Inspection of cables and anchorages will require some special expertise.	300' tall towers and modern looking cables will have the greatest visual impact.	300' tall towers and installing cables will require special equipment & expertise.	Floor system contains multiple members or is precompressed and cables are redundant at each location.	Designing cable planes and tower legs for future expansion would need to be considered in the initial design.	

The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Alternate 6 | Concrete Segmental Box Girders

Alternate 6 Design Drawing



Similar Bridge Design to Alternate 6

Evaluation Matrix for Alternate 6

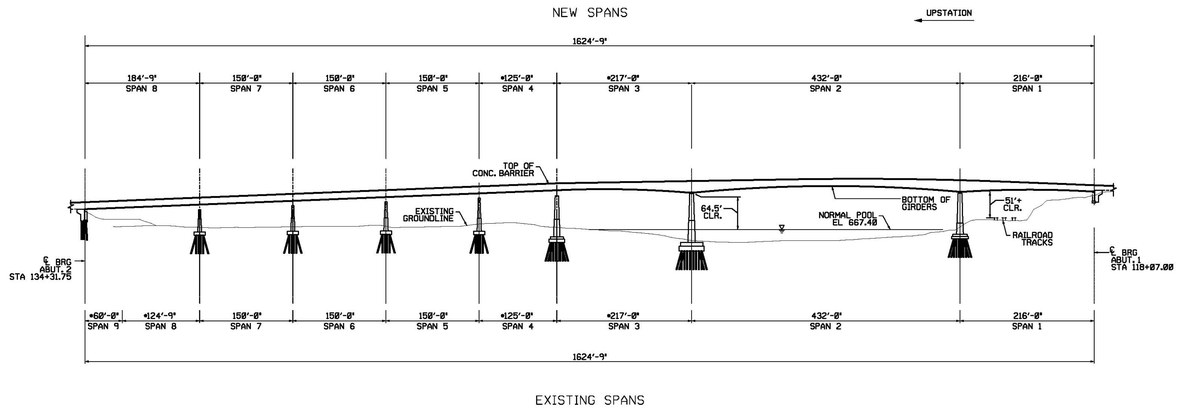
Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
High	Low	High	Medium	Low	Low	Low
13 ft	Concrete box girders require little maintenance and will be fairly easy to inspect.	13' Grade raise will cause a visual impact.	This type of construction has become more common. Staging challenges with the required grade raise.	Concrete segments are precompressed and multiple girder lines provide redundancy.	Additional box girders could be constructed to add additional lanes at a future date.	

The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Red Wing Bridge Alternates

Alternate 7 | Steel Box Girders

Alternate 7 Design Drawing



Similar Bridge Design to Alternate 7

Evaluation Matrix for Alternate 7

Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Construction Cost
Medium/High	**Medium**	**Medium/High**	**Medium**	**Low**	**Low**	**Low**
10 ft	Requires future painting, but inspection will be the most routine of all of the alternatives.	10' Grade raise will cause a visual impact.	Most common type of construction of all of the alternatives. Staging challenges with the required grade raise.	Multiple girder lines provide redundancy.	Additional box girders could be constructed to add additional lanes at a future date.	

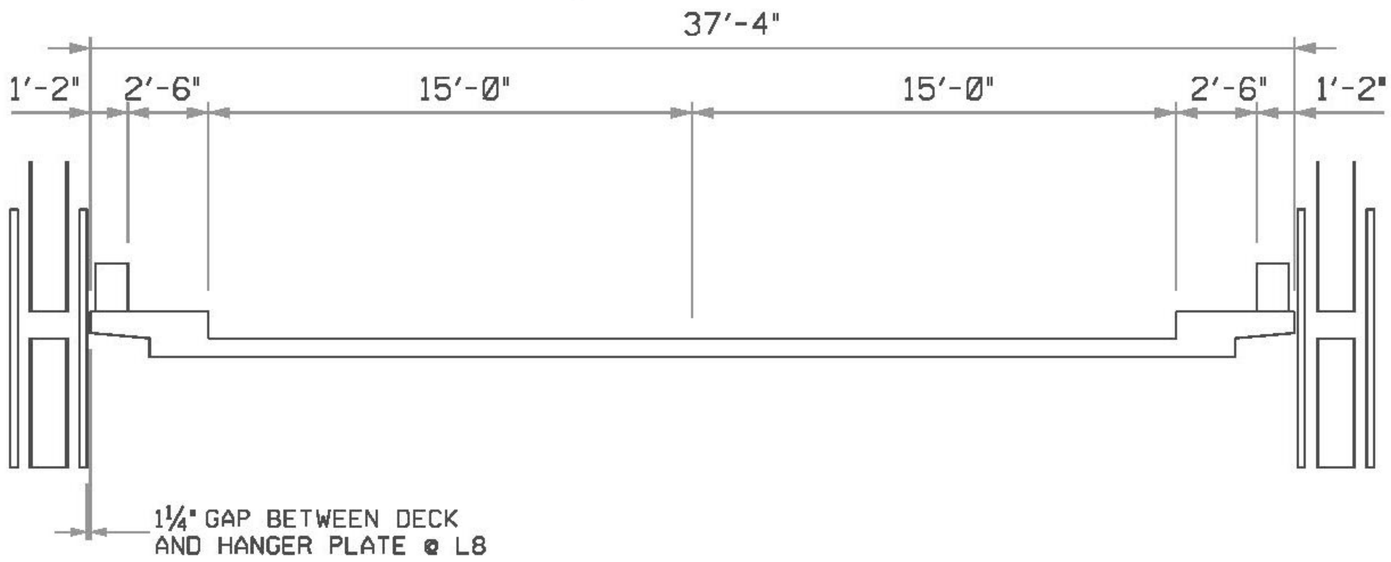
The table above provides a comparison of the alternates based on seven selected categories of issues and impacts. In all categories, the "Low" ranking is most desirable.

Evaluation Matrix Summary

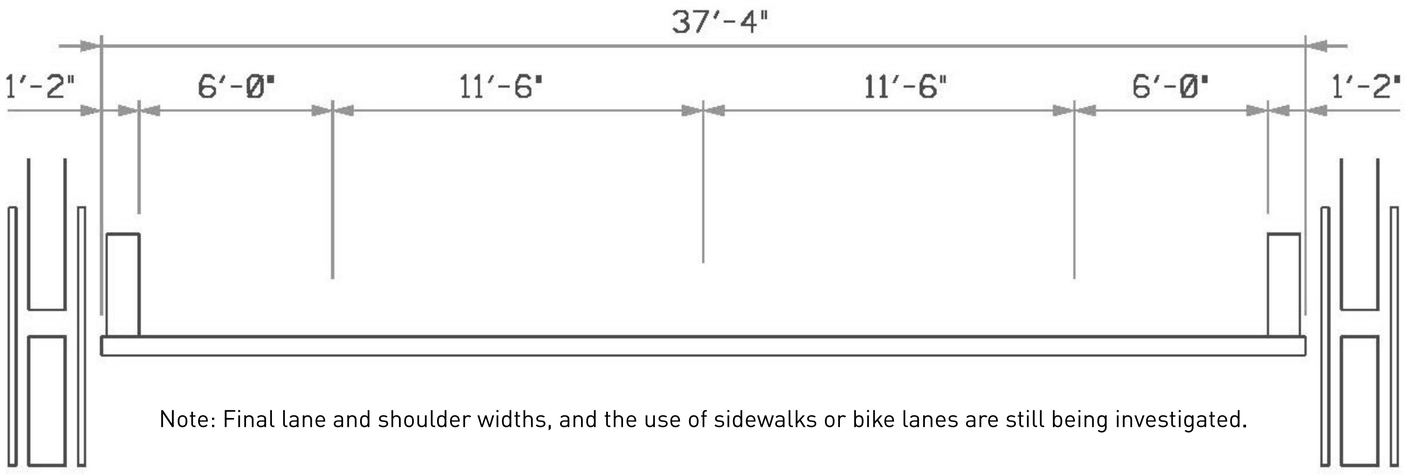
	Grade Raise Required	Future Maintenance & Inspection Requirements	Visual Impacts	Constructability Complexity	Redundancy & Fracture Critical Issues	Difficulty of Future Expansion	Constr. Cost
Alternate 1 Tied Arch	**Low**	**Medium**	**Low**	**Medium**	**Medium**	**Medium**	**Medium**
	2 to 5 ft	Requires future painting. Inspection will require special expertise.	Looks somewhat similar to existing bridge. (Similar to new Hastings bridge).	Bridge could be built in pieces using temp supports, or built off-site and moved into place.	Tie girder will require special design similar to Hastings Bridge.	Original design would have to account for future addition of third arch.	
Alternate 2 Simple Span Truss	**Low**	**High**	**Low**	**Medium**	**High**	**Medium**	**Medium**
	2 to 5 ft	Requires future painting. Inspection will be costly.	Looks similar to existing bridge.	Bridge could be built in pieces using temp supports, or built off-site and moved into place.	Lower chord, tension diagonals and verticals will require special design.	Original design would have to account for future addition of third truss.	
Alternate 3 Three-Span Continuous Truss	**Low**	**High**	**Low**	**Medium**	**Medium/High**	**Medium**	**Medium/ High**
	2 to 5 ft	Requires future painting. Inspection will be costly.	Looks most like existing bridge.	Balanced cantilever construction of fairly light pieces.	Will be similar to Simple Span Truss but continuous spans will provide some additional load paths.	Original design would have to account for future addition of third truss.	
Alternate 4 Extradosed Bridge	**Medium/High**	**Medium**	**High**	**High**	**Low**	**Medium/High**	**High**
	10 ft	Inspection of cables and anchorages will require some special expertise.	Towers and grade raise will have visual impact. More modern appearance.	Least common structure type. Only one extradosed currently in US. Staging challenges with the required grade raise.	Concrete segments are precompressed and cables are redundant at each location.	Original design would have to account for future addition of a third tower.	
Alternate 5 Cable-Stayed Bridge	**Low**	**Medium**	**High**	**High**	**Low**	**High**	**High**
	1 to 6 ft	Inspection of cables and anchorages will require some special expertise.	300' tall towers and modern looking cables will have the greatest visual impact.	300' tall towers and installing cables will require special equipment & expertise.	Floor system contains multiple members or is precompressed and cables are redundant at each location.	Designing cable planes and tower legs for future expansion would need to be considered in the initial design.	
Alternate 6 Concrete Segmental Box Girders	**High**	**Low**	**High**	**Medium**	**Low**	**Low**	**Low**
	13 ft	Concrete box girders require little maintenance and will be fairly easy to inspect.	13' Grade raise will cause a visual impact.	This type of construction has become more common. Staging challenges with the required grade raise.	Concrete segments are precompressed and multiple girder lines provide redundancy.	Additional box girders could be constructed to add additional lanes at a future date.	
Alternate 7 Steel Box Girders	**Medium/High**	**Medium**	**Medium/High**	**Medium**	**Low**	**Low**	**Low**
	10 ft	Requires future painting, but inspection will be the most routine of all of the alternatives.	10' Grade raise will cause a visual impact.	Most common type of construction of all of the alternatives. Staging challenges with the required grade raise.	Multiple girder lines provide redundancy.	Additional box girders could be constructed to add additional lanes at a future date.	

Bridge 9040 Rehabilitation Study

Existing Cross Section

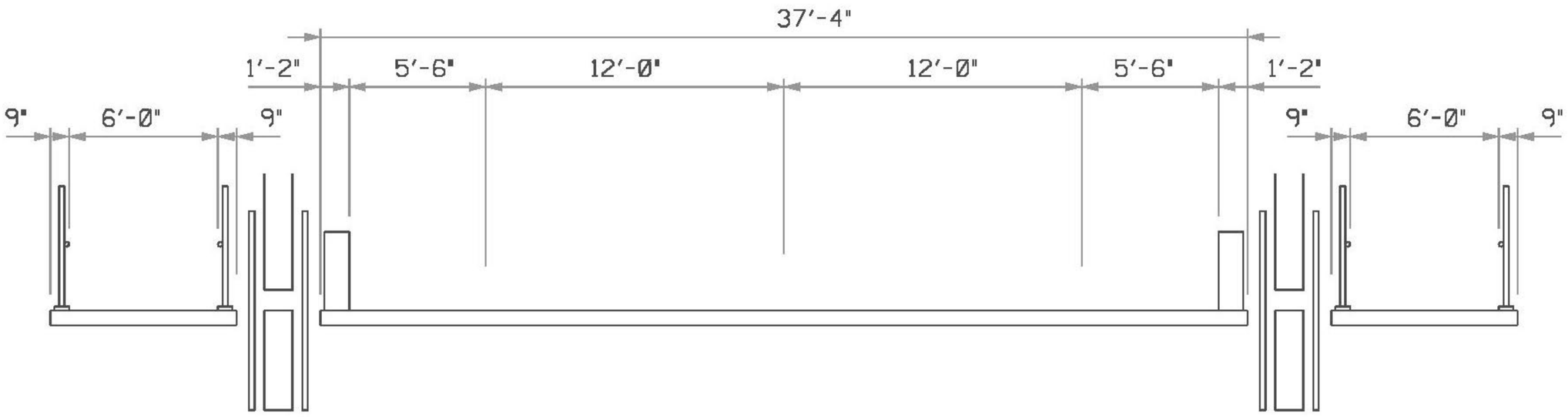


Cross Section A: Proposed Rehabilitation



Note: Final lane and shoulder widths, and the use of sidewalks or bike lanes are still being investigated.

Cross Section B: Proposed Rehabilitation with Added Sidewalks



Maintenance of Traffic (MOT) Information

MOT Schemes

Scheme	Description	Estimated Construction Duration
Preferred Schemes		
1	Work performed on entire bridge while closed; assumes a parallel structure is constructed first.	1 construction season
2	Work performed half-width; one lane closed full time during entire duration of rehabilitation.	2 construction seasons
Other schemes considered		
3	Work performed during 8-hour night closures; entire bridge closed at night, fully open during day.	2 construction seasons
4	Work performed during 8-hour night closures; one lane open at night, fully open during day.	3 construction seasons
5	One lane closed during day, complete closure at night, accelerated schedule.	1 ½ construction seasons

MOT Schemes Rehabilitation Costs

Rehabilitation Work Required	Cost MOT Scheme 1	Cost MOT Scheme 2
Cross Section A: Proposed Rehabilitation		
• Replace concrete deck • Perform required steel repairs • Repair or replace approach spans	$28M - $31M	$39M - $42M
Cross Section B: Proposed Rehabilitation with Added Sidewalks		
• Replace concrete deck • Perform required steel Repairs • Repair or replace approach spans • Add 6’ wide Sidewalks	$34M - $39M	$46M - $54M

Estimated construction costs for bridge rehabilitation work only (in 2018 dollars)

Bridge 9103 Rehabilitation Study

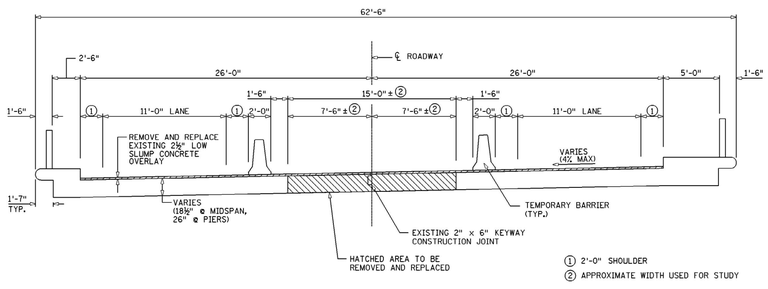
The current bridge is in need of repair or replacement

Quick Facts

- Bridge 9103 is eligible for the National Register of Historic Places.
- Following the new MnDOT - FHWA process for studying historic bridges.
- The goal of the rehabilitation study is to determine if there is a feasible rehabilitation alternative that meets federal Standards for the Treatment of Historic Properties.
- Feasible rehabilitation alternatives that meet the Standards will be considered in the overall Project Alternatives Analysis.

Rehabilitation Alternatives for Bridge 9103

Alternative 1



- Remove and replace an approximately 15'-wide strip along centerline for entire length of bridge
- Patch deck and substructures
- Replace expansion joints at ends of bridge and repair slope paving
- Design exceptions are needed for strength, height, and opening size in rail
- Design exception is needed for vertical clearance over Highway 61 or include option to lower Highway 61
- Also has an option to include cathodic protection (a system to mitigate future corrosion)

Alternative 2

- All items in Alternative 1
- Add a rail on the inside of the sidewalk that meets new crash requirements (see rendering above)
- Design exceptions are needed for height and opening size in rail
- Design exception is needed for vertical clearance over Highway 61 or include option to lower Highway 61
- Also has an option to include cathodic protection (a system to mitigate future corrosion)

Alternative 3

- Full deck replacement
- Patch substructures and repair slope paving
- Include rail on inside of sidewalk that meets new crash requirements
- Design exception is needed for vertical clearance over Highway 61 or include option to lower Highway 61
- Longer estimated service life
- Does not meet federal Standards for the Treatment of Historic Properties

Alternative 4

- All items in Alternative 3
- Widen 18' to provide 4-lane section
- Widening has to be to the west due to Barn Bluff
- Widening to the low side of the curve has vertical clearance impacts
- Does not meet federal Standards for the Treatment of Historic Properties