



BRIDGE REHABILITATION / REPLACEMENT ALTERNATIVES STUDY REPORT

Route 19 over Current River and Spring Valley
(Project No. J9P3305)

Bridges No. G0804 and J0420

October 2019

Prepared for:
Missouri Department of Transportation





November 27, 2019

Attn: Mr. Pete Berry, P.E.
Transportation Project Manager
Southeast District
Missouri Department of Transportation
2675 North Main Street
Sikeston, MO 63801

RE: Route 19 Bridge Rehabilitation / Replacement Concept Study Report
Project No. J9P3305
Structures No. G0804 and J0420
Rte. 19 over the Current River and Spring Valley

Dear Mr. Berry:

In accordance with our agreement approved on July 8, 2019, we are submitting this final report of findings for the study of options to rehabilitate or replace the historic concrete arch bridges carrying Route 19 over the Current River and Spring Valley in Shannon County, Missouri and within the Ozark National Scenic Riverways.

This report presents the results of the alternatives studied for alignment, profile and structure type at each site. The appendices of this report contain a report of the site investigation performed and the substructure materials sampling and testing completed as part of the project. Also included are the materials presented at the design charrette on September 19, 2019 and a report summarizing the findings of the charrette.

If you should have any questions please feel free to call.

Sincerely,

HDR Engineering, Inc.

A handwritten signature in black ink that reads 'Kurt Gribble'.

Kurt Gribble, P.E.
Project Manager

Enclosures



Contents

1	Executive Summary	1
2	General Information.....	2
	2.1 Existing Bridge Description	2
	2.2 Location Map and Aerial Photograph.....	4
	2.3 Configuration of Existing Bridges	6
	2.4 Concept Study Limitations.....	9
3	Study Issues Identified	11
	3.1 Project Limitations and Requirements	11
	3.2 Constructability Concerns	12
	3.3 Hydraulic Uncertainties	13
	3.4 Subsurface Concerns.....	13
	3.5 Cultural and Environmental Considerations.....	13
	3.6 Aesthetic Considerations.....	14
4	Conceptual Alternatives Studied	14
5	Alignment Alternatives Studied	18
	5.1 Existing Roadway Conditions.....	18
	5.2 General Roadway Design Parameters.....	19
	5.3 Current River - Temporary Shoofly with Pedestrian Bridge Removal (Alternatives 1, 2 & 5).....	19
	5.4 Current River - Temporary Shoofly Downstream of Pedestrian Bridge (Alternatives 1, 2 & 5).....	20
	5.5 Current River - New Offset Bridge with Pedestrian Bridge Removal (Alternatives 3 & 4).....	20
	5.6 Current River - New Offset Bridge Downstream of Pedestrian Bridge (Alternatives 3 & 4).....	21
	5.7 Current River - Phased New Bridge near Existing Alignment (Alternatives 6 & 7).....	21
	5.8 Spring Valley - Temporary Shoofly Upstream (Alternatives 1, 2 & 5).....	22
	5.9 Spring Valley – New Offset Bridge Upstream (Alternatives 3 & 4).....	22
6	Current River Bridge Alternatives Studied	23
	6.1 Current River - Temporary Bridge.....	24
	6.2 Current River - Replacement In-Kind on Alignment.....	24
	6.3 Current River - Girder Bridge Replacement on Alignment.....	25
	6.4 Current River - Replace In-Kind on Offset Alignment	26
	6.5 Current River - Girder Bridge Replacement on Offset Alignment	26
	6.6 Current River - Rehabilitation and Widening of Existing Bridge.....	27
	6.7 Current River - Phased Bridge Replacement near Existing Alignment.....	28
7	Spring Valley Bridge Alternatives Studied.....	28
	7.1 Spring Valley - Temporary Bridge	29
	7.2 Spring Valley - Replace In-Kind on Alignment	30
	7.3 Spring Valley - Girder Bridge Replacement on Alignment.....	31

BRIDGE REHABILITATION / REPLACEMENT ALTERNATIVES STUDY REPORT
Route 19 over Current River and Spring Valley (Project No. J9P3305)

7.4	Spring Valley - Replace In-Kind on Offset Alignment	31
7.5	Spring Valley - Girder Bridge Replacement on Offset Alignment	32
7.6	Spring Valley - Rehabilitation and Widening of Existing Bridge.....	32
8	Bridge Rail Alternatives Considered	33
9	Alternatives Cost Analysis.....	39
9.1	Cost Estimate Summary.....	40
9.2	Cost Estimate Details for each Alternative.....	42
10	Studied Alternatives Performance Summary	53

Tables

Table 4-1.	Current River Studied Alternatives Summary	17
Table 4-2.	Spring Valley Studied Alternatives Summary	18
Table 9-1.	Current River Bridge Cost Analysis Summary.....	41
Table 9-2.	Spring River Bridge Cost Analysis Summary	42
Table 9-3.	Current River Bridge Cost Analysis – Alternative 1A, Option 1	42
Table 9-4.	Current River Bridge Cost Analysis – Alternative 1A, Option 2	43
Table 9-5.	Current River Bridge Cost Analysis – Alternative 1B.....	43
Table 9-6.	Current River Bridge Cost Analysis – Alternative 2A, Option 1	44
Table 9-7.	Current River Bridge Cost Analysis – Alternative 2A, Option 2	44
Table 9-8.	Current River Bridge Cost Analysis – Alternative 2B.....	45
Table 9-9.	Current River Bridge Cost Analysis – Alternative 3, Option 1	45
Table 9-10.	Current River Bridge Cost Analysis – Alternative 3, Option 2	46
Table 9-11.	Current River Bridge Cost Analysis – Alternative 4, Option 1	46
Table 9-12.	Current River Bridge Cost Analysis – Alternative 4, Option 2	47
Table 9-13.	Current River Bridge Cost Analysis – Alternative 5A.....	47
Table 9-14.	Current River Bridge Cost Analysis – Alternative 5B, Option 1	48
Table 9-15.	Current River Bridge Cost Analysis – Alternative 5B, Option 2.....	48
Table 9-16.	Current River Bridge Cost Analysis – Alternative 6	49
Table 9-17.	Current River Bridge Cost Analysis – Alternative 7	49
Table 9-18.	Spring Valley Bridge Cost Analysis – Alternative 1A.....	50
Table 9-19.	Spring Valley Bridge Cost Analysis – Alternative 1B.....	50
Table 9-20.	Spring Valley Bridge Cost Analysis – Alternative 2	51
Table 9-21.	Spring Valley Bridge Cost Analysis – Alternative 3A.....	51
Table 9-22.	Spring Valley Bridge Cost Analysis – Alternative 3B.....	52
Table 9-23.	Spring Valley Bridge Cost Analysis – Alternative 4	52
Table 9-24.	Spring Valley Bridge Cost Analysis – Alternative 5A.....	53
Table 9-25.	Spring Valley Bridge Cost Analysis – Alternative 5B.....	53
Table 10-1.	Current River – Alternative 1A, Option 1 Performance	54
Table 10-2.	Current River – Alternative 1A, Option 2 Performance	54
Table 10-3.	Current River – Alternative 1B Performance	55
Table 10-4.	Current River – Alternative 2A, Option 1 Performance	55
Table 10-5.	Current River – Alternative 2A, Option 2 Performance	56

Table 10-6. Current River – Alternative 2B Performance	56
Table 10-7. Current River – Alternative 3, Option 1 Performance	57
Table 10-8. Current River – Alternative 3, Option 2 Performance	57
Table 10-9. Current River – Alternative 4, Option 1 Performance	58
Table 10-10. Current River – Alternative 4, Option 2 Performance	58
Table 10-11. Current River – Alternative 5A Performance	59
Table 10-12. Current River – Alternative 5B, Option 1 Performance	59
Table 10-13. Current River – Alternative 5B, Option 2 Performance	60
Table 10-14. Current River – Alternative 6 Performance	60
Table 10-15. Current River – Alternative 7 Performance	61
Table 10-16. Spring Valley – Alternative 1A Performance	61
Table 10-17. Spring Valley – Alternative 1B Performance	62
Table 10-18. Spring Valley – Alternative 2 Performance	62
Table 10-19. Spring Valley – Alternative 3A Performance	62
Table 10-20. Spring Valley – Alternative 3B Performance	63
Table 10-21. Spring Valley – Alternative 4 Performance	63
Table 10-22. Spring Valley – Alternative 5A Performance	64
Table 10-23. Spring Valley – Alternative 5B Performance	64

Figures

Figure 2-1. Location Map	4
Figure 2-2. Aerial Photo of Route 19 through the Study Area	5
Figure 2-3. Current River Bridge (G0804) General Elevation	6
Figure 2-4. Current River Bridge (G0804) Typical Section through Arch Spans	7
Figure 2-5. Current River Bridge (G0804) Typical Section through Filled Abutment Houses	7
Figure 2-6. Spring Valley Bridge (J0420) General Elevation and Plan	8
Figure 2-7. Spring Valley Bridge (J0420) Typical Section through Approach Spans	9
Figure 2-8. Spring Valley Bridge (J0420) Typical Section through Arch Span	9
Figure 8-1. Existing Current River Bridge Rail – Front Face	34
Figure 8-2. Existing Current River Bridge Rail – Back Face with Post	34
Figure 8-3. Existing Spring Valley Bridge Rail – Front Face	35
Figure 8-4. MoDOT Type D Concrete Barrier Curb	35
Figure 8-5. Vertical Concrete Barrier and Steel Tube Rail – Front Face	36
Figure 8-6. Vertical Concrete Barrier and Steel Tube Rail – Back Face	36
Figure 8-7. Corral Rail and Steel Rail	37
Figure 8-8. Open Concrete Curb and Rail with Concrete Posts – Front Face	38
Figure 8-9. Open Concrete Curb and Rail with Concrete Posts – Back Face	38
Figure 8-10. Oregon DOT Stealth Rail Installation	39
Figure 8-11. Oregon DOT Stealth Rail Complete-In-Place	39
Figure A-1. Current River – Two-Lane Temporary Shoofly– Option 1 (Pedestrian Bridge Removal) (Alternatives 1A, 2A & 5A)	A.1
Figure A-2. Current River – Two-Lane Temporary Shoofly– Option 2 (Downstream of Pedestrian Bridge) (Alternatives 1A, 2A & 5A)	A.2

BRIDGE REHABILITATION / REPLACEMENT ALTERNATIVES STUDY REPORT
Route 19 over Current River and Spring Valley (Project No. J9P3305)

Figure A-3. Current River – One-Lane Temporary Shoofly (Pedestrian Bridge Removal)
(Alternatives 1B & 2B)..... A.3

Figure A-4. Current River - New Offset Bridge – Option 1 (Pedestrian Bridge Removal)
(Alternatives 3 & 4)..... A.4

Figure A-5. Current River - New Offset Bridge – Option 2 (Downstream of Pedestrian Bridge)
(Alternatives 3 & 4)..... A.5

Figure A-6. Current River - Phased Bridge Replacement Near Existing Alignment (Alternatives 6
& 7)..... A.6

Figure A-7. Spring Valley - Temporary Shoofly Upstream (Alternatives 1, 2 & 5)..... A.7

Figure A-8. Spring Valley - New Bridge Upstream (Alternatives 3 & 4)..... A.8

Figure A-9. Current River - Temporary Bridge Elevation and Section..... A.9

Figure A-10. Current River - Replacement In-Kind on Alignment Plan and Elevation..... A.10

Figure A-11. Current River - Girder Bridge Replacement on Alignment Plan and Elevation A.11

Figure A-12. Current River - Girder Bridge Replacement Typical Section A.12

Figure A-13. Current River - Replacement In-Kind on Offset Alignment Plan and Elevation A.13

Figure A-14. Current River - Rehabilitation and Widening of Existing Bridge Phasing A.14

Figure A-15. Current River - Phased Replacement Near Existing Alignment A.15

Figure A-16. Spring Valley - Temporary Bridge Elevation and Section..... A.16

Figure A-17. Spring Valley - Replacement In-Kind on Alignment Plan and Elevation..... A.17

Figure A-18. Spring Valley - Girder Bridge Replacement on Alignment Plan and Elevation..... A.18

Figure A-19. Spring Valley - Girder Bridge Replacement Typical Section A.19

Figure A-20. Spring Valley - Replacement In-Kind on Offset Alignment Plan and Elevation A.20

Figure A-21. Spring Valley - Rehabilitation and Widening of Existing Bridge Plan and Elevation A.21

Appendices

- Appendix A. Supporting Figures
- Appendix B. Field Investigation Report
- Appendix C. Substructure Evaluation and Remaining Life Report
- Appendix D. Options Charrette Report
- Appendix E. Bridge and Roadway Estimates

1 Executive Summary

This report documents the analysis of conceptual alternatives studied to rehabilitate or replace the bridges carrying Route 19 over the Current River and Spring Valley in Shannon County, Missouri, within the Ozark National Scenic Riverways. The results of the field investigations and the structural analysis are presented and incorporated into the consideration of each of the identified alternatives at each bridge. This report presents the benefits and challenges of each of the alternatives studied but does not recommend an alternative for further development. The selection of the preferred alternative is left to the following Environmental Assessment project that is expected to begin shortly after this report is finalized.

Preliminary study limitations and preferences were gathered during preparation for the project and include alternatives to replace the bridges on and off alignment as well as to rehabilitate each bridge. This information was supplemented with a field investigation that observed the general condition of the bridges and included on-site material testing and concrete sampling for further laboratory testing. The field investigations were limited to portions of the structures accessible from the ground and no access equipment was used. The field observations reported many areas of spalls and delaminations of the existing concrete that would need to be repaired or replaced if a rehabilitation is selected. The on-site and laboratory materials testing concluded that chloride ion contamination high enough to induce corrosion was present in many of the areas tested. The report of materials testing also noted that field testing and samples were limited to areas away from the portions of the bridge likely to contain high levels of chloride ion contamination, specifically the mid-spans of the arches near the roadway surface. If rehabilitation is selected, a comprehensive corrosion mitigation plan should be undertaken and include the use of embedded galvanic anodes.

Alignment alternatives considered included offset temporary bridges to maintain the existing alignments as well as new permanent alignments shifted away from the existing roadway. Bridge alternatives considered at each site include rehabilitation and widening of the existing structure and replacement either on alignment or offset with either a similar concrete arch structure or a haunched steel plate girder structure. The alignment and bridge analysis showed that all alternatives considered are viable. The rehabilitation option considered for the Current River Bridge would mostly obscure the existing bridge behind the widened structure. The rehabilitation of the bridge over Spring Valley would only save the existing concrete arches (not the approach spans) and would not fully support an HS20 design live load but would provide a calculated posting load of 44 tons which exceeds the posting requirements. Options to replace the concrete arch spans will generally have greater cost and impact on the streambed during construction while girder bridge options generally have lower costs and streambed impacts. Depending on the alternative selected, the cost to rehabilitate or replace the bridge over the Current River varies from \$6,700,000 to \$12,700,000. The cost to rehabilitate or replace the bridge over Spring Valley varies from \$5,800,000 to \$7,800,000. The estimated costs include the construction of the bridge and roadway and do not include the cost of right of way acquisition, engineering or possible utility relocations.