2 General Information

The existing bridge over the Current River (G0804) was constructed in 1924 and the bridge over Spring Valley (J0420) was constructed in 1930 and are within the limits of the Ozark National Scenic Riverways dedicated in 1972. Together with the bridge over Sinking Creek, which was not included in this study, these bridges make up the Three Bridges Historic District. A pedestrian and utility bridge constructed in the 1970's is downstream of the Current River Bridge and is not included in the Historic District. The Current River Bridge has been identified as being eligible for the National Register of Historic Places and the Spring Valley Bridge is possibly eligible for the register. Route 19 is the primary north-south route through this part of the state and serves a variety of stakeholders. Rehabilitation and replacement options for each bridge were studied while considering the variety of stakeholder requirements and preferences. Options to replace the bridges on and off alignment are included in the study as well as off alignment temporary shoofly bridges. Figure 2-2 shows many of the challenges in this study.

2.1 Existing Bridge Description

Bridge G0804 over Current River

Bridge G0804 carries Route 19 over the Current River north of Round Spring. The bridge is 602 feet long carrying an 18 foot roadway which has been reduced to a single lane due to the condition of the supporting cantilever brackets. The bridge is square to the alignment, comprised of five continuous spans of filled spandrel arches and two filled abutment houses. The abutment houses are each 34 feet long. The three main arches are each 130 feet long and the end arches are each 60 feet long. The five arch spans are separated by four piers with six foot wide pilasters. The arch ring in each span is 14 feet wide with cantilever brackets supporting the roadway and bridge barrier. See Figure 2-3 thru Figure 2-5 for the general configuration of the existing bridge. All pier foundations are unreinforced concrete footings socketed into bedrock. The foundations at the abutment houses are spread footings on rock. The roadway over the bridge is supported directly on the fill of the arches and abutment houses. Each pilaster contains a decorative relief for most of the exposed height and the remaining exposed concrete shows a relief of the form boards used in construction. The bridge rail is a continuous concrete curb except at the joints in the spandrel walls. A concrete top rail supported on concrete pickets completes the rail in the bridge spans. Decorative posts are included in the bridge rail at each pier and at each end of the abutment houses.

The current bridge condition ratings from the last available official inspection on December 13, 2018 indicate the bridge is in fair condition with a rating of 5 for the deck, superstructure and substructure. A site visit to the bridge identified areas of spalling, delamination and cracking in the concrete. Rain water was observed seeping from the joints between the spandrel walls and through the drain holes near each pier. See Appendix B for the complete report of the field site visit including photographs. During the site visit, limited testing and sampling of the existing concrete was performed. The results of the concrete tests indicate some of the arch concrete is saturated with freeze / thaw damage and chloride ion concentrations high enough to initiate corrosion in the embedded reinforcing steel which could result in additional spalling. Testing was limited to portions of the bridge

that could be reached from the ground and did not collect samples from the areas likely to have higher concentrations of chloride ions. Testing indicates remediation of the existing concrete would be needed to keep the concrete in service and should be included in any rehabilitation. See Appendix C for the complete report of material sampling and testing.

Bridge J0420 over Spring Valley

Bridge J0420 carries Route 19 over Spring Valley, just south of Round Spring. The bridge is almost 523 feet long carrying two traffic lanes on a 20 foot wide roadway. The bridge is skewed 45 degrees to the alignment and is comprised of eight simple spans, including an open spandrel arch main span and seven concrete deck girder approach spans. The main arch span is 155 feet long and the approach spans vary between approximately 51 feet and 54 feet. The approach spans are supported on two girders with a curved haunched shape and intermediate floorbeams and cantilevers supporting the deck and barrier rail. The main span is two concrete arches supporting rectangular concrete columns and cap beams. See Figure 2-6 thru Figure 2-8 for the general configuration of the existing bridge. The bridge configuration offers two lines of support which precludes the option of a phased rehabilitation that includes removal of the concrete deck. The bridge rail is composed of an intermittent concrete curb and a concrete rail supported on concrete pickets. Larger decorative posts are included at each pier, abutment and at the 1/3 points of the arch span.

The current bridge condition ratings from the last available official inspection on December 13, 2018 indicate the bridge is in fair to poor condition with a rating of 4 for the deck, 5 for the superstructure and 6 for the substructure. Site visits to the bridge identified areas of spalling, delamination and cracking. The overhang portions of the deck below the curb perforations are particularly deteriorated with exposed reinforcing in several locations. See Appendix B for the complete report of the field site visit including photographs. During the site visit, limited testing and sampling of the existing concrete was performed. The results of the concrete tests indicate chloride ion concentrations high enough to initiate corrosion in the embedded reinforcing steel in 2 of the 6 locations tested. Testing was limited to portions of the bridge that could be reached from the ground and did not collect samples from the worst concrete areas observed in the deck and overhang brackets. Testing indicates remediation of the existing concrete would be needed to keep the bridge in service and should be included in any rehabilitation. See Appendix C for the complete report of material sampling and testing.

Additional Bridges Considered

While it is not included in this study Bridge A8295 over Sinking Creek is included in the historic district. This bridge is over 364 feet long carrying two curving lanes on a straight bridge with a 31 foot wide roadway. The superstructure consists of three spans of weathering steel plate girders haunched to mimic the previous arch shape and each span is approximately 120 feet. The bridge is supported on square concrete column intermediate bents with web walls and formliners. The bridge rail is a vertical concrete barrier with a structural steel tube rail.

In addition to the highway structures already mentioned this study took into account the existing pedestrian and utility bridge downstream of the Current River Bridge. The bridge is owned and operated by the National Park Service (NPS) and no plans were available during the study. The pedestrian bridge is founded on wall piers that mimic the

arrangement of the adjacent highway bridge. The piers support two parallel flange steel plate girders with a timber deck and steel handrail. The center of the pedestrian bridge is offset approximately 50 feet from the center of the highway bridge as measured in the aerial image gathered from Google Earth and corrected for distortion. The underside of the pedestrian bridge carries up to ten utility lines. NPS has confirmed the bridge carries a water supply line, a sewer line, communication lines and park service electric lines. It appears two of the utility lines supply lights installed in the handrail posts. NPS also indicated the bridge carries commercial three-phase service for the local electric utility.

2.2 Location Map and Aerial Photograph

Figure 2-1. Location Map

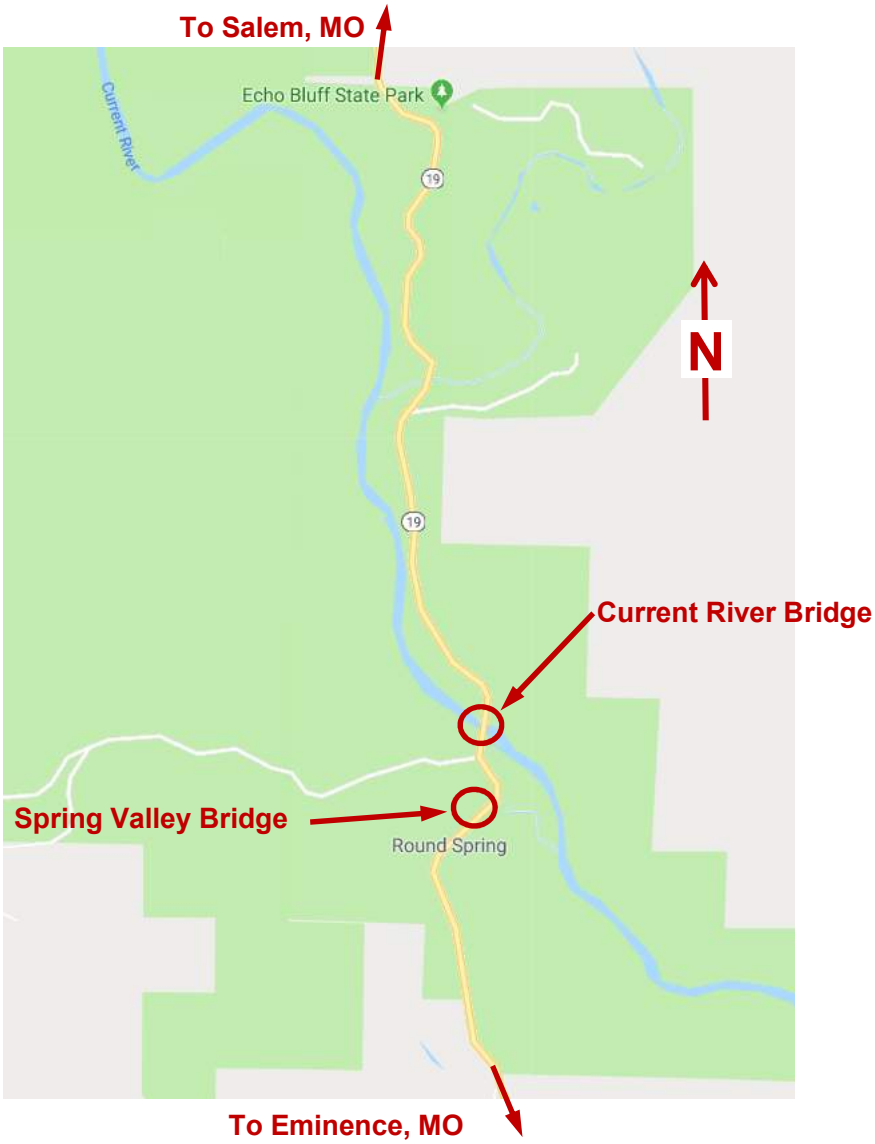
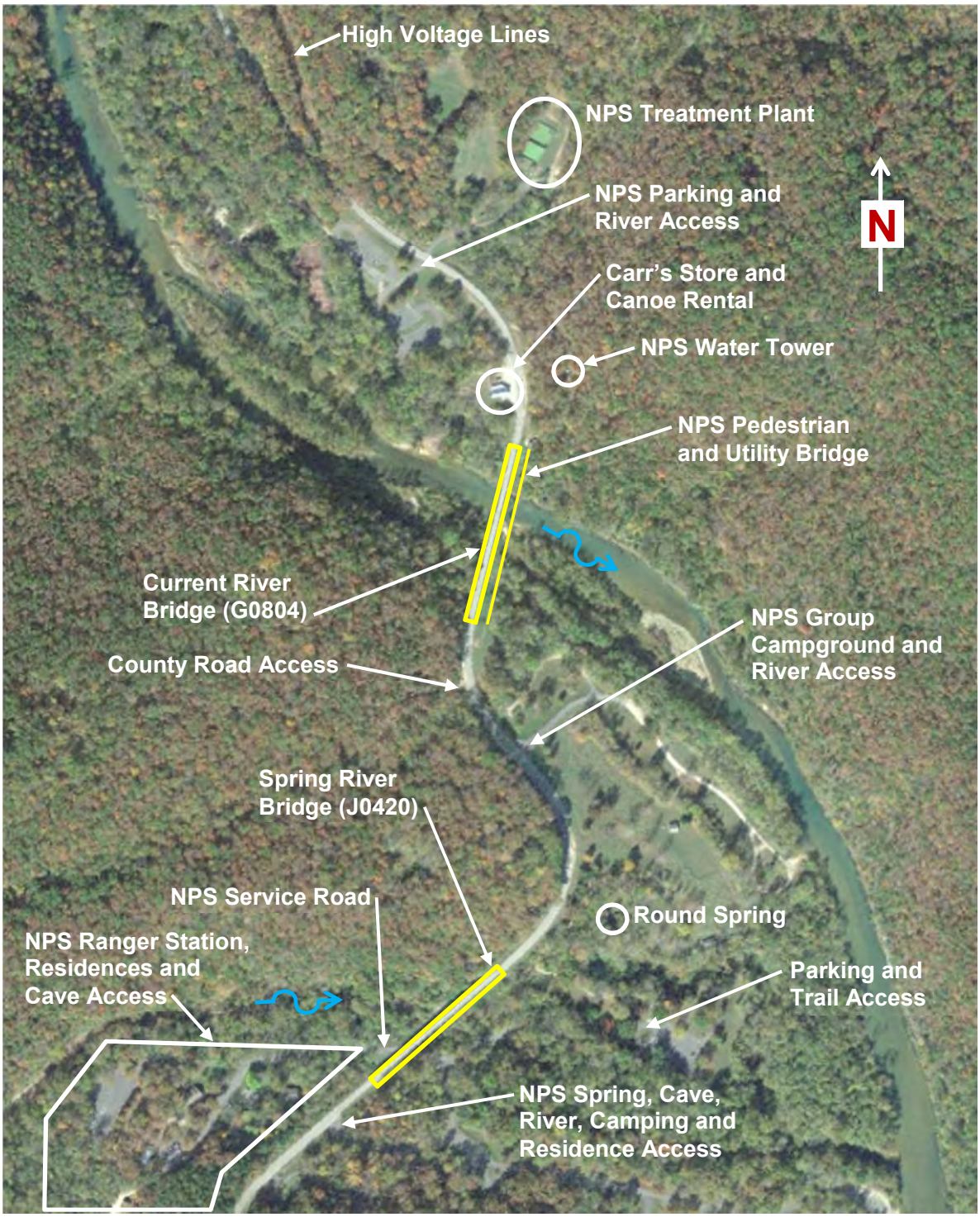


Figure 2-2. Aerial Photo of Route 19 through the Study Area



2.3 Configuration of Existing Bridges

The figures below were taken from the original construction plans and represent the basic configuration for each bridge. The complete set of original construction plans are available.

Figure 2-3. Current River Bridge (G0804) General Elevation

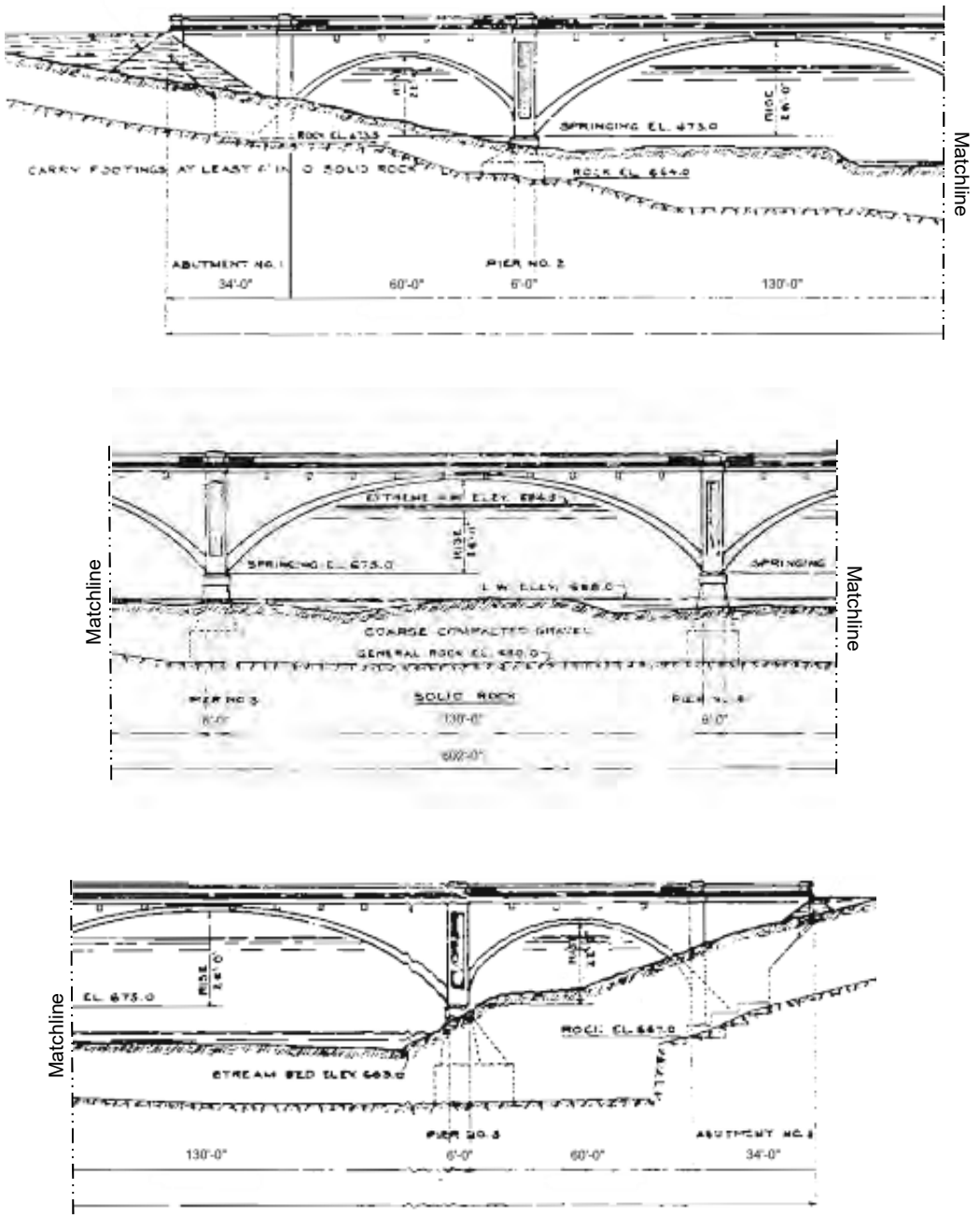


Figure 2-4. Current River Bridge (G0804) Typical Section through Arch Spans

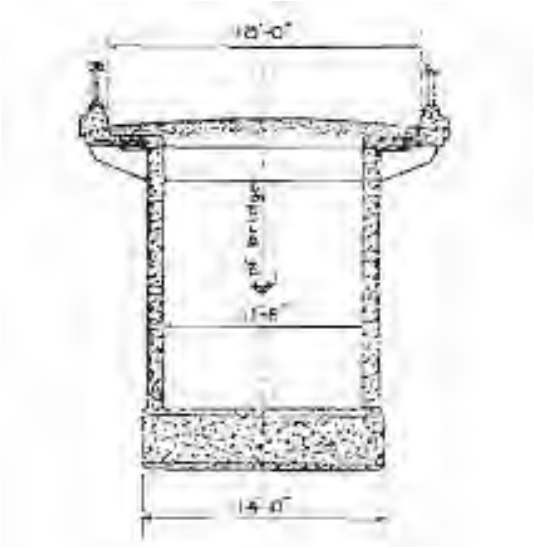


Figure 2-5. Current River Bridge (G0804) Typical Section through Filled Abutment Houses

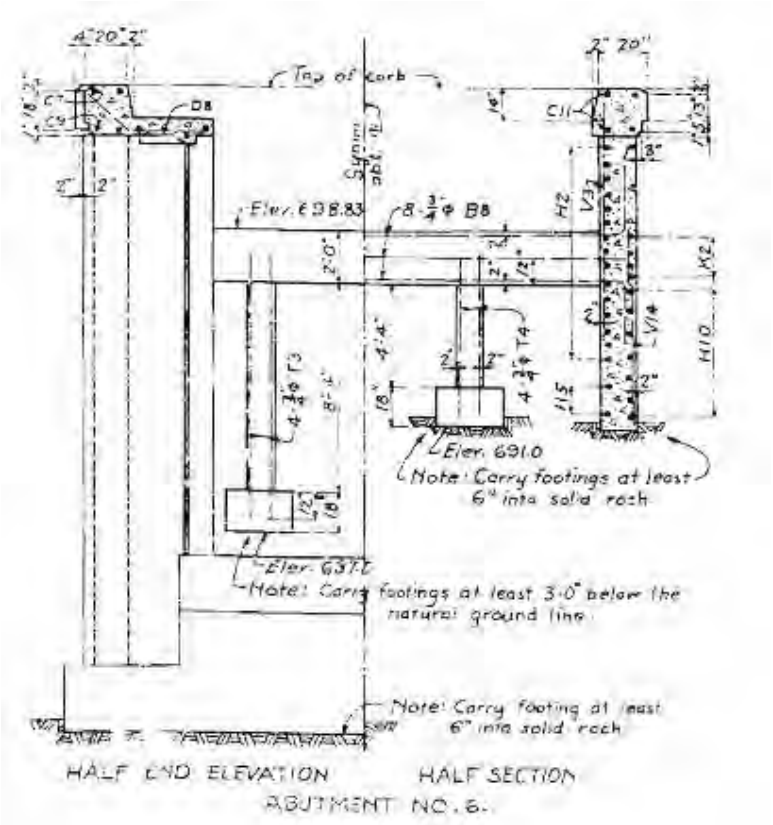


Figure 2-6. Spring Valley Bridge (J0420) General Elevation and Plan

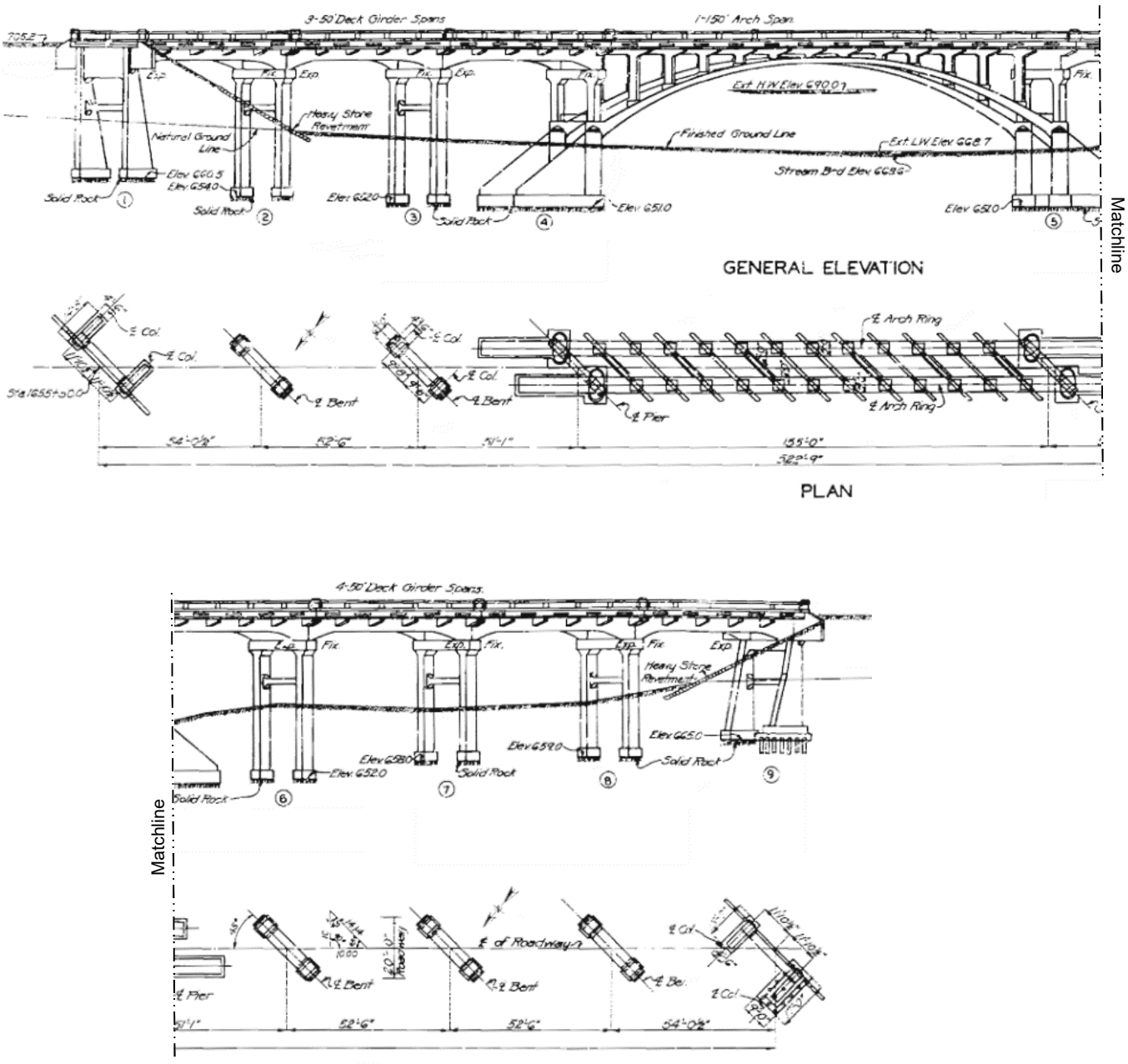


Figure 2-7. Spring Valley Bridge (J0420) Typical Section through Approach Spans

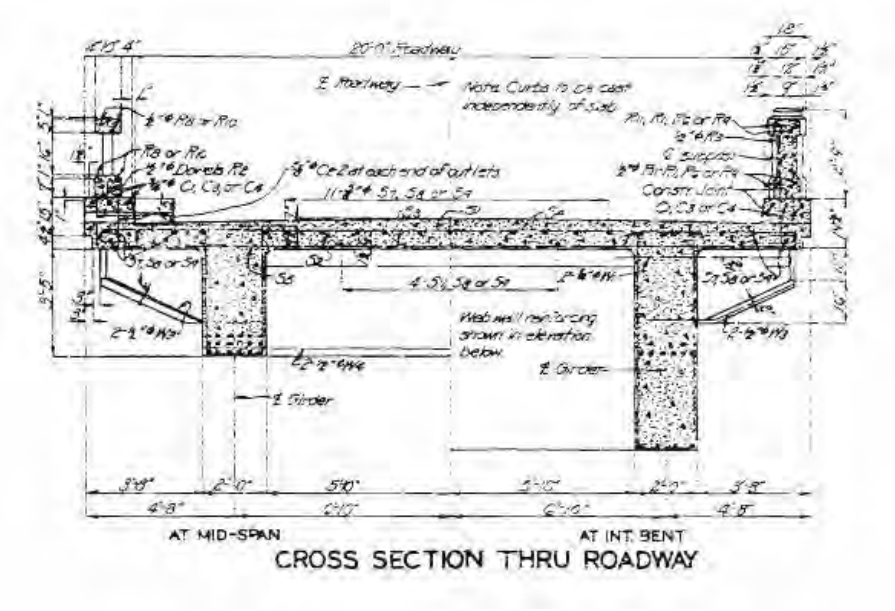
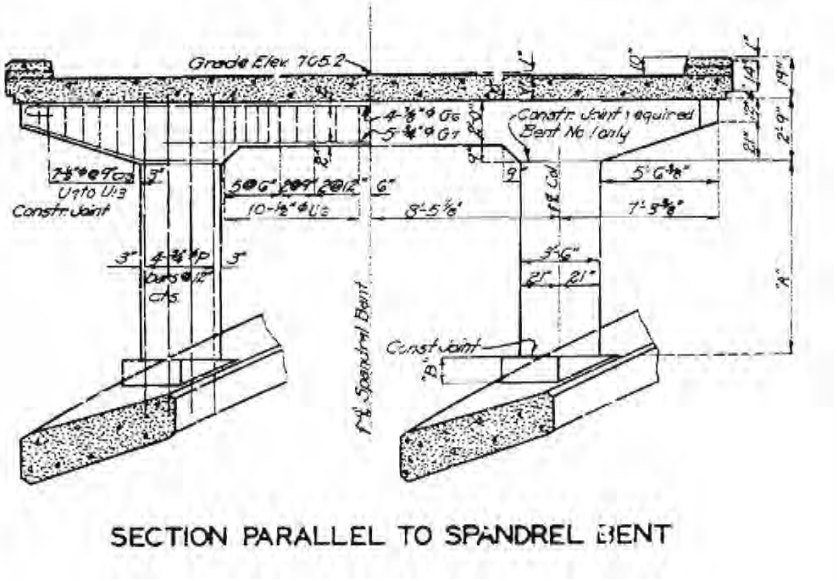


Figure 2-8. Spring Valley Bridge (J0420) Typical Section through Arch Span



2.4 Concept Study Limitations

This study was performed using limited data collected in the field and other available information. Additional information was gathered from various stakeholders during the design charrette. The limitations noted below were not addressed in this study and should be included in any future work on this project.

Alignments and profiles were developed from a limited topographic survey. Vehicle mounted LiDAR was used to gather information along the roadway surface and the adjacent features. Beyond the limits of the LiDAR surface the survey was supplemented

with a one meter digital elevation model that was created by the US Geological Survey in 2017. The limits of the study were established to be approximately one quarter of a mile north of the Current River Bridge and one third of a mile south of the Spring Valley Bridge. These limits captured the roadway curves past each bridge and identified various access points. Further refinement of a selected alignment will require a more extensive survey of the area.

The existing conditions of each bridge were determined by reviewing available inspection reports and supplemented with a limited field investigation that did not include access equipment. Specifically, no access to the upper portions of either bridge was possible including the floorbeams or the midpoints of the arches. Field testing and material sampling of the existing concrete was similarly limited to portions of the bridge that could be accessed from the ground. The results of the limited testing was extrapolated to the remainder of the structure. The complete testing report is included in Appendix C and includes the observation that concrete higher on the structures is likely to contain elevated levels of chloride ion contamination. Prior to a rehabilitation project for either bridge, a more extensive investigation of the condition of the portions of each bridge to be included in a rehabilitated structure should be completed to verify the condition of the concrete closest to the roadway surface or plans should include replacement of concrete expected to be deteriorated. A rehabilitation of the bridge over the Current River should include plans to temporarily close the road and perform a partial pavement removal to access the buried arch concrete that cannot be inspected using traditional inspection methods.

The hydraulic adequacy of the existing structures is based on the design high water elevations presented in the existing plans as well as field observations of the structures during their nearly 100 year life. The existing plans for the Current River Bridge show 6.5 feet of freeboard to the extreme high water elevation. The recurrence interval of this elevation is unknown but is assumed to be 100 years. Field observations report that frequent high water events occur at the Current River crossing. The existing plans for the Spring Valley Bridge show 9.1 feet of freeboard to the extreme high water elevation. The recurrence interval here is also unknown and assumed to be 100 years. The spring runoff feeding the creek through Spring Valley does not produce enough flow to reach the extreme water elevation noted. The drainage area feeding the creek through the valley also does not appear large enough to create the design elevation. It is likely the extreme high water elevation at Spring Valley is due to backwater from the Current River. Bridge alternatives were developed to match or improve the waterway opening provided today. The adequacy of the waterway opening compared to current engineering policy was not investigated. Also not considered were temporary conditions, either shoofly bridges or permanent offset bridges, with foundations that do not align with the existing bridges resulting in a temporary reduction of the waterway opening. Both temporary and permanent conditions should be considered during further refinement of the project.

Utilities are known to be carried on the pedestrian / utility structure immediately downstream of the Current River Bridge. Past the bridge on both ends the utilities are buried and no utility locates were included in this study. Based on information from NPS personnel, water supply and sewer treatment facilities are located north of the Current River Bridge but the route of the buried utilities is not included in the current survey. NPS personnel did identify a utility corridor near Spring Valley east of the road and roughly parallel. Several of the options for the Current River Bridge will require relocation of the

existing utilities. NPS personnel expressed a willingness to relocate the utilities, possibly by directional boring under the river, but no alternate utility corridor was identified in this study. If a temporary bridge converted to a permanent pedestrian bridge or a phased girder bridge replacement is selected, the existing utilities could be moved to the new structure in lieu of boring under the river to reduce project costs.

3 Study Issues Identified

3.1 Project Limitations and Requirements

Based on conversations with various stakeholders before and during the design charrette the following project requirements and limitations were identified:

- Route 19 must remain open to traffic at all times in some fashion. It is the primary north / south route through this part of the state and the potential detour route around a closure is excessive and cannot be tolerated. This route serves several local industries including logging and tourism and connects a NPS ranger station to the remainder of the Ozark National Scenic Riverways.
- Any proposed design must meet the current EPG and AASHTO standards for highway design and safety features. Included in these standard requirements are vertical and horizontal curve limitations for site distance, roadway superelevation requirements and travel lane and shoulder width. Design exceptions are possible but should be considered sparingly and their acceptance is not guaranteed.
- Any proposed design must meet the current EPG and AASHTO standards for bridge design or rating requirements if a rehabilitation is considered. Design exceptions may be possible however most structural design is driven by safety requirements and design exceptions will likely not be granted.
- Carr's Store and Canoe Rental on the northwest corner of the Current River Bridge must not be disturbed and access must be maintained in some fashion. The location of this store limits the consideration of a temporary or permanent bridge offset to the west at the Current River.
- No impact is allowed to Round Spring which is east of Route 19 between the Current River and Spring Valley bridges. The location of the spring limits consideration of a temporary or permanent alignment that is offset to the east at Spring Valley.
- The Round Spring Cave, NPS ranger station and NPS residences are accessed by an NPS service road beneath the existing Spring Valley Bridge. Access to this area must be maintained. Limited road closures for demolition or construction activities could be tolerated but will require close coordination with NPS.
- The utilities carried on the existing pedestrian bridge must remain in service. If relocation of the utilities is needed, limited outages to make new connections could be tolerated.
- An allowance must be made for river traffic on the Current River to traverse the project site during the majority of construction. Limited closure of the river may be