Bartlett & West

Driving Community and Industry Forward, Together.

April 15, 2021

Mr. Tom Wright
Presiding Commissioner
Miller County
P.O. Box 12
Tuscumbia, MO 65082-0012

Re: Bridge No. 2740017 – Swinging Bridges Road over Grand Auglaize Creek
Bridge Engineering Assistance Program (BEAP) Report – 21TTAP-32

Dear Mr. Wright,

Miller County forces discovered during their routine maintenance of the Joe Dice swinging bridge over the Grand Auglaize Creek on January 6, 2021 that increasingly rapid deterioration of the concrete anchorages of the main cables was occurring at the west end of the bridge. MoDOT inspection personnel were immediately notified. Their data collection and assessment, as well as an evaluation by MoDOT's Bridge Division resulted in a January 10, 2021 Critical Inspection Finding (CIF) that the bridge be closed to all traffic. Bartlett & West was approached to provide preliminary engineering services to determine if and how the bridge could be repaired and safely reopened to traffic.

Figure 1 – Narrow unpaved approach to historic Grand Auglaize swinging bridge. (MoDOT photo)

Bartlett & West visited the Grand Auglaize bridge and the nearby Mill Creek bridge on February 3, 2021 with all three Miller County commissioners, Miller County maintenance personnel, and members of the Save the Brumley Swinging Bridge group in attendance. Site visit findings are summarized in the **BRIDGE REHABILITATION SCOPE OF WORK** section on pages 2, 3 & 4 of this BEAP report.

Our findings, conclusions and recommendations can be found in the **SUMMARY** section on pages 7 & 8. The summary information contains repair tasks and construction costs for what is needed to simply be able to reopen the bridge, with the Owner's understanding that other bridge repairs will be necessary in upcoming years as other issues arise. The summary information also contains tasks and costs for more comprehensive repairs that would potentially reduce the amount of work over the next 10 years to be primarily routine bridge maintenance. Miller County's available budget on this project, and bridge needs elsewhere in the county, may dictate that some, but not all, of the repairs can be done at this time. Accordingly, the repair tasks have been prioritized in an attached cost estimate to help with planning and budgeting purposes if all recommended repairs had to be done incrementally.

The conclusions and recommendations contained within this BEAP report also draw upon the general information, and the specific conclusions, recommendations, guidance and requirements contained within the documents and websites listed on page 9. The list of sources for **BRIDGE DOCUMENTATION: BRIDGE REPORTS AND OTHER RELATED INFORMATION** is provided for reference purposes.

Because of the bridge's historical significance, it was necessary to identify additional issues that might impact decisions about rehabilitation and replacement options. **HISTORIC BRIDGE PRESERVATION CONSIDERATIONS** can be found on pages 4 & 5 and include the recommendation to involve and communicate with the State Historic Preservation Office (SHPO) and other stakeholders.

Existing Conditions – Bridge No. 2740017
The 500' long wire cable suspension bridge built sometime between 1920 and 1931 is comprised of two spans approximately 86' and 414' long with hanger cables spaced at 6' connecting the main cables to the transversely-oriented steel floor beams that support longitudinally-aligned steel stringers. The stringers support a timber deck comprised of 2" x 10" transverse planks with timber runners running along the expected wheel lines of the single lane roadway. Steel towers at the intermediate bent and the west abutment support the pair of main cables whose ends are anchored in concrete set in the ground. The bridge had a 3 ton load posting at the time of its closure, but previously had been posted for a 5 ton weight limit.

The Grand Auglaize Bridge is inspected by MoDOT in odd years, a fracture critical inspection is performed by consultant in even years, and the bridge also has been studied at other times through BEAP. Consequently, the condition of the bridge as a whole and the deterioration of specific structural components are well documented. This BEAP report has been developed in part by synthesizing the results of those findings and augmenting them with what has occurred since the last Fracture Critical Inspection in August, 2020, that is, the October, 2020 designation of the bridge on the National Register of Historic Places and the January, 2021 bridge closure. A list of inspection reports and other sources of bridge-related information is listed in the **BRIDGE DOCUMENTATION** section found on page 9.

Prior to the problems found on January 6, 2021 with the concrete anchorages at the west end of the two main cables, the bridge had been found to be deficient or obsolete based on three criteria:

1. The superstructure was in poor condition at the time of its 2019 inspection with a rating of '4' on a scale of 0 (Failed Condition) to 9 (Excellent Condition) most attributable to the 82 pairs of hanger cables having an increasing number of individual wires that are loose, untwisted, rusting, pitted and incrementally having total section loss, being fractured or possibly having been cut. Past reports have also made note of loose, broken, rusted and pitted wires in the main cables, as well as section loss in steel stringers, and less severe problems with the steel floor beams.
2. The bridge was considered "functionally obsolete" based on the roadway width of 12 feet across the bridge and the resulting "Deck Geometry" rating being a '2' (Basically Intolerable).
3. The bridge did not have sufficient load-carrying capacity for vehicular traffic resulting in a load rating historically in the range of 3 to 5 tons for Missouri's posting vehicles and an inventory load rating of 4 tons for the HS20 vehicle according to previous studies and analyses of the bridge.

BRIDGE REHABILITATION SCOPE OF WORK
A bridge of this vintage is inevitably going to have problems relating to age, deterioration due to the elements, the occasional overweight vehicle, the accumulation of repetitive loads, or other common causes of bridges to essentially wear out. The three areas of greatest concern are documented here, with those being the concrete anchorages at the west end of the bridge (Figures 2 & 3), the hanger cables (Figures 4 & 5), and the main cables at the west end of the bridge (Figures 6 & 7). For more comprehensive documentation of conditions throughout the entire bridge, recent Fracture Critical Inspection reports, MoDOT inspection reports and previous BEAP studies listed in the **BRIDGE DOCUMENTATION** section can be reviewed.

No construction plans are available for the bridge and the exact methods used by the builder (Joe Dice) to anchor the main cables at this bridge are not definitively known. Consequently, there is uncertainty as to how the concrete anchorages were intended to function so there was not and should not be any further removals of additional chunks of deteriorating concrete or the earth covering other portions not yet discovered until the main cables have been anchored by other means. Other resource materials listed on page 9 have indicated that the anchor of the main cables during construction consisted of looping each wire around large steel rods driven into the ground as each wire was incrementally laid along the length of each main cable. Once the main cable work was complete, the construction phase's steel rods were likely encased with unreinforced mass concrete blocks and the two could be viewed as a redundant system. However, it is likely that the concrete blocks were the intended long-term means of anchorage.

Figure 2 – Concrete anchorage at northwest corner of the bridge is being compromised by deterioration so new reinforced concrete anchorage must be constructed.

Figure 3 – Concrete anchorage at southwest corner of bridge is being compromised by deterioration so new reinforced concrete anchorage must be constructed.

Figure 4 – Attachment details at top and bottom of replacement hanger cables can be improved. Rub-guard or saddle would slow the section loss in wires and floor beams. (MoDOT photo)

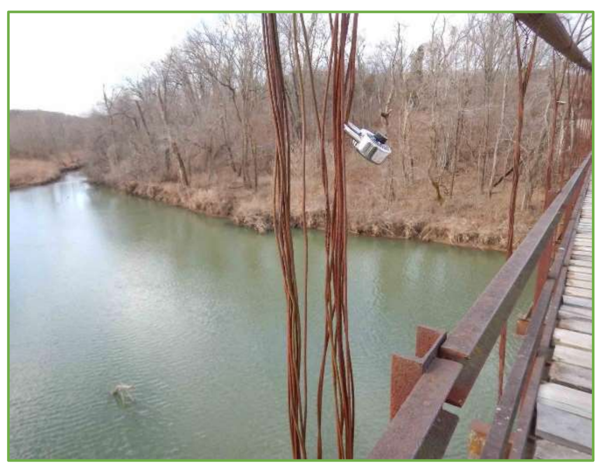

Figure 5 – Some hanger cables have become untwisted and lost tension; others have section loss or breakage in individual wires. (MoDOT photo)

Figure 6 – Loose and broken outer wires are becoming more prevalent thus exposing the inner core and increasing the risk of being compromised.

Figure 7 – Main cables at west anchorages no longer have outer wrap wires around a tightly bound core of individual wires.

HISTORIC BRIDGE PRESERVATION CONSIDERATIONS

Based on the guidelines and recommendations contained within AASHTO bridge preservation documents (*Historic Bridge Preservation Guide*, 1st Edition (2020) and 2008's *Guidelines for Historic Bridge Rehabilitation and Replacement*) intended to supplement AASHTO bridge design specifications, the items below should be considered when evaluating whether a historic bridge should be rehabilitated or replaced. It should be noted that the environmental-related regulations related to the bridge being located within the limits of the Lake of the Ozarks State Park have not been identified as part of this BEAP study.

1. Historic bridges are protected by Section 4(f) of the Department of Transportation Act and by Section 106 of the Historic Preservation Act of 1966, with some exceptions defined. Both regulations require consultation with the State Historic Preservation Office (SHPO) and other stakeholders. While Section 4(f) and Section 106 specify nationally applicable processes for considering preservation or replacement of historic bridges, there is no corresponding protocol that ensures a nationally consistent approach to making bridge replacement or repair decisions. Consequently, state and local transportation agencies have developed a wide variety of written and unwritten approaches for addressing historic bridges which understandably reflect the priorities and culture of an organization as well as the knowledge, expertise and bias of individuals therein. To ensure that rehabilitation versus replacement decision making is balanced and consistent among the states, nationally applicable guidance for that very process has been provided through those AASHTO guideline documents.
2. AASHTO's 2008 historic bridge guidelines provide a decision matrix procedure to aid those making decisions about rehabilitation versus replacement that are a function of the bridge's physical condition, its load-carrying capacity and its geometry that ultimately puts the project in one of six categories for its rehabilitation potential.
3. A range of alternatives should be considered for any project involving a historic bridge. Common alternatives include rehabilitation, relocation, conversion for pedestrian use, and constructing a parallel structure. The preferred alternative typically is to use a historic bridge as-is or with rehabilitation to satisfy the intended level of service. The *Secretary of the Interior's Standards* apply when rehabilitating a historic bridge.
4. The AASHTO bridge preservation documents note that the need for good relations and communication between the Owner and the SHPO cannot be overstated. It further states that 3D renderings of existing features and of proposed aesthetic changes are an effective way to improve communication with SHPO and stakeholders. Drone photography and LIDAR, three-dimensional

radar-based scanning technology that produces point clouds representing the scanned object are two methods of documenting the current condition of historical bridges. LIDAR point clouds have also been used to create as-built plans of bridges with missing original construction plans like this bridge, or to determine dimensions for load-rating analysis.

5. Historic bridge preservation and rehabilitation projects should leave the bridge in a condition to serve with reasonable maintenance indefinitely into the future, so main structural components should be designed appropriately.
6. There often are project features, such as the bridge deck geometry, the bridge's load capacity and the bridge railings that currently do not satisfy AASHTO design standards but may be acceptable for a bridge's intended level of service. Documentation of appropriate design exceptions or deviations are important elements of many historic bridge preservation projects.

ADDITIONAL BRIDGE SECURITY AND INTEGRITY CONSIDERATIONS

1. Historic covered timber bridges are at unique risk because of fire, arson and vandalism. Similarly, planning for suspension bridge security items to address anchorages, towers, main cables and hanger cables should be considered for the Grand Auglaize bridge. Corrosion protection methods such as paint coatings, sheathing or other means, should also be considered.
2. Corrosion protection systems for suspension bridges are reversible changes that "harden" the bridge for extraordinary events or degradation. These changes may meet *The Secretary of the Interior's Standards*.

ADDITIONAL STRUCTURAL LOAD RATING AND OTHER BRIDGE ENGINEERING CONSIDERATIONS

1. AASHTO bridge preservation guidelines emphasize that bridge rehabilitation must correct the deficient features using methods that do not require constant maintenance. Selected materials and methods should be the best available and in conformance with generally accepted preservation guidance. The guidelines state that the prudent approach is to rehabilitate well so that the work does not need to be repeated in the near future and that maintenance costs are not abnormal.
2. Functional features, such as the strength of the bridge rail and the horizontal clearance for traffic, are but two items that the bridge rehabilitation work should provide that are appropriate for the intended level of service.
3. Comprehensive load rating calculations should be developed for the Grand Auglaize bridge as a whole given the bridge's level of redundancy and its vernacular design. This includes but is not limited to a structural assessment of the main cables, hanger cables, concrete anchorages, steel floor beams and stringers, as well as the timber deck. Load ratings have been done over time for several of these components when accumulating deterioration has dictated that the load-carrying capacities had changed.
4. AASHTO 2020's historic bridge preservation document indicates that on some other historic suspension bridge projects, additional main cables have been added adjacent to the existing cables and with their own hanger cables, just like the work done in 1979 to the nearby Mill Creek bridge shown in Figure 8.
5. In-kind replacement of members using similar shapes and dimensions is another example of changes that may meet *The Secretary of the Interior's Standards*. Such changes to stringers, floor beams and even the hangers are an opportunity to improve the structural integrity of the bridge, if not the load-carrying capacity as well. Such improvements need to strike a

Figure 8 – Nearby Mill Creek bridge with 15 ton load limit was repaired in 1979 with new main cables, suspender cables, concrete anchorages and corrugated metal deck.

balance between maintaining the bridge's original integrity and making the bridge more functional. We recommend that SHPO and other stakeholders be consulted on these types of repairs.

6. Main cable wire breaks can be repaired following FHWA-developed protocols by using special swaged ferrules to splice new wires into place and tighten them.
7. Coupon testing of available wires from the main cables and/or the hanger cables, or of samples from the steel floor beams and stringers used to determine their material properties is another means of confirming or increasing the bridge's load ratings.

ADDITIONAL LOW VOLUME ROUTE AND DESIGN EXCEPTIONS-RELATED CONSIDERATIONS

1. Bridges with geometry or safety features that do not meet current design standards are classified as functionally obsolete, but many functionally obsolete bridges perform adequately. For those instances, AASHTO bridge preservation guidelines state that a design exception for width should be considered and used if it is appropriate.
2. For low-volume routes such as Swinging Bridges Road where the Average Daily Traffic (ADT) may be in the range of 40 to 50 vehicles per day, an alternative to AASHTO's *A Policy on Geometric Design of Highways and Streets* (the AASHTO Green Book) for geometric features is AASHTO's *Guidelines for Geometric Design of Low-Volume* Roads (2019), which serves to an update to the *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT<400).* The low-volume road specifications say that new one-lane bridges may be provided on single-lane roads and on two-lane roads with design volumes less than 100 vehicles per day where it's found that the one-lane bridge can operate effectively. Existing bridges can remain in place without widening unless there is evidence of a site-specific crash pattern related to the width of the bridge. Evidence of a site-specific crash pattern may include not only crash history but other evidence such as skid marks, damage to bridge rail, and concerns raised by local residents or law enforcement.
3. AASHTO historic bridge guidelines state that if the bridge's roadway width is equal to that of the approaches and neither the bridge roadway width or approach roadway width meet current design requirements, a bridge may still be a candidate for rehabilitation until such time as the approach roads are also upgraded as long as they demonstrate adequate safety performance.
4. Many railing systems on historic bridges do not meet current safety standards for crashworthiness, minimum height, and adequacy of guardrails at the approaches, or the transition between the two systems. They therefore are often evaluated as substandard and obsolete. A design exception for bridge barriers and railings like those on this Big Swinging Bridge is typically justified by some combination of lower speed, lack of significant horizontal curvature and benign accident history.

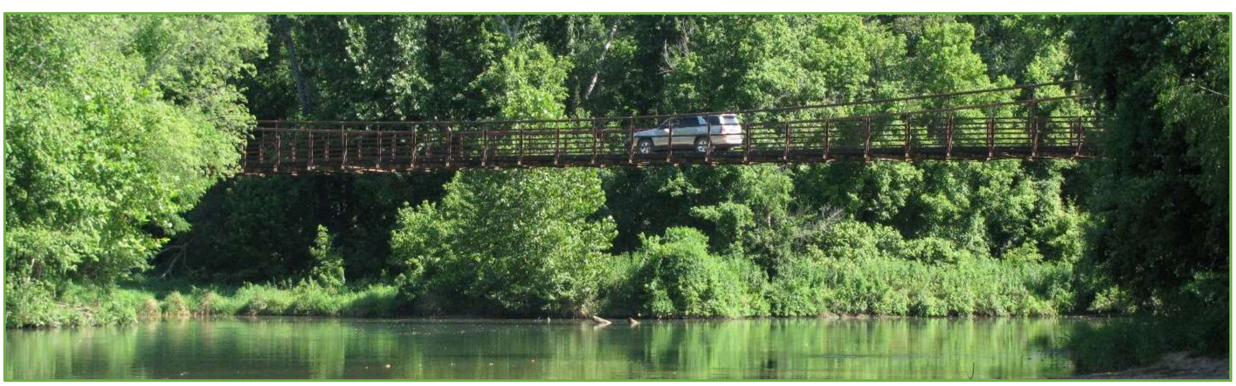

Figure 9 – Single lane bridge's railing system consists of three horizontal rails between vertical steel posts.

SUMMARY

The structural integrity of the Grand Auglaize Bridge is currently in question with the significant deterioration happening at the concrete anchorages, main steel cables and steel hanger cables, and to a lesser extent at abutments, piers, floor beams and stringers. A complete replacement of the bridge with one of a similar length and a greater width, along with other project costs, very likely could exceed two or three million dollars depending on the final solution chosen. Based on the small amount of traffic using the bridge and the project funding limitations of Miller County, it doesn't appear feasible, realistic and sensical to plan for a full bridge replacement project. Given all of the considerations outlined in this report, we recommend that the bridge be rehabilitated to extend its service life for at least a few more years rather than being replaced. Construction cost estimates for the bridge repair items noted below, as well as estimates for final design engineering and plan preparation, are attached.

To get the bridge open to traffic, albeit with a load posting of 5 tons, the following repairs at an estimated construction cost of $125,000 must be made:

1. Replace, splice or otherwise repair individual wires in each main cable. The exact number of wires can be determined during final bridge design as it is outside the scope of this BEAP study. Because the ends of the main cables are to be encased in concrete anchorages, the Contractor will have to coordinate the repair work on the main cables with that on the concrete anchorages.
2. The concrete anchorages at the west end of the bridge should be replaced, likely one at a time but depending on the Contractor's specific means and methods. Each new concrete anchorage could be constructed in the same spot as the existing anchorage if the main cable were temporarily held in place and cable tension maintained until the removal and reconstruction activities for the anchorage were complete. The Contractor could maintain the cable tension if they were able to clamp or otherwise attach to the bundled wires in the main cable and prevent movement with a deadman system or very large stationary mass. Alternatively, the new concrete anchorages could be constructed adjacent to the existing anchorages and located closer to the creek. This option would make the new west-end anchorages more visually apparent, but they would be similar to the bridge's east-end anchorages, the anchorages of the Mill Creek bridge, and those of the Warsaw Upper Bridge.
5. Replace approximately 11% of the 164 hanger cables. Recent observations place the current number of hangers that definitely need replacement at 9. With time passing and to accommodate the fact that typical bridge rehabilitation projects commonly encounter quantity overruns, the cost estimate accounts for 18 hangers being replaced or repositioned. These replaced and repaired hanger cables need to have their tension measured by observing the natural frequency of each and correlating it to tension. Further adjustments may then be necessary.

More comprehensive repairs to the bridge with construction costs up to $550,000 would address more of the current deficiencies as well as others likely to appear within the next ten or so years. There is a distinct possibility that all of the three current condition, load-carrying and geometry deficiencies could be resolved in one fashion or another, whether it be through repairs or design exceptions as follows:

1. The condition rating for the superstructure could be increased to an acceptable level and its deficiency fixed by doing the following:
   a. Replace both of the concrete anchorages at the west end.
   b. Replace all 82 pairs (164 total) of vertical hangers.
   c. Replace, splice or otherwise repair the wires in each main cable.
   d. Repair steel stringers and floor beams where needed where section loss due to deterioration or rubbing from the hanger has occurred.
2. The condition rating for the substructure, currently a '5' and on the cusp of making the bridge structurally deficient, could be increased to an acceptable level by doing the following:
   a. Repair section loss in steel towers and replace bolts/rivets where needed.
   b. Repair concrete deterioration and cracking in west abutment and the concrete pillars supporting the steel towers.
3. Repair the bridge railing where welds in the steel have cracked.

4. Use a Design Exception document signed by the Engineer of Record, Owner and possibly other stakeholders stating that the roadway width across the bridge is acceptable.
5. Use a Design Exception document signed by the Engineer of Record, Owner and possibly other stakeholders stating the bridge railings are acceptable for the conditions found at this site.
6. Once the condition ratings of the bridge have been addressed, the load carrying capacity issue must be better resolved. The current HS20 inventory rating is 4 tons and the National Bridge Inventory "Structural Evaluation" rating is a '2'. The bridge would not be structurally deficient solely on the basis of the HS20 inventory rating if the 4 tons rating were increased to 12 tons ('4' $\approx$ minimally tolerable), 18 tons ('5' $\approx$ somewhat better than minimally adequate) or to at least 23 tons ('6' $\approx$ present minimum criterion). Although the exact means selected to do so are outside the scope of this BEAP study, the following are ways the load rating can be increased:
    a. Replace the stringers and/or floor beams as needed. Stringers near the east end of the bridge were previously replaced because of deterioration and section loss.
    b. Strengthen the stringers and/or floor beams as needed.
    c. Add more stringers in between the existing stringers.
7. The timber deck has been repaired over the years with each repair effort resulting in an increased National Bridge Inventory deck condition rating. Inevitably, the deck condition ratings have decreased over time, sometimes more rapidly than expected. Miller County may consider thicker treated timber decking of a high grade as a means to maximize the time between subsequent timber deck repair work.

Bartlett & West appreciates the opportunity to serve Miller County through the BEAP program and looks forward to future opportunities to serve you. Please feel free to contact us with any comments, questions or concerns.

Sincerely,

Chris J. Criswell, P.E.

Attachment

Cc: Jamey Laughlin - MoDOT Bridge Division
Joanie Prenger - MoDOT Central District

STATE OF MISSOURI
CHRISTOPHER
J. CRISWELL
NUMBER
PE-028605
PROFESSIONAL ENGINEER
4/15/2021

Sealed 4/15/2021
Bartlett & West, Inc.
Certificate of Authority No. 000167 (Engineering)

BRIDGE DOCUMENTATION: BRIDGE REPORTS AND OTHER RELATED INFORMATION

The conclusions and recommendations contained within this BEAP also draw upon the general information, and the specific conclusions, recommendations, guidance and requirements found within the documents and websites listed below.

BRIDGE REPORTS AND EVALUATIONS

- Critical Inspection Finding letter from MoDOT's Bridge Division to MoDOT's Central District dated January 10, 2021 that recommended bridge closure.
- Non-State Structure Inspection Report by MoDOT dated January 6, 2021
- Fracture Critical Inspection Report dated August 20, 2020 by Poepping, Stone, Bach & Associates, Inc. (PSB+A).
- BEAP reports originally dated October 24, 2019 and revised April 7, 2020 by McClure Engineering Co.
- Fracture Critical Inspection Report dated September 17, 2018 by PSB+A
- Bridge Load Rating Summary dated October 5, 2016 by Shafer, Kline & Warren, Inc.
- Fracture Critical Inspection Report dated November 17, 2014 by Shafer, Kline & Warren, Inc.
- Bridge Load Rating calculations dated November 12, 2014 by Shafer, Kline & Warren, Inc.
- BEAP report originally dated December 13, 2010 and revised December 16, 2010 by Shafer, Kline & Warren, Inc.
- Historic American Engineering Record (HAER) Inventory – Missouri Historic Bridge Inventory of the Glaize Bridge by Fraser Design in 1993
- HAER Inventory – Missouri Historic Bridge Inventory of the Mill Creek Bridge by Fraser Design in 1993
- HAER Inventory – Missouri Historic Bridge Inventory of the Little Niangua River Bridge by Fraser Design in 1993

HISTORIC BRIDGE, SUSPENSION BRIDGE & LOW-VOLUME ROAD GUIDELINES

- *Historic Bridge Preservation Guide*, 1st Edition (2020) by the American Association of State Highway and Transportation Officials (AASHTO)
- *Guidelines for Geometric Design of Low-Volume Roads* (2019) by AASHTO
- *FHWA-IF-11-045 Primer for the Inspection and Strength Evaluation of Suspension Bridge Cables* by Federal Highway Administration (2012)
- *Guidelines for Historic Bridge Rehabilitation and Replacement* (2008) by AASHTO
- *Guidelines for Inspection and Strength Evaluation of Suspension Bridge Parallel Wire Cables (2004)* through the National Cooperative Highway Research Program (NCHRP)

REGISTRATION FORMS FOR THE NATIONAL REGISTER OF HISTORIC PLACES

- Grand Auglaize Bridge, also known as the Glaize Bridge and the Big Swinging Bridge, officially nominated by the Missouri Department of Natural Resource's (DNR) State Historical Preservation Office (SHPO) on August 18, 2020.
- Upper Bridge, also known as the Warsaw Swinging Bridge, officially nominated on August 12, 1999 by the Missouri DNR SHPO.
- Boeckman Bridge in Miller County officially nominated in 1979 by the Missouri DNR SHPO.

HISTORICAL-BASED WEBSITES, NEWSPAPER ARTICLES AND MAGAZINE ARTICLES

- Bridgehunter.com: Information was reviewed for the Grand Auglaize Swinging Bridge (Big Swinging Bridge), Mill Creek, Warsaw Upper Bridge, Boeckman Bridge, Kemna Bridge, Saline Creek Swinging Bridge and the Little Niangua Swinging Bridge.
- Historicbridges.org: Information was reviewed for the Big Swinging Bridge, Mill Creek Swinging Bridge and the Little Niangua Swinging Bridge.
- MillerCountyMuseum.org
- Jefferson City's *News Tribune* newspaper: various articles about the Big Swinging Bridge
- LakeExpo.com, MissouriLife.com, ENR.com, RuralMissouri.com: various articles about the Big Swinging Bridge and the Little Niangua (Green's Mill) Swinging Bridge

Driving Community and Industry Forward, Together.

Cost Estimate: BEAP Study

Date: 4/15/2021
Project No.: 20442.000

(86' - 414') Rehabilitate Existing 2-Span Suspension Bridge
Swinging Bridges Road over Grand Auglaize Creek
Bridge 2740017
Miller County

Priority	Description	Quantity	Unit	Engineer's Estimate	
				Unit Price	Extension
1	Traffic Control - bridge end barricades & MUTCD-approved signage	1	LS	2,500.00	$2,500.00
1	Temporary Anchorages - to secure main cables during anchorage replacement	2	EA	12,000.00	$24,000.00
1	Class 1 Excavation - for concrete anchorages at west abutment	40	CY	50.00	$2,000.00
1	Reinforcing Steel (Bridges) - for anchorages at west abutment	2200	LB	2.00	$4,400.00
1	Class B Concrete (Substructure) - for concrete anchorages at west abutment	18.5	CY	1,200.00	$22,200.00
1	Gravel or Crushed Stone - for disturbed approach roadway at west end	10	TON	250.00	$2,500.00
1	Misc. Steel Repairs to Main Cables - splice wires and add protective sleeves	1	LS	40,000.00	$40,000.00
1	Replacement Hanger Cables - remove and replace cables currently damaged	18	EA	1,500.00	$27,000.00
	Subtotal for Priority 1 Pay Items - Construction				**$124,600.00**
	Subtotal for Priority 1 Pay Items - Engineering				**$35,100.00**
2	Miscellaneous Steel Repairs to Stringers	25	EA	1,200.00	$30,000.00
2	Miscellaneous Steel Repairs to Floor Beams	10	EA	2,500.00	$25,000.00
2	Replacement Hanger Cables - new cables add strength & durability	146	EA	700.00	$102,200.00
	Subtotal for Priority 2 Pay Items - Construction				**$157,200.00**
	Subtotal for Priority 2 Pay Items - Engineering				**$1,500.00**
3	Partial Removal of Substructure Concrete - minor repairs to pier and abutments	1	LS	2,500.00	$2,500.00
3	Substructure Repair (Unformed) - minor repairs to pier and abutments	100	SF	60.00	$6,000.00
3	Protective Coating - Concrete Bents and Piers (Epoxy)	1	LS	2,500.00	$2,500.00
3	Miscellaneous Steel Repairs to Main Cable Towers	1	LS	15,000.00	$15,000.00
3	Bolt Removal and Replacement - in steel towers for main cables	6	EA	600.00	$3,600.00
	Subtotal for Priority 3 Pay Items - Construction				**$29,600.00**
	Subtotal for Priority 3 Pay Items - Engineering				**$1,000.00**
4	Miscellaneous Repairs to Steel Bridge Railing Posts - repair connections	30	EA	500.00	$15,000.00
	Subtotal for Priority 4 Pay Items - Construction				**$15,000.00**
	Subtotal for Priority 4 Pay Items - Engineering				**$1,200.00**
5	Removal of Existing Timber Deck - as means to install thicker timber planks	7200	SF	2.00	$14,400.00
5	Treated Timber and Lumber - thicker timber planks to increase deck longevity	25.48	MFBM	8,000.00	$203,840.00
5	Sacrificial Graffiti Protection System - to be applied to concrete surfaces	1	LS	3,000.00	$3,000.00
	Subtotal for Priority 5 Pay Items - Construction				**$221,300.00**
	Subtotal for Priority 5 Pay Items - Engineering				**$1,200.00**
	Total for All Pay Items (Priorities 1 through 5) - Construction				**$547,700.00**
	Total for All Pay Items (Priorities 1 through 5) - Engineering				**$40,000.00**
	Notes: All construction items include mobilization and contingency.				
	Construction observation costs are not included in engineering.				