BROWN+KUBICAN
STRUCTURAL ENGINEERS

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October 31, 2024

Mr. Brian Easton
Facilities Project Manager
Kentucky Community and Technical College System
Office of Facilities Support Services
300 North Main Street
Versailles, Kentucky 40309

RE: Southeast Kentucky Community and Technical College
Replacement of Whitesburg Bridge
2 Long Ave.
Whitesburg, KY 41858
B+K Project Number: 24310
AE job #: 000001

Mr. Easton,

Pursuant to your request, Brown + Kubican, PSC performed an updated structural condition survey and opinion of probable cost estimate to further develop the scope of replacement for the pedestrian bridge at Southeast Kentucky Community and Technical College in Whitesburg, Kentucky. Our work included a new site observation of the pedway and review of available construction documents. We also reviewed the previous structural condition survey performed by Brown + Kubican, PSC in 2019. Preparation of construction documents (drawings and specifications) are not included in our current scope. Our observation was performed on October 28, 2024. All items discussed in the kick-off meeting on October 28, 2024 were also considered in the development of the scope of replacement.

Executive Summary:

Per visual inspection of our updated photos in comparison to the photos taken in 2019, the bridge shows accelerated corrosion and delamination of the bottom chords, cross members, lateral bracing, and steel deck. **The entire pedestrian bridge superstructure should remain closed and barricaded until replacement or demolition can be arranged. Portions of the raised pavilion slab, supporting beams and columns, and lintels above the parking garage openings also show signs of accelerated deterioration and should be replaced or remediated. The existing bridge piers and abutments will likely become structurally sufficient after patching spalled areas; however, a full load capacity check of the existing piers will be necessary as part of the scope of a future phase to determine the adequacy of the existing piers.** We recommend the future bridge include a roof as part of the design to improve its design life. Regular maintenance should also be conducted in the future to prevent deterioration of the future bridge. See the following report for observations, recommendations for repair, and a cost opinion.

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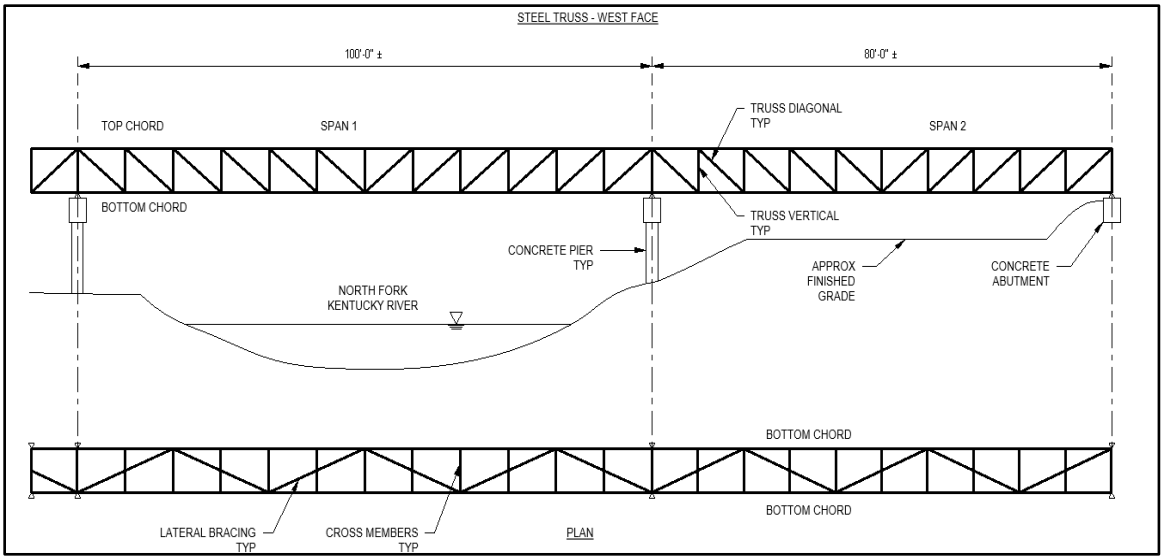

Image 1: Bridge Diagram

Kick-Off Meeting:

A kick-off meeting was held in the Belinda Mason Academic/Technical Building on October 28, 2024 to discuss the programming phase project scope for the replacement of the pedestrian bridge. Topics were discussed that relate to the scope of the project, including:

1. The current bridge lighting is inadequate for the safety of pedestrians. The new future bridge should incorporate a more robust lighting system. Brown + Kubican, PSC will coordinate with the electrical engineer in a future phase.
2. The current bridge may not meet accessibility standards per the Americans with Disabilities Act if it slopes steeper than 5% as it has no intermittent landings. The existing drawings that BK has on file does not include the bridge elevations. The new bridge should meet ADA standards, or the accessibility signage will need to be removed from the bridge side of the building. There is access on the front side of the building that will not be affected.
3. A survey will need to be conducted to gather elevations for the existing abutments and piers, including existing anchor bolt locations and existing vertical truss ends. This will streamline the construction of a new bridge and provide the data needed for a future load capacity analysis of the existing piers. Brown + Kubican, PSC will coordinate with the surveyor to determine the details as part of the scope of a later phase.
4. An extreme flood event occurred in Eastern Kentucky in 2022, and this bridge falls within the target area. Per comments from KCTCS, the water level was approximately 2 feet below the bottom chord of the bridge at crest and therefore did not encroach on the bridge directly; however, it was noted that one of the masonry-wrapped columns supporting the north landing is damaged, leaving the wrapped steel column exposed to mud during the flood event, and open air thereafter. See the discussion on the landing for a detailed explanation of our conclusions after conducting a new visual inspection.
5. There is an existing fiber line that will need to be attached to the new bridge in a secure manner, preferably with a conduit. New design should incorporate a conduit, but not relocate the line.
6. KCTCS reported that a neighbor living in the house near the bridge currently drives under the bridge to access their home. Reasonable accommodation for the neighbor may be necessary once construction begins.

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2024 Inspection:

We performed a visual investigation which included the extent of the pedway, raised landing, and overall site conditions for future construction. Visual observation was performed from the ground and photographs were taken for comparison to the original inspection of 2019. We did not use selective demolition as part of this observation, since the repair of the bridge is no longer a viable option, and selective demolition is unnecessary to determine the scope of replacement.

Image 2: Cross Member Above Abutment

Structure Description:

Existing construction documents made available to us for the Belinda Mason Academic/Technical Building by DCT Design Group, Ltd. and Bradford Walton Structural Engineer, dated July 15, 2002 are on file. Shop drawings of the existing pedway bridge were not provided.

The existing pedestrian bridge is a two-span steel pratt truss between the Mason Academic Building and the Hogg Allied Health Center. The truss has HSS8x8 top and bottom chords, HSS5x5 verticals and HSS3x3 diagonals. Each truss is connected together with HSS6x4 cross members and HSS3x3 lateral bracing below the concrete slab on deck to provide lateral buckling stability. The bridge has an open top with tabs welded to the vertical members for the attachment of a roof. The existing drawings call for the roof to be an alternate; no roof was installed at the time of our inspection. All steel tube members are welded together all around. Steel guardrails are constructed using channels and rounds steel rods for the entire length of the pedway. All steel has a weathering finish. Weathering steel is installed as "raw" steel and allowed to rust. The rust performs a

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protective coating to the elements. The bridge is spliced with bolted splice plates at two locations, the mid span of each span.

Image 3: Bridge West Elevation

The walking surface is exposed concrete with no apparent sealer or traffic membrane. The concrete surface has a broom finish with sawn construction joints at ~7'-6" on center with no sealer in the joints. The walking surface is constructed with 2 1/2" concrete over non-composite 11/2" galvanized metal deck (4" total thickness). The bridge spans between concrete abutments and piers with no apparent sealer applied to their surface. The Southeast span (~80'-0") is over a parking lot and the Northwest span (~100'-0") is over the North Fork Kentucky River. The height to the underside of the bridge ranges from ~7'-6" at the Southeast span and ~17'-9" at the Northwest span. Photographs of the bridge and its components were taken, some of which are included herein.

The raised landing at the North end of the bridge is constructed of a concrete walking surface that appears to be unsealed. The walking surface is constructed with a 2 ½" concrete slab over 1 ½" composite painted metal deck (4" total thickness) spanning between wide flange steel beams. The steel beams are supported by steel columns wrapped in masonry piers and the building. A steel handrail is attached to the edge angle around the perimeter of the raised landing. The foundation system of the landing is concrete drilled piers. All steel, including the underside of the steel deck, is painted.

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Image 4: Bridge Walking Surface

Image 5: Raised Landing

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Observed Deficiencies:

We observed the following structural deficiencies:

Item 001: Truss Bottom Chords

The truss bottom chords are in moderate to poor condition. The truss bottom chords have consistent mild delamination on the underside of the tube for the full length of the bridge on both chords. While no new measurements were taken, these chords appear to be in worse condition when compared to the photos in the 2019 report. The corrosion is especially severe near the splices.

We believe this is caused by the improper drainage of the walking surface above. The salt/water combination is draining onto the top of the steel bottom chords and causing the chords to rapidly deteriorate. Also, the bridge generally slopes to the west side of the deck, causing the water to drain to the West chord more than the East chord.

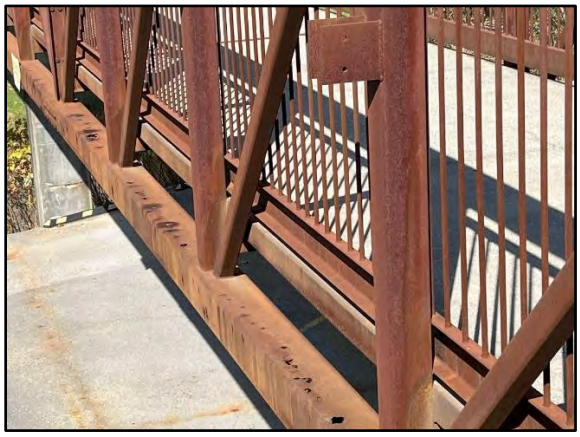

Image 6: West Bottom Chord Deterioration

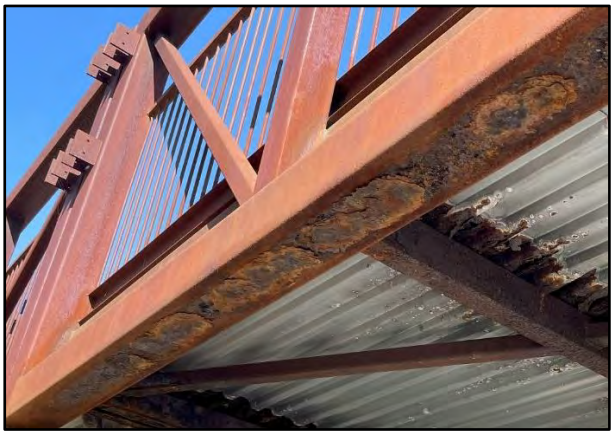

Image 7: Underside of Bottom Chord Delamination

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Item 002: Bridge Cross Members

The cross members are consistently corroded and delaminating at both ends where they connect to the trusses. The bridge is spliced in two locations and has three end-bearing conditions. Each end bearing condition and splice is experiencing infiltration of water through the slab joint and significant corrosion of the cross members.

We believe this is due to the bridge improperly draining over the edge of the walking surface and corroding the end of the cross members. The lack of joint sealants at the splice and bearing locations is causing extra water to corrode the members below these locations.

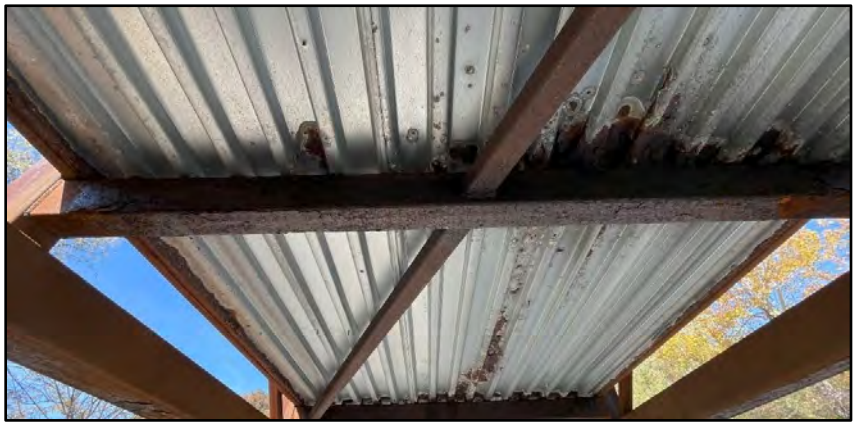

Image 8: Cross Member Corrosion

Item 003: Lateral Bracing

In general, the condition of the lateral braces below the deck are fair. The lateral brace members are corroding on all sides of the section at the ends connected to the cross members. Deterioration is currently localized to the surface of the members, deterioration has yet to greatly impact the welded connections.

We believe this is caused by the lack of joint sealant in the concrete slab on deck sawn joints. Water is infiltrating through the sawn joints and corroding the ends of the lateral braces.

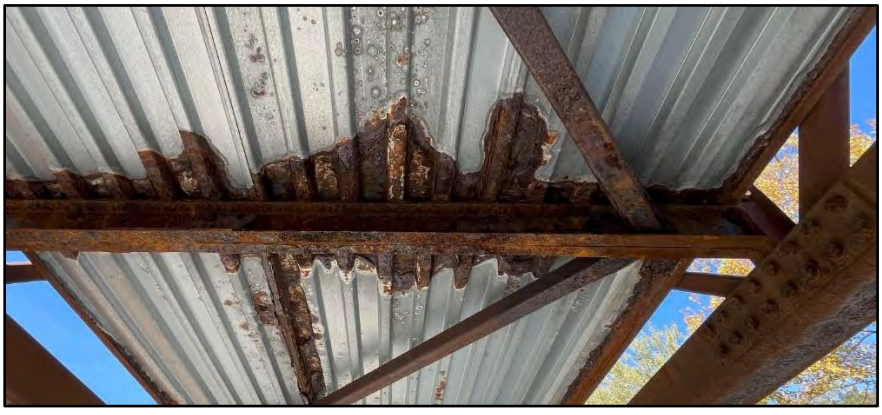

Image 9: Lateral Bracing Corrosion

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Item 004: Concrete Slab Over Steel Deck

The concrete slab over the steel deck is in fair condition. All bearing locations of the galvanized steel deck are experiencing corrosion. Bearing locations include the ends, intermediate supports, and all edge conditions at the perimeter. All locations are experiencing moderate to severe corrosion with some localized areas experiencing full loss of the steel deck.

We believe the deck is corroding at these locations due to the interaction between the galvanized steel and weathering steel. Galvanized steel rapidly deteriorates when in contact with weathering steel. The weathering steel protective rust coating constantly corrodes the galvanized coating until it is gone, and the steel below deteriorates. Another cause is the lack of a traffic membrane allowing water to infiltrate through the sawn joints and corroding the steel deck.

This issue cannot be resolved without full replacement of the concrete slab on deck.

Image 10: Weathering Steel/Galvanized Deck Interaction

Item 005: Concrete Abutments/Piers

Overall, the concrete piers and abutments are in good condition. A few locations are experiencing spalling of the concrete and exposed corroded rebar. The south pier between spans 1 and 2 has an exposed section of reinforcement the full width of the Pier. Further exposure to the elements will result in additional loss of concrete and reinforcement section.

We believe this is a result of inadequate cover for the reinforcement, leading to accelerated corrosion of the reinforcement.

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Image 11: Concrete Pier Spall

Item 006: Bolted Splice Connections

The condition of the bolts at the chord splices were not able to be inspected. Each splice has external cover plates with bolts that thread to an interior nut. Some surface rust was seen at the interior of the chord splice. We are concerned that the bolts are experiencing section loss and severe loss of bearing against the chord walls.

We believe this is caused by the lack of weep holes in the bottom chord, leading to the bottom chords collecting water.

Image 12: Bottom Chord Splice Corrosion

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Landing at North end of Bridge:

While on site we performed a visual observation of the landing attached to the Mason Academic Building, below are our observations.

Image 13: North Raised Landing

The condition of the landing has deteriorated since the observations made in 2019. The steel beams are showing moderate section loss due to corrosion of the top and bottom flanges around the perimeter of the landing. Some localized corrosion was observed at the underside of the deck and at bearing conditions resulting in approximate 90% section loss of the steel deck. The edge angle is experiencing surface rust where it is in contact with the beam top flange.

We believe the corrosion of the underside of the raised landing is due to no galvanizing used on the steel, no special detailing for exterior exposure, no sealant on the concrete slab, and concealed/trapped structure against the building with no weathering protection.

Also, as mentioned in the kick-off meeting, the 2022 flood crest elevation was within feet under the bridge and appears to have chipped off the masonry wrapping on the east column, exposing the steel column to the elements. Due to an exposure of over 2 years and the state of the remainder of the landing, we believe it is unreasonable to repair this column.

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Image 14: North Landing Underside Corrosion

Image 15: Chipping of Masonry from Flooding

Due to the acceleration of corrosion determined by comparing the photos from 2019 to our current photos, and the compromised state of the masonry-wrapped columns from the flood of 2022, it is recommended to remove and replace the landing slab, including all steel support beams and both masonry-wrapped steel columns. The lintels beneath the landing in the parking garage wall, should also be replaced (including the soldier bricks between the lintels and landing support beams) due to their accelerated corrosion. The slab on deck should be replaced with a formed slab and be sealed to prevent further water infiltration.

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Image 16: Lintel Corrosion Under Raised Landing

Replacement

The current condition of the bridge is not sustainable to keep the bridge operational for its intended lifespan. **During replacement efforts the bridge shall remain closed with a barricade that states the closure.** The following elements shall be replaced based on our visual observation.

1. Full superstructure replacement shall be performed. An in-depth load capacity check will be required at a later phase of the project to determine the structural viability of the piers and abutments, however for now, assume they will be retained.
2. If the piers and abutments are found to be structurally sufficient to support the proposed load of the new superstructure, per load capacity calculations, the exposed rebar in the abutments and piers would be repaired. Sawcut around the perimeter of the exposed rebar, undercut concrete to ¾" behind reinforcement, blast clean, prime, and apply repair mortar.
3. The original construction documents planned for a covering over the bridge. It is recommended to incorporate this covering as part of the replacement bridge.
4. Replace the raised landing slab, including all steel supporting members and the two masonry-wrapped columns. Also, replace the two lintels beneath the landing (above the two openings for the parking garage), including the soldier bricks between the lintels and landing support beams.

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Summary:

In summary, we believe that there are two root causes to the bridge deterioration discussed below:

- Use of de-icing salts
  - De-icing salts have been used on the bridge to provide a safe walking path for pedestrians. The salt, mixed with melted snow and ice improperly drains onto the weathering steel and is causing excessive corrosion.
- Bridge detailing
  - Improper drainage of the walking surface:
    - The walking surface drains the salt/water combination onto the bottom chords below.
    - The construction joints in the slab on grade are actively leaching the salt/water combination onto the steel cross members below.
    - Drip edges are not provided, allowing the water to drip from the bottom of the steel members and causing corrosion and delamination.
    - The bridge generally slopes to the West side, leading more water to drain over the West side of the bridge and deteriorate the West side faster.
    - Lack of drainage holes on underside of closed sections.
  - The galvanized deck is in contact with the weathering steel
    - Constant contact with the weathering steel has caused the galvanized steel to deteriorate and lose its galvanized coating.

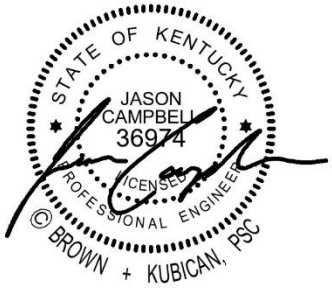
In 2019, we considered both repair and replacement of the bridge superstructure. However, due to accelerated deterioration over the past 5 years, we no longer consider the repair option as viable. The existing bridge was not detailed for serviceability and maintenance, explaining the accelerated corrosion and spalling we have observed. **We recommend a full replacement of the superstructure with one that is properly detailed for serviceability, along with a properly detailed replacement of the raised landing and its supporting structural members.**

Opinion of probable cost:

Due to the speed of project schedule, our opinion of probable cost will be provided under separate cover.

If you have any questions regarding this report, or if we can be any further assistance, please call.

Best regards,



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Additional Photographs

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