RICHLAND ENGINEERING LTD
A WALLACEPANCHERGROUP COMPANY

22185

June 4, 2024

Johnson's Island Road Commission
Mr. Rich Schulz
15559 Pecan Oval
Middleburg Heights, Ohio 44130

Re: 2024 Bridge Inspections
Johnson's Island Causeway
Ottawa, Ohio

Dear Mr. Schulz:

On May 13, 2024, Richland Engineering Limited inspected the five bridge structures on the Johnson's Island Causeway Bridge. All five structures have precast prestressed box beam superstructures with asphalt wearing surfaces and reinforced concrete substructures.

For this report we numbered the bridges 1 through 5 with Bridge 1 being the southernmost bridge near the island and Bridge 5 the northernmost bridge near Marblehead. Bridges 1, 2, 4 and 5 are single-span flow equalization structures with spill-through slopes and 51 feet spans. Bridge 3 is a higher level three-span structure for a small boat navigation channel and is also a spill-through type structure.

The following is a summary of our inspection findings and maintenance recommendations for each structure.

Bridge 1 (southernmost)

Picture 1: Looking north (Bridge 1).
The new approach pavement corrects settlement and smooths the road surface.

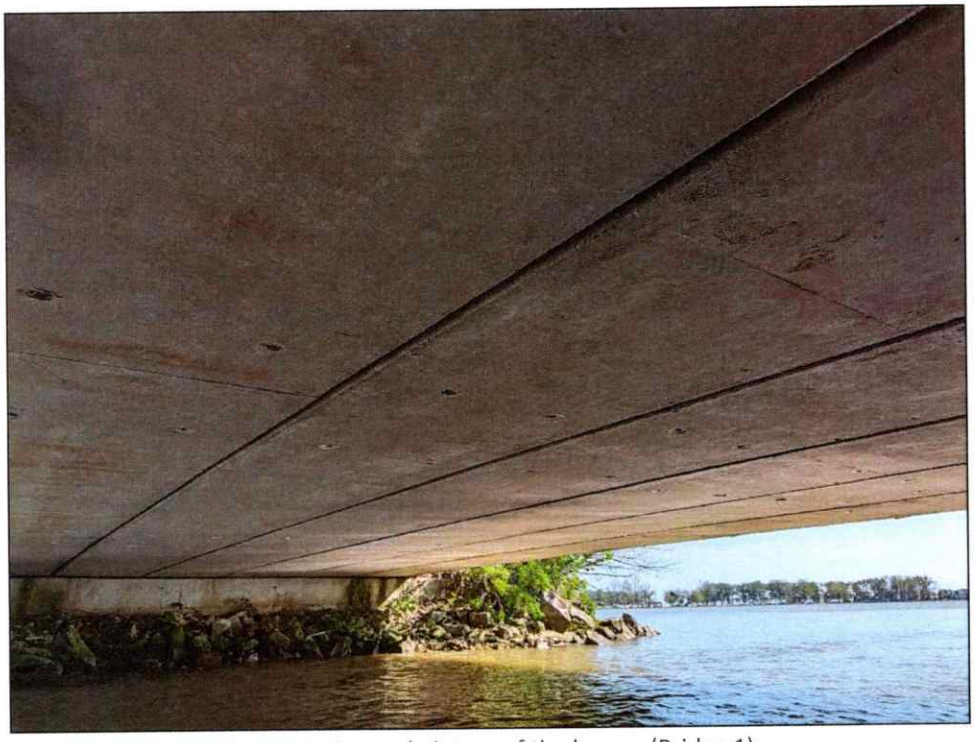
The asphalt wearing surface on the box beams is in good condition. The asphalt pavement behind the abutments was removed to place porous backfill and drainage pipes to drain the fill and correct the settlement. The drip strip works with the beams' waterproofing on both sides of the bridge to keep water from draining down the beam sides. The upturned sections of the drip strip keep water from running directly off the road surface onto the railing posts. These sections are generally covered with asphalt, which allows the water to flow onto the railing posts. The asphalt and waterproofing still seems to be preventing water from draining down to the beams.

The key joints between the box beams were repaired sometime after our 1999 inspection. We noticed some joint cracking during our 2007 inspection. During this inspection, differential beam movement was not apparent even though large vehicles were crossing the bridge and there were no signs of pavement reflective cracks from the box beam joints.

The northernmost railing post on the east side of the bridge is missing. The northernmost railing post on the west side is missing an anchor nut. Another three posts on the bridge have loose nuts. The single guardrail rail without a tubular backup does not meet current minimum standards.

The box beams are in satisfactory condition with some problem locations. There are spall locations at the southwest bearing and the west beam joint is wide at the bottom. There are many locations of water staining from previous leaking through the beam joints visible on the bottom. However, as mentioned above, the waterproofing seems to have stopped the water leakage through the deck.

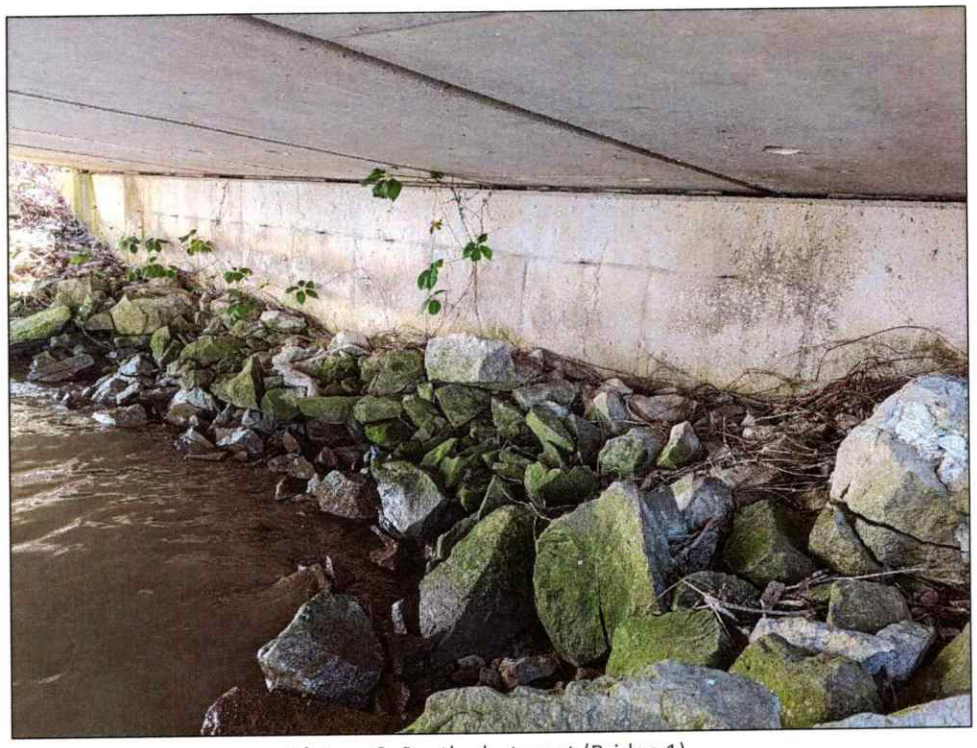
Picture 2: Wearing surface (Bridge 1).



Picture 3: General picture of the beams (Bridge 1).

Picture 4: Missing railing post at northeast (Bridge 1).

Picture 5: North abutment (Bridge 1).



Picture 6: South abutment (Bridge 1).

Probably the most serious problem is the cracking, leaking and rusting found on the north end of the east beam. The cracking and beam damage had been previously progressing due to water leaking through the asphalt and down the beam joints. The waterproofing of the top and end of the beam seems to have stopped the water from progressing the beam's damage. The life of this beam is hard to quantify, but 10 to 15 years seems to be a safe estimate.

The abutments are in good condition with only minor spalls and water stains at a few locations. Water is no longer running out from under the beams across the seats and down the breast walls due to the installation of the waterproofing. The rock channel protection in front of the abutments, protecting them from wave action, is also in good condition. Vegetation on the rock channel protection can cause problems for the bridge (see Pictures 4, 5, and 6). Growing trees can dislodge the rock from protecting the abutments, and the trees' growth can add unwanted forces to the bridge. Vines and other vegetation growing near or on the bridge holds moisture against the bridge and can possibly build up enough to affect normal performance of some aspects of the bridge.

Overall Bridge 1 is in satisfactory condition and the new waterproofing has done a lot to limit future additional deterioration.

Bridge 1 Maintenance and recommendations:

- Replace missing railing post and fix anchor bolt problems with other posts.
- Consider upgrading railing to deep beam railing with tubular backup.
- Maintain the rock channel protection around and in front of the abutments.
- Remove vegetation from the rock channel protection at the abutments.
- Remove asphalt covering the drip strip at the railing posts.

Bridge 2

Picture 7: Looking north (Bridge 2).
The new approach pavement corrects settlement and smooths the road surface.

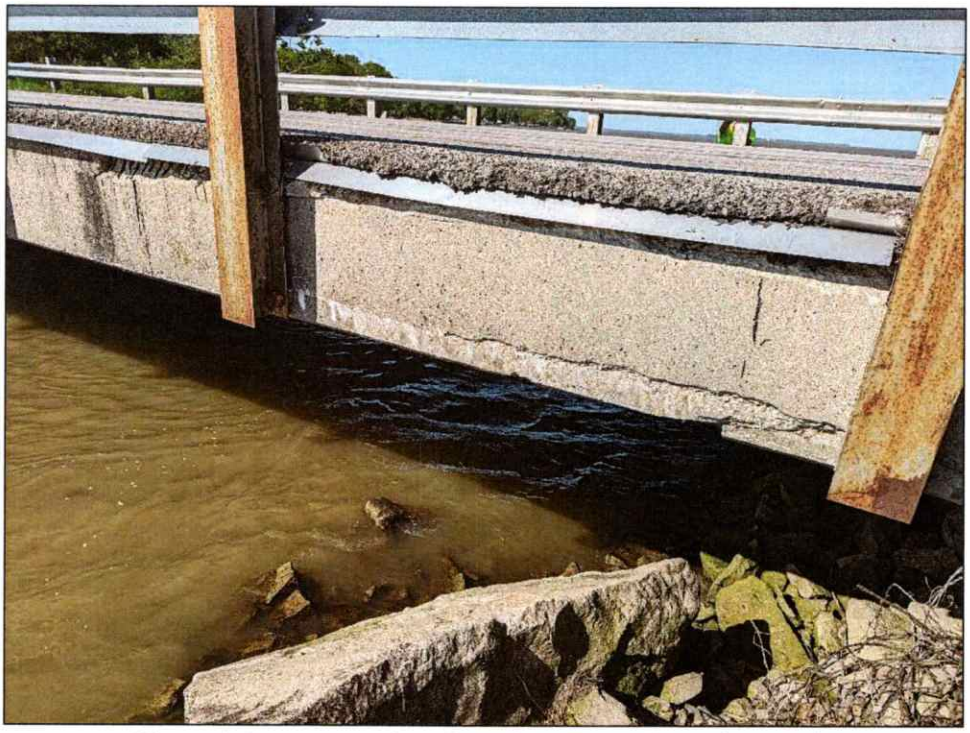
The asphalt wearing surface on the box beams is in good condition. The asphalt pavement behind the abutments was removed to place porous backfill and drainage pipes to drain the fill and correct the settlement. The drip strip works with the beams' waterproofing on both sides of the bridge to keep water from draining down the beam sides. The upturned sections of the drip strip keep water from running directly off the road surface onto the railing posts. These sections are generally covered with asphalt, which allows the water to flow onto the railing posts. The asphalt and waterproofing still seems to be preventing water from draining down to the beams.

The key joints between the box beams were also repaired at the same time as Bridge 1. During this inspection, there were pavement reflective cracks (see Picture 8) from the box beam joints over the eastern half of the bridge, which usually indicate differential movement at beam joints.

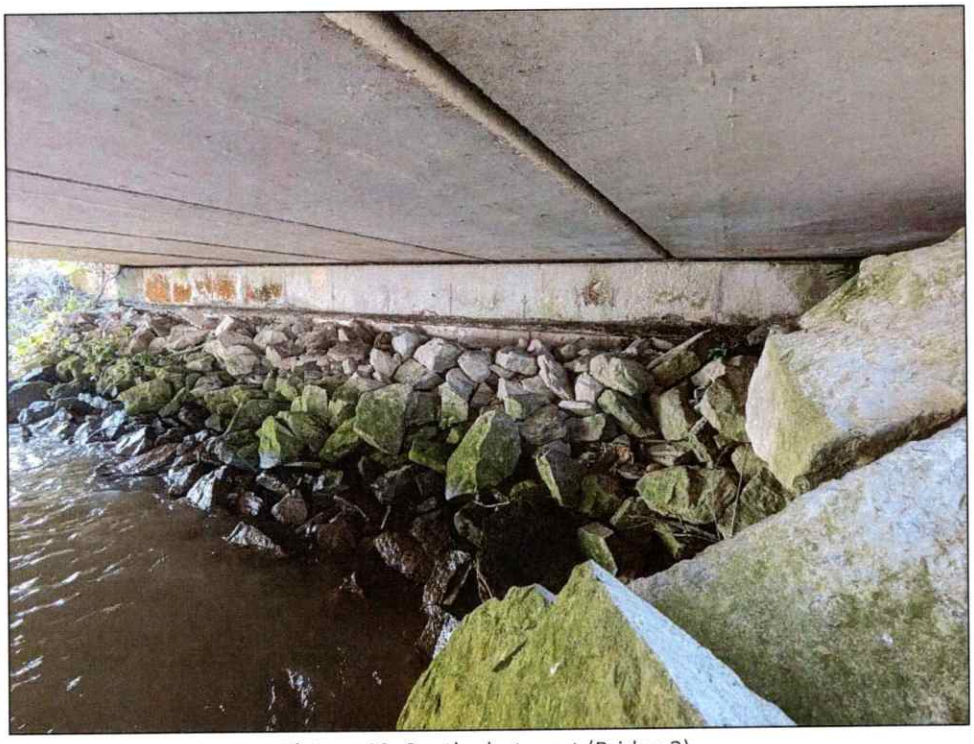
The north railing post on the east side has apparently been hit, cracking the side of the box beam and compromising the anchorage. This railing does not meet minimum standards.

The box beams are in fair condition with a major problem in the east beam with large cracks and delaminated concrete due to the railing post anchorage breaking from collision damage. The life of the beam is now much reduced since the steel reinforcing and prestressing strands have been exposed to water and deicing chemicals (see Picture 9) and there are locations of water staining through the beam joints visible on the bottom. However, the waterproofing seems to have eliminated this water leakage now. The life of this beam is hard to quantify, but 10 years seems to be a safe estimate.

Picture 8: Cracks in the wearing surface (Bridge 2).



Picture 9: Damage on edge of east beam at north end (Bridge 2).



Picture 10: South abutment (Bridge 2).

The abutments are in good condition after being repaired since being severely eroded at the water level on the front faces. The repairs still look in good condition, and there is now rock channel protection around and in front of the abutments protecting them from wave action. The rock channel protection is in good condition.

Overall Bridge 2 is in fair condition and the waterproofing has done a lot to limit future additional deterioration (especially since the east beam has been damaged).

Bridge 2 Maintenance and recommendations:

- It is probably too late to repair or improve the damaged east beam and replacement will eventually be required. However, the water drainage through the beam has been greatly reduced with the installation of the waterproofing and this could greatly extend the beam's life. Patching the outside edge of the beam and then sealing it may also help to slow the deterioration of beam strands. Do not patch the bottom, because if water is entering the beam from another place, the patch will not let water escape and the strands will deteriorate faster.
- Consider upgrading railing to deep beam railing with tubular backup. At a minimum tighten or add nuts on the posts as required.
- Maintain the rock channel protection around and in front of the abutments.
- Seal the cracks in the asphalt wearing surface.
- Remove asphalt covering the drip strip at the railing posts.

Bridge 3

Picture 11: Looking north (Bridge 3).
The new approach pavement corrects settlement and smooths the road surface.

The asphalt wearing surface on the box beams is in good condition. The asphalt pavement behind the abutments was removed to place porous backfill and drainage pipes to drain the fill and correct the settlement. The drip strip works with the beams' waterproofing on both sides of the bridge to keep water from draining down the beam sides. The upturned sections of the drip strip keep water from running directly off the road surface onto the railing posts. These sections are generally covered with asphalt, which allows the water to flow onto the railing posts. There are transverse cracks (that are mostly sealed) in the asphalt pavement at the ends of the beams at each abutment and over the piers at the continuity connection points. There is enough deflection of the beam spans and rotation at the bearings to keep these joints moving. The waterproofing and sealing of these joints seem to be preventing water infiltrating into the beam system.

There is a small hole in the east railing in the north span. The railing does not meet minimum standards.

The box beams are in satisfactory condition. The end span beams are a smaller size than the center span beams, and a special two-level pier seat is required to raise the seat up for the end spans. In this case the infill continuity concrete was poured between the center span beams and end span high seat limiting expansion movement of the center span. Cracking and spalling of the continuity concrete and asphalt wearing surface cracks are the likely consequence. Some patching of this concrete at the side of the deck appears to have been done.

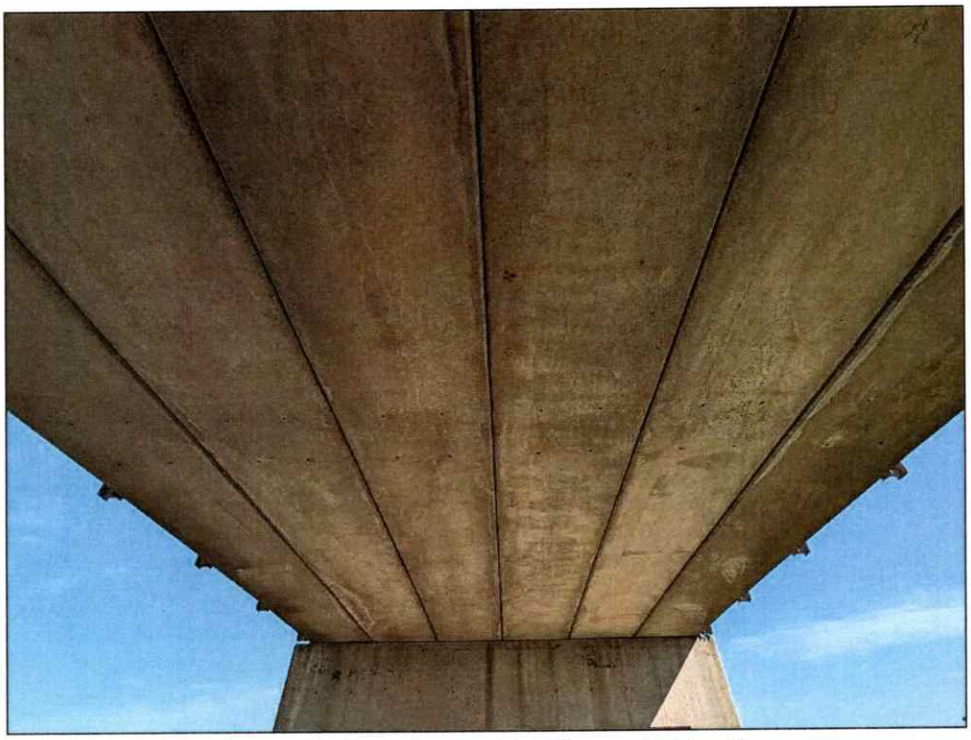
Picture 12: Small hole in east railing (Bridge 3).

There are many locations of staining from previous water leaking through the beam joints visible on the bottom of the concrete. This is especially true at the piers and abutments where water was previously running down the pier caps and the faces of the abutments from the various leaks above. All these areas appear dry now after the installation of the waterproofing.

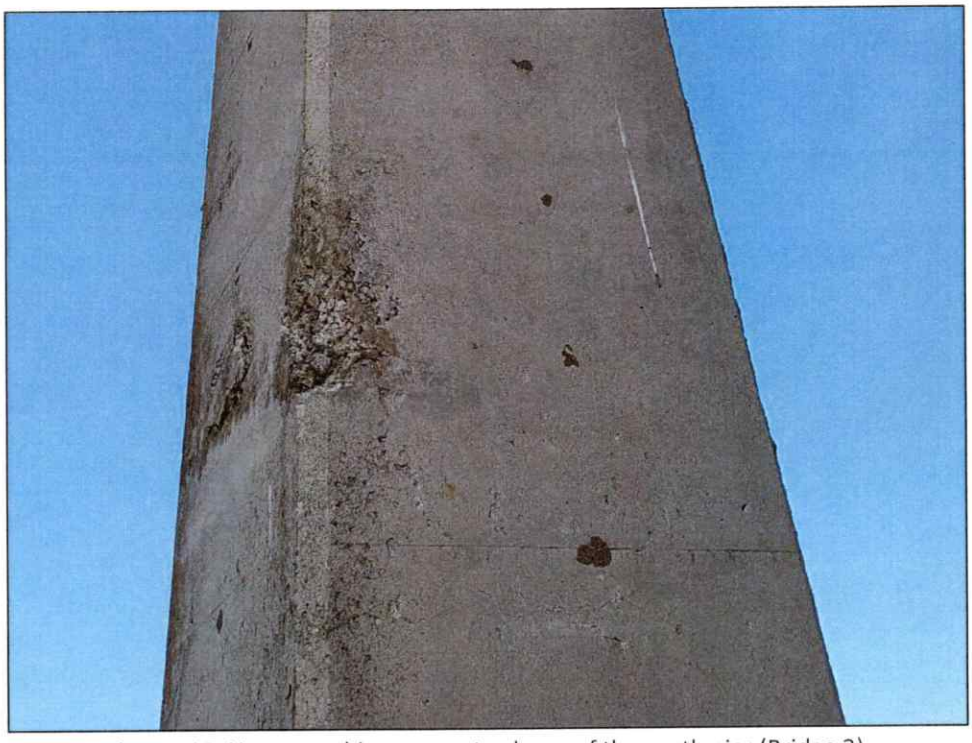
The abutments are in good condition. The water previously leaking from the superstructure has stained the face of the abutments (see Pictures 16 and 17), but the concrete surfaces all seem to be dry now. The spill-through slopes, in front of the abutments, are rutted, muddy with some rock protection. Vegetation on the spill-through slope can cause problems for the bridge (see Pictures 15 and 16). Growing trees can dislodge the rock from protecting the substructure, and the trees' growth can add unwanted forces to the bridge. Vines and other vegetation growing near or on the bridge holds moisture against the bridge and can possibly build up enough to affect normal performance of some aspects of the bridge.

The piers are in good condition after being repaired since being severely eroded at the water level on the front face of the pile cap. The repairs were done well, and rock channel protection still protects the piers from wave action.

The pier legs, especially the north pier, were constructed with a lot of honeycomb areas. There are several cracks and one spall area on the west leg of the north pier. There is water staining on the pier cap from the superstructure, but cap and leg areas seem to be dry now. There does not seem to be much change or additional deterioration when compared with previous inspections.

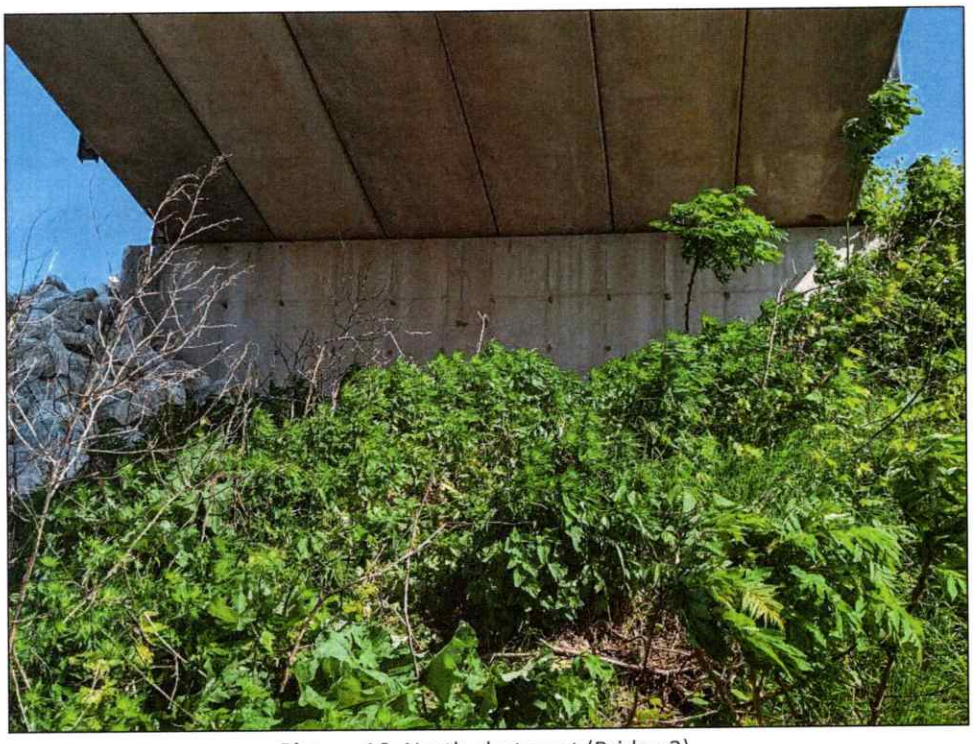


Picture 13: Typical underside of beams (Bridge 3).



Picture 14: Honeycombing on west column of the north pier (Bridge 3).

Picture 15: Spall with exposed rebar at southeast corner of the north pier (Bridge 3).



Picture 16: North abutment (Bridge 3).

Picture 17: Animal holes at top of south slope (Bridge 3).

The pavement behind the north abutment had previously settled and created a bump for southbound traffic coming on to the bridge. This area was dug out so the waterproofing and drain system could be installed but could still exhibit some settlement. New preventative rock was placed along the west side and has likely stabilized the embankment, which was previously steep from settling over time.

Overall Bridge 3 is in satisfactory condition and the waterproofing has done a lot to limit future additional deterioration.

Bridge 3 Maintenance and recommendations:

- Consider upgrading railing to deep beam railing with tubular backup.
- Patch spall and honeycomb areas on piers legs. Epoxy-Urethane sealing could also be done after repairing the pier legs.
- Continue to use an asphalt sealer at the pavement joints over the piers and at the abutments.
- Monitor the settlement behind the north abutment and then patch the pavement when the bump up to the bridge becomes significant. Observe the embankment and any erosion or movement on the slopes possibly causing change that is affecting the settlement of the pavement above.
- Remove vegetation from the spill-through slope and around the piers and abutments.
- Remove asphalt covering the drip strip at the railing posts.

Bridge 4

Picture 18: Looking north (Bridge 4).
The new approach pavement corrects settlement and smooths the road surface.

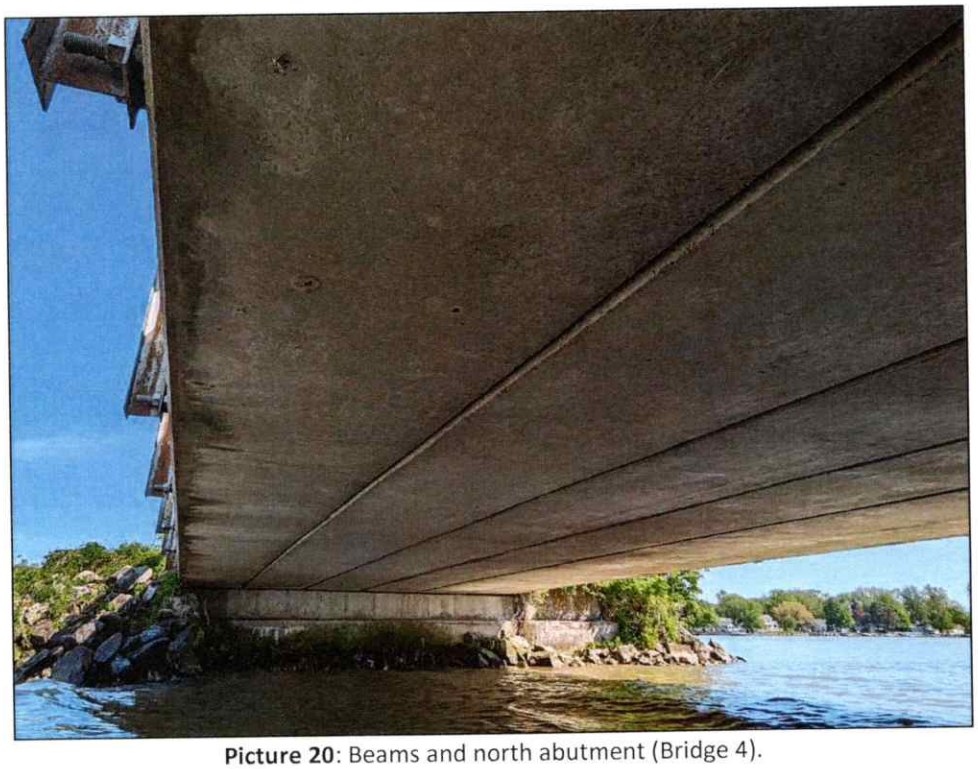
The asphalt wearing surface on the box beams is in good condition. The asphalt pavement behind the abutments was removed to place porous backfill and drainage pipes to drain the fill and correct the settlement. The drip strip works with the beams' waterproofing on both sides of the bridge to keep water from draining down the beam sides. The upturned sections of the drip strip keep water from running directly off the road surface onto the railing posts. These sections are generally covered with asphalt, which allows the water to flow onto the railing posts. The asphalt and waterproofing still seems to be preventing water from draining down to the beams.

The key joints between the box beams were also repaired at the same time as Bridge 1. During this inspection, differential beam movement was not apparent even though large vehicles were crossing the bridge, but there were some reflective cracks from the box beam joints that had been sealed (or partly sealed). The beam joints on this bridge seem to be wider than normal and have always been a problem that is causing asphalt cracking (see Picture 19). The waterproofing membrane seems flexible enough to allow some movement between beams and still prevent leakage between the beams.

The railing has two posts with untightened nuts. This railing does not meet minimum standards.

The box beams are in good condition, but have the key joint problem as mentioned above. There is no sign of leakage between the beams or water draining down the abutments, indicating that the waterproofing is working well.

Picture 19: Wearing surface (Bridge 4).



Picture 20: Beams and north abutment (Bridge 4).

Picture 21: South abutment (Bridge 4).

The abutments are in good condition after being repaired since being severely eroded at the water level on the front faces. Rock channel protection was added around and in front of both abutments to protect against wave action, but there is some missing in front of the south abutment (see Picture 21).

The pavement seems to be smooth over the bridge and approach pavement transition and no sign of sagging or settlement was noticed like what was seen at the previous inspection.

Overall Bridge 4 is in good condition.

Bridge 4 Maintenance and recommendations:

- Consider upgrading railing to deep beam railing with tubular backup. At a minimum tighten the nuts on the posts as required.
- Maintain the rock channel protection around and in front of the abutments (especially at the south abutment).
- Continue to seal any reflective pavement cracking over the bridge.
- Remove asphalt covering the drip strip at the railing posts.

Bridge 5 (northernmost)

Picture 22: Looking north (Bridge 5).
The new approach pavement corrects settlement and smooths the road surface.

The asphalt wearing surface on the box beams is in fair condition. The asphalt pavement behind the abutments was removed to place porous backfill and drainage pipes to drain the fill and correct the settlement. The drip strip works with the beams' waterproofing on both sides of the bridge to keep water from draining down the beam sides. The upturned sections of the drip strip keep water from running directly off the road surface onto the railing posts. These sections are generally covered with asphalt, which allows the water to flow onto the railing posts. The asphalt and waterproofing seem to be preventing water from draining down to the beams for most of the bridge. There is one active leak in the 2nd beam joint from the west at the north abutment. This leak seems to be new from the last inspection.

The key joints between the box beams were also repaired at the same time as Bridge 1. During this inspection, there was a longitudinal crack along the centerline that could be a reflective crack and may be indicative of differential movement from the box beam joint below.

The railing is in good condition but does not meet minimum standards.

The box beams are in good condition. There is one active leak in the 2nd beam joint from the west at the north abutment indicating that the waterproofing is mostly working.

The abutments were repaired on this bridge also and are now in good condition. Rock channel protection was added around and in front of the abutments to protect against wave action but is now largely missing in front of both the north and south abutments (see Pictures 27 and 28).

Picture 23: Wearing surface (Bridge 5).

Picture 24: Erosion at northwest corner (Bridge 5).

Picture 25: Beams (Bridge 5).

Picture 26: Leaking beam joint at north abutment (Bridge 5).
(This leak was not present during the previous inspection)

Picture 27: North abutment (Bridge 5).

Picture 28: South abutment (Bridge 5).

Picture 29: Transverse cracks at north transition (Bridge 5).

There are transverse cracks in the pavement at the north end of the bridge in the southbound lane. These cracks can be indicative of settlement behind the north abutment.

Overall Bridge 5 is in good condition.

Bridge 5 Maintenance and recommendations:

- Consider upgrading railing to deep beam railing with tubular backup.
- Maintain the rock channel protection around and in front of the abutments (especially at the south abutment).
- Seal the cracks in the asphalt wearing surface in hopes of eliminating or reducing the water leakage in the 2nd beam joint from the west. If the sealing does not work, then you may want to consider removing a portion of the asphalt over this section and repairing or overlaying the waterproofing.
- Remove asphalt covering the drip strip at the railing posts.

If the Commission desires to load rate the bridges, we are able to do that. Please feel free to contact us with any future questions about maintenance or bridge repair details.

The following is included for your use:

- A copy of the current ODOT Bridge Inspection Report Form for each bridge.
- A copy of pictures taken during the inspection.

We previously gave you a copy of ODOT Standard Drawing DBR-2-73 (deep beam railing with tubular backup). If you need another copy sent to you, then please let us know.

We can supply details and have some ideas for upgrading the railing and repairing the damaged post anchorages. Let us know if you desire to make any of these improvements and we would be happy to assist you in any way.

Please contact us if you have any questions or need to meet with us to discuss the findings.

Sincerely,

RICHLAND ENGINEERING LIMITED
A WallacePancher Group Company

Douglas H. Timmer

Douglas H. Timmer, P.E.