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119013

May 9, 2019

Johnson's Island Property Owners Association
Mr. Rich Schulz
15559 Pecan Oval
Middleburg Heights, Ohio 44130

Re: 2019 Bridge Inspections
Johnson's Island Causeway
Ottawa, Ohio

Dear Mr. Schulz:

On March 29, 2019, 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 will number the bridges 1 through 5 with number 1 being the southern most bridge near the island and number 5, north near Marblehead. Bridges 1, 2, 4 and 5 are single span flow equalization structures with spill through slopes and 51 feet spans. Bridge number 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 (south most)

Photo #1 is looking south at Bridge #1. The asphalt is in good condition and there are no reflective cracks from the box beam joints seen in the pavement at this time.

The asphalt wearing surface on the box beams is relatively new and is in good condition. The asphalt pavement over the box beams was removed relatively recently and a waterproofing membrane was placed on the top of and behind the end of the beams to below the beam seat level. There is now an effective drip strip that works with the waterproofing on both sides of the bridge to keep water from draining down the beam sides. The asphalt and sealing work seems to have been done well and should prevent 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 northern most railing post on the bridge is missing on the east side. The northern most railing post on the west side is missing an anchor nut and another three nuts are loose. The single guardrail rail without a tubular backup does not meet current minimum standards.

Photo #2 is looking north along the east side of the bridge. Note how dry the beams and abutments are. The waterproofing seems to be working well.

Photo #3 is looking at the south abutment. The dark spots seen on the abutment breast wall just appear to be staining from previous water leakage.

Photo #4 shows the missing railing post near the end of the east side that should be replaced.

Photo #5 is at taken at the north end of the east beam that was damaged and cracked allowing water from the deck to cause additional deterioration. Notice how dry it is now (compare with the wet rusty condition seen on the bottom of the beam in the previous report).

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 spalled and wide at the bottom. There are numerous locations of water staining from previous leaking through the beam joints visible on the bottom. However, as mentioned above, the new waterproofing seems to have stopped the water leakage through the deck.

Probably the most serious problem is the cracking, leaking and rusting found on the north end of the east beam (see photo #5). The cracking and beam damage had been previously progressing due to water leaking through the asphalt and down the beam joints. Hopefully, the waterproofing sealing of the top and end of the beam will greatly limit additional deterioration. 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.

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

Bridge #1 Maintenance and Repair Recommendations

1. Replace missing railing post and fix anchor bolt problems with other posts.

2. Consider upgrading railing to deep beam railing with tubular backup.

3. Maintain the rock channel protection around and in front of the abutments.

Bridge #2

Photo #6 is looking south at Bridge #2. The asphalt is in good condition and there are no reflective cracks from the box beam joints seen in the pavement at this time.

The asphalt wearing surface on the box beams is relatively new and is in good condition. The asphalt pavement over the box beams was removed relatively recently and a waterproofing membrane was placed on the top of and behind the end of the beams to below the beam seat level. There is now an effective drip strip that works with the waterproofing on both sides of the bridge to keep water from draining down the beam sides. The asphalt and sealing work seems to have been done well and should prevent water from draining down to the beams.

The key joints between the box beams were also repaired at the same time as bridge #1. The repaired joints appear to be functioning fairly well now on this bridge. 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 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.

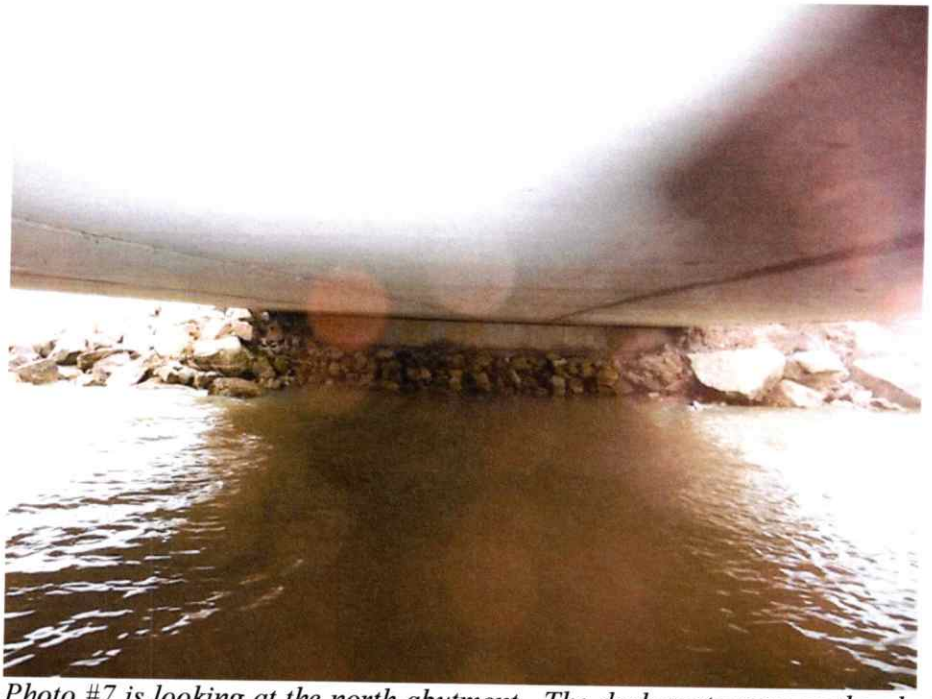

Photo #7 is looking at the north abutment. The dark spots seen on the abutment breast wall just appear to be staining from previous water leakage.

Photo #8 is looking at the south abutment. Note how dry the beams and abutments are. The waterproofing seems to be working well.

Photo #9 shows cracking and deterioration of the north end of the bottom of the east beam. This damage apparently resulted from an impact to the railing.

Photo #10 shows the same east beam damaged area looking at it from under the bridge. The beam bottom is now dry after the installation of the waterproofing.

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 photos #9 & 10) 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.

The abutments are in satisfactory 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 new waterproofing has done a lot to limit future additional deterioration (especially since the east beam has been damaged).

Bridge #2 Maintenance and Repair Recommendations

1. It is probably too late to repair or improve the damaged east beam and replacement will be eventually 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.

2. Consider upgrading railing to deep beam railing with tubular backup. At a minimum tighten or add nuts on the posts as required.

4. Maintain the rock channel protection around and in front of the abutments.

Bridge #3

Photo #11 is looking north at Bridge #3. The asphalt is in good condition and there are no reflective cracks from the box beam joints seen in the pavement at this time.

The asphalt wearing surface on the three span box beam bridge is relatively new and is in good condition. The asphalt pavement over the box beams was removed relatively recently and a waterproofing membrane was placed on the top of and behind the end of the beams to below the beam seat level at the abutments. There is now an effective drip strip that works with the waterproofing on both sides of the bridge to keep water from draining down the beam sides. The asphalt and sealing work seems to have been done well and should prevent water from draining down to the beams. There are sealed transverse cracks 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 new waterproofing and sealing of these joints should prevent 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 (see Photo #14).

Photo #12 is looking at the south pier and abutment. Note the steepness of the embankment slope. The rock channel protection is in good condition. The vines and brush have been sprayed.

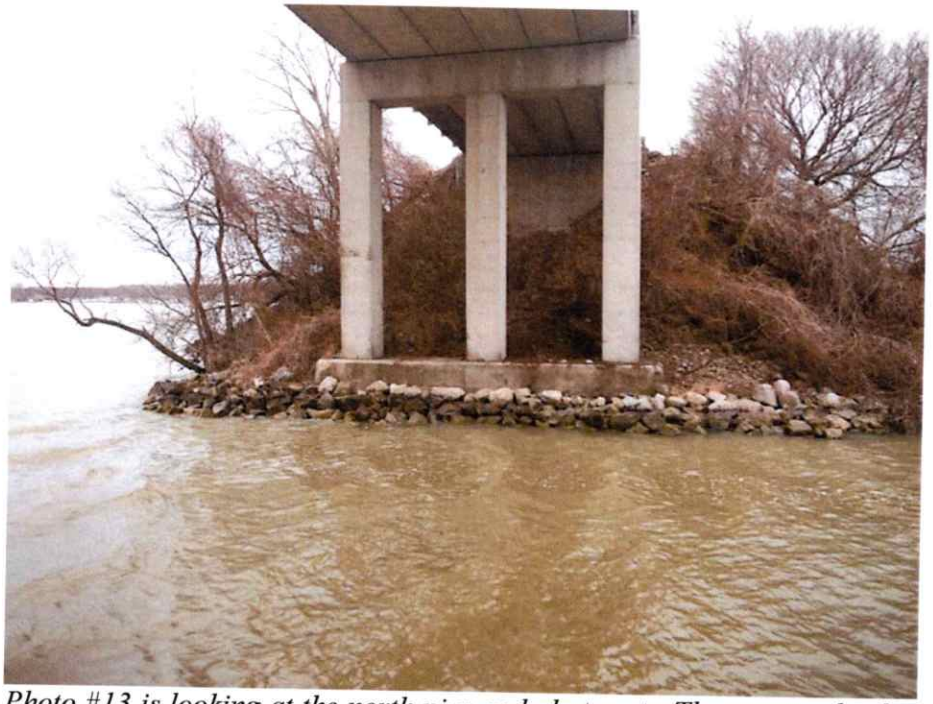

Photo #13 is looking at the north pier and abutment. The steep embankment is very uneven and eroded. The rock channel protection is also in good condition here. The bottoms of the beams in all spans appear to be dry.

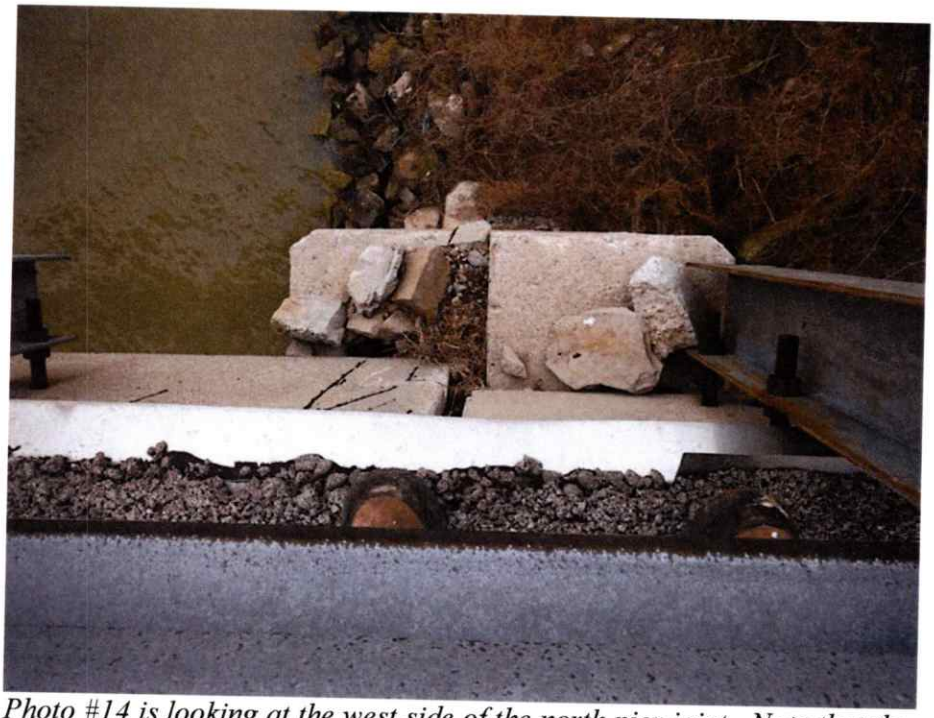

Photo #14 is looking at the west side of the north pier joint. Note that there is no concrete in the joint here between the beams. The other locations still have the concrete in the joint or have been patched.

Photo #15 shows the honeycombed and spalling concrete at the north pier. There does not seem to be much change from previous inspections.

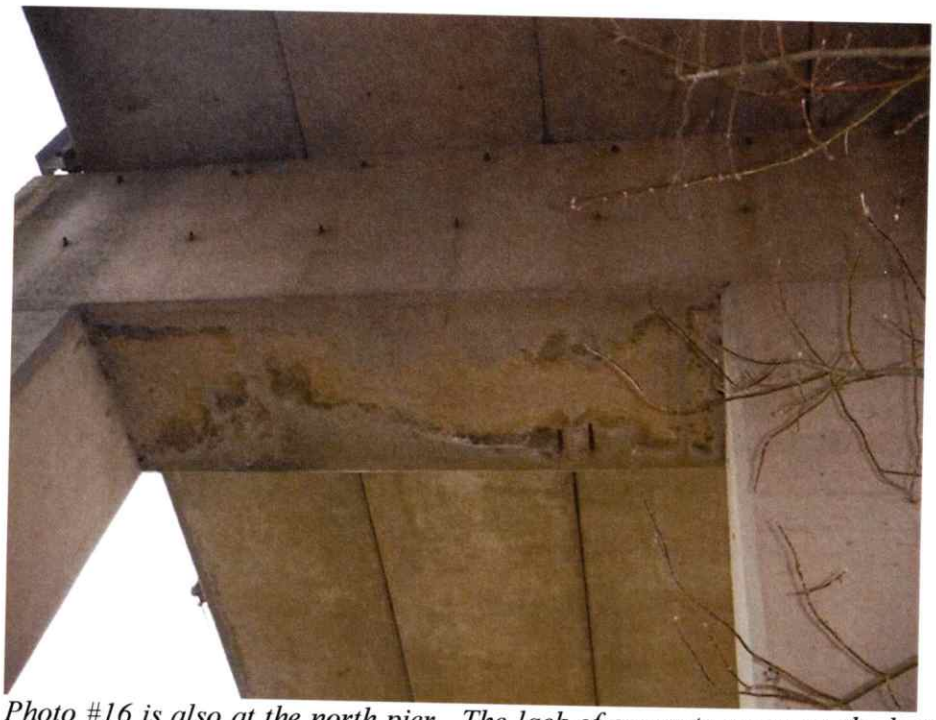

Photo #16 is also at the north pier. The lack of concrete cover on the bottom of the pier cap is the cause of the exposed bars here.

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 satisfactory condition. The water previously leaking from the superstructure has stained the face of the abutments (see Photo #12), 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. Most of the vines and briers appear have been sprayed and are dead now.

The piers are in satisfactory 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 now protects the piers from wave action.

The pier legs, especially the north pier, were constructed with a lot of honey comb 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 addition deterioration when compared with previous inspections.

Photo #17 is behind the north abutment and shows the embankment settlement.

The pavement has settled behind the north abutment and has created a bump for south bound traffic coming on to the bridge. This area was dug out so the waterproofing and drain system could be installed. It seems that the steep embankment may be bulging out and settling over time. This problem has been noticed over several inspections and appears to be an ongoing, long term problem.

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

Bridge #3 Maintenance and Repair Recommendations

1. Consider upgrading railing to deep beam railing with tubular backup.

2. Patch spall and honey comb areas on piers legs. Epoxy-Urethane sealing could also be done after repairing the pier legs.

3. Continue to use an asphalt sealer at the pavement joints over the piers and at the abutments.

4. 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 effecting the settlement of the pavement above.

Bridge #4

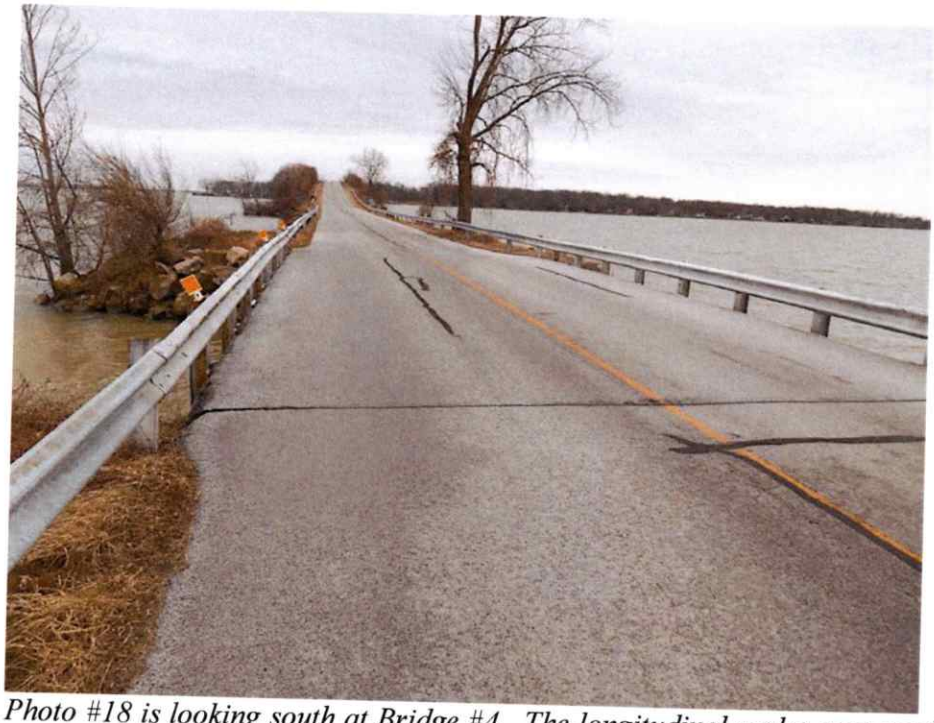

Photo #18 is looking south at Bridge #4. The longitudinal sealer seen on the deck is apparently over one of the beam joints.

The asphalt wearing surface on the box beams is relatively new and is in good condition. The asphalt pavement over the box beams was removed relatively recently and a waterproofing membrane was placed on the top of and behind the end of the beams to below the beam seat level. There is now an effective drip strip that works with the waterproofing on both sides of the bridge to keep water from draining down the beam sides. The asphalt and sealing work seems to have been done well and should prevent 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, 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 photo #19). The waterproofing membrane should be flexible enough to allow some movement between beams and still prevent leakage between the beams.

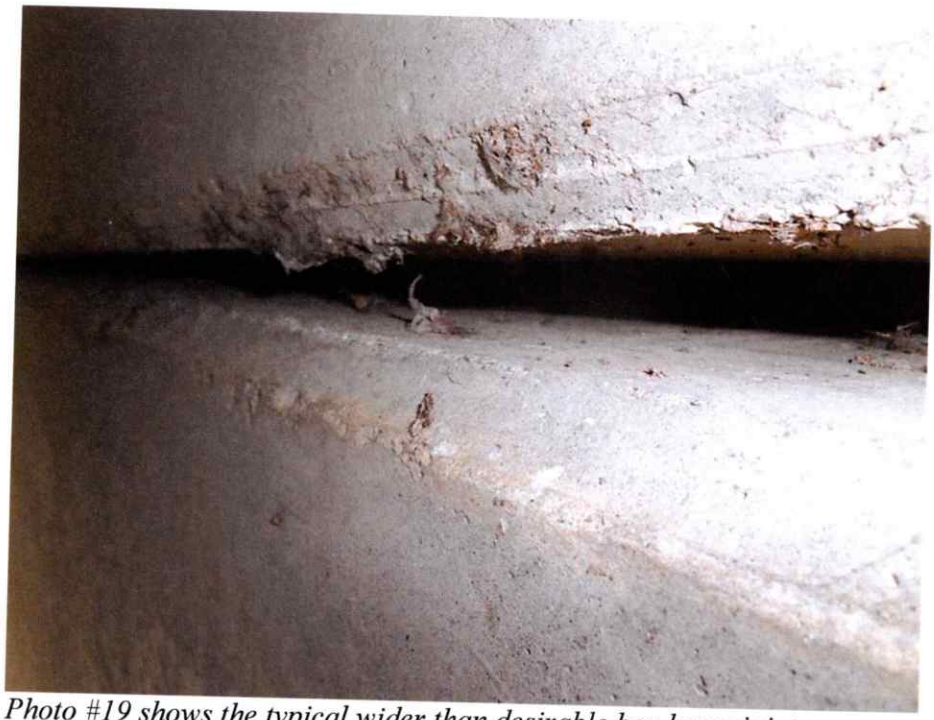

Photo #19 shows the typical wider than desirable box beam joints,

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.

The abutments are in satisfactory condition after being repaired since being severely eroded at the water level on the front faces. There is now rock channel protection around and in front of the abutments protecting them from wave action. The south abutment rock has moved down or washed away and more is required (see photo #21).

Photo #20 is looking at the north abutment. Adding additional rock channel protection would be desirable.

Photo #21 is looking at the south abutment. Some of the rock channel protection appears to have slumped down in front of the abutment breast wall.

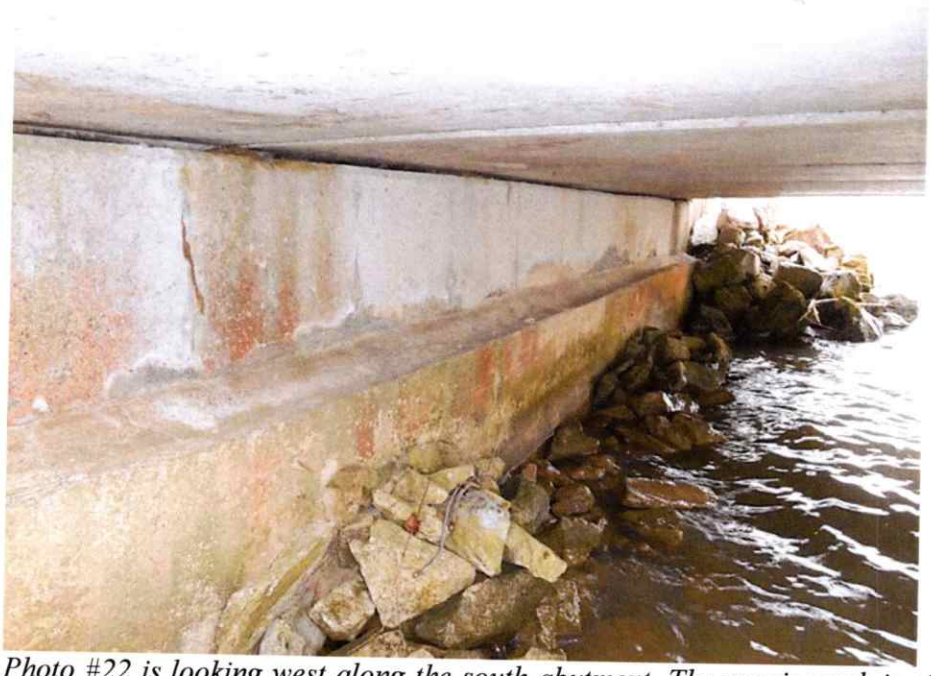

Photo #22 is looking west along the south abutment. The repair work is visible and it is still in good condition.

The new 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 the Bridge #4 is good condition.

Bridge #4 Maintenance and Repair Recommendations

1. Consider upgrading railing to deep beam railing with tubular backup. At a minimum tighten the nuts on the posts as required.

2. Maintain the rock channel protection around and in front of the abutments (especially at the south abutment).
3. Continue to seal any reflective pavement cracking over the bridge.

Bridge #5 (North most)

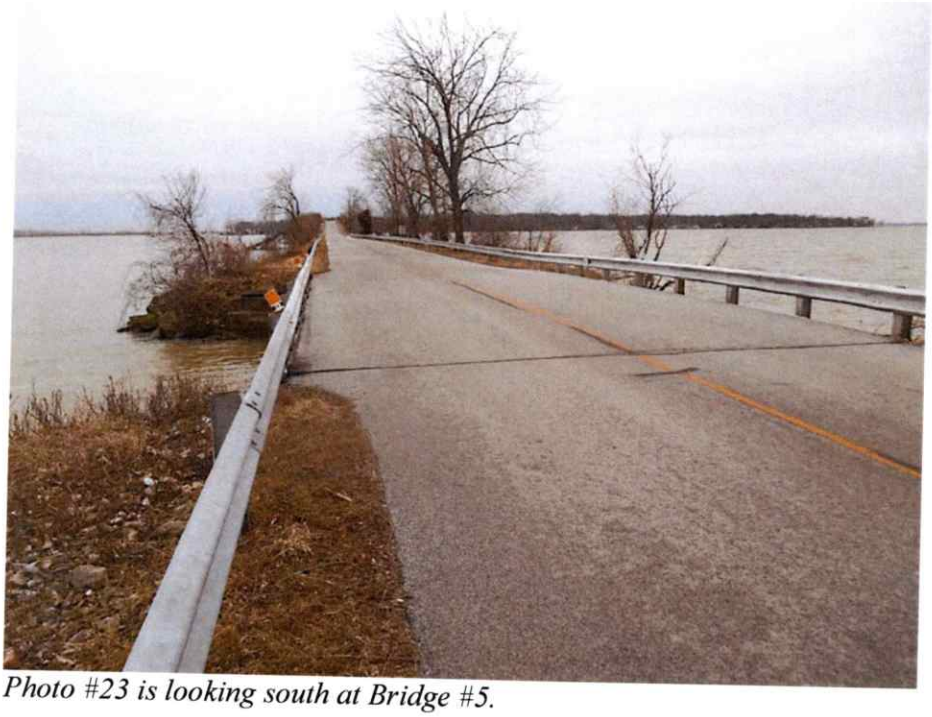

Photo #23 is looking south at Bridge #5.

The asphalt wearing surface on the box beams is relatively new and is in good condition. The asphalt pavement over the box beams was removed relatively recently and a waterproofing membrane was placed on the top of and behind the end of the beams to below the beam seat level. There is now an effective drip strip that works with the waterproofing on both sides of the bridge to keep water from draining down the beam sides. The asphalt and sealing work seems to have been done well and should prevent 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 no reflective cracks from the box beam joints were noticed.

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

The box beams are in good condition. There is no sign of leakage between the beams or water draining down the abutments indicating that the waterproofing is working well.

The abutments were repaired on this bridge also and are now in satisfactory 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 photos #24-#26).

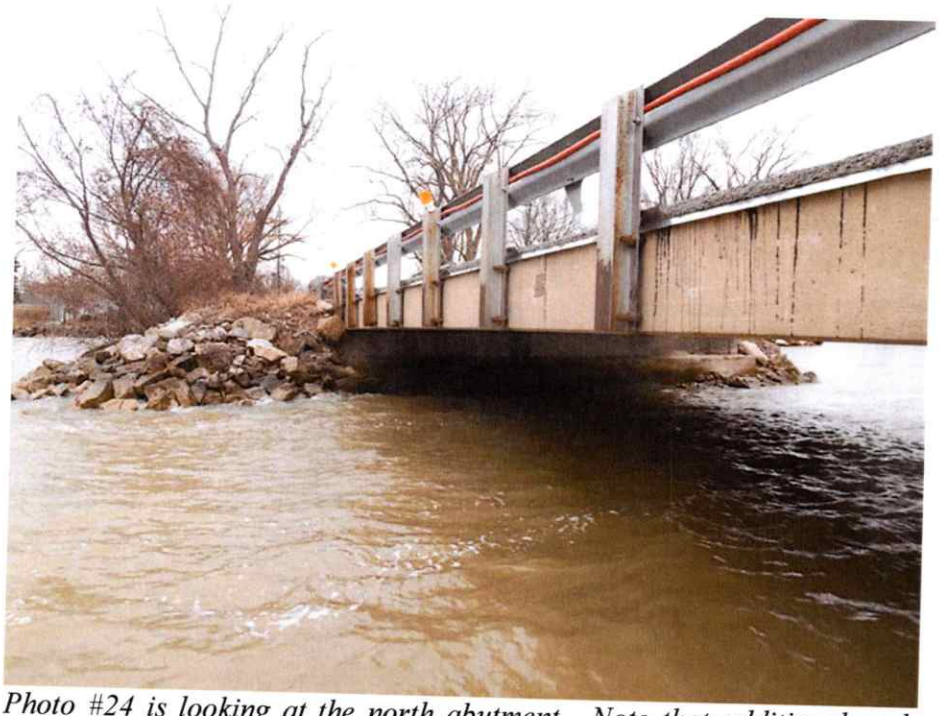

Photo #24 is looking at the north abutment. Note that additional rock channel protection is needed.

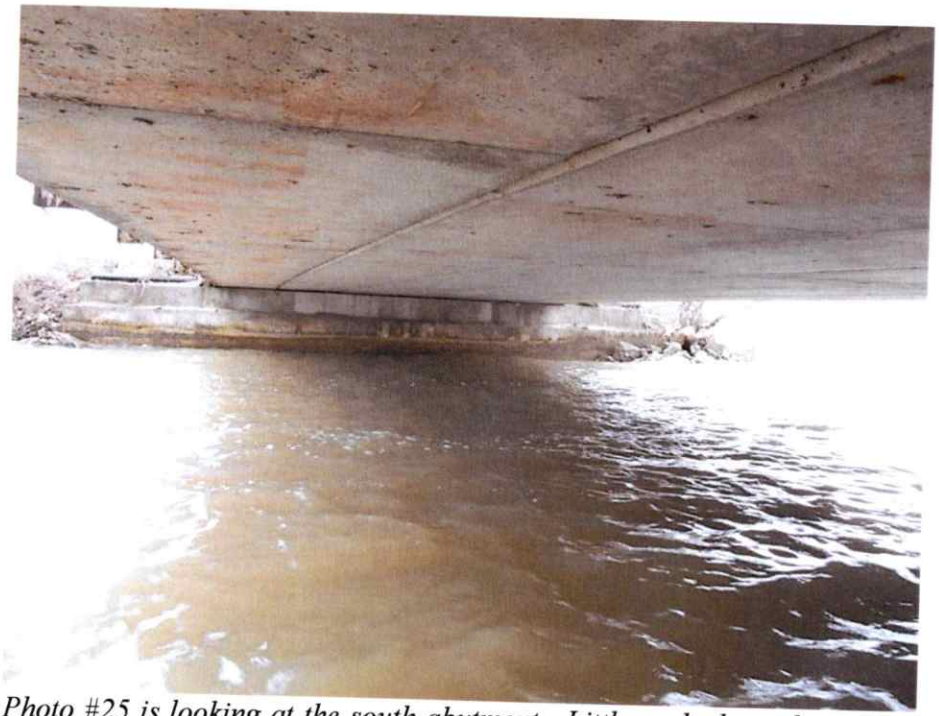

Photo #25 is looking at the south abutment. Little rock channel protection is still visible above the water. Note that the bottom of the beams and the face of the abutment are dry now with the new waterproofing.

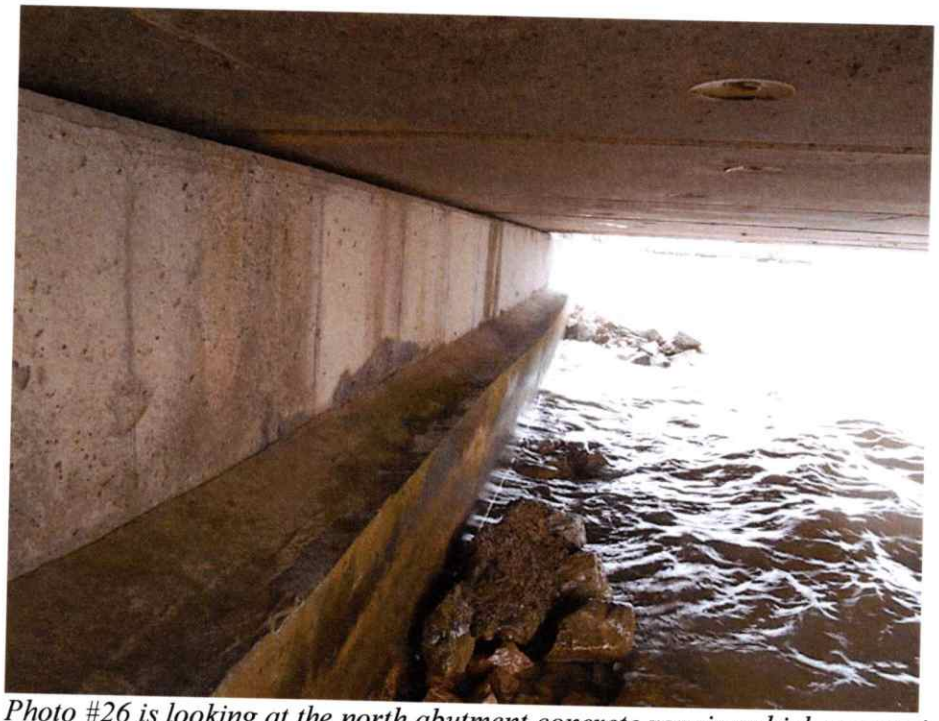

Photo #26 is looking at the north abutment concrete repairs which appear in good condition.

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

Overall the Bridge #5 is in good condition.

Bridge #5 Maintenance and Repair Recommendations

1. Consider upgrading railing and deep beam railing with tubular backup.

2. Maintain the rock channel protection around and in front of the abutments (especially at the south abutment).

If the Association desires to load rate the bridges we are able to do that. Please be 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.
- Copy of ODOT Standard Drawing DBR-2-73 (deep beam railing with tubular backup).

We can supply details and have some ideas for upgrading 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 anyway.

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

Very truly yours,

RICHLAND ENGINEERING LIMITED

Barry L. Neumann, P.E.

BLN
Enc.