

## Summary of Comments on Cover

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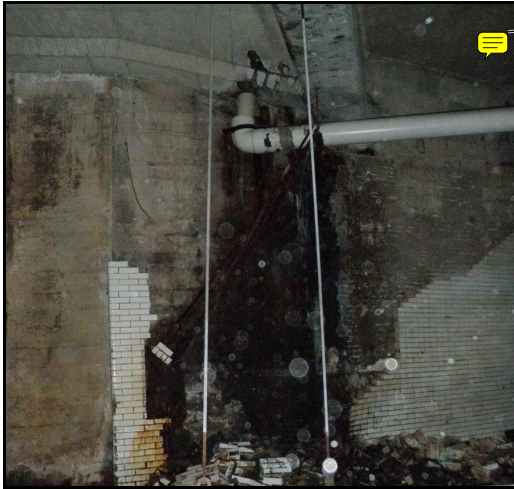
Author: ahaupt Subject: Highlight Date: 9/21/2011 1:07:33 PM  
Routine Maintenance: City of Cleveland; Drainage Repair: Review all drainage pipes for positive connection.  
Major Maintenance: ODOT; review and program project to eliminate standing water at east and west approach.



*Photo 8: Damaged Vandal Protection Fence*

### Drainage

The drainage was rated a 2 which means that it is in Fair Condition. The drainage system effectively moves water out of the travel way and off of the bridge deck. The drain pipes below the upper deck have some breaks and misalignment (See Photo 9). Additionally water pools on the lower deck. It has completely filled the east and west stations and the east tunnel has a large lake of water spanning the entire width of the bridge, approximately 200 feet long and up to 4' deep (See Photo 10).



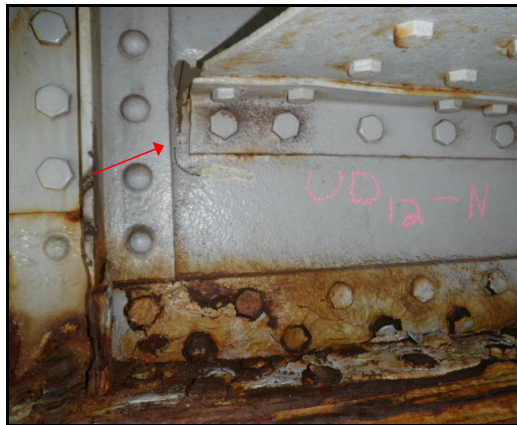
*Photo 9: Broken and Leaking Drainpipe near the East Abutment*



*Photo 10: Standing Water in the East Tunnel*

*Span 4:*

All of the steel floor beams in span 4 have active corrosion and pitting below the openings in the deck where the hangers connect to the trusses. In addition, some of the floor beams have small through holes. The through holes in the north sides of FB-U12, FB-U11', FB-U8' and FB-U6' have not changed since last inspection (See Photos 15 - 18). There are circular welds in the south sides of the webs of FB-U2' and FB-U1' near the connections with the south truss. **These welds are cracked. The northern cracked weld in FB-U2' was previously noted, but the crack has grown. The southern cracked weld in FB-U2' and the cracked weld in FB-U1' are new (See Photos 19-22).**



*Photo 15: Hole in FB-U12-N Showing No Change from Previous Inspection*

*Span 5:*

**North Interior:**

The lower face of the arch rib is cracked and delaminated between columns 2-3.

**South Interior:**

The top interior corner is delaminated for 1' over each side between columns 3-4.

**South Exterior:**

The interior face from columns 1-3 has large cracks and the concrete sounds dead, but is not delaminated. The exterior face is cracked with small isolated delaminated areas from columns 13-15; over the same range, the interior face is cracked with no delaminated areas.

*Span 6:*

**North Exterior:**

The bottom face is cracked, 50% of the surface area is delaminated between columns 1-3. The bottom interior corner is cracked and delaminated between columns 6-7. The exterior face is cracked and delaminated over 50% of the area from columns 9-12.

**North Interior:**

No deficiencies noted.

**South Interior:**

No deficiencies noted.

**South Exterior:**

The exterior face from columns 2-3 is cracked and delaminated. The bottom face from columns 3-4 is spalled with exposed reinforcing. Spall is 4' long, 2' wide, 6" deep, with a large delaminated area around the spall (See Photo 39).



Photo 39: Spalled and Delaminated Area in the South Exterior Arch Rib of Span 6

South Exterior:  
No deficiencies noted.

Span 11:  
No deficiencies noted.

Span 12:  
North Exterior:  
The exterior face of Column 5 is spalled.

North Interior:  
No deficiencies noted.

South Interior:  
No deficiencies noted.

South Exterior:  
No deficiencies noted.

Span 13:  
No deficiencies noted.

**Bearing Devices**

The Bearing Devices were rated a 2, meaning that they are in Fair Condition. The Span 4 bearings have cracked retaining washers, some of the cracks have grown or are newly noted this inspection (See Photos 44-48). The steel bolsters are heavily corroded due to standing water inside the bolsters.



Photo 52: Typical Crack Monitor Installed on a Crack in the Cellular Construction

*Tower A:*

No noted deficiencies

*Tower B:*

Cracked and delaminated, the south side of the tower is moving away from the bridge. Crack monitors have been installed at the deck level. (See Photos 53-56).

*Tower 1:*

No noted deficiencies

*Tower 2:*

Southeast corner is spalled nearly full-height

*Tower 3:*

The north face of the tower is completely map cracked from the base up to 10' above the arch-ribs, all concrete is tight (See Photo 57-59 for typical map-cracked area).

*Tower 10:*

The exterior face of the north exterior pillar on the span 9 side is cracked and delaminated from 2' above the lower deck to 6' below the lower deck. On the span 10 side it is cracked, delaminated and spalled along column 1 for 15' below the lower deck. All the concrete is tight.

The exterior face of the south exterior pillar on both the span 9 and 10 sides is spalled around the corbel; this concrete is loose.

*Tower 11:*

The exterior face of the north pillar is map cracked for the full height and spalled at column 12 from 4' above the lower deck to 6' below the lower deck on the span 10 side.

The exterior face of the south exterior pillar is spalled around the corbels on both the span 11 and span 12 sides with loose concrete.

*Tower 12:*

The exterior face of the north exterior pillar has a 3' wide spalled and delaminated area extending from the lower deck to the top of the arch rib on the span 12 side. There is some loose concrete.

The exterior face of the south exterior pillar is cracked from the upper deck to the lower deck on the span 11 side. The concrete is tight.

*Tower 13:*

The exterior face of the south exterior pillar has isolated spalls.

The entire tower is map cracked, all the concrete is tight.

**X. General Appraisal and Recommendations**

The Detroit Superior Bridge over the Cuyahoga River was rated as a 5, meaning that it is in Fair Condition. This rating was based on the rating of the substructure. The following maintenance actions are recommended to be performed in the future for this bridge.

Repair/Maintenance Task	Immediately	Ongoing	1-3 years	3-5 years	5+ years
Remove loose corbels	X				
Remove any loose concrete over traveled areas	X				
Monitor the movement of Tower B		X			
Monitor the cracking in the Cellular Construction		X			
Zone paint the steel in Span 4 below the lower deck and at the portals			X		
Repair the drainage in the East Tunnel to prevent ponding on the lower deck				X	
Repair the concrete deck, columns and jack-arches in the West Tunnel					X
Stabilize Tower B if necessary					X



**OBSERVATIONS**

**GENERAL**

- Small amounts of biological growth and zebra mussels were present at the time of inspection. Very little cleaning required.
- Visibility was less than 4 inches.
- The concrete surfaces were sounded with a hammer and found to be in good condition except where noted below.

**CHANNEL**

- Little to no current present at the time of inspection.
- The channel alignment is not perpendicular to the bridge piers. At this specific location, the Cuyahoga River flows in a northeast direction. However the bridge is aligned from northeast to southwest. Only the southeast end of Pier 3 and the northwest corner of Pier 4 are exposed to the river.
- Upstream and downstream of the bridge steel sheet pile walls direct the flow. A steel sheet pile dolphin helps protect Pier 4 from barge traffic on the east bank of the river. Likewise, the remains of a steel sheet pile wall exist on the west river bank beside Pier 3. Both of these steel structures, regardless of their condition, influence the flow of water and the bottom topography around the piers.
- The bottom material around Pier 3 consists of rebar, concrete rubble and various other construction debris. The bottom topography slopes steeply towards the center of the river. Conversely, the bottom around Pier 4 consists of flat, soft mud. The depths are shown in Figure 1.

**DEFECTS & DEFICIENCIES**

**PIER 3**

- The concrete surfaces had up to 1 ½-inch deep scaling typical with exposed aggregate. The conditions in the splash zone and at the corners were much worse. Photos 5, 6 and Figure 2 show heavy scaling and large corner spalls. The corner spall in the splash zone at corner A is 2 feet deep and 2.9 feet tall. It continues in both directions, eventually diminishing to the typical scaling discussed above. Likewise the corner spall in the splash zone at corner B is 1.3 feet deep and 3.7 feet tall. Both corners are rounded from the splash zone to the bottom. No exposed reinforcing steel was detected in these spalls.
- Both corners A and B had large spalls approximately 9 feet below the water surface. The spall on corner A's east face is only 3 inches deep but 2.8 feet tall and 2.8 feet wide. Similarly on corner B, the spall is only 6 inches deep but 1.5 feet tall and travels in both directions approximately 1-foot. It also is in 9 feet of water with no exposed reinforcing steel exposed. The common depth and the clean sharp edges around these defects suggest possible impact damage from a barge. This is also supported by the fact that there is no protection from shipping traffic for this pier.
- The scupper drain pipe above corner A is not properly connected; hence the water leaks by the pipe and runs down the pier face directly over the already damaged corner.

Author: ahaupt Subject: Cuy-480-0957; SFN 1812513 Date: 9/21/2011 1:44:07 PM  
Major Maintenance: ODOT; Lack of collision protection

Author: ahaupt Subject: Cuy-480-0957; SFN 1812513 Date: 9/21/2011 1:43:34 PM  
Routine Maintenance: City of Cleveland; Drainage: disconnect scupper.



- The bottom composition around the submerged section of this pier consists of a large amount of concrete rubble and rebar sloping steeply down towards the center of the channel.
- No exposed footing was present and no other defects were found at the time of inspection.

**PIER 4**

- There is a sinkhole on the surface along the north face of Pier 4 that is 4 feet wide, 8.5 feet long and 5 feet deep. Water was visible at the bottom of the sinkhole. This sinkhole has more than doubled in size since the 2003 inspection (see Photo 10). The backfill material, reinforcing steel and concrete made it impossible to probe perfectly vertical into the bottom of the sinkhole. However, the survey rod was lowered 17 feet into this hole at an angle suggesting a large void below the waterline. The diver probed into this cavity from the outside a distance of 8.1 feet. This is described below and shown in Figure 3.
- The concrete surfaces had up to 1 ½-inch deep scaling typical with exposed aggregate. The conditions in the splash zone and at the corner were worse. The deterioration of the pier concrete at the corner below the horizontal construction joint (splash zone) is approximately 5 inches deep, 1-foot wide and 4 feet tall. This surface is shown in Photos 7 and 8. No exposed reinforcing steel was detected on the bridge pier.
- The bridge scupper drain pipe drips directly onto the river bank wall concrete cap adjacent to the pier corner. The concrete wall cap surrounding the corner of the pier has failed exposing its horizontal reinforcing steel. The 69-foot long wall cap is approximately 30 inches wide by 7 feet tall. This cap intersects the corner of the bridge pier 21 feet from its upstream end (Photos 7 and 8).
- At the time of inspection, the bottom of the wall cap was 2.3 feet below the water surface. Below this, the steel sheet pile and concrete wall is recessed back away from the river. This allows 4.1 feet of pier face to be exposed horizontally underwater below the cap. There is approximately a 6-inch wide void on either side where the pier's northwest corner and north face meet the vertical wall. This area is shown in Figure 3. The diver was able to probe on the right (upstream) void to a depth of 2.6 feet. Original timber formwork is still located in this void area and is shown in Photo 9. The void to the left (downstream) was probed to a depth of 8.1 feet horizontally along the pier face. This is directly below the sinkhole seen on the surface and shown in Photo 10. A pile of bank material was not found below this void on the bottom and soundings do not show this area to be raised.
- The bottom composition around the submerged section of this pier consists of flat soft mud.
- No exposed footing was present and no other defects were found at the time of inspection.

**COMPARISION TO PREVIOUS REPORTING AND SUMMARY**

The concrete deterioration in the splash zone below the horizontal construction joint on Pier 3 is consistent with that documented in the 2003 inspection. Fortunately, reinforcing steel was not exposed in these areas. Likewise, the spalls underwater on Pier 3, corners A and B remain unchanged. The sharp edges of the spalls along with the fact that they are both near the same underwater elevation suggest that impact damage is the probable cause.

For Pier 4, the previous inspection report thoroughly documented the defects of the above water adjacent wall concrete cap structure; however, gave very little detail of the bridge pier concrete defects. By comparing Photo 4 of the 2003 inspection with Photo 8 of this report, we see the pier concrete condition is consistent. In contrast, the above water sinkhole along the north face of Pier 4 has significantly grown in size. The horizontal probing directly below the sinkhole underwater found an 8.1-foot void along the north face of Pier 4. This was measured through the downstream 6" wide vertical void at the wall/pier intersection. This information was not recorded during the previous inspection therefore a comparison cannot be made. The horizontal probing on the upstream wall/pier corner intersection was found to be similar at 2.0 feet in 2003 and 2.6 feet in 2010.

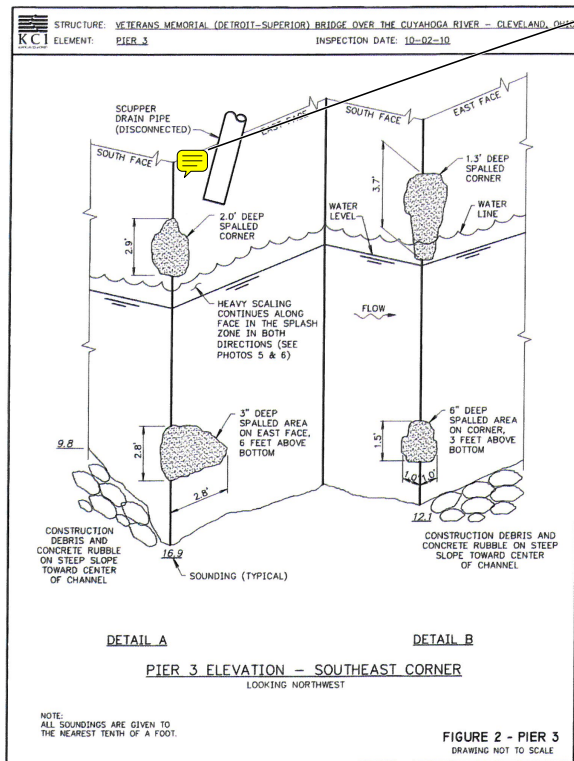
Because the 2003 inspection did not establish a hydrographic reference point, the previous soundings cannot be adjusted and compared to the 2010 inspection soundings. However the 2003 report photos show the water level at a similar elevation. Without a reference point, sounding data is typically useless; we can only generalize about bottom topography trends. With that in mind, the 2010 soundings on Pier 3, corners A and B appear to be 2 feet greater than the 2003 numbers. The 2003 report also indicates a deteriorated steel sheet pile wall east of these corners. The remains of this wall were not found during the 2010 inspection in that area. Only the steel sheet pile to the north (shown in Photo 12) was found. The disappearance of the sheet pile bank protection correlates with the increase in depths below corners A and B on Pier 3's steep bank.

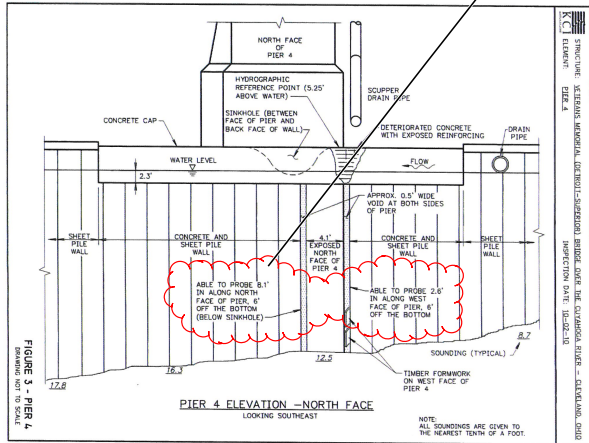
**RECOMMENDATIONS**

As discussed above, Pier 3 is directly exposed to barge/shipping traffic in an area of the Cuyahoga River Channel that is narrow with bends both upstream and downstream. There are three steel sheet pile dolphins for this bridge, though none located around Pier 3. Without the protection of a dolphin, timber pile or steel sheet pile wall, Pier 3 is highly vulnerable to collision damage. Likewise without this protection, the material on this steep slope will continue to move towards the center of the deeper channel eventually exposing the top of the spread footing.

The bank material between the north face of Pier 4 and the retaining wall continues to wash out creating a larger sinkhole on the surface and void below it. There is a pedestrian sidewalk nearby without a sufficient fence separating the two. This sinkhole is a potential liability and should be excavated, the void inspected underwater and finally backfilled with large riprap stone.







CUV-06-1458  
Project Number

Veteran's Memorial Bridge (Detroit Superior Bridge)  
over the Cuyahoga River in Cleveland, Ohio  
Bridge Name

Oct 2, 2010  
Inspection Date

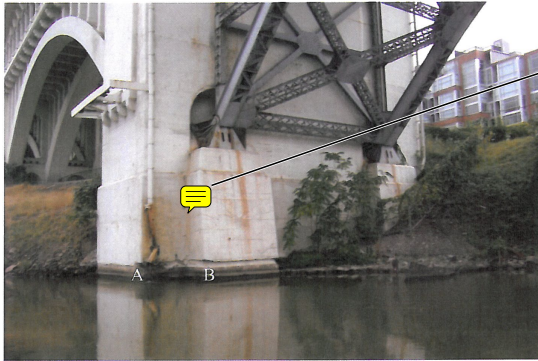


Photo by T. Clower, 10/2/10

Photo 5 – Facing West. East face of Pier 3.  
Note Scupper Pipe disconnected allowing water to run down the east face of the Pier 3.



Photo by M. Suchan, 10/2/10

Photo 6 – Facing North. Southeast corner of Pier 3.  
Note the Scaling and Spalling of the concrete at the construction joint.