2010 PHYSICAL CONDITION REPORT

CUY – 00006 – 1456
DETROIT-SUPERIOR BRIDGE
OVER THE
CUYAHOGA RIVER

CUYAHOGA COUNTY, OHIO SFN 1800930

INSPECTED: AUGUST 30, 2010 THROUGH OCTOBER 3, 2010
REPORT PREPARED: JANUARY 30, 2011

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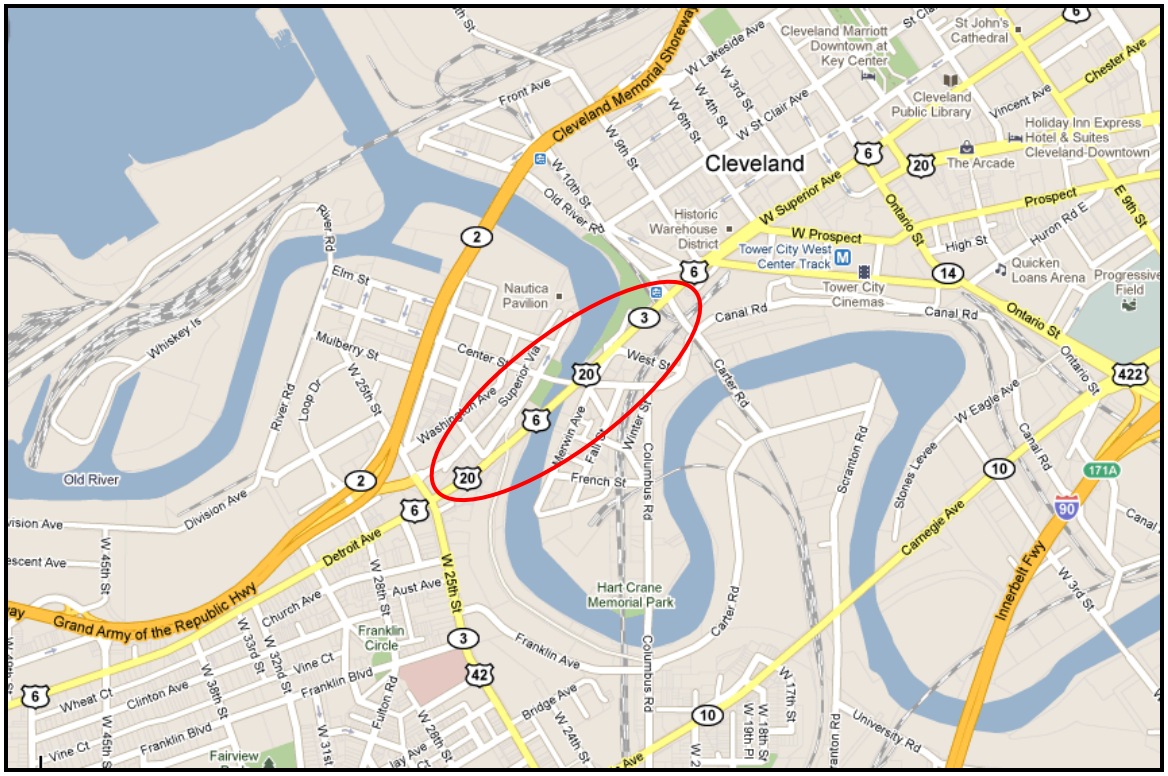


Map of the Location of the Detroit-Superior Bridge over the Cuyahoga River

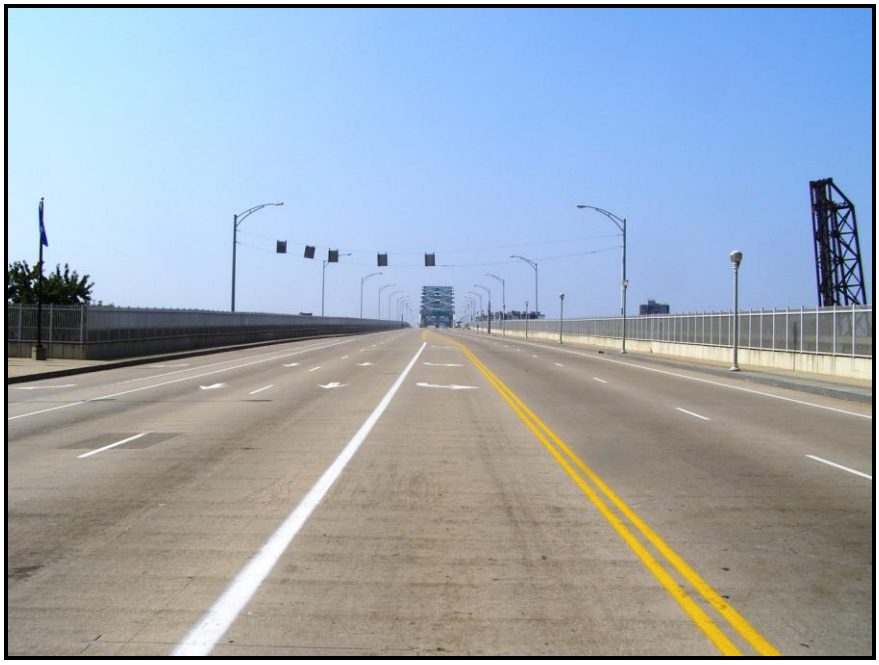
Detroit-Superior Bridge over the Cuyahoga River – South Elevation View of Span 4

II. INTRODUCTION

The Detroit-Superior Bridge, also known as the Veterans Memorial Bridge (CUY-00006-0156, SFN 1800930) carries 6 lanes of traffic over the Cuyahoga River in Cleveland, Ohio. The bridge was constructed in 1917 and had two major rehabilitations in 1970 and 1997.

The Detroit-Superior Bridge consists of a 591 foot, three-hinge steel arch spanning over the Cuyahoga River, 2 spans of cellular construction, 12 spans of concrete open-spandrel arch construction and 2 approach tunnels. The overall length of the bridge is approximately 2,600 feet. The bridge carries concrete upper and lower decks. The upper deck is used for normal traffic service. The lower deck is closed to the public except during the Ingenuity Festival and occasional tours.

Euthenics, Inc. performed an in-depth inspection of this structure between August 30, 2010 and October 3, 2010. Personnel included Micah M. Pilat, P.E. and Luke A. Baker. The superstructure inspection access was achieved using a combination of a 40' man lift and climbing gear. The substructure inspection was achieved using a 125' man lift. All Aerials provided the man lifts.



Detroit-Superior Bridge over the Cuyahoga River – East End View

III. Deck

Summary

The deck is rated a 7, meaning that it is in good condition. The rating is based on the condition of the Floor which is rated 1 – Good.

The individual items are rated as follows:

Floor:	1 - Good
Wearing Surface:	1 - Good
Curbs, Sidewalks &Walkways:	1 - Good
Railing:	1 - Good
Drainage:	2 - Fair
Expansion Joints:	2 – Fair

Floor Slab

The floor slab was rated a 1, meaning that it is in Good Condition. The concrete upper floor slab in Spans 1A, 1B and 1 – 13 have deficiencies in less than 1% of the surface area, the concrete upper floor slabs in the west and east approach tunnels have deficiencies in 33% and 5% of their areas, respectively. Overall the entire deck area is 1% - 5% deteriorated. The following deficiencies were noted:

West Tunnel:
Significant amounts of spalled areas with exposed reinforcing steel, numerous delaminations, large mottled areas, large transverse cracks with efflorescence and failing patches cover approximately 1/3 of the area of the west tunnel floor slab. This section of the slab is by far in the worst shape and should be considered for future replacement based on the area of spalls with exposed reinforcing (See Photos 1 & 2).

Span 1B:
No Deficiencies

Span 1A:
No Deficiencies

Span 2:
No Deficiencies

The joint armor is corroding in the center of the joint between Spans 2 & 3

Span 3:
No Deficiencies

Span 4:
The stay-in-place forms are corroded

There are transverse cracks where utility pipes enter the deck. Cracks typically cross 2 stringers or 3 panels, between L_8-L_9 and L_8'-L_9'

There are spalls with exposed reinforcing, between stringer lines C & D, located between pane points L_7-L_8 (2 spalls), L_{11}-L_{12}, L_{12}'-L_{11}' & L_1'-L_0'

Span 5:
No Deficiencies

Span 6:
No Deficiencies

Span 7:
No Deficiencies

Span 8:
Small edge of a delaminated area visible in the north most panel, between columns 2 and 3

Span 9:
No Deficiencies

Span 10:
No Deficiencies

Span 11:
No Deficiencies

Span 12:
No Deficiencies

Span 13:
No Deficiencies

East Tunnel:
Large transverse cracks with efflorescence, cracking, and staining around the locations where the drain pipes pass through the deck and small longitudinal cracks at the abutment.

Photo 1: Large Crack with Efflorescence in the West Approach Tunnel

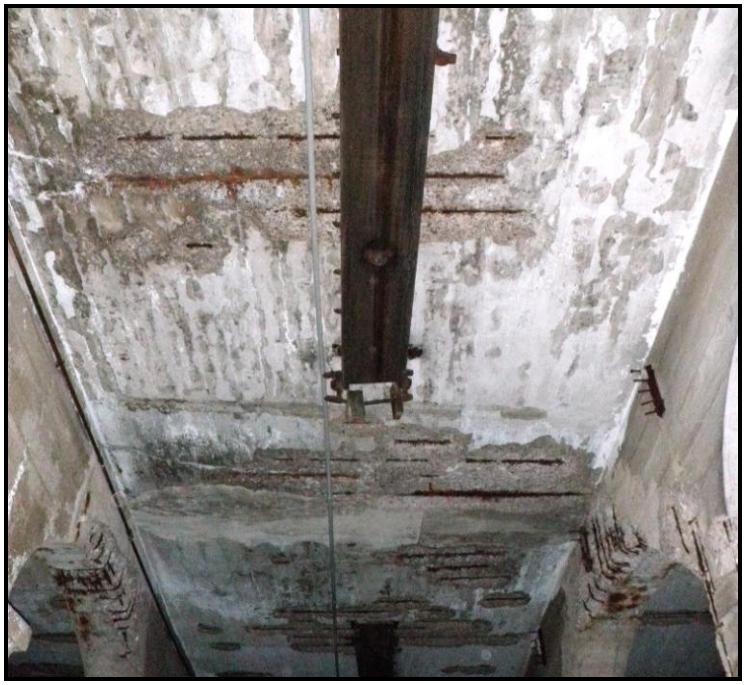


Photo 2: Typical Large Spalled Areas with Exposed Reinforcing Steel in the West Approach Tunnel

Wearing Surface

The wearing surface was rated a 1, meaning that it is in Good Condition. The wearing surface is 1" thick monolithic concrete. The deficient areas make up less than 1% of the total wearing surface area. The following deficiencies were noted:

- Spall with exposed reinforcing immediately southwest of Joint 5 in the leftmost eastbound lane (See Photo 3)
- Spalled patches southwest of Joint 5 in rightmost eastbound lane, full width of the lane, approximately 2″ in the direction of travel and up to 1¾″ deep
- Small popout at Panel Point 11 in the leftmost westbound lane
- Large spalled patch at Panel Point 9, approximately 48″ x 36″ x 1″ deep
- Large spalled patch at Panel Point 7, approximately 24″ x 30″ x 2 ½″ deep (See Photo 4)
- Small spalls along the entire northeast end of the deck

Photo 3: Wearing Surface Popout with Exposed Reinforcing Steel

Photo 4: Large Spall at Panel Point 7

<u>Curbs, Sidewalks and Walkways</u>

The curbs, sidewalks and walkways were rated a 1, which means that they are in Good Condition. There is a concrete sidewalk on the north side of the bridge and a concrete safety curb on the south side of the bridge. There are also curbed traffic dividers that run beneath both of the trusses in Span 4. The deficient areas make up less than 1% of the total area of the curbs, sidewalks and walkways. The following deficiencies were noted:

- Spalls along the southeast sidewalk between joints 7-8, 14-15, 15-16 and 17-18 (See Photo 5)

- Spalls along the south median (traffic divider) between joints 7 and 8 - these spalls are concentrated around where the lower chord passes through the deck

- Long longitudinal cracks run in the northwest section of the sidewalk for approximately 20′ (See Photo 6)

Photo 5: Typical Sidewalk Spall

Photo 6: Typical Longitudinal Cracks in the Sidewalk

Parapet/Railing

The parapet and railing are rated 1 which means that they are in Good Condition. The deficient areas amount to less than 1% of the total parapet and railing areas. The following deficiencies were noted:

- Both the northwest and southeast side concrete parapet is fractured on the northeast side of Joint 9 (See Photo 7)

- The wrought-iron style vandal protection fence is damaged on the southeast side between Joints 12-13 and 15-16 (See Photo 8)

Photo 7: Fractured Concrete Parapet at Joint 9

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

Expansion Joints

The expansion joints were rated a 2 which means that they are in Fair Condition. Measurements were taken at the joint openings along the north and south curb lines as well as at the center of the deck. The joints are numbered from west to east. All of the joints had typical small spalls in the wearing surface along both sides of the joint armor (See Photo 11). Following is the table which lists the joint openings and any deficiencies noted:

Joint Number	Type	Measurement (80 °F)			Comments
		North	Center	South	
1	Strip Seal	1 7/8"	11/16"	1 1/4"	None
2	Strip Seal	1 13/16"	1 3/4"	2 1/32"	The north half of the joint has been damaged by snowplows. The west side of joint armor is ¼" higher than the east side (See Photo 12)
3	Strip Seal	1 7/8"	1 7/8"	1 31/32"	None
4	Strip Seal	1 3/4"	1 7/8"	1 7/8"	None
5	Strip Seal	1 5/8"	1 3/4"	1 3/4"	None
6	Strip Seal	1 7/8"	2"	2 1/8"	There are spalled patches in the wearing surface up to 1 ¾" deep with exposed reinforcing, south of the joint, the full width of rightmost eastbound lane.
7	Strip Seal	1 3/16"	1"	1"	The east side of the joint armor is 3/8" higher than the west side, but there is no plow damage
8	Strip Seal	1 1/2"	1 3/4"	1 15/16"	None
9	Strip Seal	2 1/4"	2"	2"	None
10	Strip Seal	1 1/8"	1 1/2"	1 3/16"	The west side of the joint armor is ¼" higher than the east side. There is plow damage to the west side of the joint armor near the center o f the joint (See Photo 12)

Joint Openings (continued):

Joint Number	Type	Measurement (80 °F)			Comments
		North	Center	South	
11	Strip Seal	2 1/8"	2"	2 1/8"	None
12	Strip Seal	1 5/8"	1 5/8"	1 5/8"	None
13	Strip Seal	1 3/4"	1 7/8"	1 7/8"	None
14	Strip Seal	1 7/8"	1 3/4"	1 7/8"	None
15	Strip Seal	2"	2"	2"	None
16	Strip Seal	1 15/16"	1 7/8"	2"	None
17	Strip Seal	1 7/8"	1 7/8"	1 7/8"	None
18	Strip Seal	2"	2"	1 7/8"	None
19	Strip Seal	1 7/8"	2"	1 15/16"	None
20	Strip Seal	1 5/8"	1 1/2"	1 5/8"	None

Photo 11: Typical Spalls on Both Sides of the Joint Armor

Photo 12: Typical Plow Damage to Joint Armor

IV. Superstructure

Summary

The superstructure was rated a 6, meaning that it is in satisfactory condition. The rating is based on the condition of the Beams, the top Chord and the Lower Chord which are all rated 2 – Fair.

The individual items are rated as follows:

Alignment:	1 - Good
Beams/Girders/Slab:	2 – Fair
Stringers:	2 – Fair
Floor Beams:	2 – Fair
Floor Truss Connections:	2 – Fair
Verticals:	2 – Fair
Diagonals:	2 – Fair
End Posts:	1 - Good
Top Chord:	1 - Good
Lower Chord:	2 – Fair
Lower Lateral Bracing:	2 – Fair
Top Lateral Bracing:	1 - Good
Sway Bracing:	2 – Fair
Portals:	2 – Fair
Bearing Devices:	2 – Fair
Arch:	2 – Fair
Arch Columns or Hangers:	2 – Fair
Protective Coating System:	5 – Fair
Pins/Hangers/Hinges:	2 – Fair
Fatigue Prone Connections:	2 – Fair
Live Load Response:	S – Satisfactory

Alignment

The bridge alignment was rated a 1, meaning that it is in Good Condition. There are no observable discontinuities in the horizontal or vertical alignment of the bridge structures.

Beams/Girders/Slab

The beams were rated a 2, meaning that they are in Fair Condition. The Concrete beams in spans 1A-3 & 5-13 have isolated delaminated areas, cracks and small spalls with exposed reinforcing.

Joists/Stringers

The steel stringers in Span 4 were rated a 2 meaning that they are in Fair Condition. There is some pitting and section loss typical over most of the stringers (See Photo 13). These areas have been repainted and are fine with the following exceptions. The lower web and bottom flanges of the upper deck stringers in lines D, E, P and R (notation starts from A and proceeds alphabetically from northwest to southeast) are heavily corroded with occasional through-holes (See Photo 14). The lower deck stringers below the exterior walkways are corroded but carry only minimal loads.

Photo 13: Old Pitting in Upper Deck Stringers

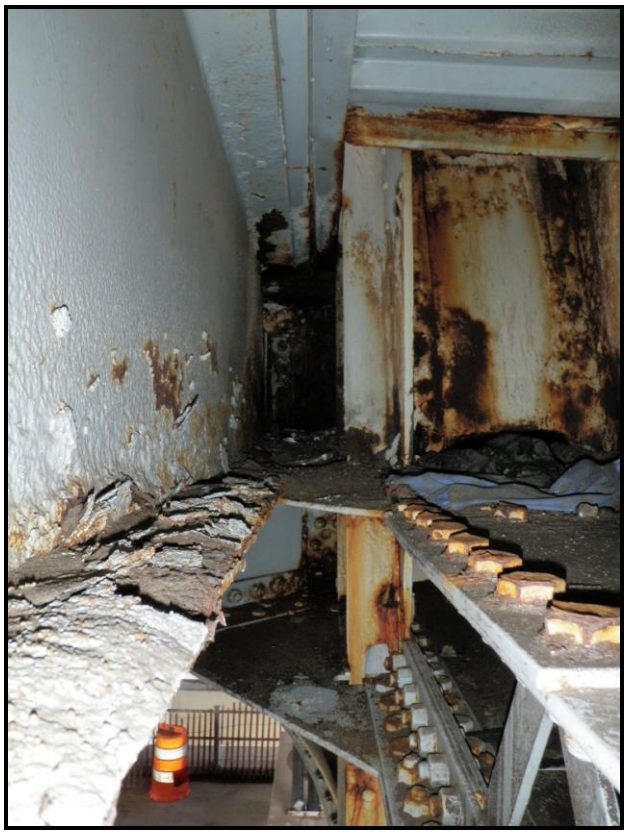


Photo 14: Typical Corroded Bottom Flange of Upper Deck Stringer

Floor Beams

The Floor Beams were rated a 2, meaning that they are in Fair Condition. The floor beams are located beneath both the upper and lower deck. The numbering system proceeds from west to east and starts at 1 at the beginning of each span. The floor beams in Spans 1A-3 and Spans 5-13 are concrete, while those in Span 4 are steel.

Upper Floor Beams:

The upper floor beams in spans 1A, 1B, 1-3, and 5-13 are concrete and span between the jack-arch columns with cantilevered ends. In span 4 they are steel and span between the trusses with cantilevered ends. In the concrete sections, cracks along the floor beams vary from 2 to 10 feet in length, cracks across the beams run the entire width of the beam; delaminated areas are typically 10-15 square feet and spalled areas are typically 2-8 square feet.

The following floor beams have noted deficiencies:

Span 1A:
Floor Beams 3-7 – Spalled between column lines F-D

Span 1B:
Floor Beam 3 – Spalled between column lines A-B

Floor Beam 9 – Spalled between column lines B-C

Span 1:
Floor Beams 4, 6-8 – Spalled between column lines A-B

Span 2:
Floor Beam 7 – Spalled between column lines C-D

Floor Beam 8 – Delaminated and spalled between column lines C-D

Floor Beam 15 – Delaminated between column lines C-D

Span 3:
Floor Beam 8 – Delaminated between column lines B-C & C-D

Floor Beam 10 – Delaminated between column lines C-D

Floor Beam 11 – Spalled between column lines C-D

Floor Beam 14 – Transverse (to the bridge deck) cracks between column lines C-D

Floor Beam 15 – Transverse cracks between column lines C-D

Floor Beam 16 – Spalled between column lines C-D

Floor Beam 17 – Delaminated and spalled between column lines C-D

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

Photo 16: Hole in FB-U11'-N Showing No Change from Previous Inspection

Photo 17: Hole in FB-U8'-N Showing No Change from Previous Inspection

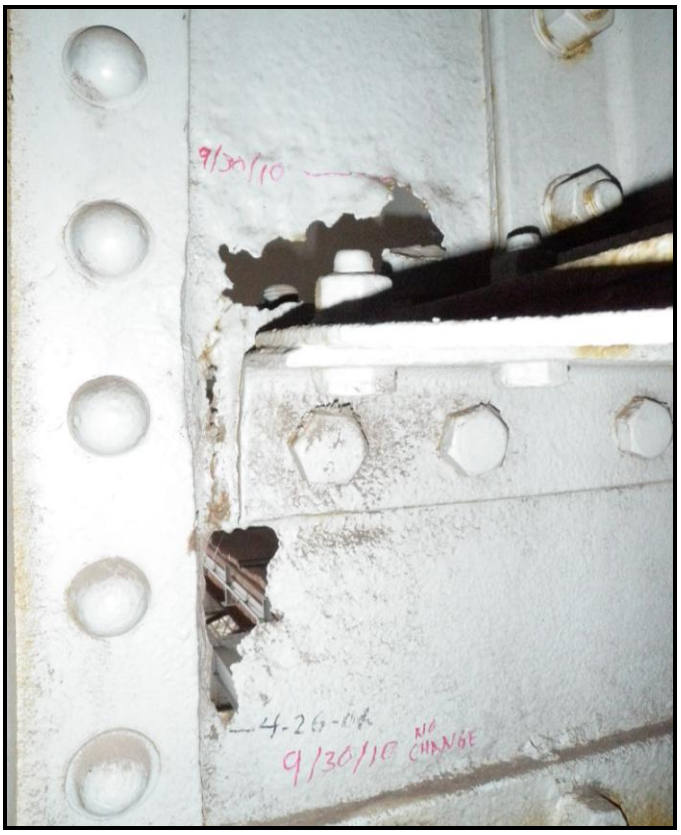


Photo 18: Hole in FB-U6'-N Showing No Change from Previous Inspection

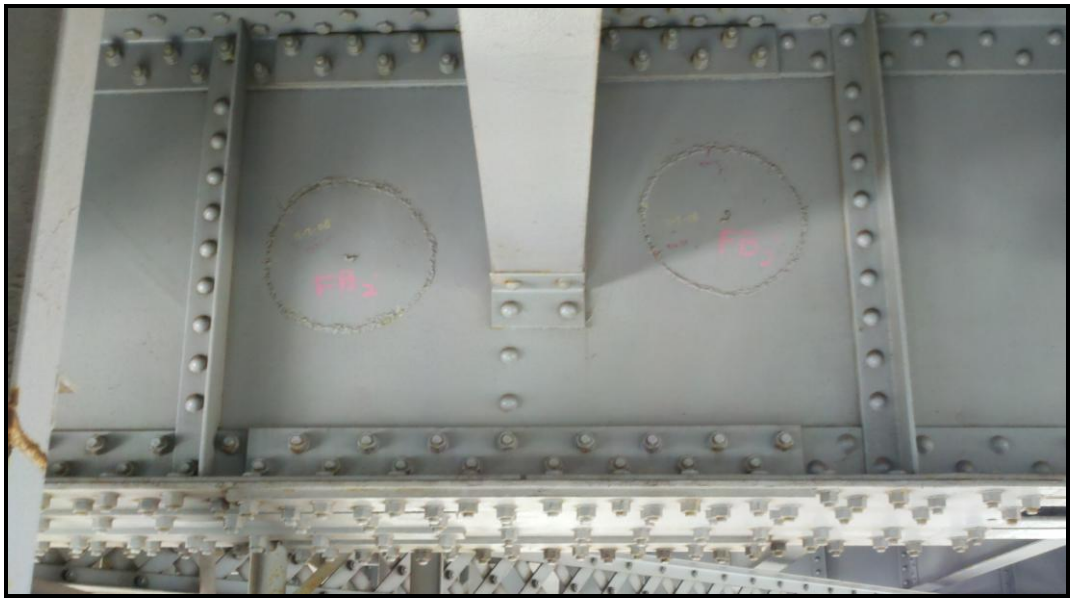


Photo 19: Showing Location of Circular Welds in the South End of FB-U2'

Photo 20: Showing the New Cracked Weld in the Southern Circular Weld in FB-U2'

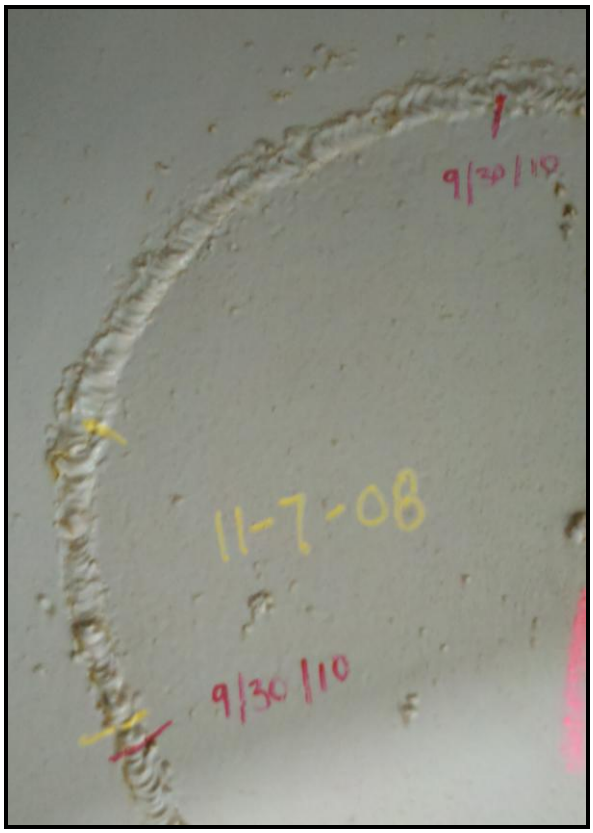


Photo 21: Showing the Extent of the Growth of the Crack in the Southern Circular Weld in FB-U2'

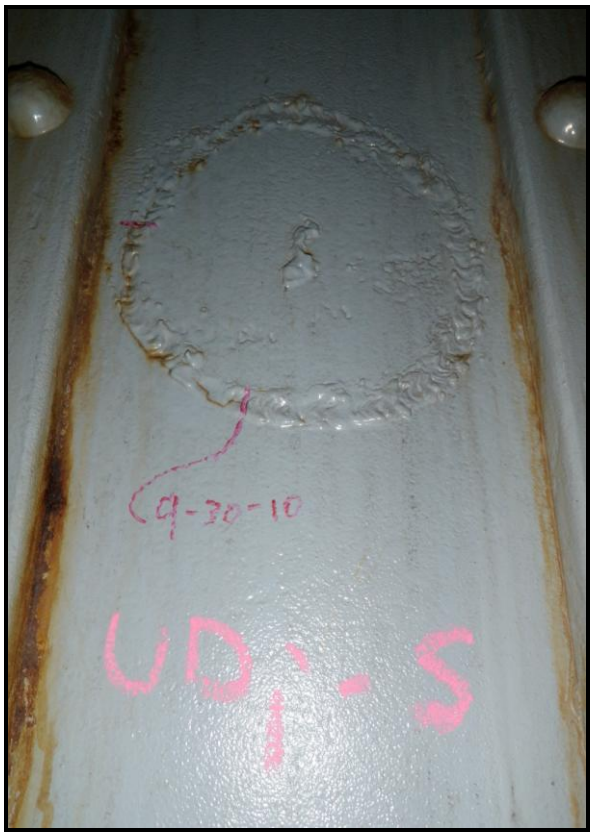


Photo 22: Showing the New Cracked Weld in the Southern Circular Weld in FB-U1'

Span 5:
Floor Beams 2-14 – 4′ on center longitudinal (to the bridge deck) cracks across the floor beams between column lines B-C

Floor Beam 11 – Delaminated between column lines B-C

Span 6:
Floor Beam 2 – Transverse cracks and delaminated areas between column lines B-C

Span 7:
No noted deficient floor beams.

Span 8:
No noted deficient floor beams.

Span 9:
Floor Beam 3 – Delaminated between column lines C-D

Floor Beams 4-7 & 10-12 – 4′ on center longitudinal cracks across the floor beams between column lines C-D

Floor Beam 5 – Delaminated between column lines C-D

Span 10:
Floor Beams 2 & 4-11 – 4′ on center longitudinal cracks across the floor beams between column lines B-C

Floor Beams 6 & 7 – Spalled between column lines C-D

Span 11:
Floor Beam 2 – Spalled between column lines C-D

Floor Beams 2-8 – 4′ on center longitudinal cracks across the floor beams between column lines C-D

Floor Beam 3 – Spalled between column lines A-B

Floor Beam 5– Spalled between column lines C-D

Floor Beam 7– Spalled between column lines A-B

Span 12:
Floor Beam 2– Delaminated between column lines C-D

Floor Beam 3– Delaminated between column lines A-B & C-D

Floor Beam 4– Delaminated between column lines A-B

Floor Beam 5-7 & 9– Delaminated between column lines C-D

Floor Beam 10 & 11 – Delaminated between column lines A-B

Floor Beam 12– Delaminated between column lines C-D

Span 13:
Floor Beam 4– Delaminated between column lines A-B

Floor Beam 4– Delaminated between column lines A-B & C-D

Floor Beam 4– Delaminated between column lines C-D

Lower Floor Beams:

The lower deck floor beams in spans 1A, 1B, 1-3, 5-13 are concrete and span between the jack-arch columns with cantilevered ends. In span 4 they are steel and span between the trusses with cantilevered ends. These floor beams carry only minimal loads, with the exception of during the Ingenuity Festival which is held on the lower deck. The festival only applies pedestrian loads and occasional maintenance vehicle, but no large truck loads. The following floor beams have noted deficiencies:

Span 1A:
No deficient Floor Beams noted

Span 1B:
No deficient Floor Beams noted

Span 1:
No deficient Floor Beams noted

Span 2:
Floor Beam 9 – Cracked between column lines A-B, north half

Floor Beam 10 – Cracked between column lines A-B, south half

Span 3:
Floor Beams 3-7 – Cracked between column lines C-D

Floor Beam 5 – Delaminated across whole bottom of beam between column lines C-D

Floor Beam 6 - Delaminated and spalled across whole bottom of beam between column lines C-D

Span 4:
No deficient Floor Beams noted

Span 5:
Floor Beam 1 – Cracked with corner delaminations between column lines B-C and 1/3 of the way across the span between column lines C-D

Span 6:
Floor Beams 11-15 – Map cracked between column lines A-B, concrete is sound

Floor Beam 13 – Delaminated and cracked area between column lines B-C

Floor Beam 14 – The whole bottom of the beam is delaminated between column lines C-D

Span 7:
Floor Beam 1 – Spalled in northeast cantilevered external cantilevered section and cracked between column lines C-D

Floor Beam 4 – Cracked, delaminated and spalled full width between column lines A-B

Floor Beam 7 – Spalled between column lines A-B, north half of span, both corners

Floor Beam 8 – The north $^{1}/_{3}$ of the span between column lines A-B is spalled, the rest of the span is cracked and delaminated

Floor Beam 9 - Spalled between column lines A-B, south half of span, both corners

Floor Beam 10 – Spalled between column lines C-D

Floor Beams 12-15 – Cracked between column lines C-D

Span 8:
Floor Beams 15 – Small cracks in bottom of beam between column lines C-D

Span 9:
Floor Beam 11 – The south $^1/_3$ of the span between column lines A-B is cracked, the concrete is tight

Floor Beam 13 – The whole bottom of the beam is cracked and spalled between column lines A-B and the bottom corners are cracked in the south 1/3 of the span between column lines B-C

Span 10:
Floor Beam 1 – Cracked, delaminated and spalled full width between column lines C-D, some concrete is loose

Floor Beam 2 – Shallow spalls over the vertical legs of the stirrups in the east face of the floor beam between column lines B-C (Photo 23)

Floor Beams 3 & 8 – Shallow spalls over the vertical legs of the stirrups in the east face of the floor beam between column lines A-B (Photo 23)

Floor Beams 4, 6, 10 & 11 – Shallow spalls over the vertical legs of the stirrups in the west face of the floor beam between column lines A-B (Photo 23)

Floor Beam 10– Shallow spalls over the vertical legs of the stirrups in the west face of the floor beam between column lines B-C (See Photo 23)

Photo 23: Typical Shallow Spalls over the Vertical Legs of the Stirrups in the Face of the Floor Beam

Span 11:
No deficient Floor Beams noted

Span 12:
Floor Beams 4 – the bottom of the floor beam is cracked between column lines A-B, concrete is tight

Floor Beam 5 – The bottom of the floor beam is cracked 6' from the north end between column lines A-B. The concrete along the lower east corner is loose.

Floor Beam 6 – The bottom of the beam is cracked between column lines B-C. The concrete sounds dead, but is tight.

Floor Beam 10 – The north $^{1}/_{3}$ of the bottom of the beam between column lines A-B has been patched; the patch is cracked and sounds hollow, but is tight.

Floor Beam 12 – The bottom of the beam is cracked and spalled between column lines A-B

Span 13:
Floor Beam 2 – Cracked and spalled between column lines C-D

Floor Beam 7 – the north ½ of the bottom of the beam between column lines A-B

Corbels:

The corbels are located on the exterior of the bridge at the termination of the lower deck floor beams. The corbels are numbered from West to East, starting at the beginning of each span.

Span 1A:
No noted deficient corbels

Span 1B:
No noted deficient corbels

Span 1:
North:
Corbel 6 – Spalled but the concrete is tight

South:
Corbel 3 – Cracked with small delaminations, concrete is tight

Corbel 10 – Cracked with small delaminations, concrete is tight

Corbel 12 – Cracked with small delaminations, concrete is tight

Span 2:
South:
Corbel 4 – Cracked with small delaminations, concrete is loose (See Photo 24)

Corbel 12 – Cracked, concrete is loose

Photo 24: Corbel 4, Span 2 Cracked and Loose

Span 3:
South:
Corbel 11 – Cracked, but tight

Span 4:
No noted deficient corbels

Span 5:
No noted deficient corbels

Span 6:
South:
Corbel 12 – Completely delaminated and loose, corbel should be removed (See Photo 25)

Corbel 14 – Completely delaminated and loose, corbel should be removed (See Photo 26)

Photo 25: Corbel 12, Span 6 Completely Delaminated and Loose

Photo 26: Corbel 14, Span 6 Completely Delaminated and Loose

Span 7:
North:
Corbel 1 – Spalled but tight

South:
Corbel 2 – Spalled but tight

Span 8:
North:
Corbel 1 – Vertical cracks through corbel, concrete is tight

Corbel 2 – Horizontal cracks through bottom of corbel, concrete is tight

Corbel 12 – Vertical cracks through corbel, bottom of the corbel is delaminated

Corbel 13 – Cracked and spalled with exposed reinforcing steel, concrete is tight

Corbel 14 – Cracked and spalled with exposed reinforcing steel, concrete is tight

Span 9:
North:
Corbel 3 – Cracked, but concrete is tight

Corbel 5 – Cracked, but concrete is tight

Span 10:
North:
Corbel 5 – Spalled with exposed reinforcing steel, concrete is tight

South:
Corbel 1 – Spalled with loose concrete

Corbel 12 – Spalled with loose concrete

Span 11:
South:
Corbel 1 – Spalled with loose concrete

Span 12:
No noted deficient corbels

Span 13:
No noted deficient corbels

Floor Beam Connections

The Floor Beam Connections were rated a 2 meaning that they are in Fair Condition. The Floor Beam Connections are only found in Span 4. Some of the floor beam hangers are pitted and corroded with a few isolated through holes.

Verticals

The Vertical members were rated a 2 meaning that they are in Fair Condition. The Vertical members are only found in Span 4. There is active corrosion with some section loss on most of the vertical members, concentrated around where they pass through the upper deck. The verticals at panel points L_0 and $L_{0'}$ have the worst section loss with through holes in the cover plates and batten bars. The ends of the Verticals in the trusses from panel points L_0-L_4 and $L_{4'}$-$L_{0'}$ are pitted and corroded at the connections with the Lower Chord. There are some with significant through-holes (See Photos 27-29).

Photo 27: Typical Corrosion on Vertical Member Immediately Below the Upper Deck Pass-Through

Photo 28: Through Holes in Cover Plate of L_0-S Vertical

Photo 29: Through Holes in Cover Plate of $L_{0'}$-S Vertical

Diagonals

The Diagonal members were rated a 2, meaning that they are in Fair Condition. Diagonal members are only found in Span 4. There is active corrosion with some section loss on most of the diagonal members, concentrated around the openings through the upper deck. The diagonal on the north side at $L_{1'}$-$U_{0'}$ has two previously noted through holes in the legs of the upper angles. The ends of the Diagonals in the trusses from panel points L_0-L_4 and $L_{4'}$-$L_{0'}$ are pitted and corroded at the connections with the Lower Chord. There are some with significant through-holes (See Photo 30).

Photo 30: Holes through the Ends of the Vertical and Diagonal Members at the $L_{2'}$ Panel Point in the South Arch

End Posts

The End Posts were rated a 2, meaning that they are in Fair Condition. End Posts are only found in Span 4. There is active corrosion with some minor section loss on the end posts, but no through holes were noted.

Top Chord

The Top Chord was rated a 1, meaning that it is in Good Condition. The Top chord is only found in Span 4. There are isolated light patches of active corrosion, but no noticeable section loss.

Lower Chord

The Lower Chord was rated a 2 meaning that it is in Fair Condition. The lower chord is only found in Span 4. The main built-up member of the lower chord is heavily corroded from panel points L_0-L_4 and $L_{4'}$-$L_{0'}$. In these areas the batten plates and bars have through-holes in the bottom of the member (See Photo 31).

Additionally, the gusset plates at the connections with the vertical and diagonal members are groove pitted along the top of the lower chord (See Photo 32).

Photo 31: Corrosion and Holes to the Bottom of the Lower Chord from Panel Point $L_{0'}$-$L_{4'}$

Photo 32: Typical Groove Pitting along the Gusset Plates at the Top of the Lower Chord

Lower Lateral Bracing

The Lower Lateral Bracing was rated a 2, meaning that it is in Fair Condition. The lower lateral bracing is only found in Span 4. There is old pitting in the members with some light corrosion at the connections. The gussets connecting the lower lateral bracing with the exterior stringers are heavily pitted with through-holes (See Photo 33).

Photo 33: Through Holes in the Gusset Connecting the Lower Lateral Bracing with the Northern Most Exterior Stringer as seen through the Fiberglass Deck Panel

Top Lateral Bracing

The Top Lateral Bracing was rated a 2, meaning that it is in Fair Condition. The top lateral bracing is only found in Span 4. The members have old pitting in the steel with light corrosion at the connections.

Sway Bracing

The Sway Bracing was rated a 2, meaning that it is in Fair Condition. The sway bracing is only found in Span 4. The members have old pitting in the steel with light corrosion at the connections.

Portals

The Portals were rated a 2 meaning that they are in Fair Condition. The portals are only found in Span 4. The portals have minor pitting and light corrosion with isolated through holes in the batten plates inside of the lower portion of the portals (See Photo 34).

Photo 34: Typical Corrosion and Through-Hole in a Batten Plate inside of the Portals

Arch

The Arches were rated a 2 meaning Fair Condition. The bridge has 2 sets of arches, the concrete Spandrel Arch ribs that support the lower deck through the Arch Columns and the Jack Arches, mounted on the Jack Arch Columns that support the upper deck. The Spandrel Arch Ribs and Arch Columns are found in Spans 1-3 and 5-13. The Jack Arches and Jack Arch Columns are found in the East and West Tunnels, Span 1A, Span 1B, Spans 1-3 and Spans 5-13.

Jack Arches:

The typical sections of the bridge have 4 lines of jack-arches supported on columns, with the arch lines designated A-D with A being North Exterior, B being North Interior, C being South Interior and D being South Exterior. In Spans 1A and 1B, additional arch lines exist and are designated E-F with E being in between A and B, and F being in between C and D. The columns are numbered from West to East, starting at the beginning of each span the arches are labeled by which columns they connect. The following jack arches had the noted deficiencies.

East & West Tunnels:
30% of the jack arches are spalled with exposed reinforcing. (See Photo 35 for a typical spall)

Photo 35: Typical Spalled Jack Arch in the West Tunnel

Span 1A:
Jack Arch C4-C5 – Small spall at the top of the arch (See Photo 36 for typical spall)

Jack Arch C9-C10 – Cracked and delaminated over 30% of the north side and 25% of the bottom face of the arch

Jack Arch F2-F3 – Spalled over 2/3 of the length of the arch with exposed reinforcing.

Photo 36: Typical jack arch spall in Spans 1A, 1B, 1-3 and 4-13

Span 1B:
Jack Arches B3-B4, C5-C6 & C6-C7 – Small spall with exposed reinforcing steel at the top of the arch

Jack Arch C1-C2 – Base of the arch cracked through at C1

Span 1:
Jack Arch B12-B13 – The top 1/3 of the arch has been patched, the patch is now delaminated.

Span 2:
Jack Arch B4-B5 – There is a void with cracked concrete in the jack arch above column B4

Jack Arches B6-B7, B7-B8 & B10-B11 – Small spall with exposed reinforcing steel at the top of the arch

Jack Arch B9-B10– Small spall with exposed reinforcing steel at the top of the arch and 2 x 3' long longitudinal cracks in each the east and west sides of the jack arch starting at the top of the column capital.

Span 3:
Jack Arch B2-B3 – 3' long cracks running from column B2 along the underside of the jack arch

Jack Arch B3-B4 – 3' long cracks running from column B3 along the underside of the jack arch and a vertical crack full height of jack arch from the top of column B3.

Jack Arch B8-B9 – 5' long longitudinal crack along the west underside of the jack arch, 3' long longitudinal crack along the east underside

Jack Arch B10-B11 – Small spall with exposed reinforcing steel at the top of the arch, bottom of arch delaminated around the spall

Jack Arch B11-B12 – Small delaminated area at the top of the arch

Jack Arches C10-C11. C12-C13 & C16-C17 - Longitudinal cracks over 1/3 of the underside of the jack arch.

Span 4:
No Jack Arches exist in this span

Span 5:
No noted deficiencies in the Jack Arches in this span

Span 6:
Jack Arch B7-B8 – Small spall at top of arch

Jack Arch B11-B12 – Small spall at top of arch, spall along top of north face of the jack arch

Jack Arches D2-D3 & D10-D11 - Longitudinal cracks over the entire underside of the jack arch

Jack Arches D4-D5 & D9-D10 – The top 1/3 of the jack arch is cracked and delaminated

Jack Arch D11-D12 – Two longitudinal cracks run along the top 1/3 of the jack arch

Span 7:
Jack Arch D8-D9 – 2 x 3' long longitudinal cracks in each the east side of the jack arch starting at the top of the column capital.

Span 8:
Jack Arches B9-B10 C4-C5, C8-C9, C12-C13, C13-C14 & D11-D12 – Small spall with exposed reinforcing steel at the top of the arch

Jack Arch D12-D13 – Two longitudinal cracks run along the top 1/3 of the jack arch

Span 9:
Jack Arch C5-C6 - Small delaminated area at the top of arch

Jack Arch D7-D8 - Two longitudinal cracks run along the top 1/3 of the jack arch

Span 10:
Jack Arch D2-D3 – Two longitudinal cracks run along the top 1/3 of the jack arch

Jack Arch D4-D5 - Longitudinal cracks over the entire underside of the jack arch

Span 11:
Jack Arch C7-C8 – Delaminated area on the east side of the north vertical face of the jack arch

Span 12:
Jack Arch B11-B12 – Small spall at the top of the arch

Jack Arch C9-C10 – The entire south vertical face of the arch is delaminated

Jack Arch D9-D10 – Small spall with exposed reinforcing in the east $^1/_3$ of the arch

Span 13:
Jack Arch D4-D5 – 2 x 3' long longitudinal cracks in each the east side of the jack arch starting at the top of the column capital.

Jack Arch D5-D6 – 1 x 4' long longitudinal cracks in each the west side of the jack arch starting at the top of the column capital.

Spandrel Arch Ribs:

Span 1A:
No Arch Ribs this span

Span 1B:
No Arch Ribs this span

Span 1:
North Exterior: there is a cracked patch from column 4-6 on the exterior face, concrete is tight. The south interior bottom corner is spalled and delaminated at column 9.

North Interior:
The arch rib is cracked along all corners nearly the whole length of the arch. (See Photo 37 for typical corner crack)

South Interior:
The top of the arch rib is cracked and delaminated from columns 2-3 & 3-5.

South Exterior:
The top interior corner is cracked and delaminated between columns 1-7 & 11-12.

Photo 37: Typical Corner Crack in Spandrel Arch Rib

Span 2:
North Exterior:
The bottom interior corner is cracked between columns 4-5 & 12-16. The top exterior corner is cracked between columns 11-12

North Interior:
No deficiencies noted

South Interior:
The top exterior corner has been patched from columns 3-4 and 5-9; the patch concrete is cracked. The top exterior corner is cracked from columns 9-10 & 14-15

South Exterior:
The whole arch rib has been patched from columns 1-5, the patch concrete is map cracked, but tight (See Photo 38). The interior face has been patched from columns 12-16, the patch concrete is cracked but tight. The top exterior corner is cracked between columns 3-6.

Photo 38: Typical Map Cracking in the Spandrel Arch Rib Concrete

Span 3:
North Exterior:
The exterior face is map cracked with isolated delaminated areas from columns 1-4. The interior face of the arch rib is cracked and delaminated from column 2-4. The top exterior corner is spalled and delaminated across the patch from columns 15-16. The interior face has a large crack around the patch from columns 16-17.

North Interior:
The top exterior corner is cracked and delaminated for 1' each side from columns 9-10.

South Interior:
The patch at where the arch rib frames into tower 4 is cracked with small delaminated areas.

South Exterior:
The exterior face from columns 1-4 & 16-18 has been patched, the patch concrete is map cracked with isolated small delaminated areas.

Span 4:
No Arch Ribs this span

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

Span 7:
North Exterior:
The patched areas on the arch rib are map cracked, but the concrete is sound. The interior face is delaminated from columns 11-12.

North Interior:
No deficiencies noted.

South Interior:
The bottom face is cracked and delaminated between columns 2-10. The top face is cracked and delaminated between columns 5-7 & 10-11. The bottom interior corner is delaminated and spalled with exposed reinforcing from columns 7-10. The bottom interior corner is spalled between columns 8-10. The center of the bottom face is delaminated between columns 9-10. The top exterior corner is cracked and delaminated between columns 10-11 & 12-15. The bottom exterior corner is cracked between columns 11-12. The top interior corner is cracked and delaminated between columns 12-14.

South Exterior:
The bottom face from columns 1-6 & 13-15 and the top face from columns 13-14 have been patched. The patches are map cracked with isolated small delaminations. The bottom face is spalled below column 11. The bottom interior corner is delaminated from columns 1-3 & 4-7. The exterior face is 50% delaminated from columns 2-8.

Span 8:
North Exterior:
The bottom interior corner is cracked from columns 4-6 & 10-12. The bottom exterior corner is cracked from columns 12-13. The bottom face is map cracked from columns 13-15.

North Interior:
The bottom interior corner is cracked from columns 3-7. The bottom exterior corner is cracked from columns 5-6.

South Interior:
Both bottom corners are cracked from columns 1-3.

South Exterior:
The bottom face from columns 4-6 & 13-15 and the top face from columns 13-14 have been patched. The patches are map cracked with isolated small delaminations.

Span 9:
North Exterior:
There are large longitudinal cracks in the bottom face from columns 1-4 & 11-13. The interior face is cracked and delaminated at column 3.

North Interior:
There are large longitudinal cracks in the bottom face from columns 5-6 & 11-13. The top exterior corner is cracked from columns 10-12.

South Interior:
The bottom corners from columns 1-4 & 12-13 and the top corners from columns 2-3 have been patched. The patches are map cracked with isolated small delaminations.

South Exterior:
No deficiencies noted.

Span 10:
North Exterior:
The bottom face is map cracked from columns 1-5. The bottom interior corner is cracked and sounds dead from columns 5-12. The concrete is tight. The top interior corner is cracked from columns 5-6, 7-8, 10-11.

North Interior:
Both bottom interior corners are cracked over the entire length of the arch rib.

South Interior:
The bottom corners from columns 3-4, 5-6 & 9-10 have been patched. The patches are map cracked with isolated small delaminations.

South Exterior:
The corners from columns 1-3 & 9-12 have been patched. The patches are map cracked with isolated small delaminations.

Span 11:
North Exterior:
The bottom face and both corners from columns 6-8 have been patched. The patches are map cracked with isolated small delaminations. The top interior corner is cracked from columns 7-9.

North Interior:
The concrete around the arch rib corners is cracked at the frame-in with Tower 11.

South Interior:
The concrete around the arch rib corners is cracked at the frame-in with Tower 12.

South Exterior:
The arch rib is cracked and delaminated between columns 4-5.

Span 12:
North Exterior:
The entire arch rib from columns 1-4 and the exterior face from columns 8-12 have been patched. The patches are map cracked with isolated small delaminations.

North Interior:
No deficiencies noted.

South Interior:
No deficiencies noted.

South Exterior:
The concrete around the arch rib corners is cracked delaminated and spalled at the frame-in with Tower 12.

Span 13:
North Exterior:
No deficiencies noted.

North Interior:
The exterior face has a large vertical crack between columns 4-5. The bottom interior corner is cracked from columns 5-7.

South Interior:
The concrete around the arch rib corners is cracked delaminated and spalled at the frame-in with Tower 13.

South Exterior: The patches on the bottom face of the arch rib are map cracked, the patch concrete is sound.

Arch Columns

The Arches Columns were rated a 2 meaning Fair Condition. The bridge has 2 sets of Arch Columns, the concrete Spandrel Arch Columns that are mounted on the top of the Spandrel Arch Ribs and support the lower and the Jack Arch Columns, which support the Jack Arches that support the upper deck. The Spandrel Arch Ribs and Arch Columns are found in Spans 1-3 and 5-13. The Jack Arches and Jack Arch Columns are found in The East and West Tunnels, Span 1A, Span 1B, Spans 1-3 and Spans 5-13.

Jack Arch Columns:

The typical sections of the bridge have 4 lines of jack-arch columns with the column lines designated A-D with A being north exterior, B being North Interior, C being south interior and D being south exterior. In Spans 1A and 1B, additional column lines exist and are designated E-F with E being in between A and B, and F being in between C and D. The columns are numbered from West to East, starting at the beginning of each span. The columns are topped with fluted capitals just before the transition to the jack-arches. Most of the interior columns are connected with horizontal cross beams which connect at about 1/3 of the way up the column. Approximately 10% of these cross beams have deficiencies. The following Jack-arch columns had noted deficiencies:

Span 1A:
A-4 – Cracked top and base

A-5 – Cracked top

B-2 – Spalled base (See Photo 40 for typical spalled column base)

B-7 – Spalled base

B-8 – Spalled base

B-10 – Spalled base

E-2 – Spalled base

E-5 – Spalled capital (See Photo 41 for typical spalled capital)

E-6 – Cracked and spalled capital

E-7 – Spalled capital

E-8 – Spalled capital

E-9 – Cracked and spalled capital

C-2 – Spalled at cross beam tie-in

C-3 – Spalled base, spalled at cross beam tie-in

C-4 – Spalled base

C-5 – Spalled base

C-6 – Spalled base

C-7 – Spalled base, spalled at cross beam tie-in

C-8 – Spalled base, spalled at cross beam tie-in

C-9 – Spalled base, spalled at cross beam tie-in

C-10 – Spalled base, spalled at cross beam tie-in

F-2 – Spalled base

F-4 – Spalled base and top

F-5 – Spalled base

F-6 – Spalled base

F-7 – Spalled base

F-8 – Spalled base

F-9 – Spalled base

D-4 – Delaminated at base and at cross beam tie-in

D-6 – Delaminated at base

D-7 – Spalled base

D-8 – Spalled base

D-9 – Spalled base

D-11 – Spalled capital

Span 1B:
A-4 – Spalled 3'x3' approximately 1/3 of the way up from the base on the north face of the column

A-5 – Spalled approximately 75% of the north face of the column, spalled base

A-8 – Spalled at cross beam tie-in

A-11 – Spalled base

B-2 – Spalled base

B-3 – Spalled bottom 1/3 of the north face of the column, spalled capital

B-4 – Spalled base

B-5 – Spalled base

B-6 – Spalled base

B-7 – Spalled base, spalled capital, vertical cracks through the capital and up into the jack-arch

B-8 – Spalled base

B-9 – Spalled base, spalled capital

B-10 – Spalled base

B-11 – Spalled base, vertical cracks approximately ¼ of the column height located at the cross beam tie-in

C-2 – Delaminated base

C-3 – Spalled base

C-4 – Spalled base

C-6 – Spalled base

C-8 – Spalled base

C-9 – Spalled base

C-10 – Spalled base

C-11 – Spalled base

D-5 – Delaminated base

D-6 – Spalled base

D-7 – Spalled base

D-8 – Spalled base

D-9 – Vertical cracks for ½ of the column height

Span 1:
A-3 – Cracked and spalled for ¼ of total height located at ¼ of the way up from the bottom

A-10 – Top 1/3 of column cracked, delaminated and spalled

B-10 – Spalled base

Span 2:
A-4 – Spalled above the capital, delaminated below

B-8 – Spalled base

B-9 – Spalled base

B-15 – Top 1/3 of column spalled

C-4 – Spalled capital

C-7 – Top ¼ of the north face of the column is delaminated

C-14 – Spalled base

C-15 – Spalled base

D-11 – Small spall ½ way up the column

D-13 – Cracked capital

D-15 – Cracked capital

Span 3:
B-2 – Spalled above capital, cracked capital

B-13 – Vertical cracks for ½ of the column height

Span 4:
No noted deficient jack-arch columns

Span 5:
C-5 – Spalled at cross beam tie-in

Span 6:
B-5 – Spalled capital

Span 7:
B-3 – The top 1/3 of the northwest corner of the column is spalled

C-7 – The capital has completely spalled off

Span 8:
B-4 – The top 1/3 of the northeast corner of the column is cracked and delaminated

B-6 – Cracked and delaminated base

B-13 – The top 1/3 of the northwest corner of the column is cracked and delaminated

C-2 – The northwest corner is delaminated and cracked for ¾ of the column height

Span 9:
B-4 – Cracked capital and cracked and delaminated north face of the column from the cross beam tie-in to the base

B-5 – Cracked capital

B-8– Cracked delaminated and spalled north face of the column from the cross beam tie-in to the base

B-10 – Cracked capital

B-11 – Delaminated base

B-12 – Vertical cracks for 1/3 of the column height immediately below the capital

C-9 – Top 1/3 of the column is delaminated, cracked capital

C-10 – Cracked capital

D-2 – Spalled base

Span 10:
No noted deficient jack-arch columns

Span 11:
No noted deficient jack-arch columns

Span 12:
A-6 – The north face of the column is delaminated for the full height

A-7 – The north face of the column is delaminated for the full height, the column has no capital

A-9 – The north face of the column is delaminated for the full height

A-11 – Small spall 2/3 of the way up the column

A-13 – The top 1/3 of the column is spalled

C-6 – Delaminated from the bottom of the arch rib to the base

C-8 – Delaminated from the bottom of the arch rib to the base

Span 13:
A-2 – Cracked capital, cracks are full-depth

C-2 – Spalled base

C-6 – Bottom 1/3 of the column is delaminated or spalled

Photo 40: Typical Spalled Column Base

Photo 41: Typical Spalled Column Capital

<u>Spandrel Arch Columns:</u>

<u>Arch Columns:</u>

Span 1A:
No Arch Columns this span.

Span 1B:
No Arch Columns this span.

Span 1:
North Exterior:
Columns 2, 4, 5, 11 & 12 are map cracked. Columns 5, 11 & 12 have large, full-height vertical cracks (See Photo 42 for typical column cracks).

North Interior:
Column 13 has a large, full-height vertical crack.

South Interior:
Columns 2 & 13 have large, full-height vertical cracks.

South Exterior:
No deficiencies noted.

Span 2:
North Exterior:
No deficiencies noted.

North Interior:
No deficiencies noted.

South Interior:
Column 1 has large, full-height vertical cracks.

South Exterior:
The southwest corner of column 13 is spalled with exposed reinforcing.

Span 3:
North Exterior:
No deficiencies noted.

North Interior:
No deficiencies noted.

South Interior:
Column 1 has a large, full-height vertical crack.

South Exterior:
No deficiencies noted.

Span 4:
No Arch Columns this span.

Span 5:
North Exterior:
Column 1 has large, full-height vertical cracks and corner delaminations for 75% of height.

North Interior:
Column 1 has large, full-height vertical cracks and corner delaminations for 75% of height.

South Interior:
Column 1 has large, full-height vertical cracks and corner delaminations for 75% of height.

South Exterior:
Column 13 has a 4' long vertical crack proceeding down from the corbel.

Span 6:
North Exterior:
Column 1 had loose concrete along the corners, this concrete was removed (See Photo 43). Column 12 has large, full-height vertical cracks.

North Interior:
Column 1 had loose concrete along the corners, this concrete was removed. Column 1 also has large, full-height vertical cracks.

South Interior:
Column 1 has large, full-height vertical cracks and corner delaminations for 75% of height.

South Exterior:
No deficiencies noted.

Photo 42: Typical Arch Column Cracks

Photo 43: Large Corner Spall Removed along Column 1 on the North Exterior Arch Rib of Span 6. The Spall along Column 1 on the North Interior Rib is Similar.

Span 7:
North Exterior:
No deficiencies noted.

North Interior:
Column 15 has a vertical crack in the top ½ of the exterior face.

South Interior:
Column 15 has a large, full-height vertical crack.

South Exterior:
No deficiencies noted.

Span 8:
No deficiencies noted.

Span 9:
North Exterior:
Columns 3 & 11 have vertical cracks in the top 1/3 of the exterior face. The northwest corner of Column 4 is cracked and delaminated for the full height of the column.

North Interior:
No deficiencies noted.

South Interior:
Column 1 has large, full-height vertical cracks.

South Exterior:
Column 1 has large, full-height vertical cracks.

Span 10:
North Exterior:
No deficiencies noted.

North Interior:
The interior face of Column 10 has large, full-height vertical cracks and is delaminated on the southeast corner.

South Interior:
No deficiencies noted.

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.

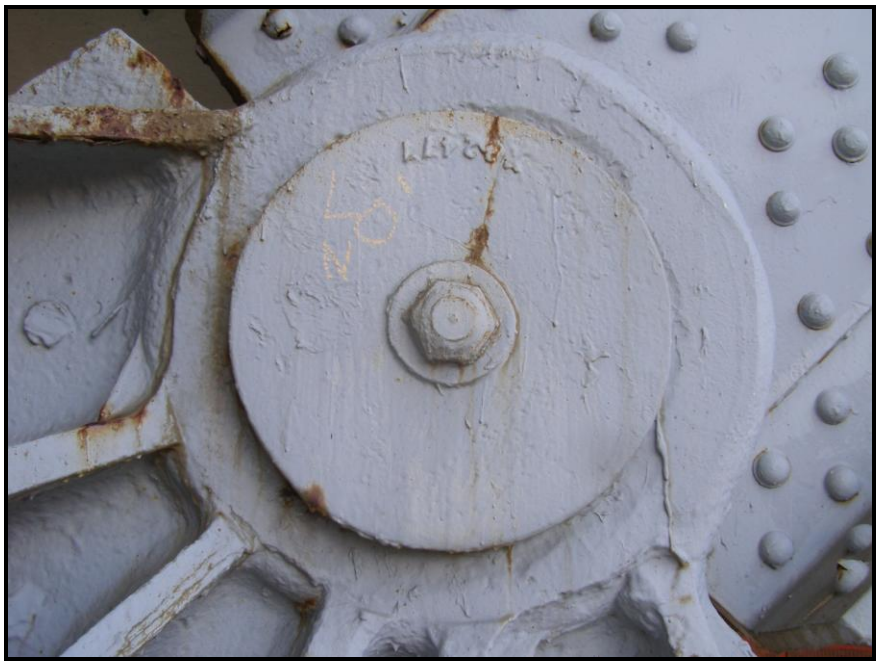


Photo 44: Cracked South Retaining Washer at $L_{0'}$ - N

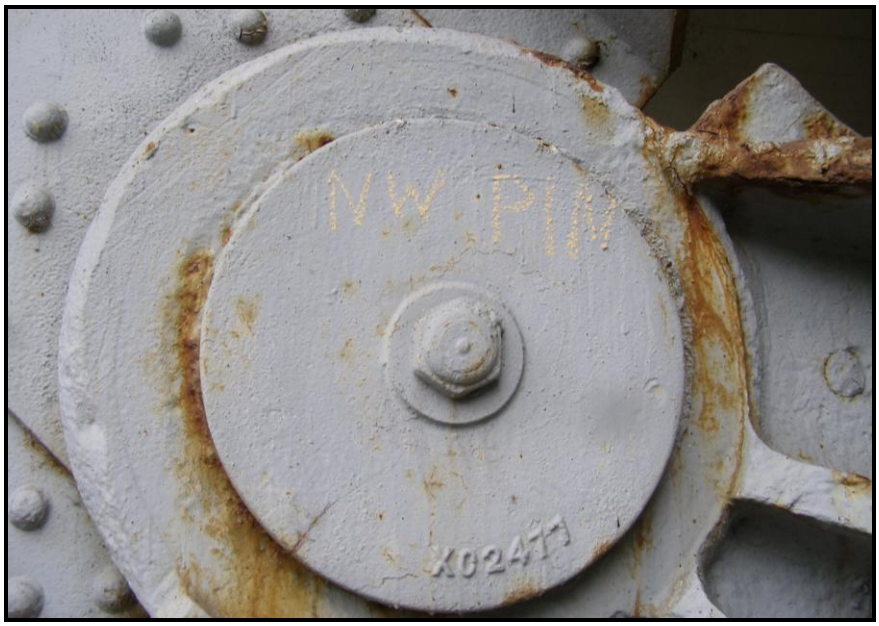


Photo 45: Cracked South Retaining Washer at L_0 – N

Photo 46: Cracked South Retaining Washer at L_0- S. No Change to Previously Noted Cracks.

Photo 47: Cracked North Retaining Washer at L_0- S. Note the New Crack on the Other Side of the Center Bolt.

Photo 48: Cracked South Washer at $L_{0'}$- S

Protective Coating System

The Protective Coating System was rated a 5, meaning that it is in Fair Condition. This rating only applies to the Protective Coating System on the steel in Span 4, the concrete sealer in Spans 1A, 1B, 1-3 and 5-13 is not rated. Less than 1% of the paint is deteriorated above the upper deck, 5%-10% of the paint is deteriorated below the upper deck. The worst locations are at the connections with the chords and directly below the holes where members pass through the upper deck. Common deficiencies include peeling and flaking paint and areas of exposed steel with active corrosion. Overall 1%-5% of the Protective Coating System is deteriorated. This bridge is a candidate for zone painting, focusing on the lower chord and connections below the upper deck.

Pins/Hangers/Hinges

The Pins and Hangers were rated a 2, meaning that they are in Fair Condition. Generally, the pins were in good condition with little to no corrosion. The pins and eye-bars at panel points L_4 and $L_{4'}$ are corroded (See Photos 49 & 50). These pins are protected by protective sleeves, but those sleeves have through holes. Pin testing was performed by PSI on these pins; the report is included as Appendix C. No section loss was found on the pins. The eye-bars at these locations have some corrosion and section loss around the interior openings.

Photo 49: Corroded Pin Sleeve at L_4 North

Photo 50: Corroded Pin Sleeve at $L_{4'}$ North

Fatigue Prone Connections

The only Fatigue Prone Connection found on the bridge is the vertical eye-bars located in Span 4 (See Photo 51). These were rated a 2, meaning that they are in Fair Condition. The pins and eye-bars at panel points L_4 and $L_{4'}$ are corroded, but there are no signs of fatigue-induced cracking.

Photo 51: Corroded Eye-Bar at $L_{4'}$-S. No Cracks Visible.

Live Load Response

The live load response is satisfactory with no excessive deflections, vibrations or unusual noises noted.

V. Substructure

Summary

The Substructure is rated a 5, meaning that it is in Fair Condition. The rating is based on the condition of Abutments and Piers which are each rated 2 – Fair.

The individual items are rated as follows:

Abutment:	2 – Fair
Abutment Seats:	1 - Good
Piers:	2 – Fair
Pier Seats:	1 - Good
Wingwalls:	1 - Good
Fenders and Dolphins:	1 - Good
Scour:	2 – Fair

Abutments

The Abutments were rated a 2, meaning that they are in Fair Condition. The concrete abutments have some minor cracking and small delaminated areas.

Abutment Seats

The Abutment Seats were rated a 1, meaning that they are in Good Condition. The concrete abutment seats had only minor shrinkage cracks observed.

Towers and Cellular Construction

The Towers and Cellular Constriction were rated a 2, which means that they are in Fair Condition. The Cellular Construction is only found below Spans 1A & 1B. The concrete towers are given the same number as the span that finishes at the tower, with the numbers proceeding from West to East.

Cellular Construction: There is cracking in the concrete of the cells. Crack monitors have been installed and are monitored by ODOT District 12 (See Photo 52). The bottom of the lower deck slab is heavily spalled with exposed reinforcing throughout.

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 4:
Both faces of the tower are map-cracked from the base up to the arch-ribs, the northwest corner is cracked, all the concrete is tight.

Tower 5:
The north interior and north exterior posts have corner spalls from the arch ribs up to the lower deck, on both faces of the tower (See Photo 60).

Tower 6:
The south exterior and south interior posts are cracked for up to 10′ above the arch-ribs, on both faces of the tower.

Tower 7:
The exterior face of the north exterior pillar is delaminated nearly full-height on the span 6 side and has large spalls and delaminated areas on the span 7 side.

The exterior face of the south exterior pillar has a large delamination near the corbel on the span 6 side and is cracked and delaminated for 40′ below the lower deck, on the span 7 side.

All vertical posts are map cracked from the arch-ribs up to the lower deck.

Tower 8:
The exterior face of the north exterior pillar is delaminated for 15′ below the lower deck, on the span 7 side there are vertical cracks and spalls just above the arch-rib.

The exterior face of the south exterior pillar has large spalls with loose concrete on the span 7 side.

Tower 9:
The exterior face of the north exterior pillar is spalled at the capital (at the upper deck) on the span 8 side, spalled at the lower deck and the area for 10′ below the lower deck is delaminated. The span 9 side is spalled around corbel 1 and the area for 8′ below the lower deck is cracked and delaminated with loose concrete.

The south face of the south exterior pillar is delaminated and has large spalled areas with loose concrete on the span 8 side. There are also large delaminated areas on the span 9 side.

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.

Photo 53: Tower B Rotating South Away from the Bridge. Note the Large Gap between the Top of the Tower and the Adjacent Jack Arch Column.

Photo 54: Crack Monitor Installed at the Interface between the Top of the Lower Deck and Tower B

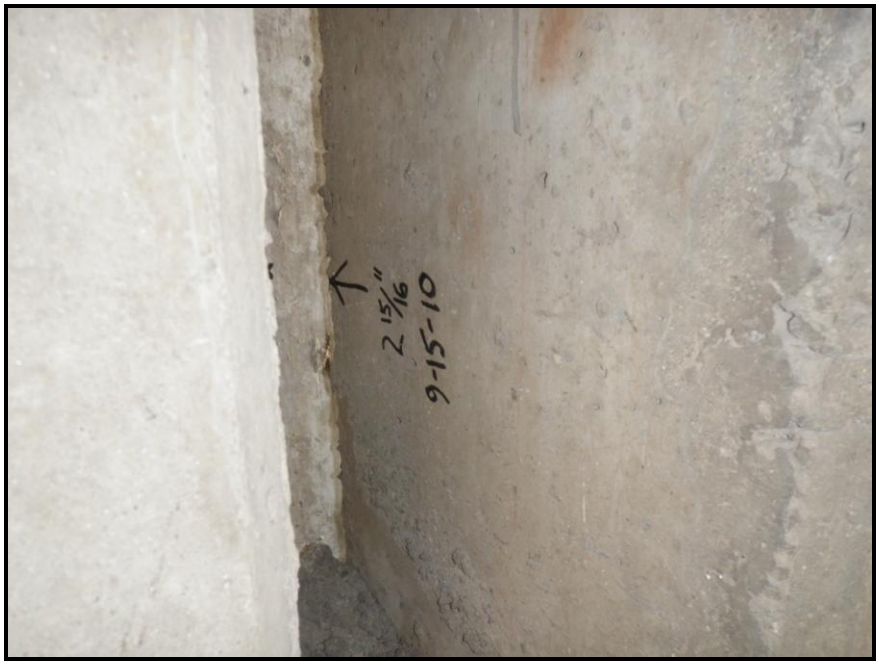


Photo 55: Gap Measurement between the West Edge of Tower B Showing the Amount of Rotation Away from the Surrounding Structure

Photo 56: Gap Measurement between the East Edge of Tower B Showing the Amount of Rotation Away from the Surrounding Structure

Photo 57: Typical Map Cracked Concrete at the Base of the Towers

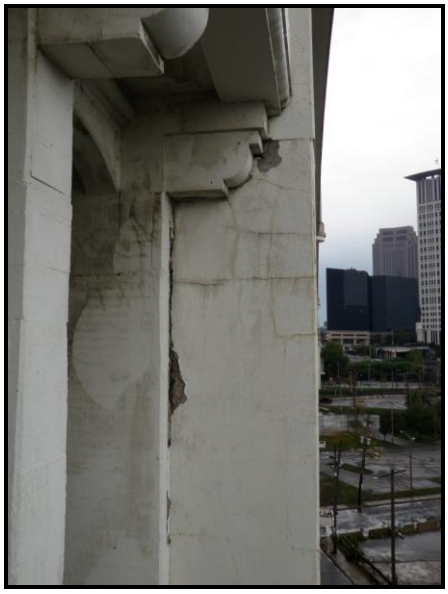


Photo 58 & 59: Typical Spalled and Map Cracked Concrete at the Tops of the Towers

Photo 60: Typical Large Corner Spall on Tower 5

Pier Seats

The Pier Seats were rated a 1, meaning that they are in Good Condition. The concrete abutment seats had only minor shrinkage cracks observed.

Wingwalls

The Wingwalls were rated a 1, meaning that they are in Good Condition. There were no deficiencies observed in the concrete wingwalls.

Fenders and Dolphins

The fenders and dolphins were rated a 1, meaning that they are in Good Condition. There are some minor cracks in the concrete and the steel exterior sheathing is corroded at the waterline. Notes about these can also be found in the Underwater Inspection Report included in Appendix B.

Scour

The channel scour is rated as a 2 meaning that it is in Fair Condition. Notes about these can also be found in the Underwater Inspection Report included in Appendix 3.

VI. Channel

Summary

The Channel is rated a 6, meaning that it is in Satisfactory Condition. The rating is based on the Channel Alignment and Protection which are each rated 2 - Fair.

The individual items are rated as follows:

Alignment:	2 - Fair
Protection:	2 - Fair
Waterway Adequacy:	1 - Good

Alignment

The Channel Alignment was rated a 2, meaning that it is in Fair Condition. The channel passes under Span 4 at approximately a 65 degree skew angle.

Protection

The Channel Protection is rated a 2, meaning that it is in Fair Condition. The steel sheet pilings that line the channel are corroded at the waterline. Additional notes about these can also be found in the Underwater Inspection Report included in Appendix B.

Waterway Adequacy

The Waterway Adequacy was rated as a 1, meaning that it is in Good Condition. The structure does not impede the flow of the waterway during flood conditions and there are no channel restrictions.

VII. Approaches

Summary

The Approaches are rated a 6, meaning that they are in Satisfactory Condition. The rating is based on the Pavement, which is rated 2 – Fair.

The individual items are rated as follows:

Pavement:	2 - Fair
Guardrail:	1 – Good
Embankment:	2 - Fair

Pavement

The Approach Pavement was rated a 2, meaning that it is in Fair Condition. There are some minor longitudinal cracks in the asphalt approach pavement. There are no significant potholes or indications of settling.

Guardrail

The Approach Guardrail was rated a 1, meaning that it is in Good Condition. No deficiencies were noted.

Embankment

The Embankment was rated a 2, meaning that it is in Fair Condition. There are some minor slope stability issues with the southwest slope.

VIII. General

Navigation Lights

The Navigation lights are rated as a 1, meaning that they are in Good Condition. All six navigation lights function properly.

Warning Signs

The Warning Signs were rated as a 1, meaning that they are Good Condition. No deficiencies were noted.

Sign Supports

The Sign Supports were rated as a 1, meaning that they are Good Condition. No deficiencies were noted.

Utilities

The Utilities were rated as a 1, meaning that they are in Good Condition. New electrical wires and boxes were installed in 2010 to be used for the Ingenuity Festival. The existing conduits and utility boxes have some isolated breaks in the conduits and minor corrosion on the existing boxes.

Vertical Clearance

The Vertical Clearance was rated as a 1, meaning that it is in Good Condition. There has been no change in vertical clearance from previous years.

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**

XI. SIGNATURE SHEET

2010 Physical Condition Report of the Detroit-Superior Bridge over the Cuyahoga River (CUY – 00006 – 1456, SFN: 1800930)

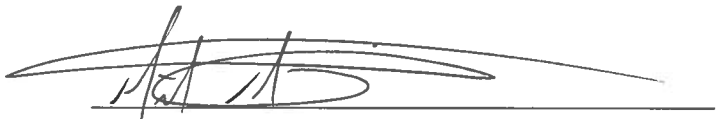
Report Prepared for:

Ohio Department of Transportation, District 12

Inspection Performed:

August 30, 2010 through October 3, 2010

Inspected By:



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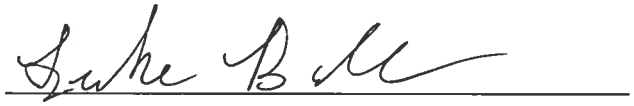

Luke A. Baker, E.I., S.I.
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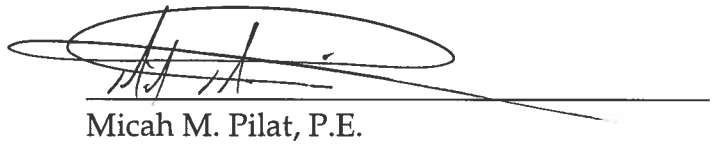
Report Prepared By:



Micah M. Pilat, P.E.
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Reviewed By:

K. Robert. Deetz, P.E.
Euthenics, Inc.
8235 Mohawk Drive, Strongsville, Ohio 44136
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APPENDIX A

BR-86 BRIDGE INSPECTION FORM

State of Ohio Department of Transportation

Bridge Inspection Report

1800930 (STRUCTURE FILE NUMBER) | Year Built: 1917

Bridge Number: CUY (Co.) | 00006 (Route) | 1456 (Unit) | Cleveland (Municipality)

Dist: 12 | Bridge Type: 354 | Type Service: 5 7 | (1499)Cuyahoga River & RTA (Location)

DECK *Out/Out 85.2* *Deck Area 226,205 SF*			
1. Floor	1	2. Wearing Surface *Integral Conc (1" Monolithic)*	1
3. Curbs, Sidewalks & Walkways	1	4. Median	
5. Railing	1	6. Drainage *Scuppers & Downspouts*	2
7. Expansion Joints	2	**8. SUMMARY**	**7**
SUPERSTRUCTURE			
9. Alignment *Max Span 591'*	1	10. Beams/Girders/Slab	2
11. Diaphragms or Crossframes		12. Joist/Stringers	2
13. Floor Beams	2	14. Floor Beam Conns.	2
15. Verticals	2	16. Diagonals	2
17. End Posts	1	18. Top Chord	1
19. Lower Chord	2	20. Lower Lateral Bracing	2
21. Top Lateral Bracing	1	22. Sway Bracing	2
23. Portals	2	24. Bearing Devices	2
25. Arch	2	26. Arch Columns or Hangers	2
27. Spandrel Walls		28. Protective Coating System *Paint Date 7/15/1999*	5
29. Pins/Hangers/Hinges	2	30. Fatigue Prone Connections	2
31. Live Load Response	S	**32. SUMMARY**	**6**
SUBSTRUCTURE			
33. Abutment	2	34. Abutment Seats	1
35. Piers *Tower B South is rotating away from structure*	2	36. Pier Seats	1
37. Backwalls		38. Wingwalls	1
39. Fenders and Dolphins	1	40. Scour 3	2
41. Slope Protection		**42. SUMMARY**	**5**
CULVERTS			
43. General		44. Alignment	
45. Shape		46. Seams	
47. Headwalls or Endwalls		48. Scour	
49		**50. SUMMARY**	
CHANNEL			
51. Alignment	2	52. Protection	2
53. Waterway Adequacy	1	**54. SUMMARY**	**6**
APPROACHES			
55. Pavement	2	56. Approach Slabs	
57. Guardrail	1	58. Relief Joints	
59. Embankment	2	**60. SUMMARY**	**6**
GENERAL			
61. Navig. Lights	1	62. Warning Signs *Maint. Resp. ODOT*	2
63. Sign Supports	1	64. Utilities	2
65. Vertical Clearance	1	**66. GENERAL APPRAISAL & OPERATIONAL STATUS**	**5** **A**

67. Inspected By: _____ P.E. | LAB (Intials)

Luke A. Baker
Euthenics, Inc.
Date: 10/04/10

68. Reviewed By: _____ P.E. | MMP (Intials)

Micah M. Pilat
P.E. No. 74876
Euthenics, Inc.
Date: 11/1/2010

Survey: 1 1 1 1 1 N 1 N

APPENDIX B

UNDERWATER INSPECTION REPORT

Underwater Inspection Report for:

Veteran's Memorial Bridge (Detroit Superior Bridge) over the Cuyahoga River in Cleveland, Ohio
(Thirteen-span Steel Truss and Concrete Arch Bridge with Concrete Piers)

KCI personnel on site during inspection:

1. Capt. Travis M. Clower, MBA, P.E. (Diver / Lead Inspector)
2. Mark A. Suchan, (Backup Diver / Inspector)
3. Steve Tomsic, P.E. (Supervisor / Inspector)

Euthenics, Inc. contact:

K. Robert Deetz
8235 Mohawk Drive
Strongsville, Ohio 44136
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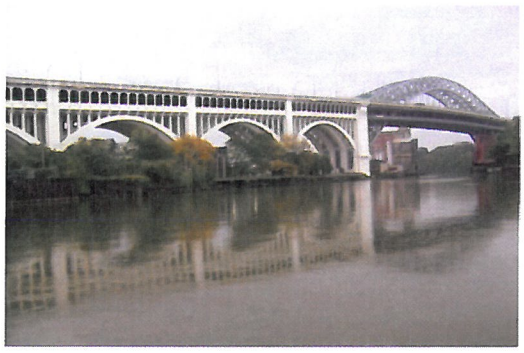
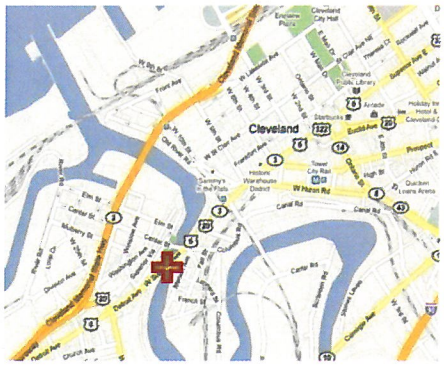


North Elevation View



Location Map

Prepared for:

Euthenics, Inc.
8235 Mohawk Drive
Strongsville, Ohio 44136
Phone: (440) 260-1555

Prepared by:

KCI Associates of Ohio, P.A.
388 S. Main Street, Suite 401
Akron, Ohio 44311
Phone: (330) 564-9100

DESCRIPTION

The Veteran's Memorial Bridge, also known as the Detroit Superior Bridge and CUY-06-14.56 carries W. Superior Avenue across the Cuyahoga River on the west side of Cleveland, Ohio. The bridge is 3,112 feet long with the main steel truss spanning 591 feet by itself. The bridge opened Thanksgiving Day, 1917 and has had two major renovations since that time. During the first major renovation in 1969, two additional lanes of traffic were added cantilevering outside the steel truss main span. The second renovation was completed in 1997. Originally the structure consisted of two decks, the upper for vehicle and pedestrian traffic and the lower for rail streetcar traffic. By 1955 the lower deck was shut down to the general public and the streetcar tracks eventually removed.

The structure crossing the river consists of open spandrel concrete arches joined by a steel arch truss main span supported by reinforced concrete piers on reinforced concrete spread footings. Only the piers adjacent to the riverbanks (Piers 3 and 4) were partially submerged and considered part of this inspection. Following the nomenclature established in the original plans, Pier 4 is on the east shore and Pier 3 is on the west shore. Adjacent to Pier 3, steel sheet pile once served as river bank stabilization and a crude fender system (Photo 12). Very little of this steel sheet pile remains intact and will not be considered part of this inspection.

INSPECTION OPERATIONS

KCI's three-person dive team performed an underwater inspection on October 2nd, 2010. The underwater inspection was conducted by a Licensed Professional Engineer and National Highway Institute (NHI) Certified Bridge Inspector. All dives were conducted by an Association of Diving Contractors International (ADCI) certified commercial diver in accordance with the Occupational Safety and Health Administration (OSHA) guidelines. A visual inspection was performed from 1-foot above the waterline (splash zone) to the mud line. Where the diver's visibility was limited, tactile methods were used. Soundings were taken along all substructure units and up to 30 feet upstream and downstream of the bridge using an ultrasonic depth sounder. Sounding data was verified using a survey rod.

The top surface of the wall concrete cap on the west side of Pier 4 was chosen as the hydrographic reference point. The water surface was measured to be 5.25 feet below this point (see Photo 11).

Hazards Encountered:	*Poor visibility and construction debris, rebar, etc.*
Inspection Mode:	*Surface supplied diving with hard wire communcations*
Flow Direction / Velocity:	*The flow was from south to north. Little to no current.*
Order of Inspection:	*The diver inspected Pier 3 first, followed by Pier 4.*
Bottom Composition:	*The bottom composition was different for each pier. See below.*
Scour Checked By:	*Soundings, probing and tactile methods.*
Equipment Used:	*Superlite 27 dive helmet and drysuit*
Elements Cleaned:	*Very little cleaning required.*
Hydrographic Reference:	*The top surface of the wall concrete cap next to Pier 4.*

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.

- 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.

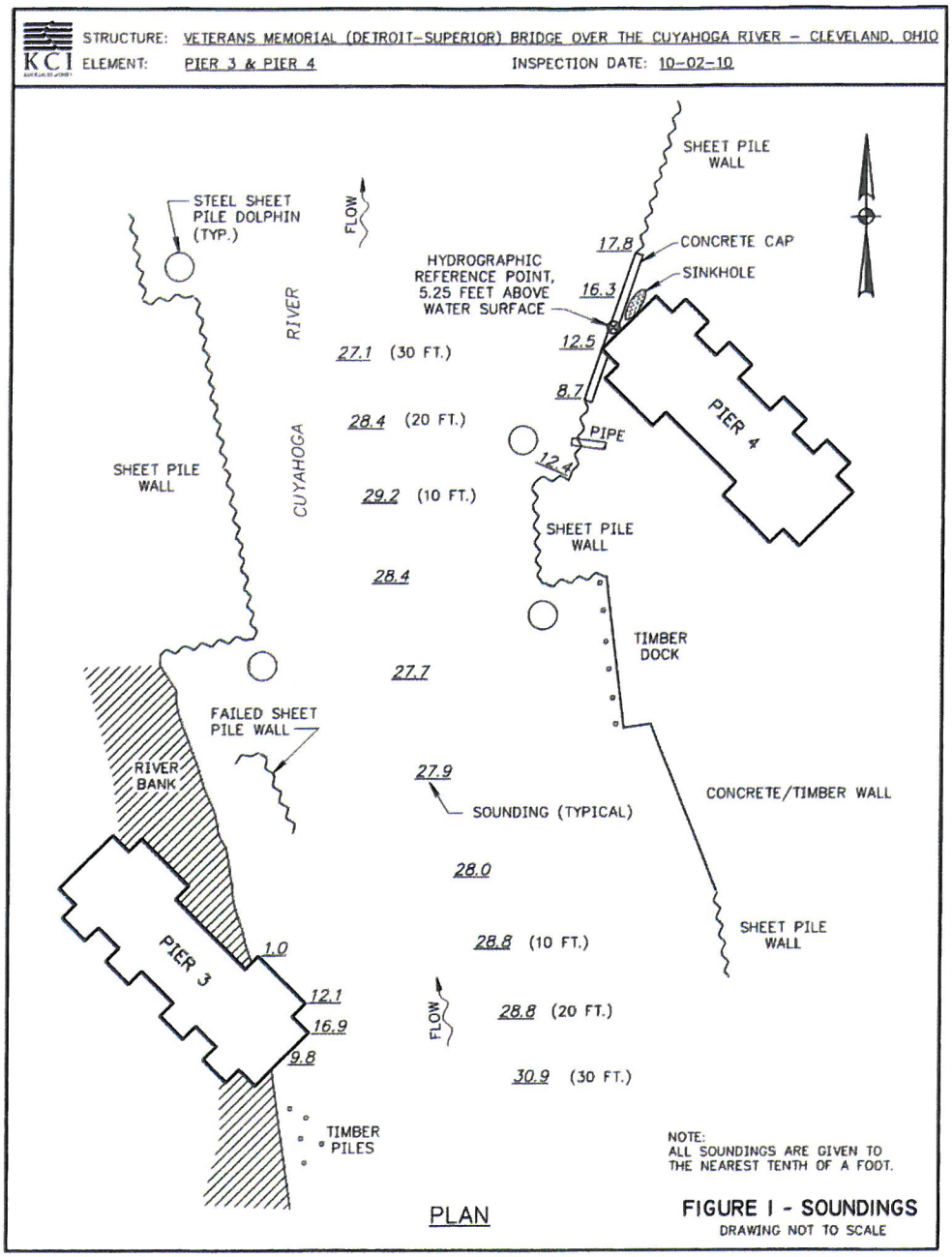
For Pier 4, the previous inspection report thoroughly documented the defects of the above water adjacent wall concrete cap structure; however, gave very little detail of the bridge pier concrete defects. By comparing Photo 4 of the 2003 inspection with Photo 8 of this report, we see the pier concrete 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.


STRUCTURE: VETERANS MEMORIAL (DETROIT-SUPERIOR) BRIDGE OVER THE CUYAHOGA RIVER – CLEVELAND, OHIO
ELEMENT: PIER 3 & PIER 4
INSPECTION DATE: 10-02-10
SHEET PILE WALL
STEEL SHEET PILE DOLPHIN (TYP.)
FLOW
17.8
CONCRETE CAP
SINKHOLE
HYDROGRAPHIC REFERENCE POINT, 5.25 FEET ABOVE WATER SURFACE
16.3
12.5
8.7
PIER 4
PIPE
12.4
RIVER
CUYAHOGA
27.1 (30 FT.)
28.4 (20 FT.)
29.2 (10 FT.)
SHEET PILE WALL
SHEET PILE WALL
28.4
TIMBER DOCK
27.7
FAILED SHEET PILE WALL
RIVER BANK
27.9
SOUNDING (TYPICAL)
CONCRETE/TIMBER WALL
28.0
28.8 (10 FT.)
SHEET PILE WALL
PIER 3
1.0
12.1
16.9
9.8
FLOW
28.8 (20 FT.)
30.9 (30 FT.)
TIMBER PILES
NOTE:
ALL SOUNDINGS ARE GIVEN TO THE NEAREST TENTH OF A FOOT.
PLAN
FIGURE 1 - SOUNDINGS
DRAWING NOT TO SCALE

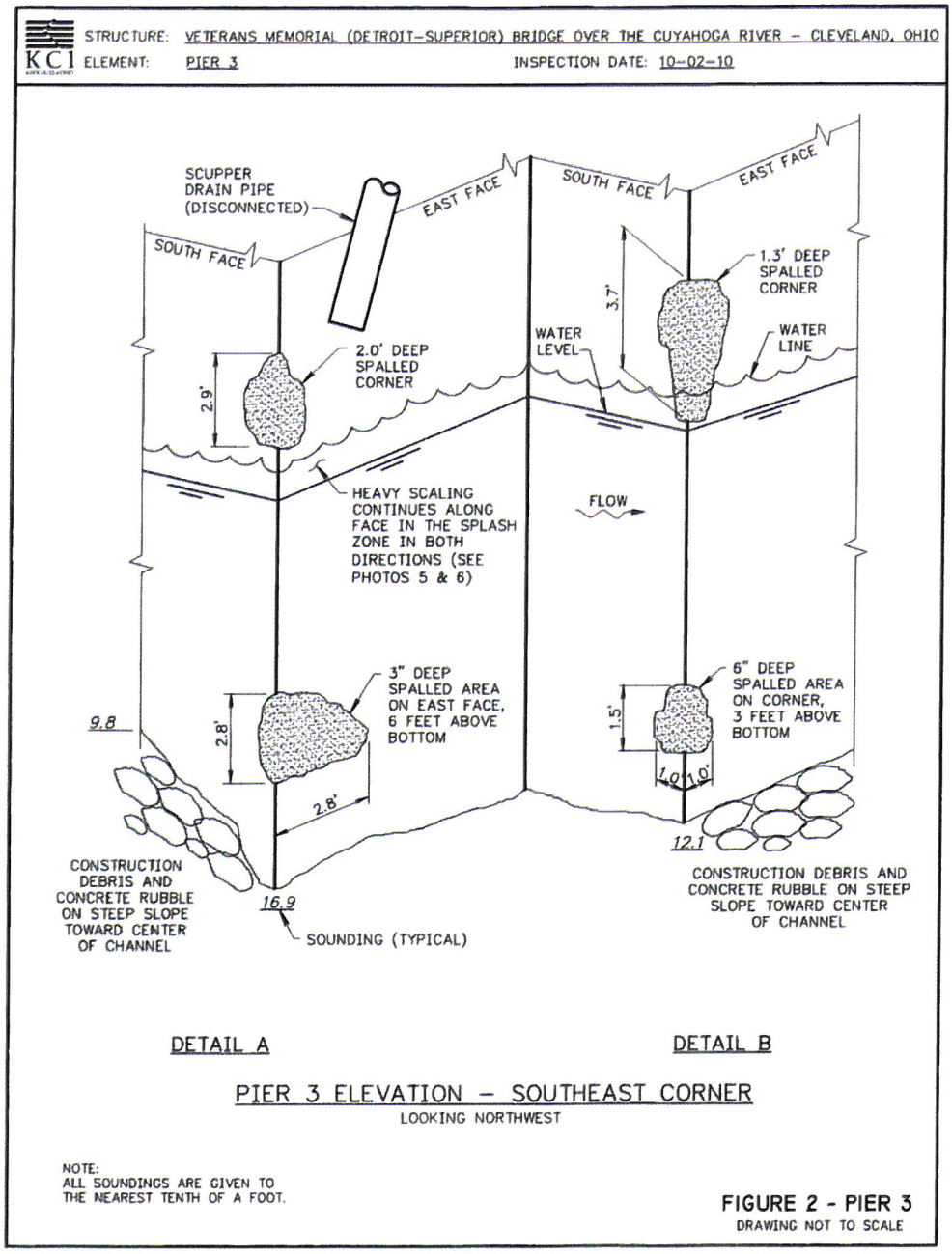


FIGURE 2 - PIER 3
DRAWING NOT TO SCALE

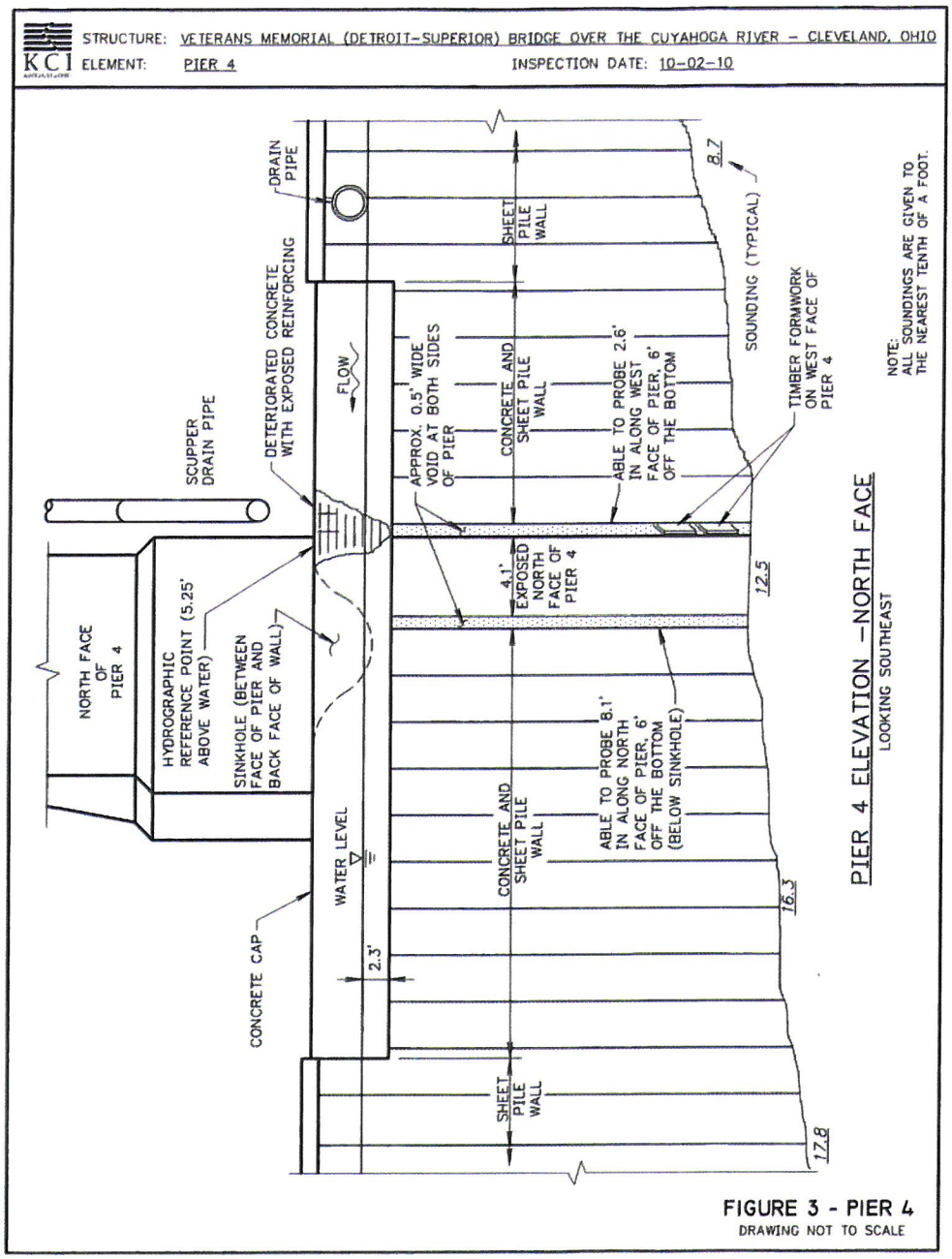


FIGURE 3 - PIER 4
DRAWING NOT TO SCALE

Photo by T. Clower, 10/2/10

Photo 1 – Facing North. South Elevation of the Bridge.

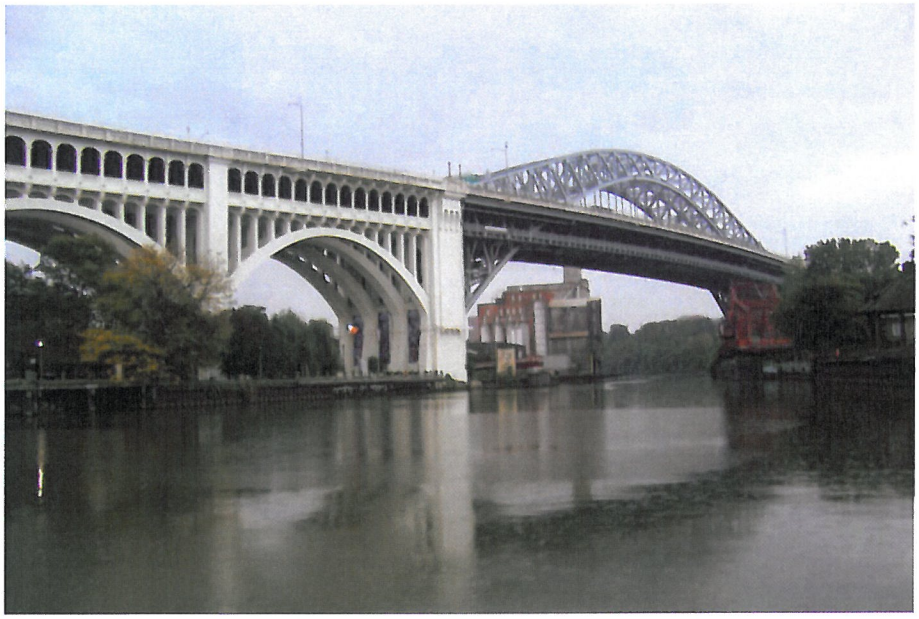


Photo by T. Clower, 10/2/10

Photo 2 – Facing South. North Elevation of the Bridge.

Photo by T. Clower, 10/2/10

Photo 3 – Facing North (Downstream) from the Bridge.

Photo by T. Clower, 10/2/10

Photo 4 – Facing South (Upstream) from the Bridge.

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.

Photo by T. Clower, 10/2/10

Photo 7 – Facing Southeast. North face of Pier 4 with concrete cap and adjacent steel sheet pile walls.

Photo by M. Suchan, 10/2/10

Photo 8 – Facing East. Southwest corner of Pier 4 shown behind the deteriorated concrete cap and exposed rebar .

Photo by T. Clower, 10/2/10

Photo 9 – Facing East Underwater. Southwest corner of Pier 4 (left) with adjacent timber formwork (right) 4 feet above the mud line.

Photo by T. Clower, 10/2/10

Photo 10 – Facing Southwest. Sinkhole between Pier 4 and wall concrete cap. Sinkhole is 4 feet wide by 8.5 feet long by 5 feet deep with the water surface visible.

Photo by T. Clower, 10/2/10

Photo 11 – Facing South. Hydrographic Reference Point
Top of wall concrete cap next to Pier 4 is 5.25 feet above the water surface.

Photo by T. Clower, 10/2/10

Photo 12 – Facing North. Steel Sheet pile Wall on the north side of Pier 3.

APPENDIX C
PIN TESTING REPORT

PSI Information To Build On
Engineering • Consulting • Testing

FIELD REPORT

TESTED FOR:	BOB DEETZ EUTHENICS, INC. 8235 MOHAWK DRIVE STRONGSVILLE, OHIO 44136	PROJECT:	DETROIT-SUPERIOR BRIDGE CLEVELAND, OHIO
DATE:	October 1, 2010	OUR REPORT NO.:	0138252

As requested, a Professional Service Industries, Inc. (PSI) representative visited the Detroit-Superior Bridge in Cleveland, Ohio. The purpose of our visit was to ultrasonically test four (4) hinge pins associated with the bridge structure. The scope of our involvement was detailed in PSI proposal 138-16914 dated March 4, 2010 with subsequent authorization to proceed provided by Mr. Robert Deetz of Euthenics Inc. Our scope was as follows:

PSI supplied the personnel and test equipment to conduct an ultrasonic test of four (4) truss pins associated with the Detroit-Superior Bridge. Access to the test locations was supplied by the client. The testing was conducted in general accordance with ASTM E-114, with scanning of the transducer conducted from at least one end face (s) of each pin. This report details test locations, procedure and information obtained from the test. The report does not include disposition as to the serviceability of the pins.

The test locations were chosen by the client and were identified as L-4 prime north, L-4 north, L-4 prime south, and L-4 south. Manual scanning was conducted from the end face of each pin. A calibration standard was used to set the distance and sensitivity of the test unit.

The test did not reveal any indications of discontinuity in excess of the evaluation of indications described in ASTM E114.

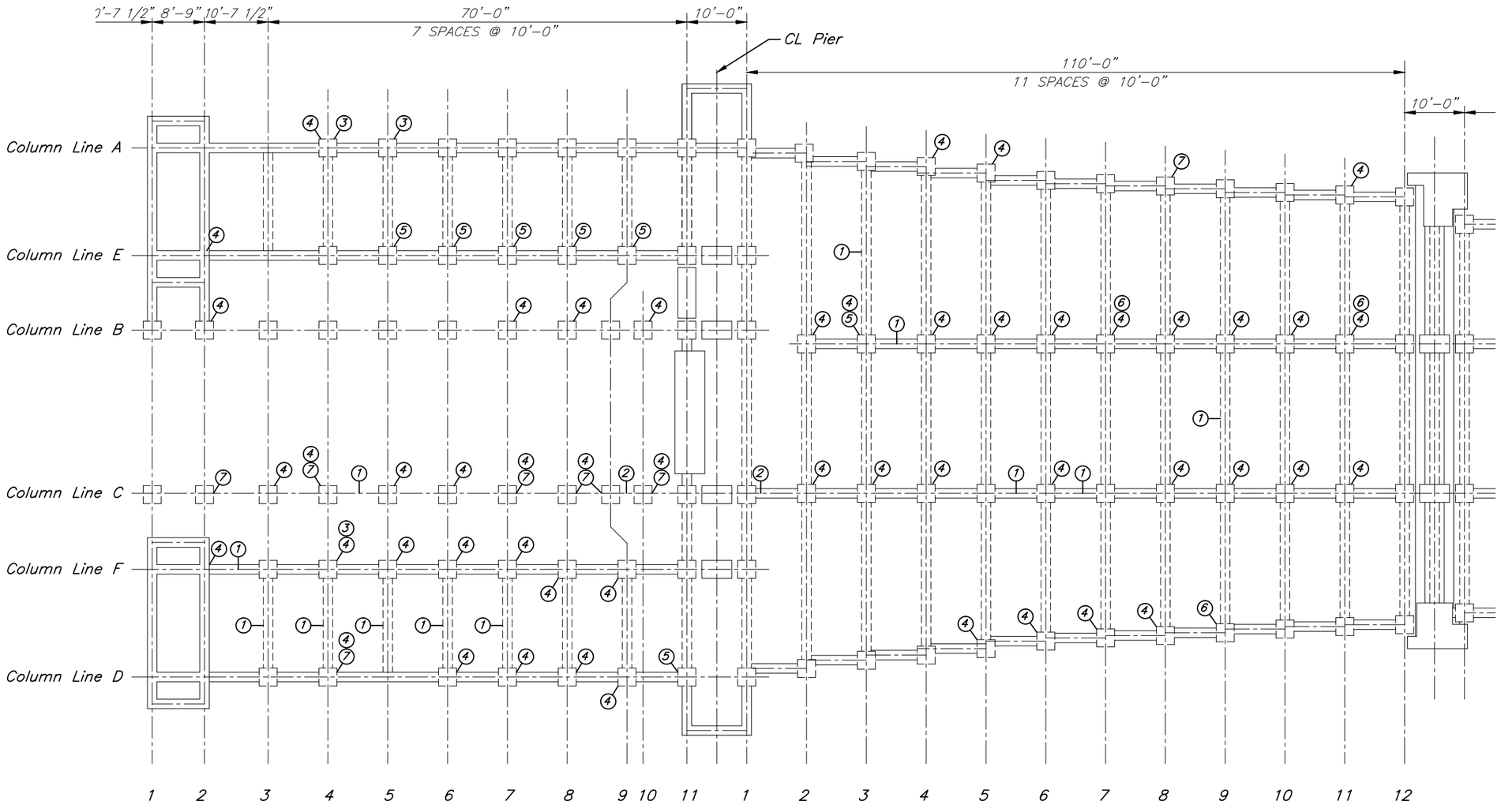
The equipment used was as follows:

Test unit: GE USM 35X, serial number 9236A with a date of last calibration of January 29, 2010
Transducer: KBI 2.25 MHz, ¾" diameter longitudinal mode
Couplant: Exosen #20
Reference standard: 1¾" diameter x 11" long bar

Respectfully submitted,
Professional Service Industries, Inc.

Edward Kudlaty
SNT-TC-IA Level III

APPENDIX D
STRUCTURE DEFICIENCY MAPS



PLAN – SPAN 1A

PLAN – SPAN 1B

Deficiency Key

1. Spall
2. Crack / Delam
3. Cracked/Spalled Top
4. Cracked/Spalled Base
5. Cracked/Spalled Capital
6. Large Vertical Cracks
7. Cracked/Spalled at Cross-Beam
8. Cracked/Spalled Floor Beam – Lower Deck
9. Cracked/Spalled Corbel

SCALE IN FEET 0 5 10

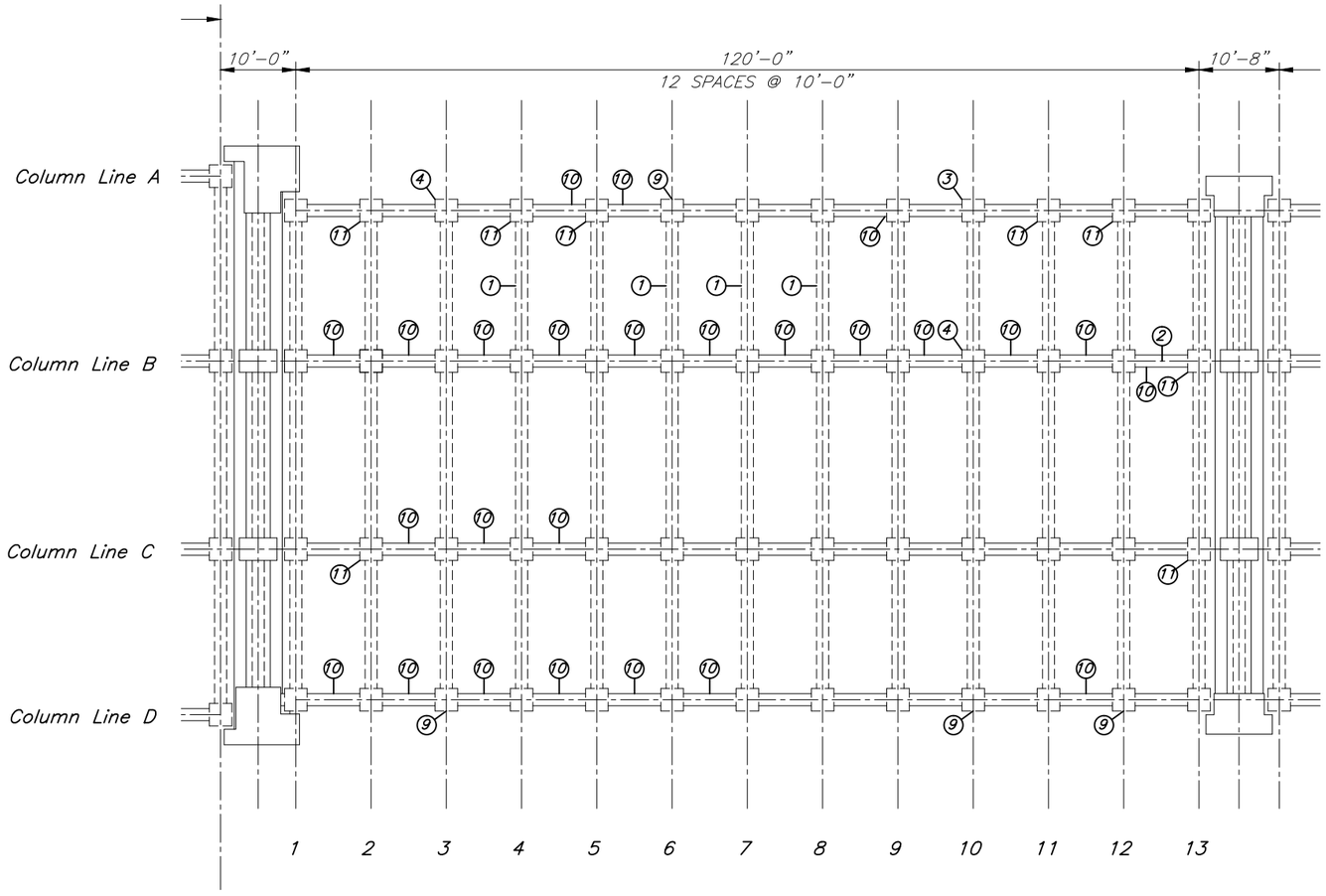
CALCULATED

CHECKED

PLAN - SPANS 1A & 1B DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 5'



PLAN – SPAN 1

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

SCALE IN FEET 0 5 10

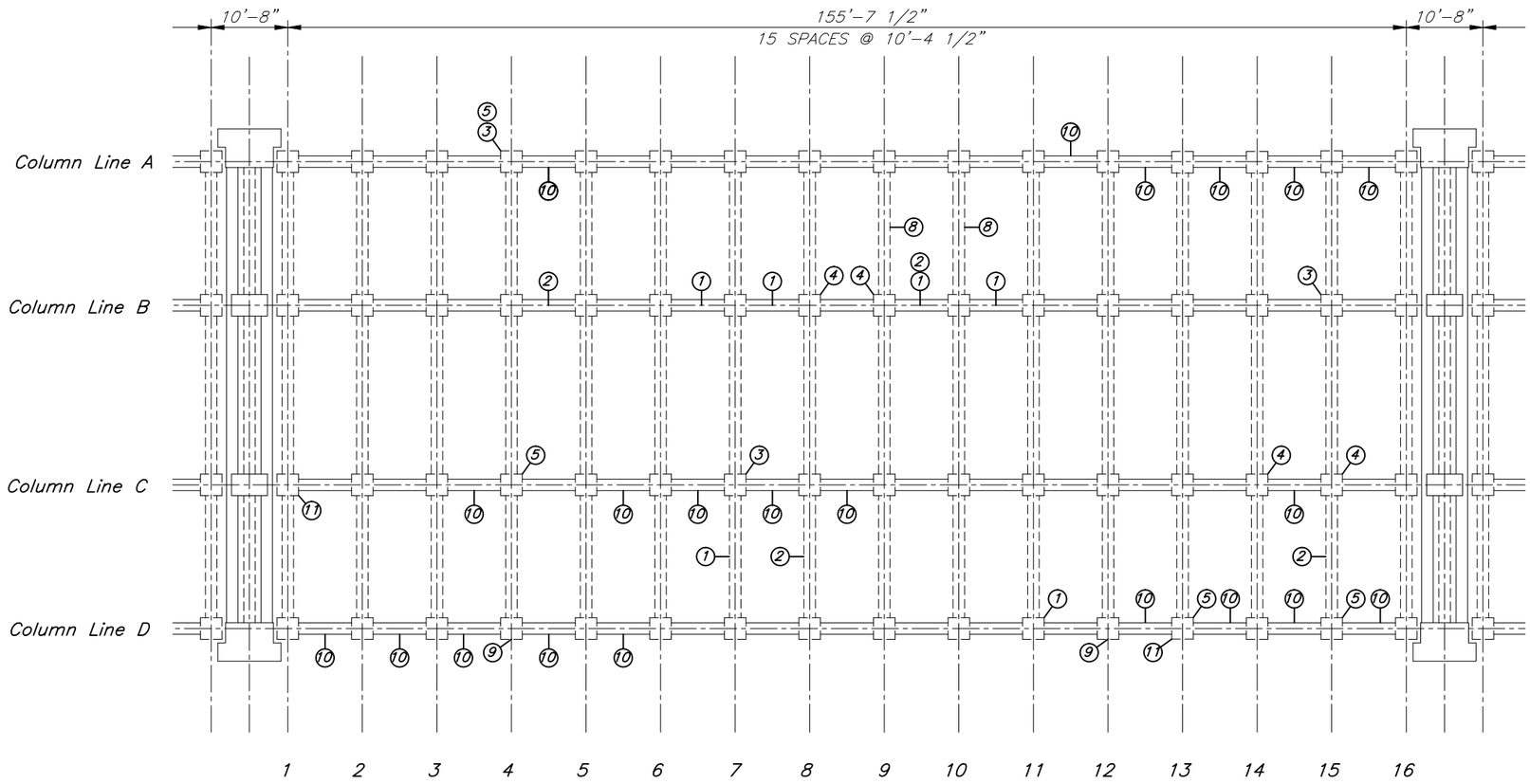
CALCULATED

CHECKED

PLAN - SPAN 1 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 5'



PLAN – SPAN 2

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross-Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

SCALE IN FEET 0 5 10

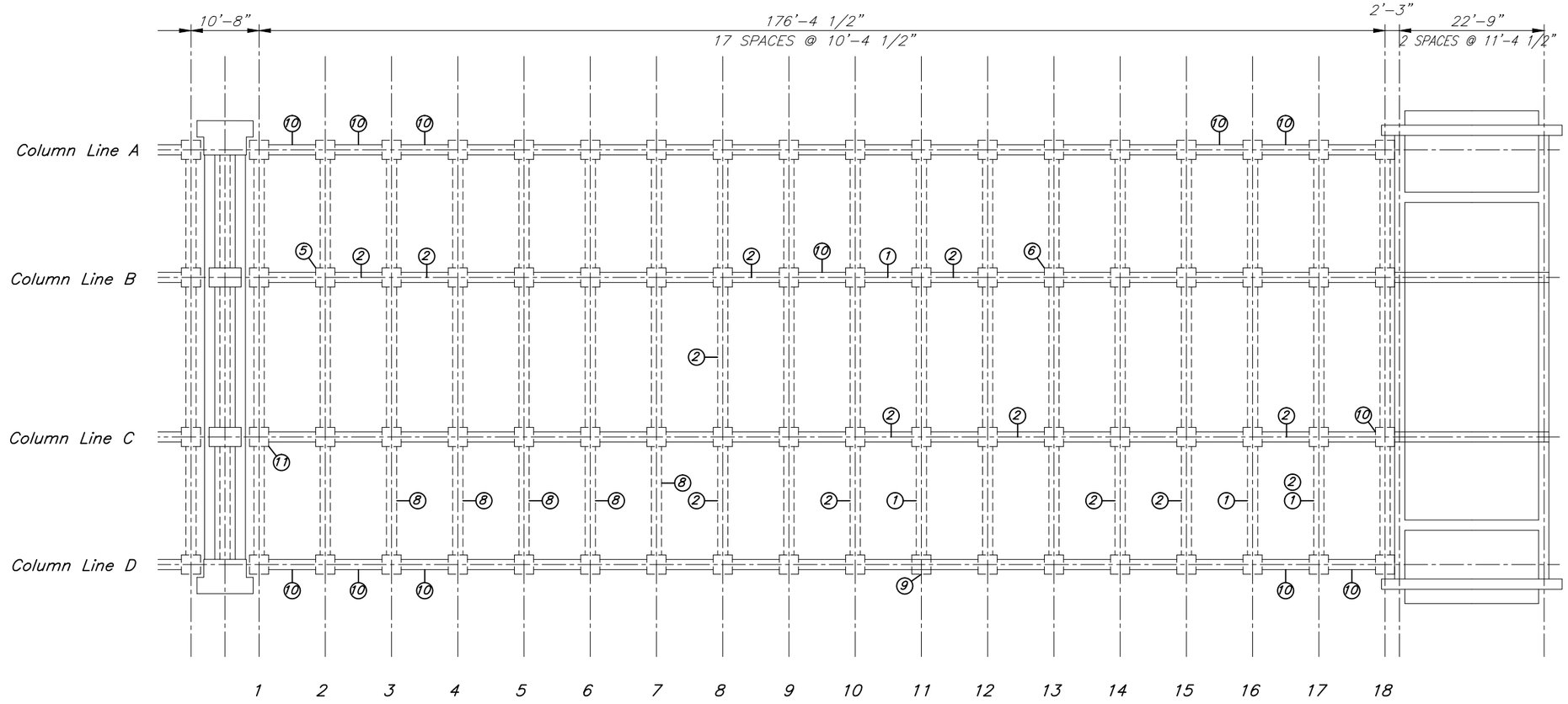
CALCULATED

CHECKED

PLAN - SPAN 2 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 – Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 5'



PLAN – SPAN 3

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

SCALE IN FEET 0 10 20

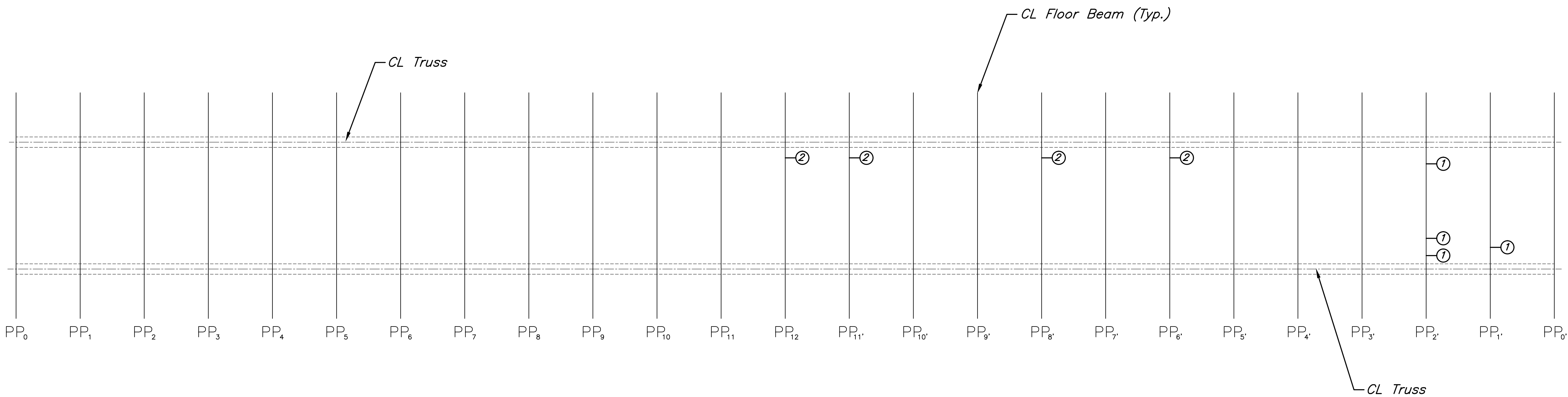
CALCULATED

CHECKED

PLAN - SPAN 3
DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 10'



PLAN – SPAN 4

Deficiency Key

(1) Cracked Weld

(2) Through–Hole in Web of Floor Beam

SCALE IN FEET 0 20 40

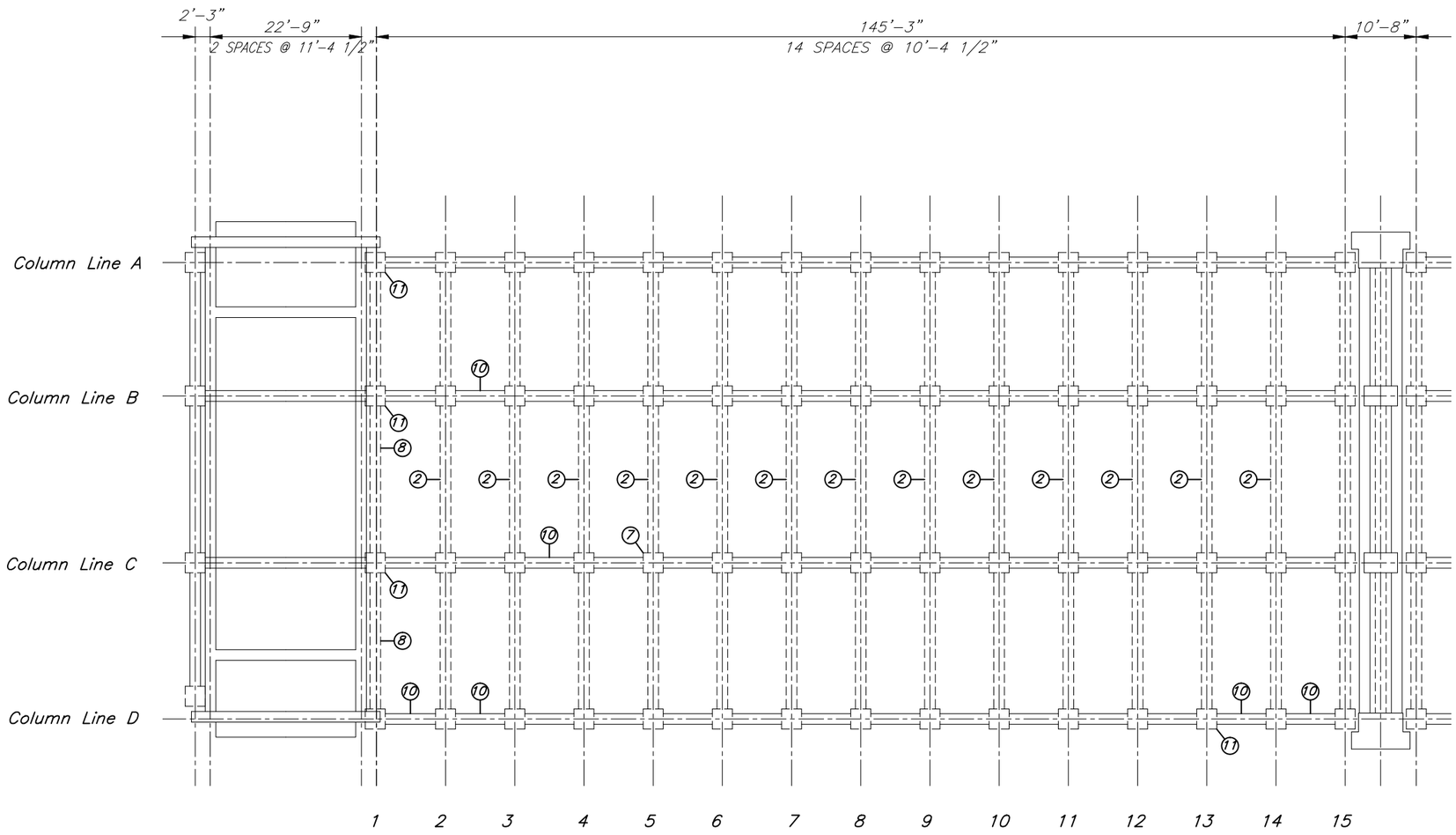
CALCULATED

CHECKED

PLAN - SPAN 4 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 – Detroit–Superior Bridge\Plan.dwg LAB 4–26–11 PLOT 1" = 10'



PLAN – SPAN 5

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

SCALE IN FEET 0 10 20

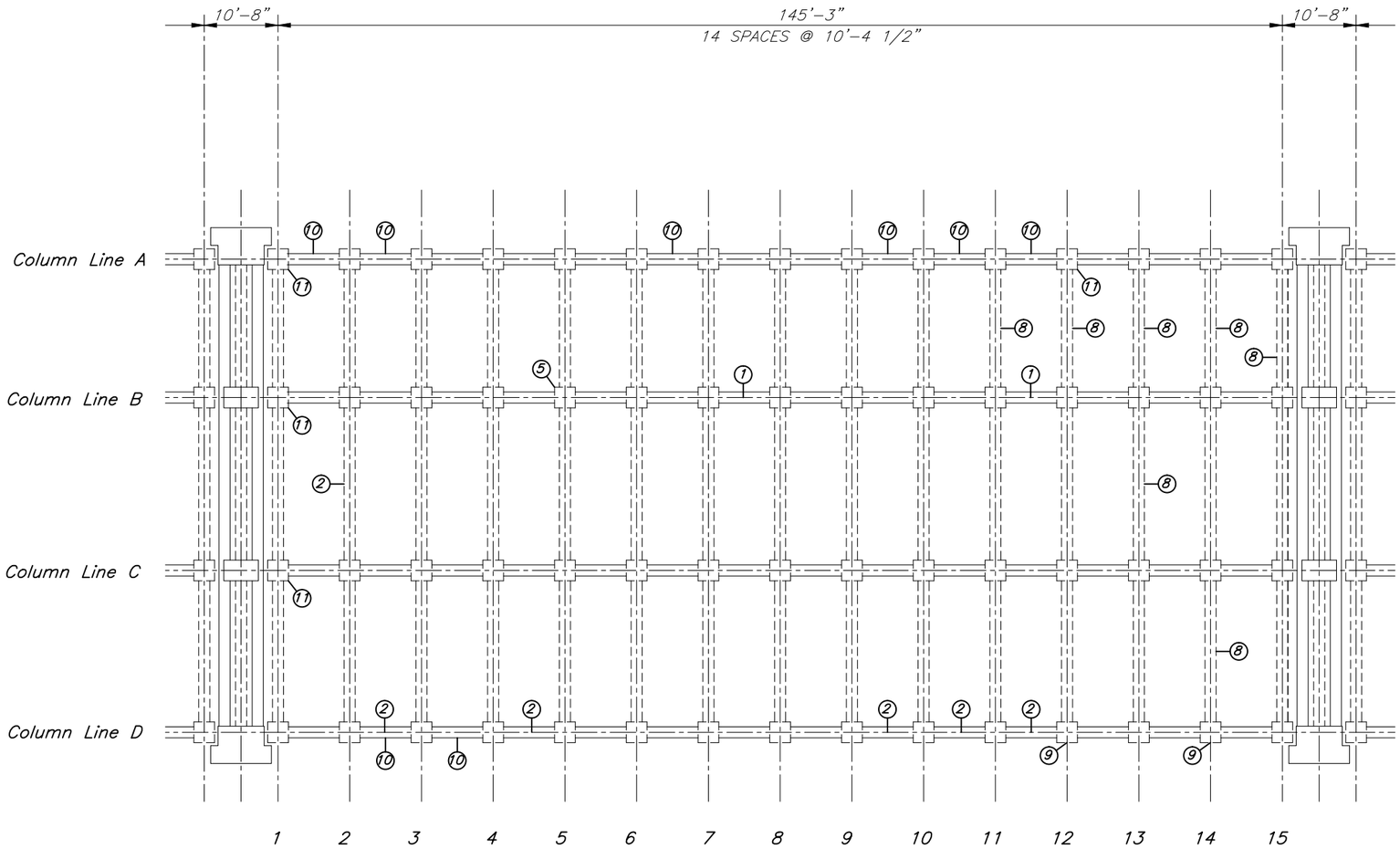
CALCULATED

CHECKED

PLAN - SPAN 5
DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 10'



PLAN – SPAN 6

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

SCALE IN FEET 0 10 20

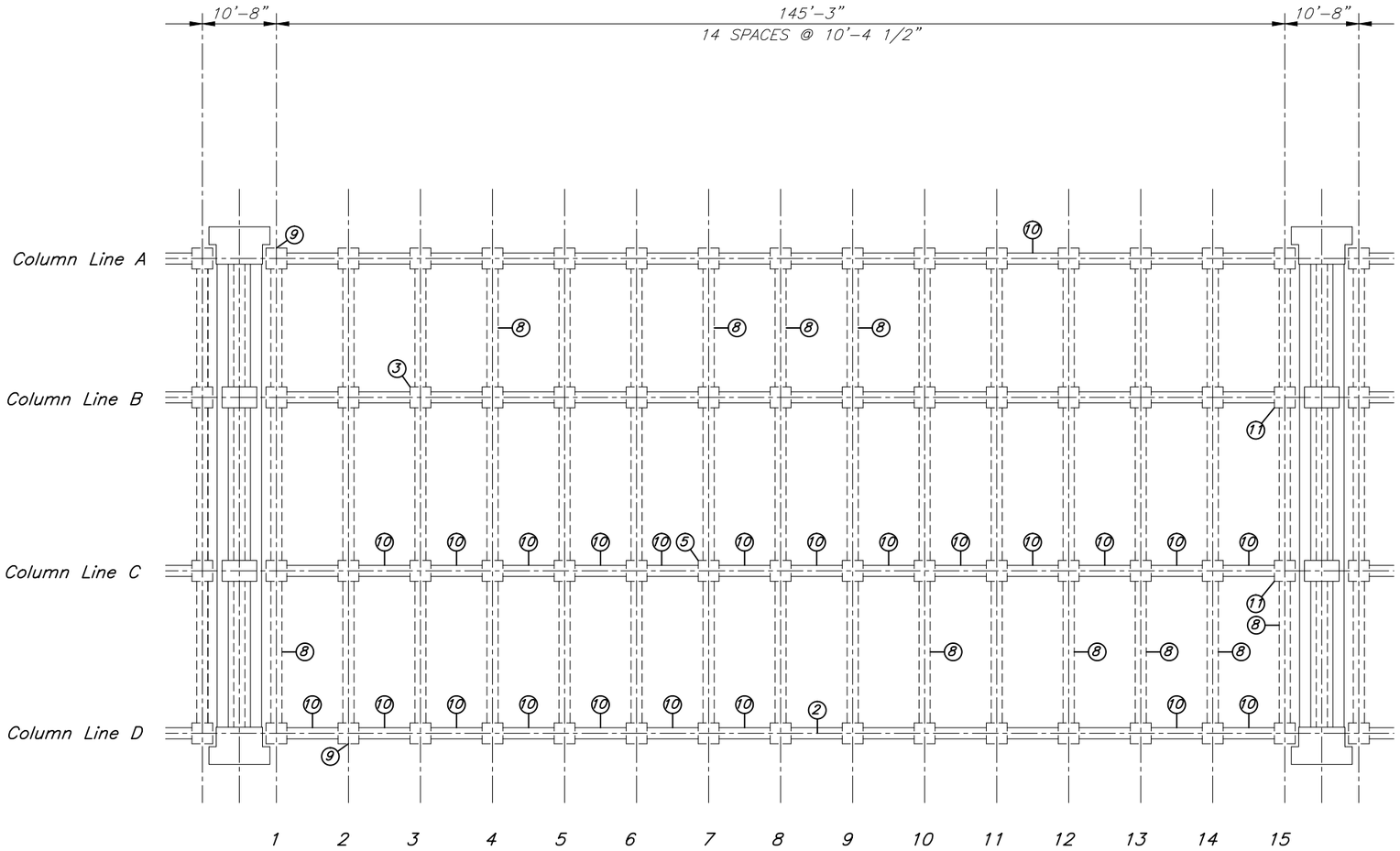
CALCULATED

CHECKED

PLAN - SPAN 6
DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 10'



PLAN – SPAN 7

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

SCALE IN FEET 0 10 20

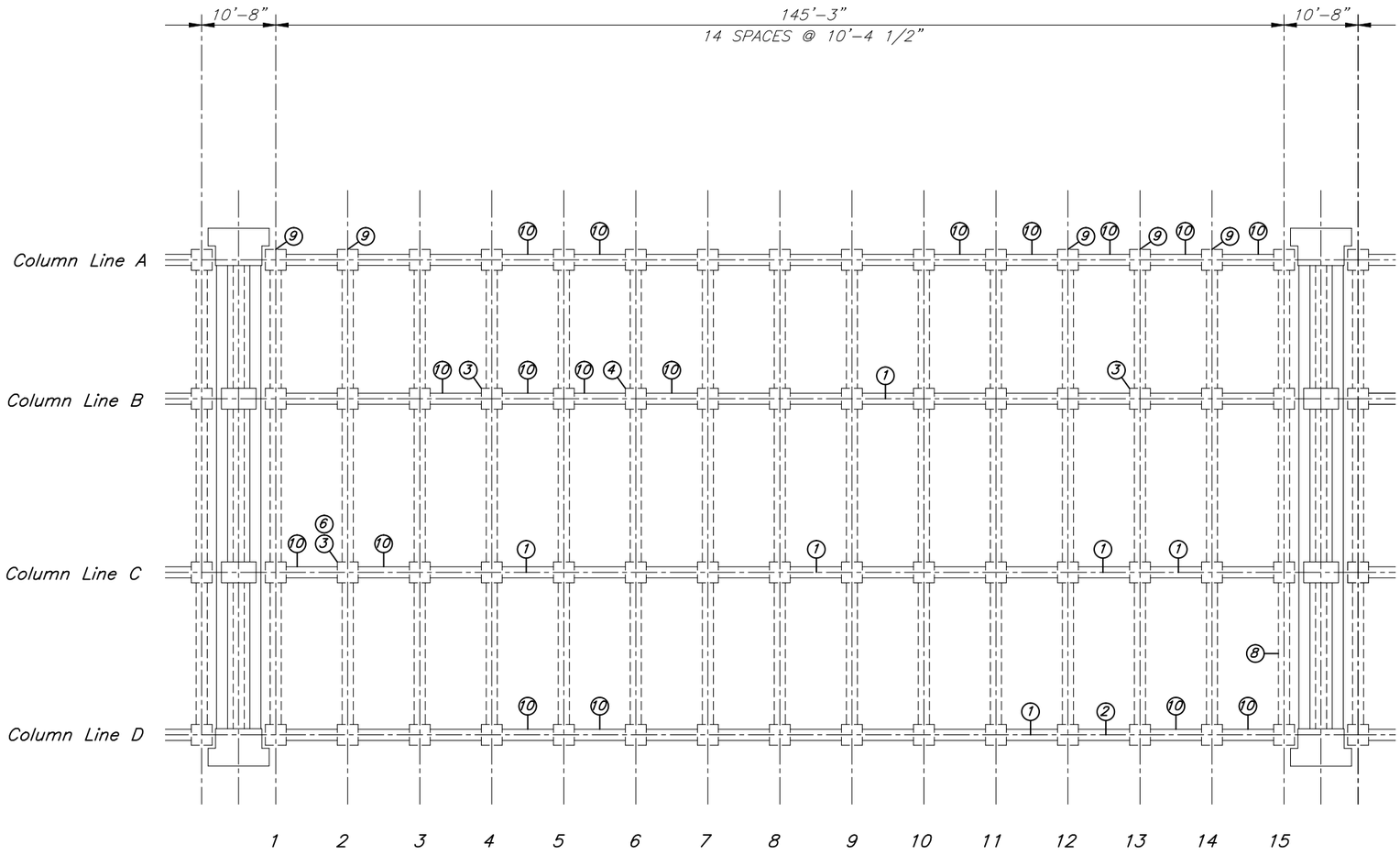
CALCULATED

CHECKED

PLAN - SPAN 7 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 10'



PLAN – SPAN 8

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

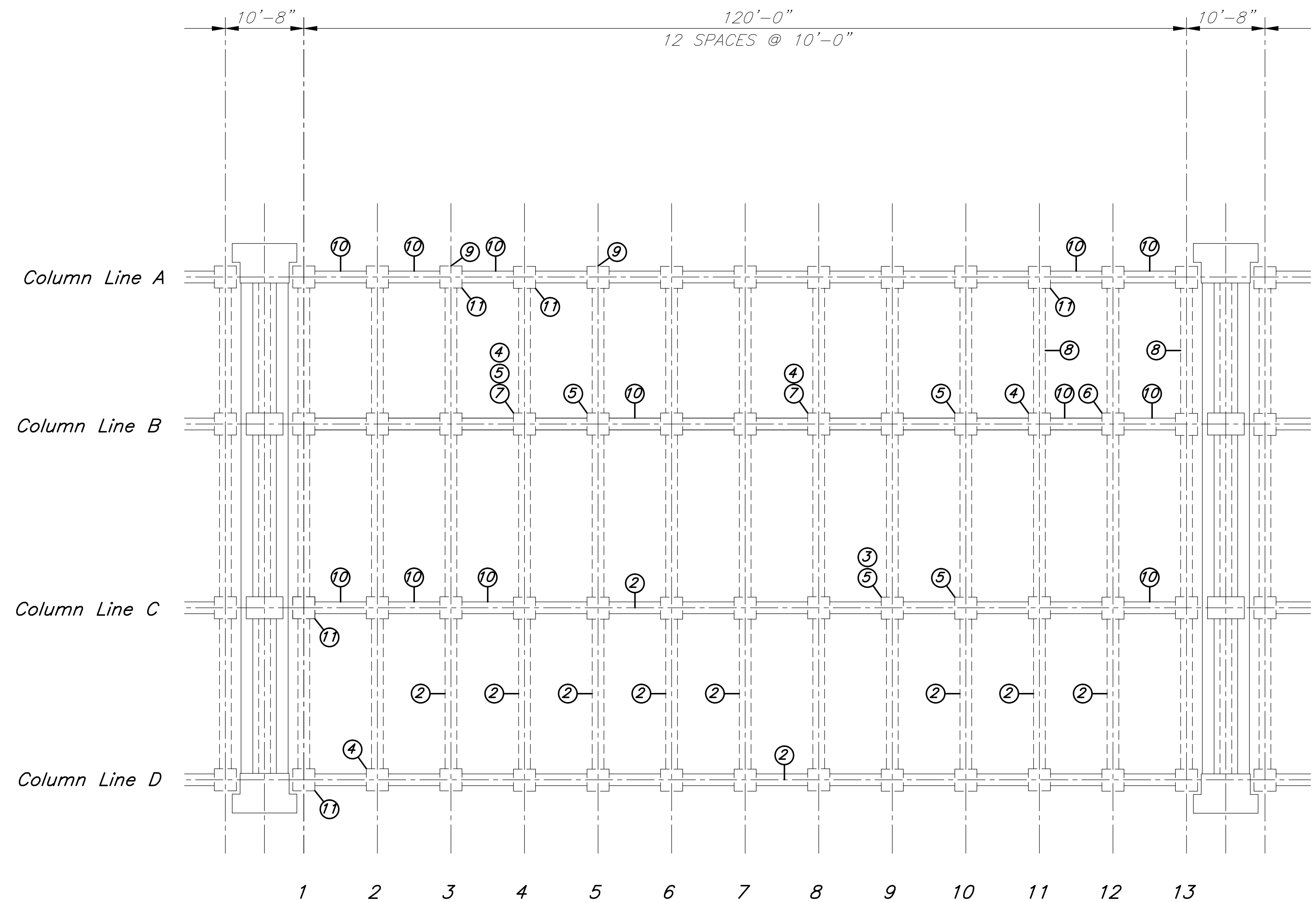
SCALE IN FEET 0 10 20

CALCULATED CHECKED

PLAN - SPAN 8 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 - Detroit-Superior Bridge\Plan.dwg LAB 4-26-11 PLOT 1" = 10'



PLAN – SPAN 9

Deficiency Key

- (1) Spall
- (2) Crack / Delam
- (3) Cracked/Spalled Top
- (4) Cracked/Spalled Base
- (5) Cracked/Spalled Capital
- (6) Large Vertical Cracks
- (7) Cracked/Spalled at Cross–Beam
- (8) Cracked/Spalled Floor Beam – Lower Deck
- (9) Cracked/Spalled Corbel
- (10) Cracked/Spalled Spandrel Arch Rib
- (11) Cracked/Spalled Spandrel Arch Column

0 10 20 SCALE IN FEET

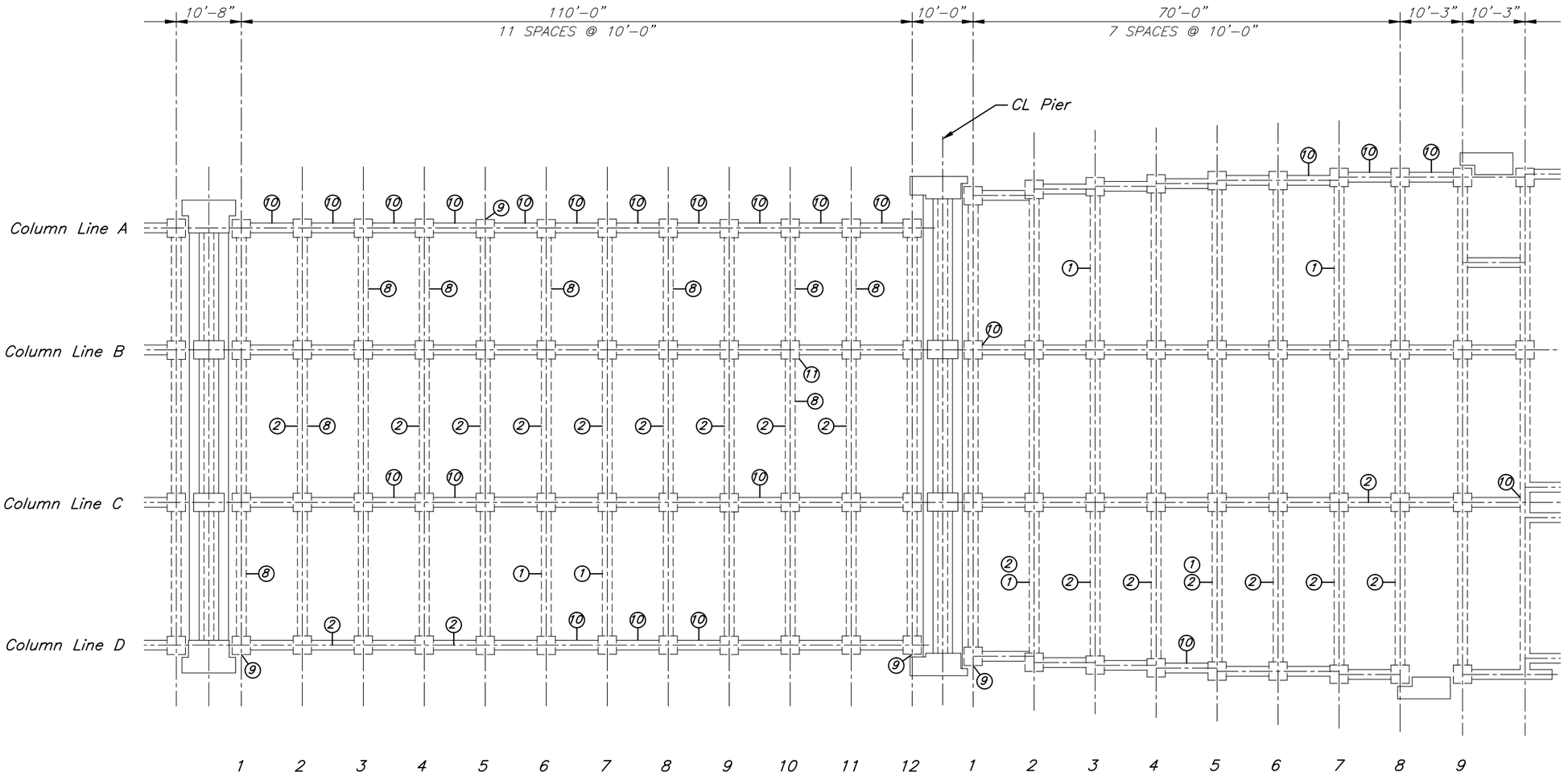
CALCULATED

CHECKED

PLAN - SPAN 9 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 – Detroit–Superior Bridge\Plan.dwg LAB 4–26–11 PLOT 1" = 10'



PLAN – SPAN 10

PLAN – SPAN 11

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

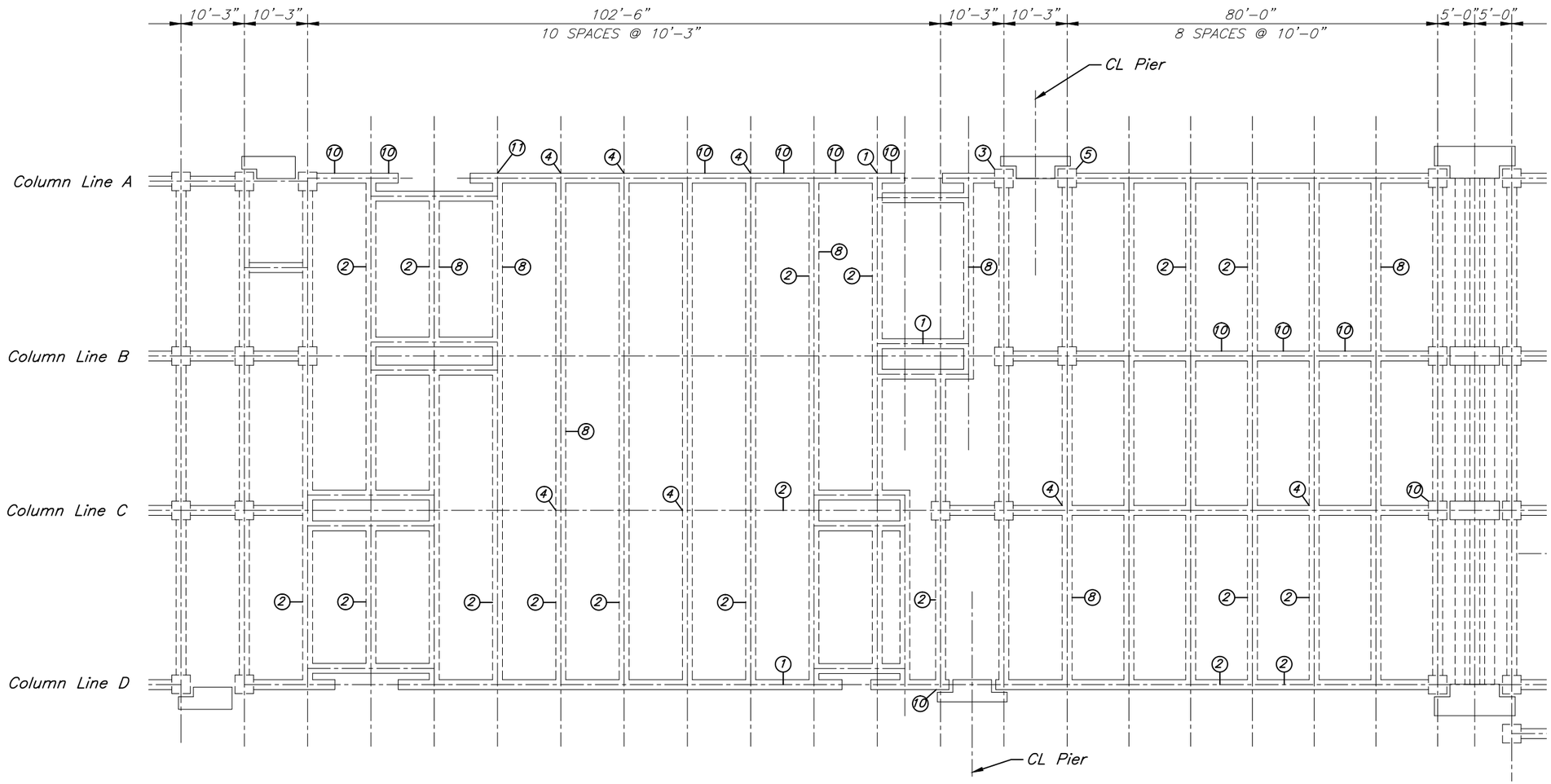
0 10 20 SCALE IN FEET

CALCULATED CHECKED

PLAN - SPANS 10 & 11 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 – Detroit–Superior Bridge\Plan.dwg LAB 4–26–11 PLOT 1" = 10'



PLAN – SPAN 12

PLAN – SPAN 13

Deficiency Key

(1)	Spall	(7)	Cracked/Spalled at Cross–Beam
(2)	Crack / Delam	(8)	Cracked/Spalled Floor Beam – Lower Deck
(3)	Cracked/Spalled Top	(9)	Cracked/Spalled Corbel
(4)	Cracked/Spalled Base	(10)	Cracked/Spalled Spandrel Arch Rib
(5)	Cracked/Spalled Capital	(11)	Cracked/Spalled Spandrel Arch Column
(6)	Large Vertical Cracks		

0 10 20 SCALE IN FEET

CALCULATED CHECKED

PLAN - SPANS 12 & 13 DEFICIENCY MAP

EUTHENICS INC

F:\...\2010 – Detroit–Superior Bridge\Plan.dwg LAB 4–26–11 PLOT 1" = 10'