Ohio Department of Transportation
2015 Physical Condition Report

Detroit-Superior Bridge over Cuyahoga River
Bridge No. CUY-6-1456

SFN: 1800930

March 2016

Prepared By:

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DETROIT-SUPERIOR BRIDGE OVER CUYAHOGA RIVER
2015 PHYSICAL CONDITION REPORT

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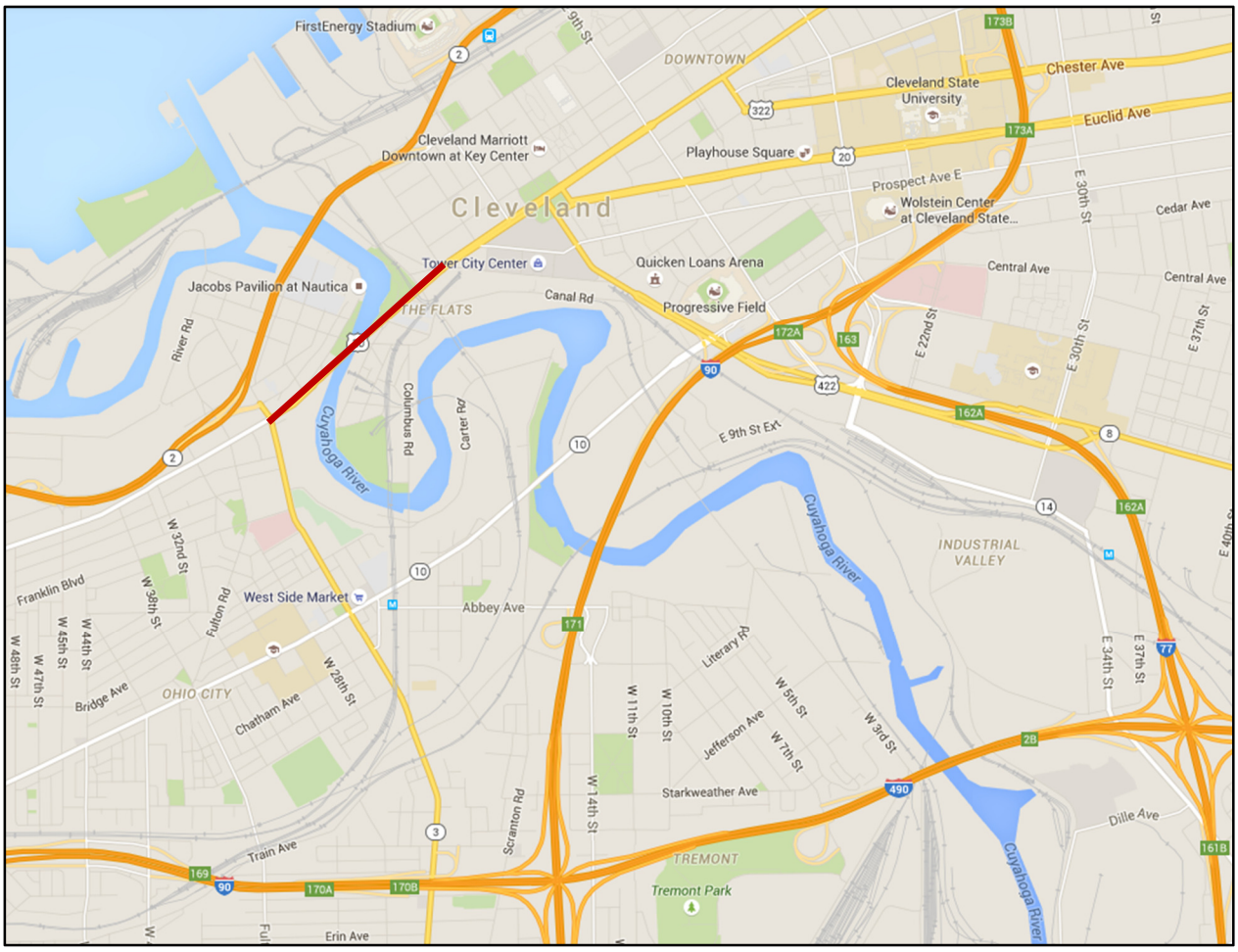

Figure 1 – CUY-6-1456 (Detroit-Superior Bridge) Location Map.

Bridge Description

CUY-6-1456 (SFN 1800930), commonly known as the Detroit-Superior Bridge and later renamed the Veteran's Memorial Bridge, is a 1917 double-deck structure carrying vehicular and pedestrian traffic over the Cuyahoga River Valley (**Photos 1 & 2**). The bridge is approximately 2,880 feet long, including 1,673 feet of subway tunnel that is linked by the lower deck. In its original design, the upper deck carried vehicular and pedestrian traffic while the lower deck had four streetcar lines and capacity for two future tracks. The streetcar lines across the Detroit-Superior Bridge were discontinued in 1953. The Detroit-Superior Bridge is included on the National Register of Historic Places.

General plan and elevation views of the Detroit-Superior Bridge are included in **Figure 2**. **Figure 3** shows the schematic plan and elevation views, and also a typical cross section. **Figure 4** contains the typical nomenclature of the concrete elements of the main concrete spans.

The Detroit-Superior Bridge is composed of three distinct units. The first unit, the West Approach, is comprised of the West Station area spanning a total of 350 feet west of Tower A and two abandoned subway tunnels: the Detroit Avenue Tunnel (660 feet long) and the West 25th Street Tunnel (480 feet long). Several utilities are pass through the West Station and tunnels. Since the late 1980s, the West Station has been opened to the public for tours and festivals.

The main unit is Spans 1A, 1B and 1 through 13. Spans 1A and 1B are transition structure from the subterranean West Station to the double-deck approach and main spans. These two concrete cellular spans total 220 feet long and each has enclosed cellular construction below the lower deck.

The main spans, Spans 1 through 13, are double-deck spans with vehicular and pedestrian traffic on the upper deck and utilities and maintenance access on the lower deck. Occasional tours and festivals also take place on the lower deck. Spans 1 through 3, 5 through 11 and Span 13 are concrete open spandrel arch spans, and Span 12 is a concrete encased steel half through arch. The main span, Span 4, is a 591-foot, three-hinged steel half-through arch truss in a Pratt configuration.

The third unit, the East Station, is a concrete cellular span that extends 165 feet past the East Abutment. A three panel long, cellular construction is present under the East Station lower deck immediately behind the East Abutment.

Photo 1– North Elevation, Spans 4 through 6.

Photo 2– East Approach Spans Deck, Looking East.

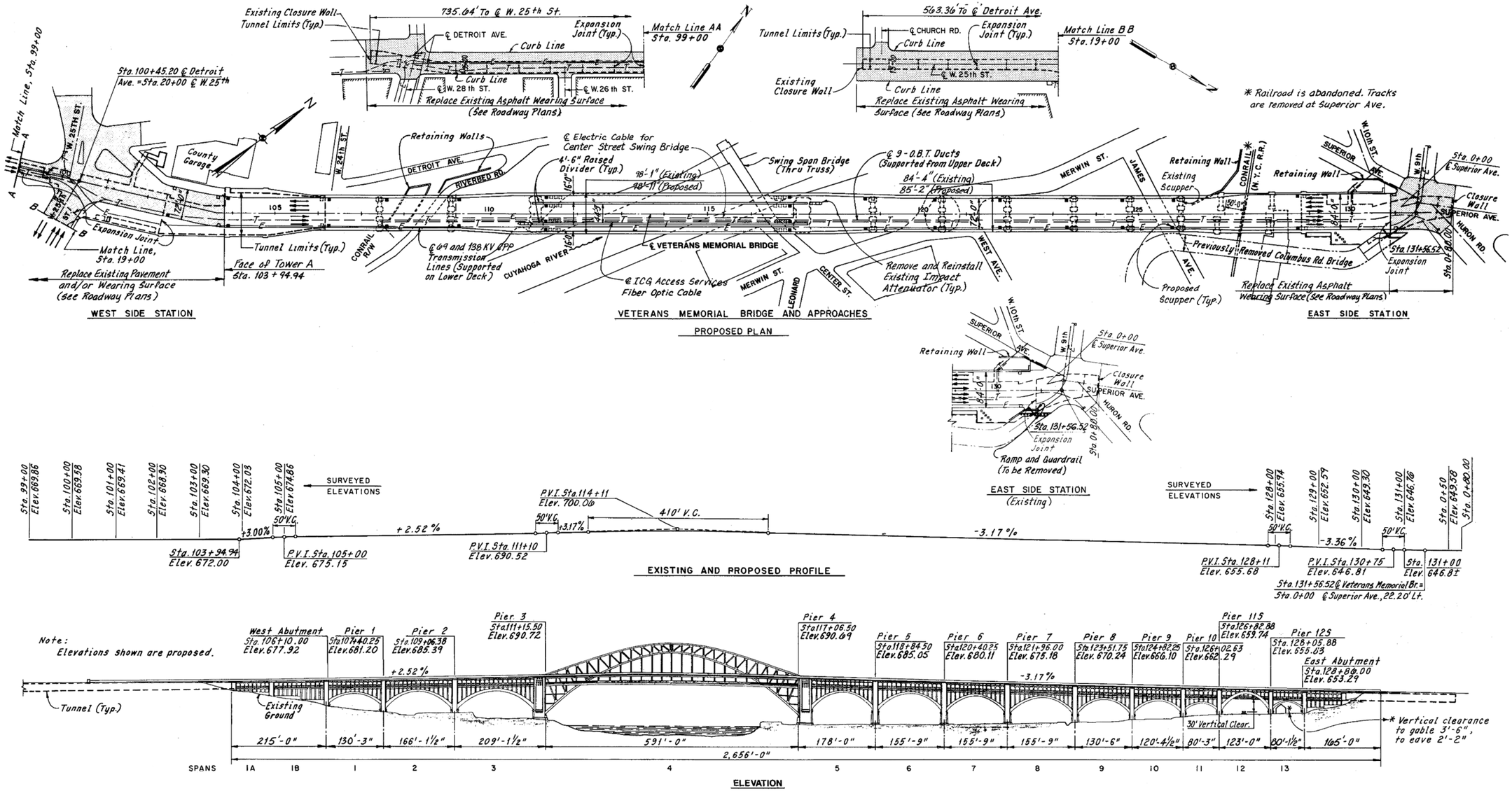

Figure 2 – CUY-6-1456 Plan & Elevation (Veterans Memorial Bridge Rehabilitation Plans, 1994).

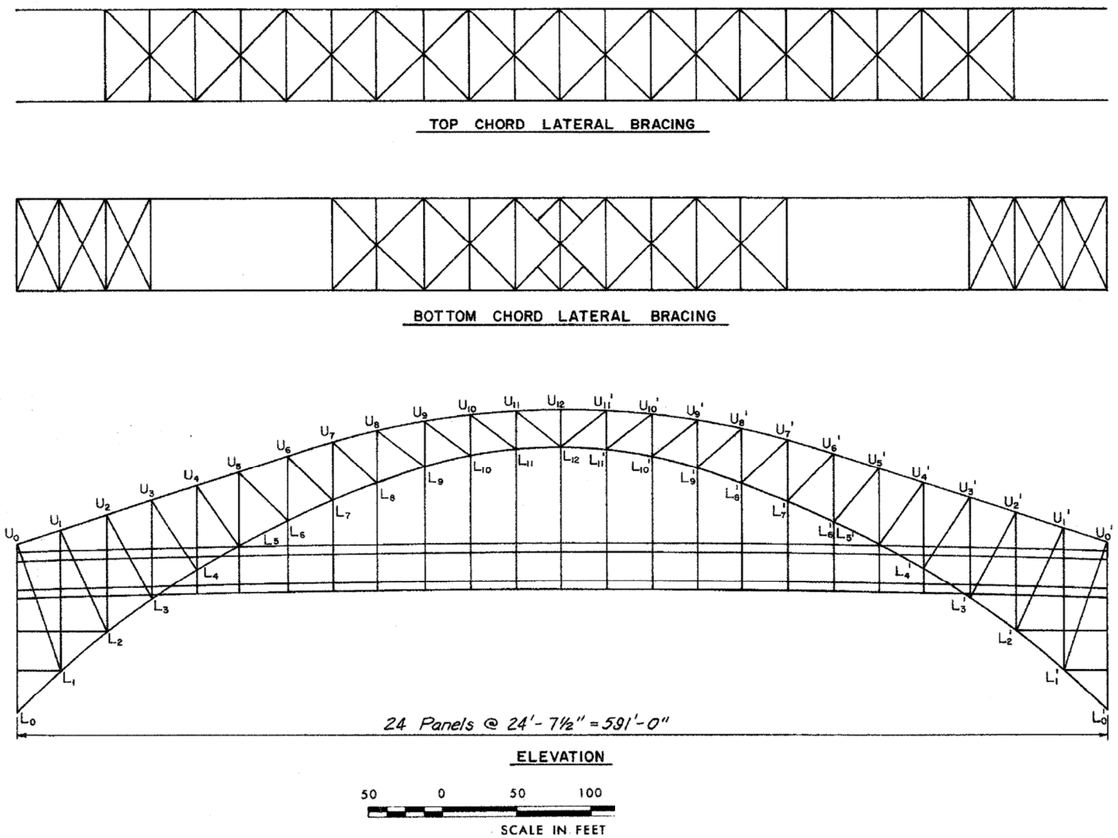

Figure 3 – Span 4 Nomenclature.

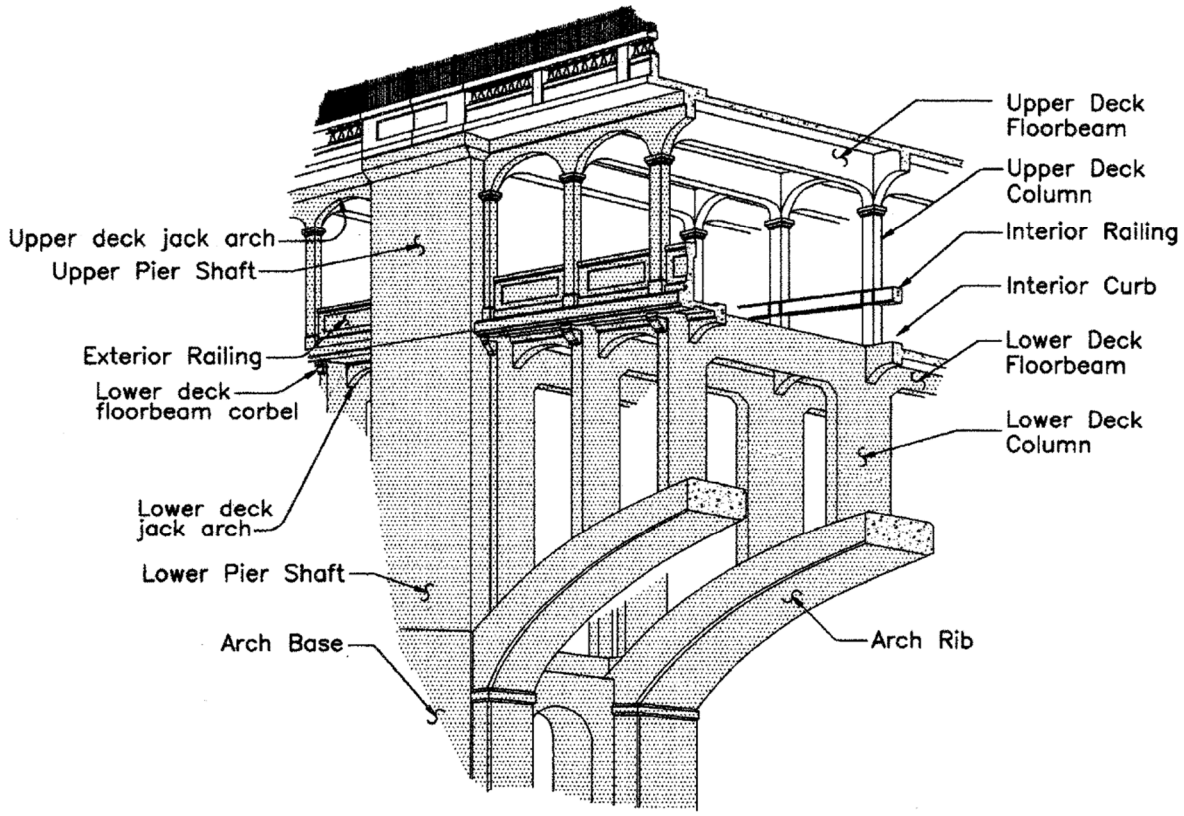

Figure 4 – Upper & Lower Deck Element Nomenclature, Approach Spans.

Construction, Service & Rehabilitation History

The Detroit-Superior Bridge was constructed from 1914 through 1915 to provide a high level vehicular and streetcar crossing over the Cuyahoga River, connecting the Ohio City community and Downtown Cleveland. The bridge replaced the Superior Viaduct, opened in 1878. Construction of the foundation began in 1913. The steel arch truss, Span 4, was erected from July 24 to November 6, 1915. On October 8, 1915, the two halves of the main truss were connected[1].

The Detroit-Superior Bridge was opened to vehicular traffic in November 1917, and streetcar traffic in January 1918. By 1930, the average daily traffic was 70,000, making it briefly the most highly used bridge in the United States. [2]

By the mid-1930s, spalled concrete was occurring due to improper drainage. Repairs were discussed but postponed due to the needs of World War II, and ultimately not performed until the 1960s.

[1] Beyer, William E, The History of the Veterans Memorial Bridge, 90th Anniversary Edition, Bookmasters, Inc, Ashland, Ohio.

[2] Cleveland Plain Dealer, *High Level Span is Busiest in U.S.*, October 17, 1930, p. 6.

The Detroit-Superior Bridge has received a series of various major and minor rehabilitations as follows[3]:

1. 1967-70 Major Rehabilitation
    a. Removal of the original upper deck consisting of four vehicular lanes and two 15-foot wide sidewalks.
    b. Strengthening or replacement of all upper deck concrete floorbeams.
    c. Span 4: Erection of new steel floorbeam cantilevers.
    d. Construction of the new upper deck with six vehicular lanes and two five-foot wide sidewalks.
2. 1995-97 Major Rehabilitation
    a. Replacement of the upper and lower deck floors.
    b. Replacement of select upper and lower concrete floorbeams, columns, jack arches and pier shafts (**Table 1**).
    c. Application of epoxy-urethane or non-epoxy sealer to most exposed concrete surfaces.
    d. Span 4: Replacement of all steel hangers, Panel Points 6 through 6'.
    e. Replacement of Upper Deck and Lower Deck Floor Beams 5 and 5' and stringers.
    f. Painting of all steel superstructure components.
    g. Installation of new drainage system.
    h. Installation of architectural lighting.
3. 2003 North Sidewalk Linear Park Conversion.
    a. Conversion of vehicular traffic to two westbound and one eastbound lane between the steel trusses and on eastbound lane on the Span 4 south cantilever.
    b. Widening of the north sidewalk. With longitudinal trench drainage.
    c. Installation of public art and benches along the modified north sidewalk.
4. 2014-Present
    a. Span 1A through Span 13: Patching deficient upper deck wearing surface areas.
    b. Patch deficient concrete super- and substructure components in West Station, Detroit Avenue Tunnel, West 25th Street Tunnel and Spans 1-3 and 5-13. (Note: In Spans 1-3 and 5-13, the patching below the lower deck was later restricted to areas adjacent to and over public areas.)
    c. Span 4: Perform zone painting of primary and secondary truss members between upper and lower decks.
    d. Install hanger caps at hanger opening in upper deck, Panel Points 6 through 6'.
    e. Replace four concrete columns in West Station. (This task has not yet started.)
    f. Perform pipe cleanout for pedestrian tunnels in the West and East Station. (This task was performed but not successful.)

[3] Vermes, William J., Gasparini, Dario A. & Conley, Natalie, *Cleveland's Historic Bridges: Architectural & Engineering Masterpieces*, Publication of the 7th Historic Bridge Conference, Cleveland, Ohio, 2001.

During the mid-2000s, new cracks appeared in the substructure of Span 1A and increasing the movement in Tower B South was observed. In 2013 a series of slope inclinometers were installed along the north and south sides of the bridge from Tower A to Pier 2 (**Photo 3**) and crack gauges were installed on Tower B South and under Spans 1A and 1B. The inclinometer readings are include in Appendix C.

Member	Total Members	Members Replaced	Total Percent Replaced
Upper Deck Floor Beams	686	316	38%
Upper Deck Columns	693	179	26%
Upper Deck Jack Arches	564	260	45%
Lower Deck Floor Beams	548	50.5	11%
Lower Deck Corbels	279	79	28%
Lower Deck Jack Arches	520	176	34%
Lower Deck Columns	488	8	2%
Upper Exterior Pier Shafts	32	17.5	55%
Lower Exterior Pier Shafts	28	5.5	20%

Table 1 – 1995-97 Detroit-Superior Bridge Rehabilitation Concrete Superstructure Member Replacement Summary, Spans 1 to 3, 5 to 13 & East Station.[4]

[4] Vermes, William J., *Rehabilitation of The Detroit-Superior Bridge*, Proceedings of an International Conference on Historic Bridges to Celebrate the 150th Anniversary of the Wheeling Suspension Bridge, West Virginia University Press, 1999, pp. 117-132.

Photo 3– Slope Inclinometer, Tower B South.

Inspection Procedure

Jones-Stuckey performed a routine inspection of this structure from September 10 through December 23, 2015. Personnel included William J. Vermes, P.E., Christian Lunt, PE, Dale Arnold, PE, Jessica Sizemore, CBSI, Elizabeth Trapp, EI, and Samuel Dudek, EI. The inspection access was achieved via 120-foot manlift, modified rock climbing equipment and extension ladders. Confined space entry procedures were performed for the cellar construction areas beneath the lower deck in Spans 1A, 1B and the East Station. LED lighting with heavy duty extension cords were used to provide supplemental lighting in the Detroit Avenue and West 25th Street tunnels, West Station and the confined space area beneath Span 1A.

Greenman-Pederson Inc. performed the underwater inspection of Piers 3 and 4. The underwater inspection report is included in **Appendix D**.

The 2015 SMS Bridge Inspection Field Report and Structure Deficiency Maps are included in **Appendix A** and **Appendix B** respectively.

Condition & Element Level Inspection Guidelines

Ohio and National Bridge Inspection Standards (NBIS) guidelines for evaluating the condition of bridges have been developed to promote uniformity of bridge inspections performed by different teams and at different times. Table 1 contains the bridge inspection rating matrix established by the Federal Highway Administration (FHWA), using a 0-Failure through 9-Excellent scale, and used by the Ohio Department of Transportation (ODOT). In this report, component conditions will generally be discussed based on the ODOT rating guidelines for individual components, 1-Good through 4-Critical. The General Appraisal, the Deck, Superstructure, Substructure, Channel and Approach Summaries, and the Protective Coating System rating will follow the NBIS/ODOT 0 through 9 rating guidelines.

Additionally, this bridge inspection was performed in accordance with the following documents:

- Manual of Bridge Inspection, Ohio Department of Transportation, 2014.
- Manual for Condition Evaluation of Bridge, 2nd Edition, American Association of State Highway and Transportation Officials (AASHTO), 2011.
- Bridge Inspector's Reference Manual (BIRM), U.S. Department of Transportation, revised December 2012.

Since the 1995-97 bridge rehabilitation, a different bridge nomenclature system has been used. With the original construction and rehabilitation drawings included as a significant element of the bridge record, and past FHWA policy of recommending that original member identification system be followed, this inspection therefore followed the structure's original member identification. This practice ensure that this inspection will at a minimum conform to the original shop drawings and documentation for prior bridge rehabilitation.

RATING		CONDITION	RATING GUIDELINES	Inspector Guidelines
ODOT	NBIS			
1 – Good	9	Excellent		Make brief comments as necessary. Communicate the predominant deficiency.
	8	Very Good	No problems noted.	
	7	Good	Some minor problems present.	
2 – Fair	6	Satisfactory	Structural elements show some minor deterioration.	
	5	Fair	All primary structural elements are sound but have minor section loss, deterioration spalling or scour.	Document deficiencies quantitatively. Consider taking photos or making sketches.
3 – Poor	4	Poor	Advanced section loss, deterioration, spalling or scour.	Candidate to establish monitoring benchmarks to track the rate-of-change. Take photos, make sketches and document quantitatively in order to determine if a re-load rating is possible. Include in-service conditions to verify capacity.
	3	Serious	Loss of section, deterioration, spalling or scour has seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.	Above… And discuss the deficiency immediately with Control Authority.
4 – Critical	2	Critical	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.	Above… And the bridge is a candidate to dispatch road closure and/or immediate and/or increased monitoring (Interim Inspections). Confirm in writing, critical finding.
	1	Imminent Failure	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structural stability. Bridge is closely monitored is closed to traffic but corrective action may put bridge back into light service.	Above… And Dispatch immediate lane or bridge closure. Contact the Control Authority. Stay at the bridge until the safety of the traveling public is achieved. Confirm in writing.
	0	Failure	Out of Service, beyond corrective action.	

*** Advanced** – widespread deficiencies or a likely reduction to capacity (more examples on following page).

**** Structurally Deficient (SD) –**Bridge Deck, Superstructure, or Substructure Summary rated 4- Poor or below.

Table 2 – ODOT & NBIS Condition Rating Guidelines.

II. Deck

The deck is in ***Good*** Condition, or ***7*** on the NBIS condition rating guidelines. Deck findings are shown in **Appendix B**. Condition findings of individual deck items are as follows:

Floor-Upper Deck (c7.1)

The upper deck floor is in ***Fair*** condition. The observed deficiencies vary due to the diverse floor design and period of construction. Therefore the floor condition is discussed by section as follows:

Section	Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
Detroit Ave. Tunnel	17,950 SF	17,950 SF				1.00
West 25th St. Tunnel	13,750 SF	13,650 SF	100 SF	100 SF		1.13
West Station	37,800 SF	29,600 SF	7,350 SF	850 SF		1.55
Spans 1A, 1B, 1-13	232,250 SF	232,250 SF				1.00
East Station	31,150 SF	31,150 SF				1.00
Total Structure	332,900 SF	324,500 SF	7,450 SF	950 SF		1.08

Detroit Avenue Tunnel: During the 1995-97 rehabilitation, the Detroit Avenue Tunnel slab was uncovered for full-depth replacement at the slab joints and for application of a new waterproofing membrane. The top of the tunnel slab was found to be in poor condition, and the most economical repair was determined to be placement of a new reinforced slab on top of the original slab (**Photo 4**). The new slab covers the entire original slab and was designed for a HS20 live load with the original slab contributing no structural support. Neither the top nor bottom surfaces of the new structural slab are visible, thus the Detroit Avenue Tunnel floor is assumed to be in good condition despite the poor and critical conditions of the original tunnel slab underside.

West 25th Street Tunnel: The original floor is extant, except for sections replaced full depth adjacent to the tunnel joints. The West 25th Street Tunnel floor is in good condition with local areas of delamination and shallow spalls.

West Station: The original floor is extant except for the southeast corner, which was replaced in the 1995 rehabilitation due to on-going instability of the south embankment. In the West Station, the floor has a minimum 16-inch thickness. When the West Station floor was uncovered in Fall 1995, a large area along and under the south upper deck roadway curb was found to be unsound due to water ponding under the asphalt wearing surface and passing through the failed 1917 waterproofing. The subsequent floor patching averaged a depth of four to six inches with one patch area reaching a depth of nine inches. A Type 3 waterproofing was applied to the station slab prior to the placement of the new asphalt wearing surface.

The West Station floor is in ***Fair*** condition with areas of efflorescence, active water inflation and exposed bottom mat reinforcement (**Photo 5**). As shown in Figure B-1, the most significant areas of deterioration are adjacent to the restored floor joints and in Bays A and B.

Span 1A, 1B, and 1 through 13: The upper deck floor in the main spans were constructed in the 1995-97 rehabilitation. The floor is in ***Good*** condition with few cracks and efflorescence observed. However there are indications of accelerated deterioration after 18 years of service. In the Panel 3, Center Bay, of Span 8, water has been observed leaking from an area of mottled concrete floor. In Span 9, an area of wearing surface spalled in November, resulting in an emergency deck patching operation (**Photo 6**). The resulting patch revealed 1/8-in section loss to the top reinforcement (**Photo 7**) with one area of full-depth repair in Panel 3, Center Bay. An local area of efflorescence is present in Panel 4, Center Bay, of Span 7 (**Photo 8**).

East Station: The East Station floor was replaced during the 1995-97 rehabilitation, and no deficiencies were observed.

Photo 4 - Construction of Detroit Avenue Tunnel Supplemental Roof Slab, Looking East, 1996.

Photo 5 – Active Efflorescence, Water Infiltration & Rebar Corrosion, Panel D12, West Station.

Photo 6 – Recent Wearing Surface Repair, Span 9 (November 2015).

Photo 7 – 1/8-Inch Deep Section Loss of Epoxy Coated Rebar Following 18 years of Service.

Photo 8 – Full Depth Upper Deck Floor Patch, Span 9.

Edge of Floor-Upper Deck (c7.2)

The upper deck floor is in ***Fair*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
5,312 LF	5,312 LF				1.00

Floor – Lower Deck

The lower deck floor is in good condition with minor deficiencies present. The lower deck consists of reinforced concrete with stay-in-place forms in Spans 1 through 3, and Spans 5 through 13. In Span 4, the lower deck is a combination of an interior vehicular steel grid deck and exterior pedestrian fiberglass grating. Spans 1A and 1B still retain the original reinforced concrete deck.

At Span 2, Panel 15, Center Bay, the stay-in-place form has advanced corrosion despite no observed cause for this deterioration (**Photo 9**). In Span 1B, the South Bay has exposed top mat reinforcement, indicating concrete loss at least four inches deep in the 12-inch thick slab. Below, some corrosion with diagonal cracking is present in the center and south bays.

Photo 9 - Corroded & Missing Stay-in-Place Form (Circled), Lower Deck Panel 15 Center, Span 2.

Wearing Surface (c8)

The wearing surface is in ***Fair*** condition. Over the West Station, the asphalt wearing surface has wide longitudinal cracks coinciding with the placement seams (**Photo 10**). During this inspection, approximately 30% of the concrete wearing was sounded by a chain drag, with approximately 5% of the total concrete wearing surface unsound. Large delaminations are present on Span 5, Panel 2' (**Photo 11**), and Spans 7 through 9. In the latter location, a series of longitudinal delaminations are present near the current roadway center line. Also, the wearing surface is delaminated in the Span 9 westbound lanes adjacent to the eastbound wearing surface repair performed in November 2015 (**Photo 12**). Throughout the concrete wearing surface, scattered longitudinal crack up to 0.030" wide are also present. Wearing surface delaminations and other deck findings from Span 1A through the East Station Unit are including on **Sheets B-2** and **B-3**.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
191,232 SF		191,232 SF			2.00

Photo 10 - Cracked Asphalt Wearing Surface, West Station.

Photo 11 – Large Area of Delaminated Wearing Surface, Panel 2', Span 4.

Photo 12 – Delaminated Wearing Surface Adjacent to November 2015 Repair, Span 9.

Curb & Sidewalk (c9)

The curbs and sidewalks are in ***Fair*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
5,312 LF		5,312 LF			2.00

Isolated spalls on the south sidewalk surfaces are present along the curb plates. Along the north sidewalk, local spall and delaminations are present in the sidewalk widening placed in 2003 (**Photo 13**).

Median (c10)

The median, located along the south truss line, is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
674 LF	635 LF	40 LSF			1.09

Shallow spalls are present on the concrete median. At the time of this inspection, the traffic attenuator had no signs of collision damage with one cover panel dented and slightly misaligned.

Railing (c11)

The railing is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
5,312 LF	5,312 LF				1.00

The railing exhibits shallow shrinkage cracks that have been present soon after completion of the 1995-97 rehabilitation. The aluminum architectural vandal protection fence on the south railing has several panels dented due to vandalism and/or attempted theft (**Photo 14**). Also along the south rail, misalignment of the top of rail is present at the Tower A and Tower B expansion openings, with the east top of rail $^{7}/_{8}$" and $^{1}/_{4}$", respectively (**Photo 15**). This top rail misalignment may be associated with the south slope movement below. See **Substructure, Tower B South** for further discussion.

Photo 13 – Cracked & Delaminated Concrete, 2003 North Sidewalk Extension.

Photo 14 – Vandalism & Attempted Theft of Aluminum Fence, South Rail.

Photo 15 – Uneven Top of South Rail, Tower A.

Drainage (c12)

The drainage is in ***Fair*** condition. The drainage system was installed during the 1995-97 rehabilitation, and was initially specified to be galvanized steel pipe throughout the structure. However, at the contractor's recommendation, PVC pipe was installed for most drainage components as a means to meet critical path benchmarks and reduce some construction costs.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
28	26		2		1.82

Drainage system deficiencies are noted as follows:

- North sidewalk: Most longitudinal trench drains added during the 2003 linear park construction are filled with grit and are not functioning.
- Along the south curb over the West Station, deck runoff is ponding immediately east of the Panel D20 catch basin, permitting water infiltration through the asphalt wearing surface and past the top of floor waterproofing (**Photo 16**).
- West Abutment: The south drain pipe which is clogged at the catch basin.
- Pier 1 South: The drainpipe is broken (**Photo 17**) and the catch basin is buried in soil and/or construction material.
- Pier 1 North: The catch basin grating is missing.
- Pier 3 North: The end of the PVC drain pipe is fractured and hanging disconnected from the upper portion of drain pipe.
- Pier 8 South: Catch basin is clogged.
- Pier 9 North: Catch basin is partially clogged.
- Pier 9 South: Catch basin is clogged with concrete frame dislodged seven inches.

Photo 16 – Water Ponding Adjacent to Panel D20 Catch Basin, South Curb, West Station.

Photo 17 – Broken PVC Drainpipe, Pier 1.

Expansion Joints (c13)

The expansion joints are in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
2579 LF		2538 LF	40 LF		2.09

At the left westbound lane of the Tower B expansion joint, the pack rust has broken several fillet welds attaching the joint extrusion to the joint armor, resulting in two gaps approximately two feet long each (**Photo 18**). Snow plow damage is present on several joint extrusions, especially at the Tower B west bound joint where the west armor is $^{1}/_{2}$-inch higher than the east half. Expansion joint measurements are included in **Appendix E**.

Lighting

The lighting is in ***Good*** condition. All general upper deck lighting installed in 1997 is functioning. Several upper deck architectural lights installed on the Pier 3 and Pier 4 pilasters are not functioning as are some of the architectural north sidewalk installed in 2003. Additionally, several architectural light pole bases are cracked with missing sections (**Photo 19**).

Photo 18 – Pack Rust (at Arrows) & Broken Fillet Welds (Inset) with Infiltration Points, Tower B Expansion Joint.

Photo 19 – Fractured Light Base, North Sidewalk.

III. Superstructure

The superstructure is in ***Fair*** condition, or ***5*** on the NBIS condition rating guidelines. Superstructure findings are shown in **Appendix B**. Condition of individual superstructure items are as follows:

Alignment of Members (c14)

The alignment of primary superstructure members is ***Good***.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
40	40				1.00

Steel Superstructure

Arch (c27)

The concrete arches are in ***Fair*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
6,740 LF	6,540 LF		200 LF		1.50

During the current rehabliation, the concrete arches of Span 2, 3, 5 through 10, and 13 were repaired with select patching over public areas and epoxy injection of open cracks. Hands-on and cursory inspection of the arches reveal two diverse trends in advancing deterioration.

Vertical & Horizontal Cracking:

Following the customary design practice of early concrete arch design and review of the final original construction plans, no shear reinforcement was placed in the concrete arch ribs. Inspection of the arch ribs noted that open vertical cracks are present in 19 of the 44 reinforced concrete arches (**Photos 20 & 21, Table 3**). Several arch cracks were present prior to the 1995 reghabilitation while other cracks received epoxy injection in 2014. As shown in **Figure 5**, one crack in the Span 5 NE Arch Rib is suspected to be completely through the rib section longitudinally and has propogated into the the bases of several spandrel columns. Additionally, several horizontal cracks are present in other arch ribs, as illustrated in **Figure B-6**. One horizontal crack on the north face of Span 3 NI Arch Rib epoxy injected in 1996 exhibits new cracking through the concrete sealer and concrete surface (**Photo 22**). **Sheets B-4** through **B-6** further illustrate the location and detail of these arch rib cracks.

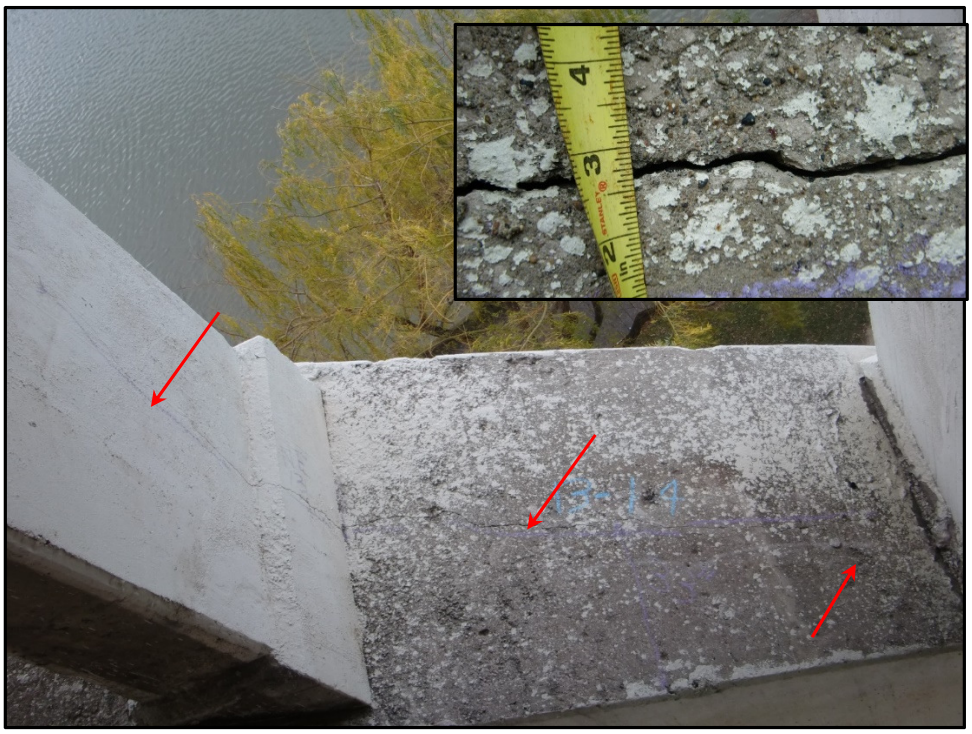

Photo 20 – Open Crack (at Arrows) on NE Arch Rib Extrados, Panel 14, Span 5.

Photo 21 – Close-up of $^{5}/_{32}$" Epoxy-Injected Intrados Crack, Panel 13, NE Arch Rib, Span 5.

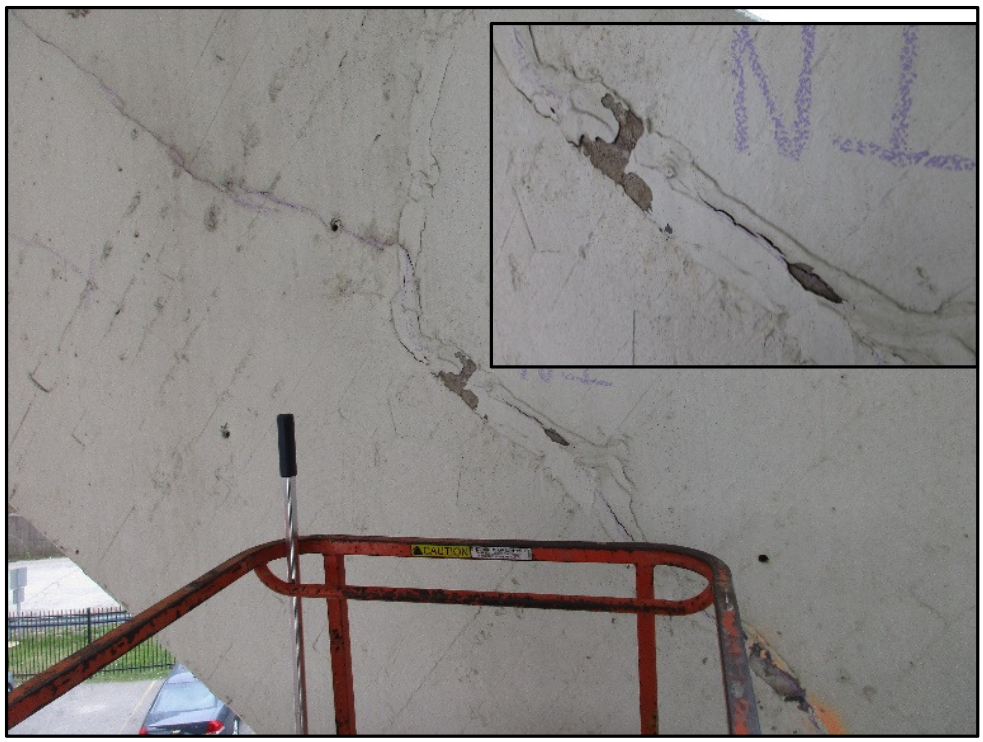

Photo 22 – New Crack at Previous Epoxy Injection Repair, NI Arch Rib, Span 3.

Span	Longitudinal Arch Rib Crack Location	Comments
1	NI East	
2	SE East	
3	NE West	
	NE West	(1995 Qty.: NE 43 LF)
	NI East	(1995 Qty.: 36 LF)
	SE East	Surrounded by map cracking.
5	NE West	(1995 Qty.: 28 LF)
	NE East	Crack on intrados epoxy injected in 2014/15. Crack location & widths measured on intrados and extrados. See Photos 20 & 21.
	SI West	
	SE West & East	Located adjacent to deep three-sided 1996 patch. May be related to deterioration.
6	NE West & East	
	NI East	
7	NE East	(1995 Qty.: 18 LF)
	SE West	
8	NE East	
9	NE West	(1995 Qty.: 8 LF)
	NE East	
10	NE West	
11	NE East	(1995 Qty.: 6 LF)

Table 3 - Longitudinal Vertical Arch Rib Crack Summary.

Other 1995 Plan Quantities -
Arch Rib Epoxy Injection Repairs:
Span 9 SE Arch – 3 LF
Span 13 SI Arch- 3 LF

Other 2013 Plan Quantities -
Arch Rib Epoxy Injection Repairs:
Span 2 NE Arch East End – 40 LF
Span 2 SE Arch Center – 10 LF
Span 8 SI Arch Center

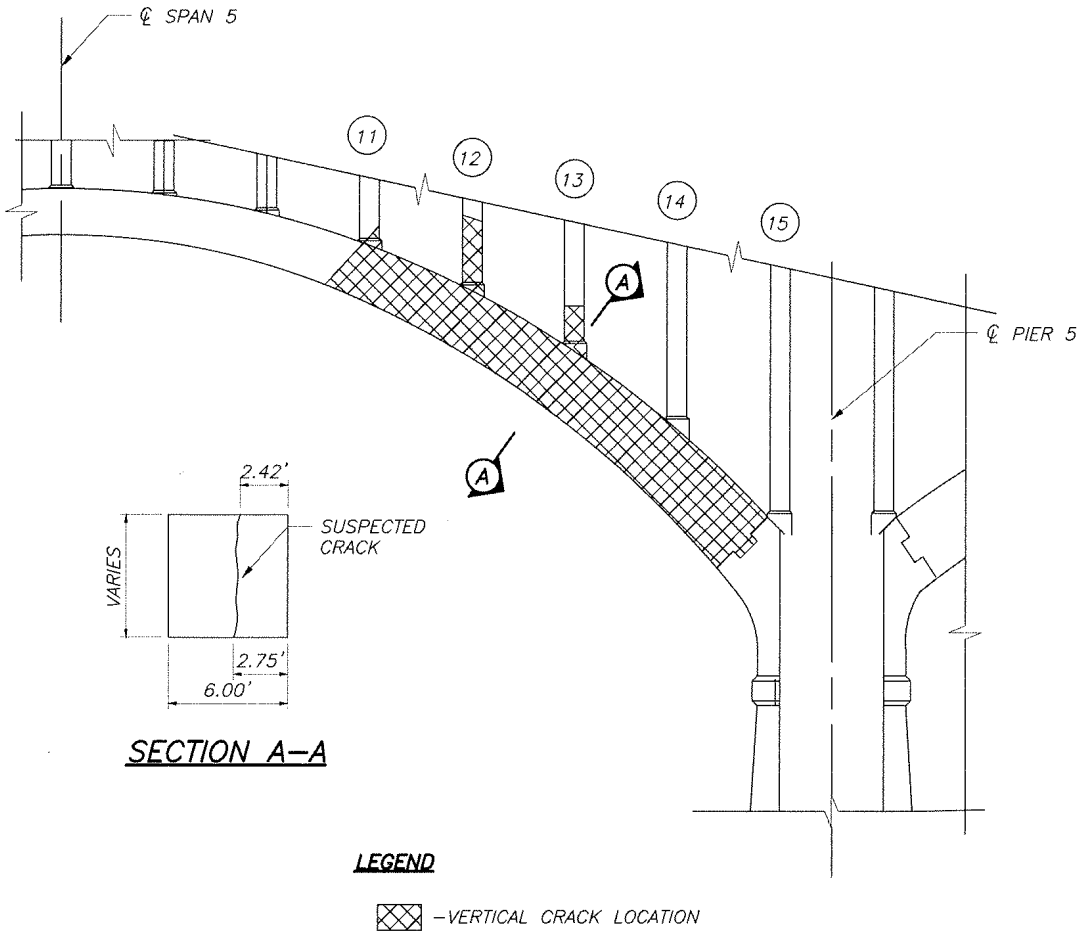

Figure 5 – Estimated Alignment of Vertical Crack, Span 5 NE Arch & Spandrel Columns.

Arch Rib Delamination & Spalls:

Over public areas, most arch rib surfaces are sound. One delaminated area not repaired is on the lower north corner of the Span 7 SI Arch Rib near the apex of the arch. Upon removal of the unsound concrete, the 1995 shotcrete material was found to be intact with post-1995 fractures in the original concrete section above the patch (**Photos 23 & 24**). Examination of the reinforcement shows an ongoing corrosion that is causing the new delaminations. The center of the Span 7 SI arch Rib is an area not subjected to chloride contamination throughout its 98-year service life, and without shear reinforcement, these bottom mat reinforcement bars have little electrical connectivity to other reinforcement subject to chlorides. The cause for the reinforcement continuing corrosion likely is the loss of the concrete passivation layer due to decreased pH of the concrete.

Photo 23 – Outline of Delaminated Arch Rib Corner, SI Arch Rib, Span 7.
(Inset: Active rebar corrosion present.)

Photo 24 – Sound 1996 Shotcrete Patch & Fractured Original Concrete,
SI Arch Rib, Span 7.

Arch Columns (c28)

The arch columns are in ***Good*** condition. This element covers the columns set on the arch ribs and arch bases.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
747	697	50			1.07

Several arch columns exhibit corner cracking or shallow spalls (**Photo 25**) while others have large delaminations surrounding previously patched concrete (**Photo 26**).

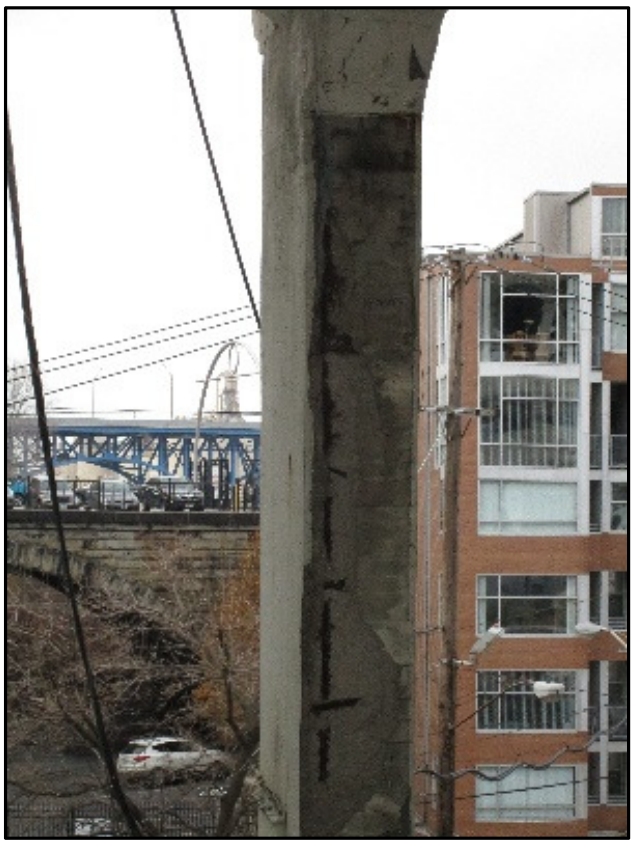

Photo 25 – Cracked & Spalled Lower Deck Column NE 2, Span 3.

Photo 26 – Delaminated Surfaces Surrounding 1995 Patch Area (at Arrow), Lower Deck Column SE 1, Span 3.

Floorbeams – Concrete (c18)

The concrete floorbeams are in ***Good*** condition. Isolated spalls are present of original 1917 upper deck floor beams, most of which are in the north bay and strengthened in the 1967-70 rehabilitation. Among the lower deck floor beams, isolated large delaminated areas are present among concrete surfaces that were sound during the 1995 rehabilitation and have since been protected from chloride contamination (**Photo 27**). In Span 6, removal of the bottom delamination of Floorbeam 15, South Bay, reveals that the delamination in the 20-year old shotcrete material was cracked due to continued reinforcement corrosion (**Photo 28**).

While appearing as architectural embellishments, the lower deck corbels are actually cantilevered end of the lower deck floorbeams, directly supporting the exterior upper deck column loads above. Many lower deck corbels were patched or replaced in the 1995 and 2014 rehabilitations. Additional cracks, delaminations and spalls are present on several lower deck corbels due to concrete corrosion of the main compressive diagonal reinforcement (**Photo 29**).

The lower deck floorbeams of the East Station, behind the East Abutment and accessible from an access opening in the south exterior wall gate, have the bottom mat of reinforcement exposed (**Photo 30**). This deterioration has changed little since the 1980s, and with no live load carried by these floorbeams, no repairs are recommended.

Photo 27 – Delaminated Surfaces of Lower Deck Floorbeam 16, Center Bay, Span 2.

Photo 28 – Spalled 1996 Shotcrete Patch, Lower Deck Floor Beam 14, South Bay, Span 6. (Inset: Continued reinforcement corrosion at shotcrete patch/original concrete interface.)

Photo 29 – Common Crack in Line of Primary Reinforcement, Lower Deck Corbel.

Photo 30 – Exposed Bottom Reinforcement Mat, Lower Deck Floorbeams 1 & 2, North Bay, East Station.

Beams – Concrete (c15.1)

The beams are in ***Good*** condition. These elements consist of the longitudinal beams in the Detroit Tunnel, West 25th Street Tunnel and West Station.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
7,394 LF	7,205 LF	189 LF			1.04

Repairs of the West Station concrete beams were non-performed in the 1995 rehabilitation due to budget considerations and general shallow spalls present. Since this rehabilitation, several beams have continued to spall despite being protected from continued chloride penetration (**Photo 31**). These locations are to be repaired at the conclusion of the current rehabilitation in Spring 2016.

Photo 31 – Spalled Beam D22, West Station.

Steel Superstructure

The load bearing components (web plates and flange angles) of the primary truss members and gusset plates are composed of nickel steel, an early high strength steel also known for its corrosion resistant properties.[5] The original hangers, composed of nickel steel, were replaced with 50 ksi steel. All lacing member components of the primary truss members, upper and lower deck floorbeams, lateral and longitudinal bracing and sway bracing are composed of 30 ksi carbon steel.

Stringers (c17)

The stringers are in ***Good*** condition with little deterioration noted. All upper deck stringers have shear studs welded to the top flange providing composite action with the deck. The upper and lower deck stringers in Panels 4, 5, 5' and 4' were replaced in 1995.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
10,638 LF	10,638 LF				1.00

All upper deck stringers are in good condition. Light pitting is present on the bottom flanges of the original curb stringers of Lines 5 and 14. The lower deck stringers supporting the steel grid deck and the outer pedestrian fiberglass grid deck are also in good condition. Several lower deck stringers supporting only their own dead load have advanced corrosion at the saddle bearings.

Floorbeams – Steel (c18)

The Span 4 floorbeams are in ***Good*** condition. New bolted upper deck floorbeam cantilevers were installed during the 1967-70 rehabilitation to support the new wider upper deck. The Upper and Lower Deck Floorbeams 5 and 5' were replaced in kind in 1995. The lower deck floor beams received no structural repair though corroded top and bottom flanges received local removal of thin and knife-edge sections.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
3,925 LF	3921	4			1.01

The Upper Deck Floorbeams 8' and 10' have web perforations above the upper deck later bracing gusset plates. This section loss does not appear to have increased since 1997. The lower deck floor beams have light active corrosion adjacent to the recently protective coating system below the north and south truss lines.

[5] Vermes, William J., Performance of Early 20th Century High Strength Steels on American Bridges, The First Fatigue & Fracture Conference, Philadelphia, Pennsylvania, August 7, 2006, pp.7, 13-15.

Truss Verticals (c19)

The truss verticals are in ***Good*** condition. Local perforations are present on diaphragm plates located between the upper and lower decks and minor corrosion of the lacing bars below the lower deck (**Photo 32**).

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
50	50				1.00

Truss Diagonals (c20)

The truss diagonals are in ***Good*** condition. Little or no section is present on the web plates or flange angles. Below the lower deck, several top stay plates at the lower chord gusset connection have minor pitting (**Photo 33**).

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
48	48				1.00

Photo 32 – Typical Minor Corrosion of Vertical Below Lower Deck.

Photo 33 – Minor Pitting Top Stay Plate, U1'-L2' South.

Truss Upper Chord (c21)

The truss upper chord members are in ***Good*** condition. Isolated rust staining is present on the upper chord members with no significant section loss present. At North $U_{12}U_{11}$' (a zero load member), pack rust between the hinge cover plate and truss top flange has resulted in minor perforations of the cover plate.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
48	48				1.00

Truss Lower Chord (c22)

The truss lower chord members are in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
48	36	12			1.33

Despite the age of the steel truss span, little pack rust and section loss is present throughout the lower chord due the corrosion-resistant nickel steel and the relatively thick sections. Additional comments are as follows:

- From L_0 to L_5 and L_0' to L_5' on both truss lines, many uphill lower transverse angles of the lower chord diaphragms have caught water and debris, resulting in pitting and perforations of these carbon steel truss diaphragm plate and transverse angles (**Photos 34 & 35**).
- The resulting local paint failure has resulted in vertical interior section loss up to $^5/_{16}$" of the two 1-inch thick nickel steel lower chord web plates (**Photo 36**).
- Several top and bottom lacing channels have corrosion holes.
- On South L_0L_1, a fractured bolt installed in 1995 is present on a top lacing channel connection (**Photo 37**). Close inspection of the fracture shows the bolt either had a material flaw or was overtightened during installation.

Photo 34 – Common Perforations of Lower Chord Diaphragm.

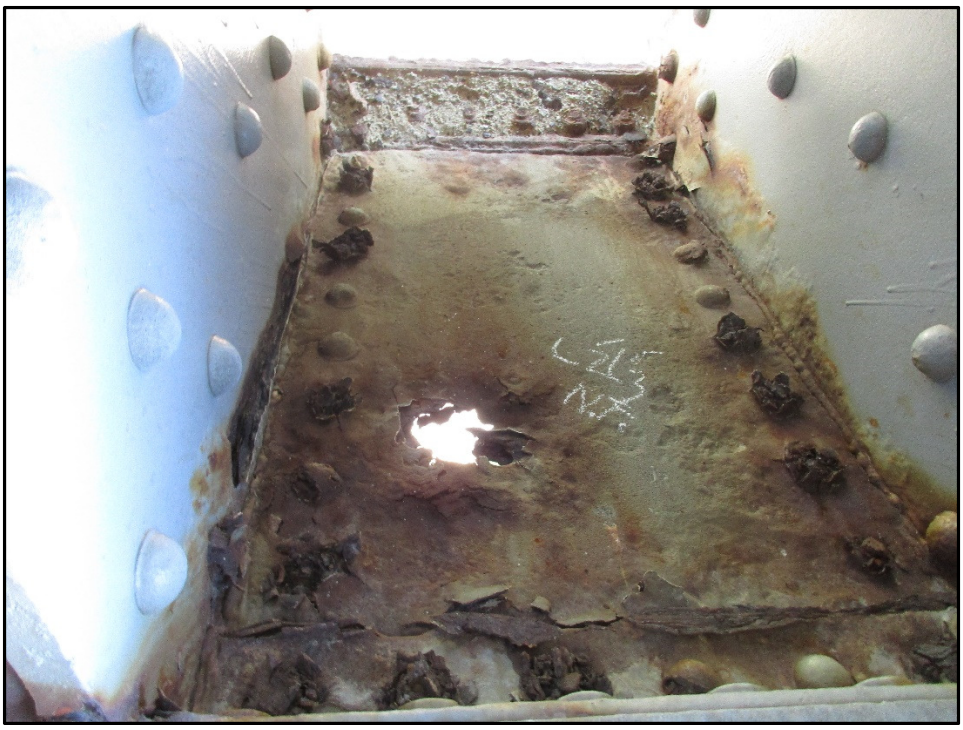

Photo 35 – Common Perforations of Lower Chord Diaphragm & Debris on Lower Transverse Angle.

Photo 36 – Moderate Isolated Section Loss on Lower Chord Web Plate, Below Upper Deck.

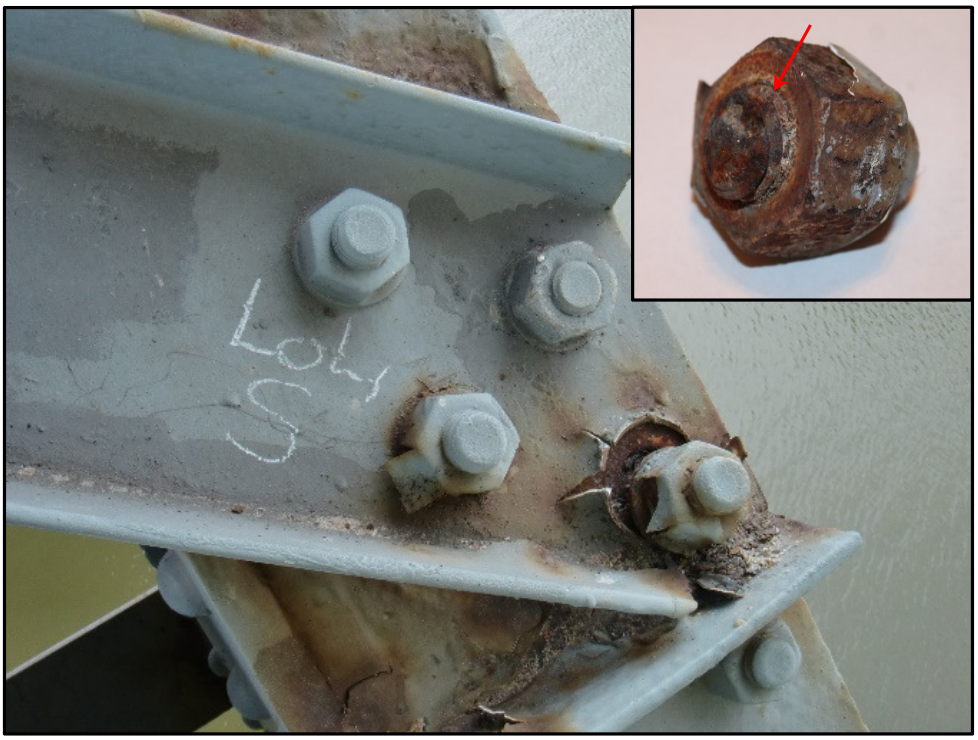

Photo 37 – Fractured Bolt, South L_0L_1.
(Inset: Fracture Origin at Arrow.)

Truss Gusset Plates (c23)

The truss gusset plates are in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
104	102	2			1.03

Most $^3/_4$"-thick gusset plates have minor corrosion above the top of the lower chord member. At North L_3, south plate and South L_2, north plate, moderate section loss is present (**Photo 38**). Elsewhere below the lower deck, rust nodules are present on the interior gusset plate surfaces (**Photo 39**).

Photo 38 – 0.23" Deep Section Loss x 6" Long at Edge of Gusset Plate, North L_3.

Photo 39 – Typical Rust Nodule (at Arrow) on Interior Gusset Plate Surface.

Lateral Bracing (c24)

The lateral bracing is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
36	36				1.00

No significant deficiencies were noted with minor corrosion present below the lower deck (**Photo 40**).

Sway Bracing (c25)

The truss lower chord is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
28	28				1.00

Below the lower deck, isolated perforations are present at the connections to the truss verticals members (**Photo 41**).

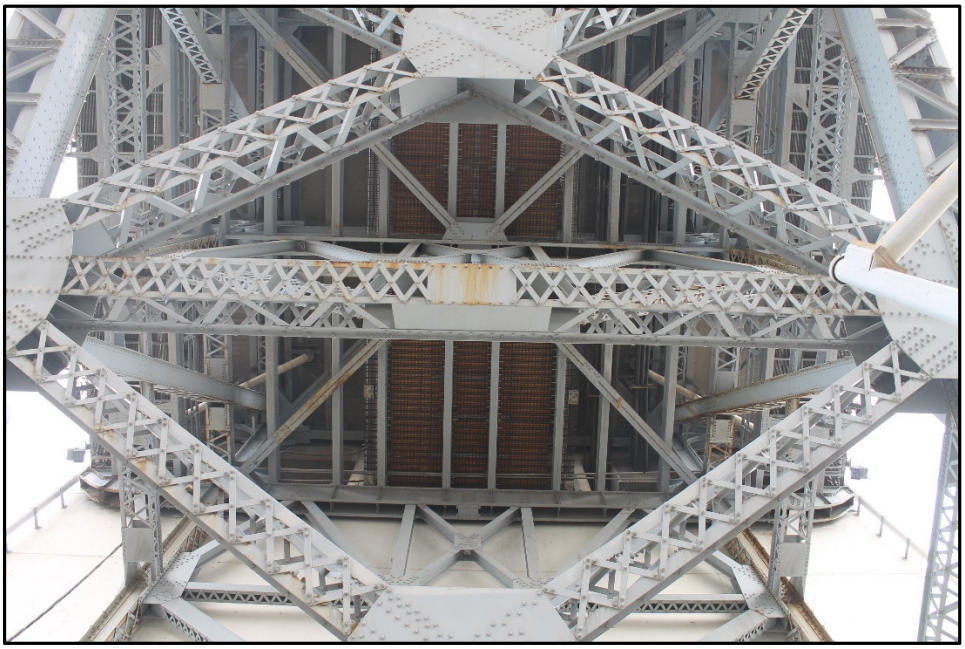

Photo 40 – Light Corrosion Stains, Lower Lateral Bracing.

Photo 41 – Perforation of Sway Brace Stay Plate & Lacing Bar, North L_2.

Bearing Devices (c26)

The bearing devices are in ***Fair*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
4		4			2.00

The cracks on the non-structural bearing pin cover plates have not significantly propagated (**Photo 42**). On all four bearing castings, steel shot blasting material from the 1997 painting operation is piled within the casting chambers. Also on the interior surfaces of all four bearing castings, the OZEU paint has failed with active corrosion present (**Photo 43**).

Protective Coating System (c30)

The protective coating system is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
14,469 LF	12,869 LF	1200 LF	400 LF		1.49

Pockets of local protective coating systems failure are present on the main truss members below the lower deck (**See Photos 34, 35, 38 & 39**). The structural steel between the upper and lower decks have been repainted in 2014-15, and is in very good condition. Below the lower deck, however, blast material not contained during the recent painting operation has accumulated on bracing and gusset connections (**Photo 44**). Above the upper deck, the top coat of the OZEU system is oxidized with minor rust staining (**Photo 45**).

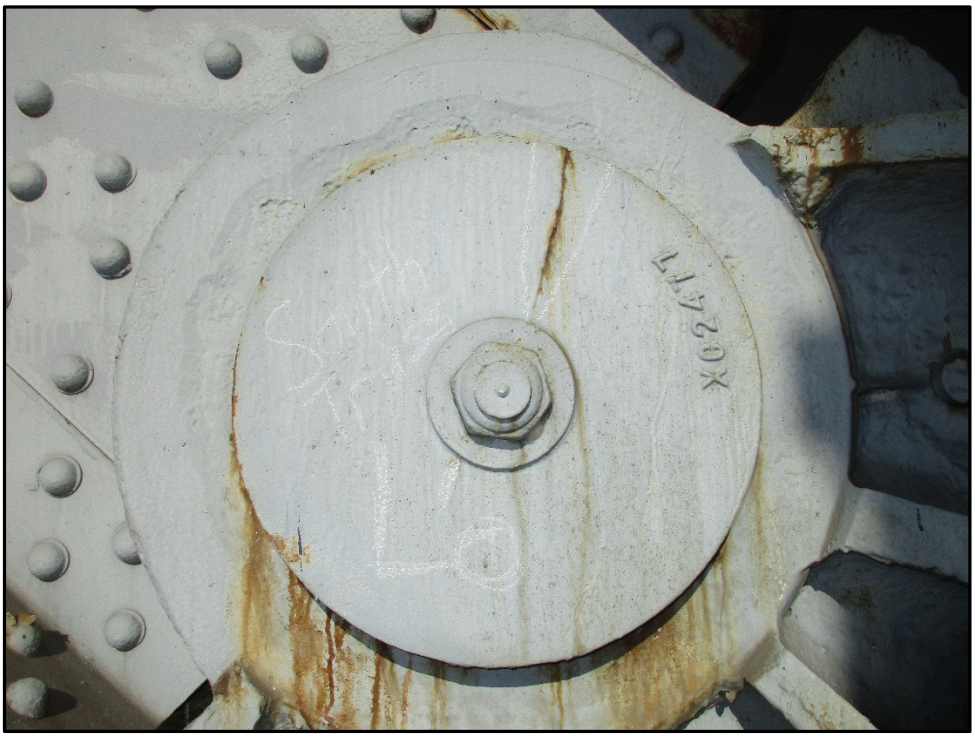

Photo 42 – Typical Bearing Pin Cover Plate Crack.

Photo 43 – Typical Corrosion Interior Surface of Bearing Casting.

Photo 44 – Blast Material Accumulation, Top of Lower Lateral Bracing Gusset Plate, Panel Point North L2.

Photo 45 – Oxidized Top Coat & Light Rust Staining Above Upper Deck.

Pins, Hangers & Hinges (c31)

The pins, hangers and hinges are in ***Good*** condition with no deficiencies noted.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
30	30				1.00

Fatigue (c32)

The fatigue prone details are in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
14,469 LF	14,469 LF				1.00

IV. Substructure

The substructure is in ***Satisfactory*** Condition, or ***6*** on the NBIS condition rating guidelines. Condition findings of individual substructure items are as follows:

Abutment Walls (c33)

The abutment walls are in ***Good*** condition. This item consists of the West and East Abutments and also the walls of the Detroit Avenue and West 25th Street Tunnels.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
3459 LF	1689 LF	1600 LF	170 LF		1.97

At the East Abutment, two $^1/_2$" drainpipes have been installed to relieve the water pool in the three cellular concrete panels behind the abutment. Previous opinion suggested these drains would relieve the water in the East Station pedestrian tunnels and in the Lower Deck profile sag. However, a sediment-clogged drain leading into the cellular area suggests that the ineffective pedestrian tunnel drainage had once emptied into the East Abutment chambers (**Photo 45**).

The spalls and delaminations along the tunnel walls have changed little since late 1980s and likely have been present decades earlier (**Photo 46**). Deep spalls behind the first layer of steel reinforcement is present at the wall section adjacent to construction joints. These spalls were not repaired as part of the 1995-97 rehabilitation due to construction cost limitations.

Pier Walls (c36)

The pier walls are in ***Good*** condition. This element consist of the solid cellular construction of Pier 3 and Pier 4.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
200 LF	200 LF				1.00

Photo 45 – Possible Deposit Clogged Pedestrian Tunnel Drain Outlet (at Arrow),East Abutment Cellular Construction.

Photo 46 – Typical Wall Base Spalls, Detroit Ave. & West 25th St. Tunnel.

Pier Columns/Bent (c36)

The pier walls are in ***Fair*** condition. With the redesign of the upper deck pier slabs and the elimination of the paired expansion joints, the upper deck pier shafts no longer support live loads and the lower deck interior and exterior pier shafts (pier walls) only support the end of the lower deck spans and occasional lower deck live loads. In the original design, vitrified clay drain pipes were placed within the south exterior upper and lower deck shafts. With 90° bends at the pier base, this drainage likely soon proved ineffective and spilled onto the lower deck. This drainage system was bypassed in the 1967-70 rehabilitation, and largely removed with the pier shaft replacement during the 1995 rehabilitation.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
40	39		1		1.38

The South Exterior Lower Deck Shaft at Pier 6 exhibits deep scaling over a majority of its exterior surface (**Photos 47 & 48**). This deterioration may be attributed to the failed original drainage that has been bypassed over 40 years ago. Sound concrete may not be present for depths between 6 to 12 inches. Also on the exterior pier shafts, fractured concrete continues to occur at the interface with the lower deck corbels (**Photo 49**) due to inadequate bond breaker placed in the 1995 rehabilitation. Following completion of the 1995-97 rehabilitation, streaming rust staining from ongoing interior corrosion of the steel reinforcement has also been present (**Photo 50**).

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Photo 47 – Scaled Concrete Core, SE Lower Deck Shaft, Outlined in Dotted Paint. (Note: Original encased drain pipe is located behind red line.)

Photo 48 – Scaled Concrete & Rebar Corrosion, SE Lower Deck Shaft.

Photo 49 – Deeply Cracked East Face of South Exterior Lower Deck Shaft, Pier 5 at Lower Deck Corbel.

Photo 50 – Rust Stains Indicating Active Corrosion of Pier Reinforcement.

Pier Columns – Tunnels, West Station & East Station (c38)

The pier columns of the tunnels and station area are in ***Fair*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
371	337	30	4		1.28

In the West Station, four columns, C13, C14, C23 & C24, are to be replaced as part of the current rehabilitation project (**Photo 51**). There columns were to be repaired in 1995, but the repairs were non-performed due to construction budget constraints. Over the nearly 20 years since, these columns have steadily deteriorated despite no evidence of salt water saturation or other chloride contamination.

Photo 51 – Advanced Concrete Corrosion, Column C13, West Station.

Backwalls (c39)

The abutment backwalls are in ***Good*** condition. The backwalls consist of the closure panels of the West 25th Street and Detroit Avenue Tunnels and the low slump mortar fill of the end of the East Station.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
92 LF	92 LF				1.00

West Slope Movement

The south embankment of the west approach has had a history of movement dating at least to the 1960s. During the 1995-97 rehabilitation, the southeast corner of the West Station, including Tower A South, were reconstructed due to slope instability. While few signs of movement are present in the West Station, movement and opening cracks are present in the cellular construction and Tower B South. Crack gages and slope inclinometers have been installed since 2007 to document structure and soil movements. **Table 4** documents the crack gage measurements and the slope inclinometer measurements are included in **Appendix D**.

Date	No. 5B Tower B Lower Deck		No. 1		No. 2		No. 3		No. 4	
	V (mm)	H (mm)	V (mm)	H (mm)	V (mm)	H (mm)	V (mm)	H (mm)	V (mm)	H (mm)
May 17, 2007	---	---	0	0	0	0	0	0	0	0
April 16, 2013	---	---	2.0	1.0	2.5	0.3	0	0	0.8	0.2
October 3, 2014	6.0	2.0	2.3	1.0	3.0	0.6	0	0	0.8	0.2
August 16, 2015	8.0	2.0	2.8	1.1	4.5	0.8	0	0	0.9	0.5

Table 4 – Crack Gage Measurements, Span 1A and Tower B South.

Wingwalls (c40)

The abutment wingwalls are in ***Good*** condition. The wingwalls consist of the south wall of the West Station, Spans 1A and 1B, and East Station and the north wall of the East Station.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
12	12				1.00

Tower B South

Tower B South has had a history of movement for at least the past 10 years. Measurements indicate the tower is leaning approximately $^{1}/_{8}$-inch per foot. The tower has shifted outward and rotated at least six inches (**Photo 52**) while at the lower deck level, the gap between that the upper deck column and face of tower is 4 $^{3}/_{4}$ inches, included the 1-inch original construction space. Also at the top of the tower, the section is spalled and cracked because it is wedged up against the upper deck sidewalk above (**Photo 53**). Review of the original plan sheet A2.38 and observations of the terrain within the confined space of Spans 1A and 1B suggests that the full footing adjacent to Tower B South was not constructed, and thus possibly contributing to the current rotation and instability of Tower B South. (**Figure 6**).

Photo 52 – Rotation of Tower B South (Inset: 6" rotation at top NW corner.)

Photo 53 – Fracture of Top Interior Section Against Upper Deck Slab, Tower B South.

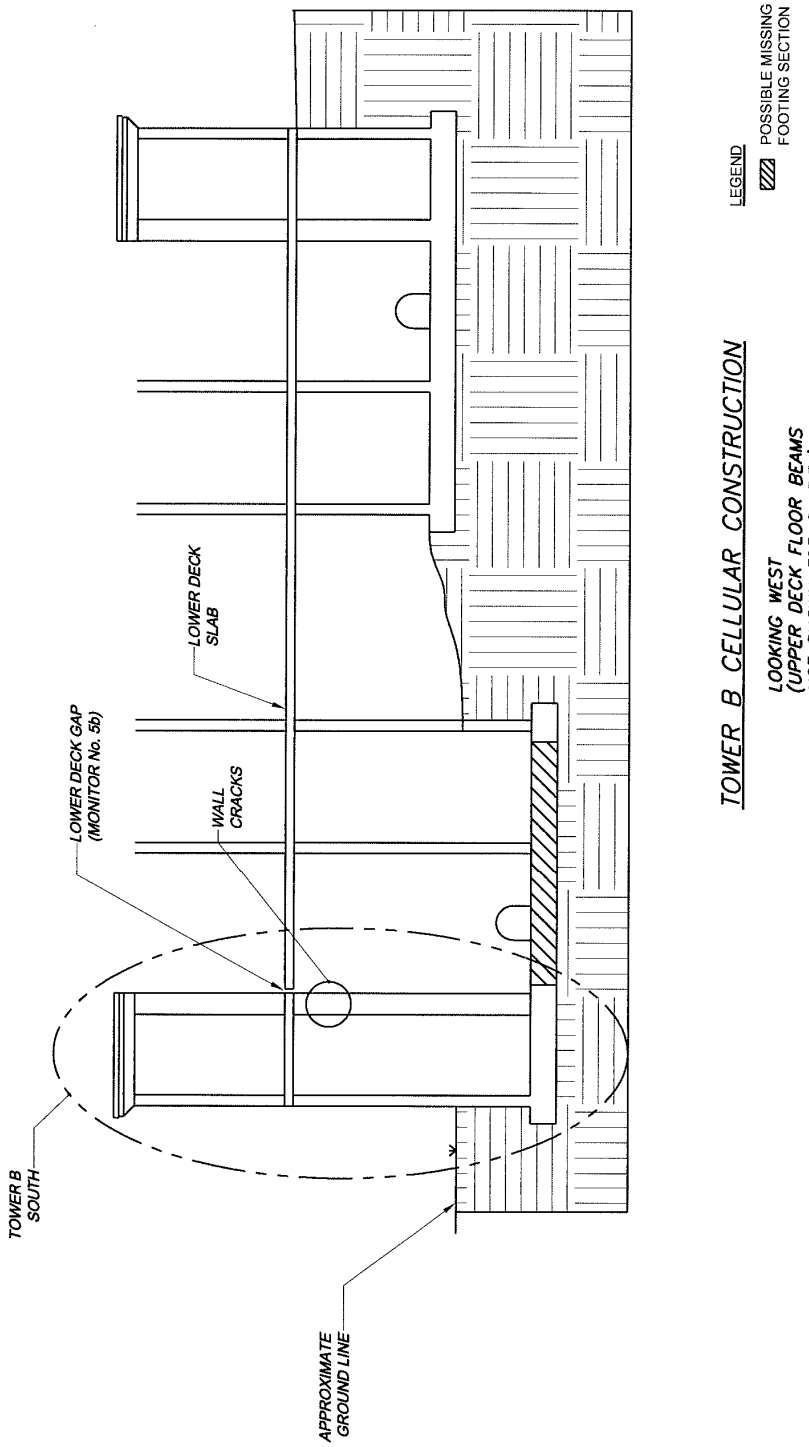

Figure 6 – Location of Possible Unconstructed Footing Section, Tower B South.

Scour (c42)

The scour is in ***Good*** condition. No scour was identified. For further discussion, see Appendix E for the 2015 Underwater Bridge Inspection Report.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
2	2				1.00

Slope Protection (c43)

The slope protection is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
2	2				1.00

V. Channel

The channel is in ***Very Good*** Condition, or ***8*** on the NBIS condition rating guidelines. Condition findings of individual channel items are as follows:

Alignment (c51)

The channel alignment is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
200 LF	200 LF				1.00

Protection (c52)

The channel protection is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
200 LF		200 LF			2.00

Hydraulic Opening (c53)

The hydraulic opening is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
1	1				1.00

Navigation Lights (c54)

The navigation lights are in ***Critical*** condition as none of the lights are functioning at the conclusion of this inspection.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
6				6	4.00

VI. Approaches & General Items

The approaches are in ***Satisfactory*** Condition, or ***6*** on the NBIS condition rating guidelines. Condition findings of individual approach items are as follows:

Approach Wearing Surface (c1)

The approach wearing surfaces are in ***Fair*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
2		2			2.00

The West Approach pavement has isolated spalls. Moderate map cracking throughout the East and West Approaches was observed.

Embankment (c4)

The approach embankment is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
4	3		1		2.50

Under Span 3, the embankment has several slope depressions (**Photo 54**). Much of this embankment was loose soil placed over demolition debris. Beneath this loosely placed fill is a concrete strut between Piers 2 and 3 used as a means of structure stability during construction. This strut is preventing portions of the fill from sliding into the Cuyahoga River.

For additional discussion regarding the west embankment movement, see **Substructure, West Slope Movement.**

Photo 54 – Slope Settlement, Beneath Span 3.

Guardrail (c5)

The approach guardrail is in ***Good*** condition.

Total Quantity	CS 1	CS 2	CS 3	CS 4	Transition Rating
1	1				1.00

Security

Following the terrorist attacks on September 11, 2001, security fencing was installed around the bases Piers 2 and 3, and also from Tower A South to Pier 1, enclosing the land beneath Span 1 and along Spans 1A and 1B. The gate to this enclosed area is unlocked, permitting public access and homeless camping under Span 1 and access along the south wall of Spans 1A and 1B. Furthermore, the steel mesh placed outside Span 1A to prevent unauthorized access to the lower deck has been breached (**Photos 55 & 56**).

On the west side of Pier 4, a covered chain-link enclosure for the Center Street bridge operator's vehicle has been built. From inside this enclosure, vandals have climbed through the top fencing cover to access the sway bracing, and paint graffiti on Pier 4. From this sway bracing, vandals also have unauthorized access to the truss lower chord and lower deck (**Photo 57**).

Photo 55 – Improvised Access Ladder on East Face, Tower A South.

Photo 56 – Continuation of Unauthorized Access to Span 1A Lower Deck.
(Inset: Trash can used to exit lower deck.)

Photo 57 – Illegal Access onto Steel Superstructure Through Vehicle Enclosure & Grafitti on Pier 4. (Inset: Barricade propped up for access through broken chain-link cover.)

Land Use

Within the intended secure area beneath Span 1, homeless tents are present (**Photo 58**). Immediately adjacent to and outside the south security fence, a series of shanties are also present.

Photo 58 – Homeless Tents Within Intended Span 1 Secure Zone.

Utilities

The utilities are in ***Fair*** Condition. One lower deck telephone junction chamber in Span 2 and Span 13 each are severely corroded and lacking security due to salt water infiltration through the manhole above (**Photo 59**).

Architectural Lighting

For the City of Cleveland Bicentennial Celebration in 1996, architectural lighting was installed throughout the structure. All exterior pier shaft light brackets exhibit paint failure and corrosion with minor section loss present (**Photo 60**). Currently, the over half of the pier lights, approximately 20% of the lower deck exterior lights and 10% of the lower deck interior silhouette lights are not working. Additionally, three south lower deck silhouette light in Span 13 have been broken.

(Note: Following this inspection, all transverse lights on Piers 4 through 12 were restored.)

Photo 59 – Corroded & Unsecure Telephone Junction Chamber, Span 2 Lower Deck.

Photo 60 – Typical Paint Failure & Corrosion, Exterior Pier Shaft Lighting Brackets.

Summary & Recommendations

The Detroit-Superior Bridge over the Cuyahoga River is in ***Fair*** condition, or ***5*** on the NBIS rating guideline (**Table 2**, Page 11). The complete Bridge Inspection Report Form is included in **Appendix A**. The following repairs and maintenance tasks shown in Table 1 are recommended to improve the General Appraisal of the Detroit-Superior Bridge, to minimize future repair costs, and to extend the service life of the bridge.

	Repair/Maintenance Task	2016	2017	2018	2019	2020
1.	Restore navigation lighting.	X				
2.	Conduct ground penetrating radar survey of upper deck floor, West Station and Spans 1A through 13, and East Station.	X				
3.	Notify Army Corps of Engineers of failed west dock line & potential navigation hazard.	X				
4.	Span 1A South Exterior Wall: Remove vandal fencing and Install cinder block wall on top of lower deck rail.	X				
5.	Pier 4: Place anti-climb fence along back of bridge operators' car storage area and keep area locked at all times. Clear West	X				
6.	Clear West Abutment drain pipe.	X				
7.	Clean out all catch basins Piers 1, 2 and 5 through East Abutment.	X				
8.	Pier 4: Repair sink holes along sheet pile wall.					
9.	Tower B South: Establish plumb bob to monitor lean and top movement of concrete section.	X				
As part of the 2016 Deck Rehabilitation Contract, the following tasks are recommended to be included:						
10.	Perform pH tests of concrete superstructure elements.	X				
11.	Repair broken drain pipes at Pier 2 and 3.	X				
12.	Stabilize Tower B South.		X			
13.	Concrete arch ribs: Investigate need for external shear reinforcement				X	
14.	Place FRP sheets on select concrete surfaces over public areas.				X	
15.	Pier 3: Install fender system at southeast corner of pier.				X	

Table 1 – Five-Year Repair & Maintenance Schedule.