

2000 PHYSICAL CONDITION REPORT



VETERANS' MEMORIAL BRIDGE OVER CUYAHOGA RIVER VALLEY

BRIDGE NO. CUY-6-1499
CUYAHOGA COUNTY, OHIO

Prepared for:

**Ohio Department of Transportation
District 12**

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Table of Contents

| | | |
|------------|--|----|
| | LOCATION MAP | 1 |
| I. | INTRODUCTION | 2 |
| | Exhibit A - Plan and Elevation | 4 |
| | Exhibit B - Member Identification Approach Spans | 5 |
| | Exhibit C - Member Identification Main Span | 6 |
| | Exhibit D - Typical Cross Section Approach Spans | 7 |
| | Exhibit E - Typical Cross Section Main Span | 8 |
| | Exhibit F - West Station | 9 |
| II. | DECK ITEMS | 10 |
| | A. Upper Level Concrete Deck | 12 |
| | B. Lower Level Decks | 14 |
| | C. Traffic Dividers | 18 |
| | D. Drainage | 18 |
| | E. Expansion Joints | 19 |
| III. | SUPERSTRUCTURE | 20 |
| | A. Concrete Approach Spans | 22 |
| | B. Steel Arch Span | 31 |
| | C. Bearings | 39 |
| IV. | SUBSTRUCTURE | 40 |
| | A. Abutments | 40 |
| | B. Piers | 41 |
| | C. Cellular Construction | 43 |
| V. | GENERAL | 45 |
| | A. Channel | 45 |
| | B. Approaches | 45 |
| | C. Land Use | 45 |
| | D. Navigation Lighting | 45 |
| | E. Structure and Decorative Lighting | 45 |
| VI. | STATIONS AND TUNNELS | 46 |
| | A. East Station | 46 |
| | B. West Station and Tunnels | 49 |
| | | |
| APPENDICES | | |
| | A. BRIDGE INSPECTION REPORT (FORM BR-86) | |
| | B. EXPANSION JOINT MEASUREMENTS | |
| | C. UNDERWATER INSPECTION REPORT | |
| | D. SUMMARY OF RECOMMENDATIONS | |

2000 PHYSICAL CONDITION REPORT

VETERANS' MEMORIAL BRIDGE (DETROIT-SUPERIOR)



EXHIBIT 1 – LOCATION MAP

I – INTRODUCTION

The Veterans' Memorial Bridge (Bridge No. CUY-6-1499, Cuyahoga County Br. No. 84) is a high level, double deck structure constructed in 1917. The structure carries an average daily traffic of 21,300 (1994) and was originally designed to carry four lanes of vehicular traffic on the upper level deck and three lines of street railway traffic on the lower level deck over the Cuyahoga River Valley. Located in downtown Cleveland, the structure connects West 25th Street and Detroit Avenue at the west end with Superior Avenue, West Ninth Street and Huron Road at the east end.

The 591-ft three-hinged steel arch main span over the Cuyahoga River has a low steel elevation of 96-ft above mean low water. The main span is flanked by thirteen arch approach spans, ranging from 75'-1½" to 209'-1½". The bridge extends 720.5-ft west of the main span and consists of a cellular type abutment and three concrete arch spans. The east approach is of similar construction to the west approach and is comprised of eight concrete arch spans and one concrete encased steel arch. Including the subway station area, the east approach has a length of 1,344.5-ft. The total length of the structure from the west cellular abutment through the east station area is 2,656-ft.

The lower roadway extends through the west cellular abutment to a subway station area. At this point, approximately 350-ft from the Tower A, the roadway divides into two subway tubes. From the junction with the west station, one tube continues to the west under Detroit Avenue for a distance of approximately 659-ft and the second tube extends to the south under West 25th Street for a distance of 479-ft. At the east end, the lower roadway continues in a tunnel under Superior Avenue for a distance of approximately 185-ft beyond the east station area. Street railway access to the lower deck was originally provided by means of open wells along the center areas of West 25th Street, Detroit Avenue and Superior Avenue. Closure walls were constructed at the tunnel ends and the open tunnel wells were filled and paved over in 1955.

There have been two major reconstruction/rehabilitation projects performed on this structure. The first began in 1967 and was completed in 1970. Extensive upper deck flooring modifications, repairs and replacements were performed to widen the bridge to carry six traffic lanes on the upper deck. The upper deck was replaced (including the drainage system, joints, sidewalk and railing), traffic dividers, parapets and railings. All exposed concrete surfaces were sealed with a white cement epoxy coating. Repairs to the steel span and other member replacements were also completed, along with the replacement of the bridge drainage system and upper deck expansion joints.

The second began in 1995 and was completed in 1997. This extensive rehabilitation project included the replacement of the entire upper deck, including the drainage system, the removal and partial replacement of the lower deck, modifying the upper deck framing of the concrete approach slabs to eliminate joints and the removal, replacement or repair of deteriorated concrete. Repairs to the main steel span upper and lower decks included the removal and replacement of the upper deck (including the drainage system, joints, sidewalk and railing), removal of the lower deck timbers, and partial replacement of the lower deck. Other repairs to the main span include replacement of four upper deck and lower deck floorbeams, all pins and hangers except at panel points 4 and 4', the removal, replacement or repair of structural members and painting of all structural steel. Limited repairs were made to the east and west approach tunnels and stations. The roof slab was waterproofed, limited areas around construction and expansion joints were replaced, and some repairs to deteriorated concrete were made. The easternmost end of the east subway was filled and a new endwall was placed. Architectural lighting was installed across the structure.

Between the first and second repair and rehabilitation projects smaller rehabilitation projects repairs were made. These include an emergency repair of the upper deck stringer expansion supports at Panel Point 5 in the main span, replacement of catch basin covers and the repair of concrete members. Other maintenance items, such as paving of the asphalt approaches over the station areas and painting of the steel curbs were also completed.

A hands-on visual inspection of the bridge and routine inspections of the station and tunnel areas were performed by HNTB personnel between October 28 and November 24, 2000. Inspection personnel included Byron Sah, P.E., Nicole Heisler, P.E., Jacob Merriman, E.I., and Joanne Gamble, E.I. Inspection assistance was provided by Lake Erie Diving, who performed the underwater inspection of Piers 3 and 4 under subcontract to HNTB. The ODOT UB-60 Reach-All was used for inspection access. Pre-printed field forms were used to record deficiencies and condition of structural members.

A Plan and Elevation of the structure, Typical Section and Member Identification Plans are included as Exhibits A through F.

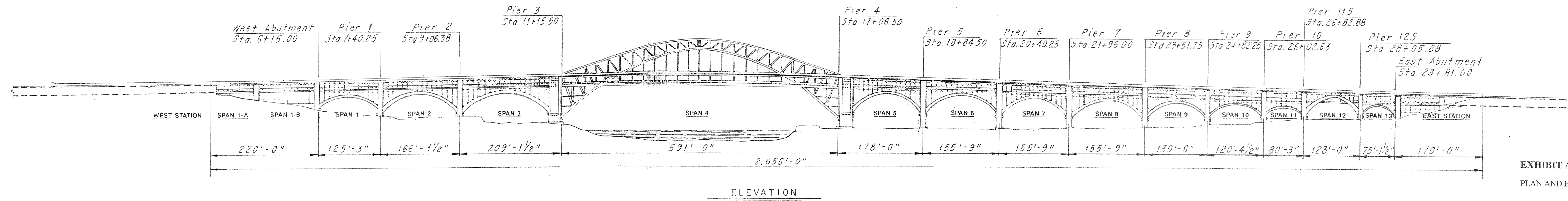
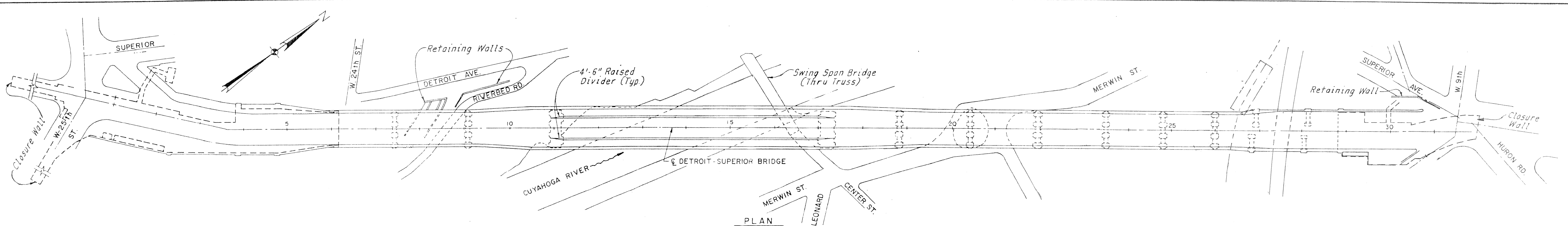
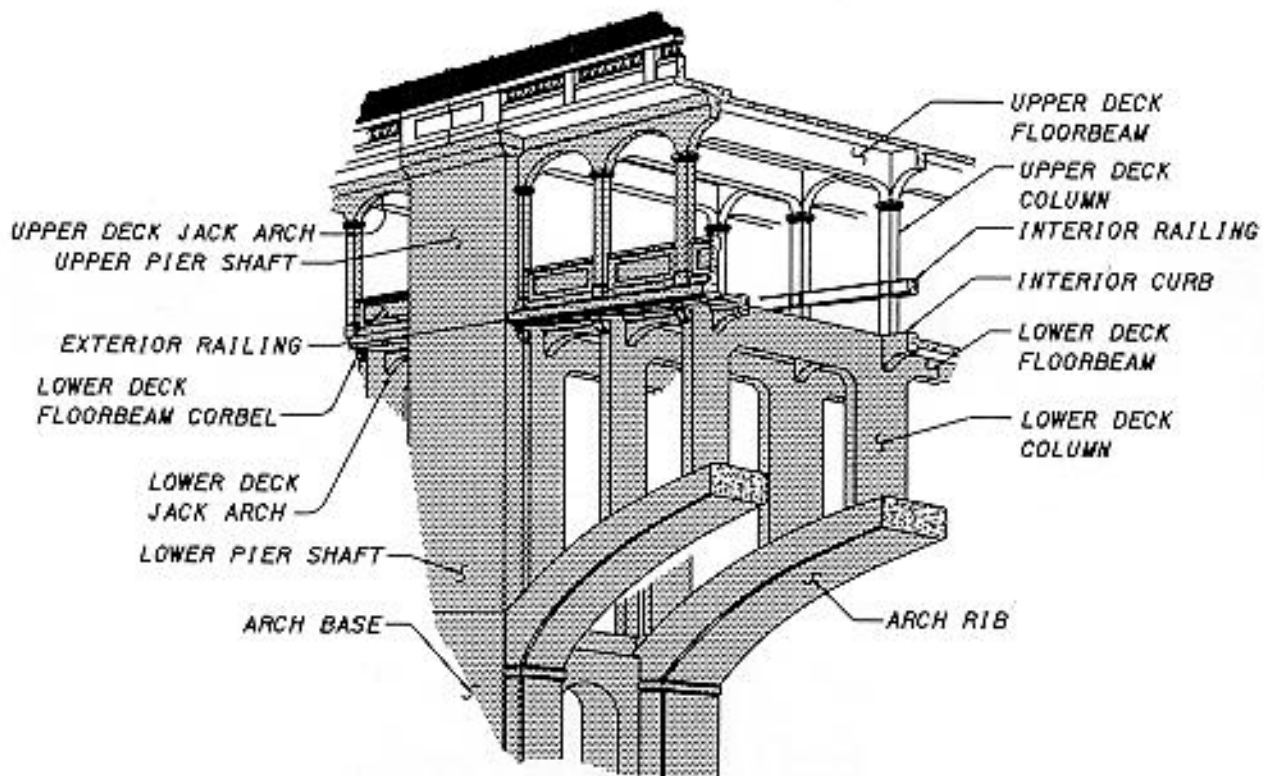


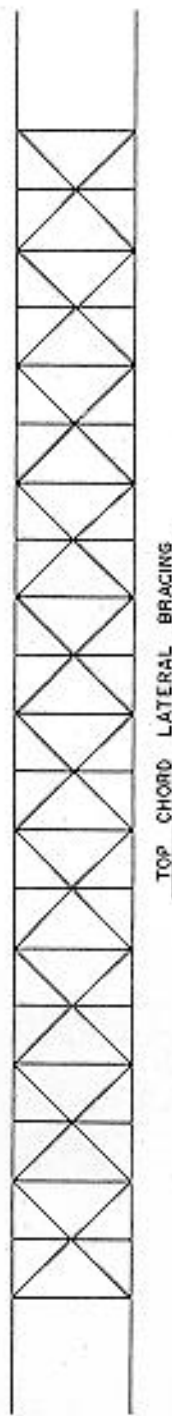
EXHIBIT A
PLAN AND ELEVATION



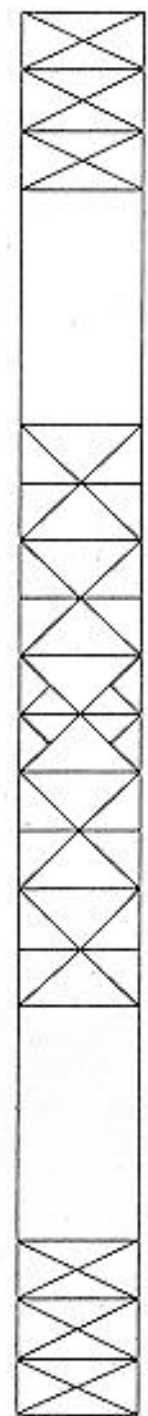
MEMBER IDENTIFICATION
TYPICAL APPROACH SPAN

EXHIBIT B

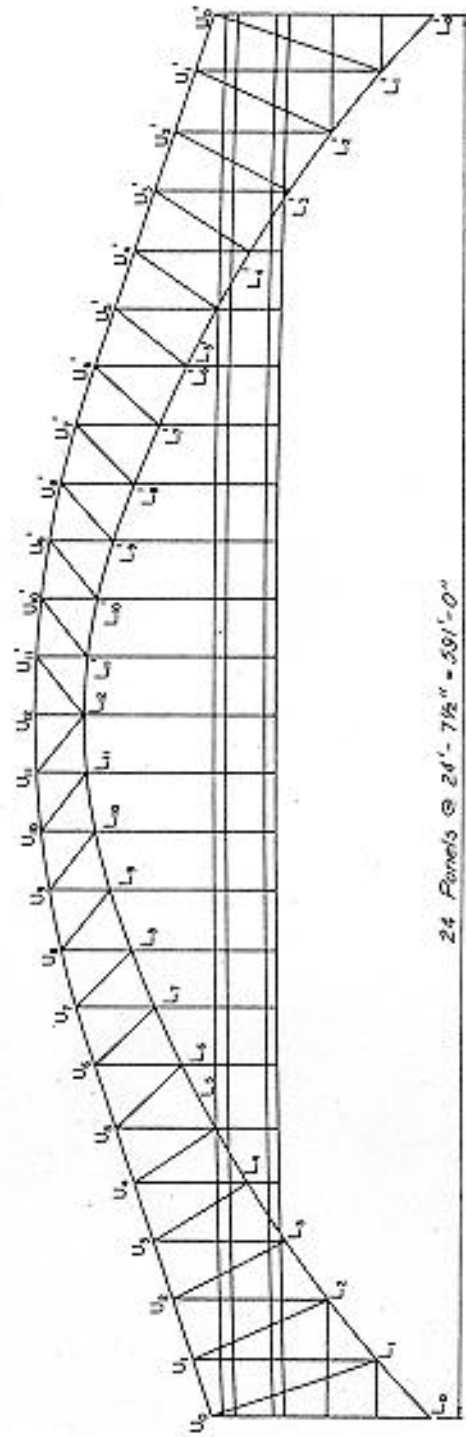
MEMBER IDENTIFICATION
APPROACH SPANS



TOP CHORD LATERAL BRACING



BOTTOM CHORD LATERAL BRACING

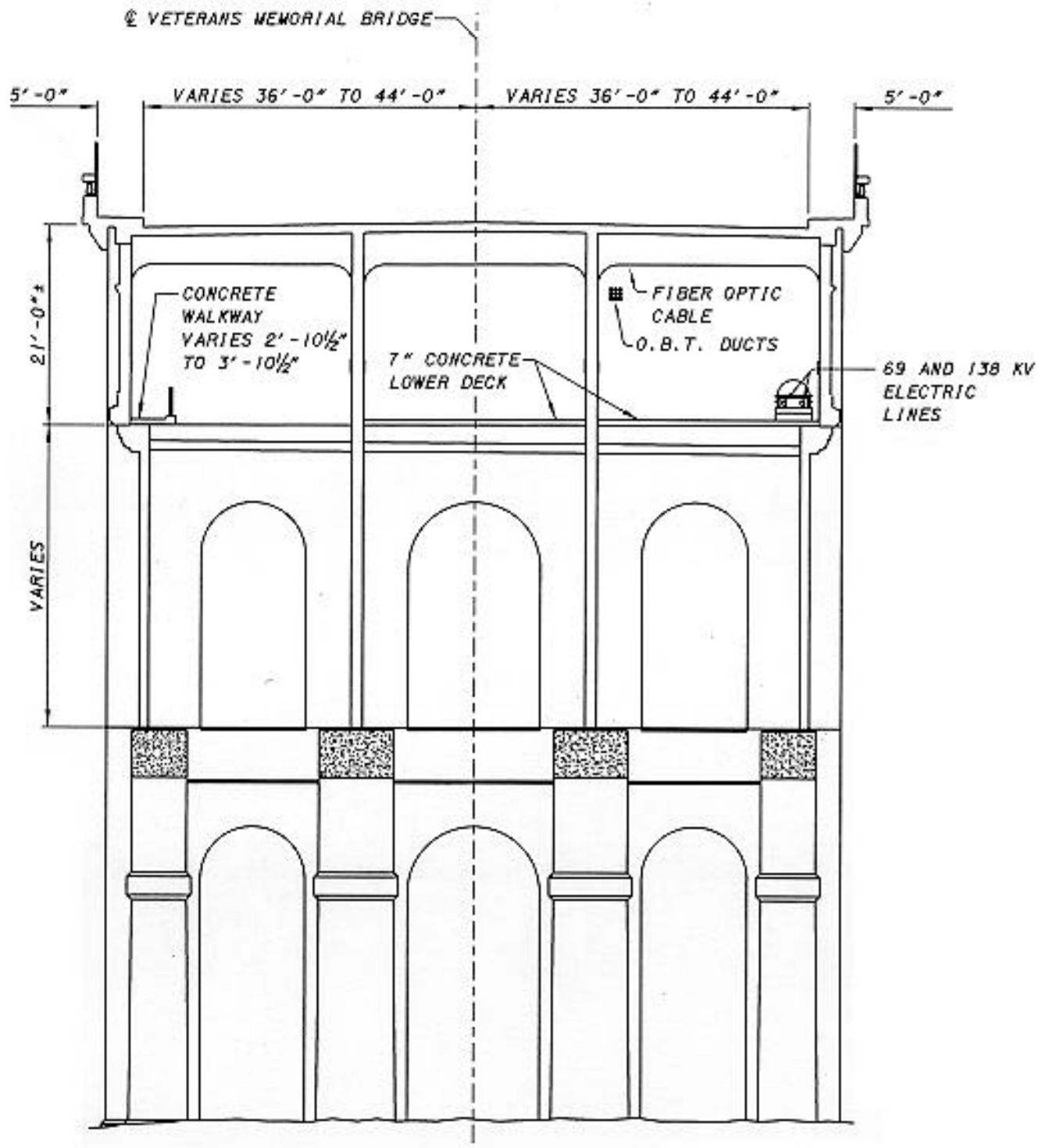


24 Panels @ 24'-7 1/2" = 591'-0"

ELEVATION

EXHIBIT C

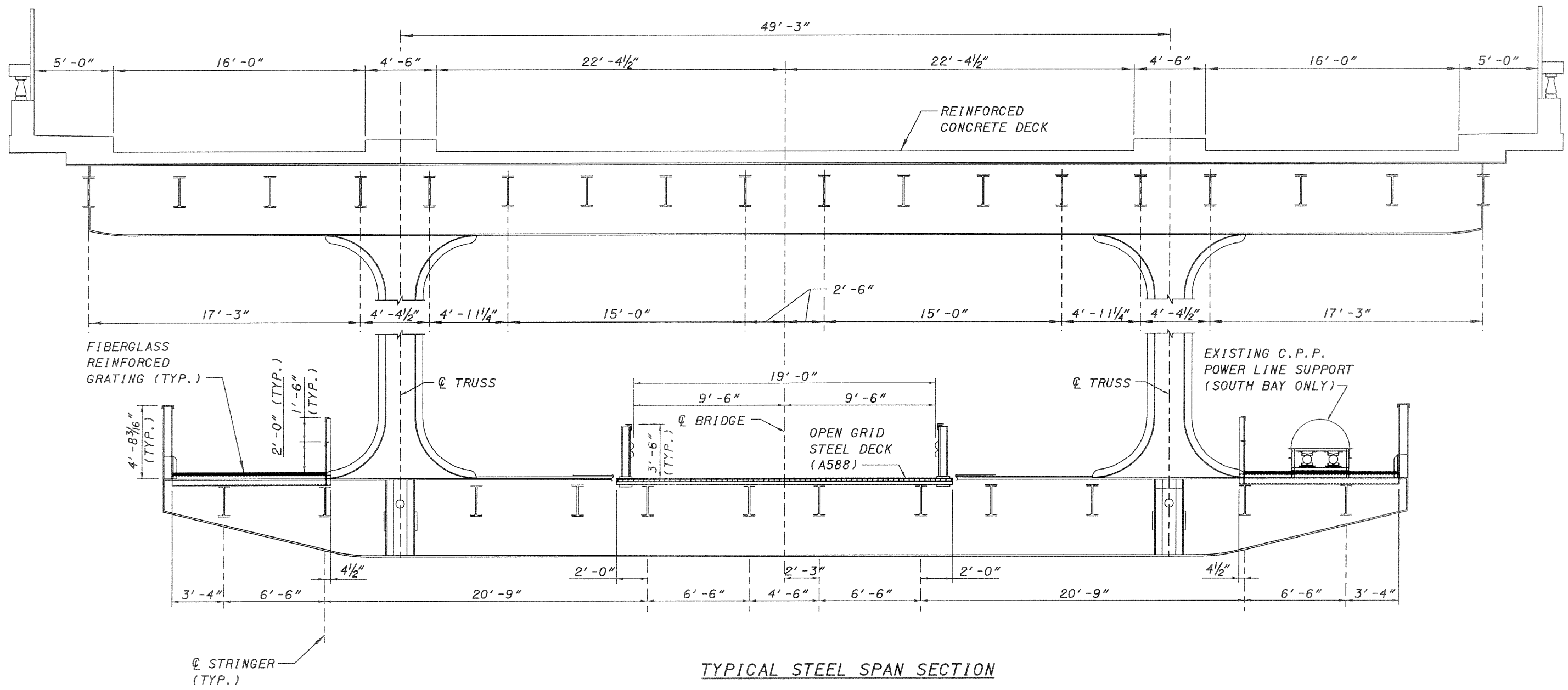
MEMBER IDENTIFICATION
MAIN SPAN



TYPICAL APPROACH SPAN SECTION
 LOOKING EAST

EXHIBIT D

TYPICAL CROSS SECTIONS
 APPROACH SPANS



TYPICAL STEEL SPAN SECTION

EXHIBIT E
 TYPICAL CROSS SECTIONS
 MAIN SPANS

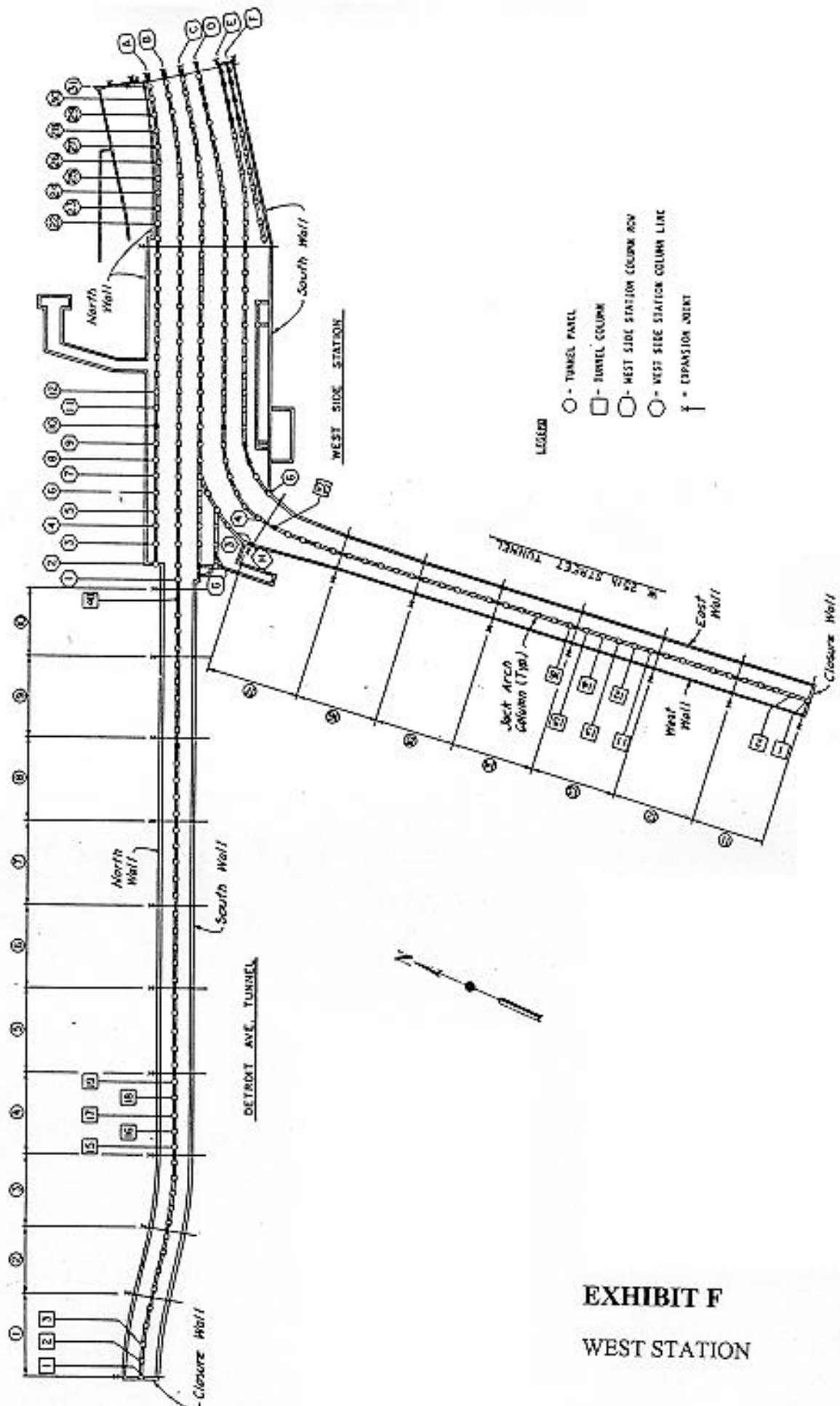


EXHIBIT F
WEST STATION

II – DECK ITEMS

The upper level deck is an 8¾-in thick reinforced concrete slab on the concrete approach spans and 8-in minimum thick in the steel main span. The upper deck is supported longitudinally by floor beams and transversely by jack arches in the approach spans, while the main span upper deck is supported by a floorbeam and stringer system. There are 5-ft nominal sidewalks with 8-in high plated steel curbs on both sides of the bridge. Each sidewalk has a 2-ft 3-in high concrete parapet topped with a 2-ft 3-in decorative railing consisting of 1-ft 6-in precast nylon fiber reinforced concrete balusters and a 9-in concrete top rail. In addition, there is a 5-ft 9-in aluminum picket-type fence along the inside face of the railings. Photo 1 shows a general view of the upper deck.



Photo 1 – General Upper Deck

dcp00187.jpg

In the main span, traffic dividers are provided to channel traffic to each side of the through arches. The dividers consist of 12-in high steel plated concrete curbing topped with 1-ft high-galvanized steel rails. These dividers run along each arch face and tie into a raised island. The dividers are carried beyond each blunt end of the arch where the arch passes through the deck. In addition to the islands, Low Maintenance Attenuators (LMA) are located at the approach traffic end of each arch.

Elastomeric strip seal joints accommodate thermal expansion in the upper deck. In the approaches, expansion joints are located at the center of each pier. However, at piers 3 and 4 (adjacent to the main span), strip seal joints are located at each side of the piers. In addition to the joints at the ends on the main span, strip seal joints are provided at panel points 5 and 5' to provide for stringer movement.

Primary drainage for the upper deck are catch basins located along each gutter at each pier in the approach spans and scuppers located at the gutters at both ends of the main span. From these deck drains, the runoff is transported in a closed system of piping to either the underground storm sewers or the river.

In the approach spans, the lower deck is separated into three bays (south, center and north) and supported in a manner similar to the upper level deck. The deck consists of a 7-in thick reinforced concrete slab. In the center and south bays, the deck extends full width. The north bay, however, is primarily open except for a 3-ft 10½-in wide walkway along the north railing. In the main span a 19-ft wide maintenance deck is carried across the center of the structure. This maintenance deck is a 5-in open grid steel (A588) deck with Type 4 guardrail. Along the north and south bays, 9-ft 4-in wide walkways are provided adjacent to each exterior railing. These walkways are fiberglass-reinforced gratings supported on steel framing.



Photo 2 – Lower Deck, Center Bay

dcp00134.jpg

A. Upper Level Concrete Deck

The upper level concrete deck, including the sidewalks, wearing surface and parapets, are in good condition. Two delaminated and cracked sidewalk patches (patched in 1997) in the main span were noted (Photo 3). Minor map cracking is prevalent throughout the structure. Horizontal cracks were common to the bottom of the concrete rail. Vertical cracks, at approximately 5-ft spacing, were noted, but no delaminations or efflorescence was observed (Photos 4). No deficiencies were noted to the aluminum fence.



Photo 3 – Delaminated and cracked sidewalk patch, North sidewalk near panel point 3

dcp00192.jpg



Photo 4 – Cracks and staining to railing

dcp00185.jpg

There is a spalled and cracked patch to the north rail at the expansion joint at panel point 0' (Photo 5). The concrete sealer on the upper deck railing is also showing signs of wear and flaking as well as staining from the aluminum fence above. There is active rust on the 8" curb plate.



Photo 5 – Spalled patch to north rail at panel point 0'

dcp00189.jpg

The underside of the deck is in fair condition. Minor cracking and efflorescence is occurring at several locations but is sporadic.

Finally, the 1" monolithic wearing surface, is in good condition. Minor map, longitudinal and transverse cracking was noted. Chain dragging of the deck produced less than 1% delamination of the areas dragged.

B. Lower Level Decks

The lower deck slabs are in very good condition. Approximately 50% of the reinforced concrete lower decks were chain dragged with no delaminations detected. The underside of the lower deck is also in good condition. No efflorescence or delaminations were observed. Water leaking from the utility boxes has left debris, water and rust staining to the south bay in spans 3 and 7.

The steel grid deck in the middle bay of the main steel span is also in good condition. No visible deterioration or deficiencies were noted.

The fiberglass grating walkways are in good condition with two deficiencies noted. Minor damage to the walkway grating to the north walkway at panel point 0' was observed (Photo 6). Second, vertical displacement between adjacent grid panels was observed in the north walkway near panel point 3' (Photo 7).

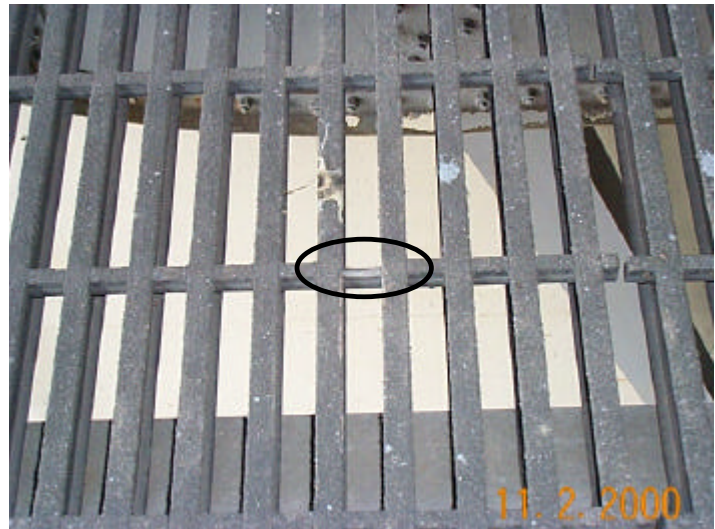


Photo 6 – Damage to Fiberglass grating, North walkway near Panel Point 0'

dcp00128.jpg

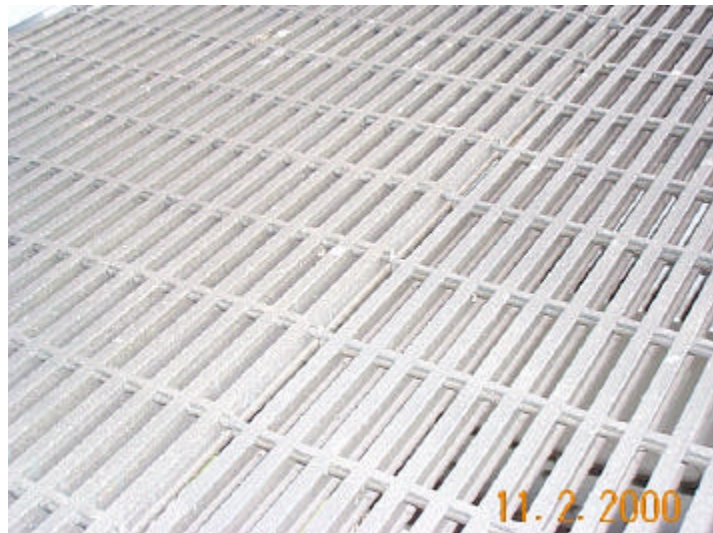


Photo 7 – Vertical Displacement between grating, North walkway near Panel Point 3'

dcp00129.jpg

The lower deck railing is in fair to good condition. The exterior concrete rails in the concrete approach spans are in good condition with few, sporadic areas of small spalls and areas of delamination recorded. No deficiencies were noted to the metal pipe rails to the north bay walkway. Several of the center bay rails had areas of delamination, cracks or spalls (Photos 8 & 9). The spalls and delaminations present were not repaired during the last rehabilitation.



Photo 8 – Crack to center bay railing
dcp00111.jpg



Photo 9 – Spall with exposed reinforcing to center bay railing
dcp00112.jpg



Photo 10 – Lower Deck, South Bay
dcp143.jpg



Photo 11 – Lower Deck Compression Joints
dcp00146.jpg

The compression joints are in good condition. Water leaking from the utility chambers (Photo 10) is collected and pooling in the compression joints (Photo 11). No leaking under the deck was observed.

Several deficiencies were observed to the exterior railing in the main span. Packrust up to 2 inches between post channels was common (Photo 12). Holes through the vertical tubular rails were noted to the north rail near panel point 5 (Photo 13).



Photo 12 – Packrust to main span exterior railing posts
dcp00071.jpg



Photo 13 – Holed through vertical tubular rails
dcp00123.jpg

Holes and loss of section were also noted to numerous post channels throughout the span (Photo 14), as well as packrust (Photo 15) and missing bolts (Photo 16) between the end of the lower deck floorbeam and the vertical channel posts.



Photo 14 – Holed through exterior railing posts
dcp00125.jpg



Photo 15 – Packrust between lower deck floorbeam and railing
dcp00195.jpg



Photo 16 – Missing bolts between lower deck floorbeam and railing
dcp00072.jpg

C. Traffic Dividers

The traffic dividers and impact attenuators are in good condition. No deficiencies were noted.

D. Drainage

The drainage is in fair condition. Catch basins in the upper deck slab are clear. Downspouts appear to be clear, except at the bottom of the West Abutment and Pier 1 where debris accumulation is evident (Photos 17).

Storm sewer catch basins at the base of Pier 9, Pier 12, and the East Abutment were clogged with debris and vegetation (Photo 18).



Photo 17 – West Abutment

dcp00215.jpg



Photo 18 – Pier 9 South Exterior clogged

Catch Basin

dcp00234.jpg

E. Expansion Joints

The expansion joints are in good condition. No damage, tears or cracks to the upper deck strip seals were noted. The lower deck compression seals are in excellent condition. Minor debris and ponding water is collecting at the curbs, especially at the expansion joints (Photo 19). There is minor wear and loss of paint to the expansion joint armor (Photo 20).



Photo 19 – Debris Accumulation at Gutter
at Expansion Joint
dcp00186.jpg



Photo 20 – Expansion Joint
dcp00202.jpg

III – SUPERSTRUCTURE

The approaches consist of eleven reinforced concrete arch spans and one concrete-encased steel arch span. Four lines of arch ribs support the upper and lower decks with reinforced concrete beam and spandrel column construction (Photo 21). The concrete encased steel arches are part-through and have hanger supports for a portion of the lower deck (Photo 22).



Photo 21 – Typical Concrete Approach, Span 11
dcp00238.jpg



Photo 22 – Concrete Encased Steel Approach, Spans 12
dcp00237.jpg

In contrast to the approaches, the main span superstructure is a single three hinge steel arch span of part-through design. The main arch elements are two lines of Pratt trusses spanning 591-ft between end bearings (Photo 23). Both roadway decks are supported by longitudinal stringers, which span between transverse floor beams. The stringers are rolled sections whereas the floor beams are built-up members consisting of plates and angles.

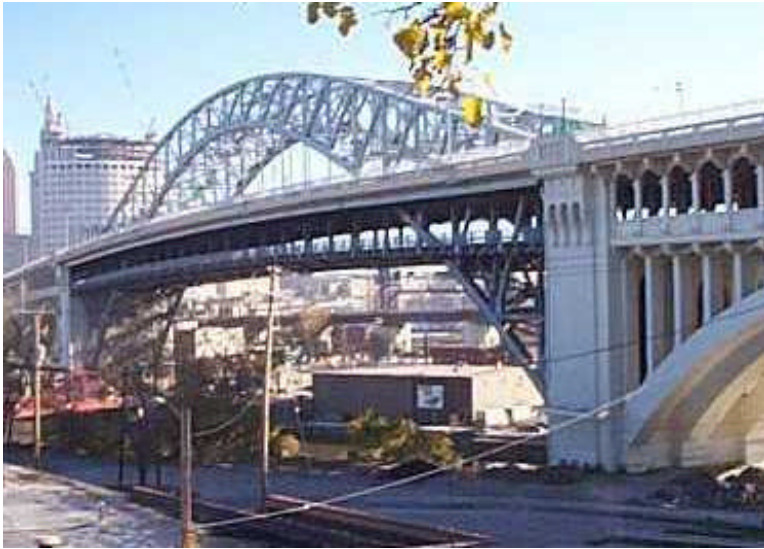


Photo 23 – Main Steel Span

dcp00102.jpg

Upper and lower deck floor beams are framed together by vertical built-up hangers having rigid connections to the floor beams. The floor beam frames are pin supported at the vertical posts of the trusses and at pairs of eye-bar hangers. The main members of the trusses are box sections made up of plate and angle sections tied together with lacing channels or bars. Corrosion resistant nickel steel was used for the main member plate and angle sections. For economy, carbon steel was used for all other members. Horizontal struts brace the two end truss panels and the lower level deck between floor beams. Lateral bracing is provided in the plane of the bottom flange of the upper and lower roadway floor beams and in the plane of each truss chord.

A typical cross section of the approach spans and main span superstructure are included as Exhibits D & E.

A. Concrete Approach Spans

General

The concrete approach spans are in generally good condition. Minor areas of delaminated concrete were observed to the arch ribs, spandrel columns and floorbeams. Significant areas of delamination were noted to the bottom of the arch ribs in span 11. Total delaminated area to the approach spans is less than 3%.

Upper Deck Floorbeams

There are three distinct and different upper deck floorbeams, which are based on the time of construction. These are floorbeams from original construction, floorbeams replaced during the 1967 rehabilitation and floorbeams replaced during the 1995 rehabilitation. All remaining floorbeams from original construction were strengthened during the 1967 rehabilitation. The majority of deficiencies to the floorbeams were found on those original floorbeams (Photo 24), with the other minor spalls and delaminations found on the 1967 rehabilitation replacement floorbeams. All the 1995 rehabilitation floorbeams were found to be in excellent condition.



Photo 24 – Span 2, Floorbeam 8, South Bay (original)

dcp00223.jpg

Typically, the floorbeams are in good condition with 10 square feet or less of delaminated concrete were noted to the upper deck floor beams per span, per bay.



Photo 25 - Span 1A, Floorbeam 4, Center Bay
dcp00113.jpg

Exceptions to this were in span 1A south bay (26 s.f.), span 1 north bay (55 s.f.), span 2 south bay (23 s.f., Photo 3D), span 11 north bay (13 s.f.) and span 12 north and south bays (28 s.f. and 29 s.f., respectively). Spalls with exposed reinforcing were noted in span 2 south bay, span 12 north bay and span 13 north bay. Minor flexural cracks were also noted, but not significant. Sporadic cracks with efflorescence were observed to isolated floorbeams (Photo 25). The epoxy-injected cracks appear to be functioning properly.

Lower Deck Floorbeams

The lower deck floorbeams are in good condition. Generally, areas of delaminated concrete were noted to isolated, random floorbeams, while several other lower deck floorbeams have spalls with exposed reinforcing (Photo 26). While all the spalls have been sealed, bleeding and rust staining due to active corrosion is present at some locations (Photo 27). Minor hairline flexural and map cracks were noted but are not significant at this time.



Photo 26 – Span 5, Floorbeam 2, South Bay
dcp00226.jpg



Photo 27 – Span 10, Floorbeam 5, South Bay
dcp00240.jpg

In Span 12, spalls, cracks and crumbling concrete patches were noted. There are horizontal cracks at the south end of floorbeams 5 and 6 (Photo 28). A crumbling patch over Robert Lockwood Jr. Drive was noted on the east face of floorbeam 4 in the south bay (Photo 29). Similarly, a second poor patch with voids is located on the east face of floorbeam 6 in the center bay (Photo 30).



Photo 28 – Span 12, Floorbeam 5, South Face
dcp00248jpg



Photo 29 – Span 12, Floorbeam 4, South Bay
dcp00245jpg



Photo 30 – Span 12, Floorbeam 5, Center Bay
dcp00251jpg

Jack Arches

The upper deck jack arches are in good condition. Sporadic areas of voids, cracking and delamination (Photo 31) were noted, mainly in spans 1A and 1B and the north interior column line in span 2. There are two spalls with exposed reinforcing in span 1A at the north interior jack arch between floorbeam 5 and 6 and floorbeams 6 and 7 (Photo 32).



Photo 31 – Span 1A, South Interior
Jack Arch between FB 8 & 9

dcp00120jpg



Photo 32 – Span 1A, North Interior
Jack Arch between FB 6 & 7

dcp00119jpg

Upper Deck Columns

The upper deck columns are in generally good condition. Voids to columns replaced during the 1994 rehabilitation are common (Photo 33), as well as deterioration and peeling to the textured surface on original columns (Photo 34).

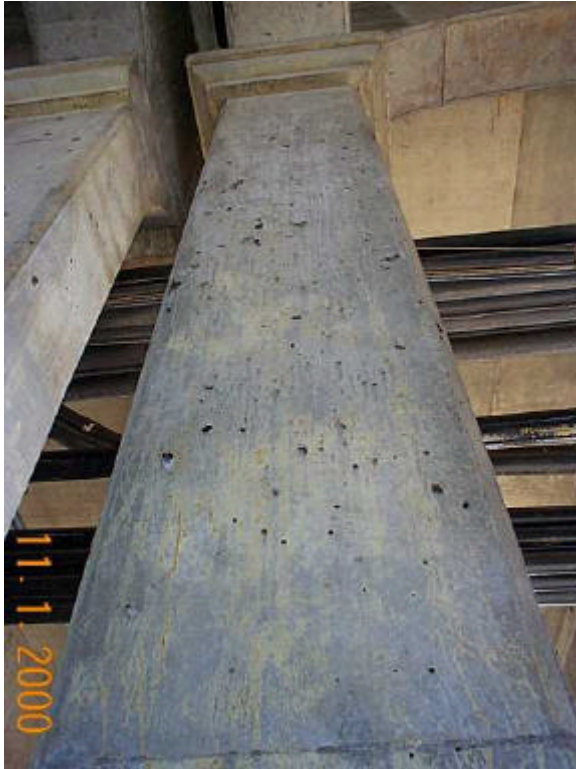


Photo 33 – Span 3, South Int. Column 18
dcp00099.jpg



Photo 34 – Span 2, North Int. Column 11
dcp00132.jpg

Cracks, delamination and spalls to the corbel detail were noted throughout the concrete spans (Photo 35). Additionally, three columns in span 3 were replaced without the corbel detail (Photo 36). Minor spalls with exposed reinforcing were observed in spans 1A and 1B, typically near the corbel detail (Photo 37).



Photo 35 – Span 1 South Interior Column 7
dcp00091.jpg



Photo 36 – Span 3, North Interior Col. 13
dcp00212.jpg



Photo 37 – Span 1A, North Exterior Column 5
dcp00116.jpg

Several columns also had spalls and/or voids to the column core above the corbel detail (Photos 38 and 39).



Photo 38 – Span 2, North
Exterior Column 4
dcp00139.jpg



Photo 39 – Span 2, South
Exterior Column 7
dcp00211.jpg

Lower Deck Columns

The lower deck columns are in good condition. Localized areas of voids, honeycombing and cracking from original construction were noted to several lower deck columns (Photo 40). An example of this is at South Interior Column 11 in Span 5.



Photo 40 – Span 5, South Interior Column 11

dcp00228.jpg

Several columns also have cracks and/or delaminations, including 4 s.f. to the North Exterior Column 1 and 20 s.f. to the North Exterior Column 4 in Span 2 (Photo 41); 5 s.f. to the North Exterior Column 3 and 4 s.f. to the North Exterior Column 16 in Span 3; and 9 s.f. to the South Exterior Column 1, 10 s.f. to the North Interior Column 10 and 11 s.f. to the North Interior Column 12 in Span 10.



Photo 41 – North Exterior Column 4, Span 2

dcp00224.jpg

Arch Ribs

A typical condition that was noted is the presence of debris on top of the arch ribs. This debris included mainly excess concrete waste material. An example of this is shown in photo 42, located at the South Interior arch between columns 9 and 10 in Span 5.



Photo 42 - Debris on top of concrete arches

dcp00227.jpg

Several other locations have areas that are cracked, delaminated, and/or have seepage, particularly in the north exterior line and the south exterior line. Near the West Abutment, the outside of the South Exterior arch shows this typical condition (Photo 43).



Photo 43 - Cracked exterior arch face, Span 1 South Face at West Abutment

dcp00214.jpg

In span 10, approximately 35% of the bottom of the arches were delaminated. This may be due to the fact that this span was the first to be patched and proper procedures may not have been developed. During the 1995 rehabilitation, a deep section of deficient concrete was uncovered on the southeast arch rib in span 5 between columns 1 and 2. It is uncertain if the problem was due to poor original materials or from deterioration. This area should be carefully monitored for additional deterioration.

B. Steel Arch Span

General

Overall, the structural steel in the main steel arch span is in fair to good condition. The steel above the upper deck is in good condition with very few minor deficiencies noted. The majority of members below the upper deck that were not replaced during the 1994 rehabilitation exhibit moderate to heavy pitting, loss of section and localized areas that are holed through. All of these areas were cleaned and painted as part of the last rehabilitation. While there is no significant loss of additional section since that rehabilitation, rust staining and corrosion continues to be active at many locations.

One source for corrosion is the holes in the upper deck for the eyebars between the upper and lower arch. These holes allow water and de-icing chemicals from the upper deck to come in contact with floorbeam members, vertical hangers, and other members below the upper deck.

Debris and most noticeably sand blasting material from the recent rehabilitation are present at random locations throughout the steel span. Some of the material has been painted over (Photo 44). The amounts of accumulation of debris ranges from minor to moderate (Photo 45).



Photo 44 – Debris under paint

dcp00020.jpg



Photo 45 – Debris and Blast
Material

dcp00085.jpg

Truss Main Members

The truss members above the upper deck are in good condition. Below the upper deck, however, a significant number of deficiencies were noted. Although numerous repairs and a total repainting was performed during the previous rehabilitation, areas of paint are beginning to deteriorate leading to minor corrosion and staining. Heavy staining, paint deterioration and flake rusting to the verticals at U2'-L2' and U3'-L3' and the diagonal between U1' and L2' below the upper deck (Photo 46 and 47).



Photo 46 - South Arch at panel point L2

dcp00066.jpg



Photo 47 - South Arch U2-L2, flaking on lacing bars

dcp00063.jpg

Minor paint deterioration was commonly noted, especially at hanger locations below the upper deck. Rust staining is prevalent below the upper deck and flake rust is beginning to form at some locations. The lower chord pins and nuts at L11' and L6' are unpainted (Photo 48).



Photo 48 - North Arch Bottom Chord L11'

dcp00086.jpg

Random lacing bars and channels throughout the steel span have been holed through by rust and section loss throughout the steel arch span (Photo 49). In all instances, those areas were cleaned and painted during the last rehabilitation. Active rust staining and corrosion is occurring at numerous locations. At panel point L2' of the north arch, broken lacing bars were noted.



Photo 49 - South Arch L4-L5

dcp00058.jpg

Stay plates and keeper plates have been holed through throughout the main steel span (Photo 50). Similar to lacing bars and channels, those areas were also cleaned and painted during the last rehabilitation. There was either no active corrosion or very minor corrosion noted.



Photo 50 - South Arch Diagonal U3-L4

dcp00057.jpg

Accumulation of water and debris was common on angles that open upward. While the drilled holes in those members allow some drainage, full drainage is not achieved due to lack of slope. Water was also observed to have collected at panel points in both the upper and lower chords, especially inside vertical members.

Packrust and bowing to the top sliding plate at U12 of the north arch was noted. At U12 of the south arch, the bottom leg of the exterior angle behind the vertical sliding plate has corroded through.

The main truss gusset plates from Panel Points L1 to L4 and L1' to L4' have up to 30% section loss above the top flange of the lower chord (Photo 50a). Typically these plates have 1/8" to 1/4" loss in the area 2" above the lower chord and top lateral bracing gusset plates to both the exterior and interior faces. Throughout the life of the bridge, water has infiltrated through the upper deck truss openings and run along the top flange of the lower chord. This has caused early paint failure to the gusset plates, exposing the corrosion-resisting nickel steel. Currently, corrosion is beginning to reappear at these locations (Photo 50b).



Photo 50a - South Arch North Gusset Plate
at L2'
dcp00329.jpg



Photo 50b - North Arch South Gusset Plate
at L1'
dcp00330.jpg

Eyebar Hangers and Vertical Hangers

The main span hangers are in good condition. Several vertical hangers were coped during the last rehabilitation at the lower deck floorbeam to minimize potential locations of packrust. Vertical hangers have section loss at the upper deck floorbeam. There is rust staining and minor active corrosion but no significant additional section loss has occurred since the last rehabilitation (Photo 51). Packrust between angles is common, especially at expansion joint locations (Photo 52).



Photo 51 - South Arch at panel point 1'

dcp00164.jpg



Photo 52 - South Arch at panel point 1'

dcp00162.jpg

Two sets of lacing bars to the North vertical hanger at 0' are severed due to corrosion near the upper deck floorbeam. Additionally, a 4"x6" hole through the North vertical hanger at U4-L4 above the lower deck floorbeam was noted.

Floorbeams

The main span upper deck and lower deck floorbeams are generally in good condition. There is corrosion and rust staining to the upper deck floorbeam in the area around the pin and hanger assemblies (Photo 53). Holes through the web and bottom flange angles of the lower deck floorbeams occur throughout the steel arch span, but particularly at upper deck expansion joint locations at panel points 0, 5, 5' and 0'. Hole locations are typical near the upper deck hanger pins (photo 54) and in the cantilever ends at 0 and 0'.



Photo 53 - Upper Deck Floorbeam at 7',
South Arch
dcp00158.jpg

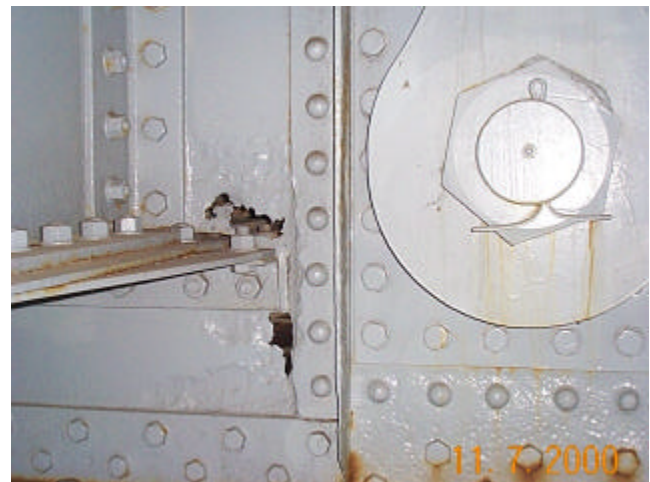


Photo 54 - Upper Deck Floorbeam at 8', North
Arch hanger
dcp00200.jpg

As part of the 1995 rehabilitation project, some floorbeam top and bottom flanges were coped at hanger locations. No additional section loss was noted.

The stiffener at PP8' near the north arch has been torn or cut 2/3 of the way through the stiffener. It was painted over during the last rehabilitation.

Stringers

The stringers are in fair condition. Minor deficiencies noted include several missing bolts at various locations and a horizontal and/or vertical offset of upper deck exterior stringers. There is a kink to upper deck stringer U between PP3' and PP4' (Photo 55), and upper deck stringer F at 6' is missing 2 of 4 bolts to the floor beam connection angle. There is also a loose nut at that same location.



Photo 55 - South Exterior Upper Deck Stringer Span 4 near panel point 10'

dcp00159.jpg

Section loss and holes through members were common to stringers 1-3 and 10-11 of the lower deck. Stringers 4-9 are typically in good condition with no significant section loss. The lower deck expansion stringer bearings at panel points 3 and 3' exhibit section loss and have some holed through seat hangers (Photo 56). The upper deck stringers near the expansion joints at panel points 5 and 5' were replaced in the 1995 rehabilitation and are in good condition.



Photo 56 - Lower Deck Stringer 10 at panel point 3'

Dcp00023.jpg

Bracing

The bracing members are in good condition. Similar to the main truss members, the bracing members above the splash zone are in better condition than the bracing members below the upper deck. As part of the 1995 rehabilitation project, the lower deck framing under the catwalks was modified as transverse and diagonal wind bracing members were removed.

There are holes through flanges, angle legs, lacing bars and gusset and connection plates common throughout the lower bracing. As stated previously, all have been painted over during the last rehabilitation.



Minor rust staining and some active corrosion, especially near hanger locations was observed. The paint is beginning to breakdown, with areas of flaking and peeling paint and rust staining (Photo 57).

Photo 57 - Horizontal at U4'

dcp00056.jpg

Packrust between the bottom bracing members and gusset plates was noted (Photo 58). Isolated areas of construction damage were also noted, including a bent horizontal gusset plate at U5' at the south arch (Photo 59). Water and debris accumulates in the uphill angle legs of horizontal bracing members.



Photo 58 - Packrust at 8', South Arch

Dcp00197.jpg



Photo 59 - Bent Gusset at U5', South Arch

Dcp00054.jpg

C. Bearings

The main arch bearings at the tiebacks are pitted with minor active corrosion and rust staining. No additional section loss was observed. Accumulation of debris and water between stiffeners is typical. There is standing water above the pin inside the vertical member at all locations (Photo 60).



Photo 60 - Standing water at L0', North Bearing

Dcp00321.jpg

IV- SUBSTRUCTURE

The substructure includes twelve reinforced concrete piers and two reinforced concrete abutments. The abutments are of cellular construction below the lower level deck and provide for four lines of beam and column supports for the upper level deck. Each pier and the front face of the abutments consist of arch ribs, walls and columns.

A. Abutments

The abutments are in good condition. There is ponding water adjacent to the east abutment (Photo 61). The epoxy sealer is in good condition with minor rust staining bleeding through in isolated locations.



Photo 61 – East Abutment

dcp00236.jpg

There is debris and fill adjacent to the west abutment. Minor diagonal cracks were noted on the west abutment south wall.

B. Piers

The piers are in generally good condition. Cracks, delaminations, and/or spalls to the pier shafts are common, especially near corbel details and the interface between the lower pier shafts and adjacent end columns (Photos 62 & 63).



Photo 62 – Pier 9

dcp00170.jpg



Photo 63 – Pier 9

dcp00171.jpg

Pier 3 and Pier 4 have extensive delaminations and spalls on the interior faces of the towers (Photo 64). The interior arches are also spalled with exposed reinforcing (Photo 65).



Photo 64 – Pier 3 North Interior Bay

dcp00219.jpg



Photo 65 – Pier 3 North Interior Bay

dcp00218.jpg

Voids occur sporadically in the arch base. Rust staining of reinforcing is bleeding through at various locations (Photo 66), but otherwise the epoxy-urethane sealer is in good condition.



Photo 66 – Pier 9 North Face

dcp00177.jpg

The ground below span 3 is being used as a dump location. Periodically, the ground line is leveled out and the excess fill pushed toward the West Bank of the Cuyahoga River.

C. Cellular Construction

As noted previously, spans 1A and 1B are of cellular construction. Access to the east abutment was limited. Access to the west abutment was gained through the passage just west of the county garage rolling door.

The condition of the cellular construction is fair. There are areas of heavy cracking with efflorescence and spalls with exposed reinforcing to the walls and roof slabs in both the south and north bays (Photo 67, 68 & 69)



Photo 67 – North Cell, North wall (4th from the West end)

dcp00026.jpg



Photo 68 – South Cell, Roof Slab (1st cell from the West end)

dcp00037.jpg



Photo 69 – North Cell, Roof Slab (1st cell from the West end)

dcp00030.jpg

V- GENERAL

A. Channel

The Cuyahoga River passes under the main steel span at an approximate skew of 65 degrees. An underwater investigation performed by Lake Erie Diving has found the river channel bottom to be in good condition. See Appendix C.

B. Approaches

East approach and west approaches are in good condition. Minor cracking in the asphalt approaches was observed. A depression in the east approach asphalt pavement was also noted.

C. Land Use

In addition to the Cuyahoga River passing under Span 4, several other areas under the bridge are utilized. On the West side of the river, Riverbed Road passes under Span 2. The area under Span 3 was being backfilled during the inspection. On the East side of the river, parking lots are located under Spans 5, 6, 8, and 9. West Avenue and Merwin street pass under Span 7. A pedestrian walkway is located under Span 10 and a RTA rapid line runs under Span 11 (see Photo 21, page 20). Robert Lockwood Jr. Drive passes under Span 12 (see Photo 22, page 20).

D. Navigation Lighting

The navigation lights on the structure are operating properly.

E. Structure and Architectural Lighting

During the bridge inspection, a lighting contractor was replacing several decorative lights. A night inspection of the lighting found the structure and architectural lighting to be in good working condition.

APPENDICIES

- A. BRIDGE INSPECTION REPORT (FORM BR-86)**
- B. EXPANSION JOINT MEASUREMENTS**
- C. UNDERWATER INSPECTION REPORT**
- D. RECOMMENDATIONS**

APPENDIX A

BRIDGE INSPECTION REPORT (FORM BR-86)

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
BRIDGE INSPECTION REPORT

2000

BR-85 REV. 02-95

1 8 0 0 9 3 0
STRUCTURE FILE NUMBER

BRIDGE NUMBER CUY 00006 1499
CO ROUTE UNIT

CLEVELAND

YEAR BUILT 1979

DIST 12 BRIDGE TYPE STEEL/ARCH/THRU TYPE SERVICE 1 57 CUYAHOGA RIVER/GCRTA

| DECK | | THICK = 1.0 | |
|--------------------------------|---|--|---|
| 1. FLOOR | TRANSVERSE CRACKS WITH WATER STAINING AND EFFLORESCENCE 1-CONC | 2. WEARING SURFACE | 2-CONCRETE MOND |
| 3. CURBS, SIDEWALKS & WALKWAYS | SMALL ISOLATED SPALLS ON MAIN SPAN 1-CONC/1-CONC | 4. MEDIAN | |
| 5. RAILING | VERTICAL CRACKS ON POSTS (SPACED 4' 10"); MINOR HORIZONTAL CRACKS, DETERIORATION OF SEALER 5-CONC POST PNL | 6. DRAINAGE | DOWNSPOUT CLOGGED AT PIER 9, PIER 12, EAST ABUTMENT, PIERS 3-SCPRS DWN SPT |
| 7. EXPANSION JOINTS | 8-STRIP | 8. SUMMARY | |
| SUPERSTRUCTURE | | | |
| 9. ALIGNMENT | MAX. SPAN=591 | 10. BEAMS/GIRDERS/SLAB | N-N/A |
| 11. DIAPHRAGMS or CROSSFRAMES | TOT. LGTH=2656 | 12. JOISTS/STRINGERS | |
| 13. FLOOR BEAMS | DELAMINATION AND SPALLS WITH EXPOSED REBAR IN CONCRETE FLOOR BEAMS, HOLES THRU STEEL FLOOR BEAMS | 14. FLOOR BEAM CONNECTIONS | |
| 15. VERTICALS | SPORADIC HOLES THROUGH LACING BARS THROUGHOUT | 16. DIAGONALS | |
| 17. END POSTS | CUT LACING BARS AT PANEL POINT 0' | 18. TOP CHORD | |
| 19. LOWER CHORD | | 20. LOWER LATERAL BRACING | |
| 21. TOP LATERAL BRACING | US' - SOUTH TRUSS - TEAR AND DEFORMATION OF CONNECTIONAL PLATE | 22. SWAY BRACING | |
| 23. PORTALS | | 24. BEARING DEVICES | 8-ARCH RB |
| 25. ARCH | MINOR DELAMINATION AND CRACKS | 26. ARCH COLUMNS or HANGERS | |
| 27. SPANDEL WALLS | | 28. PAINT | TYPE: 5 YEAR = 70% CORROSION HAS STARTED |
| 29. PINS/HANGERS/HINGES | 2 PINS IN NORTH ARCH UNPAINTED | 30. FATIGUE PRONE CONNECTIONS | |
| 31. LIVE LOAD RESPONSE | | 32. SUMMARY | NO SECTION LOSS SINCE LAST REHAB |
| SUBSTRUCTURE | | | |
| 33. ABUTMENTS | 2-CONC | 34. ABUTMENT SEATS | |
| 35. PIERS | POST STAINS, MINOR DELAMINATIONS AT ALL PIERS, SPALLS ON PIER SHAFTS 2-CONC | 36. PIER SEATS | |
| 37. BACKWALLS | | 38. WINGWALLS | |
| 39. FENCERS and DOLPHINS | SPANS=13 PIERS=NOT ON PILING PIERS=12 | 40. SCOUR | ABUTMENT: NOT ON PILING |
| 41. SLOPE PROTECTION | | 42. SUMMARY | DIVE DT= 10/20/97 |
| CULVERTS | | | |
| 43. GENERAL | | 44. ALIGNMENT | |
| 45. SHAPE | | 46. SEAMS | |
| 47. HEADWALLS or ENDWALLS | | 48. SCOUR | |
| 49. | | 50. SUMMARY | |
| CHANNEL | | | |
| 51. ALIGNMENT | SEVERELY SKEWED CHANNEL | 52. PROTECTION | LOSS OF SHEETING AT WEST BANK 3-SHT PILING |
| 53. WATERWAY ADEQUACY | | 54. SUMMARY | |
| APPROACHES | | | |
| 55. PAVEMENT | LEAKING AT WEST STATION 1-CONC | 56. APPROACH SLABS | |
| 57. GUARDRAIL | 0-OTHER | 58. RELIEF JOINTS | |
| 59. EMBANKMENT | BROG. WIDTH=72 | 60. SUMMARY | PCT. LEGAL=150 |
| GENERAL | | | |
| 61. NAVIGATION LIGHTS | | 62. WARNING SIGNS | MAINT. RESP: 3-COUNTY |
| 63. SIGN SUPPORTS | MVC DN=1400 UND=3000 OVERHEAD SIGN DAMAGE @ NORTHEAST CORNER OF STEEL SPAN | 64. UTILITIES | LEAKING UTILITY BOXES |
| 65. VERTICAL CLEARANCE | | 66. GENERAL APPRAISAL & OPERATIONAL STATUS | COND 7 STAT A |

INSPECTED BY
Joseph D. Morrison
SIGNED

76 PE

JDM
78 NTHS

REVIEWED BY
John Sal...
SIGNED
DATE 111111 NN

PE
81 PE

BDS
83 NTHS

DOT 2852
DECK AREA 226291

DATE 112000
86 91

111111 NN
87 89 SURVEY 89

DATE 112000
100 105

APPENDIX B

EXPANSION JOINT MEASUREMENTS

EXPANSION JOINT MEASUREMENTS

| Location | Strip Seal Gland Size | Design Opening @ 60°F | Measured at South Lane Line | | | | Measured at North Lane Line | | | | |
|----------------|-----------------------|-----------------------|-----------------------------|--|--|--|-----------------------------|--------|--|--|--|
| | | | 2000 (11/7) | | | | 2000 (11/7) | | | | |
| | | | Opening @ 50 °F | | | | Opening @ 50 °F | | | | |
| Tower A | 3 | 2 | 2 1/8" | | | | | 2 1/8" | | | |
| Tower B | 3 | 2 | 2 3/8" | | | | | 2 1/8" | | | |
| West Abutment | 3 | 2 | 2 5/8" | | | | | 2 1/2" | | | |
| Pier 1 | 3 | 2 | 2 1/2" | | | | | 2 3/8" | | | |
| Pier 2 | 3 | 2 | 2 3/8" | | | | | 2 1/4" | | | |
| Pier 3 | 3 | 2 | 2 1/2" | | | | | 2 1/2" | | | |
| Panel Point 0 | 4 | 2 | 1 3/4" | | | | | 1 3/4" | | | |
| Panel Point 5 | 3 | 2 | 2 1/8" | | | | | 1 7/8" | | | |
| Panel Point 5' | 3 | 2 | 2 3/8" | | | | | 2 1/2" | | | |
| Panel Point 0' | 4 | 2 | 2" | | | | | 1 7/8" | | | |
| Pier 4 | 3 | 2 | 2 3/8" | | | | | 2 3/8" | | | |
| Pier 5 | 3 | 2 | 2" | | | | | 2" | | | |
| Pier 6 | 3 | 2 | 2 3/8" | | | | | 2 3/8" | | | |
| Pier 7 | 3 | 2 | 2 3/8" | | | | | 2 1/2" | | | |
| Pier 8 | 3 | 2 | 2 1/2" | | | | | 2 1/2" | | | |
| Pier 9 | 3 | 2 | 2 1/4" | | | | | 2 3/8" | | | |
| Pier 10 | 3 | 2 | 2 1/2" | | | | | 2 1/4" | | | |
| Pier 11 | 3 | 2 | 2 1/4" | | | | | 2 1/4" | | | |
| Pier 12 | 3 | 2 | 2 1/4" | | | | | 2 1/4" | | | |
| East Abutment | 3 | 2 | 2 1/8" | | | | | 2 1/8" | | | |

APPENDIX C

UNDERWATER INSPECTION REPORT

Lake Erie Diving, Inc.

546 Hoyt St. Unit #5
Painesville, OH 44077

Office (440) 942-3814

Fax (440) 352-8471

UNDERWATER BRIDGE INSPECTION REPORT

Location:

Bridge #: CUY-6-1499
Detroit-Superior
Waterway: Cuyahoga River
City: Cleveland, Ohio

Inspected By:

Diver: Tim Brunkala
Jeff Burke
Tender: Pat Murphy - Mark Maquire
Date: 30 October 2000

Inspection Performed For:

Name: HNTB
Address: 55 Erieview Plaza Suite 500
Cleveland, Ohio 44114-1816
Field Representative: Byron Sah
Telephone #: (216) 522-1140

Water Elevation:

Reference Location: Pier #4-East Bank From the top of the concrete cap to the
waterline, just downstream of the pier column corner. (See Sketch)
Water Elevation (Field Measurement): 5.3'

Weather Conditions: Sunny

Water Conditions: Calm - 60 Degrees

Soundings: Equipment Used: Weighted Tape Measure
(See Attached Print)

Number of Piers Inspected: 2
(See Attached For Detailed Observations)

Number of Abutments Inspected: 0
(See Attached For Detailed Observations)

Culvert: N/A
(See Attached For Detailed Observations)

Lake Erie Diving, Inc.

546 Hoyt St. Unit #5
Painesville, OH 44077

Office (440) 942-3814

Fax (440) 352-8471

PIER OBSERVATIONS

Bridge #: CUY-6-1499 **Inspection Date:** 30 October 2000

Pier Number: West Bank - Pier #3
(Reference Attached Print)

Type of Construction: Concrete: Cut-Stone: Timber: Steel:
Other:

Bottom Material: Concrete rubble & rebar

Debris Around Pier: Concrete rubble & rebar

Scour: None

Exposed Footer: None

Footer Undermining: None

Exposed Piling Under Footer: N/A

Piling Condition: N/A

Cracks & Spalls: Minor - see sketch

Fender Condition: N/A

Impact Damage: Both water side corners are spalled above the waterline. I believe this is from barge or ship impact.

Unusual Conditions: New concrete placed during rehab stopped 35"-40" above waterline. Existing concrete below the new has minor spalling.

Overall Condition Rating: Good

SHORELINE
CONCRETE RUBBLE & REBAR

UPSTREAM

APPROXIMATELY 40" FROM WHERE THE
NEW CONCRETE STOPS TO WATERLINE.
THE UNDERCUT AREAS SHOWN BELOW
START UNDER WHERE THE NEW REHAB
STOPPED

S-15.9'

S-12.0'

27.7'

PIER #3

MINOR UNDERCUT - THIS FACE
BELOW THE NEW CONCRETE

UNDERCUT AREA IS
APPROXIMATELY 6"
DEEP

S-23.7'

SEE DETAIL -A-

S-16.6'

8.8'

S-12.7'

8.0'

S-1.1'

17.0'

SEE DETAIL -B-

BOTH -A- & -B- CORNERS ARE ROUNDED
5'-7" FROM THE WATERLINE DOWN TO
THE MUDLINE

S-24.3'

CONCRETE RUBBLE AND
REBAR IN CORNER ON
CHANNEL BOTTOM

CUVAHOGA RIVER
DOWNSTREAM

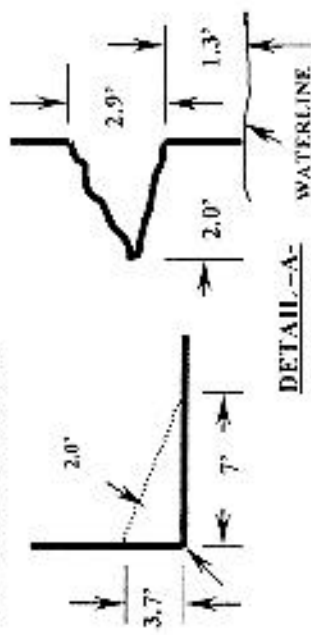
OLD STEEL
SHEET PILING

S-21.4'

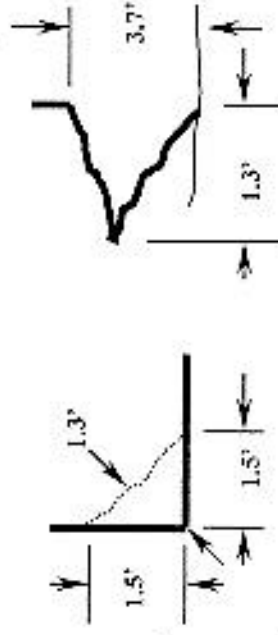
DETROIT SUPERIOR PIER #3 WEST BANK

ALL NUMBERS PRECEDED BY AN S-
REPRESENT SOUNDINGS TAKEN
AGAINST THE PIER AND 25' OUT

MINOR ZEBRA MUSSEL COVERAGE ON
CONCRETE FACES UNDERWATER - APPROX.
12 PER SQUARE FOOT



DETAIL - A-



DETAIL - B-

LAKE ERIE DIVING, INC.

CLIENT: HNTB

SUBJECT: UNDERWATER BRIDGE INSPECTION

SCALE: NONE STRUCTURE I.D.: CUY-6-1499

DRAWN BY: PM INSPECTION DATE: 30 OCT 2000

PAGE 3 OF 5

Lake Erie Diving, Inc.

546 Hoyt St. Unit #5
Painesville, OH 44077

Office (440) 942-3814

Fax (440) 352-8471

PIER OBSERVATIONS

Bridge #: CUY-6-1499

Inspection Date: 30 October 2000

Pier Number: East Bank - Pier #4

(Reference Attached Print)

Type of Construction: Concrete: Cut-Stone: Timber: Steel:
Other: _____

Bottom Material: Soft silt

Debris Around Pier: None

Scour: None

Exposed Footer: None

Footer Undermining: None

Exposed Piling Under Footer: None

Piling Condition: N/A

Cracks & Spalls: Yes - see sketch

Fender Condition: N/A

Impact Damage: None

Unusual Conditions: None

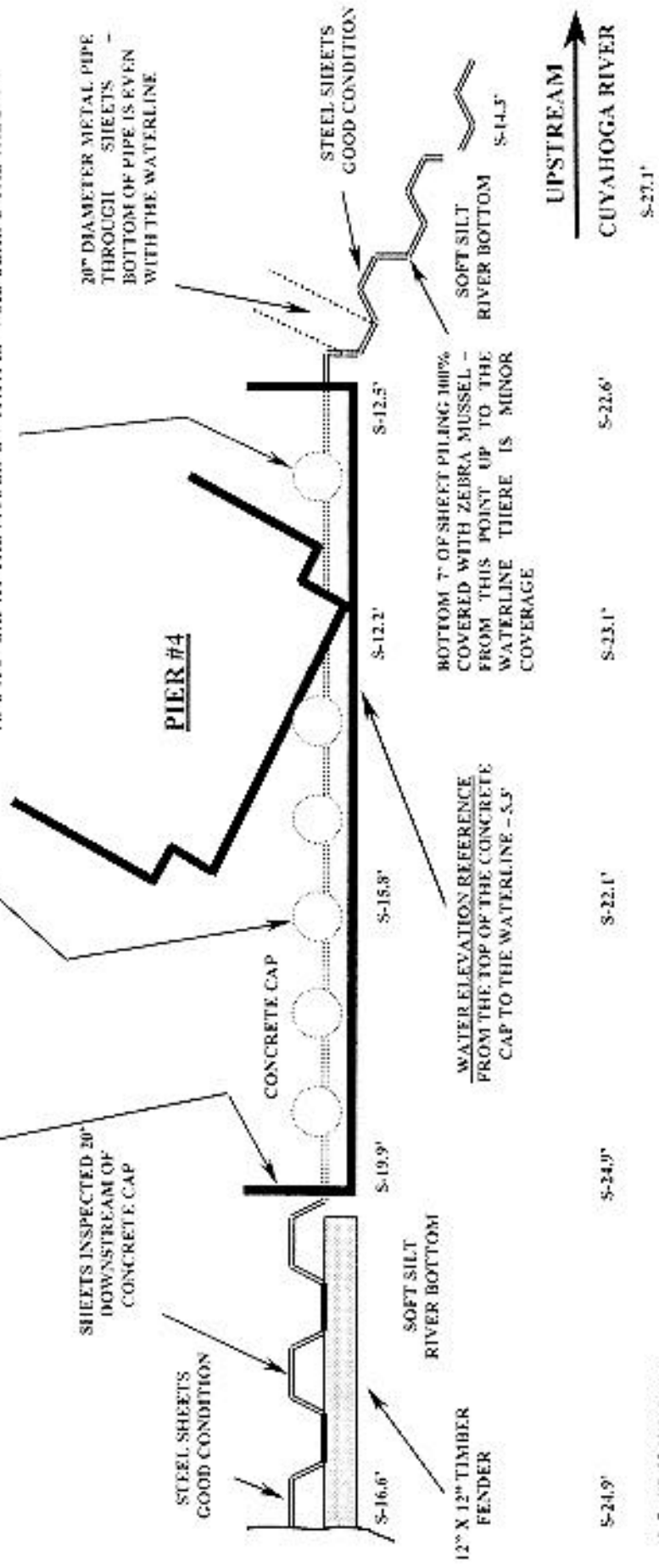
Overall Condition Rating: Good

THE SHEET PILING UNDER THE CONCRETE CAP WAS FOUND NOT TO BE Z-SHAPED, WE BELIEVE THAT IT WAS CONSTRUCTED USING SIX CURVILAR PILING WITH FLAT SHEETS BETWEEN. ALL SHEETS AND ROUND PILING ARE IN GOOD CONDITION AT THIS TIME.

CONCRETE CAP
 CONCRETE CAP HAS MINOR SPALLING ON THE LOWER HALF WITH NO EXPOSED REBAR EXCEPT WHERE THE PIER COLUMN JOINS THE CONCRETE CAP THERE IS HEAVY SPALLING THE ENTIRE HEIGHT. EIGHT HORIZONTAL REBAR ARE EXPOSED 3' DOWNSTREAM AND 10' UPSTREAM FROM THE PIER COLUMN CORNER. THE BOTTOM OF THE CONCRETE CAP IS 1.2' BELOW THE SURFACE AND EXTENDS OUT APPROXIMATELY 4' FROM THE STEEL SHEETS.

WHERE THE DOWNSTREAM SHEETS JOIN THE CONCRETE PIER COLUMN THERE IS APPROXIMATELY 5' OF THE CONCRETE FACE EXPOSED. WHERE THE STEEL SHEETS JOIN THE CONCRETE PIER COLUMN THERE IS 3" GAP AT THE TOP AND A 6" GAP AT THE MUDLINE WITH A 2.5' DEEP VOID BEHIND THE SHEETS.

WHERE THE UPSTREAM SHEETS JOIN THE CONCRETE PIER COLUMN THERE IS APPROXIMATELY 1' OF THE CONCRETE FACE EXPOSED. WHERE THE STEEL SHEETS JOIN THE CONCRETE PIER COLUMN THERE IS A 4" GAP AT THE TOP AND A 8" GAP AT THE MUDLINE WITH A 1.5' VOID BEHIND THE SHEETS.



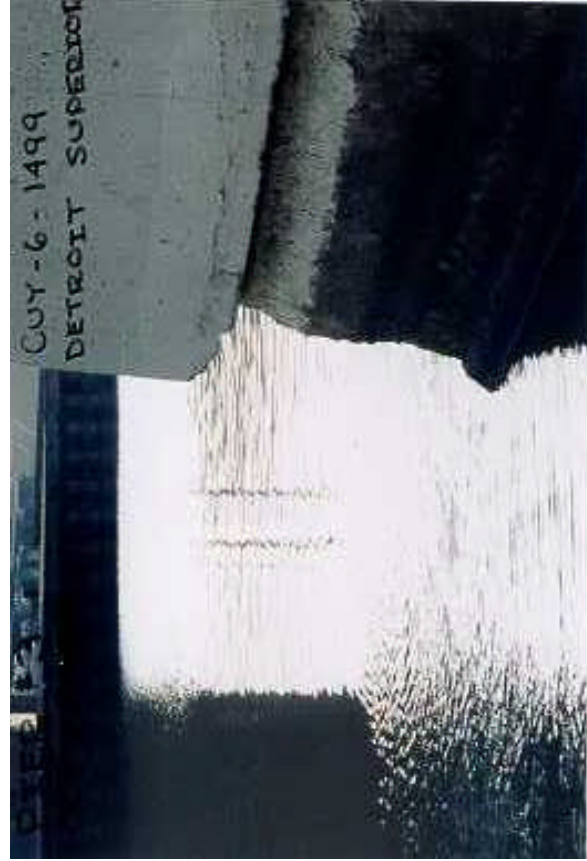
DOWNSTREAM
 CUYAHOGA RIVER

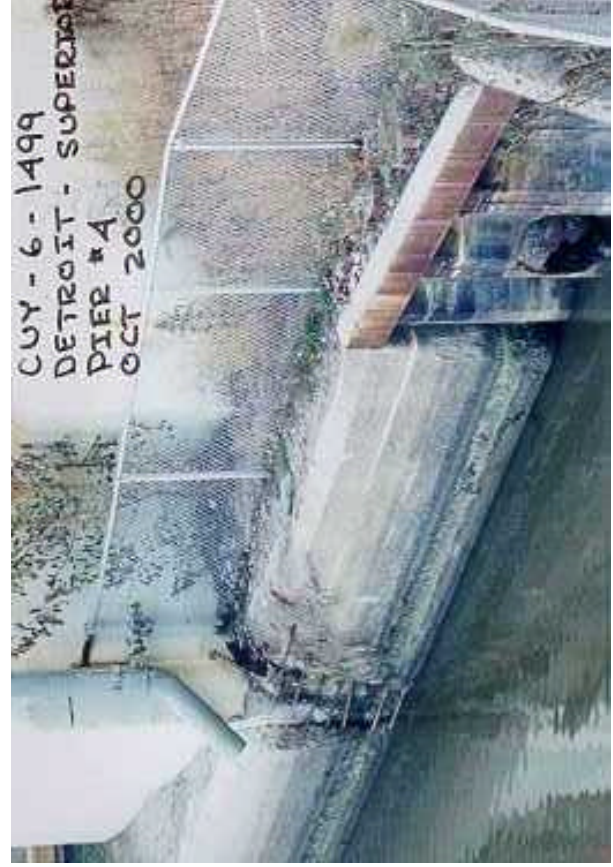
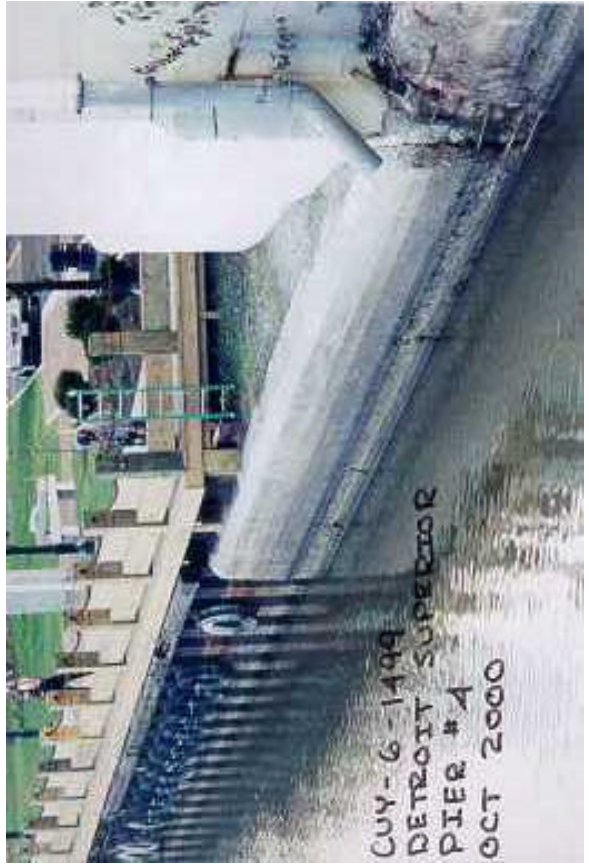
UPSTREAM
 CUYAHOGA RIVER

ALL NUMBERS PRECEDED BY AN S- REPRESENT SOUNDINGS TAKE AT THE LOCATIONS SHOWN

**DETROIT - SUPERIOR
 PIER #4 - EAST BANK**

| | |
|---------------------------------------|------------------------------|
| LAKE ERIE DIVING, INC. | |
| CLIENT: HNTB | |
| SUBJECT: UNDERWATER BRIDGE INSPECTION | |
| SCALE: NONE | STRUCTURE I.D.: CUY-6-1499 |
| DRAWN BY: PM | INSPECTION DATE: 30 OCT 2000 |
| PAGE 5 OF 5 | |





APPENDIX D

RECOMMENDATIONS

