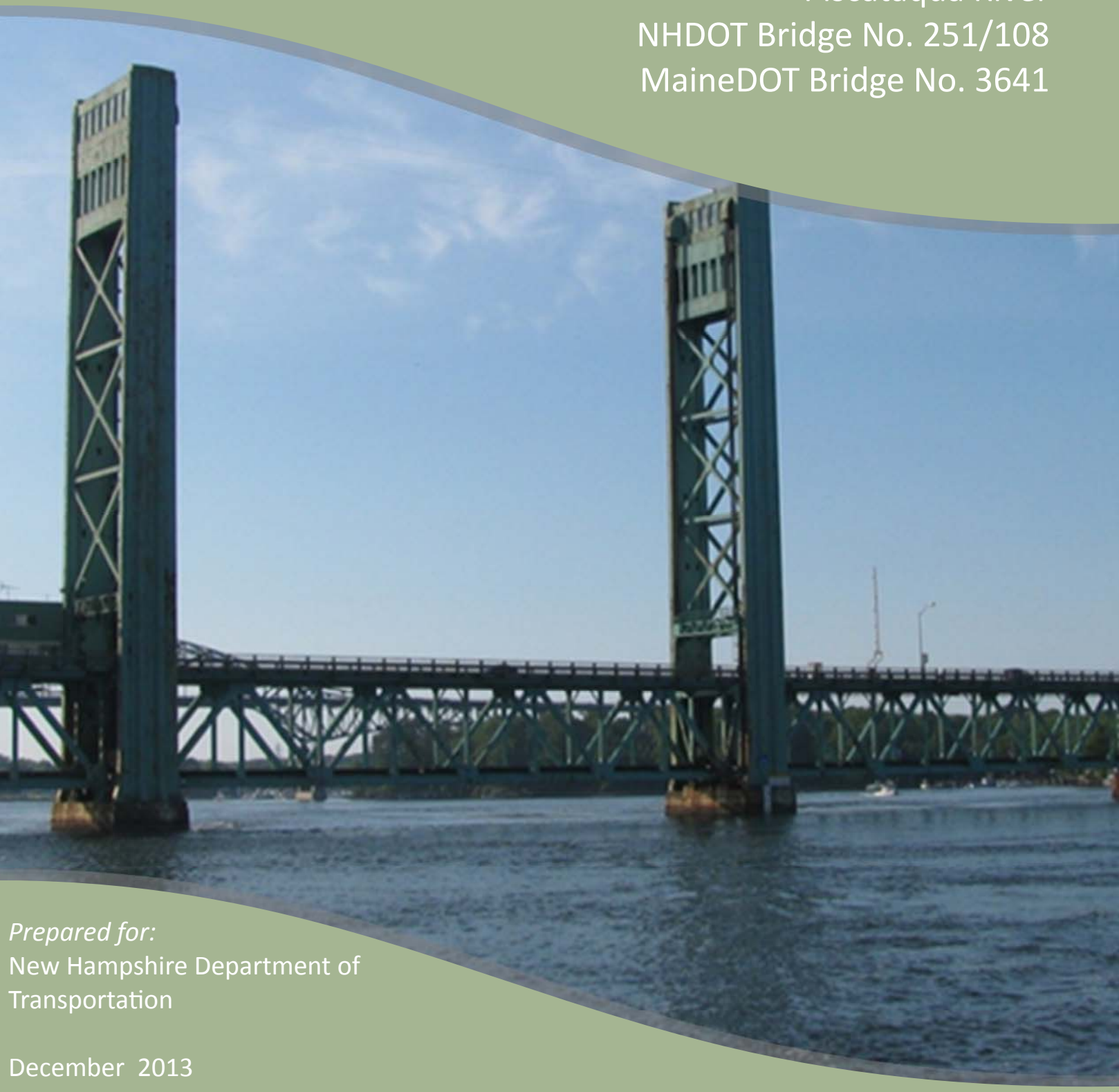
DRAFT In-Depth Inspection and Condition Report

Sarah Mildred Long Bridge over the Piscataqua River

NHDOT Bridge No. 251/108

MaineDOT Bridge No. 3641



Prepared for:

New Hampshire Department of Transportation

December 2013

Prepared By:

HDR

Hoyle, Tanner & Associates, Inc.

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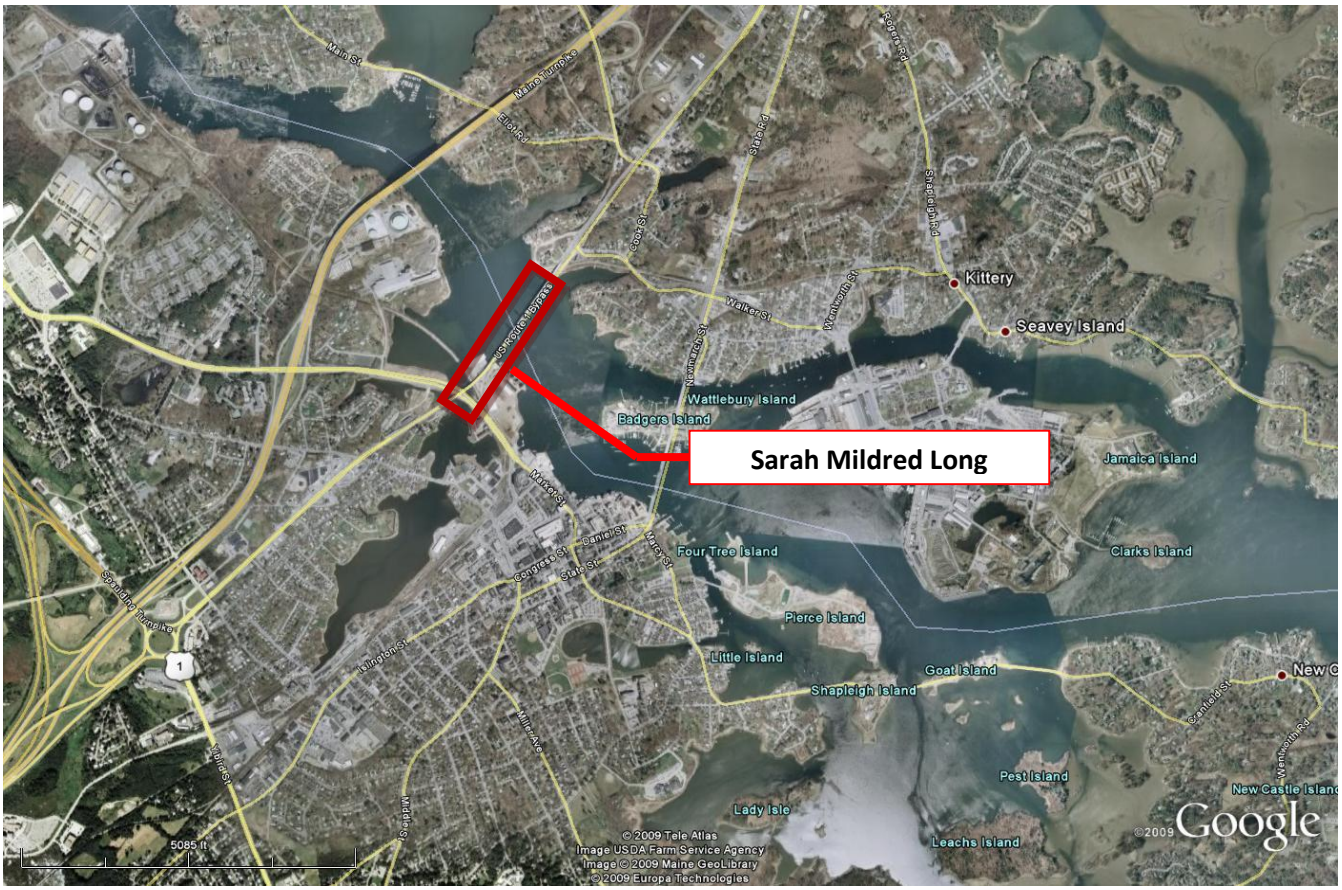
LOCATION MAP



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Sarah Mildred Long Bridge over The Piscataqua River	Hoyle, Tanner & Associates, Inc.	**File Name:** N/A	
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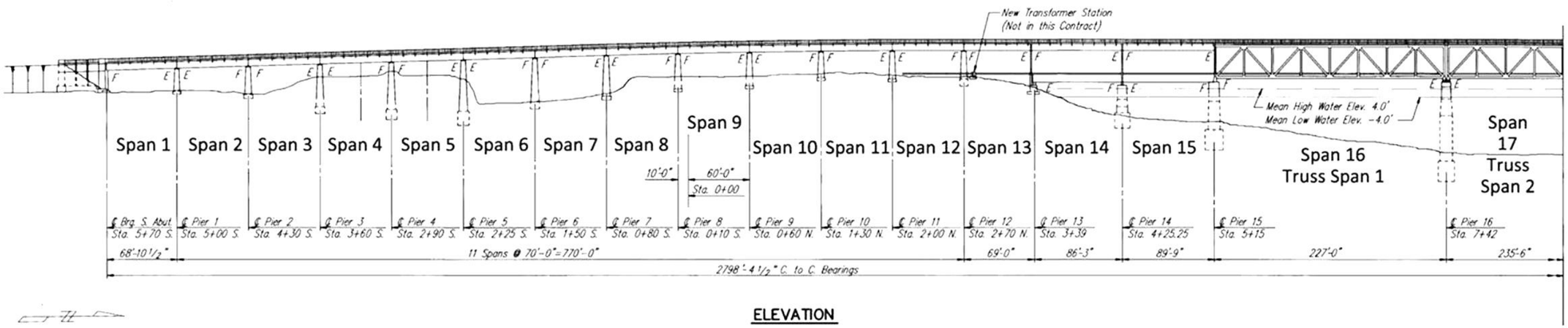
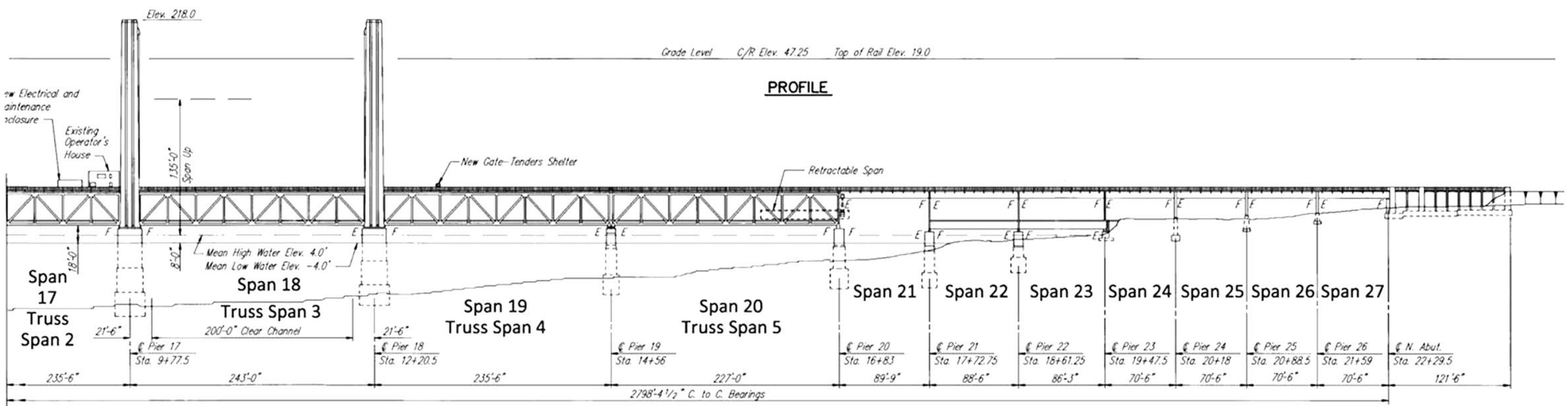
DESCRIPTION OF BRIDGE

Date of Construction:	1940
Original Design Loading:	H20 Highway Loading – with 1.65 lanes considered per truss. Cooper E-72 Railroad Loading
Bridge Type:	Tower Driven Vertical Lift Bridge; Comprised of 5 double-deck truss spans and 22 steel girder approach spans of which 5 spans are double-deck. The deck is reinforced concrete for upper level highway and open timber tie deck for lower level railroad.
Skew:	0°
Spans:	5 truss spans, 22 approach spans for highway level; 5 truss spans, 5 approach spans for railroad
Width of Highway Bridge Deck:	30'-0" between curbs for highway 10'-0" between ends of timber ties for railroad
Roadway Surface:	Monolithic concrete
Sidewalk / Walkway / Median:	Monolithic concrete
Bridge Railing:	Steel pipe rail along sidewalk
Approach Railing:	Steel pipe rail along sidewalk
Superstructure:	5 double-deck main truss spans with a vertical lift span in center. Stringers supported by floorbeams at truss panel points for both upper and lower decks. 15 steel girder south approach spans with 2 spans of double-deck and 7 steel girder north approach spans with 3 spans of double-deck and one retractable span for railroad. 2 towers adjacent to the lift span. Stringers supported by floorbeams for both upper and lower deck systems.
Modifications to Original Superstructure:	Lower level railroad span at Span 21 was modified to a retractable span in 1965; Upper level highway deck was repaired and an overlay was placed in 1987; Expansion bearings were modified, operator house was expanded and electrical and maintenance enclosure was added in 1988. Various repairs and 2012 addition of bridge barrier system. Downspouts through concrete deck added between Spans 21 through 27 in May 2013.
Utilities:	Various electric conduits along the structure from both ends of the bridge (for bridge service only).
Substructure:	Reinforced concrete piers and abutments with stone masonry fascia in tidal zone and steel pier bents at Piers 13 and 14, and supporting the north approach spans.
Modifications to Original Substructure:	None

BRIDGE ELEVATION

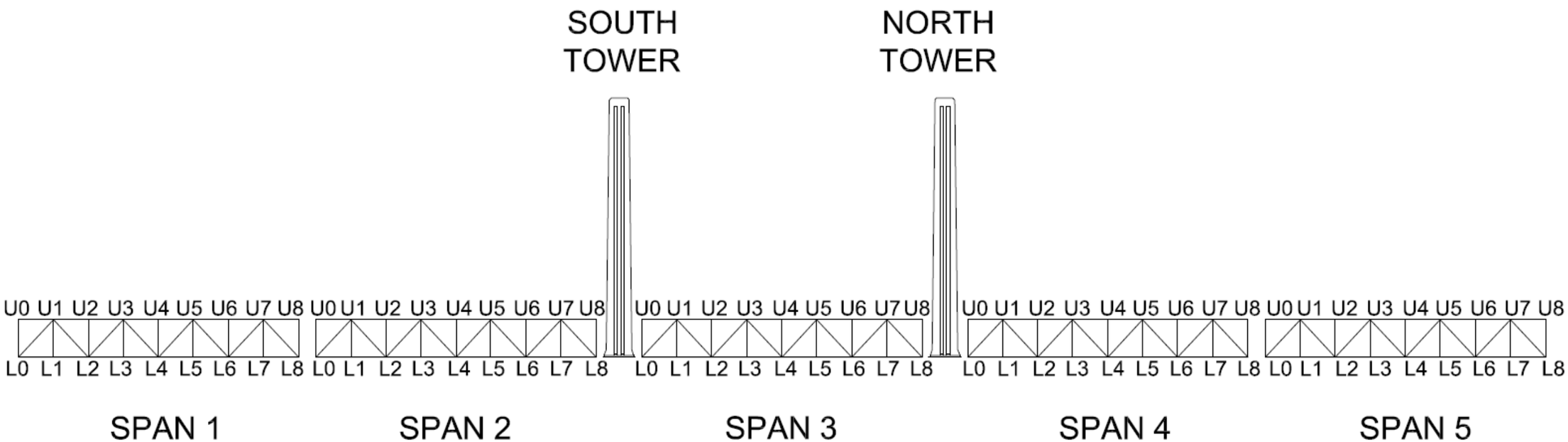


ELEVATION

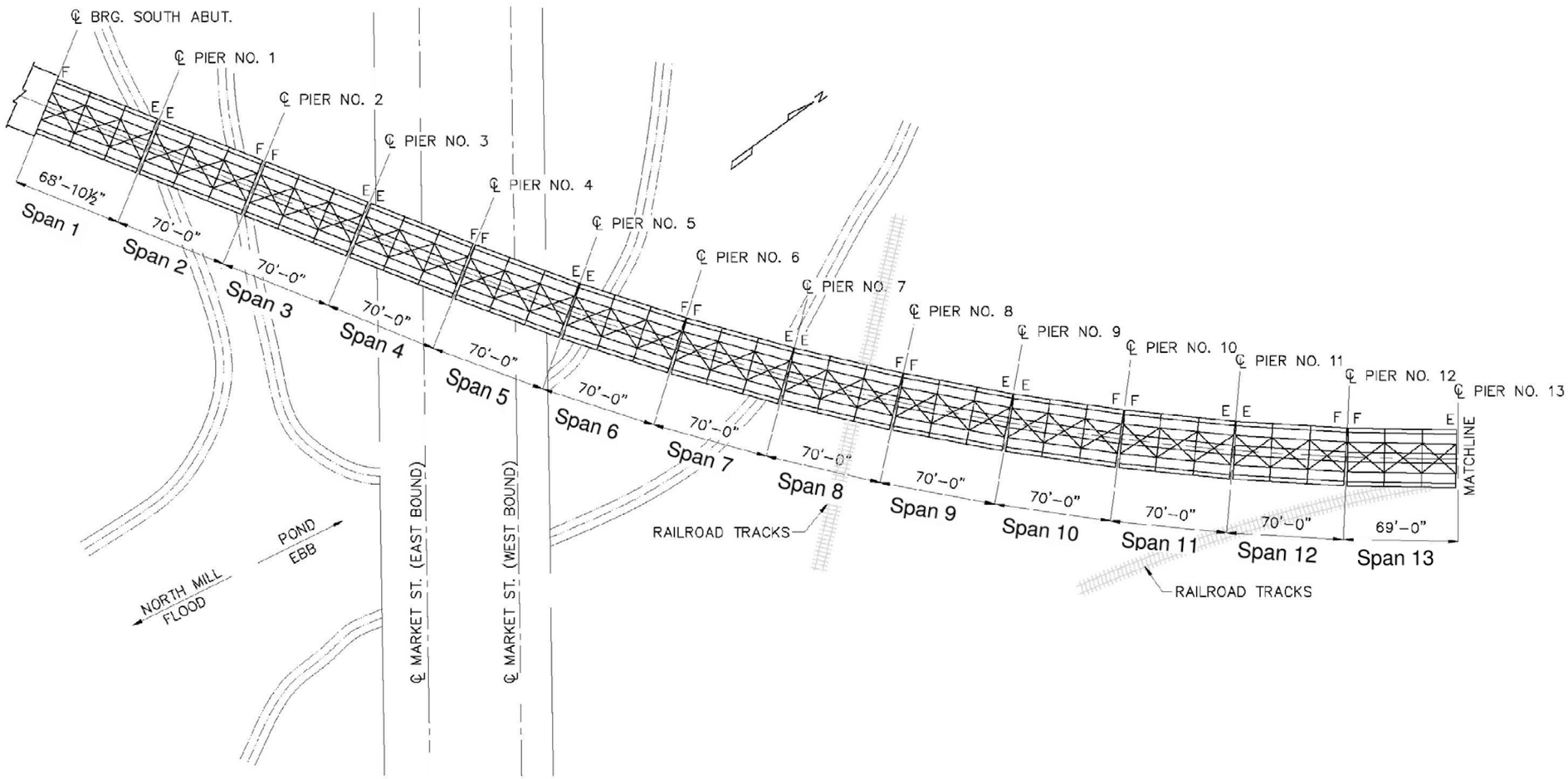


ELEVATION

BRIDGE ELEVATION – TRUSS SPANS



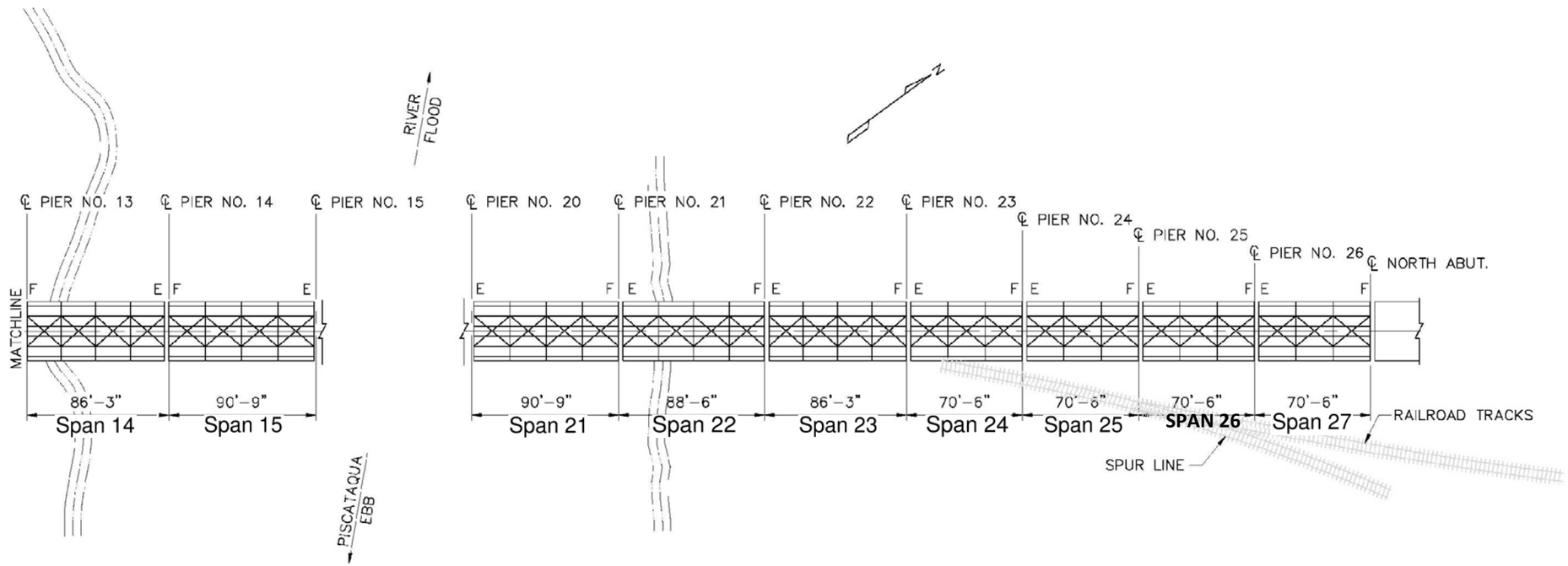
BRIDGE FRAMING PLAN – ROADWAY APPROACH SPANS 1-13



LEGEND:

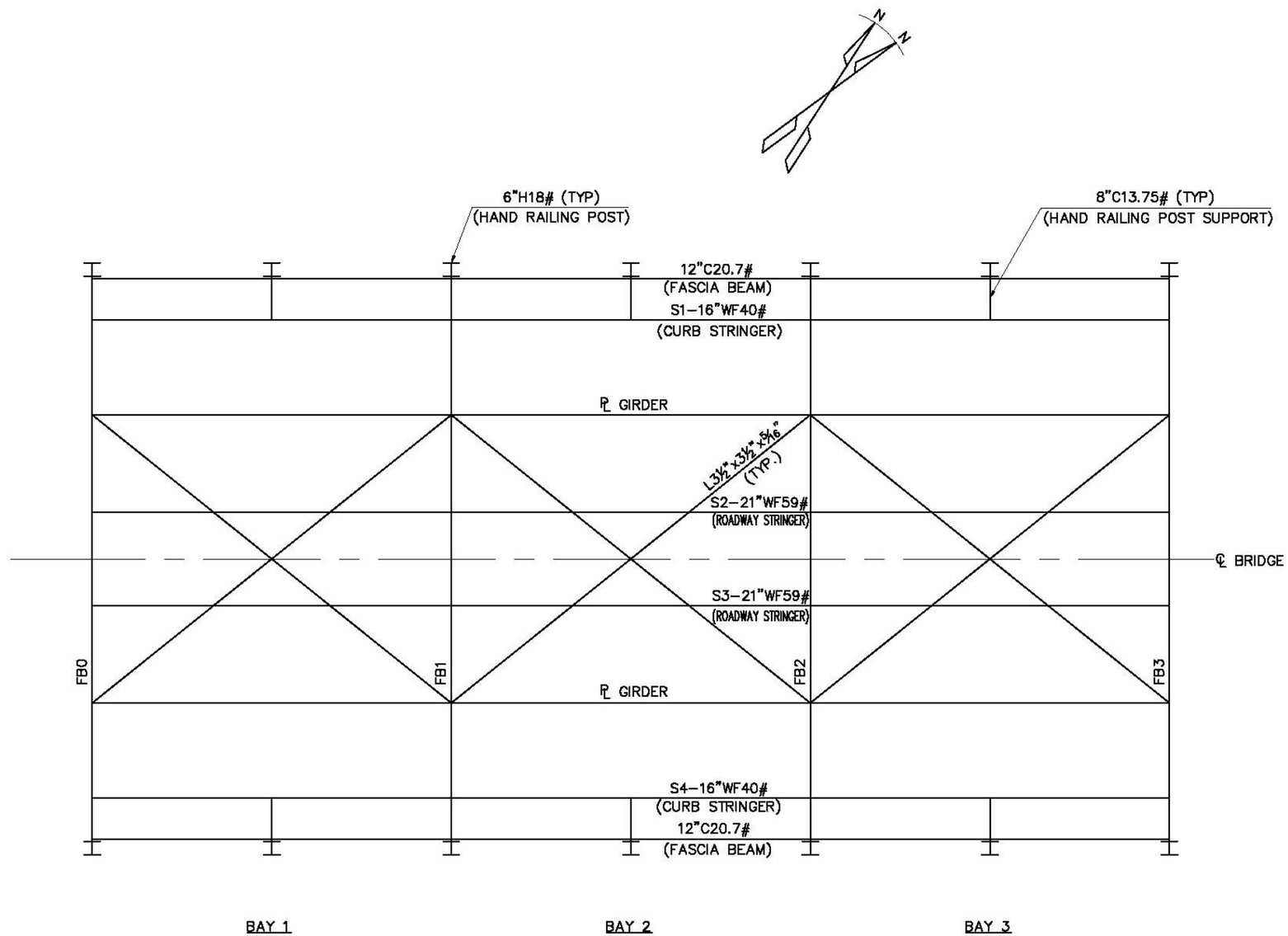
E – EXPANSION JOINT
F – FIXED JOINT

BRIDGE FRAMING PLAN – ROADWAY APPROACH SPANS 14, 15 AND 21-27



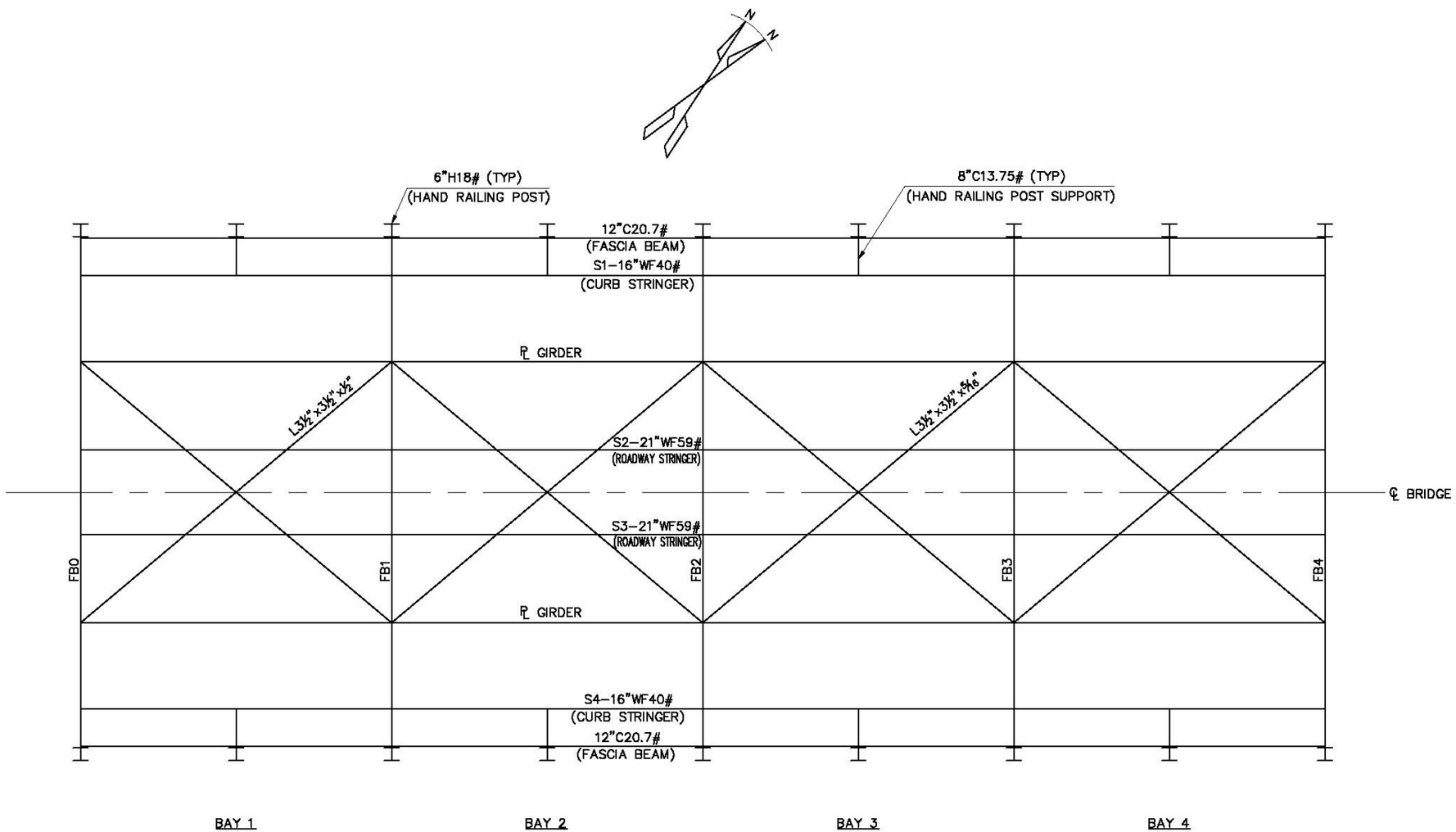
LEGEND:
E – EXPANSION JOINT
F – FIXED JOINT

TYPICAL BRIDGE FRAMING PLAN – ROADWAY APPROACH SPANS 1-13, 24-27



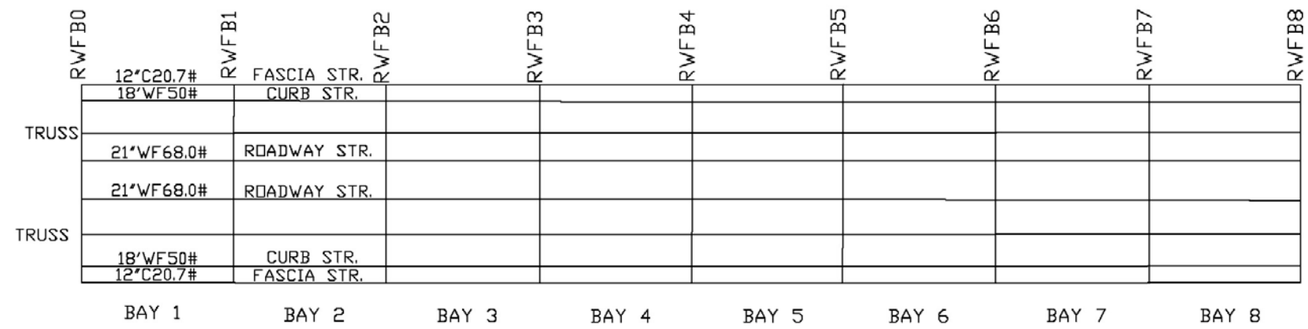
APPROACH SPAN FRAMING PLAN
(SPANS 1–13, 24–27)

TYPICAL BRIDGE FRAMING PLAN –ROADWAY APPROACH SPANS 14, 15, 21-23

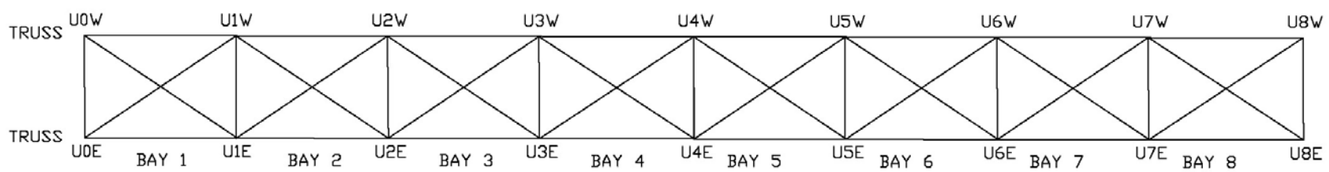


APPROACH SPAN FRAMING PLAN
(SPANS 14, 15, 21–23)

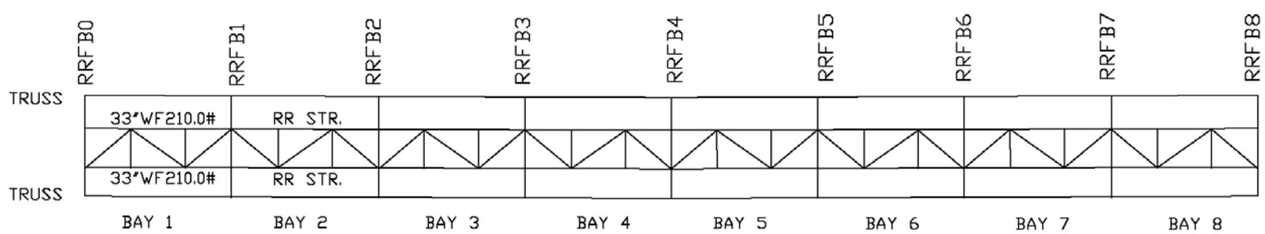
TYPICAL BRIDGE FRAMING PLAN – TRUSS SPANS



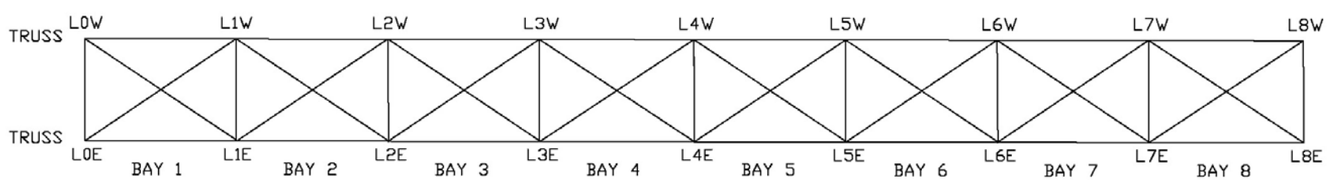
TOP DECK FLOOR SYSTEM



TOP LATERAL BRACING SYSTEM



BOTTOM DECK FLOOR SYSTEM



BOTTOM LATERAL BRACING SYSTEM

Legend:

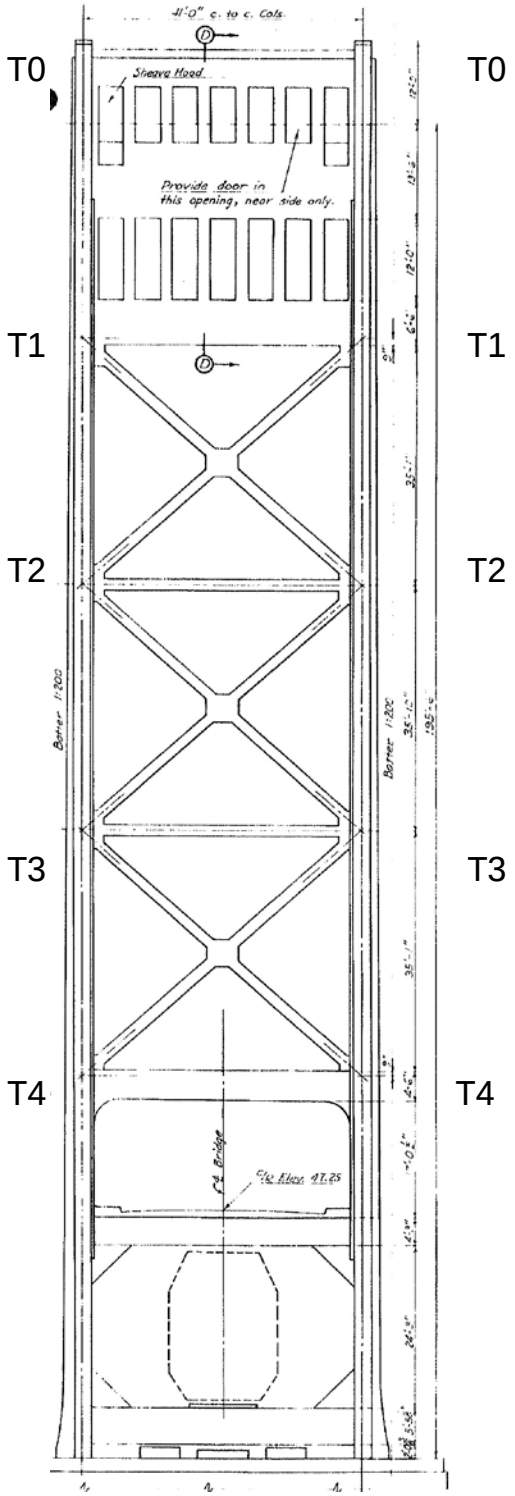
RRFB – Railroad Floorbeam

RWFB – Roadway Floorbeam

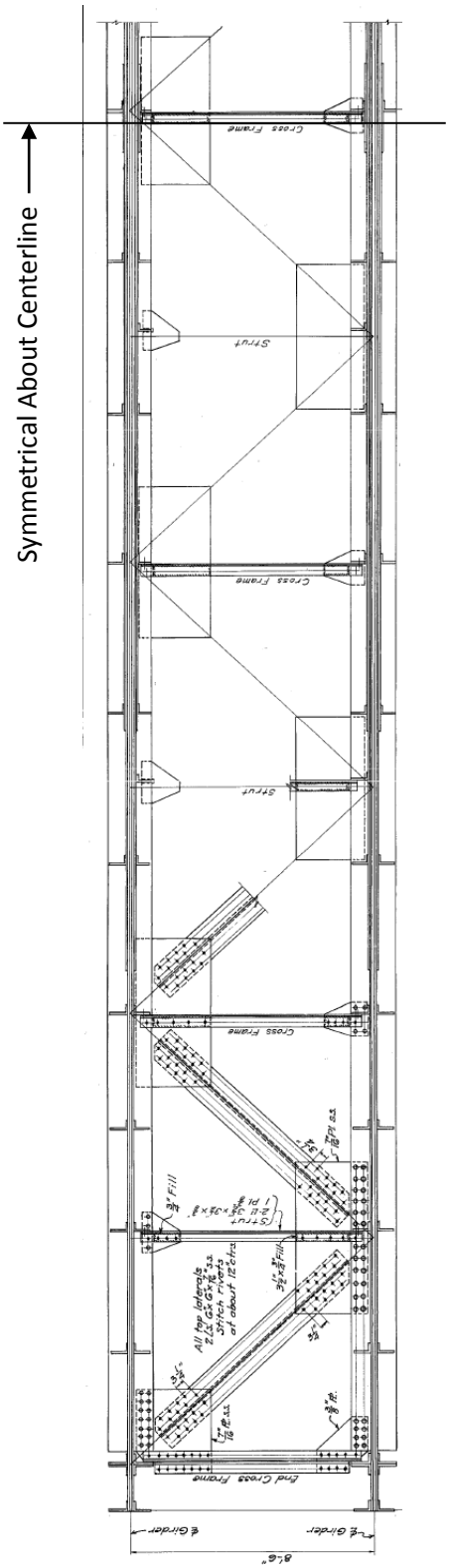
STR. – Stringer

RR - Railroad

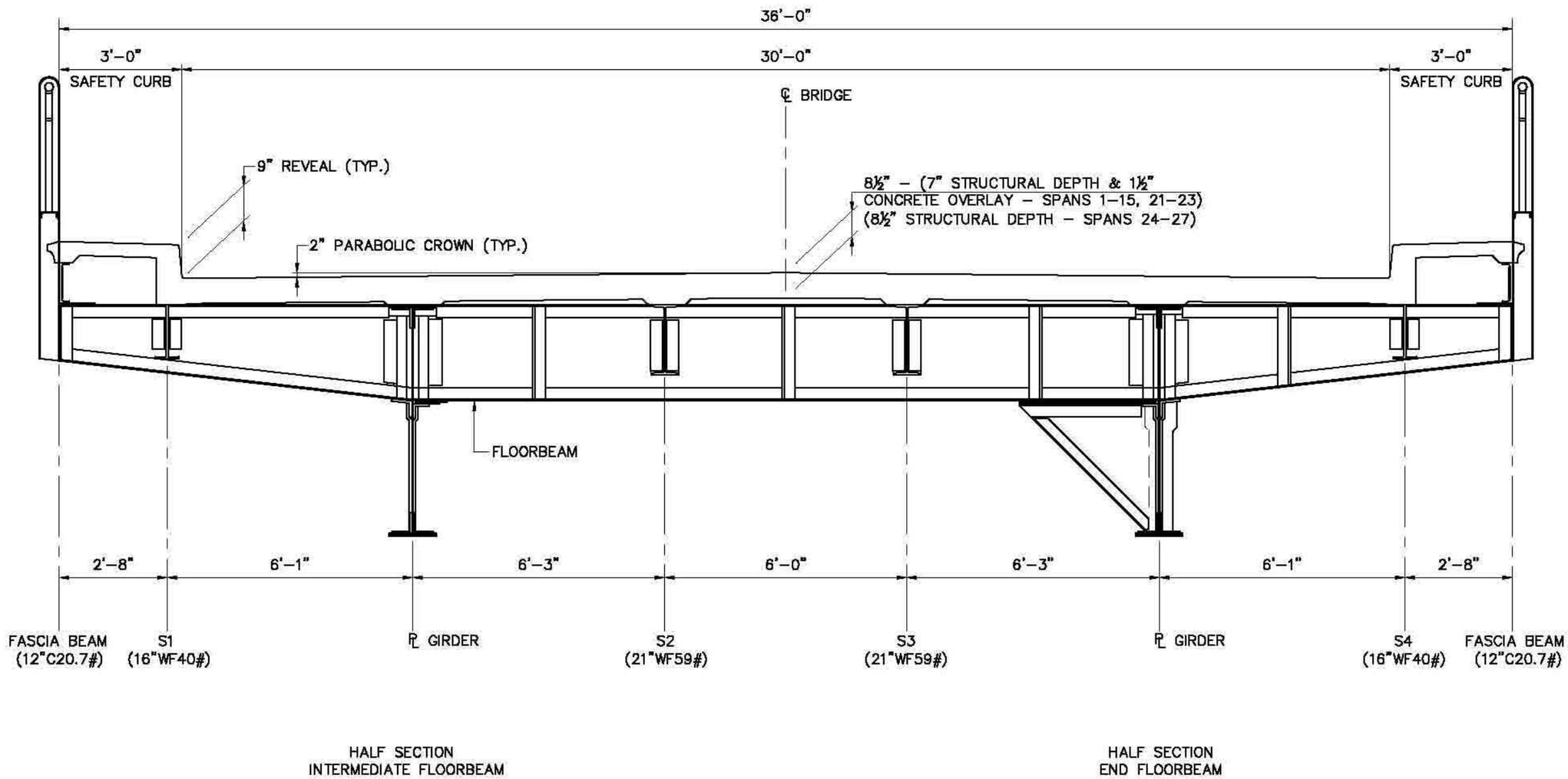
TYPICAL BRIDGE FRAMING PLAN – TOWER ELEVATION



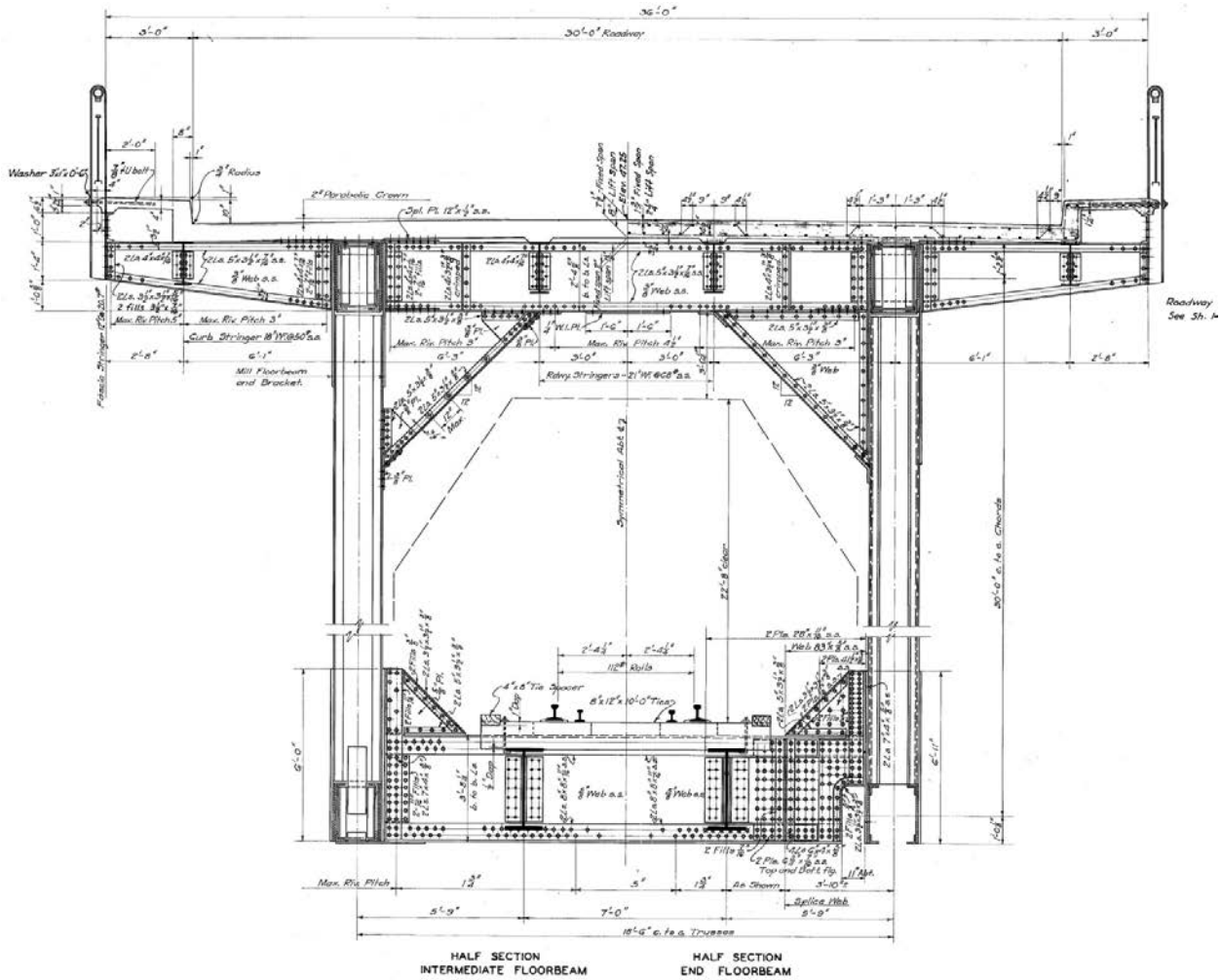
TYPICAL BRIDGE FRAMING PLAN – RAILROAD APPROACH SPANS



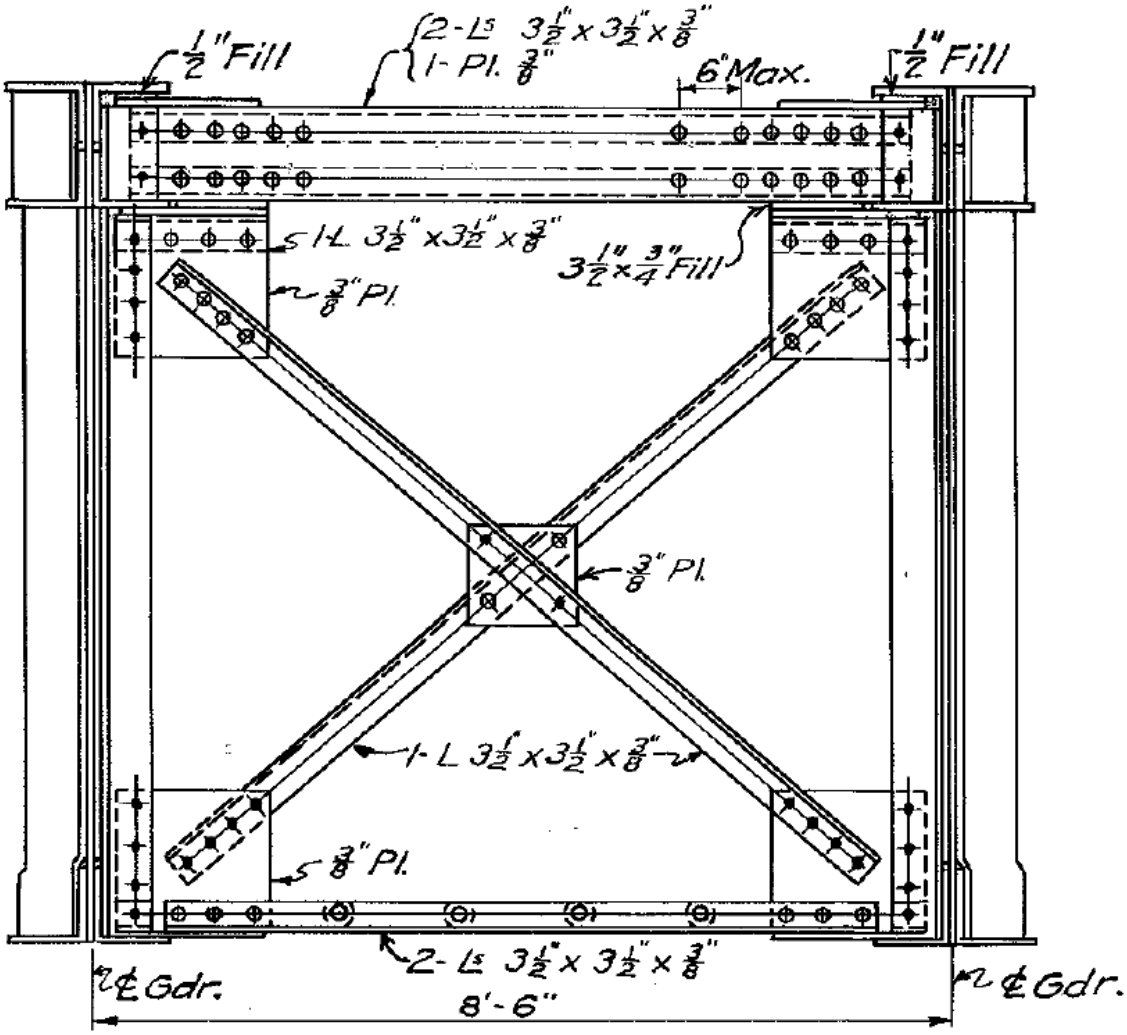
TYPICAL BRIDGE CROSS SECTION – ROADWAY APPROACH SPANS



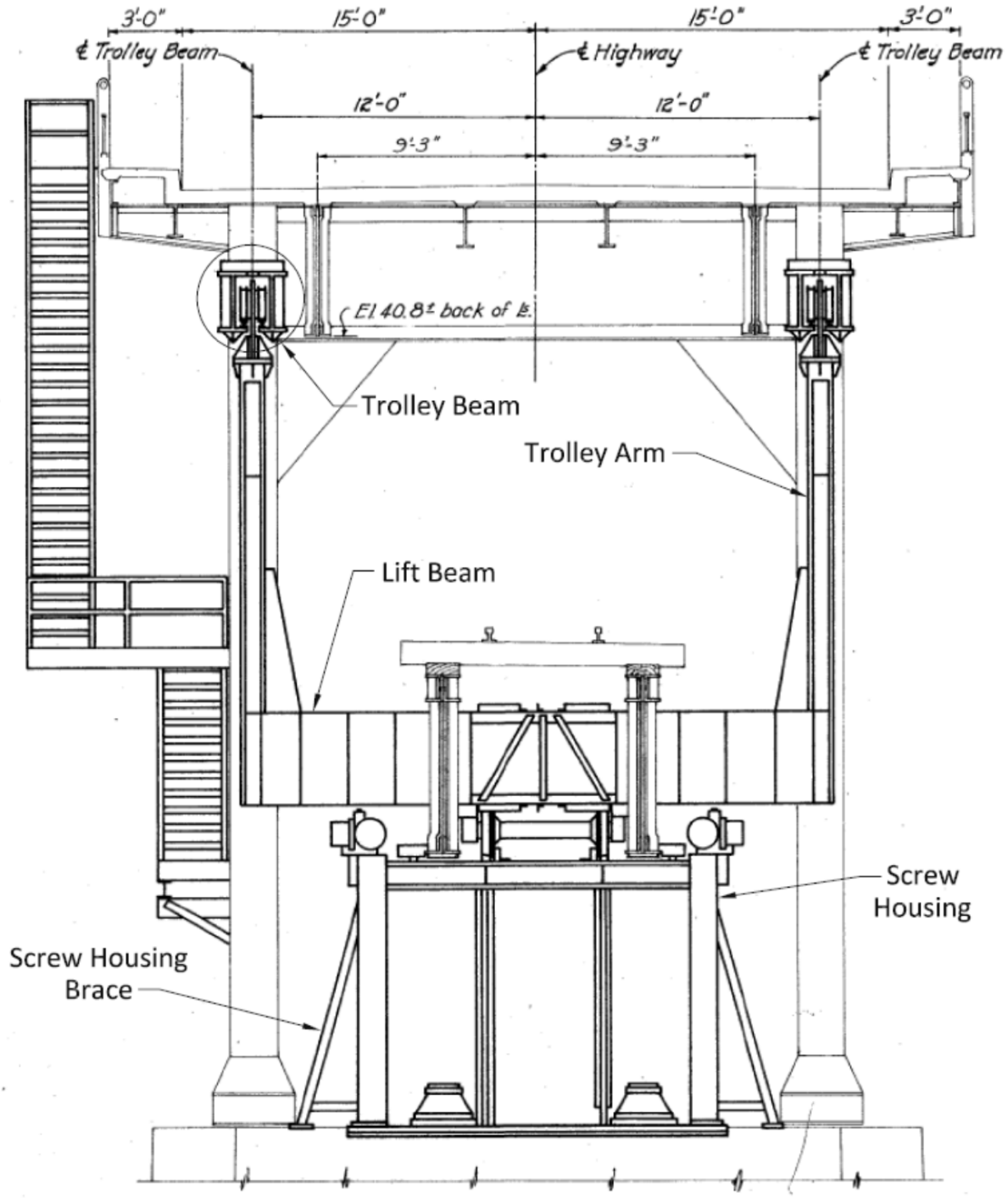
TYPICAL BRIDGE CROSS SECTION – TRUSS SPANS



TYPICAL BRIDGE RAILROAD DECK CROSS SECTION



CROSS SECTION – RETRACTABLE RAILROAD APPROACH SPAN 21



INSPECTION FINDINGS

Introduction

Hoyle, Tanner and Associates, Inc. (Hoyle, Tanner) and HDR Engineering, Inc. (HDR) performed an In-Depth Structural Inspection of the Sarah Mildred Long Bridge for the New Hampshire Department of Transportation (NHDOT) from October 28 through November 17, 2013. The purpose of the in-depth structural inspection was to satisfy the National Bridge Inspection Standards (NBIS) frequency requirements and to monitor the condition of members which exhibited significant deterioration and are considered to be in poor to serious condition as observed in previous in-depth and interim inspections. Member conditions were outlined in the In-Depth Inspection Report dated December 2009 and the Interim Structural Inspection reports dated May 2010, February 2011, August 2011, December 2011, May 2012, November 2012 and May 2013.

Bridge Description

The Sarah Mildred Long Bridge carries the Route 1 Bypass over the Piscataqua River from Portsmouth, New Hampshire to Kittery, Maine. The structure is located in a tidal area where water elevation typically has an eight to twelve foot variation between high and low tide. The tower-drive vertical lift bridge was built in 1940. The five main spans carry both highway and rail traffic and consist of five riveted steel, straight-back, warren-type truss spans. The roadway approach spans consist of fifteen approach spans on the south end of the bridge and seven approach spans on the north end of the bridge. They are comprised of built-up riveted deck girders and floorbeams, as well as rolled I-shaped and C-shaped stringers. The railroad approach spans consist of three deck girder spans on the south approach, as well as two fixed deck girder spans and a retractable deck girder span on the north approach. The roadway decks and safety curbs are composed of reinforced concrete and carry a 30 foot wide roadway. The railroad spans carry timber tie open decks. The truss spans are supported by reinforced concrete piers with granite facades. The approach spans are supported by reinforced concrete piers and abutments, and steel pier bents.

The spans are numbered 1 to 27, from south to north. The truss spans are numbered from south to north as 16 to 20 and are referred to as truss spans 1 to 5 within this report. Truss panel points and floorbeams are numbered from south to north with the southernmost panel point or floorbeam of each span designated as 0. Stringers are numbered from west to east.

Inspection Methods

Several inspection access methods were utilized to perform the in-depth inspection of the Sarah Mildred Long Bridge.

The fascia side of the trusses, the fascia side gusset plates, the overhang and floorbeam cantilevers, the bottom deck (railroad) floor system and railroad approach spans were inspected utilizing a bucket boat. The bucket boat is a custom designed and constructed craft consisting of a 30’ by 15’ boat with pontoons and a 60’ bucket.

The interior face of the trusses and the underside of the roadway deck were inspected utilizing an Aspen A-30 hi-rail vehicle operating from the railroad deck.

The towers were inspected by industrial rope access and structure climbing. Structure climbing and use of the vertical lift span were used to access the top of the towers. The tower leg interior is confined space requiring confined space entry practices to be adhered to.

The truss span piers were inspected utilizing a bucket boat.

The roadway approach span structural steel and underside of deck were inspected using an Aspen A-30 or an Inspector I-50 under-bridge inspection vehicle operating from the roadway deck. Traffic control during the approach span inspection consisted of complete closures of the southbound or northbound lanes with additional flaggers and police details on Oak Terrace in Kittery, ME and Market Street in Portsmouth, NH, respectively, when inspections of spans 4, 5 and 25 to 27 occurred. The south abutment, piers 1 through 12 and steel bents 13, 14 and 21 to 26 and north abutment were also inspected with the A-30 or I-50 inspection vehicle. Limited inspection observations were made of the abutments, approach span piers and approach span steel bents as accessible by inspection vehicle bucket.

Bridge Condition

Item 58 – Overall Deck – Poor Condition

58.1: Deck

Spans 1-23 bridge decks were rehabilitated in a 1987 project that consisted of removing the existing 1" asphalt wearing surface, scarifying ½" of the deck top surface and constructing a 1½" concrete overlay upon completion of partial and full-depth repairs. The project also included a complete deck replacement, with the thickness increased from 7½" to 8½", for spans 24 to 27.

Bridge deck soffit condition observations are noted in this section. Spans 1 to 23 concrete overlay and spans 24 to 27 integral wearing surface conditions are noted in the Item 58.2 Wearing Surface section of the report.

Roadway Approach Spans 1 to 15 and 21 to 23:

Numerous full-depth concrete repairs were observed on the deck soffit throughout the approach spans. Many of these repaired areas and other locations exhibit concrete spalling, delamination, cracking and efflorescence. Exposed reinforcement with significant section loss, including severed bars, was also observed. Deck spalls are also prominent around the curb PVC downspouts adjacent to the stringer top flanges.

The concrete safety curbs and deck overhangs also exhibit significant spalling, delamination and efflorescence. Many curb spalls on the roadway face were repaired. Significant curb spalls occur on the overhang side over the curb stringer flange at numerous locations. Curb spalls were also observed at bridge rail post locations. Exposed reinforcement was observed at many of the spall locations.

Truss Spans 1 to 5, Roadway deck:

Truss span 1 deck soffit between trusses exhibits random map cracking. Truss span 2 soffit exhibits spalling with exposed reinforcement. Truss span 3 (lift span) deck soffit between the trusses has numerous full depth repairs and other locations exhibit concrete spalling, delamination and cracking. Areas of honeycombing and spalling, with exposed reinforcement, were observed on the truss span 5 soffit.

The roadway deck overhangs are spalled around the majority of metal drain pipes and PVC downspouts. In the areas around the downspouts, spalls are up to 12" deep and have exposed and broken rebar. The deck is also spalled adjacent to locations where the pedestrian rail connects to the fascia stringer. Many bays have spalls ranging in area from one-half square foot to 24 square feet; some of these spalls have exposed rebar. The majority of bays have hairline cracks transverse to the roadway, many with efflorescence. Spalls typically occur between the interior stringer and top chord.

Railroad deck:

There are approximately 8-12 defective timbers per rail length, which is approximately 1/3 of the timbers. Some defective timbers are near rail joints. Smaller depth timbers at bridge cross members are in worse condition than full depth bridge timbers. Condition of timbers has deteriorated in some locations to allow tie plates to settle ½" to 1" from bottom of rail and shift.

The running rail is 112RE in 39' lengths, non-control cooled from 1939. Given its age, the rail appears to be in fair condition. A broken rail was found in a rail joint on the west rail near the north end of Truss Span 3. Outside guard rail is 85AS in 33' Sections. There are 2 guard rails across the span in fair condition.

Tie plates are generally 8" X 11.5" double shoulder canted (DSC) with 6 spike holes: 4 for rail holding spikes, and 1 field and 1 gage plate holding spike. Given their age, the tie plates are typically in good condition. Due to the deteriorated condition of the ties some tie plates have settled ½" to 1" from bottom of rail. Two locations were identified where tie plates fell from top of tie.

Actual spiking pattern varies on the bridge. There are typically 2 to 4 spikes per tie plate, 2 rail holding and up to 2 plate holding spikes. Due to tie conditions spikes have lifted out of ties.

Joint Bars are 24" long, head free and toeless with 4 bolt holes per bar. The joint bars are typically in good condition. Bolts are 1"(D) x 5-1/2"(L) with nut and washers. They are typically in fair condition due to corrosion. A bolt is missing from joint bar at the location of broken rail identified earlier. Bolts need to be replaced.

Roadway Approach Spans 24 to 27:

The deck in approach spans 24 to 27 is considered to be in good condition. Transverse cracking with some efflorescence was observed primarily in the overhangs. Concrete spalls were primarily observed at expansion joint locations; however, some spalls were observed at girder and stringer flange edges. Rust staining was also observed in the deck soffit and overhang cracks.

58.2 Wearing Surface:

Roadway Approach Spans 1 to 15 and 21 to 23, and Truss Spans 1 to 5:

The wearing surface is considered to be in poor condition. The following deficiencies were observed:

- The wearing surface has been repaired in numerous locations.
- Many of these repaired areas exhibit extensive cracking with some delamination.
- The wearing surface exhibits extensive cracking, some of which originates at repair locations.

Roadway Approach Spans 24 to 27:

The wearing surface, for these spans, is considered to be in good condition. The integral wearing surface exhibits random cracking. Spalling and delamination previously observed adjacent to expansion joints has been repaired. Little or no spalling or delamination was observed within the spans.

58.3 Deck Joints:

Roadway Approach Spans 1 to 15:

The south abutment compression seal is damaged and holed at the curb. The seal is filled with sand and debris.

Approach spans 1 to 15 have three different expansion joint types. The expansion joints at piers 1, 3, 5, 7, 9 and 11 consist of a Transflex 200-A elastomeric modular type joint. Fixed piers 2, 4, 6, 8, 10 and 12 consist of a nominal 2”x2” neoprene compression seal joint. The expansion joints at piers 13 through 15 are prefabricated compression joints installed during the 1987 rehabilitation project. The following deficiencies were observed:

- Joints are filled with sand and debris.
- Compression seals at fixed piers 2, 4, 6, 8, 10 and 12 continue to leak; however recent repairs appear to have slowed the water leakage.
    - These joints are located directly above the end floorbeam top flange.
    - Leakage continues to lead to advancing deterioration of the floorbeam top flanges, cantilever tension tie plates and curb stringers.
    - Extensive leakage at the safety curb has led to significant deterioration of the curb stringers.
    - Refer to Items 59.2 and 59.3 for stringer and floorbeam condition.
- Pier 12 compression seal has a missing section at the westerly safety curb. Seal was replaced with polystyrene foam.
- Piers 1, 3, 5, 7, 9, 11, and 13 through 15 expansion joints are leaking.
    - This extensive leakage continues to lead to advancing deterioration of the floorbeams and cantilever tension tie plates.
- The elastomeric modular seal at piers 1, 3, 5, 7 and 9 was repaired with what appears to be an elastomeric type sealant.

- Pier 15 joint seal has failed and is hanging below the deck.
- Expansion joint steel is heavily rusted with laminar corrosion and section loss.

Truss Spans 1 to 5:

The following deficiencies were observed:

- Finger joints are filled with sand and debris.
- Finger joints exhibit rusting with laminar corrosion.
- Moderate laminar corrosion on safety curb sliding plates.
- Pier 16 joint safety curb plates are holed.
- Pier 17 (South Tower) westerly safety curb seating plate is bent at the corner.
- Pier 18 (North Tower) safety curb seating plates are bent and torn.
- North Tower compression seal is torn and is not seated against the concrete safety curb.
- Pier 19 easterly safety curb sliding plate exhibits heavy rusting.
- Pier 19 finger joint has plow damage.
    - Broken fingers were repaired.
    - Some finger ends are damaged.

Roadway Approach Spans 21 to 27:

The existing finger plate expansion joints were replaced with prefabricated compression seal joints as part of the 1987 rehabilitation project. Joint steel is heavily rusted with laminar corrosion and section loss. Expansion joint steel rusting and subsequent staining of the concrete deck soffit is indicative of extensive joint leakage.

The north abutment compression seal is not tight against the concrete. Water leaks onto the superstructure and substructure below.

58.4 Safety Curbs:

The safety curbs are comprised of reinforced concrete, supported by the roadway deck, curb stringers, a C-shaped steel fascia beam and floorbeam cantilevers. See sections 58.1, 59.2 and 59.3 for the conditions of the concrete deck, stringers and floorbeams, respectively.

58.5 Bridge Rail:

Existing Bridge Rail:

The bridge remains in serious condition due to the following deficiencies observed:

- Rail posts are holed at connection locations below supplemental posts added to correct this deficiency.
- Pipe rail is heavily rusted with separation from rail posts and holed areas throughout.
- Heavy rusting and laminar corrosion of pipe rail, balusters, rail posts and other rail components.
- Pipe rail is severed at rail posts in numerous locations.

Bridge Barrier:

A 40" bridge barrier system, located approximately 28" from face of barrier to face of existing safety curb, was installed in the summer of 2012. The barrier system was installed to address the serious condition of the existing bridge rail and reduce the live loading on all curb stringers and floorbeam cantilevers by moving traffic closer to the center of the bridge.

58.6 Drainage:

Roadway Approach Spans 1 to 15 and 21 to 27:

The scupper downspouts exhibit significant rusting and section loss. Inserts were installed within the existing scuppers by NHDOT Bridge Maintenance. These inserts extend below the bottom of the curb stringer and prevent water and salt laden debris from collecting on the stringer flanges. Water ponds at the curb lines in spans 21 to 27 and leaks onto the curb stringers. NHDOT Bridge Maintenance installed PVC scuppers through the deck at the face of bridge barrier to address deck ponding and drainage issues.

Truss Spans 1 to 5:

The fixed truss spans have both metal and PVC drain pipes underneath the deck. The PVC downspouts are small diameter drain pipes, approximately 1" diameter, and are spaced at approximately 5' on center. The metal downspouts are large drain pipes located at the midpoint of each bay. Some of the PVC drainage pipes are secured with c-clamps and ropes.

Metal pipes are typically heavily deteriorated with corrosion holes. The corrosion holes have allowed water to pour onto the interior overhang stringer, causing laminar corrosion on the stringer. Truss bottom chords, diagonals and verticals located under the metal drains pipes have deterioration that is more advanced than the typical truss condition.

Some cracks in the deck allow water to leak onto stringers. As evident on Span 2, west side in bay 2 where a 1/4" crack is causing laminar corrosion and section loss. (Section loss was inaccessible to due to the embedded deck.)

Item 59 – Overall Superstructure – Serious Condition

59.1 Girders:

Roadway Approach Spans 1 to 15 and 21 to 27:

The girders are considered to be in fair to poor condition. The following deficiencies were observed and are summarized below:

- Many end and intermediate bearing stiffeners exhibit significant pack rust between the protruding angle legs.
- There is pack rust with section loss between girder inner and outer cover plates.
- Some girders also exhibit pack rust with section loss between the girder bottom flange angle and cover plate.

- Spans 1 to 12 girder end protruding angle legs exhibit significant section loss. Many have up to 100% section loss.
- Moderate to heavy web plate rusting with section loss at bearing locations.
- Moderate to heavy top and bottom flange angle rusting with section loss at bearing locations.
- Rivet head section loss at bearing locations for many of the girders.
    - Span 4 east girder is the most severe with rivets having 50 to 75% estimated loss.
- Rivet head section loss at isolated locations along the span.
    - Span 21 west girder has 10 rivets with estimated 80% loss and 6 rivets with nearly 100% loss.
- Isolated pitting on top surface of bottom flange exterior angles.
- Some girder webs at or near the bearings were repaired with welded plates.
- Span 13 east and west girder hinge seat flanges are holed and are very thin.
    - Span 13 east and west girder hinge seat flange holes remained the same size as the October 2012 interim inspection.
    - Top flange exhibits heavy rusting with laminar corrosion and section loss at hinge locations due to expansion joint leakage.
- Span 14 east and west girder hinge seat bottom flange exhibits pack rust, at the location where the plate passes through the pier cross beam, causing the plate to deform.
- Span 15 girder hinge seat flange angles exhibit pack rust, which has caused a 1½" gap at the top of the angle.
- Flange thickness loss, at spans 13 to 15, has not advanced significantly since the October 2012 interim inspection.
- Inside the Span 21 girders is the travel way for the movable lift arm rollers, these notes pertain to both the girders and travel ways:
    - Corrosion hole (4"x4") in the first stiffener of the east travel way
    - Random laminar corrosion and surface rusting to the east travel way
    - Corrosion hole above stiffener #1 (southernmost) in the torsional brace frame above the east girder. (100% section loss)
    - The east girder also has heavy laminar corrosion to the top and bottom flanges at the midspan under a drainage scupper.
    - The west girder has 1/16" section loss to the bottom 4" of the exterior flange between the third and fourth stiffeners from the north end of the travel way.
- Spans 24 to 27 hinge seat flange angle to web rivets exhibit head loss.
- Spans 24 to 27 girder hinge seat flanges were repaired with welded plates.
- Spans 21 to 27 girder hinge seat flange angles continue to exhibit laminar corrosion with varying levels of section loss. However, section loss has not advanced significantly since the October 2012 interim inspection.
- The flange at the span 25 west girder hinge seat is bent up approximately 3/8" and is not in contact with the bearing.
- Spans 24, 26 and 27 west girder hinge seat flanges are bent up and not in contact with the bearing due to the laminar corrosion and pack rust.
- The bottom flange of spans 25 and 26 east girder is deformed approximately ¼" due to pack rust between the stiffener and flange.
- Span 27 east girder bottom flange angles and cover plates are bent due to vehicular impact.

Refer to Appendix B for condition photographs and Appendix C for detailed girder condition sketches.

Railroad Approach Spans 14, 15, 21, 22, 23:

Railroad Approach girder deterioration has not significantly advanced since the 2009 in-depth inspection. Increased instances of pack rust between stiffener plates were observed. A new corrosion hole was observed on an interior stiffener in Span 14.

Railroad Approach Span 14:

Span 14 east girders have laminar corrosion to the top flange and longitudinal stiffeners. The east girder bottom flange has 1/8" pitting along the full length and surface rust to bearing stiffeners.

The span laminar corrosion and surface rust is typical on the inside of the girders to the top and bottom flanges, cross frames, and longitudinal stiffeners. Pitting 1/8" deep was observed on the bottom flange angle on both girders along the full length of the span.

Span 14 west girder top flange and the longitudinal stiffeners exhibit laminar corrosion along the full length. The bearing stiffener at the north bearing has 1/4" pack rust along the top half.

Also, 1/8" pitting was observed along the full length of the bottom flange angle. A corrosion hole was observed at the bottom of the third interior stiffener from the north bearing. The bottoms of the interior stiffeners exhibit laminar corrosion and section loss.

Railroad Approach Span 15:

Span 15 girders have pitting on the top face on the interior side of the bottom flange at the southern end of the span. The east girder has pitting for a length of ten feet and the west girder for a length of fifteen feet. Both girders have pitting on the bottom flange for a length of twelve feet from the north end. The fascia sides of the bottom flanges have surface rust over the full length. The west girder has pack rust with minimal prying between flange plates at midspan. The top flanges have laminar corrosion over the majority of the span length. The interior faces of the webs have surface rust at span ends.

Railroad Approach Span 21 (Retractable Span):

There are minor increases in section loss on the retractable span. Laminar corrosion on the machinery platform has increased to ¼". This does not affect the primary members of the bridge, which have no substantial changes in their condition.

Span 21 is a retractable span that is left open during summer months to allow the passage of small boats. The span was inspected while retracted, resting above truss span 5. The girders have laminar corrosion on the top flange, bottom flange, and bearing stiffener at the north end. The east girder has distortion in the web for the northernmost 6". The bottom flanges of both girders have up to 1/8" pitting over the northern four bays and at the southern end, with minor surface corrosion elsewhere. The top flanges have moderate to heavy rusting with laminar

corrosion over the northern four bays and surface rust elsewhere. The end stiffener plate at the southern end of the west girder has two corrosion holes.

An internal inspection of the retractable span was also performed. There is laminar corrosion and up to 1/8” section loss to the top flange and the longitudinal stiffeners and laminar corrosion on the bottom flange. At the west girder and stiffener there is up to 1/4" section loss on the bracing on the lateral gusset plates and up to 100% section loss on the nuts associated with these connections. At the south end of the plate and beam, there is laminar corrosion and knife edging on the plate at the bearing. There is laminar corrosion and 1/4" section loss to the machinery platform at the south end of the retractable span. There is laminar corrosion on track wheel and stiffeners and up to 1/8” section loss at wheel and wheel stiffeners. No east girder section loss observed and the west girder exhibits up to 1/8” section loss.

Railroad Approach Span 22:

Span 22 girders exhibit laminar corrosion on the bottom flanges for six to eight feet from span ends and surface rust on the top face of the top flanges, full-length. The outside faces of the girders have paint loss with some surface rust on the top face of the bottom flange. There is up to 100% section loss to the panel of bearing nuts.

Railroad Approach Span 23:

Span 23 east girder has laminar corrosion on the top face of the top flanges at the longitudinal stiffeners along the full length. Laminar corrosion was inaccessible under the railroad ties and could not be measured. The east girder bottom flange has laminar corrosion and random 1/8” pitting to the top of the bottom flange. Also on the east elevation, pack rust (no prying) was observed at the bearing stiffeners. Surface rush and laminar corrosion was observed between the east girder splice plates. There is a corrosion hole in the end stiffener at the north abutment.

The interior of the Span 23 girders has laminar corrosion and surface rust to all bracing, top flanges, bottom flanges, and lateral gusset plates. Pack rust was observed between angles of top lateral bracing. The northernmost lateral bracing has section loss up to 1/8” deep.

Span 23 west girders have laminar corrosion on the top and bottom flanges and bearing stiffeners. The typical tie anchor bolt through top flange was measured to be about 1 3/8” in diameter. The west girder splice exhibits surface rust and paint failure. The railroad ties and top flange were inaccessible; therefore, no inspection observations were made.

<u>59.2 Stringers:</u>

Roadway Approach Spans 1 to 15 and 21 to 27 Safety Curb Fascia Beams:

The safety curb fascia beams remain in serious condition. Safety curb fascia beam repairs made by NHDOT Bridge Maintenance are in good condition and are performing well.

The following critical deficiencies were observed and are summarized below:

- Web holes adjacent to rail posts at numerous locations.
- Significant web deterioration and section loss adjacent to luminaire and ancillary structure supports.
- Laminar corrosion of channel top flange.
- Perforation of the channel top flange and web at numerous locations.
- Span 6, Bay 1 east fascia beam web at floorbeam FB1 rail post is holed and nearly 100% lost.
- Span 24, Bay 3 west fascia beam web at floorbeam FB2 rail post is holed and nearly 100% lost.

Refer to Appendix B for condition photographs.

Roadway Approach Spans 1 to 15 and 21 to 27 Curb Stringers:

Roadway approach span curb stringers generally exhibit varying levels of advancing deterioration and section loss. The curb stringers remain in poor to serious condition. The following conditions and deficiencies were observed and are summarized below:

- Moderate to heavy rusting with paint system failure.
- Moderate to heavy top flange rusting with laminar corrosion and section loss.
- Moderate to heavy bottom flange rusting with laminar corrosion and section loss.
- Moderate to heavy web rusting with laminar corrosion and section loss.
- Rust pack formation prying the deck off the top flange.
- Span 2, Bay 3, Stringer S4 – 4" x 2¾" web hole remains the same size. Remaining web thickness = 0.16".
- Span 6, Bay 3, Stringer S4 – ¾" diameter web hole at the southerly end remains the same size.
- Span 7, Bay 3, Stringer S4 – 3" x 1½" web hole remains the same size.
- Span 10, Bay 3, Stringer S4 – 12½" long x 1¼" high web hole remains the same size.
- All repairs are in good condition and are performing well. Refer to Appendix D for curb stringer repair location summary.

Refer to Appendix B for condition photographs and Appendix C for detailed condition sketches of curb stringers exhibiting advanced deterioration and section loss. Refer to Appendix B of the Interim Inspection Report, dated November 2012, for detailed condition sketches of all other curb stringers.

Roadway Approach Spans 1 to 15 and 21 to 27 Roadway Stringers:

The roadway stringers are considered to be in fair condition. Moderate to heavy rusting with some laminar corrosion was observed at stringer ends. Span 6 Roadway Stringer S2, Bay 3 is considered to be in poor condition. The section loss at the web cope/flange interface has not significantly advanced; however, web section loss has advanced to approximately $^{1}/_{8}$". Refer to Appendix C for a detailed condition sketch.

Truss Spans 1 to 5:

Increase in section loss since the 2009 inspection was found on the fascia beams of the truss spans. Fascia beams at span 1, bay 5 and span 2, bay 0 were found to have up to 100% section loss in the bottom flange where knife edging and corrosion holes were found previously. Additionally, failure of the concrete deck and fascia beams were found in span 1, where the bridge was allided in April 2013. These are located directly below scuppers. Since there are barriers installed at the roadway curbs, the increased deterioration on these members does not pose a safety or structural concern.

The curb stringer at span 2, bay 8 was found to have a significant increase in section loss. Previously, knife edging was severe laminar corrosion was found on the stringer. During this inspection it was found that this stringer had up to 100% section loss on the bottom flange over a length of 3'.

The safety curb overhang is supported by an I-shaped steel curb stringer located below the concrete curb and a C-shaped channel on the fascia end of the overhang. The curb stringer typically has laminar corrosion on the bottom flange at metal drain pipe locations. The fascia beam typically has laminar corrosion at locations where the pedestrian pipe railing is bolted to the channel. In span 1, bay 4 east and span 4, bay 1 east, there is laminar corrosion on all surfaces at the south end of the curb stringers. In span 1, bay 5 east there is heavy laminar corrosion causing up to 100% section loss with knife edging at top flange and 1/4" section loss to bottom flange. In span 2, bay 3 there is heavy laminar corrosion causing up to 100% section loss with knife edging on bottom flange at the scupper. In span 2, bay 8 east, there is laminar corrosion on the west face of both flanges and the web of the curb stringer at the metal drain pipe, with up to 100% section loss in the bottom flange. Under the Operator House on span 2, bays 7 and 8, the curb stringer has paint loss and surface rust throughout, as well as laminar corrosion on the top flange. At span 2, bay 0 east the bottom flange of the curb stringer has 100% section loss on the interior half of the flange. At the area of the April 2013 tanker impact, the fascia beam is part of collateral damage. There is 100% failure of safety curb slab and two sidewalk brackets. The bridge is currently closed to pedestrian traffic. The span 3, bay 4 east fascia beam has a corrosion hole at the railing support member. The span 3, bay 4 west curb stringer has bottom flanges deteriorated to knife edging at the location of a drainage scupper. The span 3, bay 8 west curb stringer has a corrosion hole at the location of a drainage scupper. The span 4, bay 6 east curb stringer has a corrosion hole in the bottom flange at the location of a drain pipe. Truss span 4, bay 1 stringer S4 web has 5½" x $1^1/_8$" hole at bottom flange 8½" from its end near floorbeam FB0 and the top flange remaining thickness is 0.10" for end 5' at floorbeam FB0.

The truss span roadway stringers are considered to be in good condition. No serious deficiencies were observed.

Truss span railroad stringers are typically in fair condition. There is laminar corrosion on the bottom flanges at interfaces with truss lateral bracing connections. The top flanges typically have full-length surface rust and the webs typically have laminar corrosion on less than 5% of their surface area. Occasional section loss measuring up to 1/8" at the bottom flange of the stringers is evident while up to 1/16" section loss at the top flange of the stringers is evident. The span 4, bay 8 east stringer has extensive section loss to the interior bottom flange; only 1"

is remaining at 1/3 point. The span 5, bay 4 east stringer has extensive section loss to the interior bottom flange where only 1" remains at 1/3 point. The span 5, bay 6 west stringer has extensive section loss to the top and bottom flanges where only 1" remains. This stringer also has 1/32" web section loss to 10" high at the 1/3 point.

Railroad stringers at piers 17 and 18 span over the piers at the towers. There are two stringers that carry the railroad track and an additional four stringers that support working platforms at the towers. These stringers span between two cross girders that are supported by the towers. The stringers are typically heavily rusted with laminar corrosion and pack rust. These stringers are considered to be in serious condition.

The following deterioration was noted on the stringers at pier 17 (south tower):

- The east railroad stringer has 3/8" section loss in the bottom flange at span ends.
- Both railroad stringers have up to 1" pack rust between the top flange and the cover plate, with up to 1/8" section loss in the top flange. The cover plates are heavily deteriorated.
- The two eastern platform stringers have up to 1" pack rust between the bottom flange and the end connection.
- The bottom flange of the easternmost platform stringer has up to 3/16" section loss in the bottom flange.

The following deterioration was observed on the stringers at pier 18 (north tower):

- The west railroad stringer has 1/8" section loss in the bottom flange.
- The top flange of the west railroad stringer has 100% section loss in a 4" wide portion of the top flange over a length of six feet.
- The westernmost platform stringer has a 12"x1" hole in the web at approximately midspan.
- Stringer supporting the access platform have significant deterioration. Since the last inspection, flanges of these stringers have been cut to accommodate columns supports for the new electrical system.

59.3 Floorbeams:

Roadway Approach Spans 1 to 15 Floorbeams:

Intermediate floorbeam cantilever top and bottom flange angles exhibit moderate to heavy rusting with laminar corrosion and section loss. The intermediate floorbeams remain in fair to poor condition with no significant change in condition observed. The following conditions and deficiencies were observed and are summarized below:

- Numerous floorbeam cantilever top and bottom flange angles typically exhibit approximately 50% section loss from the curb stringer to the end. Refer Appendix B of the Interim Inspection Report, dated November 2012, for specific locations.
- Span 9 floorbeam FB2 easterly cantilever northerly bottom flange angle has a ¼" x ½" hole.

- Span 14 floorbeam FB2 westerly cantilever top flange angle 1" x ¾" and ½" diameter holes remain the same size.

The end floorbeam flange angles and rivet heads generally exhibit varying levels of advancing deterioration and section loss. The end floorbeams remain in serious condition. The following conditions and deficiencies were observed and are summarized below:

- Some additional flange angle section loss (width and thickness). Refer to Appendix C for specific locations.
- Span 2 end floorbeam FB3 westerly cantilever southerly top flange angle exhibits 75% to 100% section loss. Bottom flange is holed in several locations and remaining steel is very thin.
- Span 5 end floorbeam FB3 westerly cantilever bottom flange angle exhibits approximately 90% section loss.
- Span 6 end floorbeam FB0 westerly cantilever top flange angle has more than 50% section loss and is very thin. Bottom flange angle exhibits up to 100% section loss.
- Span 6 end floorbeam FB0 bottom flange angle width remaining 11" left of roadway stringer S2 is 3½". Remaining bottom flange angle thickness ranges from 0.10" to 0.22". Refer to Appendix C for additional information.
- Span 6 end floorbeam FB3 bottom flange angle width remaining right of the shoring is 2½", left of the shoring is 3" and near stringer S2 is 4".
- Span 8 end floorbeam FB3 westerly cantilever northerly bottom flange angle exhibits up to 100% section loss near the girder and is very thin elsewhere.
- Span 8 end floorbeam FB3 easterly cantilever northerly top flange angle exhibits up to 100% section loss up to the tie plate.
- Span 9 end floorbeam FB3 westerly cantilever northerly bottom flange angle exhibits up to 100% section loss near the girder and is very thin elsewhere.
- Span 10 end floorbeam FB3 easterly cantilever northerly top flange angle exhibits up to 100% section loss. The northerly bottom flange angle has a 3" x 1" hole located 30" from the girder.
- Span 10 end floorbeam FB3 westerly cantilever northerly bottom flange angle remaining width = 3¾" located 30" right of the girder and has more than 50% section loss elsewhere.
- Span 11 end floorbeam FB3 1" diameter hole in the bottom flange angle located 14" from roadway stringer S2 remains the same size. Westerly cantilever top flange angle exhibits approximately 50% section loss.
- Span 12 end floorbeam FB3 easterly and westerly cantilever top flange angles exhibit up to 100% section loss.
- Span 12 end floorbeam FB3 top flange angle at the end of the tie plate exhibits up to 100% section loss. Refer to Appendix C for additional information.

Refer to Appendix B for condition photographs and Appendix C for detailed condition sketches of floorbeams exhibiting advanced deterioration and section loss. Refer to Appendix B of the Interim Inspection Report, dated November 2012, for detailed condition sketches of all other floorbeams.

Truss Spans 1 to 5:

An increase in deterioration since the 2009 inspection was observed on railroad deck end floorbeams (FB0 and FB8) of the truss spans. Specifically, increases in section loss were observed on the corbels connected to the floorbeam webs (supporting the track ties between spans), and increases in section loss to the flanges adjacent to the corbels. See below for more information on end floorbeam conditions.

Increase in deterioration was also observed on the highway floorbeam overhangs. Specifically, span 2 FB8 has had significant deterioration on the overhang top flange adjacent to the tower, with up to 100% section loss on the top flange near the end of the overhang.

On the roadway deck, the floorbeam cantilevers supporting the concrete deck are in generally fair condition. Floorbeam cantilevers have laminar corrosion on the top flange at the ends, beneath the fascia beam, as well as surface rust on the top and bottom flanges at the interface with the truss gusset plate. Pack rust with prying was observed between floorbeam bottom flanges and knee bracing. This pack rust is causing deformation in the flanges and knee brace connection at the ends of the floorbeam. Also on the roadway deck, the larger floorbeam cantilevers supporting the traffic gate platform are in poor condition. The cantilevers have laminar corrosion to the top and bottom flanges, as well as surface rust to the flanges and stiffeners. The span 2, floorbeam cantilever at U5, end stiffener has a corrosion hole. The span 4, floorbeam cantilevers at U3 have corrosion holes in angle and member section loss.

The roadway floorbeams between trusses are in generally fair condition. Top flange angles generally exhibit light to moderate rusting. Some floorbeams exhibit areas of heavy rusting with laminar corrosion and section loss. Many of the tension tie plates have tack welds on both sides of the web that are approximately 1½" to 2" in length. Top flange angle section loss was observed on truss span 1 floorbeam 0 and is estimated to be approximately 50%. Due to the number and location of electrical conduits, a section loss could not be measured. Truss spans 1 and 2 floorbeams FB8 and FB0 respectively, also exhibit some section losses. Span 3 floorbeam FB3 has sustained impact damage at about quarter span.

The roadway end floorbeam cantilever flange angles generally exhibit varying levels of advanced deterioration and section loss and are considered to be in poor to serious condition. The following conditions and deficiencies were observed and are summarized below:

- Cantilever top and bottom flange angles exhibit light to heavy rusting with laminar corrosion and varying degrees of advanced section loss.
- Pack rust with prying at floorbeam and vertical truss member knee bracing at connection with vertical member.
- Truss span 2 end floorbeam FB8 easterly cantilever top flange angles exhibit up to 100% section loss. Southerly bottom flange angle width remaining is 3½" near the curb stringer.
- Truss span 4 end floorbeam FB0 easterly cantilever top flange angles are very thin and exhibit up to 100% section loss. Southerly bottom flange angle exhibits up to 50% section loss.

- Truss span 5 end floorbeam FB8 easterly cantilever northerly top flange angle exhibits 40% to 50% section loss. Northerly bottom flange angle rivet replacement bolt nuts exhibit 50% section loss.

Railroad Span Floorbeams:

On the railroad deck, intermediate floorbeams typically have surface rust throughout the top face of the top flange, on knee braces and on less than 5% of the web surface area. There is typically pack rust between the bottom flange and the truss lateral bracing gusset plates, and laminar corrosion on the top face of both flanges between the stringers. There is also laminar corrosion on the top flange at the interfaces with knee braces, in isolated areas there is up to 1/8” section loss to the top flange and knee bracing. Also, there is up to 1/8” section loss along connection angles. Floorbeams have two 1” diameter holes drilled in each side of the flange near midspan. The holes are not filled and are presumably holes for tie anchors that are no longer used.

Occasional section loss up to 1/8” on the bottom flange of the floorbeams is evident. Span 3, intermediate floorbeam FB3 has 1/8” section loss along the top flange of the member. Span 3, intermediate floorbeam FB6 has only 1/4" remaining for 6” over the midspan of the member. There is up to 1/8” section loss on span 3 along knee bracing connection and top flange on the floorbeam at FB1 and FB2 in span 3.

Span 4, intermediate floorbeam FB3 has up to 1/8” section loss in front of knee bracing.

Span 5, intermediate floorbeam FB1 has areas of section loss on the south face; there is 1/16” section loss, 1/2" high to the east part of the web and 1/8” section loss to the west part of the web. Span 5, intermediate floorbeam FB3 1/8” section loss on top flange and section loss on weld to the vertical on the east side at L3.

End railroad floorbeams are in similar condition to intermediate floorbeams, with the exception that top flanges typically have laminar corrosion on the full length of the top face and no pack rust at lateral gusset plate interfaces. Additionally, the steel brackets attached to the web that support the deck between spans have laminar corrosion throughout. Pack rust was noted between most stiffeners at the end floorbeam knee braces.

Span 1, end floorbeam FB0 has a 2”x1” corrosion hole in the top flange at the east stringer. The bottom flange tapers from 0” to 1/8” section loss on the north half of the floorbeam. Span 1 end floorbeam FB0 has 1/4" remaining of the south bottom flange at the midspan. The span 1 end floorbeam FB0 corbel has laminar corrosion and 1” remaining of the top and bottom flanges on its east and west side. Span 1 end floorbeam FB0 has 1/8” section loss of the south face of the exterior web between the west stiffener and west corbel extending two rivets at the top flange. Span 1 end floorbeam FB0 has laminar corrosion and up to 1/8” section loss on knee bracing and top flange. Span 1 end floorbeam FB8 has 1/16” section loss of the bottom flange on both the north and south sides.

Span 2 end floorbeam FB0 has 1/16” pitting on the bottom flange of the south side and there is 3/8” remaining to the bottom flange on the north side. The corbels located at pier 3 and the south corbels at pier 4 (span 1, FB8 and span 2, FB0 and FB8) all have 1” remaining of the top

and bottom flanges. Span 2 end floorbeam FB8 has 1/4" to full thickness remaining along the bottom flange of the north face of the abutment. Span 2 end floorbeam FB8 also has 1/16" pitting of the top flange and up to 30% of section loss on the right side of the top flange and knee bracing.

Span 3 end floorbeam FB0 is missing the bolts from the track brace frame bottom strut on both sides. Span 3 end floorbeam FB8 has pack rust and prying on plates and lacing behind knee bracing and up to 100% section loss and up to 3/16" on knee bracing.

Span 4 end floorbeam FB0 has 1/2" remaining of the top flange at the midspan and 1/16" section loss to the bottom flange of both sides of the floorbeam. Span 4, end floorbeam FB8 has 3/8" remaining to bottom flange thickness from end of flange to 3", 1/16" pitting to the north face of the bottom flange, and 1/4" remaining to the south face of the bottom flange and 1" remaining to top flange along with heavy laminar corrosion.

Span 5 end floorbeam FB0 has 1/8" to ½" remaining at south face along with 1/16" pitting while 1/8" to the full web section thickness remains on the north face. Span 5 end floorbeam FB0 has section loss of the south top flange at the west corbel and 1/16" section loss under the expansion joint. Span 5, end floorbeam FB8 has 1/16" pitting along north side of bottom flange.

Railroad floorbeams are in fair condition. See Appendix C for a diagram of typical railroad floorbeam deterioration.

Railroad cross girders at piers 17 and 18 support the stringers that span over the piers at the towers. These cross girders are typically rusted throughout with corrosion holes in the top flange cover plate. The south cross girder on the south tower has up to 1" pack rust between the web and bottom flange, laminar corrosion on the web and corrosion holes on the top flange.

Roadway Approach Spans 21 to 27 Floorbeams:

Spans 21 to 27 floorbeams remain in poor to serious condition with no significant change in condition observed. The following deficiencies were observed and are summarized below:

- Cantilever top and bottom flange angles exhibit moderate to heavy rusting with laminar corrosion and varying degrees of advanced section loss.
- Rivet head loss at tension tie plates.
- Top angles between girders exhibit moderate rusting.
- The bottom flange angles between the girders exhibit section loss.
- Rivet head section loss at isolated locations along the floorbeams.
- Top flange tension tie plates exhibit moderate to heavy rusting with laminar corrosion and section loss.

Refer to Appendix B for condition photographs and Appendix C for detailed condition sketches of floorbeams exhibiting advanced deterioration and section loss. Refer to Appendix B of the Interim Inspection Report, dated November 2012, for detailed condition sketches of all other floorbeams.

59.4 Truss Members:

Truss Spans 1 to 5:

Minor increases in deterioration since the 2009 inspection were found on the trusses throughout. Increased instances of pack rust and prying were observed, as well as increases in section loss on batten plates and lacing bars. Increases in the extents of section loss were found on top flanges of bottom chords, bottom flanges of top chords, and flanges of diagonals, but no substantial increase in depth was found on truss members.

Truss bottom chords typically have surface rust on the top face of the top and bottom flanges and laminar corrosion on the top flange at batten plate interfaces with up to 1/16" section loss. The interior web typically has laminar corrosion at interfaces with gusset plates. The exterior web plate typically has isolated paint loss and surface rust. Batten plates on the bottom chords are typically rusted. Bottom and top flanges typically have laminar corrosion with section loss between gusset plates at truss joints, with up to 1/8" section loss. Several chord members have sustained more advanced deterioration, including laminar corrosion on the exterior web, top flanges and bottom flanges. Several batten plates have advanced deterioration with corrosion holes and pack rust with prying.

Truss top chords are typically in fair condition, with surface rust on the top face of the bottom flanges. Several top chord members have pack rust with prying between the batten plate and bottom flange, as well as between the bottom flange and web plates. Minor section loss on the truss chord bottom flanges were noted in isolated locations.

Truss diagonals are typically in fair condition, with surface rust on less than 10% of the webs, top face of both flanges and lacing bars. Several members have more advanced deterioration, which consists of laminar corrosion on the top flanges, batten plates and lacing bars, as well as the exterior web. Several batten plates have corrosion holes.

Truss verticals are typically in fair condition, with some surface rust on the exterior flange and lacing bars. Several verticals have more advanced deterioration, consisting of laminar corrosion on the lacing bars, batten plates and exterior webs. Many of the verticals with advanced deterioration have pack rust between the flanges and bottom chord gusset plates. Truss span 5 west truss vertical L4-U4 has a 3"x1" corrosion hole on the exterior web near the lower gusset plate. A corrosion hole was found on the web of span 4 vertical L0-U0W. This corrosion hole measures 5" wide, but is located inside of the gusset plate, 4" from the bottom of the member.

Truss members underneath metal drain pipes typically are the members with advanced deterioration.

See Appendix C for a detailed schedule of truss member conditions.

59.5 Towers and Retractable Span 21:

The tower facades have pack rust between several panels and at the tower windows. The pack rust is causing prying between overlapping panel points as well as prying of the façade from the tower. There are twenty-nine cracks throughout the façade, ranging in length from 5" to 14'-6" in length. Three of the cracks near the northwest corner of the south tower exhibit efflorescence from the mortar bed behind the panels. All cracks occurred at butt weld splices for the façade panels. Since these panels are welded to the truss framing system, these welds do not act as structural connections. There are isolated areas with rust and laminar corrosion throughout the tower façades, with heavier corrosion within the splash zone near the bridge roadway deck. A 20' length of panel on the southwest corner of the north tower, a 15' length of panel on the northeast corner of the north tower and a 12' length of panel on the northwest corner of the south tower are prying away from the tower. Prying is up to 0.75" on the north tower and up to 2.5" on the south tower. A layer of concrete is visible behind the pried plate on the south tower. There is a hole that was previously found to be 3"x1" was found to be 6"x 2" on the south tower, south face, east side approximately 3' below the windows. This corrosion hole appears to have grown in size so dramatically due to the fact that steel around the hole was paper-thin during the previous inspection. There are numerous corrosion holes located below the highway deck on the tower facades. These holes are typically 1" to 2" in diameter, but holes are as large as 8"x3" adjacent to access doors at the piers. Several welded patch plates were found on the tower facades below the highway deck.

Tower bracing typically has some isolated surface rust on the top faces of members. Panel points typically have laminar corrosion and pack rust at interfaces between members and gusset plates. Minor section loss, up to 1/8" deep, was found in areas of laminar corrosion, and corrosion on rivet heads to 80% loss was observed. On the north tower, north face, the west gusset plate at panel point T3 is bent with laminar corrosion. Also on the north tower, north face, the diagonal between panel points T1 and T2 is bent, apparently due to impact damage. On the south tower, north face, the east gusset plate at panel point T4 has heavy laminar corrosion and it is bent out of plane approximately 2". Also on the south tower, the vertical legs underneath the windows typically have pack rust with prying on the outside face.

The towers are comprised of two legs, east and west, with bracing between. This bracing is referred to as Panel Point T0 at the top, down to T4 at the brace closed to the roadway. Each tower leg is a frame system that is fully enclosed by steel fascia plating. This leg framing consists of two columns on the north and south side of the leg, with bracing between the legs. Bracing inside of each leg was labeled by panel; this bracing was labeled as PP0 at the top of the tower, down to PP17 at the tower base.

The interiors of the tower legs are considered to be in satisfactory condition. Spot rusting was found throughout the plating, columns and bracing members. Section loss up to 1/32" was found randomly through the tower legs. Significant pigeon debris was found on horizontally oriented stiffener plates inside the north and south columns throughout the towers. Bird debris worsened near port holes, where debris was as much as 3" deep. Minor debris was found on the batten plates of horizontal struts throughout the towers.

Two corrosion holes were found on the fascia plating of the south tower, adjacent to the south column of the east leg at PP0. The holes were 8" wide x 5 ½" high and 2" in diameter. Isolated

areas of minor section loss were found on bracing members inside the tower, adjacent to port holes. Section loss was up to 1/8" deep.

There areas of section loss in the fascia plating increased near the lift span rope drum and at the base of the tower. Section loss was up to 1/8" deep.

The service elevator located in the east leg of the north tower was found to be stuck in the shaft at PP7. Personnel could not pass the tower at this point, and access was gained by rappelling from the top of the tower to this Panel Point and climbing back to the top of the tower for exit. Access below the service elevator was gained by climbing the tower to PP7, the rappelling down to the bottom of the tower for exit. Inspectors also found that the machinery wheel at the base of the elevator shaft (located just below the elevation of the roadway deck) had failed. It appeared that friction between the existing cable and elevator track was holding the elevator in place. Bridge inspectors chained the elevator to support struts inside of the tower to mitigate this potential safety hazard.

Retractable span 21 trolley beams are in generally satisfactory condition, with some surface rust on the horizontal faces of the beam. The elastomeric bearings for the trolley beams at pier 21 are crushed and bulging. The trolley arms have surface rust adjacent to the lift beams and knee braces, as well as laminar corrosion at the bolted splice adjacent to the trolley beams. The east lift beam has surface rust on the north face and section loss (3/8" remaining) of the bottom flange of the second panel and 1/8" section loss of the top flange. The trolley arms have ladder rails welded to them. The lift beams have laminar corrosion on the top flanges over the full length and on the bottom flanges at beam ends. Laminar corrosion on the top flange is more severe at the interface with knee braces. The west trolley arm has up to 1/8" section loss to the north faced and the west lift beam has surface rust and section loss (up to 1/8") to the bottom flange. Screw housing and screw housing braces at pier 20 have laminar corrosion throughout, with more severe corrosion near the base. Screw housing and screw housing braces at pier 21 have laminar corrosion throughout, with more severe corrosion and several large corrosion holes near the base. The screw housing braces at pier 21 have up to 50% loss in cross-sectional area.

59.6 Bearings:

Roadway Approach Spans 1 to 15:

Approach Spans 1 to 12 bearings exhibit heavy rusting and laminar corrosion. Bearing anchor bolts and nuts are heavily rusted with section loss. Span 13 girder hinge seat bearings are in satisfactory condition. Spans 14 and 15 bearings are also considered to be in satisfactory condition.

Railroad Approach Spans 14, 15, 21, 22 and 23:

Railroad approach span bearings typically have laminar corrosion on the bearing assemblies. The pedestal assembly bolts have up to 50-100% section loss. The laminar corrosion and rust between the pin cap and the pedestal on the exterior side of the bearing is common throughout the approach spans, unless otherwise noted. There is no sign of pin rotation on any bearing.

Span 14 pier 13 east and west bearings (expansion) exhibit pack rust in the gap between the pedestal and rocker. The pin cap had tight paint or rust on the bearing and heavy laminar corrosion to the pedestal and sole and masonry plates. There is 100% section loss on the anchor bolts. There was minor (1/16") bulging at the elastomer.

Span 14 pier 14 west bearing (fixed) exhibits up to 90% section loss in the anchor bolt nuts. Span 14 pier 14 east bearing (fixed) exhibits up to 100% section loss in the anchor bolt nuts and pack rust between rocker and pedestal. Span 15 pier 14 west bearing (expansion) exhibits 50% section loss in the east anchor bolt nuts and 100% section loss in the west anchor bolt nuts. Heavy laminar corrosion was also found on the masonry plate on this bearing and no defects were observed in the elastomer. Span 15 pier 14 east bearing (expansion) exhibits 50-100% section loss in the anchor bolt nuts and no defects were observed in the elastomer.

Span 15 pier 15 west bearing (fixed), exhibits up to 100% section loss in the anchor bolt nuts and pack rust to the exterior side. Span 15 pier 15 east bearing (fixed) exhibits up to 100% section loss in the anchor bolt nuts (except the southwest anchor bolt) and laminar corrosion to the sole plate.

Retractable railroad approach span 21 bearing plates typically have laminar corrosion and up to 50% section loss on bolts connecting the plate to the deck girders. Bearing base plates typically have surface rust on all surfaces.

Span 22 pier 21 west and east bearings (fixed) have section loss in the anchor bolts: 100% loss to the south bolts and 50% loss to the north bolts. The bearings also have pack rust between the pedestal and sole plate, rust between pedestal and roller, and rust staining between the pin cap and pedestal.

Span 22 pier 22 east and west bearings have section loss on the anchor bolts ranging from 80 to 100%. The east bearing has is pack rust between the pedestal and rocker. On the west bearing, there is pack rust between the exterior pedestal and rocker but a 1/4" gap remains.

Span 23 pier 22 east bearing has an exterior 1/4" gap between the pedestal and rocker. The east bearing also has tight paint around the pin cover. There is 80% section loss to the anchor bolt heads and 100% section loss to the northwest anchor bolt. The interior part of the east bearing, has a tight gap between the pedestal and rocker and there is tight paint at the pin head. There is laminar corrosion at the base of the sole plate as well. The west bearing has laminar corrosion of the pedestal sole plate and masonry plate with heavy laminar corrosion to the exterior part of the bearing. There is a 3/8" gap between rocket and pedestal. There is 100% section loss of anchor bolt nuts and pack rust between the pedestal and rocker on exterior.

Span 23 pier 23 (north abutment) west bearing (expansion) sole plate is rotated clockwise with respect to the masonry plate. There is pack rust with 1/8" prying between the pedestal and rocker. There is 100% section loss in the anchor bolts. That the word "RUBBER" is stamped into the elastomer. Span 23 pier 23 (north abutment) east bearing (expansion) bulging was observed at the northwest corner of the elastomer. There is 100% section loss in the anchor bolts. The bearing is slightly rotated clockwise. The extreme curve of the railroad track may be causing the two bearings to rotate.

Truss Spans 1 to 5:

Truss bearings at piers 15, 16, 19 and 20 typically have laminar corrosion on the base plate, as well as on the vertical bearing plate at the interface with the pin. The elastomers are also in good condition, unless otherwise noted. There is also pack rust up to 5/8" thick between the vertical gusset plate and gusset plate. There is also 80% section loss in the anchor bolt nuts, unless otherwise noted.

- Span 1 south bearings (fixed – pier 15) have surface rust between the pin caps, gusset plate, and the bearing assemblies. There is laminar corrosion on the pin casing and interior pedestal and random laminar corrosion to the exterior pedestal.
- Span 1 north bearings (expansion – pier 16) have laminar corrosion on the bearing pins. The anchor bolt nuts are heavily deteriorated, with up to 80% section loss, except the southeast bolt on southwest bearing. Southwest bearing pack rust between the masonry plate and the elastomer is resulting in 2-1/8" bulging. Span 2 south bearings (expansion – pier 16) have laminar corrosion on the inside of the gusset plates bearing on the pin. The anchor bolt nuts are heavily deteriorated, with up to 80% section loss, except the northeast bolt on the northwest bearing. The northwest bearing has 1/8" bulging at the north side of the elastomer.
- Span 2 north bearings (fixed – pier 17) have section loss to several anchor bolts as listed above with the exception of the southeast bolt on the southeast bearing, which has no section loss. The east bearing has laminar corrosion on all surfaces inside the bearing assembly.
- Span 3 south bearings (fixed – pier 17) have laminar corrosion on the base plates. All anchor bolts on the bearings are bent forward, toward span 3.
- Span 3 north bearings (expansion – pier 18) have some surface rust between the base plate and top bearing plate.
- Span 4 south bearings (fixed – pier 18) anchor bolt nuts have up to 80% section loss to as noted above. The east bearing has no rust between the pin cap and the pedestal; however, there is rust staining between pedestal and gusset plate on the west side of the bearing. There is rust staining between the pedestal and the gusset plate and pack rust between the pin cap and the pedestal on the east side of the east bearing.
- Span 4 north bearings (expansion – pier 19) have 80% section loss on two anchor bolt nuts on the west bearing and 40% section loss on two of the east bearing anchor bolt nuts. There is laminar corrosion on the bearing gusset plates inside of the bearing assemblies.
- Span 5 south bearings (expansion – pier 19) have laminar corrosion on the bearing gusset plates inside of the bearing assemblies. The east bearing has laminar corrosion on the outside face of the bearing assembly and pack rust (no prying) between the pedestal and masonry plate. The two south anchor bolts on the east bearing have 50% section loss. Also in the east bearing, there is paint and pack rust between the pin and gusset plate while the pin cap's paint is in good condition. The west bearing north east anchor bolt does not have section loss. The elastomer is in a retraction condition (1/8" retracted). There is pack rust with prying (1/8") between the sole plate and the tie plate.
- Span 5 north bearings (fixed – pier 20) have section loss up to 20% on the west bearing anchor bolts. There is rust staining and paint between gusset plate and pedestal along with minor laminar corrosion on the west bearing and only surface rust on the interior pin. The section loss on the east bearing anchor bolts is about 10%.

Roadway Approach Spans 21 to 27:

Piers 21 and 22 Bearings:

The stainless steel expansion bearings are in satisfactory condition.

Girder Hinge Seat Bearings:

The girder hinge seat stainless steel expansion bearings are considered to be in satisfactory condition; however, the Span 22 east and 26 east and west girder south hinge PTFE pad has slid out from between the bearing plates. The Span 24 west girder south hinge PTFE pad has completely slid out from between the bearing plates.

North Abutment Bearings:

The north abutment bearings exhibit significant rusting and laminar corrosion. Anchor bolts and nuts are heavily rusted with section loss.

Retractable Span 21 Trolley Beam Bearings:

The elastomeric bearings are bulging.

59.7 Connections and Plates:

Roadway Approach Spans 1 to 15 and 21 to 27:

The lateral bracing to floorbeam connection plates are in fair condition. The following deficiencies were noted:

- Paint system failure with moderate rusting on some connection plates.
- Holed plate with significant pack rust at Span 6, Bay 3, FB3, for FB2 to FB3 bracing member.
- Heavy rusting with laminar corrosion on FB2 to FB3 Span 8, Bay 3, FB3 connection plate.
- Span 27, Bay 3, FB3 northeasterly connection plate is bent.

Railroad Approach Spans 14, 15, 21, 22 and 23:

The railroad approach spans have gusset plates connecting lateral bracing and cross frames to the top and bottom flanges. The fixed railroad spans top and bottom gusset plates typically have laminar corrosion on the top face. End bottom lateral gussets are heavily corroded, with a corrosion hole in the northernmost gusset on span 22 east girder. Several bottom lateral gusset plates near midspan have pack rust with prying between the bottom flange and gusset plate in span 22. The cross frame gusset plates at span end are severely deteriorated, with almost 100% section loss on the east girder top gusset plate in span 23.

Span 21 lateral gusset plates located in the northernmost four bays have laminar corrosion on the top face. The northernmost bottom lateral gusset plate on the east girder has heavy

deterioration with a 3" diameter corrosion hole. Lateral gusset plates elsewhere have paint loss and surface rust on the top face.

Truss Spans 1 to 5:

Truss gusset plates remain in satisfactory condition. There have been increases in section loss at U0 and U8 Panel Points and an increased number of locations with pack rust.

Truss gusset plates are typically in satisfactory condition. Plates typically have small, isolated areas of laminar corrosion. Several gusset plates exhibit prying due to pack rust between the gusset and truss member. Upper gusset plates typically have surface rust at the interface with the upper floorbeam overhang and at the interface with the roadway floorbeam knee braces. Gusset plates at panel points U0 and U8 typically have laminar corrosion and pack rust over much of the plate. See Appendix C for a schedule of truss gusset plate deterioration.

Truss top chord lateral bracing connection plates are generally in good condition. Connection plates exhibit light rusting. Pack rust with prying action was observed at the lateral bracing angle and connection plate interface.

Truss bottom chord lateral bracing gusset plates are typically corroded on the top face. There is paint rust, surface rust and some laminar corrosion on the plates. There is typically pack rust on the plate at interfaces with the lateral bracing and floorbeams. Occasional debris build up is occurring at some lateral gusset plates. Steel around the edges of cut drain holes is typically rusted. The following bottom lateral gusset plates exhibit more than normal deficiencies:

- Span 1, L1, East Side – 1/16" section loss
- Span 1, L4, East Side – covered in bird droppings (inaccessible to measure section loss)
- Span 2, L1, West Side – 1/8" section loss and filled with debris
- Span 2, L3, West Side – 1/4" pack rust with laminar corrosion
- Span 2, L6, West Side – 3/8" pack rust
- Span 3, L8, East Side – 1/8" section loss
- Span 5 L2, East Side – 1/4" pack rust
- Span 5 L2, West Side – 1/4" pack rust
- Span 6, L6, Wide Side – 3/8" pack rust

Truss chord splice plates (top and bottom) are in generally fair condition. Plates exhibit surface rust and paint failure. Pack rust with occasional, minimal prying was observed at some locations. Splice plates also exhibit rust staining.

Stringer bracing and top cross frame gusset plates at the railroad deck are typically rusted with some laminar corrosion on the top face. Bottom cross frame gusset plates have some surface rust on the top face.

Lateral bracing gusset plates on the railroad deck at piers 17 and 18 are typically corroded and covered with debris. The gusset plate at the south end of the east railroad stringer at pier 17 has a corrosion hole.

59.8 Bracing:

Roadway Approach Spans 1 to 15 and 21 to 27:

Lateral bracing is considered to be in good condition. Paint system failure with moderate rusting with some laminar corrosion was observed on several of the bracing members. The lateral bracing angle in span 27, bay 3 from FB2 to FB3 is bent.

Railroad Approach Spans 14, 15, 21, 22 and 23:

Approach span 14 has corrosion holes in the bottom lateral bracing at the north bearing and pack rust with laminar corrosion to the top lateral bracing. The northernmost cross frame has pack rust between the diagonal angles and section loss at gusset plate along the diagonal at northeast bearing.

Truss Spans 1 to 5:

Increased deterioration was observed in the lower lateral bracing of the truss spans, with areas of 100% section loss forming in four locations. Severe laminar corrosion was previously found at these locations. Increased instances of pack rust was also found as described in Section 59.7 Connections and Plates.

Truss bottom chord lateral bracing members are in fair condition. The members typically have surface rust on the top face, as well as pack rust up to 3/4" at the interfaces with the lateral bracing gusset plates at the truss panel points and at the center of each bay. The lateral bracing typically has random laminar corrosion and up to 1/16” section loss. Truss lateral bracing also typically has pack rust up to 1” between the two steel angles comprising each bracing member, causing a scalloping effect throughout the member. The bottom lateral braces identified below have more severe deficiencies:

- Span 1, Bay 5 – Both lateral braces have 100% section loss in a 9 square inch area (3”x3”) at the connection plate. Heavy laminar corrosion and several corrosion holes on the lateral braces.
- Span 2, Bay 0 west to east lateral brace has 100% section loss in a 9 square inch area (3”x3”) at the west stringer connection.
- Span 2, Bay 5 west to east lateral brace has 100% section loss in a 12 square inch area (4”x3”) with a 1/2" diameter corrosion hole.
- Span 5, Bay 4 – The flanges of the lateral braces has significant knife edging section loss. The connection plate at the lateral braces has a 3”x3” corrosion hole along with knife edging.

Top chord lateral bracing members are in generally good condition. Members’ exhibit paint system failure with light to moderate rusting. Pack rust was noted between the bracing connections to the top chords and floorbeams, causing some prying and deformation.

Railroad deck stringer cross frames typically are rusted on the top face of the top strut. Other cross frame members exhibit some paint loss and surface rust. Top cross frame gusset plates have laminar corrosion on the top face and up to 1/4” section loss. The connection plate exhibits

laminar corrosion and section loss up to 100% causing knife edging like in span 2, bay 1. One cross frame in span 2, bay 2 has a bent top flange from an unknown cause.

Railroad deck stringer bracing typically is rusted on the top face and have pack rust between the two steel angles. Random laminar corrosion was observed on the webs of the stringers. Like the truss lateral bracing, this causes prying between the two members. The bottom flanges of the stringers have laminar corrosion and section loss, as little as 1" remaining.

Lifting Girder Bracing at Truss Span 3:

The horizontal struts bracing the bottom chord at truss ends have laminar corrosion on horizontal surfaces. There is a lacing bar missing from the I-shaped southeastern strut. The remaining struts have up to 100% section loss on the lacing bars and corrosion holes in the lacing. The steel angles connecting the box-shape struts to the end gusset plates are bent and distorted. There is a 4.5" long crack in the steel angle connecting the top flange of the northwestern box-shape strut connection to the truss gusset plate. The same box-shaped strut has corrosion holes in the top lacing bars. The box-shaped struts have laminar corrosion at the guide rail. Laminar corrosion is evident on the diagonal struts on the lift span. These struts have up to 50% section loss. Replacement repairs have been made to the horizontal struts by the installation of struts against the tower.

59.9 Operator House Support Structure:

The Operator House supports exhibit some laminar corrosion and pack rust at connections to the truss. The Operator House framing system exhibits some laminar corrosion on the support beams and stringers, as well as surface rust on top flanges. Purlins are in generally good condition. Portions of the Operator House have stay-in-place forms underneath the deck, which are rusted at the edges.

59.10 Catwalk Support Structure:

A catwalk and stairway system in span 5 o the west side of the bridge is in place to access the railroad deck and piers from the roadway deck. There is up to 1/8" section loss in the flanges of the channels that support the catwalk and up to 1/8" section loss on the railing. Widespread laminar corrosion was observed on the walkway structure. Knife edging was found directly under the floor slats on the platform support channel. The end channel at the walkway has 1/8 section loss and a 1" corrosion hole in the top of the web with 25" of 1/4" section loss. The lower supports for the catwalk above the piers have similar conditions observed including 1/8" section loss to flanges and webs and corrosion holes with knife edging up to 4" in diameter in the webs. On the catwalk support brace at L6, there is 100% to paper thin section loss to both side of top bracing angle. Due to the catwalk, the gusset plate is inaccessible but heavy laminar corrosion was observed.

59.11 Repaired Structural Members:

In April of 2013, a tanker ship collided with the east face of several truss span 1 members. The truss members and plates are in typically good condition. There is surface rust evident at corner of batten plate on the top and the bottom on truss diagonal U5-L6. This rust leakage should be monitored for future pack rust. There is 1/8" section loss for 33 inches along the top of the L6 gusset plate. Generally, there is no paint failure on the new steel except for one bolt. The caulking used at L5 is holding well. Along the bottom chord repair at L5, nuts are not fully headed – no change in nuts from the June 2013 inspection of the repair.

Item 60 – Overall Substructure – Serious Condition

60.1 Abutments:

The level of south and north abutment and wingwall spalling, delamination and map cracking is similar to that observed in June 2009, May 2010, November 2010, July 2011, October 2011, May 2012, October 2012, and April 2013. The abutments and wingwalls remain in poor condition.

60.2 Piers:

Piers 1 to 12 remain in poor to serious condition. The areas of concrete spalling, delamination and map cracking remain consistent with that observed during the June 2009 in-depth inspection and the May 2010, November 2010, July 2011, October 2011, May 2012, October 2012 and April 2013 interim inspections.

Since the last inspection, piers 16 and 17 sustained impact damage from the April 2013 allision. This damage is limited to the nose of the piers. A 2013 Underwater Inspection performed by others states that there is no structural damage to the pier below the water line.

Piers 14 through 22 have hairline cracks on the top and sides of the pier cap. The river piers (14 through 22) also have minor scaling and abrasions. The river piers also have random surface spalls and narrow longitudinal cracks. Piers 14 through 17 have vegetation on portions of the pier that are below the high water elevation. Piers 15 and 16 have previously patched spalls.

- Pier 15 has a major spall on the southwest corner with exposed broken rebar; the spall is 8" deep. There is laminar corrosion to the rebar. The masonry plate from the bearing is not undermined but it is close. The large spall continues along backwall and wraps around the southeast corner of masonry plate but does not yet undermine. There is also a 6" spall on the south nose and this spall extends vertically to the stone masonry. There are two cracks (one 1/16" thick and one 0.03" thick) that extend from the northwest anchor bolt to pier cap edge. The 1/16" thick crack spreads up to 1/4" thick on the edge of the pier granite; there is water weeping and rust staining associated with this crack. The northwest nose face from the northwest bearing has up to 1/8" cracks with rust staining and extends 3 feet with no delamination. There is also hairline cracking under the west truss bearing. At the south face of the southwest bearing at corner of bearing seat and cheekwall is a 1/4" crack.
- Pier 16 has a transverse crack along the middle of the pier that extends down both sides and over the top of the pier and has a maximum thickness of 1/4". There is also a 5'

wide spall on the nose with exposed rebar, which extends to the granite. There is also a spall at the southwest corner, which is up to 4” deep. There is a corner spall at pier 3 along with two diagonal cracks at the south face in the middle of the pier cap. The cracks are up to 1/16” wide. There is a horizontal crack at the northwest bearing along with efflorescence on the south face of the pier and two vertical cracks on the south face up to 1/8” wide. Pier 17 has cracking around the bearing area; crack width is approximately 0.02”. There is a longitudinal crack from bearing all around pier. The southeast corner of the pier has spalls with exposed rebar and cracking. There is a 1/16” longitudinal crack on the north face along the full length with rust staining. At the southwest part of the pier, there is a 1/16” vertical crack at the pier leg.

- Pier 18 has several narrow and medium cracks with efflorescence, including at the northeast corner, adjacent to the tower base. The cracking is up to 1/2" wide. There is erosion on the west face pier cap. The concrete on the bridge seat of pier 18 is covered in parge coating and debris. One spall is 12” wide and 24” high at the northeast tower base. The cracking with delamination to the left of a concrete repair was found next to a 2” corner spall that is 14” long next to the masonry plate. Efflorescence was observed along the concrete repair. There is a corner spall that is 1½” deep below the concrete repair with cracking. There is random cracking on the south face of pier 18 up to 1/8” wide. On the northwest and north face there is up to 1/4" cracking along with random 1” spalls. There is a 2” deep spall at the southwest tower leg.
- Pier 19 has a small spall on the east face and on the south face. Efflorescence is emanating from the hairline cracks in the pier cap. The north face has a full height vertical crack with associated delamination. The southeast corner of the pier has map cracking and cracks up to 1/4" around the perimeter. There is a spall at the span 4 bearing with no undermining. The spall is 4” deep with no exposed rebar. Orthogonal zigzag parge coat cracking on north face of the pier was observed. There is also minor parge coat cracking on the south face as well.
- Pier 20 has erosion on the south and east faces. There is corner spall on the east cheekwall of the lift span.
- Pier 21 has a shallow 2” by 18” spall on the south face, as well as two circular patches below the west bearing. These circular patches may be repairs for conic pop-outs on the pier cap. Pier 21 is covered with debris and has up to 1/2" scaling.
- Pier 23 has two spalls on the backwall and one on the abutment stem. There is erosion on the southwest corner of the backwall.

Steel Pier Bents at Piers 13, 14 and 21-26:

The steel bents exhibit varying degrees of rusting, laminar corrosion and section loss. The following deficiencies were observed and are summarized below:

- Cross beam cantilever top and bottom flange angles generally exhibited varying levels of advancing deterioration and section loss.
- Pier bent 14 westerly vertical column hole measuring 7½”x 1¼” in the northerly plate remains the same size. The 10” x 1” column hole in the southerly plate remains the same size. The westerly cross beam cantilever to column knee bracing southerly bottom flange angle 1” x 1½” hole remains the same size.
- Pier bent 21 easterly column 6” x 1” hole remains the same size. The westerly column 1½” x 9” and 1” x 7” holes remain the same size.

- Pier bent 22 cross beam westerly cantilever bottom flange angle exhibits 100% section loss 12" from the stiffener. Westerly cantilever top flange angle remaining thickness measurements are similar to the October 2012 interim inspection. The westerly column 11½" x 1½" hole increased to 12" x 1½" and the 1½" x 6" hole remains the same size.
- Pier bent 23 top horizontal brace has a 2" to 3" diameter hole near the west connection plate.
- Piers 13, 22, 25 and 26 flange angles exhibited some advanced section loss from the April 2013 interim inspection.

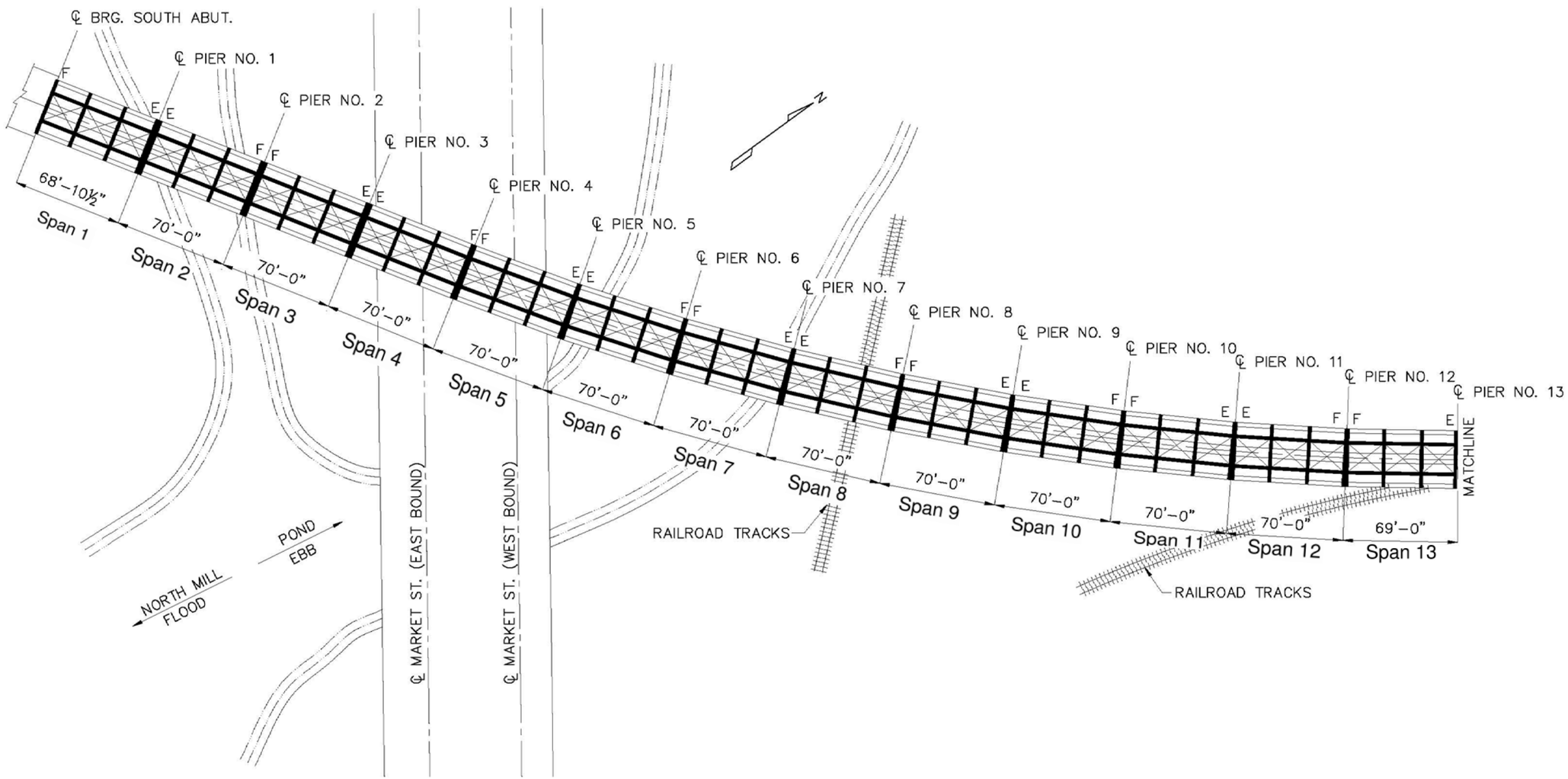
Refer to Appendix B for condition photographs and Appendix C for detailed steel bent condition sketches.

FRACTURE CRITICAL INSPECTION

IDENTIFICATION OF FRACTURE CRITICAL MEMBERS

Type of FCM:	Quantity:
Steel Riveted Built-Up Deck Girder – Roadway Approach	44
Steel Riveted Built-Up Deck Girder – Railroad Approach	12
Steel Riveted Built-Up Floorbeams – Roadway Approach Spans	85
Steel Riveted Built-Up Floorbeams – Truss Spans	45
Steel Riveted Built-Up Cross Beams – Steel Bents	8
Steel Riveted Truss Bottom Chords	40
Steel Riveted Truss Top Chords	2
Steel Riveted Truss Diagonals	20
Steel Riveted Truss Verticals	30

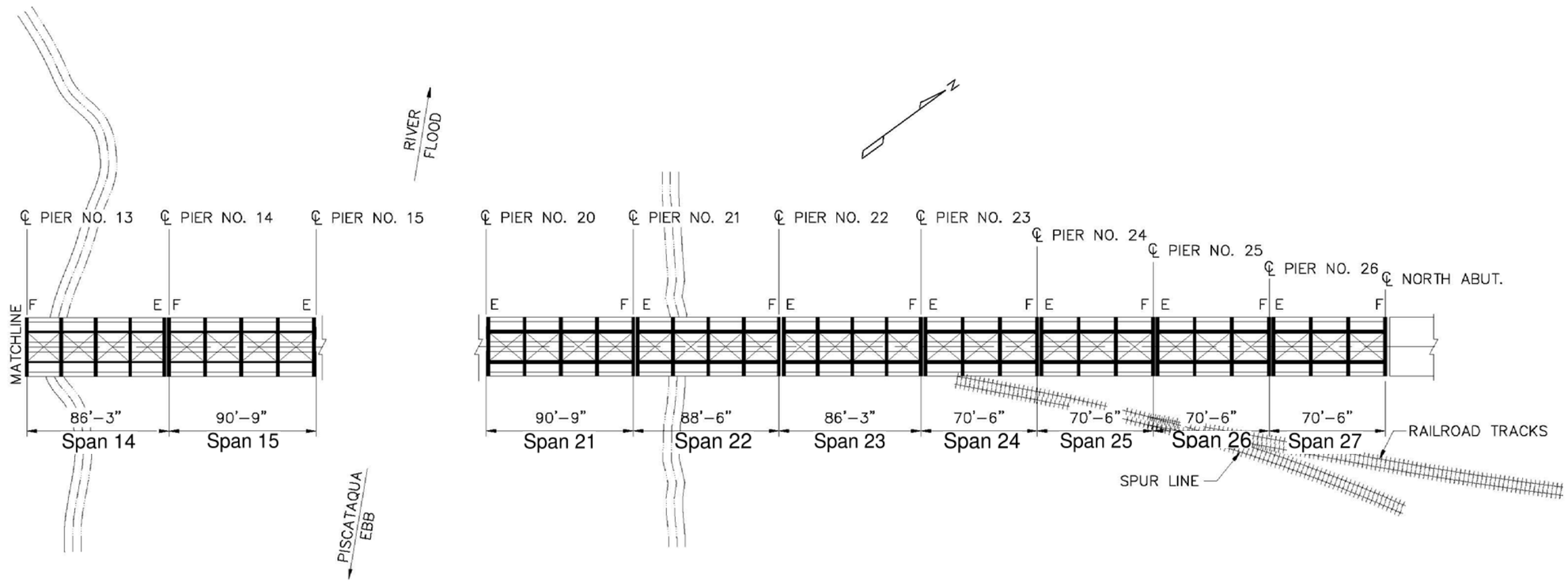
IDENTIFICATION OF FRACTURE CRITICAL MEMBERS – ROADWAY APPROACH SPANS 1-13



LEGEND:

E – EXPANSION JOINT
F – FIXED JOINT

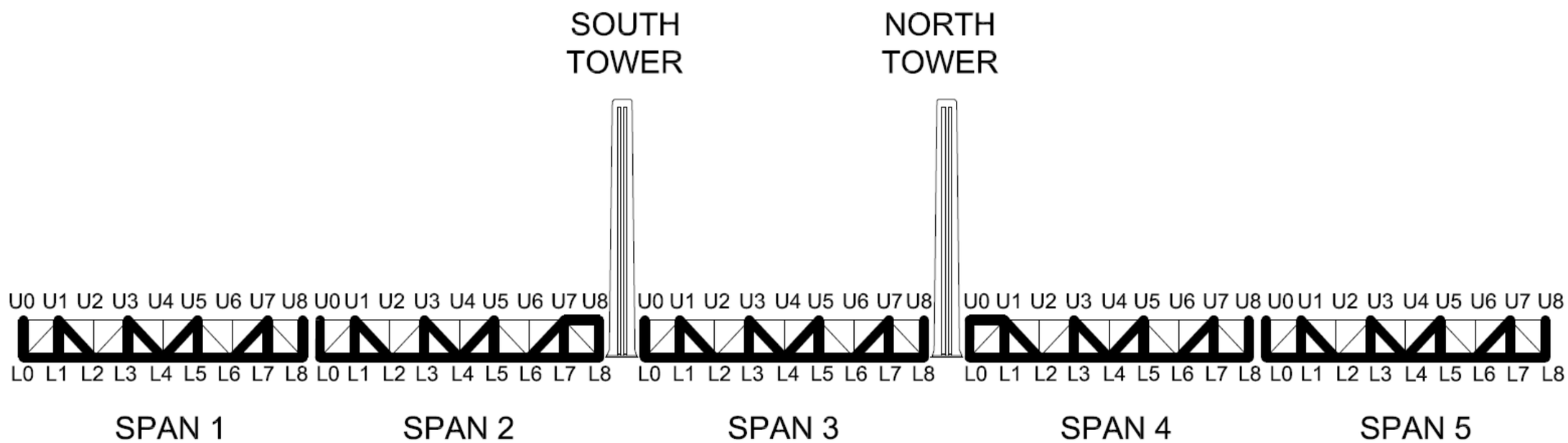
IDENTIFICATION OF FRACTURE CRITICAL MEMBERS – ROADWAY APPROACH SPANS 14, 15 AND 21-27



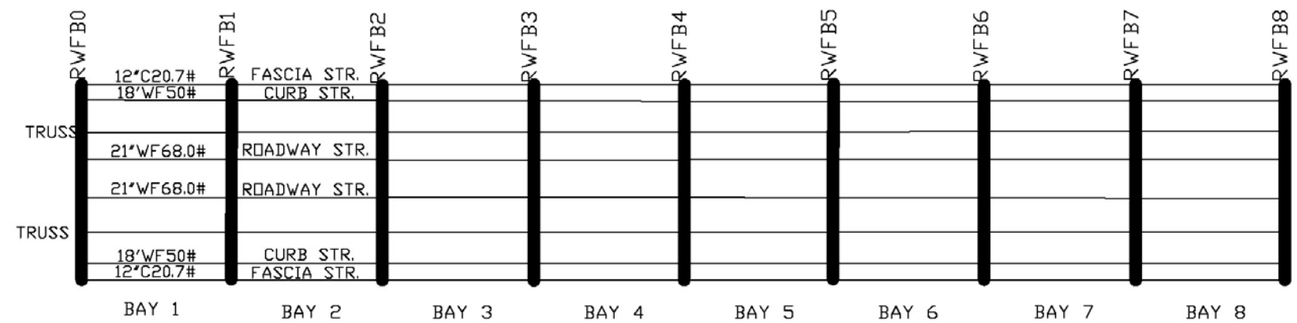
LEGEND:

E – EXPANSION JOINT
F – FIXED JOINT

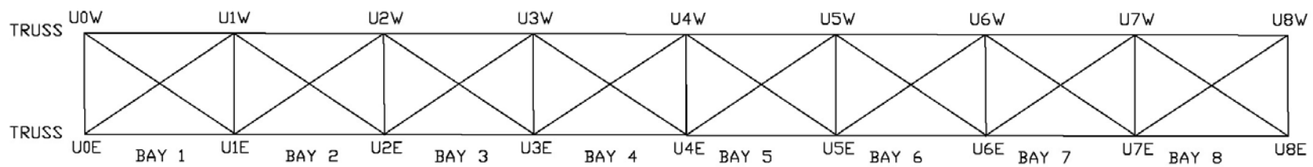
IDENTIFICATION OF FRACTURE CRITICAL MEMBERS – TRUSS ELEVATION



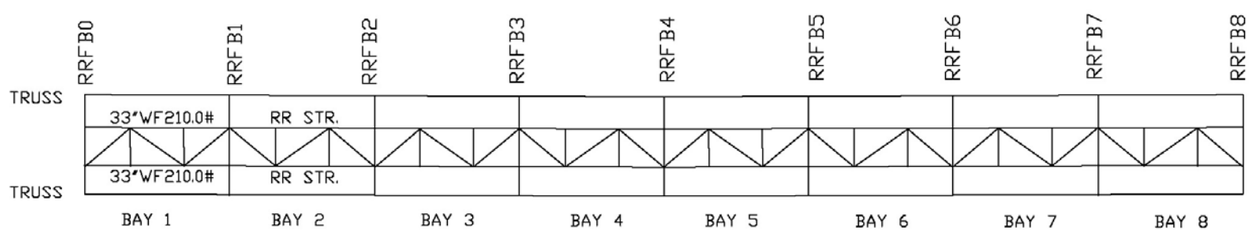
IDENTIFICATION OF FRACTURE CRITICAL MEMBERS – TRUSS FLOOR SYSTEM



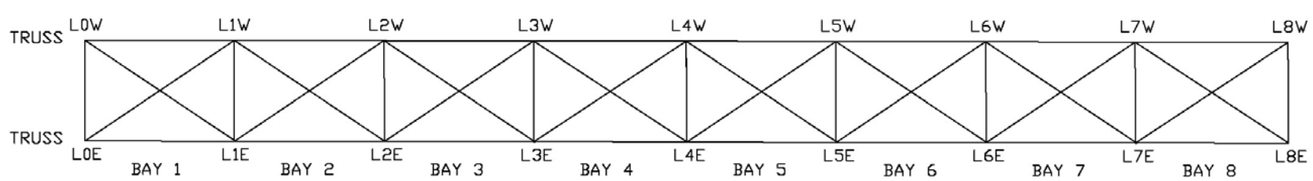
TOP DECK FLOOR SYSTEM



TOP LATERAL BRACING SYSTEM



BOTTOM DECK FLOOR SYSTEM



BOTTOM LATERAL BRACING SYSTEM

Fracture Critical Member

FRACTURE CRITICAL INSPECTION PROCEDURES

Steel Riveted Built-Up Floorbeams and Cross Girders:

1. Check all rivets and bolts to determine that they are tight and that the individual components are operating as one. Check for cracked or missing bolts, rivets and rivet heads

   Findings: Although rivet heads have section losses in some locations, all individual components are operating as one.

2. Check the member for misplaced holes or repaired holes that have been filled with weld metal. These are possible sources of fatigue cracking.

   Findings: On the lower floor system of the truss spans, there are drilled holes in the top flanges of floorbeams at midspan. No cracks were observed propagating from these holes.

3. Check the area around the floorbeam and lateral bracing connections for cracking in the web due to out-of-plane bending.

   Findings: No cracks were found in the webs due to out-of-plane bending.

4. Check the entire length of the tension flanges and web for cracking, which may have originated from corrosion, pitting, section loss, or defects in fabrication (e.g., nicks and gouges in the steel).

   Findings: There is some isolated corrosion, pitting and section loss on the floorbeam webs and tension flanges. No cracks propagating from corrosion were found.

5. Check the entire length of temporary erection welds, tack welds, welded connections not shown on the design drawings or other miscellaneous welds used in either construction or repair as these are possible sources of cracks.

   Findings: Welds were found on the Floorbeam Overhangs at the tie plates. No cracks propagating from welds were found.

Steel Riveted Truss and Tower Members:

1. Check each component to see that the loads are being evenly distributed between them by attempting to vibrate the member by hand, and that batten plates and lacing are tight.

   Findings: Although rivet heads have section losses in some locations, all individual components are operating as one.

2. Check carefully along the first row of rivets for cracking as the first row carries more load than succeeding rows. The first row is the row closest to the edge of the gusset plate and perpendicular to the axis of the member.

   Findings: No cracks were observed.

3. Check for nicks, gouges and tears due to the impact from passing vehicular or marine traffic. This type of damage can initiate future cracks.

   Findings: No nicks, gouges and tears were observed.

4. Observe carefully any tack welding used either in construction or repair as this is a potential source of cracks. Any tack welds should be flagged to the attention of the bridge engineer in the report for future observation and consideration in stress rating.

   Findings: There are several locations with welded connections, primarily utility connections to the bottom chord. No cracks were observed at repair welds.

5. If any misplaced holes or holes used for reconstruction have been plug welded, check carefully for fatigue cracks.

   Findings: There are numerous holes drilled for utility connections. These holes were covered by repair plates or by washers and bolts. No cracks were observed outside of the area covered by washers at the hole locations.

IDENTIFICATION OF FATIGUE SENSITIVE DETAILS (FSD)

FSD 4 - Base metal at details connected with full length fillet welds, with welds parallel to the direction of stress:

Welds connecting components of built-up truss bottom chord L5-L6 in truss span 1, which was replaced in April 2013.

FSD 14 - Base metal at details connected with transversely loaded welds, with the welds perpendicular to the direction of stress:

Vertical welds on truss bottom chords where electric conduit supports are welded.

FSD 17 - Base metal adjacent to details attached by longitudinally loaded fillet welds:

Horizontal welds on truss bottom chords where electric conduit supports are welded. Welds connecting the tie plate to the top flange of the Floorbeam Overhangs.

FSD 21 - Base metal at net section of riveted connections:

All fracture critical members.

FDS 21 – Base metal at net section of bolted connections:

Truss span 1 members replaced in April 2013:

- L5-L6, U5-L6 and L6-U6

Quantity of FSD Types: 5

Identification of Fatigue Sensitive Details (FSD)

General Condition	Situation	Detail Category	Illustrative Example; See Figure 6.6.1.2.3-1
Plain Members	Base metal:		1, 2
	• With rolled or cleaned surfaces; flame-cut edges with *AASHTO/AWS D1.5M/D1.5* (Section 3.2.2) smoothness of 1,000 μ-in. or less	A	
	• Of unpainted weathering steel, all grades, designed and detailed in accordance with FHWA (*1989*)	B	
	• At net section of eyebar heads and pin plates	E	
Builtup Members	Base metal and weld metal in components, without attachments, connected by:		3, 4, 5, 7
	• Continuous full-penetration groove welds with backing bars removed, or	B	
	• Continuous fillet welds parallel to the direction of applied stress	B	
	• Continuous full-penetration groove welds with backing bars in place, or	B′	
	• Continuous partial-penetration groove welds parallel to the direction of applied stress	B′	
	Base metal at ends of partial-length cover plates:		
	• With bolted slip-critical end connections	B	22
	• Narrower than the flange, with or without end welds, or wider than the flange with end welds		7
	○ flange thickness ≤0.8 in.	E	
	○ flange thickness >0.8 in.	E′	
	• Wider than the flange without end welds	E′	
Groove-Welded Splice Connections with Weld Soundness Established by NDT and All Required Grinding in the Direction of the Applied Stresses	Base metal and weld metal at full-penetration groove-welded splices:		
	• Of plates of similar cross-sections with welds ground flush	B	8, 10
	• With 2.0 ft. radius transitions in width with welds ground flush	B	13
	• With transitions in width or thickness with welds ground to provide slopes no steeper than 1.0 to 2.5		11, 12
	○ grades 100/100W base metal	B′	
	○ other base metal grades	B	
	• With or without transitions having slopes no greater than 1.0 to 2.5 when weld reinforcement is not removed	C	8, 10, 11, 12

From AASHTO LRFD Bridge Specifications, 4th Edition, Table 6.1.2.3-1

Identification of Fatigue Sensitive Details (FSD)

General Condition	Situation	Detail Category	Illustrative Example; See Figure 6.6.1.2.3-1
Longitudinally Loaded Groove-Welded Attachments	Base metal at details attached by full- or partial-penetration groove welds:		
	• When the detail length in the direction of applied stress is:		
	○ less than 2.0 in.	C	6, 15
	○ between 2.0 in. and 12 times the detail thickness, but less than 4.0 in.	D	15
	○ greater than either 12 times the detail thickness or 4.0 in.		
	—detail thickness <1.0 in.	E	15
	—detail thickness ≥1.0 in.	E′	15
	• With a transition radius with the end welds ground smooth, regardless of detail length:		16
	○ transition radius ≥24.0 in.	B	
	○ 24.0 in. > transition radius ≥ 6.0 in.	C	
	○ 6.0 in. > transition radius ≥ 2.0 in.	D	
	○ transition radius <2.0 in.	E	
	• With a transition radius with end welds not ground smooth	E	16
Transversely Loaded Groove-Welded Attachments with Weld Soundness Established by NDT and All Required grinding Transverse to the Direction of Stress	Base metal at detail attached by full-penetration groove welds with a transition radius:		16
	• With equal plate thickness and weld reinforcement removed:		
	○ transition radius ≥24.0 in.	B	
	○ 24.0 in. > transition radius ≥ 6.0 in.	C	
	○ 6.0 in. > transition radius ≥ 2.0 in.	D	
	○ transition radius <2.0 in.	E	
	• With equal plate thickness and weld reinforcement not removed:		
	○ transition radius ≥6.0 in.	C	
	○ 6.0 in. > transition radius ≥ 2.0 in.	D	
	○ transition radius <2.0 in.	E	
	• With unequal plate thickness and weld reinforcement removed:		
	○ transition radius ≥2.0 in.	D	
	○ transition radius <2.0 in.	E	
	• For any transition radius with unequal plate thickness and weld reinforcement not removed	E	
Fillet-Welded Connections with Welds Normal to the Direction of Stress	Base metal:		
	• At details other than transverse stiffener-to-flange or transverse stiffener-to-web connections	Lesser of C or Eq. 6.6.1.2.5-3	14
	• At the toe of transverse stiffener-to-flange and transverse stiffener-to-web welds	C′	6
Fillet-Welded Connections with Welds Normal and/or Parallel to the Direction of Stress	Shear stress on the weld throat Base metal at end of weld	E	9

From AASHTO LRFD Bridge Specifications, 4th Edition, Table 6.1.2.3-1

Identification of Fatigue Sensitive Details (FSD)

General Condition	Situation	Detail Category	Illustrative Example; See Figure 6.6.1.2.3-1
Longitudinally Loaded Fillet-Welded Attachments	Base metal at details attached by fillet welds:		
	• When the detail length in the direction of applied stress is:		
	○ less than 2.0 in. or stud-type shear connectors	C	15, 17, 18, 20
	○ between 2.0 in. and 12 times the detail thickness, but less than 4.0 in.	D	15, 17
	○ greater than either 12 times the detail thickness or 4.0 in.		7, 9, 15, 17
	—detail thickness <1.0 in.	E	
	—detail thickness ≥1.0 in.	E′	
	• With a transition radius with the end welds ground smooth, regardless of detail length		16
	○ transition radius ≥2.0 in.	D	
	○ transition radius <2.0 in.	E	
	• With a transition radius with end welds not ground smooth	E	16
Transversely Loaded Fillet-Welded Attachments with Welds Parallel to the Direction of Primary Stress	Base metal at details attached by fillet welds:		16
	• With a transition radius with end welds ground smooth:		
	○ transition radius ≥2.0 in.	D	
	○ transition radius <2.0 in.	E	
	• With any transition radius with end welds not ground smooth	E	
Mechanically Fastened Connections	Base metal:		21
	• At gross section of high-strength bolted slip-critical connections, except axially loaded joints in which out-of-plane bending is induced in connected materials	B	
	• At net section of high-strength bolted nonslip-critical connections	B	
	• At net section of riveted connections	D	
Eyebar or Pin Plates	Base metal at the net section of eyebar head, or pin plate	E	23, 24
	Base metal in the shank of eyebars, or through the gross section of pin plates with:		
	• Rolled or smoothly ground surfaces	A	23, 24
	• Flame-cut edges	B	23, 24

From AASHTO LRFD Bridge Specifications, 4th Edition, Table 6.1.2.3-1

Identification of Fatigue Sensitive Details (FSD)

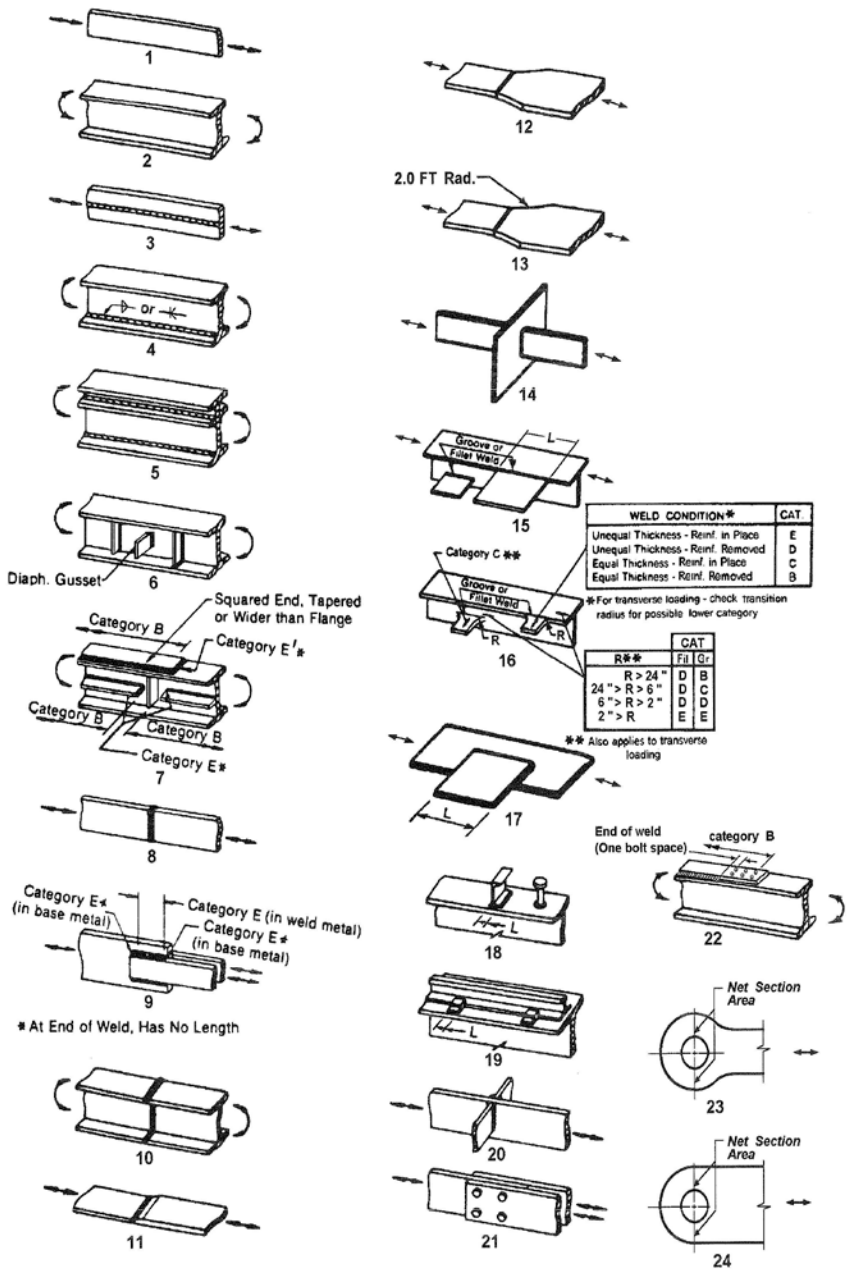


Figure 6.6.1.2.3-1 Illustrative Examples.

From AASHTO LRFD Bridge Specifications, 4th Edition, Table 6.1.2.3-1

RECOMMENDATIONS

General Inspection Recommendations:

Continued inspection at six (6) month intervals is recommended to monitor the bridge condition, update the load rating analysis and to provide repair recommendations to allow the 20 ton posting to remain in effect. The next interim structural inspection should occur in May 2014 and should include all safety curb fascia beams, curb stringers, end floorbeam and intermediate floorbeam cantilevers of roadway approach spans 1 to 15 and 21 to 27 and assess the level of deterioration and section loss as well as to supplement the current condition data and field measurements.

Repair Recommendations:

The repairs outlined in this section of the report are recommended to be completed due to the levels of advanced deterioration and the anticipated bridge replacement schedule. However, as a result of the bridge barrier system installed in front of the safety curb reducing the live loading on the curb stringers and floorbeam cantilevers, the repairs outlined do not need to be high priority.

Roadway Approach Spans 1 to 15 and 21 to 27 Safety Curb Fascia Beams:

The safety curb fascia beams are recommended for repair due to the level of deterioration and section loss observed during this structural inspection and previous interim structural inspections. Repairs similar to those made to the Span 14, Bay 2 and Span 15, Bay 3 easterly safety curb fascia beams repairs should be made to all members with holed webs and perforation at the channel flange and web interface. Refer to Appendix E for a list of recommended repair locations.

Roadway Approach Spans 1 to 15 and 21 to 27 Curb Stringers:

The following curb stringers with advanced top and bottom flange section loss are recommended for repair:

- Span 4, Bay 3, Stringer S4 – Top flange bolted angle repair (Recommended for repair in the May 2012 Interim Inspection Report). (Note: the bottom flange repair previously recommended is not required.)
- Span 6, Bay 3, Stringer S1 – Top flange bolted angle repair (Recommended for repair in the May 2012 Interim Inspection Report).
- Span 9, Bay 1, Stringer S4 – Bottom flange welded plate repair for a minimum repair length = 7'-0" centered about the scupper (Recommended for repair in the May 2012 Interim Inspection Report).
- Truss Span 2, Bay 8, Stringer S4 – Top flange bolted angle repair.
- Truss Span 4, Bay 1, Stringer S4 – Top flange bolted angle repair.

The bolted angle top flange and welded bottom flange cover plate repair details developed in February 2010 and supplemented via calculations e-mailed to the Department in August 2011

are recommended. Two 4”x4”x1/2” angles should be bolted near the top flange and a 3/8” thick welded cover plate should be added to the bottom flange when it is less than 3/8” thick.

The following curb stringers with holed webs are recommended for repair, due to the level of advanced deterioration, using the previously developed web repair details:

- Span 2, Bay 3, Stringer S4 (Recommended for repair in the May 2012 Interim Inspection Report).
- Span 7, Bay 3, Stringer S4 (Recommended for repair in the May 2012 Interim Inspection Report).
- Span 10, Bay 3, Stringer S4 (Recommended for repair in the May 2012 Interim Inspection Report).
- Truss Span 4, Bay 1, Stringer S4

Roadway Approach Spans 1 to 15 End Floorbeams:

As noted in this in-depth inspection report, the end floorbeam cantilevers remain in serious condition. Although previous rating calculations performed by Hoyle, Tanner yielded Operating Rating factors greater than 1, consideration for repair is warranted due to the extensive deterioration and section loss observed.

Railroad Deck:

Repair of the broken segment of the railroad track is recommended prior to trains crossing the bridge. Railroad deck ties where tie plates have fallen from the rail and ties where spikes have lifted from the top of tie should be replaced as soon as practical.

Repairs to the expansion joints at piers 1, 3, 5, 7, 9 and 11 are also recommended. These joints continue to leak which is accelerating the rate of deterioration and section loss of all end floorbeams and curb stringers adjacent to the joints.

Maintenance Recommendations:

The previous inspections identified deficient members that have required the bridge to be posted at 20 tons as well as members that needed to be repaired to allow the posting to remain in effect. The bridge is comprised of a large number of members that continue to deteriorate at widely varying rates which makes it difficult to predict and plan for needed repairs. Hoyle, Tanner will continue to monitor the approach spans through the interim inspections and make short and long-term repair recommendations to the Department as necessary to allow the bridge to remain in service with a 20 ton posting until it can be replaced. Short and long-term repair recommendations will need to be evaluated and revised after each interim inspection based on the observed conditions and updated load rating calculations. However, a posting of 15 tons or lower posting is a possibility depending upon the deterioration rate and future observations.

Appendix A

Inspection Forms

Bridge Inspection Report

Portsmouth 251/108

Date of Inspection: 11/05/2013
Date Report Sent: 12/26/2013
☑ Picture taken during inspection
Owner: Interstate Bridge Auth.

US 1 BYPASS
Over
PISCATAQUA RIVER,RR
Sarah M. Long Bridge

Bridge also in: Kittery , Maine

Closed after April 2013 ship impact, re-opened to vehicular traffic on 5/13/13.

Recommended Postings:

Weight: 'Weight Limit 20 Tons' ☑ Weight Sign OK
20-Ton posting implemented 7/10/2009.

Width: Not Required ☑ Width Sign OK

Primary Height Sign Recommendation: **14`-01"**
Optional Centerline Height Sign Rec: *None*
13'-11" NO SIGN AT N.E. - B/Y. 16'-5" AT N.W. - B/Y

Clearances: (Feet) Over: 16.08 Under: 16.70 Route: 16.08

☐ Height Signs OK

Condition: State Redlist
Deck: 4 Poor
Superstructure: 3 Serious
Substructure: 4 Poor
Culvert: N N/A (NBI)

Structure Type and Materials:
Number of Spans Main Unit: 5
Number of Approach Spans: 22

Main Span Material and Design Type
Steel Movable - Lift

Approach Span Material and Design Type
Steel Girder and Floorbeam

Sufficiency Rating: 3%
NBI Status: Structurally Deficient

Bridge Rail: Substandard
Rail Transition: Substandard
Bridge Approach Rail: Meets Standards
Approach Rail Ends: Substandard

NH Bridge Type: Vertical Lift
Deck Type: Concrete, Cast in Place
Wearing Surface: Monolithic Concrete
Membrane: None
Deck Protection: None
Pavement thickness: Not Applicable
Curb Reveal: 8.0 in
Plan Location: 2-14-1-1

Bridge Dimensions:

Length Maximum Span: 227.0 ft
Total Bridge Length: 2,804.0 ft
Left Curb/Sidewalk Width: 2.5 ft
Right Curb/Sidewalk Width: 2.5 ft
Width Curb to Curb: 27.6 ft
Total Bridge Width: 36.0 ft
Approach Roadway Width (W/ Shoulders): 32.0 ft
Median: No median
Bridge Skew: 0.00 °

Bridge Service:

Type of Service on Bridge: Highway and Railroad
Type of Service under: Hwy-waterway-RR
Lanes on bridge: 2
Lanes Under: 4
Year Built: 1940
Year Rebuilt: 1991
Detour Length: 8.0 mi

AADT: 14000 Percent Trucks: 5% Year of AADT: 2012
Future AADT: 20700 Year of Future AADT: 2032

Future AADT: 20720 Year of Future AADT: 2032

Federal or State Definition Bridge:	Fed. Definition Bridge
Roadway Functional Class:	Urban Expressway
New Hampshire Highway System and Class:	Turnpike, not Primary
Eligibility for the National Register of Historic Places:	Eligible (Historic)
Traffic Direction:	Two-way traffic

National Bridge Inventory (NBI) Appraisal Ratings:

Deck Geometry:	Intolerable, Correctable
Underclearances:	Above Min. Tolerable
Approach Alignment:	Equal Desirable Criteria
Structural Evaluation:	Intolerable, Replacement
Channel/Channel Protection:	Minor Damage
Waterway Adequacy:	Above Desirable Criteria
Bridge Scour Critical Status:	Stable for extreme flood
Riprap Condition:	Good Condition
Debris Present:	No Debris Present
Date of Underwater Inspection:	Sep. 2008

AASHTO CoRe Element Condition State Data:

No.	Description	Env.	Material Notes and Condition Notes
22	Concrete Deck - Protected with Rigid Overlay	Severe	*TOP OF DECK - FINE CRACKS CURB SPALLS WITH REBAR EXPOSED. PATCHED AREAS. DEPRESSED AREAS. SOME NEW PATCHES AT NORTH CURB.*
107	Painted Steel Beam or Girder (Open Web)	Severe	*HEAVILY RUSTED WITH SECTION LOSS AT JOINTS. WEST GIRDER HOLED AT PIER # 3 IN TWO AREAS. PACK RUST.*
113	Painted Steel Stringer	Severe	*FEW HOLES IN EXTERIORS. OTHERS RUSTED WITH SECTION LOSS. PLATED AREAS.*
121	Painted Steel Bottom Chord (Thru Truss)	Severe	*RUSTED WITH SECTION LOSS. BRACING HOLED.*
152	Painted Steel Floor Beam	Severe	*HEAVILY RUSTED AT JOINTS WITH SECTION LOSS.*
202	Painted Steel Column or Pile Extension	Severe	*RUSTED WITH SECTION LOSS.*
205	Reinforced Concrete Column or Pile Extension	Severe	*CRACKS, SPALLS AND REBAR EXPOSED.*

Bridge Inspection Report

Portsmouth 251/108

No.	Description	Env.	Material Notes and Condition Notes
210	Reinforced Concrete Pier Wall	Severe	*CRACKS, SPALLS, REBAR EXPOSED. DELAMINATIONS.*
215	Reinforced Concrete Abutment	Severe	*LIGHT CRACKS AND SPALLS. MEDIUM SPALL AT SOUTH EAST.*
302	Compression Joint Seal	Severe	*SOME REPAIR WORK COMPLETED. DAMAGED AND LEAKING. TIGHT.*
303	Modular Joint and Seal Assembly	Severe	*TRANSFLEX GLANDS INSTALLED. DAMAGED AND LEAKING.*
310	Elastomeric Bearing	Severe	*SOME DEFORMED.*
311	Moveable Bearing (roller, sliding, etc.)	Severe	*RUSTED AND SECTION LOSS. PACK RUST.*
334	Coated Metal Bridge Railing	Moderate	*** Steel Pipe Rail *** *SERIOUS CONDITION. HEAVILY RUSTED WITH SECTION LOSS. SEVERAL HOLED AREAS.*
357	Pack Rust Condition Warning Flag	Severe	*PACK RUST AT ANGLES AND PLATES.*
358	Deck Cracking Condition Warning Flag	Severe	*LIGHT TO MODERATE CRACKS IN AREAS.*
359	Soffit of Conc Deck or Slab Condition Warning Flag	Severe	*LARGE SPALLS AND REBAR EXPOSED. HEAVY LEAKING.*
363	Section Loss Condition Warning Flag	Severe	*HOLED AREAS.*

No.	Description	Env.	Quantity	Units	State 1	State 2	State 3	State 4	State 5
22	Concrete Deck - Protected with Rigid Ov	Severe	100,933	(SF)	0 %	0 %	100 %	0 %	0 %
107	Painted Steel Beam or Girder (Open We	Severe	16,824	(LF)	0 %	0 %	60 %	20 %	20 %
113	Painted Steel Stringer	Severe	16,824	(LF)	0 %	10 %	15 %	50 %	25 %
121	Painted Steel Bottom Chord (Thru Truss	Severe	5,607	(LF)	0 %	0 %	50 %	40 %	10 %
152	Painted Steel Floor Beam	Severe	2,917	(LF)	0 %	0 %	65 %	25 %	10 %
202	Painted Steel Column or Pile Extension	Severe	14	(EA)	0 %	0 %	70 %	25 %	5 %
205	Reinforced Concrete Column or Pile Ext	Severe	22	(EA)	0 %	60 %	30 %	10 %	
210	Reinforced Concrete Pier Wall	Severe	361	(LF)	0 %	50 %	50 %	0 %	
215	Reinforced Concrete Abutment	Severe	230	(LF)	0 %	50 %	50 %	0 %	

No.	Description	Env.	Quantity	Units	State 1	State 2	State 3	State 4	State 5
302	Compression Joint Seal	Severe	685	(LF)	40 %	40 %	20 %		
303	Modular Joint and Seal Assembly	Severe	289	(LF)	30 %	50 %	20 %		
310	Elastomeric Bearing	Severe	4	(EA)	90 %	10 %	0 %		
311	Moveable Bearing (roller, sliding, etc.)	Severe	56	(EA)	0 %	50 %	50 %		
334	Coated Metal Bridge Railing	Moderate	5,801	(LF)	0 %	0 %	0 %	50 %	50 %
357	Pack Rust Condition Warning Flag	Severe	1	(EA)	0 %	0 %	100 %	0 %	
358	Deck Cracking Condition Warning Flag	Severe	1	(EA)	0 %	100 %	0 %	0 %	
359	Soffit of Conc Deck or Slab Condition W	Severe	1	(EA)	0 %	0 %	0 %	100 %	0 %
363	Section Loss Condition Warning Flag	Severe	1	(EA)	0 %	0 %	100 %	0 %	

Bridge Notes:
Sarah Mildred Long Bridge (1987, Chapter 51:1)
ADDED TO STATE RED LIST 11/03.
LIFT INSPECTION 11/6/03; 7/15/05. 5/1/06 - 5/4/06 - 5/5/06, 8/7/07, 5/27-29/08
CWIP 11/3/08.
Special inspection event 07/10/2009 to implement 20-Ton posting following HDR inspection/rating.
SHIP ACCIDENT INSPECTION 4/1/13. SEE HTA'S IN DEPTH REPORT 11/2013.

Approach and Roadway Notes: *STEEL POST RAIL AND CHANNEL RUSTED AND HOLED. POOR CONDITION. MINOR DAMAGE. NEW W- BEAM TRASITION AND LIGHTWEIGHT GALVANIZED STEEL BARRIERS.*
ASPHALT - CRACKS AND SETTLED.POTHOLE, LARGE DEPRESSED AREA AT NORTH.

Inspection History:

Inspection Date: 11/05/2013 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:
KJT-MAS INSPECTION comments- SEE HTA'S IN DEPTH REPORT 11/2013.
DECK: FINE CRACKS AND MINOR SPALLS; REPAIRED AREAS. NEW DRAIN INSERTS IN SCUPPERS. CURB / SIDEWALK - CRACKS AND SPALLS WITH REBAR EXPOSED; REPAIRED AREAS. JOINTS - 2 FINGER JOINTS BROKEN, GLANDS DOWN AND DAMAGED, LEAKING. RAIL - NEW TEMPORARY LIGHTWEIGHT GALVANIZED STEEL BARRIERS; TUBE RAIL IS HEAVILY RUSTED AND HOLED. SOFFIT - LIGHT CRACKS, DELAMINATIONS AND LARGE SPALLS WITH REBAR EXPOSED. SIDEWALK AND RAIL LIFTED 3 FEET DUE TO SHIP ACCIDENT.
SUPERSTRUCTURE: PAINT - POOR CONDITION. HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRINGERS, FLOORBEAM'S AND GUSSET PLATES ARE HOLED. STAIRWAY HOLED IN AREAS, HEAVY SECTION LOSS. BOTTOM CHORD BENT 1 FOOT AT L5 AND L6. VERTICAL UPRIGHTS BENT 1 FOOT AT L5 AND L6.
SUBSTRUCTURE: SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RAIL ROAD SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES NOTED 3/29/2013. REPORTED TO BOBM 11/3/10. PIER 17 AND 18 CONCRETE DAMAGE FROM SHIP ACCIDENT.

PICTURES: C496.
13.HEIGHT SIGN MISSING AT NORTHEAST.
14.HEIGHT SIGN AT NORTHWEST.
15.NEW PATCHES AT NORTHEAST SIDEWALK ?.

Inspection Date: 11/05/2013 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:
NBG special comments-
SHIP IMPACT 4/1/2013 - CLOSED TO VEHICULAR TRAFFIC ON THIS DATE - DAMAGE TO MAIN TRUSS MEMBERS (TRUSS SPAN 1, EAST TRUSS, MEMBERS: L5L6, L6U7, L6U6, AND L6U5).

PICTURES: X001- 13 and 14

Inspection History:

Inspection Date: 09/18/2013 **Inspector:** JEL

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:
Underwater Inspection comments (per Stearns Engineering)-
Refer to Stearns Engineering underwater inspection for 9/17 & 18 2013

Inspection Date: 04/01/2013 **Inspector:** KJT

Deck: 3 Serious
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:
KJT inspection comments-
DECK: FINE CRACKS AND MINOR SPALLS; REPAIRED AREAS. NEW DRAIN INSERTS IN SCUPPERS. CURB / SIDEWALK - CRACKS AND SPALLS WITH REBAR EXPOSED; REPAIRED AREAS. JOINTS - 2 FINGER JOINTS BROKEN, GLANDS DOWN AND DAMAGED, LEAKING. RAIL - NEW TEMPORARY LIGHTWEIGHT GALVANIZED STEEL BARRIERS; TUBE RAIL IS HEAVILY RUSTED AND HOLED. SOFFIT - LIGHT CRACKS, DELAMINATIONS AND LARGE SPALLS WITH REBAR EXPOSED. SIDEWALK AND RAIL LIFTED 3 FEET DUE TO SHIP ACCIDENT.
SUPERSTRUCTURE: PAINT - POOR CONDITION. HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRINGERS, FLOORBEAMS AND GUSSET PLATES ARE HOLED. STAIRWAY HOLED IN AREAS, HEAVY SECTION LOSS. BOTTOM CHORD BENT 1 FOOT AT L5 AND L6. VERTICAL UPRIGHTS BENT 1 FOOT AT L5 AND L6.
SUBSTRUCTURE: SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RAIL ROAD SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES NOTED 3/29/2013. REPORTED TO BOBM 11/3/10. PIER 17 AND 18 CONCRETE DAMAGE FROM SHIP ACCIDENT.

PICTURES: C473.
45-68. SHIP ACCIDENT DAMAGE.

Inspection Date: 04/01/2013 **Inspector:** NBG

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:
NBG special comments-
SHIP IMPACT 4/1/2013 - CLOSED TO VEHICULAR TRAFFIC ON THIS DATE - DAMAGE TO MAIN TRUSS MEMBERS (TRUSS SPAN 1, EAST TRUSS, MEMBERS: L5L6, L6U7, L6U6, AND L6U5).

PICTURES: X001- 13 and 14

Inspection History:

Inspection Date: 03/29/2013 **Inspector:** MAS

Deck: 3 Serious
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

MAS - inspection comments-
DECK: FINE CRACKS AND MINOR SPALLS; REPAIRED AREAS. NEW DRAIN INSERTS IN SCUPPERS. CURB / SIDEWALK - CRACKS AND SPALLS WITH REBAR EXPOSED; REPAIRED AREAS. JOINTS - 2 FINGER JOINTS BROKEN, GLANDS DOWN AND DAMAGED, LEAKING. RAIL - NEW TEMPORARY LIGHTWEIGHT GALVANIZED STEEL BARRIERS; TUBE RAIL IS HEAVILY RUSTED AND HOLED. SOFFIT - LIGHT CRACKS, DELAMINATIONS AND LARGE SPALLS WITH REBAR EXPOSED.
SUPERSTRUCTURE: PAINT - POOR CONDITION. HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRINGERS, FLOORBEAMS AND GUSSET PLATES ARE HOLED. STAIRWAY HOLED IN AREAS, HEAVY SECTION LOSS.
SUBSTRUCTURE: SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RAIL ROAD SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES NOTED 3/29/2013. REPORTED TO BOBM 11/3/10.

PICTURES: C473-
37. SPAN FOR MEMORIAL BRIDGE, AS SEEN FROM SOUTH TOWER.
38. GUSSET PLATE REPAIR AT SOUTH TOWER.
39. SPALL AT END OF LIFT SPAN AT SOUTH END.
40. NEW DRAIN INSERTS AT SCUPPERS.
41. NEW LIGHTWEIGHT GALVANIZED STEEL BARRIERS
42. GLAND DOWN, DAMAGED.
43. C- CHANNEL HOLED AND THIN AT STAIRWAY.
44. GUSSET PLATE HOLED, HEAVY SECTION LOSS, TYPICAL OF SEVERAL.

Inspection Date: 11/21/2012 **Inspector:** KLM

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

KLM inspection comments-
CONCRETE DECK: LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS DAMAGED. CURB SPALLED AND REBAR EXPOSED. PIPE RAIL IN POOR CONDITION.
SUPERSTRUCTURE: BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRONGERS AND FLOORBEAMS HOLED.
SUBSTRUCTURE: CONCRETE PIER CAP AND COLUMN REPAIRS. SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES. REPORTED TO BOBM 11/3/10.

PICTURES: D105-
61. KNIFE EDGE ON BOTTOM FLANGE OF STAIRS, SMALL SPAN.
62. BOTTOM STEEL PLATES FOR NEW BARRIERS ON ROAD WAY.
63. COUNTER WEIGHTS ADDED DUE TO NEW BARRIERS ON LIFT SPAN.
64. NEW GAURD RAIL ON LIFT SPAN.

Inspection History:

Inspection Date: 03/21/2012 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

KJT inspection comments-
CONCRETE DECK: LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS DAMAGED. CURB SPALLED AND REBAR EXPOSED. PIPE RAIL IN POOR CONDITION.
SUPERSTRUCTURE: BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRONGERS AND FLOORBEAMS HOLED.
SUBSTRUCTURE: CONCRETE PIER CAP AND COLUMN REPAIRS. SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES. REPORTED TO BOBM 11/3/10.

PICTURES: C448.
17.BRIDGE RAIL POST HOLED TYPICAL OF SEVERAL.
18.GLAND DOWN AT EAST JOINT.
19.DECK SPALLED REBAR EXPOSED TYPICAL SEVERAL AREAS.

Inspection Date: 12/30/2011 **Inspector:** NBG

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

NBG office comments-
In-depth Inspection performed by HNTB (w/ Maine), completed 12/30/2011.
On 3/27/2013, the PDF files of the report were located at:
S:\Bridge-Design\PROJECTS\Active\PORTSMOUTH\15731\Inspections
File names: SML Inspection Report HNTB 123011 Vol1.pdf and SML Inspection Report HNTB 123011 Vol2.pdf

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Inspection Date: 12/05/2011 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

KJT inspection comments-
CONCRETE DECK: LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS DAMAGED. CURB SPALLED AND REBAR EXPOSED. PIPE RAIL IN POOR CONDITION.
SUPERSTRUCTURE: BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRONGERS AND FLOORBEAMS HOLED.
SUBSTRUCTURE: CONCRETE PIER CAP AND COLUMN REPAIRS. SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES. REPORTED TO BOBM 11/3/10.

PICTURES: C441-
43. NEW CURB PATCHES. TYPICAL OF SEVERAL AREAS.

Inspection History:

Inspection Date: 03/31/2011 **Inspector:** MHC

Deck: 4 Poor
Super: 3 Serious
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

DPC inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS DAMAGED. CURB SPALLED AND REBAR EXPOSED. PIPE RAIL IN POOR CONDITION.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST. STRONGERS AND FLOORBEAMS HOLED.
SUBSTRUCTURE- ELEMENTS IN POOR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS. SOME LARGE CRACKS AND SPALLS TO PIERS AND ABUTMENTS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES. REPORTED TO BOBM 11/3/10.

PICTURES:C427
80: DECK CRACKED, DEPRESSED, AND PATCHED TOPSIDE (TYPICAL OF SEVERAL AREAS).
81: FINGER JOINTS DAMAGED.
82: H-BEAM SUPPORTS AT RR SPAN ON LIFT TOWERS.
83: DECK SPALLED AND REBAR EXPOSED AT NORTH WEST LIFT SPAN.
84: DECK SPALLED AND REBAR EXPOSED AT SOUTH WEST LIFT SPAN.
85: PIER 2 AT SOUTH OVER RIVER SPALLED AND REBAR EXPOSED.

Inspection Date: 11/03/2010 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS REPAIRED. CURB SPALLED AND REBAR EXPOSED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. NOISE AT SOUTH WEST WHEEL FOR LIFT CABLES. REPORTED TO BOBM 11/3/10.

PICTURES: C424-
40: DECK CRACKED AND PATCHED.
41: CURB AT COMP SEAL SPALLED AND HOLED. REBAR EXPOSED. TYPICAL OF SEVERAL.

Inspection History:

Inspection Date: 03/31/2010 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

KJT- inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN. NOISE AT SOUTH EAST WHEEL FOR LIFT CABLES.

PICTURES: C413.
31.SOUTHEAST BRAKE OUT OF ADJUSTMENT.

Inspection Date: 11/10/2009 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

KJT- inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN. NOISE AT SOUTH EAST WHEEL FOR LIFT CABLES.

PICTURES: C407.
31.APPROACH POTHOLED AT SOUTH.
32.DECK CRACKED DELAMINATION PATCHED.
33.NEW POWER CHORD WHEEL FOR RAILROAD SPAN.

Inspection Date: 10/10/2009 **Inspector:** DEP

Deck: 4 Poor
Super: 3 Serious
Substr: 3 Serious
Culvert: N N/A (NBI)

Notes:

See HDR Report, inspection field work May and June, 2009. Inspection date set to intertwine with C-Team inspections.

Inspection History:

Inspection Date: 07/16/2009 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 3 Serious
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN SERIOUS (CHANGED FROM FAIR DURING HDR JUNE INSPECTION) CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN. NOISE AT SOUTH EAST WHEEL FOR LIFT CABLES.

PICTURES: C392.
8: SMALL LIFT RR SPAN CWIP.
9: NEW ELECTRIC UNIT AT NORTH EAST LIFT PIER.
10:PIER 2 SPALLED AT SOUTH EAST.

PICTURES: C399
#10: SOUTH TOWER EAST GIRDER UNDER RR SPAN TOP FLANGE HOLED AT SOUTH FLOOR BEAM,HEAVY RUSTING AND SECTION LOSS.
#11: CONNECTION PLATE HOLED AT SOUTH EAST GIRDER AT RR SPAN AT TOWER.
#12: SEVERAL RIVETS HAVE 100% SECTION LOSS AT RR SPAN SOUTH TOWER.
#13: CRIBBING UNDER SOUTH TOWER GIRDER. GIRDER IS 10 FEET LONG, FLANGES ARE 10 INCH BY 3/4 INCH. WEB IS 2 FEET HIGH.
#14: NORTH TOWER RR SPAN GIRDERS HAVE NO HOLES. HEAVY RUSTING AND SECTION LOSS.
#15: CRIBBING UNDER NORTH TOWER.

Inspection Date: 07/10/2009 **Inspector:** NBG

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN. NOISE AT SOUTH EAST WHEEL FOR LIFT CABLES.

PICTURES: C392.
8: SMALL LIFT RR SPAN CWIP.
9: NEW ELECTRIC UNIT AT NORTH EAST LIFT PIER.
10:PIER 2 SPALLED AT SOUTH EAST.

Inspection History:

Inspection Date: 06/30/2009 **Inspector:** NBG

Deck: 4 Poor
Super: 1 Closed - Failing
Substr: 4 Poor
Culvert: N N/A (NBI)

Notes:

U/W inspection comments (NBG)-
See Volume 2 of 2 of the December 2009 in-depth inspection and condition report (prepared by HDR and HTA, with underwater inspection services provided by Appledore Marine Engineering Inc.)

Inspection Date: 03/25/2009 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. DEPRESSED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN. NOISE AT SOUTH EAST WHEEL FOR LIFT CABLES.

PICTURES: C392.
8: SMALL LIFT RR SPAN CWIP.
9: NEW ELECTRIC UNIT AT NORTH EAST LIFT PIER.
10:PIER 2 SPALLED AT SOUTH EAST.

Inspection Date: 11/26/2008 **Inspector:** KJT

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN.

PICTURES: C386.
5. NEW MOTORS BOTH TOWERS.
6. NEW COUNTER INSTALLED ON CABLE WHEEL.
7. CWIP CABLE WHEELS BOTH TOWERS AT EAST.
8. NEW POWER CABLES.

Inspection History:

Inspection Date: 11/03/2008 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN.

PICTURES: C383
23: CWIP.

Inspection Date: 09/11/2008 **Inspector:** DMB

Deck: 4 Poor
Super: 3 Serious
Substr: 7 Good
Culvert: N N/A (NBI)

Notes:

DMB inspection comments- UNDERWATER INSPECTION OF PIER ELEMENTS ONLY. PIERS AND FOOTINGS IN GOOD CONDITION. ISOLATED AREAS ALONG THE TOP OF THE CONCRETE FOOTINGS EXHIBIT SOFT/BRITTLE SCALED CONCRETE. LEAD CAULKED MASONRY JOINTS IN GOOD CONDITION. OLD STEEL COFFERDAM MATERIAL HAS SEVERE CORROSION & SEVERE SECTION LOSS, BUT ARE NON-STRUCTURAL. MINOR SCOUR AT THE NOSE OF EACH PIER. 2 PIERS IN THE BACKWATER CHANNEL EACH HAVE HEAVY CORROSION OF THE STEEL ENCASEMENT AND ARE SPLIT AT CORNERS. LOOSE AGGREGATE APPEARS THRU SPLITS. BELOW THE STEEL THERE IS HEAVY SCALING/SPALLING EXPOSING SOME REINFORCEMENT. AVERAGE 3" TO 4" DEEP SPALLS ON FACE; MAX 12" DEEP ON CORNERS.

Inspection Date: 05/27/2008 **Inspector:** D. Coffey

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS. HEAVY PACK RUST.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. SOME LARGE CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN.

PICTURES: C371-
7. PIER #6; CWIP.
8. STEEL HOLED AT PIER #6.
9. DECK AND CURB SPALLED OVER EXTERIOR STRINGER AT WEST. TYPICAL OF SEVERAL AREAS.
10. DECK SPALLED AT LIFT SPAN. TYPICAL OF SEVERAL AREAS.
11. STEEL PLATES HOLED AND PLATED AND DEFORMED UNDER COMPRESSION SEAL JOINT AT ME. END OF RR SPAN.
12. IMPACT DAMAGE TO GIRDER AT NORTH EAST ME. END.
13. NEW ELECTRIC STATION AT ME. END UNDER BRIDGE.

Inspection History:

Inspection Date: 04/09/2008 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. SEVERAL EXPANSION JOINTS DAMAGED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN. NOT ABLE TO MAKE LIFT 4/8/08 AT 3:AM. YATES ELECTRIC MAKING REPAIRS 4/9/08.

PICTURES: C368-
7 - JOINT DAMAGED AT SOUTH.
8 - CURB SPALLED WITH REBAR EXPOSED AT SOUTH WEST.

Inspection Date: 11/28/2007 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

DPC - inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. PATCHED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE HAS HEAVY SECTION LOSS AND HOLED AREAS.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS. CRACKS AND SPALLS.
LIFT MOTOR AT SOUTH VIBRATING BRIDGE AT 7' HEIGHT TO 15' HEIGHT 11/28/07. BUILDING VIBRATING. HEAVY DETERIORATION OF LIFT BUILDING AT BOTTOM. SEVERAL TIMBERS ON RR SPAN HAVE HEAVY DECAY AND ARE CRUSHING. STEEL RR TRACK LIFTING 2" AT NORTH WEST LIFT SPAN.

PICTURES: C330-16 THRU 22.

Inspection Date: 08/07/2007 **Inspector:** RLM

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

RLM inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- LIGHT CRACKS AND SPALLS. PATCHED AREAS.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. AREAS OF STRAPING HOLED ON LOWER CHORD, SOUTH OF LIFT SPAN. NEW LIMIT SWITCH ON RR SPAN. MOTORS REPAIRED ON RR SPAN. STRINGER SOUTH OF LIFT SPAN IS HOLED THROUGH TOP FLANGE AT NORTH END. MOTORS REBUILT AT NORTH AND SOUTH TOWERS 11/06. SOUTH APPROACH, EAST EXTERIOR CHANNEL HOLED THROUGH WEB, OVER WATERWAY CHANNEL.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION.

PIC(S): C354- 15- 26. PIC(S): C355- 1- 9.

Inspection History:

Inspection Date: 11/16/2006 **Inspector:** RLM

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

RLM inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN AREAS WITH REBAR EXPOSED AND RUSTING, UNDERSIDE. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS . PATCHED AREAS. MANY EXPANSION JOINTS REPAIRED.
SUPERSTRUCTURE- ELEMENTS IN SERIOUS CONDITION. BRIDGE IS IN UP POSITION DUE TOO FAILED UNDERWATER POWER CABLE. REPAIRS IN PROGRESS.
SUBSTRUCTURE- ELEMENTS IN FAIR CONDITION. CONCRETE PIER CAP AND COLUMN REPAIRS IN PROGRESS.

PIC(S): C330- 16- 22.

Inspection Date: 07/11/2006 **Inspector:** DEP

Deck: 4 Poor
Super: 6 Satisfactory
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

Bogus for Pontis and Oracle review
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. DEPRESSED AREAS. CWIP.
CURBS- LIGHT CRACKS AND SPALLS WITH REBAR EXPOSED. REPAIRED AREAS.
30" CONCRETE SIDEWALK- FINE CRACKS AND MINOR SPALLS. REPAIRED AREAS.
DRAINS- STEEL IN POOR CONDITION. POLE LIGHTS- MOUNTS RUSTED. JOINT LEAKAGE HEAVY. EXPANSION DEVICE- FINGER JOINTS- FINGERS MISSING, BROKEN AND CRACKED WELDS. COMPRESSION SEALS DAMAGED AND LEAKING. G.T. SEALS DAMAGED, LEAKING AND HOLED.
SUPERSTRUCTURE- ELEMENTS IN FAIR CONDITION. ROCKERS AND ELASTOMERIC- RUSTED WITH SECTION LOSS.
STRINGERS- FEW HOLES IN EXTERIORS. OTHERS RUSTED WITH SECTION LOSS. GIRDERS- HEAVILY RUSTED WITH SECTION LOSS AT JOINTS. WEST GIRDER HOLED AT PIER #3 IN TWO AREAS. FLOOR BEAMS- HEAVILY RUSTED AT JOINTS WITH SECTION LOSS. TRUSSES- RUSTED WITH SECTION LOSS. BATTEN PLATES HOLED IN SEVERAL AREAS. SIDEWALK SUPPORT CHANNELS- HOLED IN SEVERAL AREAS. LATERAL BRACING- RUSTED. CRACKED WELDS AT RR SPAN. STEEL COLUMNS RUSTED WITH SECTION LOSS AND LARGE HOLES THROUGH WEBS. HEAVY SECTION LOSS ON BOLTS. ONE HOLED AT SOUTH WEST RR SPAN AND CRACKED WELD. CONCRETE PIERS AND CAPS HEAVILY CRACKED AND SPALLED. LIFT MACHINERY APPEARS OK. MINOR PROBLEMS. RR SHORT SPAN APPEARS OK. LIFT BUILDING IN FAIR CONDITION. WATER PROBLEM. SMALL RR SPAN OPEN THIS DATE.

PICTURE: C268-01.

Inspection Date: 05/01/2006 **Inspector:** DPC

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

Sufficiency Rating Calculation Accepted by DEP at 7/11/2006 08:21:46
DPC inspection comments-
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FIN

Inspection Date: 04/03/2006 **Inspector:** RLM

Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:

RLM inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. DEPRESSED AREAS.
CURBS- LIGHT CRACKS AND

Inspection History:

Inspection Date: 11/29/2005 **Inspector:** DPC
Deck: 5 Fair
Super: 6 Satisfactory
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. DEPRESSED AREAS. CWIP. CURBS- LIGHT CRACKS

Inspection Date: 07/15/2005 **Inspector:** DPC
Deck: 4 Poor
Super: 5 Fair
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:
Sufficiency Rating Calculation Accepted by DEP at 03/02/2006 09:35:53
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK-

---

Inspection Date: 10/28/2004 **Inspector:** DPC
Deck: 4 Poor
Super: 5 Fair
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. DEPRESSED AREAS. CURBS- LIGHT CRACKS AND SP

Inspection Date: 11/06/2003 **Inspector:** DPC
Deck: 4 Poor
Super: 5 Fair
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:
Sufficiency Rating Calculation Accepted by DEP at 6/2/2004 14:03:55
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FI

Inspection Date: 10/30/2003 **Inspector:** DPC
Deck: 4 Poor
Super: 3 Serious
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN FAIR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED EXPOSED AND RUSTING. TOP OF DECK- FINE CRACKS MINOR SPALLS. CURBS- LIGHT CRACKS AND MINOR SPALLS. REPAIRED ARE

Inspection Date: 05/10/2001 **Inspector:** D. Coffey
Deck: 4 Poor
Super: 5 Fair
Substr: 5 Fair
Culvert: N N/A (NBI)

Notes:
DPC inspection comments -
CONCRETE DECK- ELEMENTS IN POOR CONDITION. LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED AND RUSTING. HEAVY LEAKING. TOP OF DECK- FINE CRACKS MINOR SPALLS. DEPRESSED AREAS. CWIP. CURBS- LIGHT CRACK

Inspection Date: 09/29/1999 **Inspector:** DPC
Deck: 5 Fair
Super: 6 Satisfactory
Substr: 6 Satisfactory
Culvert: N N/A (NBI)

Notes:
Sufficiency Rating Calculation Accepted by DEP at 07-06-2000 15:21:33
DPC inspection comments - LIFT INSPECTION START 9/29/99 END 10/6/99.
CONCRETE DECK - LIGHT CRACKS AND MODERATE SPALLS IN SEVERAL AREAS WITH REBAR EXPOSED EXPOSED AND RUSTING. TOP OF

Inspection Date: 05/01/1997 **Inspector:** Not Available
Deck: 6 Satisfactory
Super: 6 Satisfactory
Substr: 7 Good
Culvert: N N/A (NBI)

Notes:
Sufficiency Rating Calculation Accepted by DEP at 12-23-98 08:11:39

Bridge Inspection Report

Portsmouth 251/108

Inspection History:

Inspection Date: 06/01/1995 **Inspector:** Not Available
Notes:
Deck: 6 Satisfactory
Super: 6 Satisfactory
Substr: 7 Good
Culvert: N N/A (NBI)

Inspection Date: 11/01/1993 **Inspector:** Not Available
Notes:
Deck: 6 Satisfactory
Super: 7 Good
Substr: 7 Good
Culvert: N N/A (NBI)

Inspection Date: 09/01/1991 **Inspector:** Not Available
Notes:
Deck: 6 Satisfactory
Super: 7 Good
Substr: 7 Good
Culvert: N N/A (NBI)

Bridge Lighting and Utilities: *POLE LIGHTS APPEAR OK. NAV LIGHTS OK.*
Traffic Sign Notes: *OK.*
Traffic Sign Mounts: *OK.*

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- [ ] Bureau of Turnpikes
- [x] Border State
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- [ ] Railroad
- [ ] Dept. of Res. and Econ. Dev.
- [ ] Dept. of Environmental Services
- [ ] USDA Forest Service
- [ ] Bureau of Traffic

Appendix B

Photos

Section 0:

Bridge General Pictures

Photo 0-1: West Elevation

Photo 0-2: East Elevation

Photo 0-3: East Elevation of Tower Span

Photo 0-4: East Waterway Approach

Photo 0-6: West Waterway Approach

Photo 0-7: Bridge Posting Sign (North Approach)

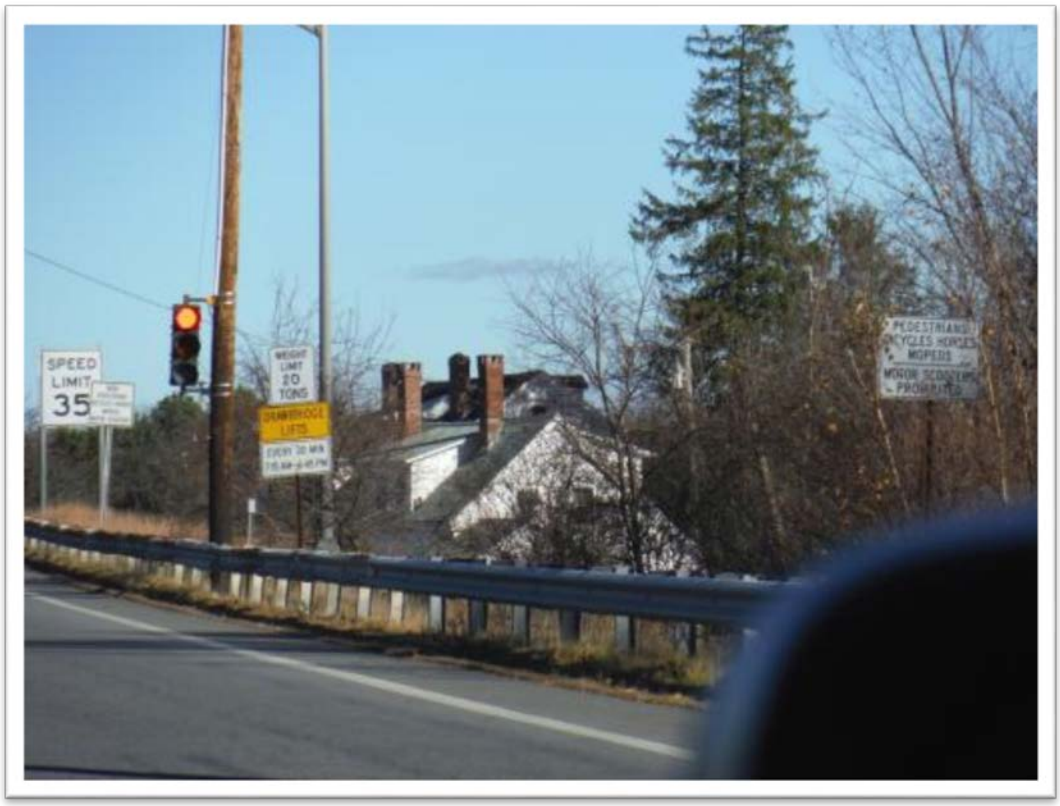

Photo 0-8: Bridge Posting Sign (South Approach)

Photo 0-9: Bridge Posting Sign (Far South Approach)

Photo 0-10: Railroad South Approach

Photo 0-11: Railroad Deck (At Pier 13 – Looking North)

Photo 0-11: Railroad North Approach

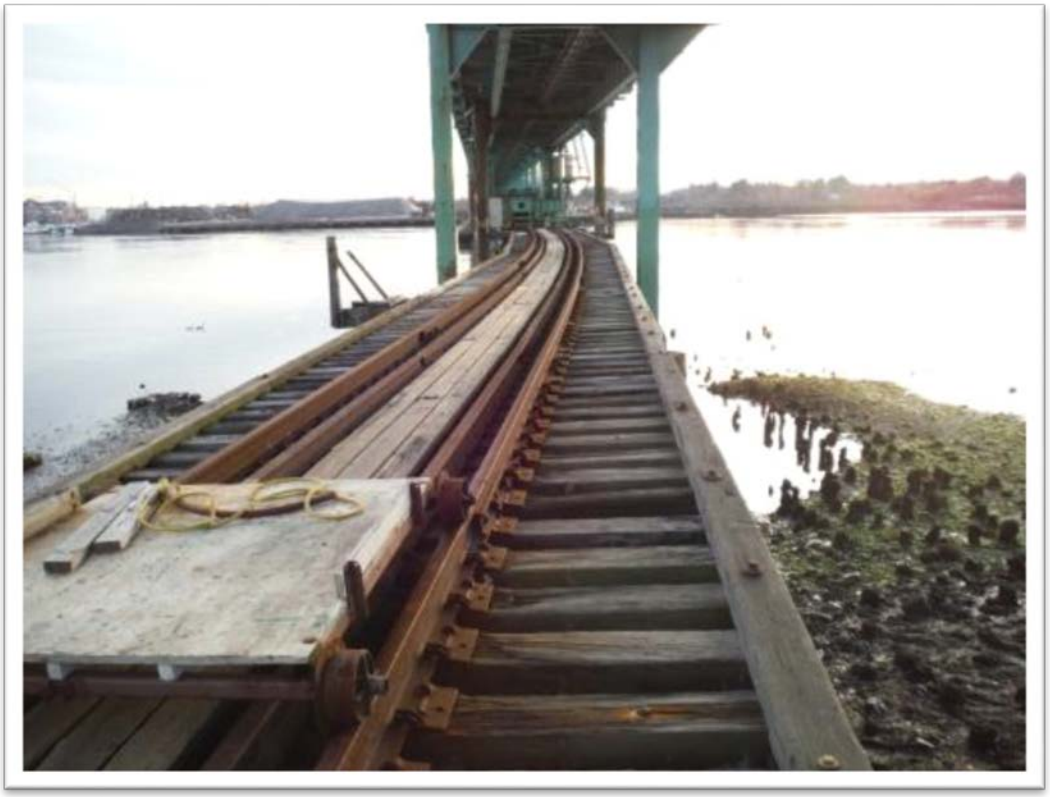

Photo 0-12: Railroad Deck (At Pier 23 – Looking South)

Section I:

Superstructure and Deck - Roadway Approach Spans

Photo I-1 – Deck Soffit Spall With Exposed Reinforcement

Photo I-2 – Typical Safety Curb Spall at Curb Stringer

Photo I-3 – NH Approach Span Expansion Joint Typical Deterioration

Photo I-4 – Pier 15 Expansion Joint Seal Hanging Below the Bridge Deck

Photo I-5– Hole in Expansion Joint Steel at Pier 16 (West Safety Curb)

Photo I-6 – Typical NH Approach Span Girder Deterioration at Fixed Bearing

Photo I-7– Typical NH Span Girder Deterioration at Expansion Bearing

Photo I-8– Span 13 West Girder Hinge Seat Bottom Flange

Photo I-9 – Spans 13 and 14 West Girder Hinge Seat

Photo I-10 – Spans 24 and 25 West Girder Hinge Seat

Photo I-11– Span 26 West Girder Hinge Seat Bottom Flange

Photo I-12– Span 6 Safety Curb East Fascia Beam at Floorbeam FB1 Rail Post

Photo I-13 – Span 24 Safety Curb West Fascia Beam at Floorbeam FB2 Rail Post

Photo I-14– Span 8, Bay 1, West Luminaire at Floorbeam FB0 Rail Post Missing Bolt

Photo I-15– Span 9, Bay 3, West Fascia Beam and Ancillary Structure Support Deterioration

Photo I-16– Gate Support Structure Connection at Pier 10

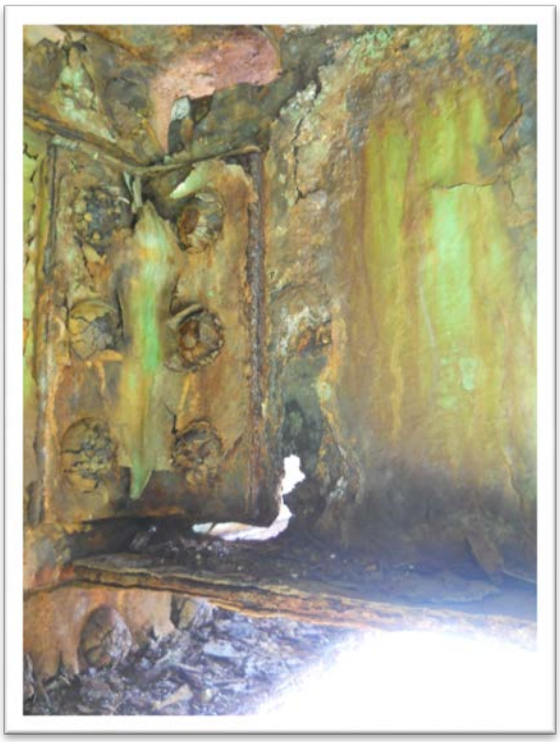

Photo I-17– Curb Stringer S4 (East), Span 2, Bay 3

Photo I-18– Curb Stringer S4 (East), Span 7, Bay 3

Photo I-19 – Curb Stringer S4 (East), Truss Span 2, Bay 8

Photo I-20 – Curb Stringer S4 (East), Truss Span 4, Bay 1

Photo I-21 – Floorbeam 3, Span 2, West Cantilever Top Flange Angle Section Loss

Photo I-22 – Floorbeam 3, Span 2, Top Flange Angle Section Loss at Roadway Stringer S2

Photo I-23 – Floorbeam 0, Span 6, West Cantilever Bottom Flange Angle Section Loss

Photo I-24 – Floorbeam 3, Span 6, Bottom Flange Section Loss at Pier Support

Photo I-25 – Floorbeam 3, Span 6, Bottom Flange Hole at End of Repair Plate
(Near Roadway Stringer S3)

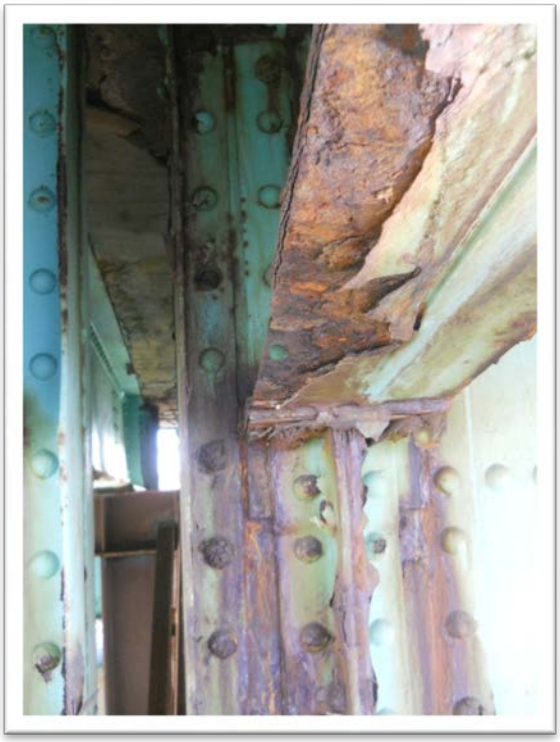

Photo I-26 – Floorbeam 3, Span 8, West Cantilever Bottom Flange Angle Section Loss

Photo I-27 – Floorbeam 3, Span 8, East Cantilever Top Flange Angle Section Loss

Photo I-28 – Floorbeam 3, Span 9, West Cantilever Bottom Flange Angle Section Loss

Photo I-30 – Floorbeam 3, Span 10, West Cantilever Bottom Flange Angle Section Loss

Photo I-31 – Floorbeam 3, Span 10, East Cantilever Bottom Flange Angle Hole

Photo I-32 – Floorbeam 8, Truss Span 2, East Cantilever Top and Bottom Flange Angle Section Loss

Photo I-33 – Floorbeam 0, Truss Span 4, East Cantilever Top Flange Angle Section Loss

Photo I-34 – Floorbeam 8, Truss Span 5, Bottom Flange Bolt Nut Loss

Section II:

Superstructure, Deck and Towers - Truss Spans

Photo II-1: Truss Span 2, Bay 3, East Side. Laminar corrosion on bottom flange of stringer at drain. Condition typical of overhang stringers at metal downspouts. Knife edging on bottom flange at downspout up to 100% section loss on scupper. Metal downspout replaced with PVC downspout.

Photo II-2: April 2013 Impact Damage to Sidewalk Fascia Channel, Decking, Railing, and Sidewalk Stringer.

Photo II-3: Catwalk Support (West of Span 5). Laminar corrosion and section loss to top flange at catwalk and corrosion hole and laminar corrosion to connection angle.

Photo II-4: Truss Span 2, Floorbeam Overhang at West Railing Support. Laminar corrosion on the top flange of the Floorbeam Overhang at the end, as well as rust and corrosion on the C-shaped Fascia Stringer. Condition typical of Floorbeam Overhang ends.

Photo II-5: Truss Span 2, West Side. Operator House Overhang.

Photo II-6: Truss Span 3, Bay 7, West Side. Spalls on deck underside at I-shaped Overhang Stringer with exposed and broken rebar. Spall is up to 2” deep.

Photo II-7: Truss Span 5, Bay 3, East Side. Large spall in deck underside with exposed rebar. Spall is approximately 6' wide' x 6' long x 2" deep.

Photo II-8: Truss Span 5, West 8, East Side. Previously patched spall in deck underside near connection of the Top Chord and Floorbeam Overhang.

Photo II- 9: Sidewalk stringer, surface rusting and up to 1/16" section loss to top flange and bottom flange away from scupper. Efflorescence in concrete. Taken at Span 5, West Side.

Photo II-10: Truss Span 4, Light Pole Support. Laminar corrosion and surface rusting. (West Side Shown)

Photo II-11: Truss Span 4, Lift Gate Arm Support at Floorbeam Overhang 3, West Side. Members at the joint between the sidewalk deck and barricade support deck exhibit surface rust.

Photo II-12: Truss Span 2, Floorbeam Overhang 5, East Side. Laminar corrosion at end of Floorbeam Overhang top flange underneath the Barricade Support. There is a corrosion hole on the end stiffener.

Photo II-13: Truss Span 4, Bottom Chord L1-L2 East. Fascia and top side of bottom chords. Typical condition shown. Laminar Corrosion, Surface Rusting, and Up to 1/16" Section Loss on the Top Flanges.

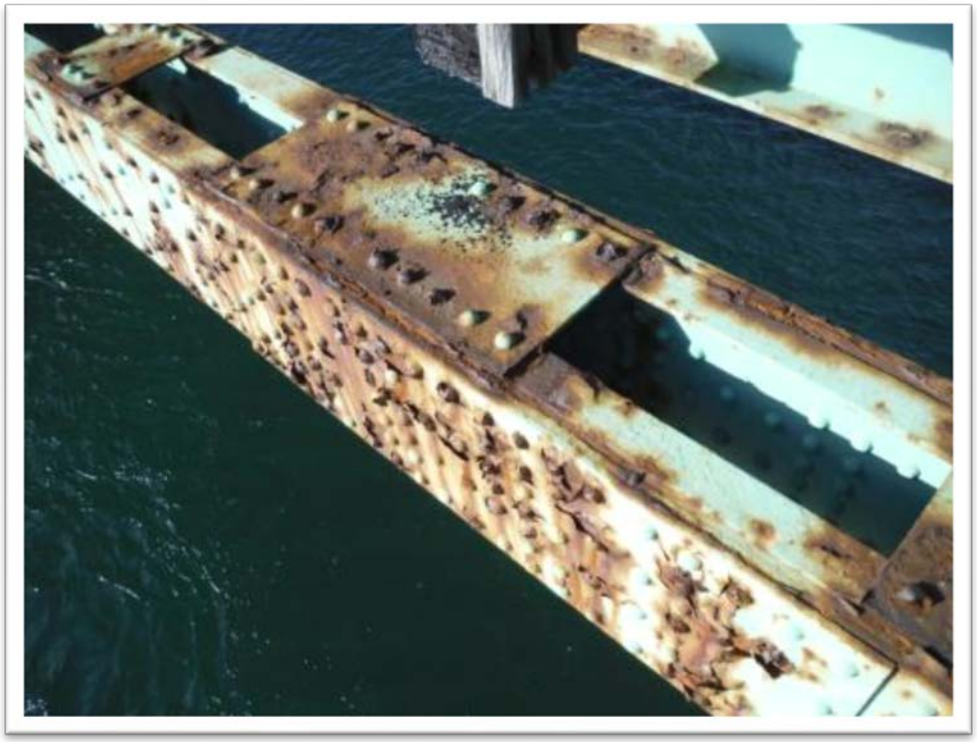

Photo II-14 : Truss Span 2, Bottom Chord L3-L4 East. Fascia side of Bottom Chord. Typical truss web and flange condition shown. There is surface rust and some laminar corrosion on the batten plate.

Photo II-15: Truss Span 2, Joint L2 East. Interior of Bottom Chord at joint. Vertical web and splice plate shown in back of photo. Conditions typical of interior of bottom chord at joints. Debris and laminar corrosion typical to top and bottom of bottom flange. Inaccessible, estimate 1/8" section loss.

Photo II-16: Truss Span 3, Bottom Chord L3-L4 West. Surface rust with bleeding and laminar corrosion on exterior web.

Photos II-17 and II-18: Truss Span 3, Bottom Chord L3-L4 West. Welded utility connection to bottom chord. Surface rust on top flange and web. Heavy corrosion on rivet head.

Photo II-19: Inside of Truss Span 5, Bottom Chord L3-L4 West. Laminar corrosion on the bottom chord member and batten plates over the full length.

Photo II-20: Top flange of Truss Span 5 Bottom Chord L2-L3 East. Typical laminar corrosion at top flange splice plates and batten plates.

Photo II-21: Truss Span 3, Bottom Chord L0-L1 West. Heavy laminar corrosion and 100% section loss to lacing. (Top and Bottom)

Photo II-22: Truss Span 3, Top Chord L0-U1 East. Pack rust with prying between the bottom flange and the splice plate. Condition occurs on several top chord members.

Photo II-23: Truss Span 4, Top Chord U0-U1 East. Pack rust with prying between the bottom flange and web.

Photo II-24: Truss Span 1, Gusset Plage U1 East. Random surface rusting.

Photo II-25: Truss Span 2, Top Chord U0-U1 East. Surface rust on top flange and bottom flange. Typical top chord condition.

Photo II-26: Truss Span 3, Top Chord U0-U1 at Joint U1. Pack rust between splice plate and exterior web causing prying.

Photo II-27: Truss Span 4, Diagonal L8-U7 West. Laminar corrosion on exterior web of Diagonal. All diagonals at span ends in similar, but less severe, condition.

Photo II-28: Truss Span 1, Diagonal L8-U7 West. Heavily deteriorated batten plate with corrosion hole at Joint L8.

Photo II-29: Truss Span 1, Bottom Chord L0-L1 East. Surface rust and section loss (up to 1/16") to flanges. Condition typical of bottom chords.

Photo II-30: Truss Span 3, Diagonal L0-U1 West. Laminar corrosion and section loss to the lacing on a diagonal, with corrosion hole (1/2" diameter hole, 4ft from L0).

Photo II-31: Truss Span 3, West, Vertical L3-U3 at Joint L3. Laminar corrosion, 1/16” section loss, 4” length of pack rust and 1/2" prying.

Photo II-32: Truss Span 5, Vertical L4-U4. 3” wide by 1” high corrosion hole in exterior web at Joint L4. Area within ½” of corrosion hole has up to 50% section loss. Corrosion hole unchanged from 2008 inspection.

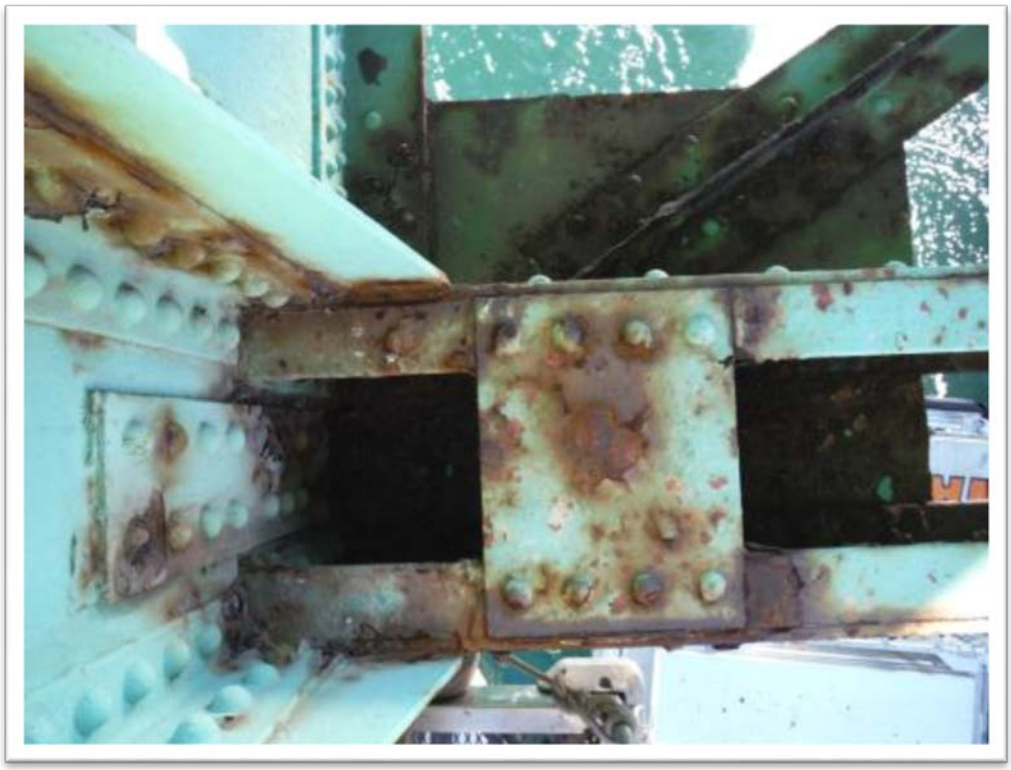

Photo II-33: Truss Span 2, Vertical L1-U1 West. Pack rust between batten plates, vertical connection plate. Heavy laminar corrosion to flanges of vertical and bottom chord.

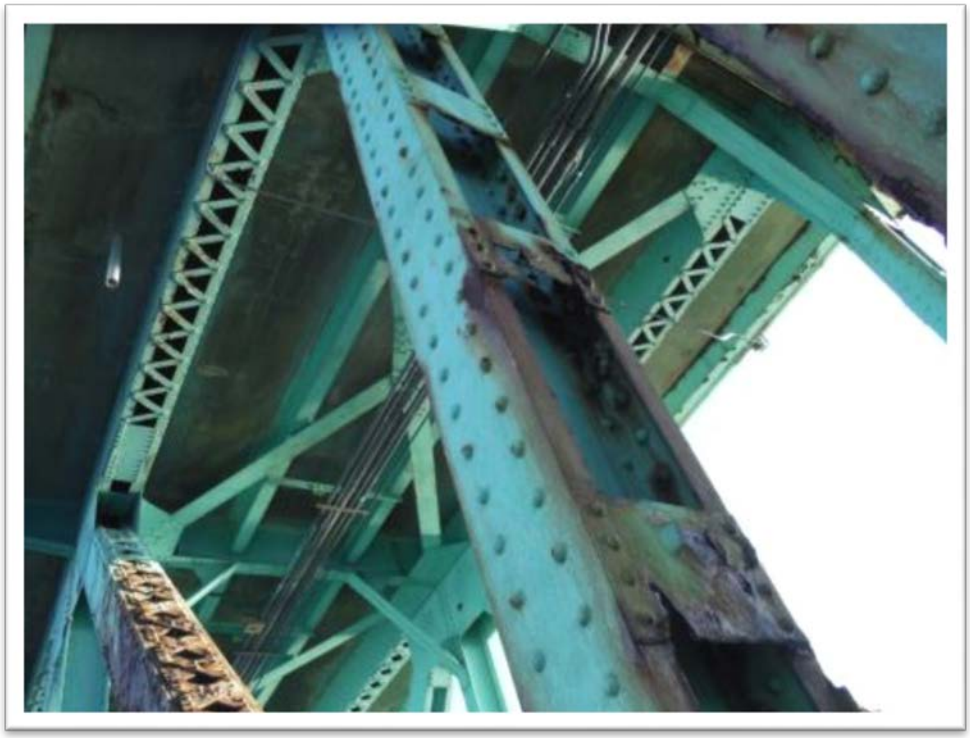

Photo II-34: Truss Span 2, Vertical L0-U0 West. Laminar corrosion to flanges and corrosion holes up to 2” in diameter to batten plates.

Photo II-35: Truss Span 1, Bottom Chord L5-L6 East. Repaired bottom chord following January 2013 Impact.

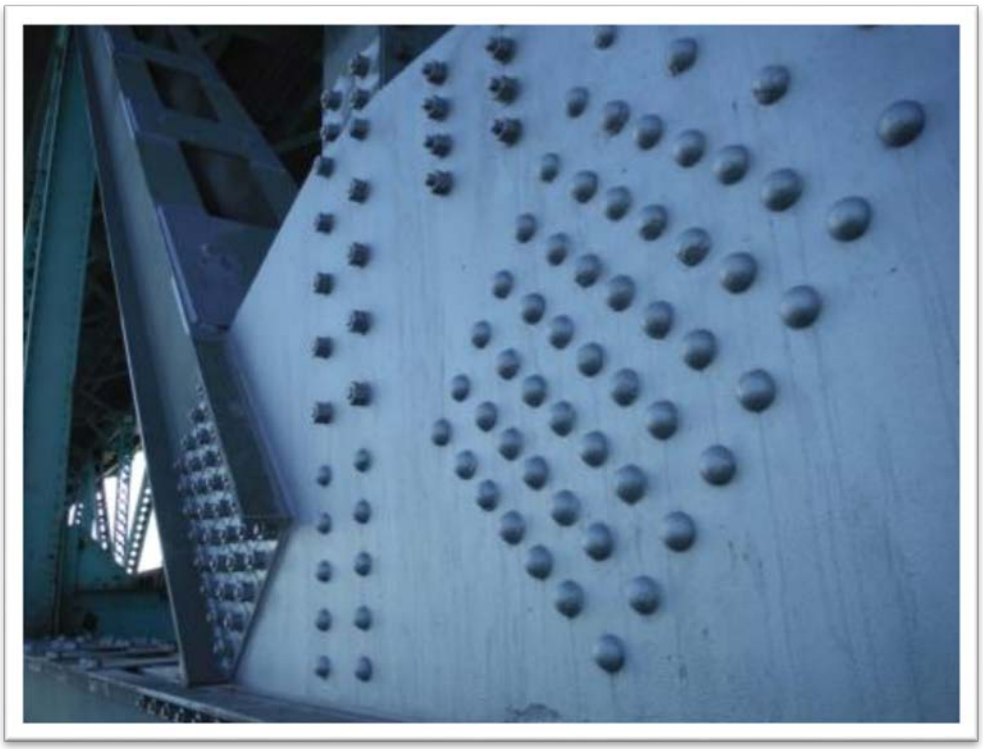

Photo II-36: Truss Span 1, Joint L6 East. Repaired L6 gusset plate, showing diagonal, vertical, and bottom chord.

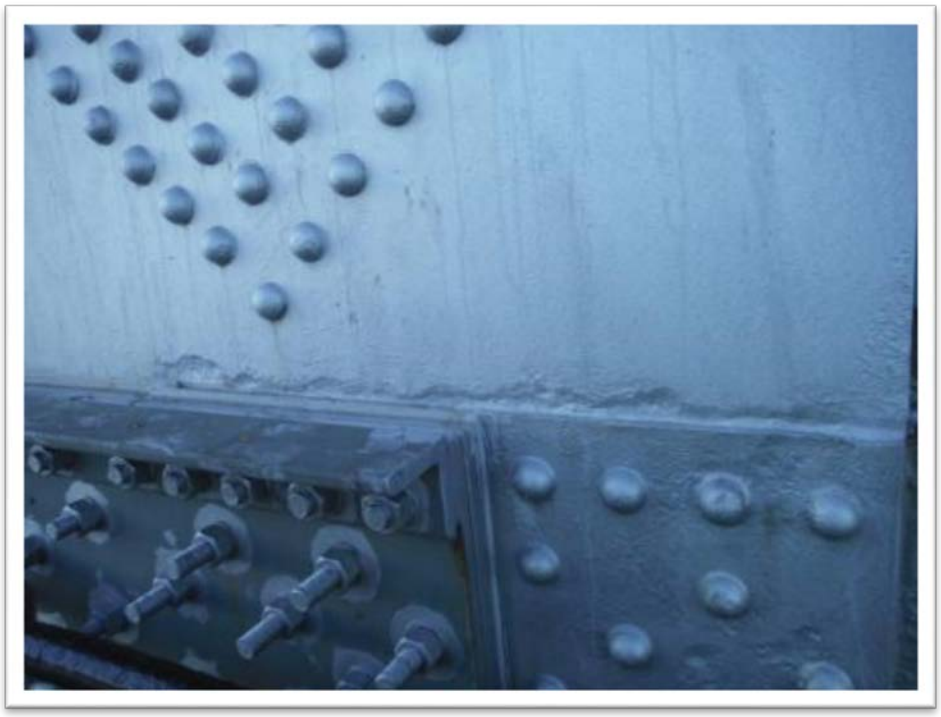

Photo II-37: Truss Span 1, Joint L6 East. 1/8" Section Loss along 33" for the Gusset Plate along the repaired bottom chord.

Photo II-38: Truss Span 1, Diagonal L6-U5, East – Repaired Diagonal showing surface rust at the corner of the bottom plate. Rust leakage – monitor for future pack rust. (Top and Bottom similar)

Photo II-39: Truss Span 2, Joint L7 West. Laminar corrosion on gusset plate and on connection for the Operator House support.

Photo II-40: Truss Span 4, Joint L0 West. Laminar corrosion on the gusset plate at rivets. Surface rust to gusset plates and web of bottom chord, section loss (1/16”) on top flange at L0.

Photo II-41: Bottom Chord Splice with Pack Rust – Interior Face at Span 4.

Photo II-42: Truss Span 4, U8, laminar corrosion to vertical member L8-U8 and to gusset plate U8. Pack rust under gusset plate.

Photo II-43: Truss Span 2, Bay 8, East Side. Laminar corrosion on I-shaped Overhang Stringer. Multiple spalls in bay with a depth up to 2.5".

Photo II-44: Truss Span 3, Vertical L3-U3. Pack rust on interior Vertical flange at interface with Roadway Floorbeam knee brace. Condition typical of truss verticals.

Photo II-45: Span 4, Joint U0 East. Pack rust with prying at bottom edge of gusset plate at U0 East. Condition typical of gusset plates at U0 and U8 Truss Joints.

Photo II-46: Span 4, Joint U8 East. Laminar corrosion on interior face of gusset plates at Joints U0 and U8 is typical.

Photo II-47: Truss Span 4, Barricade Arm Support at Floorbeam Overhang 3, West Side. Laminar corrosion on the C-shaped Fascia Stringer at the connection to the barricade support.

Photo II-48: Truss Span 1, Bay 1: Typical Lateral Bracing Layout.

Photo II-49: Truss Span 1, Bay 3: Typical Pack Rust between the angles of the lateral bracing

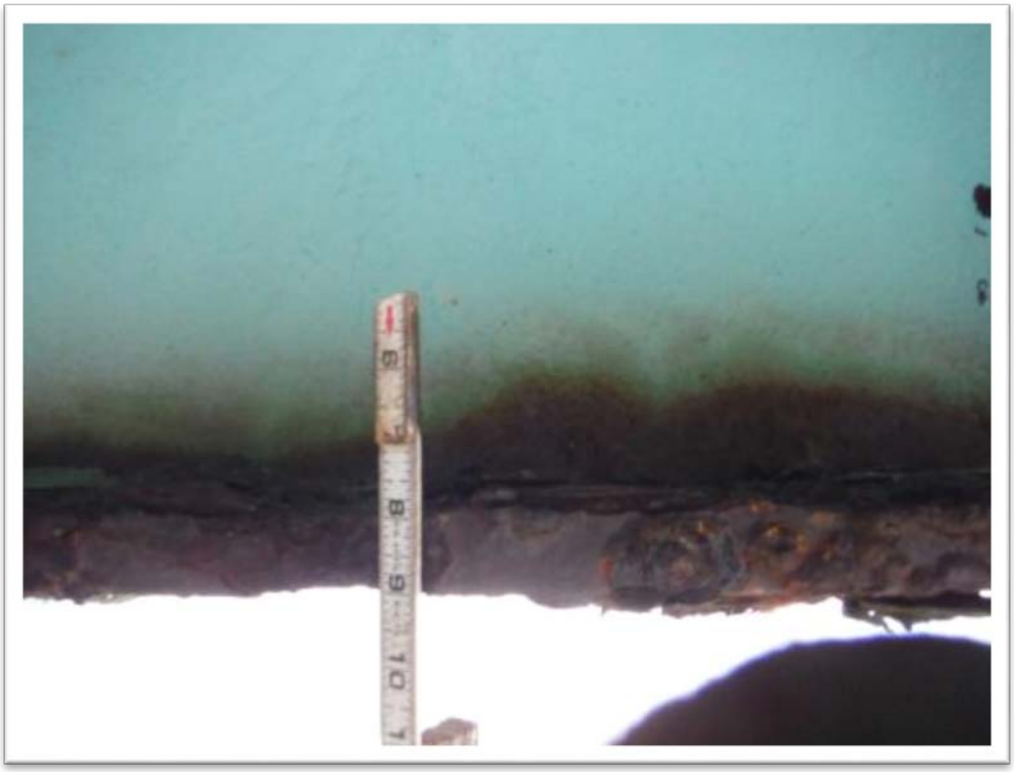

Photo II-50: Truss Span 1, Bay 3: Typical Up to 1/8” section loss to RR stringers

Photo II-51: Truss Span 2, Bay 8. Typical Laminar Corrosion and 1/32” to 1/8” section loss on lateral gusset plate and lateral bracing, also note debris build up (typical)

Photo II-52. Truss Span 2, Bay 6. 1/8” section loss on the stringer (typical)

Photo II-53: Truss Span 3, Floorbeam 7. Typical Floorbeam (East Portion) – North Face

Photo II-54: Truss Span 3, Floorbeam 7. Typical Floorbeam (East Portion) – North Face

Photo II-55: Truss Span 3, Floorbeam 4. Typical Floorbeam (Center Portion) – 1/8" Section Loss to the Bottom Flange

Photo II-56: Truss Span 4, End Floorbeam 8. 3/8" remaining from section loss to midspan of FB

Photo II-57: Truss Span 4, Bay 8. 1” remaining to top flange of stringer

Photo II-58: End Floorbeam. Pack Rust with Laminar Corrosion at Knee Bracing Stiffener

Photo II-59: Lateral Bracing in Bay 4 is warped (Span 1)

Photo II-60: Two Drill Holes in Top Flange of Floorbeam (Typical for all Floor Beams)

Photo II-61: Up to 1/8" section loss on flanges on the Lateral Bracing with laminar corrosion and surface rust (Photo taken from Span 3, Bay 4)

Photo II-62: Typical Cross Fame with Random Laminar Corrosion, Span 3, Bay 8

Photo II-63: Truss Span 2, Floorbeam 8. Laminar corrosion and rusting on end floorbeam knee brace and top flange. Surface rust and paint failure on webs. Condition typical of Truss Span End Floorbeams at towers.

Photo II-64: Pier 17 (South Tower), West Leg. Typical condition for tower anchorage: pitting on all surfaces to 1/8" deep. Laminar corrosion on stiffeners.

Photo II-65: Railroad Deck at North Tower, East Railroad Stringer. Laminar corrosion and section loss on stringer. Support column installed at midspan of stringer.

Photo II-66: Railroad Deck at North Tower, East Railroad Bearing Stringer. Pack rust and prying between stringer and support typical of Stringers at Towers.

Photo II-67: Railroad Deck at North Tower, Eastern Platform Stringer. Flanges of stringers flame cut to accommodate columns for new electrical systems.

Photo II-68: North Tower, North Face. 24" crack in façade. Typical façade crack occurs at welded joints.

Photo II-69: South Tower, Southwest Corner. Tower façade is prying in multiple locations. Concrete found behind façade plates.

Photo II-70: North Tower Verticals. Pack rust with prying on fascia plate. Typical of Verticals.

Photo II-72: North Tower Diagonal Bracing, North Face, West Side. Bracing between Tower Panel Points T1 and T2 is bent out-of-plane.

Photo II-73: South Tower Diagonal Bracing, South Face, West Side. Bracing connections typically have minor pack rust at member interfaces.

Photo II-74: Lifting Girder at Pier 18 (North Tower). A 4.5” crack in steel angle connecting the top flange of the northwestern box-shaped strut to the truss gusset plate at Joint L8 West of Truss Span 3.

Photo II-75: Lifting Girder at Pier 18 (North Tower). A 4.5” crack in steel angle connecting the top flange of the northwestern box-shaped strut to the truss gusset plate at Joint L8 West of Truss Span 3.

Photo II-76: Lifting Girder at Pier 18 (North Tower). Laminar corrosion and rust at horizontal struts bracing the truss at Truss Span 3, Joint L8 West. Typical corrosion on horizontal struts at Truss Span 3 Lifting Girders.

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Photo II-80: South Tower, East Leg. Looking downward in shaft. Typical condition inside of towers: spot rust with limited areas of laminar corrosion.

Photo II-81: South Tower, East Leg. Typical pigeon shielding installed in hand holes.

Photo II-82: South Tower, East Leg. Elevator track shown on left. The track prevents access to half of the leg interiors. The north half of the tower interior was observed from this location, a maximum distance of approximately 6'. Also, typical debris on strut is shown.

Photo II-83: South Tower, East Leg. Typical debris on horizontal stiffener plates inside of columns.

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Photo IV-4: Heavy Laminar Corrosion to Fixed Bearing at Pier 15. Up to 100% section loss in anchor bolt nuts. Pack Rust between pedestal and rocker. (Typical)

Photo IV-5: Pier 16 Pedestal/Gusset Plate Interface – Typical for Structure – Rust between Pedestal and Gusset Plate – Pack Rust in some locations

Photo IV-6: 80% section loss to anchor nuts, laminar corrosion and surface rust to plates and pedestal (Typical for Truss Expansion Bearings) – Elastomer in good condition.

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Photo IV-8: Pack rust with prying (1/8") between sole plate and tie plate – Pier 19, expansion bearing for Span 19. Elastomer in good condition – "Score" in elastomer is typical on all bearings.

Photo IV-9: Laminar corrosion to retractable span support on Pier 21.

Photo IV-10 – Retractable Span 21 Trolley Beam Bearing (West Girder at Pier 21)

Photo IV-11: Pedestal Assembly Bolts have 50 to 100% section loss. Typical of all railroad approach span bearings

Photo IV-12: Typical pin condition (interior) – minor surface rusting and laminar corrosion.

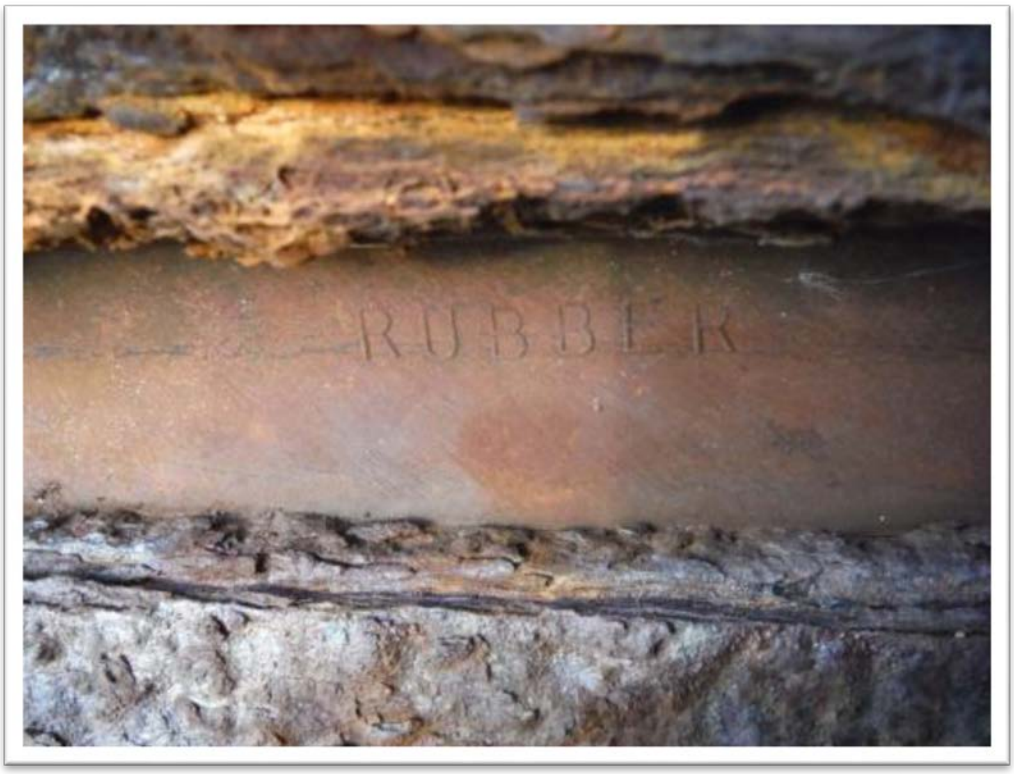

Photo IV-13: “RUBBER” stamped into elastomers (typical all expansion bearings).

Photo IV-14: 100% section loss to bearing anchor nuts.

Photo IV-15 – North Abutment Bearing (East Girder)

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Photo V-1 – South Abutment Backwall Concrete Spall

Photo V-2 – Pier 1 East Column Crack at Masonry Plate (Looking West)

Photo V-3 – Pier 2 East Column Concrete Spall (Looking East)

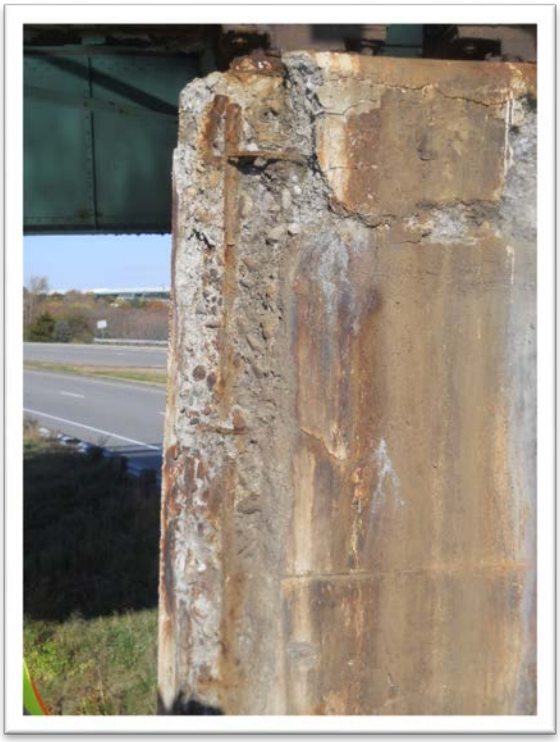

Photo V-4 – Pier 3 East Column Concrete Spall (Looking West)

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Photo V-11: Pier 14. Random Cracking – Longitudinal Crack (Typical All River Piers)

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Photo V-14: Pier 18 – Tower Base. Cracking at Corner Northeast Tower Leg – Existing Repair at Cracked Location – Crack has Efflorescence, small spalls in crack, up to 1/2" wide.

Photo V-15: Pier 19 – Vertical Crack up to 1/4" side, along with map cracking and the start of a nose spall – note the plaster and debris at the top of this pier

Photo V-16: Pier 19 – Disintegrated concrete on top of pier, note the plaster seal that is failing. Large spalls at masonry plates – no undermining.

Photo V-17: Pier 21 – Discoloration on Pier – Pier is lower than other piers, probable that flooding occurs during high water event leading to heavy laminar corrosion of bearings and bases on pier.

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Photo V-19 – Pier 22 Bent West Column Hole (Looking East)

Photo V-20 – North Abutment Concrete Crack and Spalling at East Girder (Looking North)

Section VI:

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Photo VI-1 – Typical Wearing Surface / Deck Repair

Photo VI-2 – Span 2 Wearing Surface Looking North

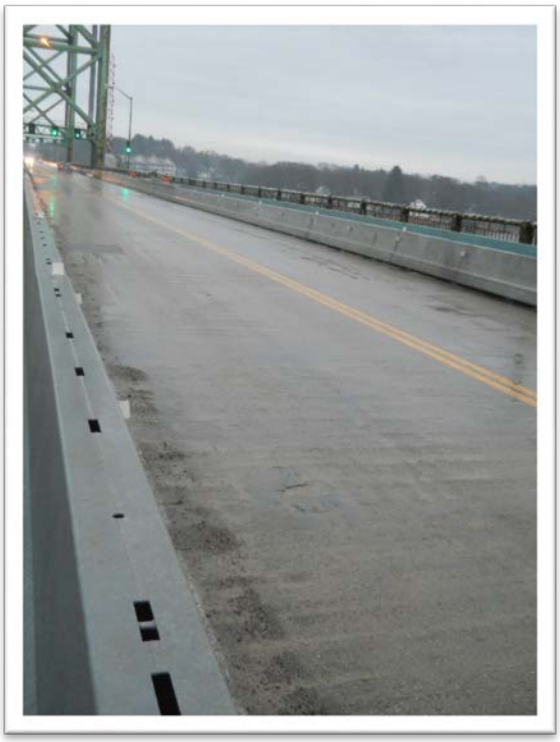

Photo VI-3 – Truss Span 1 Wearing Surface Looking North

Photo VI-4 – Truss Span 3 Wearing Surface Looking North

Photo VI-5 – Span 23 Wearing Surface Looking North

Photo VI-6 – Span 23 Wearing Surface Looking South

Appendix C

Condition Summary Tables and Sketches

Appendix D

Curb Stringer Repair Location Summary

Curb Stringer Repair Location Summary		
Location	**Repair Type**	**Year Repaired**
Span 2, Bay 3, Stringer S1	Web	2010
Span 2, Bay 3, Stringer S4	Web	
Span 2, Bay 3, Stringer S4	Top Flange	2011
Span 4, Bay 3, Stringer S1	Web	2010
Span 4, Bay 3, Stringer S4	Top Flange	
Span 5, Bay 3, Stringer S4	Web	2010
Span 6, Bay 3, Stringer S1	Top Flange	
Span 6, Bay 3, Stringer S4	Web, Top Flange	2010, 2011
Span 7, Bay 3, Stringer S4	Web	
Span 8, Bay 3, Stringer S1	Top Flange	2011
Span 9, Bay 1, Stringer S1	Top Flange	2011
Span 9, Bay 1, Stringer S4	Bottom Flange	
Span 10, Bay 3, Stringer S1	Web, Top and Bottom Flanges	2010, 2011
Span 10, Bay 3, Stringer S4	Web	
Span 10, Bay 3, Stringer S4	Top and Bottom Flanges	2011
Span 12, Bay 3, Stringer S1	Web, Top and Bottom Flanges	2010, 2011
Span 12, Bay 3, Stringer S4	Web	2010
Span 13, Bay 1, Stringer S1	Top and Bottom Flanges	2012
Span 13, Bay 2, Stringer S1	Top and Bottom Flanges	2011
Span 21, Bay 4, Stringer S1	Top and Bottom Flanges	2011
Truss Span 2, Bay 8, Stringer S4	Top Flange	
Truss Span 4, Bay 1, Stringer S4	Web and Top Flange	

Appendix E

Recommended Safety Curb Fascia Beam Repair Locations

Recommended Safety Curb Fascia Beam Repair Locations	
Location	Repair Date
Span 1, Bay 1 (East) at Intermediate and Floor Beam 1 Rail Posts	
Span 1, Bay 1 (West) at Floorbeam 1 Rail Post	
Span 1, Bay 2 (East) at Floorbeam 2 Rail Post	
Span 1, Bay 2 (West) at Floorbeam 2 Rail Post	
Span 2, Bay 1 (East) at Intermediate and Floor Beam 1 Rail Posts	
Span 2, Bay 2 (East) at Intermediate and Floor Beam 2 Rail Posts	
Span 2, Bay 2 (West) at Floor Beam 1 Rail Post	
Span 2, Bay 3 (West) at Floor Beam 2 Rail Post	
Span 3, Bay 1 (East) Floor Beam 1 Rail Post	
Span 3, Bay 2 (East) at Intermediate Rail Post	
Span 3, Bay 3 (East) at Intermediate and Floor Beam 2 Rail Posts	
Span 4, Bay 1 (East) at Floor Beam 0 Rail Post	
Span 4, Bay 2 (West) at Floor Beam 2 Rail Post	
Span 4. Bay 3 (East) at Intermediate Rail Post	
Span 5, Bay 1 (East) at Intermediate and Floor Beam 1 Rail Posts	
Span 5, Bay 1 (West) at Intermediate and Floor Beam 1 Rail Posts	
Span 5, Bay 2 (East) at Intermediate and Floor Beams 1 and 2 Rail Posts	
Span 5, Bay 2 (West) at Intermediate and Floor Beam 1 Rail Post	
Span 5, Bay 3 (East) at Intermediate and Floor Beam 3 Rail Posts	
Span 6, Bay 1 (East) at Intermediate and Floor Beams 0 and 1 Rail Posts	
Span 6, Bay 1 (West) at Floor Beam 0 Rail Post	
Span 6, Bay 2 (East) at Intermediate Rail Post	
Span 6, Bay 2 (West) at Floor Beam 2 Rail Post	
Span 6, Bay 3 (East) at Intermediate and Floor Beam 2 Rail Posts	
Span 7, Bay 1 (East) at Intermediate and Floor Beams 0 and 1 Rail Posts	
Span 7, Bay 1 (West) at Floor Beam 0 Rail Post	

Recommended Safety Curb Fascia Beam Repair Locations	
Location	Repair Date
Span 7, Bay 2 (East) at Intermediate Rail Post	
Span 7, Bay 3 (West) at Intermediate Rail Post	
Span 8, Bay 1 (East) 36” from Floor Beam 0 Rail Post	
Span 8, Bay 3 (West) at Floor Beam 2 Rail Post	
Span 9, Bay 1 (East) at Floor Beam 1 Rail Post	
Span 9, Bay 2 (East) at Floor Beam 2 Rail Post	
Span 9, Bay 3 (West) at Intermediate Rail Post	
Span 10, Bay 1 (East) at Intermediate Rail Post	
Span 10, Bay 1 (West) at Floorbeam 0 Rail Post	
Span 10, Bay 2 (East) at Intermediate Rail Post	
Span 10, Bay 2 (West) at Floor Beam 2 Rail Post	
Span 11, Bay 1 (East) at Floor Beam 1 Rail Post	
Span 11, Bay 2 (East) at Intermediate Rail Post	
Span 12, Bay 1 (West) at Intermediate and Floor Beam 0 Rail Post	
Span 13, Bay 1 (West) at Intermediate and Floor Beams 0 and 1 Rail Posts	
Span 13, Bay 2 (East) at Floor Beam 2 Rail Post	
Span 13, Bay 3 (East) at Intermediate and 50” from Floor Beam 3 Rail Posts	
Span 14, Bay 1 (East) at Intermediate Rail Post	
Span 14, Bay 1 (West) at Intermediate Rail Post	
Span 14, Bay 2 (East) at Intermediate Rail Post	2012
Span 14, Bay 2 (East) at Floor Beams 1 and 2 Rail Posts	
Span 14, Bay 2 (West) at Intermediate and Floor Beams 1 and 2 Rail Posts	
Span 14, Bay 3 (East) at Intermediate and Floor Beams 2 and 3 Rail Post	
Span 14, Bay 3 (West) at Intermediate and Floor Beams 2 and 3 Rail Posts	
Span 14, Bay 4 (West) at Floor Beam 4 Rail Post	
Span 15, Bay 1 (East) at Floor Beam 1 Rail Post	

Recommended Safety Curb Fascia Beam Repair Locations	
Location	Repair Date
Span 15, Bay 2 (East) at Intermediate and Floor Beam 1 Rail Post	
Span 15, Bay 2 (West) at Floor Beams 1 and 2 Rail Posts	
Span 15, Bay 3 (East) at Floor Beam 3 Rail Post	
Span 15, Bay 3 (West) at Floor Beam 3 Rail Post	
Span 15, Bay 4 (East) at Floor Beam 3 Rail Post	
Span 15, Bay 4 (West) at Floor Beam 3 Rail Post	
Span 21, Bay 1 (West) at Floor Beam 0 Rail Post	
Span 21, Bay 2 (East) at Floor Beams 1 and 2 Rail Posts	
Span 21, Bay 2 (West) at Intermediate and Floor Beam 2 Rail Post	
Span 21, Bay 3 (East) at Intermediate and Floor Beam 3 Rail Post	
Span 21, Bay 3 (West) at Floor Beams 2 and 3 Rail Posts	
Span 21, Bay 4 (East) at Floor Beam 4 Rail Post	
Span 22, Bay 1 (West) at Floor Beam 0 Rail Post	
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Span 22, Bay 3 (West) at Floor Beam 3 Rail Post	
Span 22, Bay 4 (East) at Floor Beam 3 Rail Post	
Span 23, Bay 1 (West) at Intermediate and Floor Beam 1 Rail Post	
Span 23, Bay 2 (East) at Floor Beam 1 Rail Post	
Span 23, Bay 2 (West) at Floor Beam 1 Rail Post	
Span 23, Bay 3 (East) at Intermediate and Floor Beams 2 and 3 Rail Posts	
Span 23, Bay 3 (West) at Intermediate and Floor Beam 3 Rail Post	
Span 23, Bay 4 (East) at Intermediate Rail Post	
Span 23, Bay 4 (West) at Intermediate and Floor Beam 4 Rail Post	
Span 24, Bay 1 (East) at Intermediate and Floor Beams 0 and 1 Rail Posts	
Span 24, Bay 2 (East) at Floor Beams 1 and 2 Rail Posts	
Span 24, Bay 3 (West) at Floor Beam 2 Rail Post	

Recommended Safety Curb Fascia Beam Repair Locations	
Location	Repair Date
Span 25, Bay 1 (East) at Floor Beam 1 Rail Post	
Span 25, Bay 2 (East) at Intermediate and Floor Beam 2 Rail Posts	
Span 25, Bay 3 (East) at Intermediate Rail Post	
Span 26, Bay 1 (East) at Floor Beams 0 and 1 Rail Post	
Span 26, Bay 2 (East) at Floor Beam 2 Rail Post	
Span 27, Bay 1 (East) at Intermediate and Floor Beam 0 Rail Posts	
Span 27, Bay 2 (East) at Floor Beam 1 Rail Post	
Span 27, Bay 3 (East) at Floor Beam 2 Rail Post	

Appendix F

Mechanical and Electrical Scoping Study for the Sarah Mildred Long Bridge over the Piscataqua River

MECHANICAL AND ELECTRICAL SCOPING STUDY FOR THE SARAH MILDRED LONG BRIDGE OVER THE PISCATAQUA RIVER

251/108

December 2013

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MECHANICAL INSPECTION

1.0 Executive Summary

An in-depth mechanical inspection of the Sarah Mildred Long Bridge Main and Secondary Movable Spans was performed on November 6th, 7th, and 8th by Brian Castelli, E.I.T. and Kevin Ciampi E.I.T. A visual inspection of all main span and secondary span mechanical systems was performed including all operating machinery, counterweight ropes, live load bearings, span locks, and span guides. Measurements were taken on the gearing, bearings, and counterweight ropes to assess the condition of the mechanical systems.

The condition of the mechanical systems of the main span is critical. The condition of the secondary span is poor. There are several important items that should be addressed:

- The rack gears are in fair condition, though the pinions are in poor condition. Plastic flow is clearly evident on the pinions in the areas that are in contact with the gears. These gears are approaching the end of their useful life.
- The span lock operators are in poor condition. There is moderate to severe corrosion of the span lock housings, fasteners and supports. Severe corrosion and section loss of the mounting hardware reduces the reliability of these components.
- A banging noise was heard at 3 of the 4 corners on the main movable span during operation. This is usually an indication that the rope tensions are uneven, which can lead to accelerated wear of the counterweight ropes.
- The main span live load bearings are in poor condition. Uneven contact patterns were noticed at three of the four corners, indicating that the bridge does not fully seat at each of the live load bearings.
- The span guides are in critical condition. The structure of the main span at the south span guides is damaged, possibly due to the span being lifted extremely out of skew prior to the inspection. The south span guides appear to be broken and do not engage the guide rails.
- The secondary span generally displays paint failure and moderate to severe corrosion on many of the machinery components and support elements.

2.0 Description of Systems

Sarah Mildred Long Bridge is a tower driven vertical lift span with two levels on the main movable span. The upper level carries the US Route 1 Bypass highway across the Piscataqua River from Portsmouth, NH to Kittery, ME and the lower level carries a railroad spur line going into the Portsmouth Naval Shipyard.

The operating machinery in each tower consists of two main motors driving a central parallel shaft gear box. The parallel shaft gear box drives pinions and racks mounted to each of the counterweight sheaves. The gear is connected to the pinions via floating shafts. Solenoid type motor brakes are mounted on each of the two motors in each tower. Machinery brakes are mounted on the floating shafts between the reducer output and the pinion gear.

There are two span locks for the main movable span, one on each end of the span. The span locks are located on the rest piers under the railroad deck. Each span lock consists of a linear actuator which direct drives a bar through a guide in the fixed span and into a receiver on the movable span.

The counterweight system for the main movable span consists of two counterweights, one in each tower connected to the span via a series of counterweight ropes supported over sheaves. There are four counterweight rope sheaves, one in each corner of the main movable span. The counterweight sheaves are supported on trunnion shafts by plain bearings. The counterweight rope connections at the span and counterweight have no means of adjusting the rope tensions at the connection point. Each counterweight has guides which engage rails along the length of the tower to ensure the position of the counterweight during travel.

The movable span has features to ensure proper position of the span while both moving and seated in the form of span guides and centering devices located on either end of the span. The main movable span also has live load shoes in each corner to transfer the live load on the movable span to the rest piers.

The secondary span is located under the US Route 1 Bypass highway and carries a section of the railroad track going into the Portsmouth Naval Shipyard. This bridge has two independent drive systems for the operation process. The first system (Lifting Machinery) consists of four 25 HP motors; each motor is located at one corner of the movable span and operates a pair of lifting screws. At each end of the lift span a platform is mounted between the two pairs of lifting screws. As the lifting screw motors turn, the screws rotate carrying the platforms and the lift span up or down based on the direction of motor rotation. Included in the system is a hydraulic pump to lubricate the lifting screws, and to operate four hydraulic bumpers. When the screws are fully open and the lifting platforms are lined up with the main track the second system is used to roll the lift span onto the south approach span to clear the navigational channel. The second system (Translation Machinery) consists of one 15 HP motor that is located inside the southern end of the lift span between the main girders of the movable span and operates two drive wheels. During translation the north end of the secondary movable span hangs from the above highway approach span on trolley wheels while the south end uses the drive wheels to ride along the south approach span rails.

The secondary span only operates once or twice a year for the rail traffic on a request submitted by the US Navy. The span is usually left open in the summer and closed in the winter.

3.0 Inspection Approach and Methodology

A visual inspection of all main and secondary span mechanical systems was performed. This included operating machinery, counterweight rope system, live load bearings, span guides, and span locks. Various other measurements were taken to help assess the condition of the mechanical systems. Gear tooth thickness was measured using a gear tooth caliper and backlash was measured using feeler gages on all open gearing. Physical dimensions such as the rope diameter and lay length were measured using calipers on the counterweight ropes. Machinery bearing were also measured using feeler gages.

All mechanical components have been evaluated and rated according to the criteria established in the AASHTO Movable Bridge Inspection, Evaluation and Maintenance Manual and the National Bridge Inspection Standards (NBIS). Table 2.3.2-1 from the AASHTO Movable Bridge Inspection, Evaluation and Maintenance Manual is presented here:

Condition	AASHTO BMS CODE	FHWA NBIS BITM/90
EXCELLENT	1	9
GOOD	2	7 (or 8)
FAIR	3	5 (or 6)
POOR	4	4 (or 3)
CRITICAL	5	2 (or 1 or 0)

The following definitions apply to the NBIS numerical ratings given in the table:

- Excellent – No defects noted, component appears to be in new condition and functions as designed. Less than 15% of predicted component life has been expended.
- Good – Minor deterioration or wear noted, component appears to be functional. 15% to 35% of predicted component life has been expended.
- Fair – Obvious deterioration or wear noted, component appears to be functional, but no longer operating like new. Component has useful remaining life. 35% to 65% of predicted component life has been expended.
- Poor- Significant deterioration or wear noted, component appears to be generally functional, but exhibits signs that failure may result from continued wear or deterioration. Component is nearing the end of its useful life. 65% to 85% of predicted component life has been expended.
- Critical - Significant deterioration or wear noted, component appears to be marginally functional and exhibits signs that failure will result from continued wear or deterioration. Corrective action is required as soon as possible to avoid failure. More than 85% of predicted component life has been expended.

4.0 Primary Movable Span Inspection Findings

4.1 Operating Machinery

The operating machinery is in fair condition. No major deficiencies were noted during operation or through visual inspection.

4.1.1 Motors, Brakes, and Mounting:

The motors have been replaced recently and are in good condition. Each tower has two drive motors with integral motor brakes. The electric motors are each rated for 100 horsepower at 2800 RPM, though they are controlled at 880 RPM at the control desk. All motors have isolated areas of paint failure on the housing. The mounting face of each motor is also unpainted with light corrosion (See photo M-1). The motor brakes are Stearns brakes capable of applying 330 foot-pounds of torque. The brakes are also in good condition with no deficiencies noted.

The motors are all mounted using Grade 8 bolts and leveled using slotted shims (See photo M-2). AASHTO requires that all shims be full length shims through which bolt holes may be drilled to prevent movement of the shims after machinery installation. As a measure to prevent the shims from shifting, dowels were installed after installation. The northwest and southwest motor supports display paint failure on approximately 25% of the support

surface area with light corrosion. The northeast and southeast supports are both unpainted with light corrosion (See photo M-3).

The machinery brakes are thruster type brakes mounted on the floating shaft between the reducer and the pinion shafts. The machinery brakes are in fair condition. The brake pads of all machinery brakes do not apply uniform pressure around the brake drum, as indicated by feeler gage measurements when the brakes were set. The brake drums are not uniformly polished, and display some areas of light corrosion and grooving. The northwest machinery brake pads are axially misaligned by 1/8" as an as built condition. All of the machinery brakes typically display areas of chipped paint and light corrosion. There are also unpainted areas on the faces of all brake wheels which display light corrosion (See photo M-4).

4.1.2 Primary Reducer:

The condition of the reducers is fair. The primary reducer is a two stage parallel shaft reducer manufactured by D.O. James. The reducers have a gear ratio of 45.27 and are rated for 140 HP at 875 RPM. All of the bearing seals on both reducers are leaking. The lubricant in both reducers is foaming (See photo M-5). The lubricant in the south primary reducer was low. Inspection of the internal gearing of the north reducer revealed that there is light to moderate pitting and scoring on the opening faces of all gear teeth, indicating that there has been a long term span heavy condition on the movable span (See photo M-6). Internal inspection of the south primary reducer revealed that there is light pitting on the opening face of the high speed pinion and intermediate pinion and gear. The low speed pinion has moderate pitting on both faces. The low speed gear has moderate pitting in the opening face. The south reducer has one missing inspection cover bolt and one broken inspection cover bolt. Neither reducer has a functioning site glass to indicate proper oil level. There are no desiccant breathers installed on the reducers, though the inspection port covers were vented. The reducers are covered in a layer of light dirt and debris. There are some isolated areas of paint failure on the housings (See photo M-7). The mounting is in good condition.

4.1.3 Shafts and Couplings:

All shafts and couplings are in good condition. The machinery shafts have isolated areas of chipped paint and light corrosion (See photo M-8). The grid couplings between the drive motors and primary reducers are all unpainted, though their housings show no signs of corrosion due to the type of metal from which they are manufactured. All gear couplings leak lubricant from the housing splits, keyways, and hub seals (See Photo M-9).

It was noted during the inspection that the floating shaft between the reducer and the pinion shaft also carries the brake wheel for the machinery brake. This arrangement is not a standard way of designing a floating shaft and it puts considerable load on the couplings on either side of the floating shaft. It is assumed that the couplings have been sized properly for the loads, despite the non-standard design detail.

4.1.4 Bearings:

The bearings are in good condition. The operating machinery bearings consist of a two sets of bearings in each tower that support the pinion shaft. These bearings are plain type bearing with split bushings and housings. In general the bearings have small isolated areas of chipped paint and are covered in a layer of dirt and debris (See photo M-10). Northeast bearing B3, Northwest bearings B3 and B4, Southeast bearing B3, and Southwest bearing B3 exceed the maximum ANSI RC6 clearance for fit, which is the AASHTO criterion for journal

bearings. The maximum clearance for an ANSI RC9 fit is the threshold clearance which is our basis for adjusting bearing clearances by removing liners to compensate for wear or replacing the worn bushings. None of the bearings currently exceed the limits of an RC9 fit. A complete table of bearing clearance field measurements can be found in Appendix C.

4.1.5 Rack and Pinion:

The racks are in fair condition and typically display isolated areas of light corrosion. Plastic flow is evident, though it is more prominent on the opening face of the teeth. The racks typically have scoring and peening on both gear tooth faces (See photo M-11). The gear tooth measurements of the rack teeth are consistent with measurements taken in the 2009 inspection. The pinions are in poor condition. The pinion gear teeth are experiencing accelerated wear based upon gear tooth measurements taken as a part of the inspection. Since the pinion face width is larger than the gear face width, the thickness of the unused portion of the pinion teeth can be readily compared to the thickness of the portion of the pinion in contact with the rack gear. The portion of the pinions in contact with the gears is approximately 90% of the thickness of the unused portion of each pinion gear. The pinions display moderate scoring and pitting on both contact faces (See photo M-12). All gear teeth are well lubricated. All gear sets achieve between 90% to full face contact based upon observed grease contact patterns. A complete table of gear tooth measurements can be found in appendix C.

4.1.6 Instrument Drives:

There are two instrument drives per tower for height and skew indication. The primary device is a resolver coupled to one of the main trunnion. The second is a resolver attached to a spring loaded reel and a piece of piano wire that is attached to the counterweight. The piano wire is difficult to see and could easily be damaged. See electrical report for more details and recommendations for these devices.

4.2 <u>Span Lock Machinery</u>

The span lock operators are gearmotor driven linear actuators manufactured by Earle. The span locks perform the function of ensuring that the movable span is fully seated on the live load bearings when the span is in the closed position. The span locks are located under the rail deck on either end of the movable span at the rest pier. The location of the span locks is difficult to access and poses a challenge for maintenance. In addition to the difficult access, the close proximity of the span locks to the water has accelerated the corrosion of the span lock components.

4.2.1 Span Lock Operators:

The lock operators are in poor condition. Due to the harsh conditions that the operators are subject to close to the salt water, there is moderate to severe corrosion and wear of the housings and mountings. The housings typically display up to 50% paint failure and light to moderate corrosion. (See photo M-13). Most of the anchor bolts display moderate to severe corrosion and section loss (See photo M-14). Makeshift covers nailed to the bottom of the rail ties on the lower deck have come unfastened and are now resting on top of the lock bar operators (See photo M-15). Dirt and debris cover the surface of the lock bar operators and supports.

4.2.2 Lock Bar, Guides, and Receivers:

The locks bars, guides, and receivers are in fair condition. The span lock bar is directly driven by the span lock operator and is supported by the lock bar guides as it passed

through the structural steel of the fixed span. When the lock bar is driven, it engages a receiver on the movable span mounted on the structural steel. All of these components as well as the structural steel they are mounted on have moderate corrosion (See photo M-16). The build up of excessive lubricant around the span lock guides made it difficult of obtain clearance measurement between the lock bars and guides. The clearance measurements gathered during this inspection increased significantly from the previous inspection in 2009. The top and bottom clearances at the front guide and rear guide of the south span lock have nearly doubled since the previous inspection. This condition is similar at the north span lock. Generally, an acceptable fit between the lock bars and guides would be an ANSI RC6 fit. These measurements are in excess of this fit for this size lock bar. A complete table of clearance measurements can be found in Appendix C.

4.3 Counterweight Assemblies

The counterweight assemblies on the main movable span are in good condition.

4.3.1 Counterweight Sheaves and Bearings:

There are 4 sets of counterweight sheaves and bearings for the main movable span, one in each corner of the span. The counterweight sheaves and bearings carry the entire weight of the movable span, counterweight and counterweight ropes. The counterweight sheaves are in good condition. The sides of the sheaves are well painted, with only isolated spots of chipped paint and light corrosion (See photo M-17). The sheave rope grooves show signs of wear, since corrugations from the wire ropes are present on the individual grooves (See photo M-18). The sheave grooves were well lubricated at the time of inspection. The trunnion bearings were visually inspected and clearance measurements were taken. A table of bearing clearance field measurements can be found in Appendix C. The clearance measurements taken are consistent with the measurements obtained during HDR's previous inspection in 2009.

4.3.2 Counterweight Ropes and Connections:

The counterweight ropes are connected at the movable span and the counterweight using rope anchor castings. The rope ends are solid blocks which bear on the rope anchor casting and are held in place with keeper plates (See photo M-19). Shims are installed between the casting and the end block of the counterweight ropes to adjust the tension in the ropes. The visual inspection did not identify any serious surface or construction deficiencies with the counterweight ropes. Counterweight diameter measurements did not reveal any unusual wear in the ropes. Lay length measurements were fairly consistent with those taken in the previous HDR inspection performed in 2009. Maintenance and lubrication of the counterweight ropes appeared to be good. During both lifting and lowering of the main movable span it was noted that 3 of the 4 counterweight sheave assemblies emit a periodic banging noise. This noise is usually an indication that the rope tensions in the counterweight ropes are not even in these corners.

The counterweight rope connections consisting of the castings at the counterweight and the lifting girder of the movable span have only minor deficiencies related to paint failure and light corrosion . It should be noted that the excessive build-up of grease underneath the counterweight sheaves at the counterweight rope connection to the counterweight, in all four corners, is a considerable safety hazard for maintenance personnel (See photo M-20). There is also significant lubrication buildup beneath the counterweight rope span connections (See photo M-21). The lack of OSHA compliant railing in these areas and the build-up of lubricant present a significant slip and fall hazard.

4.3.3 Counterweight Guides:

The counterweight guides are located laterally on either side of the counterweight and engage rails along the inside of the tower legs. The guides were not accessible to be closely inspected. Given the condition of the guide rail and the fact that the guides did not appear to be riding unevenly, the counterweight guides seem to be in good condition.

4.4 Live Load Bearings, Span Guides, and Centering Devices

4.4.1 Live Load Bearings:

The live load bearings are in poor condition. There are two live load bearings located at the corners of the span, on either end of the span, at the rest pier. They consist of an upper bearing half on the movable span and a lower bearing half mounted on the rest pier. The North live load bearings are expansion bearings and the South live load bearings are fixed bearings. The live load bearings all display up to 50% paint failure and light to moderate corrosion over their entire surface (See photo M-22). The expansion bearings also displayed fretting corrosion between the bearing surfaces (See photo M-23). The South bearings displayed uneven contact patterns based on the results of the lead wire test. The inboard sides of the bearings displayed a heavier amount of contact than the outboard sides. The southeast bearing shows a wide variation in contact, with a difference of 0.025" between the inboard and outboard sides of the bearing. Contact at the expansion bearings at the North rest pier was fairly even. The northeast expansion bearing displayed even contact, while the northwest bearing showed a variation of 0.004". Results from the test can be found in Appendix C.

4.4.2 Span Guides:

The span guides are in critical condition. There are two sets of span guides located on either end of the span. The lower set is located just below the rail deck level and the upper set is located just below the road deck level. All span guides engage a rail that runs along the inside of the tower leg. The north span guides all display good lubrication (See photo M-24). The northwest lower span guide displays some peeling paint and scaled rust at the bottom of the guide rail (See photo M-25). The span guide rails on the South tower are damaged at a location of about halfway up the travel of the movable span. There is damage to the structure of the span at the location of the south span guides. This damage may be a result of the span being lifted extremely out of skew prior to the in depth inspection. Much of the lacing is bent and new channel reinforcement has been added to reinforce this area of the lift span(See photo M-26). The south upper span guides do not engage the rail, and appear to be broken (See photo M-27).

4.4.3 Centering Devices:

The centering devices are in fair condition. There is one centering device located on either end of the span at the rest pier. They consist of a socket mounted on the movable span and a guide bar mounted on the rest pier. The centering devices display light to moderate corrosion with some scaling over their entire surface(See photo M-28). The anchor bolts of the north centering device display approximately 25% section loss, while the anchor bolts and rivet heads at the south centering device display up to 50% section loss(See photo M-29).

4.5 Span Balance

The span balance of the movable span was measured by means of a drift test. During the drift test the movable span and the counterweight were moved to same level. The brakes were then released and the bridge was allowed to drift without the aid of the span drive motors. The span began to fall, indicating a span heavy condition exists on the bridge. Through observation of the bridge throughout a full lift cycle, it was determined that after approximately ¾ of a full lift, enough of the counterweight ropes have shifted over to the counterweight side to create a counterweight heavy condition. The bridge does not have any auxiliary counterweights to offset the weight of the counterweight ropes as the span travels from fully closed to fully open.

4.6 Warning and Barrier Gates

The warning gates and barrier gates are in good condition. All housings display light corrosion where the zinc galvanization has failed (See photo M-30). All housings have light debris and corrosion at inside base of the housing. The reducers in both warning gates and in the south barrier gate have minor leaks. Pads have been placed on the south barrier gate machinery supports to absorb leaking oil (See photo M-31). The north barrier gate buffer does not make contact with the road surface during gate operation.

5.0 Secondary Span Inspection Findings

5.1 Lifting Machinery

The secondary span lifting machinery is in poor condition. The machinery could only be operated by hand during the inspection due to malfunction of the skew control system. As a result, the span position was only changed by a few inches to allow for access during the inspection. At the conclusion of the inspection, it was raised a few inches to its normal open height. Due to the span being in the open position, the southeast lifting machinery, including reducers and motors, was not accessible for close inspection.

5.1.1 Motors:

There are four lifting motors located at all four corners of the secondary movable span. Each motor drives two lifting screws which in turn lift the secondary movable span. The motors are c-face mounted to a reducer. Motors are exposed to salt water and weather; these conditions have led to paint chipping and moderate rust on the housing and fasteners (See photo M-32). The machinery was not operable during the inspection, so motor operation was not observed. The only means to raise and lower the secondary span was manually using a hand crank on the worm reducer input shaft on the lifting screw assembly.

Located in a cabinet on the north approach span, a 5 HP motor pumps oil to the lifting screws for lubrication, and to the four hydraulic bumpers on both the north and south approach spans (See photo M-33). The hydraulic motor and pump are currently inoperable. Lubricant for the lifting screws must be applied by hand due to the failure of the pump. The surface of the motor displays approximately 50% paint failure and light corrosion (See photo M-34).

5.1.2 Lifting Screw Assemblies:

Located at all four lifting corners each screw assembly includes one worm reducer, two rotary actuators and two lifting screws. The reducers were manufactured by Philadelphia Gear for Limitorque. Each reducer has one motor input shaft and two output shafts that go to Limitorque rotary actuators. Each actuator rotates one lifting screw. The housings for

the reducers and actuators display moderate corrosion, and approximately 25% paint failure (See photo M-35). On the north east corner the synchro transmitter has a jaw coupling that is not fully engaged (See photo M-36). The lifting screws appear to be well lubricated and clean however some have areas of light surface rust concentrated towards the bottom of the screw (See photo M-37). The lifting screw housings and doors have areas of moderate rust (See photo M-38). Assembly supports suffer from severe corrosion of the diagonal struts with complete section loss at the anchor points to the pier (See photo M-39).

5.1.3 Hydraulic Cylinders:

The lifting machinery uses four hydraulic cylinders as bumpers. One is located at each corner of the span, two on each lifting platform. Hydraulic fluid is pumped from the reservoir on the north approach span through rigid piping to each of the four corners of the movable span. Flexible hydraulic hoses leading from the approach spans to the movable span are fed through cable reels. All rigid piping exhibits moderate corrosion (See photo M-40). All cable reels display severe corrosion and complete section loss in many places (See photo M-41). All flexible supply hoses are dry and cracked. The cylinders display approximately 50% or greater paint failure and areas of light to moderate corrosion (See photo M-42). The support for the cylinders is coated in light rust including the mounting bolts. Lubricant accumulation around the piston seals indicates that they may leak hydraulic oil. (See photo M-43).

5.1.4 Brakes:

There is one brake per lifting assembly mounted on the back of each motor. Brake housings are in the same condition as the motor housings. Exposure to salt water and weather has lead to loss of paint, and moderate corrosion. The southeast brake is missing its hand release handle (See photo M-44).

5.1.5 Lifting Platform:

The system uses two lifting platforms one on the north, and one on the south end of the secondary movable span. Each lifting platform is attached to four lifting screws. As the screws turn the platforms moves up or down, with the movable span resting on top. Platforms have peeling paint, with areas of severe corrosion, scaling, and section loss (See photo M-45).

5.1.6 Span Guides

The span guides are in fair condition. There are four span guides, one at each corner of the secondary movable span. The span guides show no signs of wear, but have intermittent lubrication and sections with light surface rust (M-46).

5.1.7 Live Load Bearings:

The live load bearings are in poor condition. There four live load bearings, one at each corner of the secondary movable span. The two bearings on the south pier are fixed bearings, and the two bearings on the north pier are expansion bearings. The bearings display 75% paint failure and broad areas of moderate to severe corrosion (See photo M-47). The bearing surfaces have light to moderate rust where ungreased (See photo M-48). The accessible portions of the bearings to be inspected were on the rest piers. The portions of the bearings on the movable span were inaccessible for close inspection due to the span being in the open position.

5.2 Translation Machinery

5.2.1 Motor:

The translational drive motor is in fair condition. This motor is used to translate the secondary movable span along the south approach rails, and is located inside the movable span near an opening at the south end of the secondary movable span. The motor has a c-face style mounting to the reducer, and brake mounted on the back. A visual check of the bearings could not be performed, however, lubricant leaks from both sides of the motor (See Photo M-49). This leakage appears to be a combination of leakage from the motor bearings and the c-face mount to the translational machinery reducer. Some paint has peeled, and the motor has light surface rust on 25% of its surface (See photo M-50).

5.2.2 Reducer:

The translational reducer is in fair condition. The reducer is located in line with the motor inside the secondary movable span. The reducer has no inspection hatch, and no breather. Paint has peeled on housing and fasteners, allowing surface rust to form. Both input and output shaft seals are leaking (See photo M-51).

5.2.3 Machinery Support:

The machinery support spans between the two girders of the secondary movable span, and supports the motor, reducer, and Chain 1. The table has lost much of its paint, and has moderate rust with areas of severe rust around the edges (See photo M-52). There are areas of approximately 1" of pack rust between the table top and its supports, which impacts the alignment of the machinery (See photo M-53). The support for the reducer has areas of moderate rust, and the support for Chain 1 has peeling paint and areas of surface rust. The motor is c-face mounted to the reducer eliminating alignment issues between the two, the relative position between the reducer and Chain 1 is subject to misalignment caused by pack rust.

5.2.4 Brake:

The machinery brake is a 240V, single phase brake. The brake enclosure displays peeling paint and surface rust. The brake was inaccessible for visual inspection (See photo M-54).

5.2.5 Chain 1 and 2:

Chain 1 transmits torque from the reducer to Chain 2. Chain 2 transmits torque to the drive wheels. Both chains increase the gear ratio. Both chain drives are fully enclosed. Enclosures have no inspection hatch. Enclosures have minor paint chipping and surface rust. Fasteners have moderate rust. Seals for both chains are leaking lubricant (See photo M-55). Chain 1 enclosure is missing its cap, and has a duct tape replacement (See photo M-56).

5.2.6 Bearings:

There are four bearings in the drive system. All are split housing pillow block bearings and are roller type. Bearings B1 and B2 are on either side of Chain 1 and Chain 2 supporting an intermediate shaft S1. Bearings B3 and B4 are located on the underside of the span frame, and support the drive wheels. Bearings are covered in dirt, grease and oil. Areas dry of grease have peeled paint, and have light to moderate surface rust (See photo M-57). Much of the paint has peeled and bearing housings have moderate rust with pitting. Bearings appear to be leaking a small amount of lubricant between the base and the cap of the

bearings (See photo M-58). Two additional bearings support the north side drive wheels, but were inaccessible for close inspection.

5.2.7 Machinery Shafts:

Shaft S2 transmits torque between Chain 1 and Chain 2. Shaft S2 has almost no paint left on it, and has a coating of surface rust. Axle 1 transmits torque between Chain 2 and the southern drive wheels. Axle 1 has isolated areas of chipped paint, and some surface rust (See photo M-59). Axle 3, located on the north end of the secondary movable span is in similar condition.

5.2.8 Drive Wheels:

The secondary movable span rides on the approach span on the drive wheels on the north and the south side of the span. Drive wheels show moderate rust and pitting on faces that contact the rails. Paint is peeling, and hubs of wheels have surface rust to severe rust and pitting (See photo M-60). Corrosion is more severe on the east drive wheels. The proximity of the south east drive wheel to Chain 2 has prevented adequate painting.

5.2.9 Trolley Wheels and Trolley Beam:

Due to the span being maintained in the open position, the trolley wheels and trolley beam could not be accessed safely for visual inspection.

6.0 Recommendations

Recommendations are made with the understanding that the bridge is to be replaced within the next seven years. Therefore, it is only recommended that Intermediate priority and Long Term Reliability recommendations be implemented if the bridge is not replaced. The High Priority repairs recommended in the following section will provide a useful service life of seven years to the bridge mechanical systems.

6.1 Primary Movable Span

6.1.1 High Priority Repairs and Safety Issues (Repairs required within 1 year)

1. Live Load Bearings, Span Guides, Centering Devices
   a. Straighten south span guide rails at locations where guides have been bent.
   b. Replace south upper span guides to ensure they function and engage span guide rails.

6.1.2 Intermediate Priority (Repairs required within 5-7 years)

1. Operating Machinery
   a. Adjust machinery brake pads to provide even pressure on brake drums when brakes are set.
   b. Clean and paint the hubs of brake drums and brake frames to arrest paint failure and corrosion.
   c. Replace all gear coupling seals and gaskets to prevent leakage.
   d. Replace rack gears and pinion shafts at all four locations.
   e. Clean and paint all bearings to arrest paint failure and corrosion.
   f. Clean and paint all machinery supports to arrest corrosion.

g. Clean and paint machinery shafts to repair areas of chipped paint and arrest corrosion.

2. Span Lock Machinery
   a. Replace span lock operators, guides, and lock bars.
   b. Fabricate and install span lock operator covers to protect the operators from road debris, salt, and water.

3. Counterweight Assemblies
   a. To help prevent uneven wear of counterweight ropes, perform tension testing and make necessary adjustments to counterweight rope tension.
   b. Clean counterweight rope connections at the counterweight and span to prevent slip hazards at these locations.

4. Warning and Barrier Gates
   a. Service warning gate machinery. Replace all bearing seals and gaskets at reducers to prevent leakage. Change gear lubricant.

6.1.3 Long Term Reliability (7+ year repairs)

1. Operating Machinery
   a. Replace primary reducers.
   b. Replace Grade 8 bolts used to mount motors with turned bolts.
   c. Remove slotted shims and install full length stainless steel shims with at least two bolt holes to prevent shims from shifting.

2. Live Load Bearings, Span Guides, Centering Devices
   a. Clean and paint centering devices and reset devices on new anchors.
   b. Clean and paint live load bearings and reset bearing on new anchors.
   c. Clean and repaint span guides.

6.2 <u>Secondary Span</u>

6.2.1 High Priority Repairs and Safety Issues (Repairs required within 1 year)

1. Lifting Machinery
   a. Evaluate and repair hydraulic pump system to provide lubrication to lifting screws.
   b. Adjust the alignment of the northeast synchro transmitter jaw coupling.
   c. Repair section loss on diagonal struts supporting the lifting screw assemblies.
   d. Clean and paint lifting screw support assemblies to prevent further section loss and corrosion.

2. Translational Machinery
   a. Repair “table top” to prevent further pack rust and machinery misalignment.

6.2.2 Intermediate Priority (Repairs required within 5-7 years)

1. Lifting Machinery
   a. Clean and paint all motors and fasteners.
   b. Clean and paint the housings for the lifting worm reducers and rotary actuators to arrest corrosion.

   c. Clean and paint lifting screw housings.
   d. Clean and paint hydraulic buffer assemblies.
   e. Replace all flexible and rigid hydraulic supply piping and replace cable reels.
   f. Replace all hydraulic seals to prevent hydraulic leaks.
   g. Replace southeast motor brake hand release handle.
   h. Clean and paint lifting platform to arrest corrosion.
   i. Clean and paint non bearing surfaces of span guides to prevent corrosion.
   j. Clean and paint live load bearings to prevent further corrosion.

2. Translational Machinery
   a. Clean and paint translational drive motor.
   b. Replace bearing seals on translational drive motor to prevent leakage.
   c. Clean and paint reducer housing and fasteners.
   d. Replace all bearing seals and the seal between the motor and reducer.
   e. Clean and paint brake enclosure.
   f. Clean and paint chain enclosures.
   g. Replace chain enclosure seals.
   h. Clean and relubricate chains and sprockets.
   i. Replace missing cap on Chain 2 enclosure.
   j. Clean and paint bearings.
   k. Replace bearing seals to prevent leakage.
   l. Clean and paint all shafts.

6.2.3 Long Term Reliability (7+ year repairs)

1. Lifting Machinery
   a. Replace all lifting machinery.
   b. Regularly clean and lubricate lifting screw threads to prevent corrosion
   c. Replace lifting platforms.
   d. Grease bearing surfaces of live load bearings as part of regular maintenance.
   e. Grease all bearing surfaces of span guides as part of regular maintenance.
2. Translational Machinery
   a. Replace all translational operating machinery including motor, brake, reducer, bearings, shafts, and chain drives.
   b. Replace machinery supports.

Appendix A
Machinery Layout

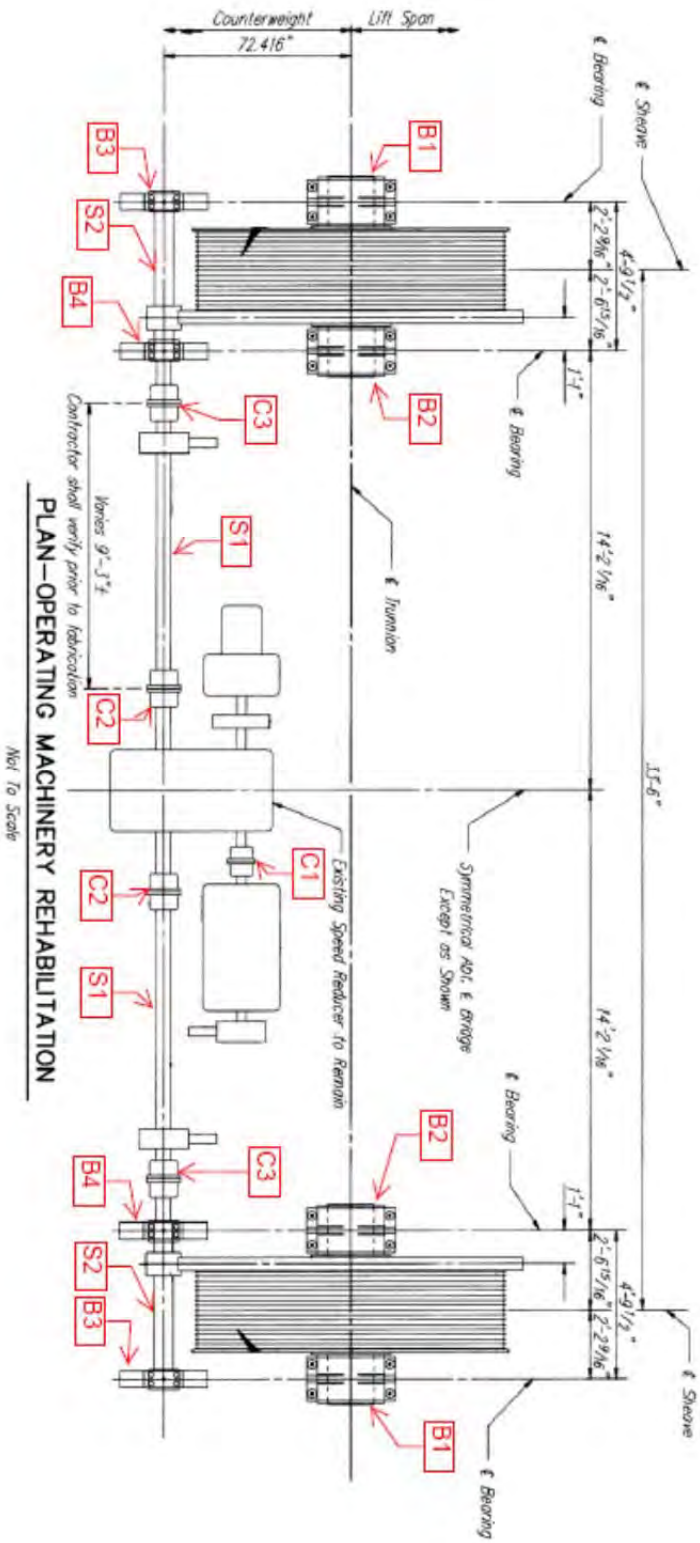


Figure 1 – Operating Machinery Layout

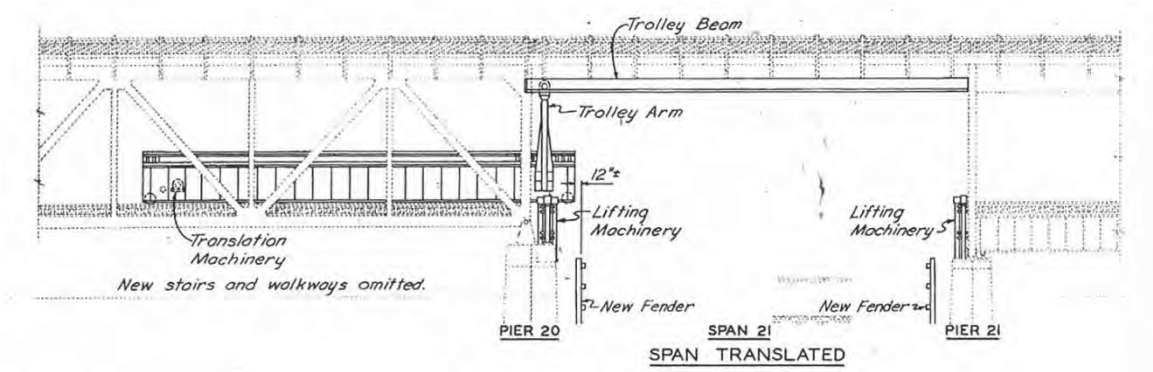


Figure 2 – Secondary Span Machinery Layout Elevation

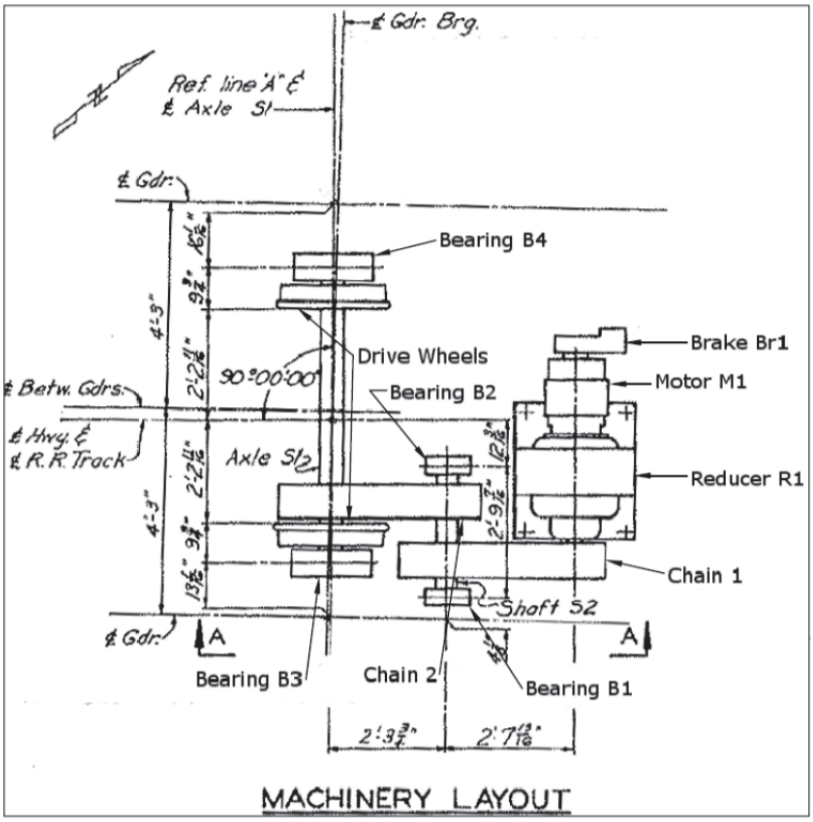


Figure 3 – Secondary Span Translation Machinery Layout

Appendix B
Mechanical Photos

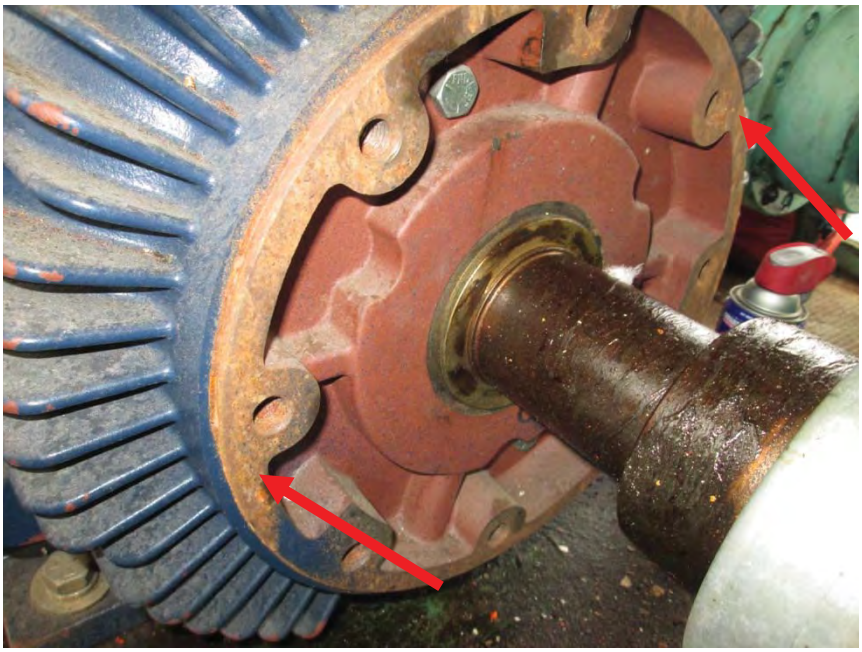


Photo M-1: Northwest Motor: The mounting face of each motor is unpainted and displays light corrosion.

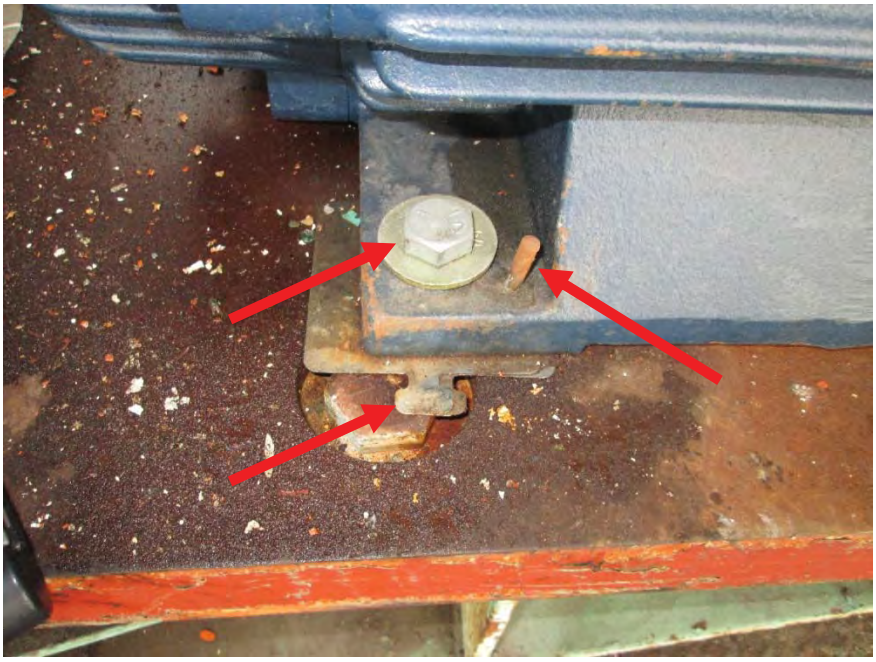


Photo M-2: Northeast Motor: The main motors are mounted with grade 8 bolts and leveled using slotted shims. Slotted shims are secured with dowels.

Photo M-3: Southwest Motor: The northeast and southeast motor supports are unpainted with light corrosion.

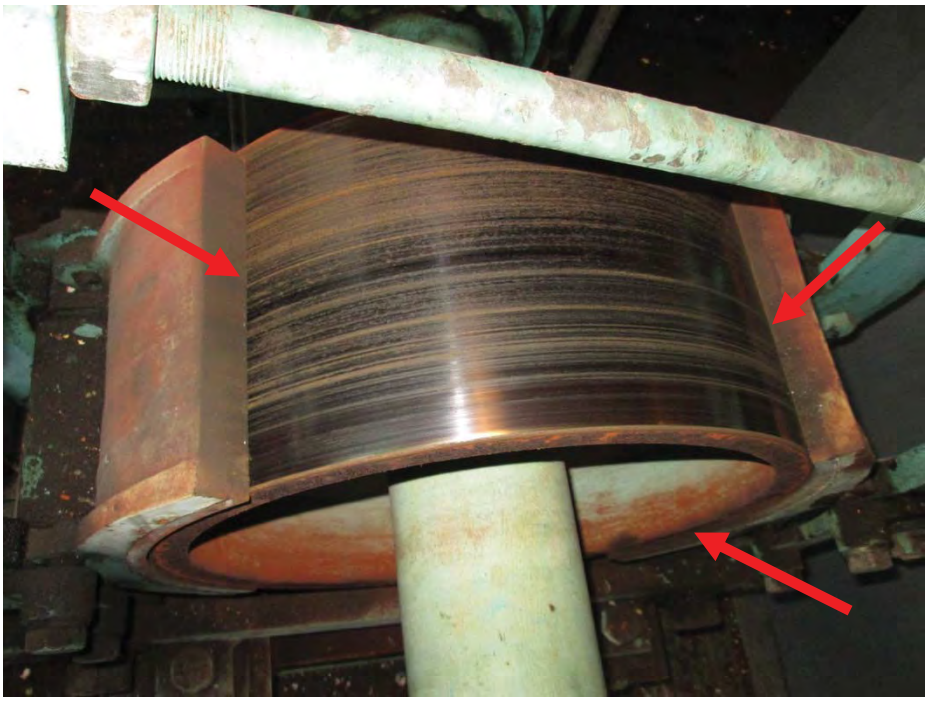
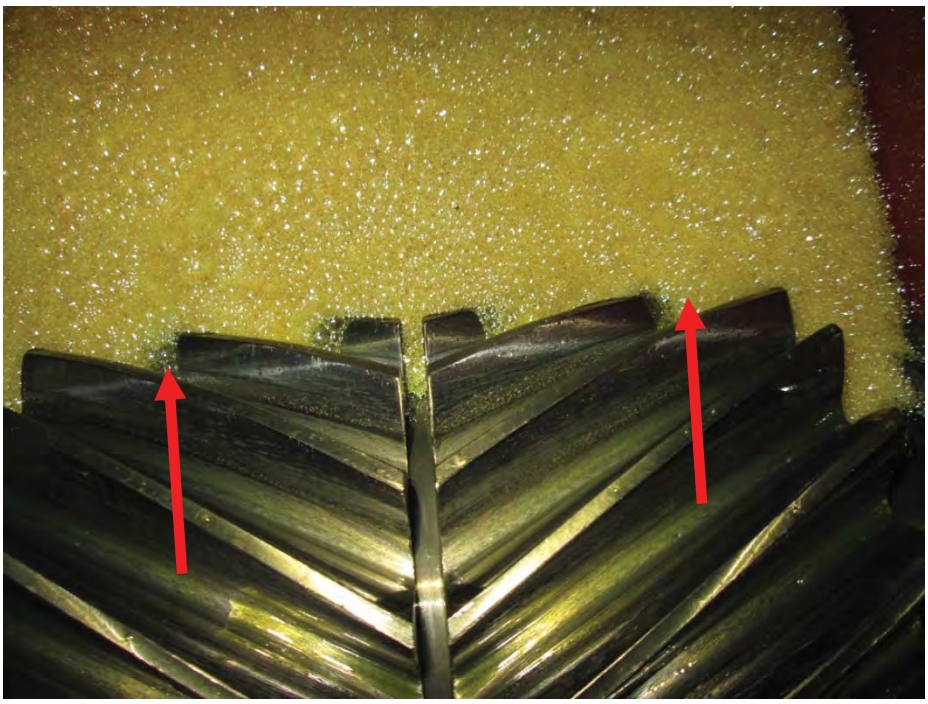


Photo M-4: Southwest Machinery Brake: All brake wheels display grooving and areas of light corrosion. There are also unpainted areas on the faces of the brake wheels which display light corrosion.



Photos M-5: North Main Reducer: The lubricant in both reducers is foaming.

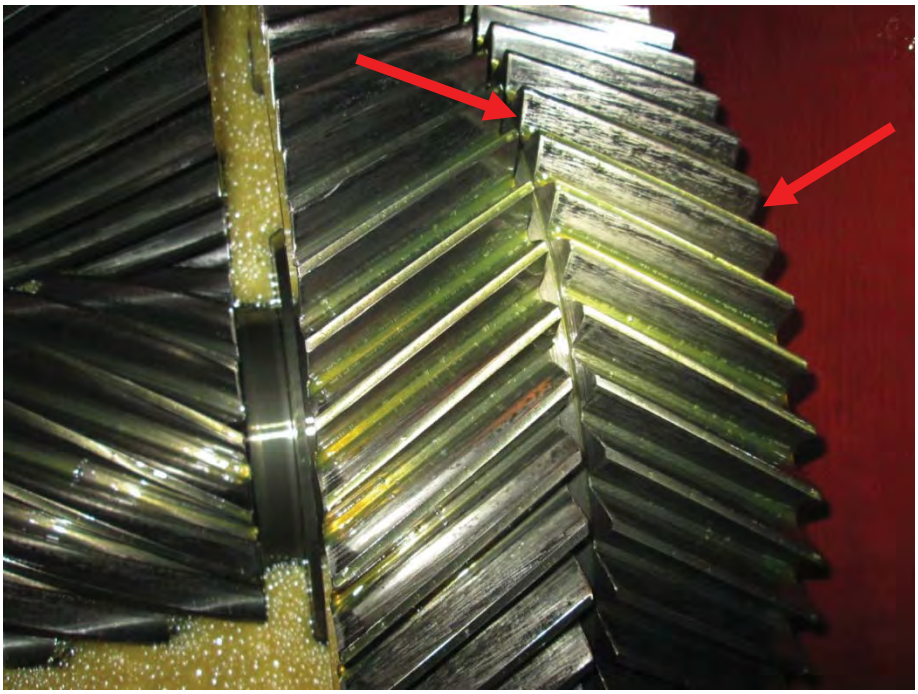


Photo M-6: North Main Reducer: Inspection of the internal gearing revealed that there is light to moderate scoring on the opening faces of all gear teeth, indicating that there has been a long term span heavy condition on the movable span

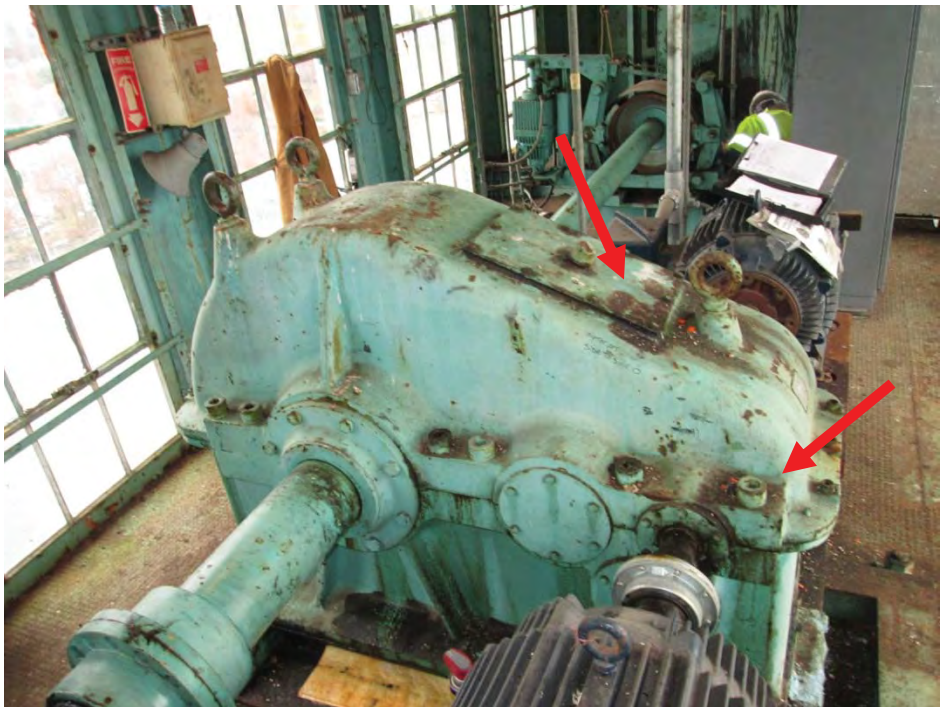


Photo M-7: North Main Reducer: Both reducers display isolated areas of paint failure and corrosion.

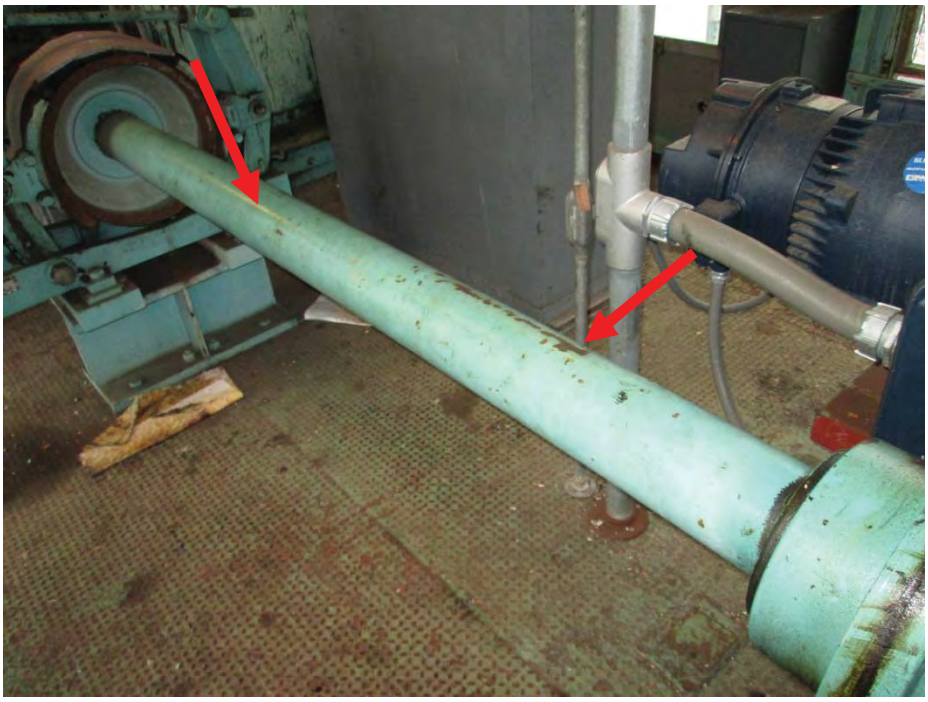


Photo M-8: Northeast Float Shaft: All machinery shafts have isolated areas of chipped paint and light corrosion.

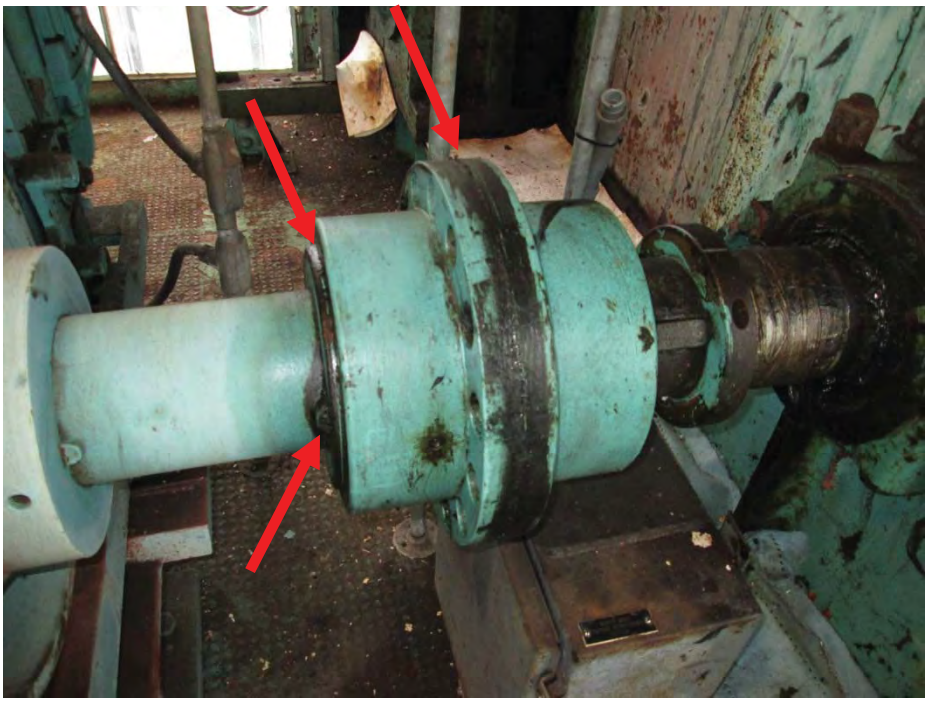


Photo M-9: Coupling C3 Northwest: All gear couplings leak lubricant from the housing splits, keyways, and hub seals.

Photo M-10: South Tower West Bearing B3: All bearings have small isolated areas of chipped paint and are covered in a layer of dirt and debris.

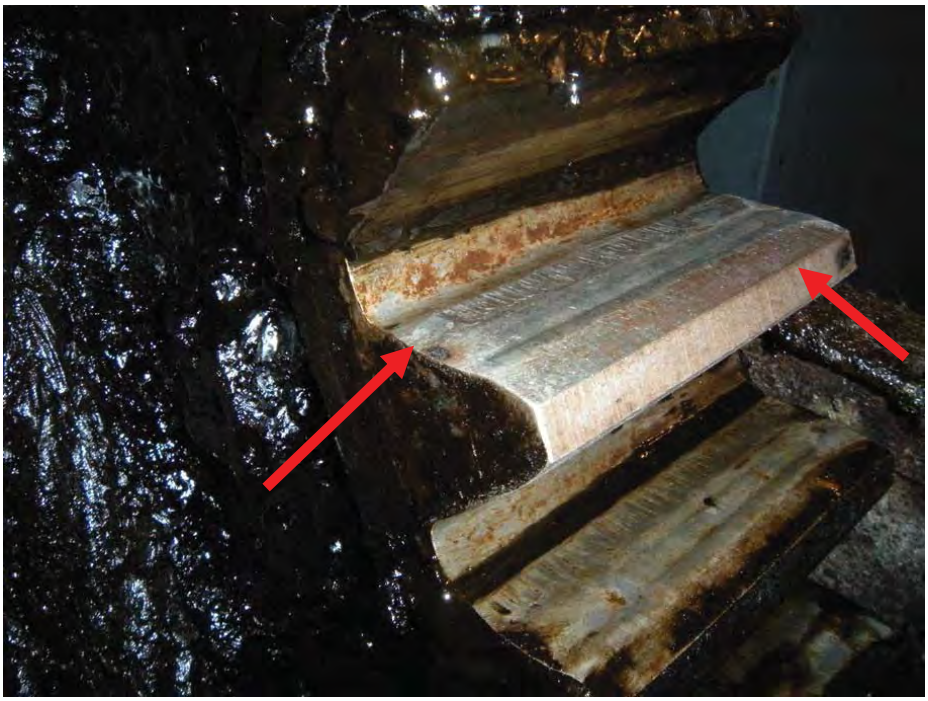


Photo M-11: Southeast Rack: The racks typically have scoring and pitting on both gear tooth faces.

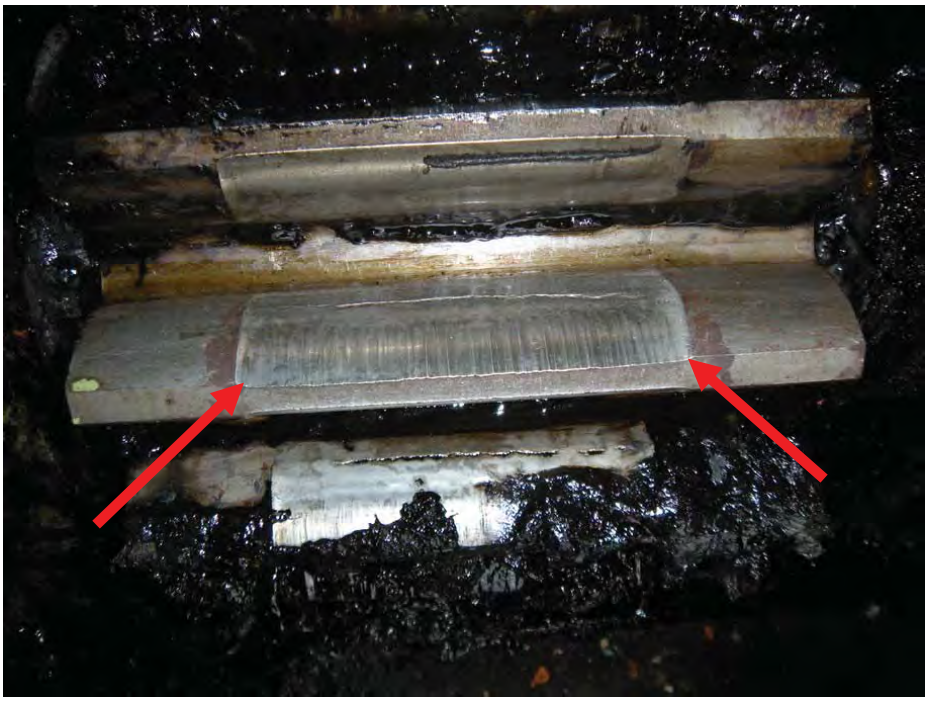


Photo M-12: Northwest Pinion: All pinions display plastic flow, moderate scoring, and pitting on both tooth faces.

Photo M-13: North Span Lock: Span lock housings typically display up to 50% paint failure and light to moderate corrosion.

Photo M-14: North Span Lock: Most of the span lock anchor bolts display moderate to severe corrosion and section loss

Photo M-15: South Span Lock: Makeshift covers nailed to the bottom of the rail ties on the lower deck have come unfastened and are now resting on top of the lock bar operators.

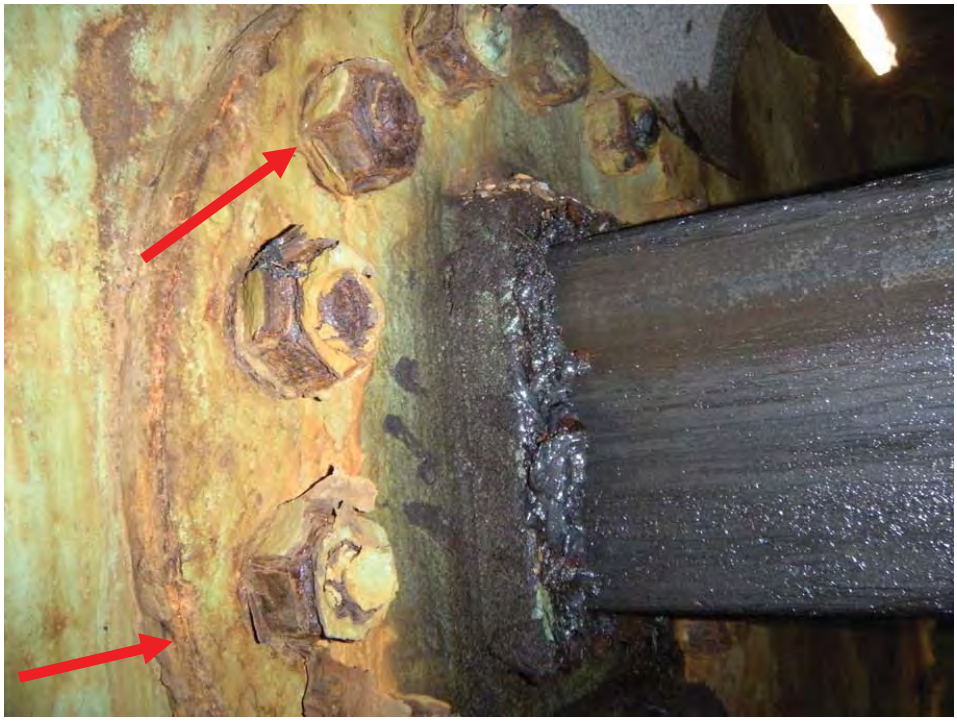


Photo M-16: North Span Lock: Span Lock receivers and mounting bolts have paint failure and moderate corrosion.

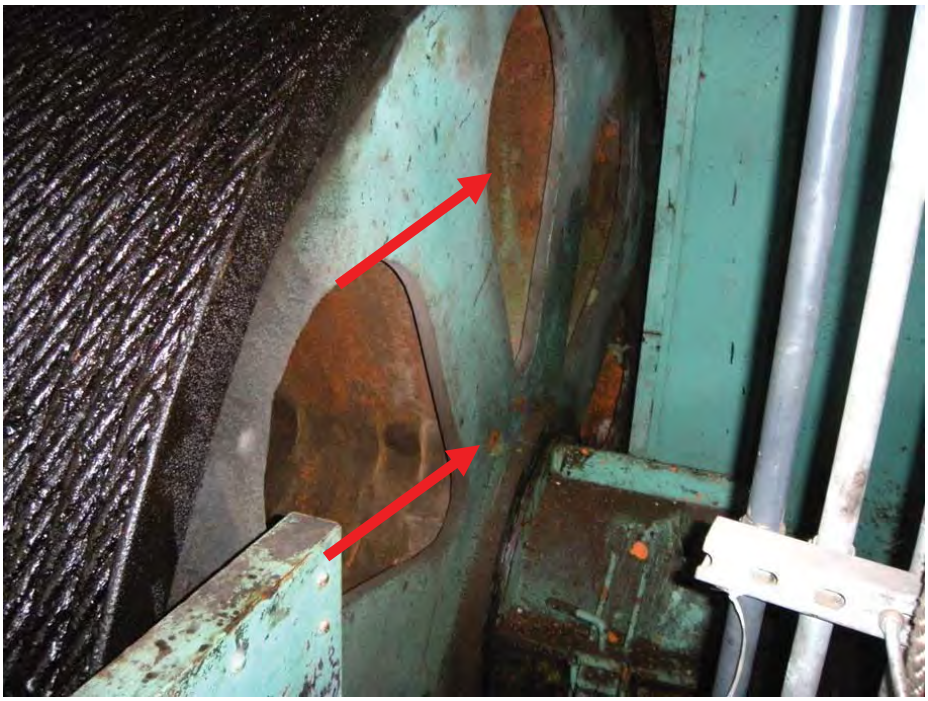


Photo M-17: Northwest Counterweight Sheave: The sides of the sheaves are well painted, with isolated spots of chipped paint and light corrosion

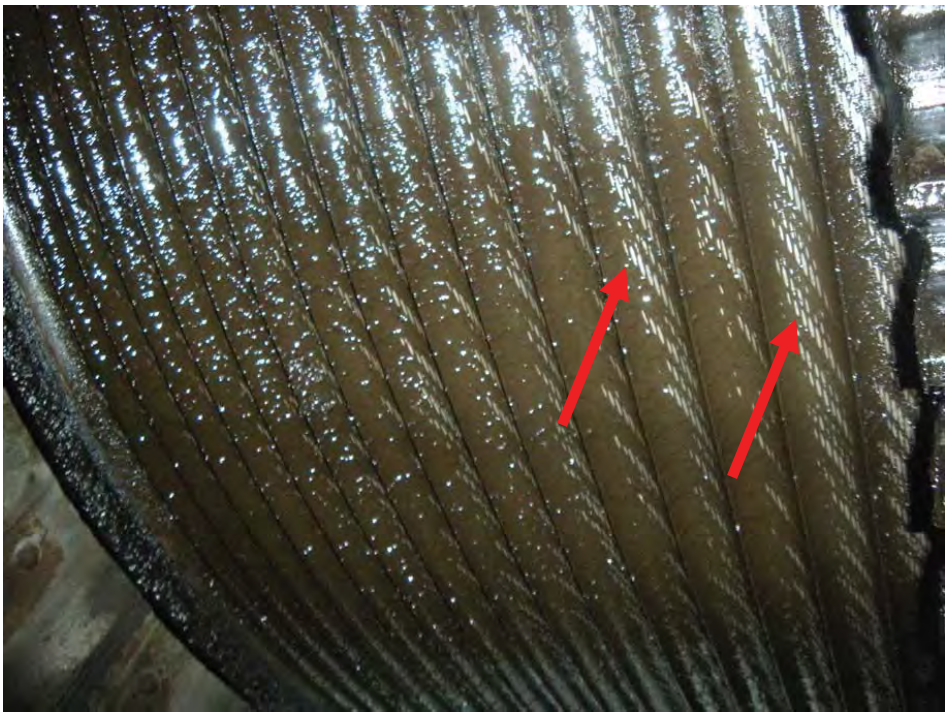


Photo M-18: Northwest Counterweight Sheave: The sheave rope grooves show signs of wear, since abrasive wear marks from the wire ropes are present on the individual grooves.

Photo M-19: Southwest Counterweight Rope Terminations: Note typical arrangement of rope anchor castings securing the rope ends with keeper plates.

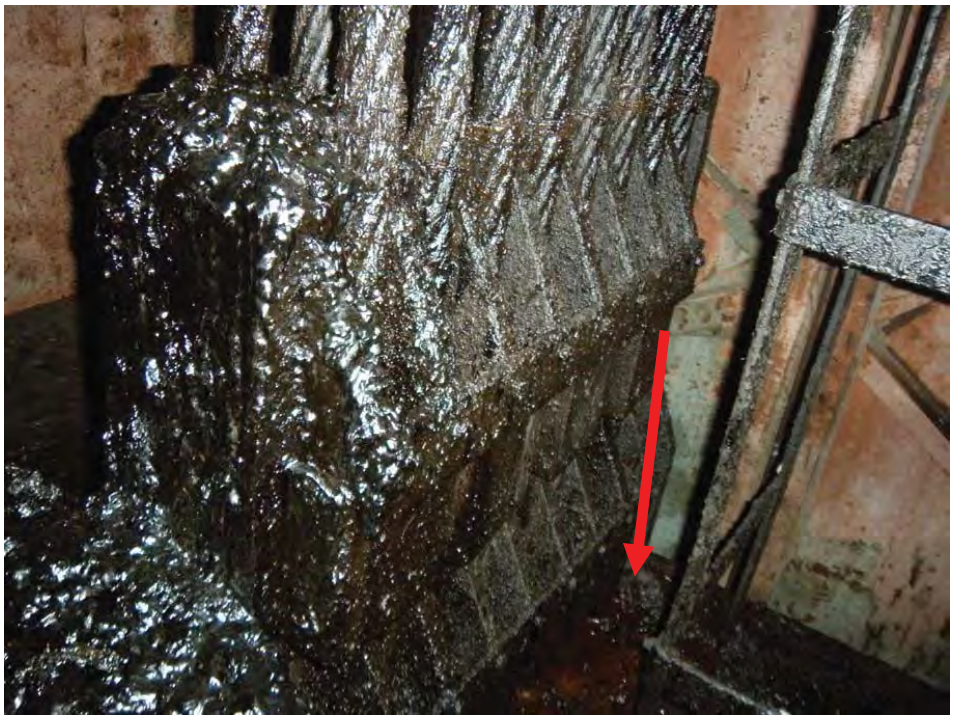


Photo M-20: Northwest Counterweight Rope Terminations: Excessive build-up of grease underneath the counterweight sheaves at the counterweight rope connection to the counterweight in all four corners is a considerable safety hazard for maintenance personnel.

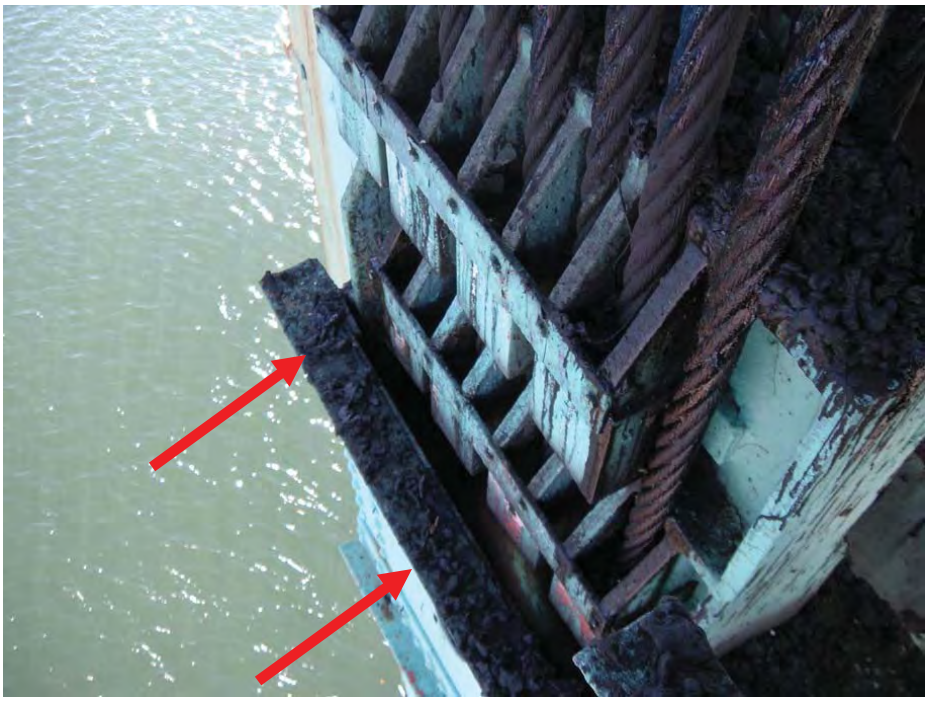


Photo M-21: Southeast Counterweight Rope Terminations: There is significant lubrication build up at the rope connections on the span.

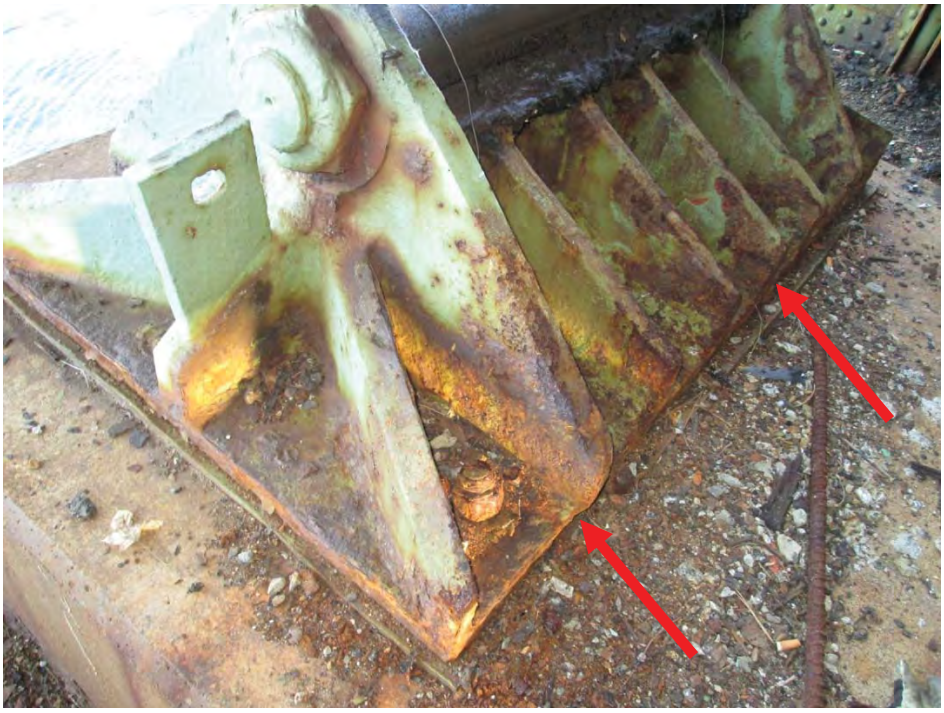


Photo M-22: Southeast Live Load Bearing: The live load bearings all display up to 50% paint failure and light to moderate corrosion over their entire surface.

Photo M-23: Northeast Live Load Bearing: The expansion bearings display fretting corrosion between the bearing surfaces.

Photo M-24: Northwest Span Guide: The north span guide rails all display good lubrication.

Photo M-25: Northwest Span Guide: The northwest lower span guide displays some peeling paint and scaled rust at the bottom of the guide rail.

Photo M-26: Southwest Span Guide: Much of the structural steel and lacing on the south side of the span is damaged. A new channel has been added for reinforcement.

Photo M-27: South west Upper Span Guide: The south upper span guides do not engage the rail, and appear to be broken.

Photo M-28: North Centering Device: The centering devices display light to moderate corrosion with some scaling over their entire surface.

Photo M-29: South Centering Device: The rivet heads fastening the south centering device display up to 50% section loss.

Photo M-30: South Barrier Gate: The south barrier gate housing displays light corrosion where the zinc galvanization has failed.

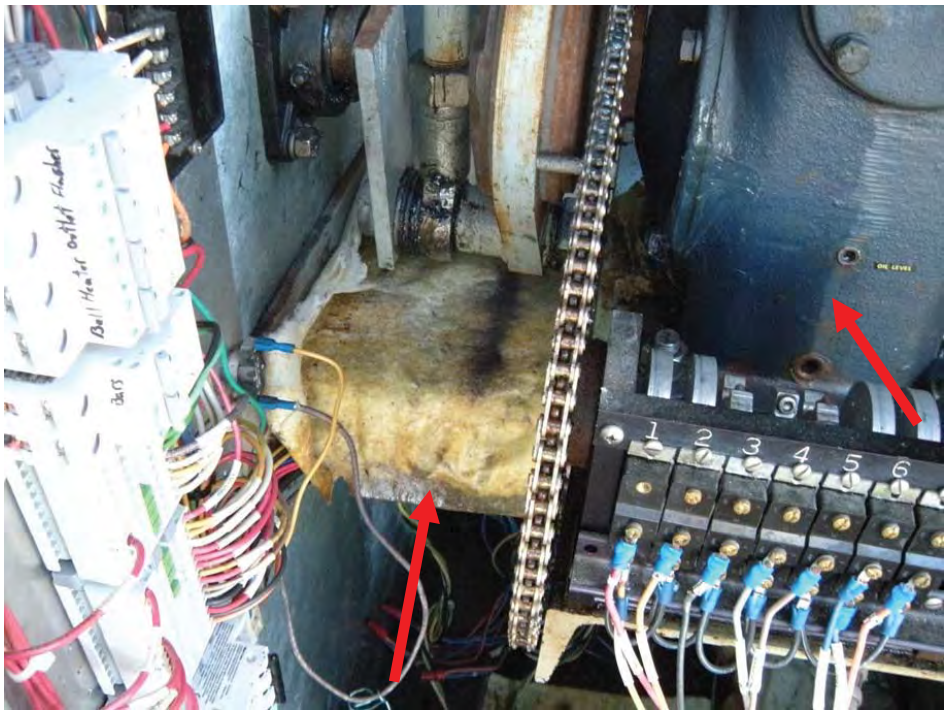


Photo M-31: South Barrier Gate: Both warning gates and the south barrier gate display light leakage at the reducers. Pads have been placed on the south barrier gate machinery supports to absorb leaking oil.

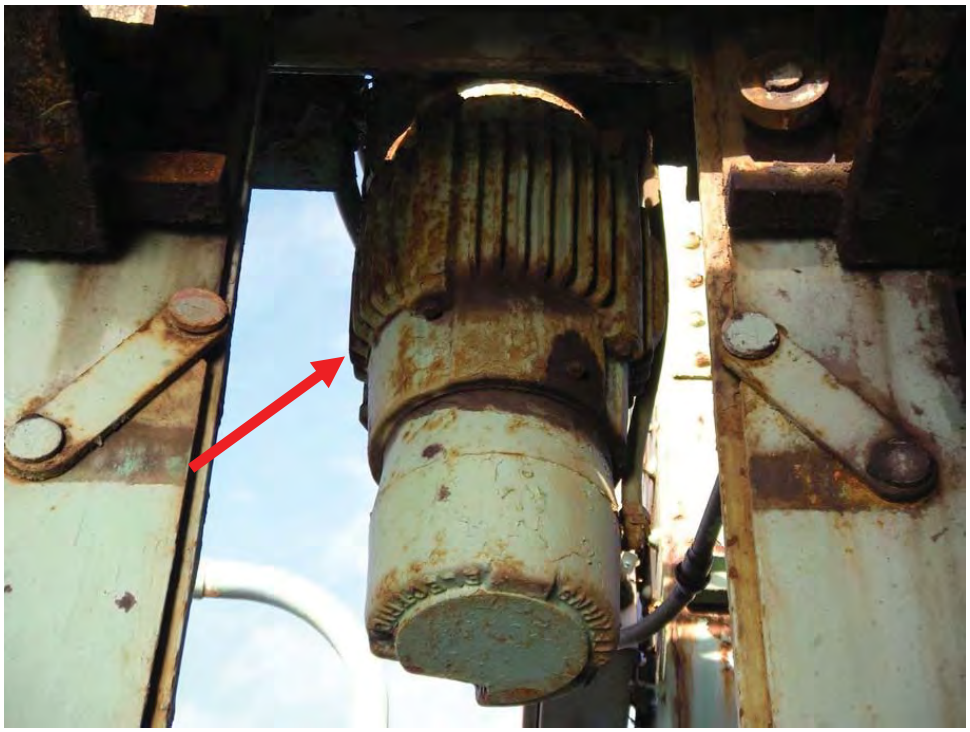


Photo M-32: Northwest Lifting Screw Motor: The housings and fasteners on the lifting screw motors have chipped paint and moderate corrosion.

Photo M-33: Secondary Span Hydraulic Motor: Note condition of hydraulic equipment located at the north approach of the secondary lift span.

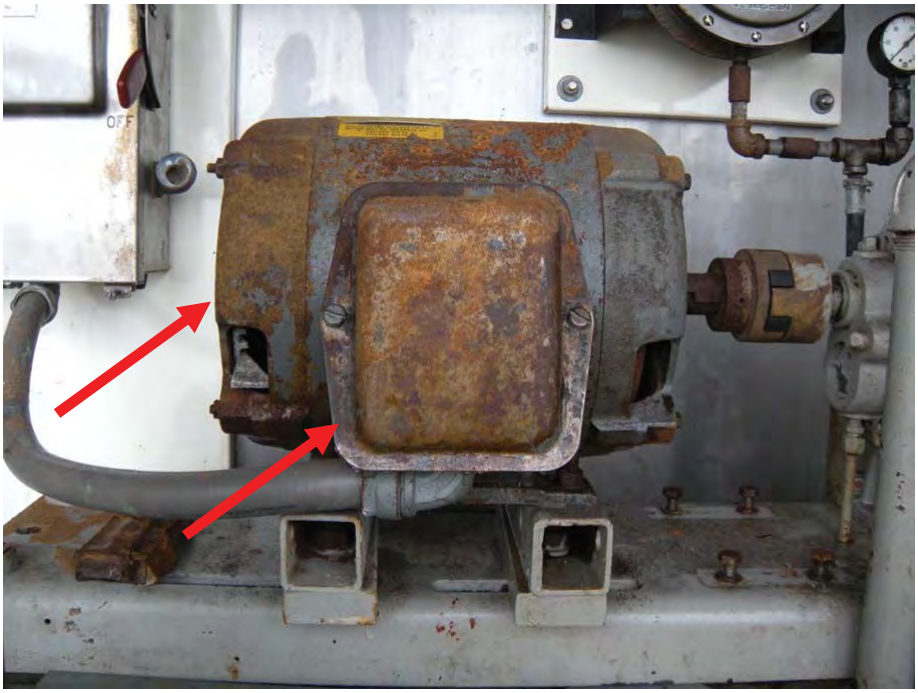


Photo M-34: Secondary Span Hydraulic Motor: The surface of the motor exhibits 50% paint failure and light corrosion.

Photo M-35: Northeast Lifting Screw Machinery: The housings for the reducers and actuators display moderate corrosion, and approximately 25% paint failure.

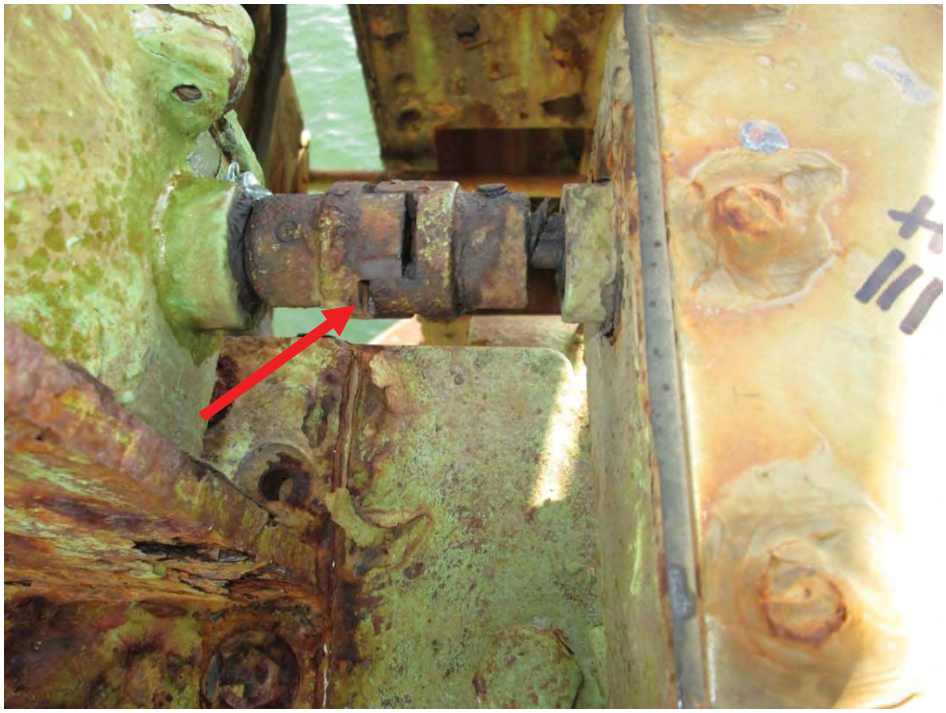


Photo M-36: Northeast Synchro Transmitter Jaw Coupling: The synchro transmitter has a jaw coupling that is not fully engaged.

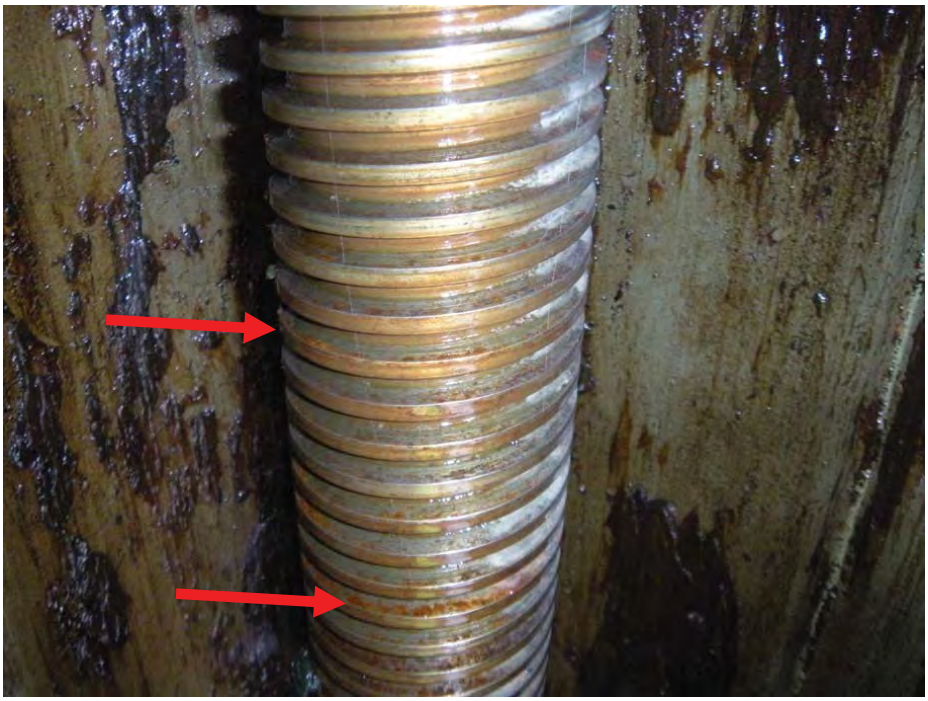


Photo M-37: Southwest Lifting Screw: All lifting screws appear to be well lubricated and clean however some have areas of light surface rust concentrated towards the bottom of the screw.

Photo M-38: Northeast Lifting Screw: The lifting screw housings and doors have areas of moderate rust.

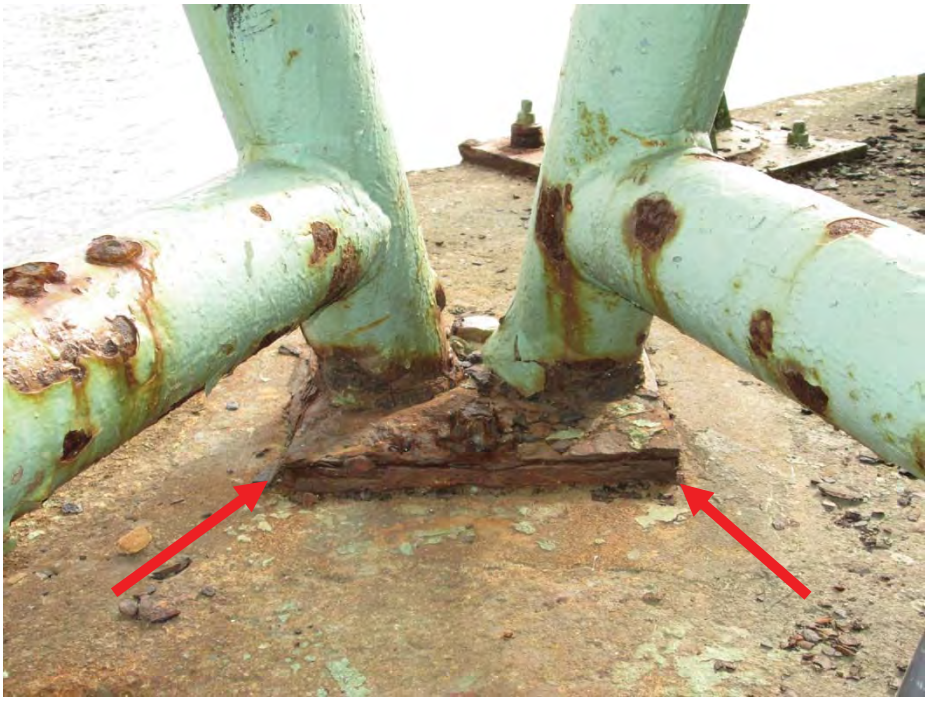


Photo M-39: Southeast Lifting Screw: The diagonal struts support the lifting screw assemblies all display severe corrosion and section loss at the anchor points to the pier.

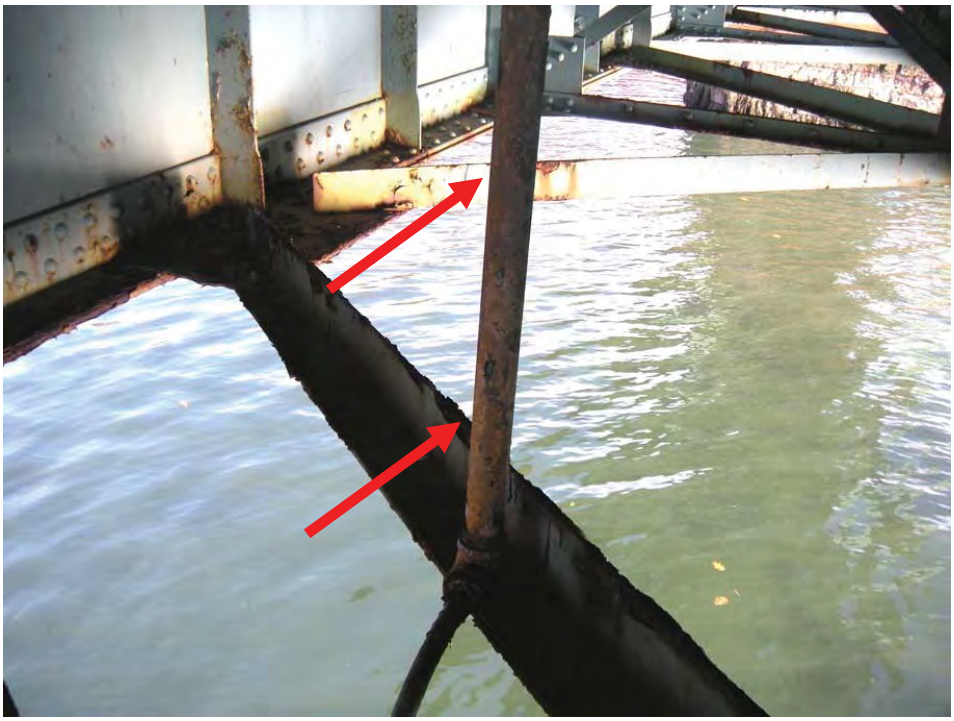


Photo M-40: North Hydraulic Piping: All rigid hydraulic piping displays moderate corrosion.

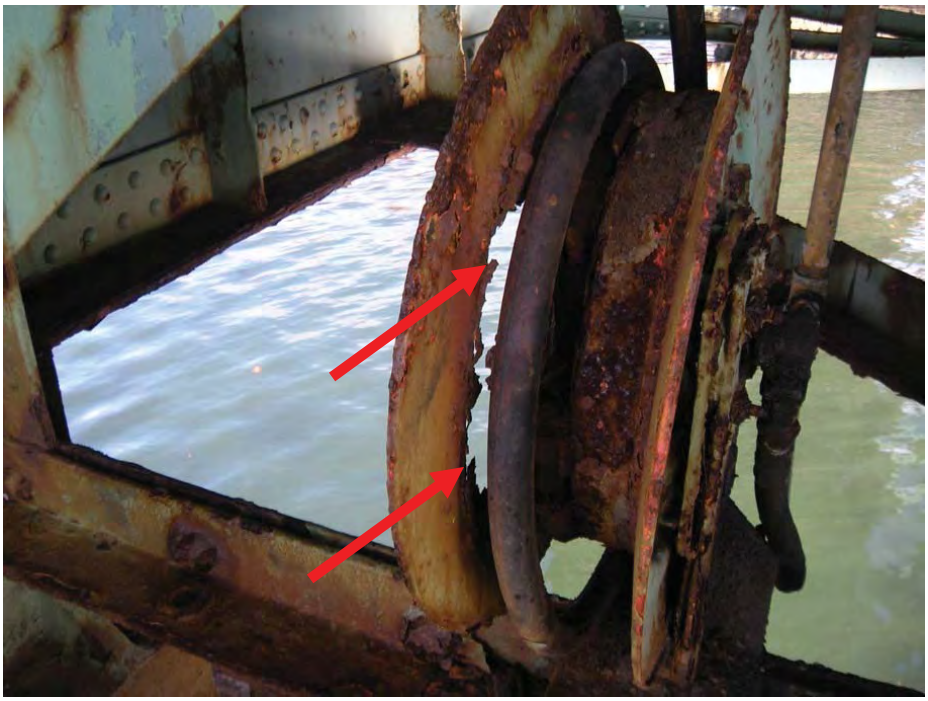


Photo M-41: North Hydraulic Reel: All reels display severe corrosion and complete section loss in many places.

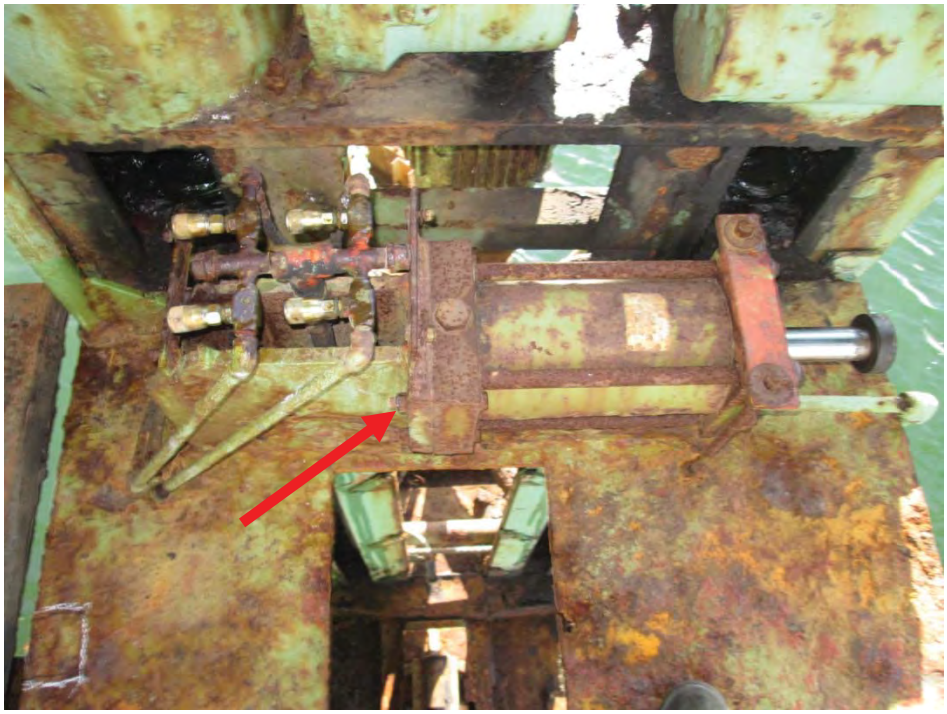


Photo M-42: Northeast Hydraulic Cylinder: Hydraulic buffer cylinders all display near complete paint failure and light to moderate corrosion.

Photo M-43: Northeast Hydraulic Cylinder: Lubricant accumulation around the piston seals indicates that they may leak hydraulic oil.

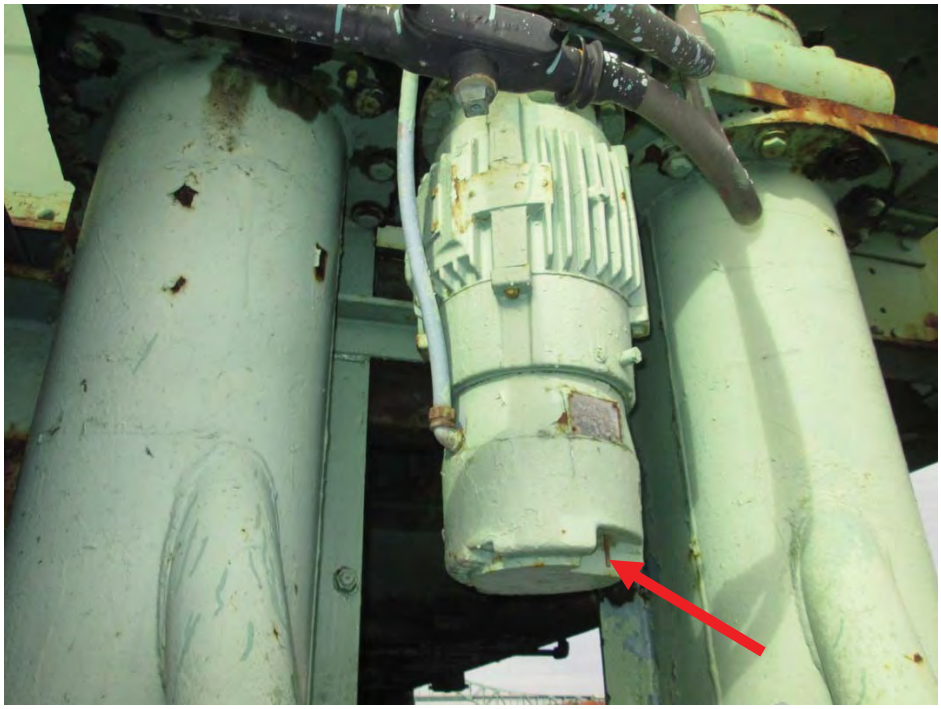


Photo M-44: Southeast Lifting Screw Motor: The southeast lifting machinery brake is missing its hand release handle.

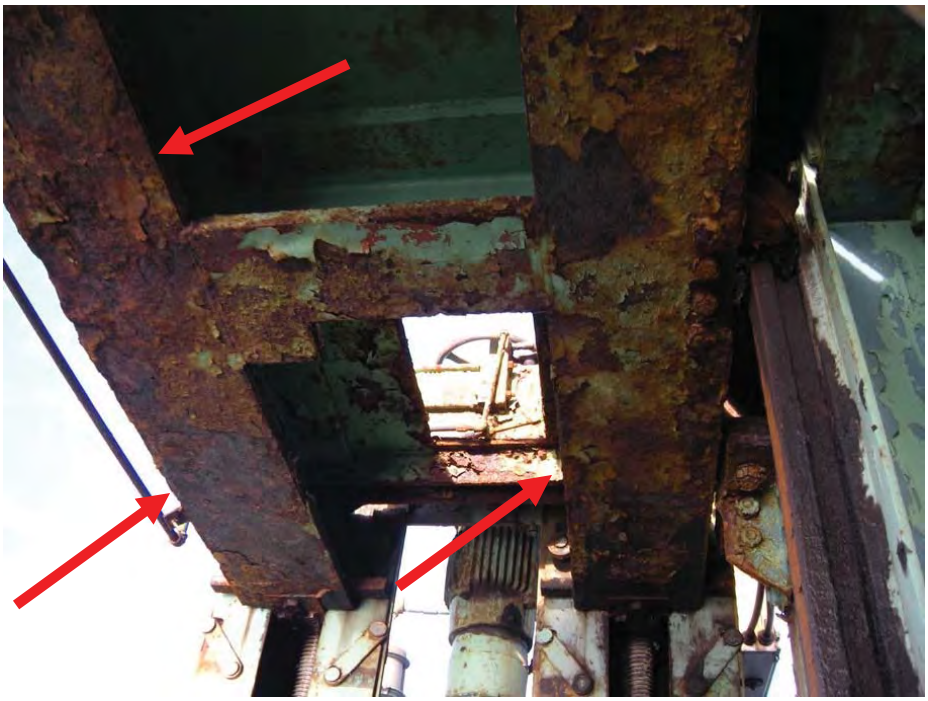


Photo M-45: North Lifting Platform: Both lifting platforms have peeling paint, with areas of severe corrosion, scaling, and section loss.

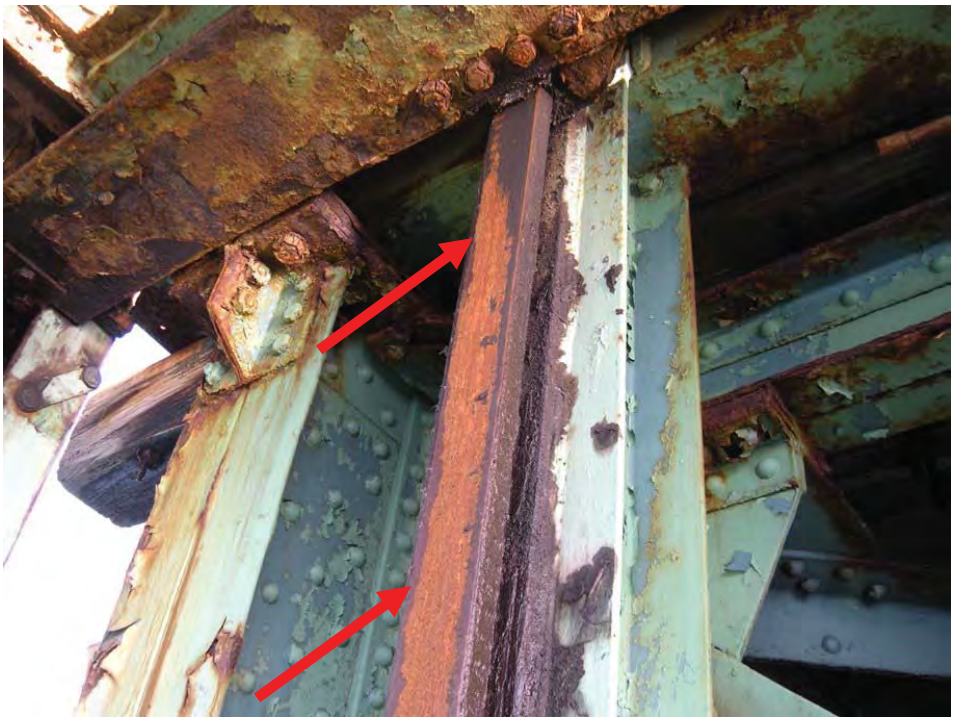


Photo M-46: Northwest Span Guide Rail: The span guide rails show no signs of wear, but have intermittent lubrication and sections with light surface rust.

Photo M-47: Northwest Live Load Bearing: All bearings display 75% paint failure and broad areas of moderate to severe corrosion.

Photo M-48: Southwest Live Load Bearing: The bearing surfaces of the live load bearings have light to moderate rust where ungreased.

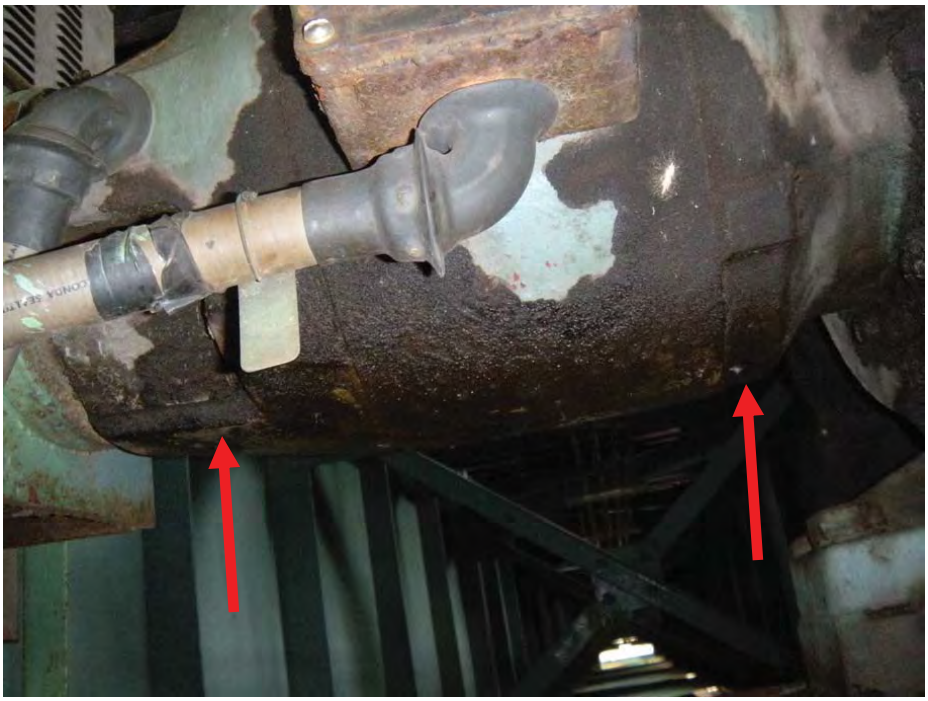


Photo M-49: Translational Machinery Motor: The motor displays combination of leakage from the motor bearings and the c-face mount to the translational machinery reducer.

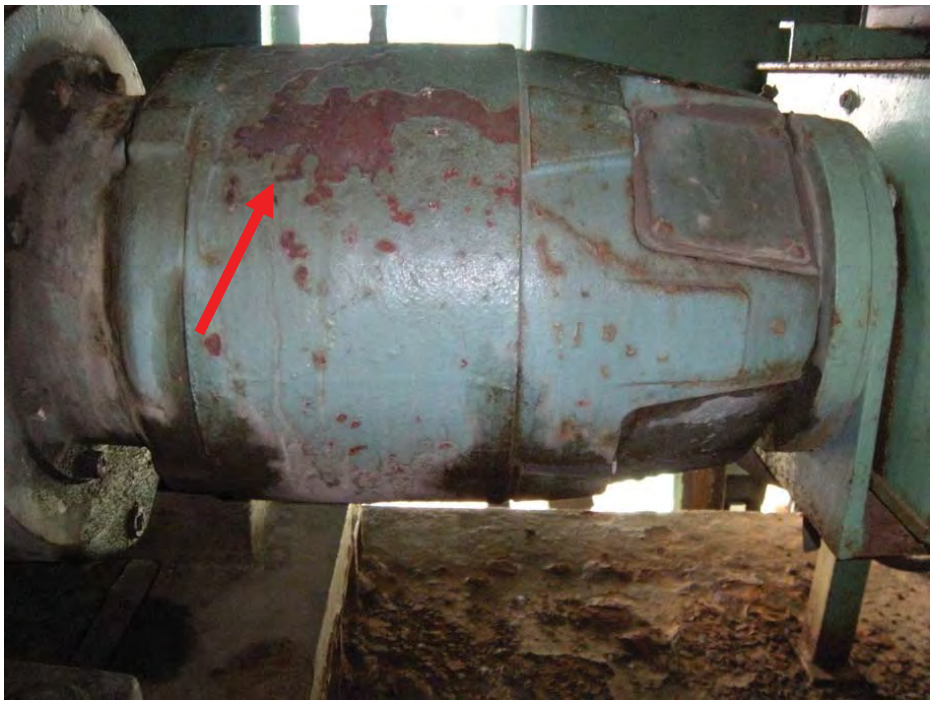


Photo M-50: Translational Machinery Motor: Some paint has peeled, and the motor has light surface rust on 25% of its surface.

Photo M-51: Translational Reducer: The reducer has peeled paint and corrosion on the housing and fasteners and displays leakage at the input seals.

Photo M-52: Translational Machinery Support: The support table has lost much of its paint and has moderate rust with areas of severe corrosion around the edges.

Photo M-53: Translational Machinery Support: There are areas of approximately 1” of pack rust between the table top and its supports.

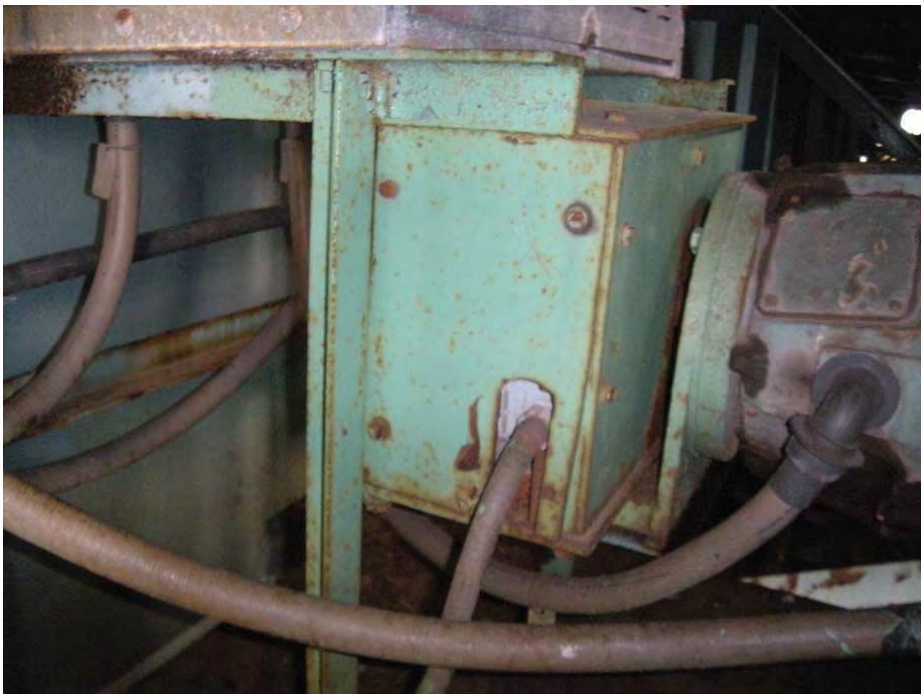


Photo M-54: Translational Motor Brake: The brake enclosure displays peeling paint and surface corrosion.

Photo M-55: Chain 2 Enclosure: The seals on both chain enclosures are leaking.

Photo M-56: Chain 1 Enclosure: The chain enclosure is missing its cap, which has been replaced with duct tape.

Photo M-57: Translational Bearing B4: Bearings display peeled paint in areas of the housing which not covered by grease.

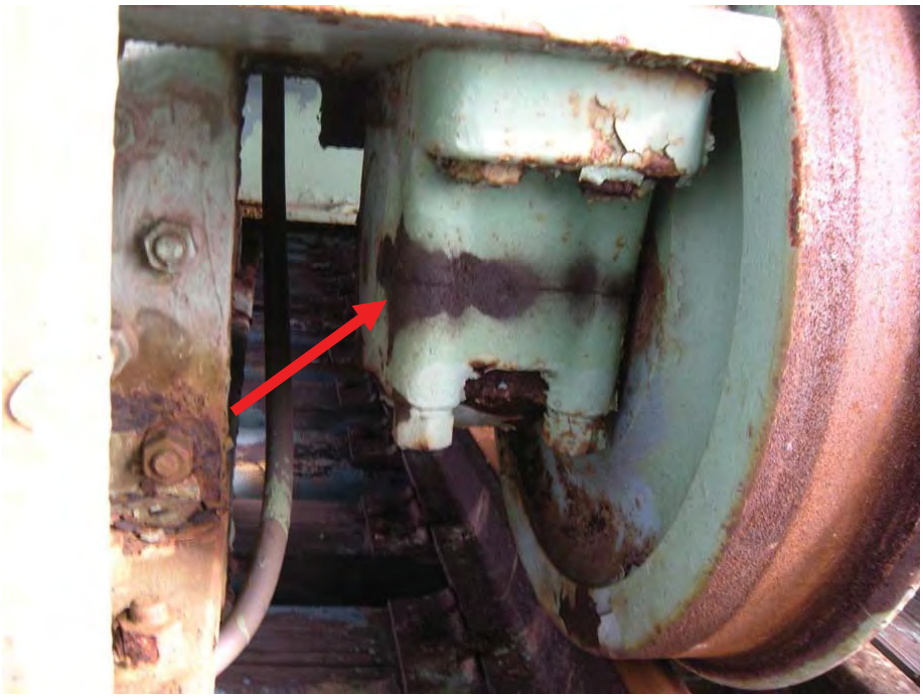


Photo M-58: Translational Bearing B5: Bearings appear to be leaking a small amount of lubricant between the base and the cap of the bearings.

Photo M-59: Translational Machinery Axle 1: Axle 1 has isolated areas of chipped paint, and some surface rust.

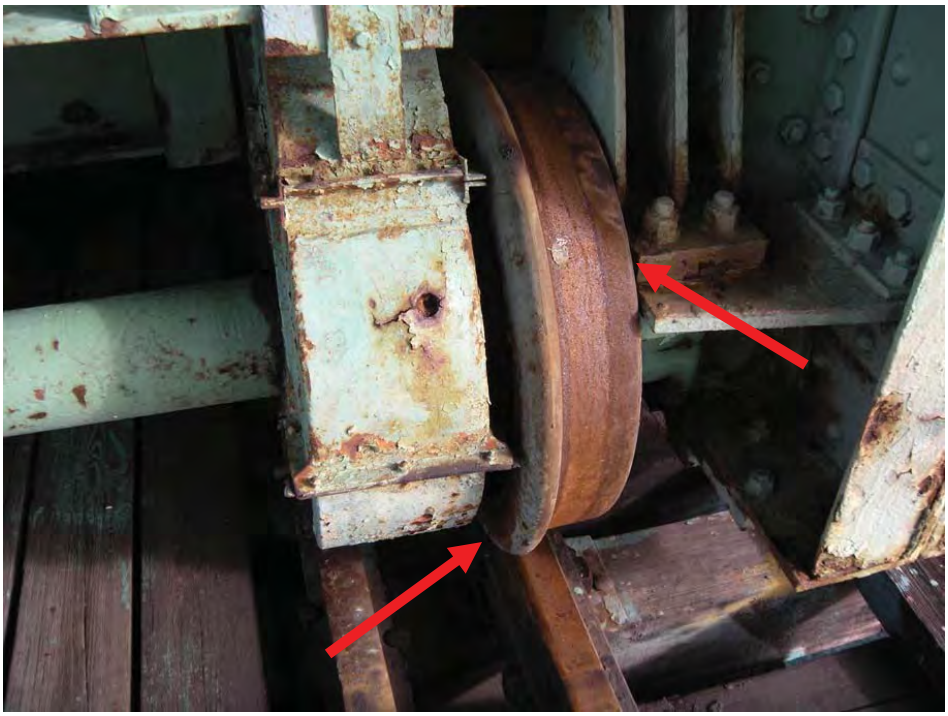


Photo M-60: Southeast Drive Wheel: The drive wheels display corrosion and pitting on the faces that contact the rails as well as the wheel hubs.

Appendix C
Field Measurements

Bearing Clearances:

Bearing Mark, Location Description	Previous Clearance	Measured Clearance	Original Fit Clearance
North Tower East Bearing B1	0.120"+	0.125"	0.008-0.018”
North Tower East Bearing B2	0.100"+	0.101"	0.008-0.018”
North Tower East Bearing B3	0.013"	0.012"	0.003-0.010”
North Tower East Bearing B4	0.007"	0.007"	0.003-0.010”
North Tower West Bearing B1	0.098"+	0.094"	0.008-0.018”
North Tower West Bearing B2	0.106"+	0.114"	0.008-0.018”
North Tower West Bearing B3	0.013"	0.013"	0.003-0.010”
North Tower West Bearing B4	0.019"	0.012"	0.003-0.010”
South Tower East Bearing B1	0.062"+	0.063"	0.008-0.018”
South Tower East Bearing B2	0.048"+	0.050"	0.008-0.018”
South Tower East Bearing B3	0.011"	0.011"	0.003-0.010”
South Tower East Bearing B4	0.017"	0.010"	0.003-0.010”

+ Bearing clearance noted is between the trunnion journal and cap, not a running fit.

*Requires immediate attention.

Bearing Clearances (Cont.):

Bearing Mark, Location Description	Previous Clearance	Measured Clearance	Original Fit Clearance
South Tower West Bearing B1	0.042"+	0.052"	0.008-0.018”
South Tower West Bearing B2	0.062"+	0.082"	0.008-0.018”
South Tower West Bearing B3	0.010"	0.011"	0.003-0.010”
South Tower West Bearing B4	0.008"	0.009"	0.003-0.010”

+ Bearing clearance noted is between the trunnion journal and cap, not a running fit.

*Requires immediate attention.

Gear Tooth Measurements:

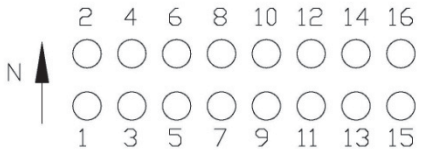
Tooth Thickness Pinion Gears measured at addendum = 0.831” Rack Gears measured at addendum = 0.799”				
	Chordal		**Backlash**	
Gear Mark	**Previous**	**Measured**	**Design**	**Measured**
South Tower West Rack Gear	T- 1.200” M- 1.215” H- 1.226”	T- 1.203” M- 1.204” H- 1.215”	0.070-0.095”	0.079”
South Tower West Pinion Gear	T- 1.228” M- 1.127” H-1.130” Unused – 1.226”	T- 1.138” M- 1.140” H-1.139” Unused – 1.224”		
South Tower East Rack Gear	T- 1.164” M- 1.180” H-1.183”	T- 1.225” M- 1.244” H-1.235”	0.070-0.095”	0.089”
South Tower East Pinion Gear	T- 1.200” M- 1.095” H-1.100” Unused – 1.226”	T- 1.123” M- 1.108” H-1.116” Unused – 1.228”		
North Tower West Rack Gear	T- 1.230” M- 1.229” H-1.225”	T- 1.226” M- 1.234” H-1.243”	0.070-0.095”	0.072”
North Tower West Pinion Gear	T- 1.105” M- 1.102” H-1.116” Unused -1.230”	T- 1.118” M- 1.115” H-1.125” Unused -1.240”		

North Tower East Rack Gear	T- 1.211” M- 1.215” H-1.172” * *Plastic flow @ tip	T- 1.232” M- 1.232” H-1.231”	0.070-0.095”	0.079”
North Tower East Pinion Gear	T- 1.121” M- 1.116” H-1.115” Unused – 1.198”	T- 1.085” M- 1.084” H-1.091” Unused – 1.243”		

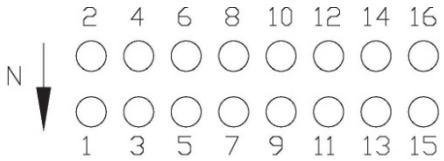
Current Chordal Measurements									
Location	Mark	No of Teeth	# Teeth Measured	New Gear	Inboard	Center	Outboard	Average	Percent Remaining
NE	Pinion	14	2	3.680	3.608	3.604	3.602	3.605	94%
NW	Pinion	14	2	3.680	3.616	3.616	3.603	3.612	94%
SE	Pinion	14	2	3.680	3.613	3.624	3.623	3.620	95%
SW	Pinion	14	2	3.680	3.633	3.618	3.630	3.627	96%

Counterweight Rope Measurements:

*Rope layout for North Sheaves is as follows:



**Rope layout for South Sheaves is as follows:



Counterweight Rope Diameter Measurements								
	Northeast*		Northwest*		Southeast**		Southwest**	
Rope #	Previous	Current	Previous	Current	Previous	Current	Previous	Current
1	N/A	1.757	N/A	1.760	N/A	1.747	N/A	1.766
2	N/A	1.752	N/A	1.721	N/A	1.760	N/A	1.756
3	N/A	1.755	N/A	1.752	N/A	1.757	N/A	1.763
4	N/A	1.754	N/A	1.761	N/A	1.761	N/A	1.757
5	N/A	1.757	N/A	1.755	N/A	1.758	N/A	1.759
6	N/A	1.760	N/A	1.752	N/A	1.750	N/A	1.756
7	N/A	1.752	N/A	1.760	N/A	1.763	N/A	1.748
8	N/A	1.762	N/A	1.758	N/A	1.755	N/A	1.760
9	N/A	1.756	N/A	1.756	N/A	1.764	N/A	1.762
10	N/A	1.757	N/A	1.758	N/A	1.764	N/A	1.755
11	N/A	1.755	N/A	1.759	N/A	1.756	N/A	1.761
12	N/A	1.762	N/A	1.762	N/A	1.762	N/A	1.755
13	N/A	1.761	N/A	1.760	N/A	1.760	N/A	1.754
14	N/A	1.757	N/A	1.748	N/A	1.769	N/A	1.761
15	N/A	1.762	N/A	1.754	N/A	1.757	N/A	1.759
16	N/A	1.756	N/A	1.752	N/A	1.757	N/A	1.763

Counterweight Rope Measurements (Cont.):

Counterweight Lay Length Measurements								
Rope #	Northeast*		Northwest*		Southeast**		Southwest**	
	Previous	Current	Previous	Current	Previous	Current	Previous	Current
1	11.533”	11.189	N/A	N/A	11.412”	11.308	11.295”	11.282
2	N/A	11.495	N/A	11.501	10.948”	11.161	11.370”	11.239
3	N/A	11.437	N/A	N/A	11.421”	11.280	N/A	11.376
4	11.485”	11.497	N/A	11.260	11.393”	11.276	N/A	11.477
5	11.395”	11.510	N/A	N/A	11.340”	11.395	N/A	11.493
6	N/A	11.506	N/A	11.420	11.320”	11.267	11.420”	11.426
7	N/A	11.491	N/A	N/A	11.380”	11.210	11.411”	11.488
8	11.414”	11.501	N/A	11.319	11.336”	11.390	N/A	11.483
9	11.300”	11.451	11.481”	N/A	N/A	N/A	N/A	11.466
10	N/A	11.438	11.397”	11.362	N/A	11.492	11.517”	11.354
11	N/A	11.539	11.410”	11.321	N/A	N/A	11.560”	11.536
12	11.344”	11.431	11.369”	11.486	N/A	11.474	N/A	11.036
13	11.526”	11.554	11.600”	11.459	N/A	N/A	N/A	11.549
14	N/A	11.407	11.400”	11.348	N/A	11.349	11.424”	11.314
15	N/A	11.470	11.450”	11.272	N/A	N/A	11.256”	11.412
16	11.625”	11.374	11.510”	11.492	N/A	11.368	N/A	11.173

Span Guide and Receiver Clearances:

North Guide/Receiver Clearances				
Front Guide	Top	Bot	East	West
Previous	0.0625	Hard Contact	N/A	N/A
Current	0.069	0.040	0.074	0.040
Rear Guide	Top	Bot	East	West
Previous	0.025	0.005	0.015	0.025
Current	0.060	0.048	0.125	0.008

South Guide/Receiver Clearances				
Front Guide	Top	Bot	East	West
Previous	0.0625	Hard Contact	0.025	0.025
Current	0.120	Hard Contact	0.037	0.045
Rear Guide	Top	Bot	East	West
Previous	0.015	0.025	0.015	0.025
Current	0.017	0.065	Hard Contact	0.065

Lead Wire Test Results:

	Northwest		Northeast		Southwest		Southeast	
Location	I	O	I	O	I	O	I	O
Wire Thickness (inches)	0.018	0.018	0.019	0.022	0.023	0.029	0.015	0.039

Appendix D
Field Inspection Sheets

Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Schematic	Page: 1	of: 46	
Job #:	No:		

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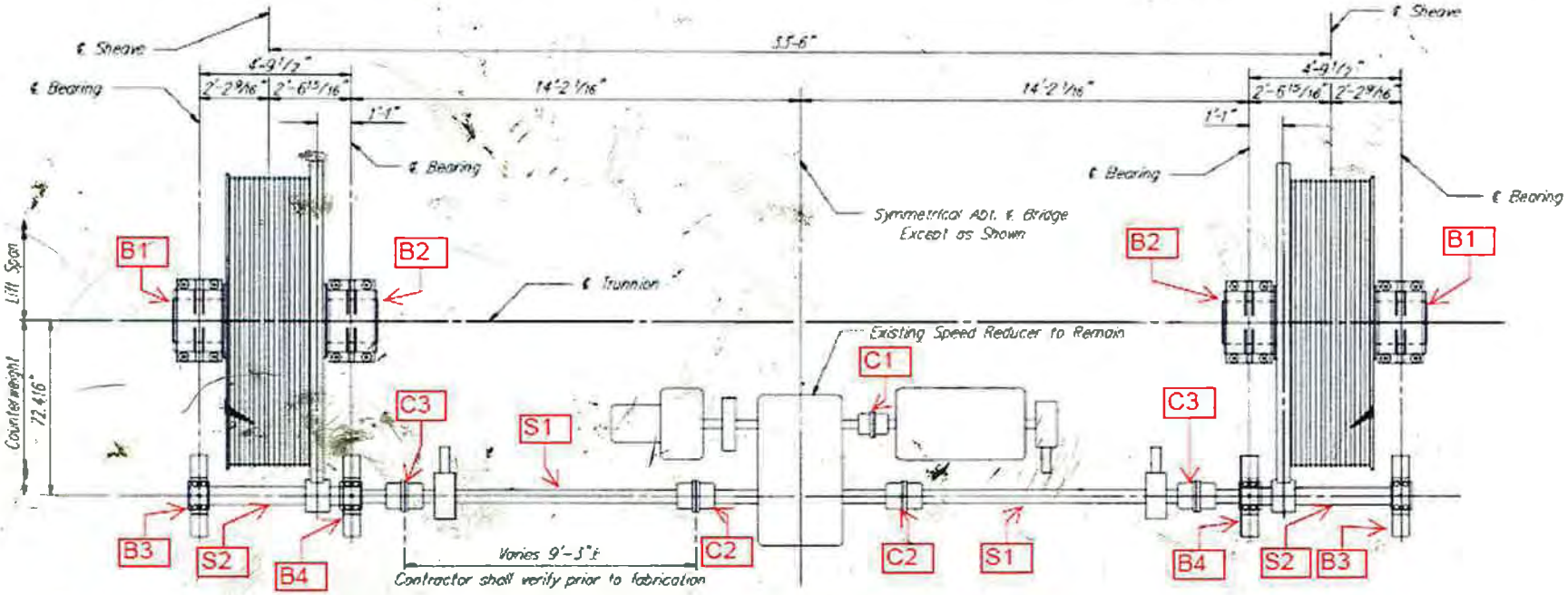

PLAN—OPERATING MACHINERY REHABILITATION

Not To Scale

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Motors	Page: 2	of: 46	
Job #:	No:		

Motor Identification per Schematic:	Northeast Motor			
Motor Nameplate Data:	Manufacturer: ~~Reuland~~ marathon			
	Ser. No.: WAT04 1385	Type:	Frame:	
	Prod. No.:		Phase:	Hz:
	HP:	RPM:	Encl: TenV	
	Volts:	Amps:	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.: 39598H001-2	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Same as NW			
Bolts:	Same as NW			
Comments:	8-11 supports unpainted w/ light rust			

Motor Identification per Schematic:	Northwest Motor @800 control desk			
Motor Nameplate Data:	Manufacturer: ~~Reuland~~ Marathon			
	Ser. No.: WAT04 7542	Type: TTS	Frame: 405TC	
	Prod. No.:		Phase: 3	Hz: 60
	HP: 100	RPM: 2300	Encl: TENV	
	Volts: 460	Amps: 112	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer: Stearns			
	Ser. No.: 39598H004-1	Volts: 460	Hz: 60	Torque: 350
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Good light rust on unpainted front mounting face red primer rot.			
Bolts:	Unpainted 6 or 8 w slotted shims + dowels			
Comments:	1-6 support has a few areas of chipped paint w/ light rust			

Motor Identification per Schematic:	Southeast Motor			
Motor Nameplate Data:	Manufacturer: ~~Reuland~~ marathon			
	Ser. No.: WAA0415 86	Type: FVH 405THT 5170 34 HN	Frame:	
	Prod. No.:		Phase:	Hz:
	HP: 100	RPM: 2880	Encl: TENV	
	Volts: 460	Amps: 33	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.: 39598H001-3	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Same as NW			
Bolts:	Same as NW			
Comments:	116 - 122			

Motor Identification per Schematic:	Southwest Motor			
Motor Nameplate Data:	Manufacturer: ~~Reuland~~ marathon			
	Ser. No.: WAA0415 93	Type:	Frame:	
	Prod. No.:		Phase:	Hz:
	HP:	RPM:	Encl:	
	Volts:	Amps:	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.: 39598H001-1	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Same as NE			
Bolts:	Same as NE			
Comments:	124 - 129			

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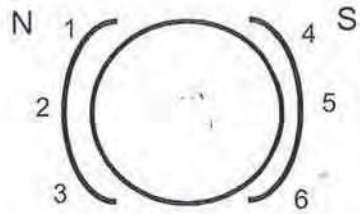
Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Brakes	Page: 4	of: 46	
Job #:	No:		

Brake Identification per Schematic	**Northeast Machinery Brake**			
Brake Type:				
Nameplate Data:	Manufacturer: Mondel (rehabbed)			
	Thrustor		Brake Assembly	
	Model: 19MB7/E-ED	No.:		
	Cat. No.: 2116		Ser. No.:	Model:
			Phase:	Volts: 460
			AMP: 1.2	
			Rated Torque: 2006	
	Ins. Cl.:		Torque Setting: 1900	
Thrustor Oil Level:	Not opened			
Delay:	Set when parked			
Thrustor Stroke:	5/8"			
Linings:	1/2" both sides			
Limit Switches:	could only check open because of hand release			
Brake Wheel:	Bearing on inboard side chipped paint @ shaft connection			
Supports:	OK no issues			
Comments:	Few areas of chipped on housing at pin connections			
	Wheel has light rust on OB side light scoring			
	hand release is tied to the floor			

28-38 28 on brake 30 on thruster

Linings	1	2	3
Tight when set	N	N	Y
Free when released			
	4	5	6
Tight when set	N	Y	N
Free when released			

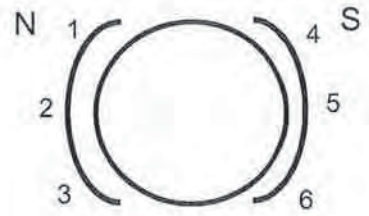


Brake Wheel/Shoe Clearance Measurements

Brake Identification per Schematic	Northwest Machinery Brake				
Brake Type:					
Nameplate Data:	Manufacturer:				
	Thrustor			Brake Assembly	
	Model:	No.:			
	Cat. No.:			Ser. No.:	Model:
				Phase:	Volts:
				AMP:	
				Rated Torque:	
	Ins. Cl.:			Torque Setting:	1600
Thrustor Oil Level:					
Delay:	Set when parked				
Thrustor Stroke:	3/4"				
Linings:	1/2"				
Limit Switches:					
Brake Wheel:	similar chipped paint @ interface light scoring full contact				
Mounting Bolts:	OK				
Supports:	OK				
Comments:	gen condition similar to NE				
	inboard lining overhanging BW 1/8"				

39-48

Linings	1	2	3
Tight when set	N	Y	Y
Free when released			
	4	5	6
Tight when set	N	Y	Y
Free when released			



Brake Wheel/Shoe Clearance Measurements

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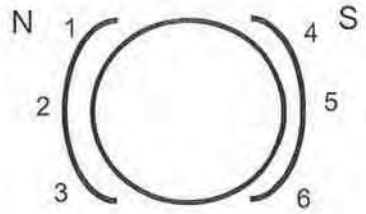
Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Brakes	Page: 6	of: 46	
Job #:	No:		

NW

Brake Identification per Schematic	Southeast Machinery Brake				
Brake Type:					
Nameplate Data:	Manufacturer:				
	Thrustor			Brake Assembly	
	Model:	No.:			
	Cat. No.:			Ser. No.:	Model:
				Phase:	Volts:
				AMP:	
				Rated Torque:	
	Ins. Cl.:			Torque Setting: 1650	
Thrustor Oil Level:					
Delay:					
Thrustor Stroke:	1"				
Linings:	1/2"				
Limit Switches:					
Brake Wheel:					
Mounting Bolts:					
Supports:					
Comments:	100-106 General condition similar to NE				

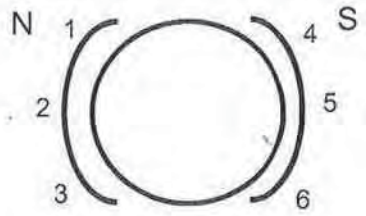
Linings	1	2	3
Tight when set	Y	Y	Y
Free when released	NA		
	4	5	6
Tight when set	Y	Y	N
Free when released			



Brake Wheel/Shoe Clearance Measurements

Brake Identification per Schematic						Southwest (East) Machinery Brake
Brake Type:						
Nameplate Data:	Manufacturer:					
	Thrustor			Brake Assembly		
	Model:		No.:			
	Cat. No.:			Ser. No.:	Model:	
				Phase:	Volts:	
				AMP:		
				Rated Torque:		
	Ins. Cl.:			Torque Setting: 1806		
Thrustor Oil Level:						
Delay:						
Thrustor Stroke:	5/8					
Linings:	1/2"					
Limit Switches:						
Brake Wheel:						
Mounting Bolts:						
Supports:						
Comments:	107 \15					
	Gen condition similar to NE					
	E side only w side OK					

Linings	1	2	3
Tight when set	N	NE	X
Free when released			
	4	5	6
Tight when set	X	N	N
Free when released			



Brake Wheel/Shoe Clearance Measurements

Shaft Condition Notes (Paint, finish, keyways, etc.):	
S-1 NE Float Shaft:	Few areas of chipped paint & surface rust 49
S-2 NE Pinion:	grease covered no deterioration 50
S-1 NW Float Shaft:	See NE 51
S-2 NW Pinion:	See NE 52
S-1 SE Float Shaft:	138 See NE
S-2 SE Pinion:	140 See NE
S-1 SW Float Shaft:	132 See NE
S-2 SW Pinion:	139 See NE

Bearing Mark, Location Description	Journal Dia.	Previous Clearance	Measured Clearance	Original Fit Clearance
North Tower East Bearing B1	18"	0.120"+	125	0.008-0.018"
North Tower East Bearing B2	18"	0.100"+	101	0.008-0.018"
North Tower East Bearing B3	6.5"	0.013"	12	0.003-0.010"
North Tower East Bearing B4	6.5"	0.007"	✓	0.003-0.010"
North Tower West Bearing B1	18"	0.098"+	94	0.008-0.018"
North Tower West Bearing B2	18"	0.106"+	114	0.008-0.018"
North Tower West Bearing B3	6.5"	0.013"	✓	0.003-0.010"
North Tower West Bearing B4	6.5"	0.019"	12	0.003-0.010"
South Tower East Bearing B1	18"	0.062"+	63	0.008-0.018"
South Tower East Bearing B2	18"	0.048"+	59	0.008-0.018"
South Tower East Bearing B3	6.5"	0.011"	✓	0.003-0.010"
South Tower East Bearing B4	6.5"	0.017"	10	0.003-0.010"
South Tower West Bearing B1	18"	0.042"+	52	0.008-0.018"
South Tower West Bearing B2	18"	0.062"+	082	0.008-0.018"
South Tower West Bearing B3	6.5"	0.010"	11	0.003-0.010"
South Tower West Bearing B4	6.5"	0.008"	8	0.003-0.010"

+Bearing clearance noted is between the trunnion cap and journal, not a running fit.

Bearing Identification per Schematic:	North Tower East Bearing B1
Bearing Type:	
Journal Diameter:	
Lubrication:	Good
Bolts:	good
Comments:	covered in grease paint is good
	very little chipped paint

Bearing Identification per Schematic:	North Tower East Bearing B2
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	see B1 similar
	A 53-54

Bearing Identification per Schematic:	North Tower East Bearing B3
Bearing Type:	
Journal Diameter:	
Lubrication:	Good
Bolts:	missing paint on cap bolts
Comments:	90% painted

Bearing Identification per Schematic:	North Tower East Bearing B4
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	See B3
	56-7

Bearing Identification per Schematic:	North Tower West Bearing B1
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	Good paint and lube. Covered in
	grease & few areas of chipped
	paint showing primer

Bearing Identification per Schematic:	North Tower West Bearing B2
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	good
Comments:	Good few areas of chipped paint to
	primer
	~~308-309~~ 58-59

Bearing Identification per Schematic:	North Tower West Bearing B3
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	
	G3 same as S4

Bearing Identification per Schematic:	North Tower West Bearing B4
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	few areas of chipped paint cap bolts are
	G0 unpainted with light rust

Bearing Identification per Schematic:	South Tower East Bearing B1
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	
	Typical of N
	S7-S8

Bearing Identification per Schematic:	South Tower East Bearing B2
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	Typical of North
	95-96

Bearing Identification per Schematic:	South Tower East Bearing B3
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	typical of North
	89

Bearing Identification per Schematic:	South Tower East Bearing B4
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	97
	Typical of North

Bearing Identification per Schematic:	South Tower West Bearing B1
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	90
	Typical of North

Bearing Identification per Schematic:	South Tower West Bearing B2
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	Typical of North
	93

Bearing Identification per Schematic:	South Tower West Bearing B3
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	Typical of North
	91-92

Bearing Identification per Schematic:	South Tower West Bearing B4
Bearing Type:	
Journal Diameter:	
Lubrication:	
Bolts:	
Comments:	Typical of North
	94 98

Coupling Identification per Schematic:	C1 Northeast
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	~~6~~ 6 8 pretty new/ unpainted looks galvanized
	or aluminum so ok although should be orange

Coupling Identification per Schematic:	C2 Northeast
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	6 5 all the gear couplings typical
	paint good. ~~app~~ leaks grease at split keys and
	seals looks recently greased

Coupling Identification per Schematic:	C3 Northeast
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	66 See C2 NE

Coupling Identification per Schematic:	C1 Northwest
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	See NE
	67

Coupling Identification per Schematic:	C2 Northwest
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	64 See C2 NF

Coupling Identification per Schematic:	C3 Northwest
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	63 See C2 NF

Coupling Identification per Schematic:	C1 Southeast
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	See C1 NE
	135

Coupling Identification per Schematic:	C2 Southeast
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	See C2 NE
	136

Coupling Identification per Schematic:	C3 Southeast
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	See C2 NF
	137

Coupling Identification per Schematic:	C1 Southwest
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	136 See C1 NE

Coupling Identification per Schematic:	C2 Southwest
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	131 See C2 NE

Coupling Identification per Schematic:	C3 Southwest
Nameplate Data:	
Coupling Type:	
Grid Condition:	
Seal Condition:	
Bolts:	
Cover Condition:	
Housing Condition:	
Hubs and Keys:	
Comments:	137 See C2 NE

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Project: Sarah Mildred Long Bridge Computed: Date: / /
Subject: Mechanical Inspection Checked: Date: / /
Task: Open Gearing Page: 22 of: 46
Job #: No:

Previous Gear Tooth Caliper Measurments

Location	Mark	No of Teeth	Circ Pitch	Diam Pitch	Pitch Diameter	Addendum	Chordal Addendum	New Chordal Thickness	Toe Chordal Thickness	Middle Chordal Thickness	Heel Chordal Thickness	Unused Tooth Thickness	Average	Percent Remaining
NE	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.211	1.215	1.172*		1.199	96%
NE	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.121	1.116	1.115	1.198	1.117	90%
NW	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.230	1.229	1.225		1.228	98%
NW	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.105	1.102	1.116	1.230	1.108	89%
SE	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.164	1.180	1.183		1.176	94%
SE	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.200	1.095	1.100	1.226	1.132	91%
SW	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.200	1.215	1.226		1.214	97%
SW	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.228	1.127	1.130	1.226	1.162	93%

*Plastic flow at tip of gear tooth

Current Gear Tooth Caliper Measurments

Location	Mark	No of Teeth	Circ Pitch	Diam Pitch	Pitch Diameter	Addendum	Chordal Addendum	New Chordal Thickness	Toe Chordal Thickness	Middle Chordal Thickness	Heel Chordal Thickness	Unused Tooth Thickness
NE	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.232	1.232	1.231	—
NE	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.085	1.084	1.091	1.243
NW	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.226	1.234	1.243	—
NW	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
SE	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.225	1.244	1.235	—
SE	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.123	1.108	1.116	1.228
SW	Rack	168	2.5	1.257	133.690	0.796	0.7987	1.2500	1.203	1.204	1.215	—
SW	Pinion	14	2.5	1.257	11.141	0.796	0.8308	1.2474	1.138	1.140	1.139	1.224
									1.118	1.115	1.125	1.240

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Project: Sarah Mildred Long Bridge Computed: Date: / /
Subject: Mechanical Inspection Checked: Date: / /
Task: Open Gearing Page: 23 of: 46
Job #: No:

Current Chordal Measurements							
Location	Mark	No of Teeth	# Teeth Measured	New Gear	Inboard	Center	Outboard
NE	Pinion	14	2	3.680	3.608	3.604	3.602
NW	Pinion	14	2	3.680	3.616	3.616	3.603
SE	Pinion	14	2	3.680	3.613	3.624	3.623
SW	Pinion	14	2	3.680	3.633	3.618	3.630

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Project: Sarah Mildred Long Bridge Computed: Date: / /
Subject: Mechanical Inspection Checked: Date: / /
Task: Open Gearing Page: 24 of: 46
Job #: No:

Current Chordal Measurements							
Location	Mark	No of Teeth	# Teeth Measured	New Gear	Inboard	Center	Outboard
NE	Pinion	14	3	6.029			
NW	Pinion	14	3	6.029			
SE	Pinion	14	3	6.029			
SW	Pinion	14	3	6.029			

Gear Tooth Condition Notes:	
NE Rack:	Tooth Contact %: Opening Face: 100% Closing Face: 100% Gear teeth display light corrosion. Plastic flow on opening face heavier than on closing face.
NE Pinion:	Tooth Contact %: Opening Face: Closing Face: Heavy plastic flow on top land of teeth. ~~Peeling~~ Peening and scoring on both faces. Prominent depressions of contacted tooth faces
NW Rack:	Tooth Contact %: Opening Face: 100% Closing Face: 100% typical ~~to~~ to NE rack
NW Pinion:	Tooth Contact %: Opening Face: Closing Face: typical to NE pinion
SE Rack:	Tooth Contact %: Opening Face: Closing Face: Significant plastic flow at the ~~tipcat~~ opening faces of all teeth. Scoring on both faces. Some peeping on the closing face. Isolated areas of light corrosion.
SE Pinion:	Tooth Contact %: Opening Face: Closing Face:
SW Rack:	Tooth Contact %: Opening Face: Closing Face:
SW Pinion:	Tooth Contact %: Opening Face: Closing Face:

Rack and Pinion Backlash	Previous Clearance	Measured Clearance	Original Fit Clearance
Northeast	0.069	0.79	0.070-0.095"
Northwest	Not measured	0.072	0.070-0.095"
Southeast	0.090	0.089	0.070-0.095"
Southwest	0.079	0.079	0.070-0.095"

North Span Lock				
Motor Nameplate Data:	Manufacturer: Sterling Electric			
	Ser. No.: 84023316	Frame: C145TDZ		
	Model. No.: JDY 154NDD03		Phase: 3	Hz: 60
	HP: 1.5	RPM: 1655	S.F.: 1.15	
	Volts: 240/480	Amps: 4.4/2.2	Full Load Eff.: 76.3	
Lock Bar Condition:	Good, well lubricated.			
Linear Actuator Condition:	Paint failure and light corrosion. Limit switch conduits sealed again st housing with heavy silicone caulk.			
Receiver and Guides:	Typical moderate corrosion, some section loss on mounting bolts for guides.			
Additional Comments:	Actuator mounting bolts display moderate corrosion			
	and section loss.			

North Guide/Receiver Clearances				
Front Guide	Top	Bot	East	West
Previous	0.0625	Hard Contact	N/A	N/A
Current	~~0.050~~	0.040	0.074	0.040
	0.069			
Rear Guide	Top	Bot	East	West
Previous	0.025	0.005	0.015	0.025
Current	0.060	0.048	0.125	0.008

South Span Lock				
Motor Nameplate Data:	Manufacturer: Sterling Electric			
	Ser. No.: U84023314	Frame: C145TDZ		
	Model. No.: JDY154NDD03		Phase: 3	Hz: 6
	HP: 1.5	RPM: 1655	S.F.: 1.15	
	Volts: 240/480	Amps: 4.4/2.2	Full Load Eff.: I/A	
		TENV		
Lock Bar Condition:	Lock bar in good condition, well lubricated.			
Linear Actuator Condition:	Moderate to severe corrosion on entire surface of housing.			
Receiver and Guides:	Fair condition, peeling paint, old built up lubricant typical.			
Additional Comments:	Cover to protect bar from falling debris has fallen off and is resting on actuator.			
	Nameplate worn, so some fields are not readable			

South Guide/Receiver Clearances				
Front Guide	Top	Bot	East	West
Previous	0.0625	Hard Contact	0.025	0.025
Current	0.120	H.C.	0.037	0.045
Rear Guide	Top	Bot	East	West
Previous	0.015	0.025	0.015	0.025
Current	0.017	0.065	Hard Contact	0.065

Live Load Bearings Condition Notes (Exterior condition, bolts, and housing):	
NE (Expansion):	Light rust on contact surface, relatively even contact 122-127 anchor bolts OK 113-117
NW (Expansion):	
SE (Fixed):	Poor anchor bolt cond light rust on top surface Poor grout IB much heavier contact 98-103
SW (Fixed):	

Centering Device Condition Notes (Side and bottom clearances, general condition):	
North:	119-121 roughly .280" on W side tight E 128-130 mid scaling of entire casting anchor bolts, 25% loss or less
South:	.225" clearance on W side tight on E many deteriorated fac, tenegrs, with up to 50% loss at rivet heads 50% paint loss 93-96 105-106

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Span Guides	Page: 29	of: 46	
Job #:	No:		

Span Guide Condition Notes:	
NE Upper: (Expansion)	2" clearance 134 132
NE Lower: (Expansion)	1/2" clearance well lubed undamaged 133 131
NW Upper: (Expansion)	look tight from below well greased 138/139 (day 1) 15-16 (Day 3)
NW Lower: (Expansion)	3/8" gap top to through bottom only a slight gap well lubed type peeling paint and corroded metal mounting bolts. 135-137, 140
SE Upper: (Fixed)	Appears ~~[illegible]~~ to be off its track 51-52 day 3
SE Lower: (Fixed)	74-82 Appears to have been damaged. has a channel reinforcement many bent lacing bars mod rust 1/2" clearance Approx 1/4" each side
SW Upper: (Fixed)	Appears broken off. rail is bent about ~~[illegible]~~ halfway up the tower 20-25 day 3
SW Lower: (Fixed)	83-92 same as SE

NW cut guide mostly F/A unless lifted. well lubed no rust 17
SW cut guide same as NW 22
SE cut guide same as NW 53

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Counterweight Ropes	Page: 30	of: 46	
Job #:	No:		

Counterweight Rope Diameter Measurements

Rope #	Northeast* Previous	Northeast* Current	Northwest* Previous	Northwest* Current	Southeast** Previous	Southeast** Current	Southwest** Previous	Southwest** Current
1	N/A	1.756 1.758	N/A	1.759 1.76	N/A	1.745 1.749	N/A	1.765 1.767
2	N/A	1.752 1.751	N/A	1.720 1.722	N/A	1.758 1.761	N/A	1.757 1.754
3	N/A	1.758 1.752	N/A	1.750 1.754	N/A	1.755 1.755	N/A	1.762 1.763
4	N/A	1.753 1.755	N/A	1.760 1.762	N/A	1.758 1.763	N/A	1.756 1.757
5	N/A	1.762 1.752	N/A	1.758 1.756	N/A	1.759 1.757	N/A	1.756 1.761
6	N/A	1.761 1.759	N/A	1.752 1.752	N/A	1.752 1.748	N/A	1.752 1.750
7	N/A	1.753 1.759	N/A	1.762 1.758	N/A	1.762 1.761	N/A	1.746 1.749
8	N/A	1.762 1.761	N/A	1.761 1.753	N/A	1.756 1.754	N/A	1.759 1.765
9	N/A	1.759 1.758	N/A	1.754 1.757	N/A	1.763 1.765	N/A	1.761 1.762
10	N/A	1.758 1.756	N/A	1.754 1.762	N/A	1.763 1.764	N/A	1.757 1.752
11	N/A	1.756 1.754	N/A	1.759 1.758	N/A	1.763 1.768	N/A	1.756 1.766
12	N/A	1.762 1.761	N/A	1.752 1.759	N/A	1.755 1.769	N/A	1.756 1.753
13	N/A	1.762 1.759	N/A	1.759 1.761	N/A	1.757 1.758	N/A	1.759 1.753
14	N/A	1.756 1.758	N/A	1.747 1.749	N/A	1.770 1.768	N/A	1.762 1.759
15	N/A	1.761 1.762	N/A	~~1.759 1.7~~	N/A	1.758 1.755	N/A	1.756 1.762
16	N/A	1.755 1.757	N/A	1.751 1.752	N/A	1.756 1.758	N/A	1.762 1.762

1.751 1.756

Counterweight Lay Length Measurements

Rope #	Northeast* Previous	Northeast* Current	Northwest* Previous	Northwest* Current	Southeast** Previous	Southeast** Current	Southwest** Previous	Southwest** Current
1	11.533"	11.189	No Measure		11.412"	11.308	11.295"	11.282
2	No Measure	11.495	No Measure	11.245	10.948"	11.161	11.370"	11.239
3	No Measure	11.437	No Measure		11.421"	11.280	No Measure	11.376
4	11.485"	11.497	No Measure	11.[illegible]	11.393"	11.276	No Measure	11.477
5	11.395"	11.510	No Measure		11.340"	11.395	No Measure	11.493
6	No Measure	11.506	No Measure	11.[illegible]420	11.320"	11.267	11.420"	11.426
7	No Measure	11.491	No Measure		11.380"	11.210	11.411"	11.488
8	11.414"	11.501	No Measure	11.[illegible]319	11.336"	11.390	No Measure	11.483
9	11.300"	11.451	11.481"	[illegible]	No Measure		No Measure	11.466
10	No Measure	11.438	11.397"	11.[illegible]362	No Measure	11.492	11.517"	11.354
11	No Measure	11.539	11.410"	11.321	No Measure		11.560"	11.578
12	11.344"	11.431	11.369"	11.486	No Measure	11.474	No Measure	11.036
13	11.526"	11.554	11.600"	11.459	No Measure		No Measure	11.549
14	No Measure	11.407	11.400"	11.348	No Measure	11.349	11.424"	11.314
15	No Measure	11.470	11.450"	11.272	No Measure		11.256"	11.412
16	11.625"	11.374	11.510"	11.492	No Measure	11.368	No Measure	11.173

Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Counterweight Ropes	Page: 31	of: 46	
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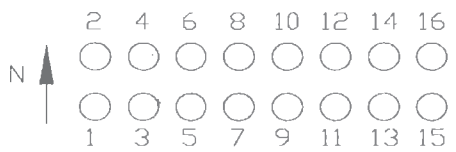
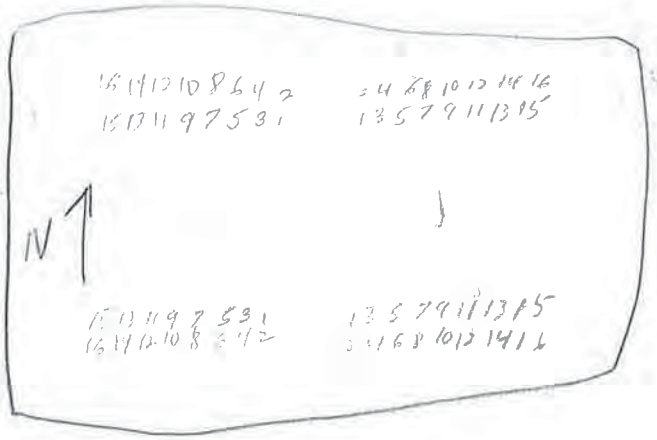
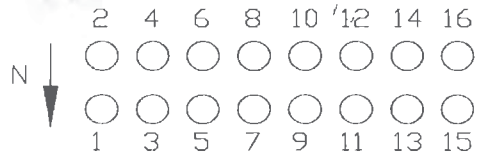
*Rope layout for North Sheaves is as follows:





**Rope layout for South Sheaves is as follows:



Counterweight Rope General Condition Notes:	
Northeast:	
Northwest:	54-58 same condition as SW
Southeast:	
Southwest:	light surface rust under the grease. Pretty well lubricated. 44-50 significant wear noted based on grease patterns on sheave + view from Mach room window I/A for hands on inspection of the wearing part of the rope

Sheave Rope Groove Measurements

Groove #	Northeast* Previous	Northeast* Current	Northwest* Previous	Northwest* Current	Southeast** Previous	Southeast** Current	Southwest** Previous	Southwest** Current
1	Worn		Worn		OK		Worn	
2	OK		OK		Worn		Worn	
3	OK		Worn		Worn		Worn	
4	OK		Worn		Worn		Worn	
5	Worn		Worn		Worn		Worn	
6	OK		Worn		Worn		Worn	
7	Worn		Worn		Worn		Worn	
8	Worn		OK		OK		Worn	
9	OK		OK		Worn		Worn	
10	Worn		OK		OK		Worn	
11	Worn		OK		OK		Worn	
12	Worn		Worn		OK		Worn	
13	Worn		Worn		OK		Worn	
14	Worn		Worn		OK		Worn	
15	Worn		Worn		OK		Worn	
16	Worn		Worn		OK		OK	

*Grooves are numbered from East to West when facing sheave

**Grooves are numbered from West to East when facing sheave

Sheave General Condition Notes:

Northeast:	Inboard side of sheave and ring gear bolts are covered in grease from open gearing. Outboard side and inside display some light corrosion.
Northwest:	NW Sheave is covered in a layer of light corrosion. Isolated areas of peeling paint on outboard side of sheave. Inboard side is covered in grease splash from gear teeth.
Southeast:	typ cond. 1 1/4 1/4
Southwest:	typ cond. ropes are very unevenly tensioned on this corner and bang loudly as the bridge operates 1/4 7-1/8

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Enclosed Reducers	Page: 33	of: 46	
Job #:	No:		

Item:	North Primary Reducer		
Type:	Manufacturer: Boston D.O. James		
	Size/Type:		Ratio: 45, 27
	Serial No.: 254878		Date:
	HP Rating:	Service Factor:	Input RPM: 870
	Lube Specification:		Approx. Cap:
Housing:	40% paint OK some dirt accumulation		
Gears:	Fair light to mod pitting on all raise faces		
	indicating long term spar heavy condition		
Bearings:	Leak at all seals		
Mount. Bolts	OK no issues		
Frame Bolts	OK a few areas of chipped paint and light rust		
Operation:			
Lubrication:	foaming		
General:			
	12-27		

Item:	South Primary Reducer		
Type:	Manufacturer:		
	Size/Type:		Ratio:
	Serial No.:		Date:
	HP Rating:	Service Factor:	Input RPM:
	Lube Specification:		Approx. Cap:
Housing:			
Gears:	P1 light pitting on rais g1 G2		
	P2 IA P3 mod pitting both faces full side		
	G3 mod pitting raise only		
Bearings:			
Mount. Bolts			
Frame Bolts			
Operation:			
Lubrication:	foaming a little low		
General:	No sightglass 1 broken 1 missing cover bolt		
	74-86		

Warning Gates - North

East:	1-9 well greased light rust on the enclosure
	in various places where the galv has failed
	a few missing lag screws on the arm pivots
	light rust on mounting bolts
	reducer leaks slightly light rust on chain drive
West:	N/A

Warning Gates - South

East:	27-40 similar cond light rust on out side
	debris inside. light rust on chain drive
	gearbox leaks a little
West:	
	N/A

Barrier Gates - North

East:	13-14 pogo doesnt sit on road. has a lot of clearance
	@ the gate connection 3/4"
	light rust on housing where gall has failed
West:	N/A

~~15-16 NW span guide~~ ~~19-21 SW span guide~~
~~17 NW end guide~~ ~~22 end guide~~

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Traffic and Barrier Gates	Page: 38	of: 46
Job #:	No:	

Barrier Gates - South	
East:	23-2 ~~#6~~ light rust on housing
	41-43 Socket ok
West:	

Photo Log

Photo No.	Description
1616	Overall view of South span lock motor
1617.	Large areas of paint failure and corrosion on span lock actuator
1618.	Debris and corrosion on base of span lock actuator
1619.	Moderate corrosion and pack rust off base of actuator
1620.	" " " " " " " "
1621.	Debris ~~[illegible]~~ shield on top of actuator, disconnected from deck above.
1622.	" " " " " " " " "
1623.	Overall view of actuator
1624.	SW live load shoe anchor bolts condition
1625.	SW Live load shoe overall condition.
1626.	SW live load shoe moderate corrosion at base
1627.	SW LL shoe, lead wire test set up
1628.	SW LL bearing from underneath while bridge is raised
1629.	" " " " " " " " "
1630.	NW LL bearing lead wire test
1631.	NW LL bearing corrosion and debris at base
1632.	NW LL Bearing overall base condition
1633.	NW LL bearing, moderate to severe corrosion at anchor bolts.
1634.	Overall condition of North lock bar rear guide
1635.	overall condition of North lock bar front guide.

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Photo Log	Page: 40	of: 46	
Job #:	No:		

Photo No.	Description
1636.	Overall condition of rear guide from actuator.
1637.	Heavy silicone caulk around limit switch conduit.
1638.	Mod to severe corrosion at North actuator mounting bolts.
1639-40	Mod to severe corrosion at underside of mounting bolts.
1641.	Overall actuator condition.
1642.	Cover is hanging down on actuator typical to south side
1643.	Nameplate no longer attached to actuator motor.
1644.	NW pinion, opening face condition
1645.	NW pinion, closing face condition
1646.	Overall NW pinion tooth condition.
1647.	Overall NW rack gear tooth condition.
1648	NW rack closing face
1649.	NW rack overall
1650.	NW rack overall view.
1651.	NE rack overall view
1652.	NE Rack closing face
1653.	NE pinion opening face
1654.	NE pinion closing face
1655.	NE pinion - top land plastic flow
1656.	NE pinion overall

Photo No.	Description
1657	NE rack overall.
1658.	NW Sheave, outboard general condition
1659	Inside NW Sheave
1660	" " "
1661	NW sheave, Inboard sheave general condition
1662	NE sheave, Inboard side
1663	NE sheave outboard side
1664-65	NE sheave inside of sheave
1666	Underside of NW sheave
1667	" " " "
1668	NW CWT rope terminations on CWT
1669	SW rack opening face
1670	SW rack closing face
1671	SW rack overall shot
1672	" " " "
1673	SW pinion opening face
1674	SW pinion closing face
1675	SW pinion overall view
1676	Overall view SW rack and pinion
1677	SE rack opening face

Photo No.	Description
1678	SE rack closing face
1679	SE pinion opening face
1680	SE pinion closing face
1681	Overall view of SE pinion
1682	Overall view of SE rack and pinion
1683	view of SE rack opening face
1684	Overall view of N barrier gate - light corrosion
1685.	Light corrosion on N barrier gate housing
1686.	N barrier gate buffer does not strike pavement
1687	Light corrosion on N barrier gate linkage
1688-89	brake pad is worn on N barrier gate motor
1690	Light corrosion on support of N barrier gate
1691.	Light corrosion on N barrier gate flange bearings
1692-94	N Barrier gate electrical
1695.	N barrier gate overtravel stop is bent
1696.	S barrier gate motor brake
1697.	S barrier gate light corrosion on bearings and linkages
1698.	" " " " " " " " "
1699-1700	S Barrier gate electrical
1701	Pads on support to soak up leaking oil

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Photo Log	Page: 43	of: 46
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Photo No.	Description
1702	Pads soaking up leaking oil on S barrier gate
1703	" " " " " " " "
1704	Oil leak on South barrier gate reducer cover
1705.	S barrier gate over travel stop bent.
1706.	Light corrosion on S barrier gate housing
1707	" " " " " " "

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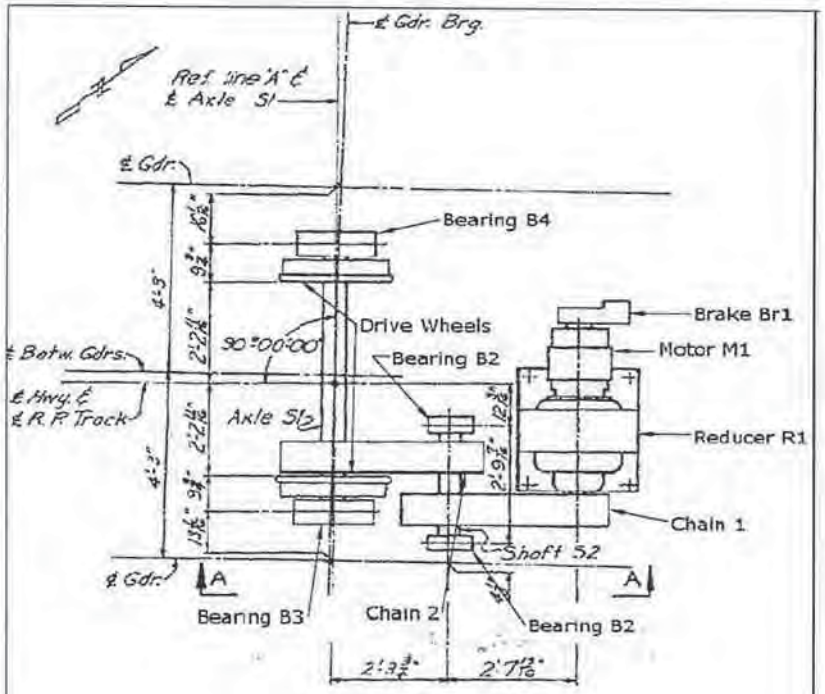
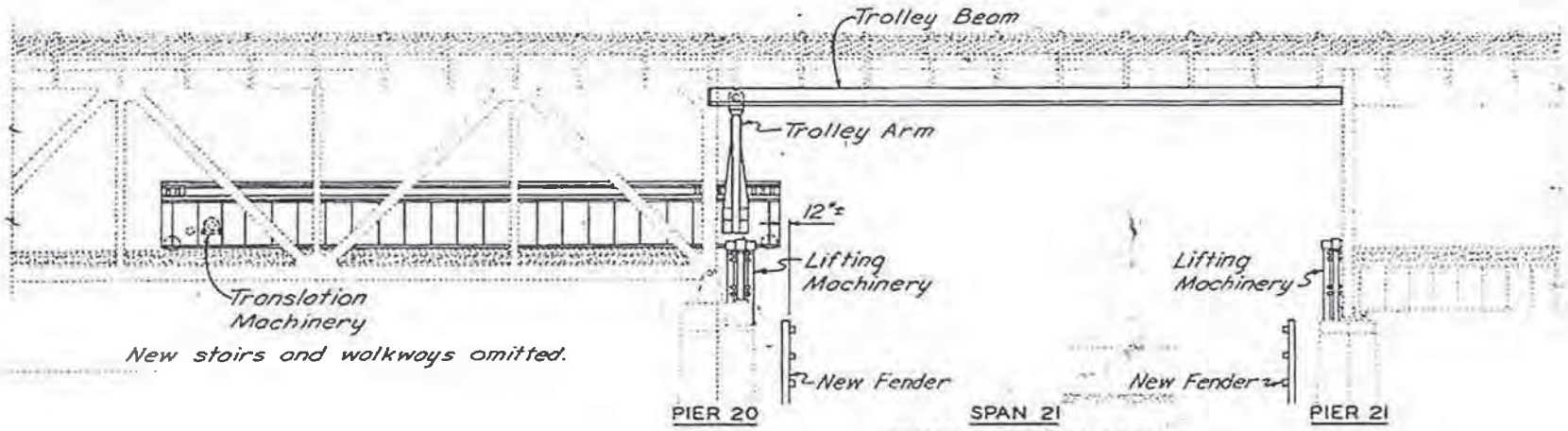
Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Schematic	Page: 1	of: 19	
Job #:	No:		



MACHINERY LAYOUT



SPAN TRANSLATED

Motor Identification per Schematic:	Hydraulic Motor			
Nameplate Data:	Manufacturer: Century Electric			
	Ser. No.: 12J	Type: SC	Frame: S184T	
	Model. No.: 6-322465-01		Phase: 3	Hz: 60
	HP: 5	RPM: 1745	Encl:	
	Volts: 230/460	Amps: 14.6/7.3	Insulation: B	
	Max. Ambient: 40° C	S.F. 1.15	NEMA B	Cont.
Lubrication:				
Bolts:	Light corrosion on bolts, unpainted			
Supports:	Painted, light corrosion beginning to form			
Comments:	Connected to pump w/ jaw coupling. Operation not			
	observed. Light corrosion on shaft and key.			
Speed Switch	None			

Motor Identification per Schematic:	Northeast Lifting Screw Motor			
Motor Nameplate Data:	Manufacturer: Reuland			
	Ser. No.:	Type:	Frame:	
	Prod. No.:		Phase:	Hz:
	HP:	RPM:	Encl:	
	Volts:	Amps:	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.:	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Light to moderate corrosion on housing			
Bolts:	I/A			
Comments:	Name plates inaccessible for inspection.			

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Motors	Page: 3	of: 19	
Job #:	No:		

Motor Identification per Schematic:	Northwest Lifting Screw Motor			
Motor Nameplate Data:	Manufacturer: Reuland			
	Ser. No.:	Type:	Frame:	
	Prod. No.:		Phase:	Hz:
	HP:	RPM:	Encl:	
	Volts:	Amps:	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.:	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Light to moderate corrosion on housing			
Bolts:	I/A			
Comments:	Nameplates I/A			

Motor Identification per Schematic:	Southeast Lifting Screw Motor			
Motor Nameplate Data:	Manufacturer: Reuland			
	Ser. No.:	Type:	Frame:	
	Prod. No.:		Phase:	Hz:
	HP:	RPM:	Encl:	
	Volts:	Amps:	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.:	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	55-59 a few area of chipped paint and mud rust			
Bolts:				
Comments:	Brake release handle is missing			

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Motors	Page: 4	of: 19	
Job #:	No:		

Motor Identification per Schematic:	Southwest Lifting Screw Motor			
Motor Nameplate Data:	Manufacturer: Reuland			
	Ser. No.:	Type:	Frame:	
	Prod. No.:		Phase:	Hz:
	HP:	RPM:	Encl:	
	Volts:	Amps:	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer:			
	Ser. No.:	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	Few areas of chipped paint and light to moderate corrosion on housing.			
Bolts:				
Comments:				

Motor Identification per Schematic:	Translational Motor			
Motor Nameplate Data:	Manufacturer: Reuland Westinghouse			
	Ser. No.: 6705206	Type: Miteline	Frame: 284XY	
	Prod. No.:		Phase: 3	Hz:
	HP: 5	RPM: 1725	Encl:	
	Volts: 440	Amps: 19.3	Ins. Sys.:	Max Ambient:
Brake Nameplate Data:	Manufacturer: F/A			
	Ser. No.:	Volts:	Hz:	Torque:
	Model No.:	Type:	Ins. Sys.:	
	Prod. No.:			
Housing:	few areas of paint loss and light rust. reducer is			
Bolts:	leaking onto bottom of motor			
Comments:	Brake is F/A and enclosed 35-37			

Lifitng Platforms General Condition

North:	Severe ~~[illegible]~~ scaling rust 75% failed paint
	1-3
	Undersides display severe scaling rust and some section loss.
	100% paint failure.
South:	Severe scaling rust similar to North - up to
	1/8" section loss on a few areas of the platform

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Lifting Screws	Page: 6	of: 19
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F

Item:	North Primary Reducer		
Type:	Manufacturer: Limitorque		
	Size/Type: HMT 3		Ratio:
	Serial No.: 70620 A		Date:
	HP Rating:	Service Factor:	Input RPM:
	Lube Specification:		Approx. Cap:
Housing:	75% painted		
Gears:	4 - 11		
Bearings:	some lube leakage at bearings		
Mount. Bolts	lots of missing paint on bolts 50% scaling rust		
Frame Bolts			
Operation:	Not operated electrical is disconnected		
Lubrication:			
General:	Fully enclosed worm reducers 1 on motor 1 per screw		
	3 total per corner		

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Lifting Screws	Page: 7	of: 19
Job #:	No:	

Item:	South Primary Reducer (W)		
Type:	Manufacturer: Limitorque		
	Size/Type: HMT 3		Ratio:
	Serial No.: 70619A		Date:
	HP Rating:	Service Factor:	Input RPM:
	Lube Specification:		Approx. Cap:
Housing:	similar to north ~~[illegible]~~ 25% paint loss with b2-b9		
Gears:	light to md rust. leaks lube at seals limit sw coupling		
	has alot of play		
Bearings:			
Mount. Bolts			
Frame Bolts			
Operation:			
Lubrication:			
General:			

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Lifting Screws	Page: 8	of: 19
Job #:	No:	

Item:	NW ~~North~~ Primary Reducer		
Type:	Manufacturer: Limitorque		
	Size/Type: Hmt 3		Ratio:
	Serial No.:		Date:
	HP Rating:	Service Factor:	Input RPM:
	Lube Specification:		Approx. Cap:
Housing:			
Gears:			
	13 - 126		
Bearings:			
Mount. Bolts			
Frame Bolts			
Operation:			
Lubrication:	similar lube ~~Leaks~~ leakage		
General:	See NE condition is similar		

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Lifting Screws	Page: 9	of: 10
Job #:	No:	

Item:	~~Southwest~~ SE ~~South~~ Primary Reducer		
Type:	Manufacturer:		
	Size/Type:		Ratio:
	Serial No.:		Date:
	HP Rating:	Service Factor:	Input RPM:
	Lube Specification:		Approx. Cap:
Housing:	areas of missing paint and severe scaling rust. many		
Gears:	anchor bolts have med section loss 46-54		
Bearings:			
Mount. Bolts			
Frame Bolts			
Operation:			
Lubrication:			
General:	screw is in fair condition. areas of light lube		
	and surface rust 46-48, 60-61		
	Reducer was mostly inaccessible. no access ladder to platform.		

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Hydraulic Cylinders	Page: 10	of: 19
Job #:	No:	

Hydraulic Cylinder Condition Notes (Paint, finish, keyways, etc.):	
NE:	17-19 rods ok 50% paint loss moderate rust/pitting tie rods also attached to ~~wold~~ hold cyl to platform. these are welded to platform
NW:	20-23 similar condition nite needle valve hose condition to NE
SE:	
SW:	similar to NE except rods covered in lube 70-71

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Span Guides	Page: 11	of: 19	
Job #:	No:		

Span Guide Condition Notes:	
NE:	Light corrosion on face of guide rails. lubrication light and pan. guides I/A for close inspection due to platform being raised.
NW:	Typical condition to NE span guides
SE:	similar to NE 41-43
SW:	similar to NE

5 hydraulic reel, 75% paint loss, areas of severe rust and section loss. bearings @ and support tee / loose
44-45

Live Load Bearings Condition Notes (Exterior condition, bolts, and housing):	
NE (Expansion):	Bearing on pier display moderate to severe corrosion. Anchor bolts on base plate display complete section loss. 40% paint loss severe rust on span 38
NW (Expansion):	Typical to NE bearings.
SE (Fixed):	Poor lube moderate rust on entire surface. a few areas of scaling rust at the base. 39-56
SW (Fixed):	Moderate rust and scaling rust over entire surface of bearing.

Bearing Identification per Schematic:	B1
Bearing Type:	roller bearing
Journal Diameter:	I/A
Lubrication:	unknown
Bolts:	typical to other bearings
Comments:	

Bearing Identification per Schematic:	B2
Bearing Type:	unkown
Journal Diameter:	I/A
Lubrication:	poor
Bolts:	fair light-mod rust
Comments:	bearing is coverd in scaled rust. lubricated oil 3/1

Bearing Identification per Schematic:	B3
Bearing Type:	Unknown manufacturer, roller bearing
Journal Diameter:	I/A
Lubrication:	Poor
Bolts:	Light to moderate corrosion
Comments:	Lubrication leakage from housing split.

Bearing Identification per Schematic:	**B4**
Bearing Type:	unknown manufacturer, roller bearing
Journal Diameter:	1/4
Lubrication:	poor
Bolts:	Light to moderate corrosion and paint failure.
Comments:	

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /	
Subject: Mechanical Inspection	Checked:	Date: / /	
Task: Shafts	Page: 15	of: 19	
Job #:	No:		

Shaft Condition Notes (Paint, finish, keyways, etc.):	
Axle S-1 :	25% areas of paint failure and light corrosion on surface of shaft.
Shaft S-2:	Mostly inaccessible for inspection. Chain covers could not be removed
N axle and wheels	I/A for hands on due to position. 50% paint loss and rust on wheels and few areas of chipped paint 25-28

Machinery Support General Condition	
Drive Machinery Support:	Condition is poor 30% missing paint and
	1" pack rust under mounting plate. this has lead
	to misalignment of the motor/reduce to the chain drive

Drive Chains General Condition	
Chain 1:	
	I/A 34 duct tape instead of an oil
	cap
Chain 2:	I/A
	Moderate leakage from chain enclosure. Entire bottom surface
	of enclosure covered in lubricant.

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Drive Wheels	Page: 18	of: 19
Job #:	No:	

Drive Wheels General Condition

North:	See [illegible] axle shaft section
South:	Light to moderate corrosion on surface of drive wheels is typical.

Trolley Arms, Wheels, and Beam General Condition	
East:	I/A for handson because the span
	was unable to be operated.
West:	See E

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Project: Sarah Mildred Long Bridge	Computed: BAC	Date: 11/6/13
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Photo Log	Page: 1	of: 8
Job #:	No:	

Photo Log - Secondary Span

Photo No.	Description
1525	NW live load shoe, general condition and rust
1526	NW live load shoe, moderate corrosion on base plate, Section loss on anchors.
1527	NW live load shoe, facing west, general condition.
1528.	NE live load shoe, general condition, moderate corrosion
1529.	NE live load shoe, general condition.
1530	NW span guide rail, poor lube, light corrosion.
1531.	NW span guide, " " " "
1532.	NW span guide, " " " "
1533	NE span guide, " " " "
1534	NE span guide, " " " "
1535.	" " " " " " " "
1536.	NW lifting screw, north screw, general condition, well lubed.
1537.	NW lifting screw, north screw, general condition
1538.	NW lifting screw, north screw, general condition
1539.	NW. lifting screw, South screw, general condition.
1540.	" " " " " " "
1541.	" " " " " " "
1542-1544	NE lifting screw, north screw general condition
1545-1547	NE lifting screw, South screw general condition
1548	NW span seated, lever arm limit switch

Photo No.	Description
1549	NE fully seated limit switch
1550	North cable reel for flex hose feeding hydraulics
1551.	Section loss on north cable reel
1552.	General condition of rigid hydraulic lines, corrosion and paint failure
1553.	General condition of rigid hydraulic line, corrosion and paint failure
1554.	Lifting platform, paint failure and moderate corrosion.
1555-61	" " " " " " "
1562.	NW lifting screw motor, general housing condition.
1563.	NE lifting screw motor, general housing condition.
1564.	Overall view of hydraulic motor
1565.	Light corrosion on motor mounting bolts
1566.	Corrosion on support mounting bolts.
1567.	Hydraulic motor Jaw coupling.
1518.	General view of motor and pump configuration.
1569-70	General shots of base of cabinet, light corrosion
1573	Translational motor, overall housing condition
1574.	Translational machinery support, pack rust and section loss
1575.	Motor support pack rust,
1576.	Translational machinery reducer leakage
1577.	" " " "

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Photo Log	Page: 3	of: 8
Job #:	No:	

Photo No.	Description
1578	Translational reducer leakage has coated oil on bottom of motor
1579.	Scaling and Corrosion on machinery Support
1580.	Brake is inaccessible.
1581.	Bearing on Chain 2 is covered in lube, light corrosion
1582.	Bearing support - peeling rust and severe corrosion
1583.	Reducer leakage from C-face motor mounting
1584.	Reducer oil leakage covering bottom of motor
1585	General shots of brake enclosure
1586.	General shots inside machinery
1587.	Bird waste on top of reducer.
1588.	Chain 2 bearing, overall condition
1589.	Lubrication covering bottom of Chain 2 enclosure
1590.	Cross shaft (Axle) on South side isolated paint failure, light corrosion
1591.	Drive wheel - light corrosion (SW)
1592	SE drive wheel - light corrosion
1593.	View from outside facing North of drive wheel condition
1594.	(SW) South Axle bearing, paint failure and moderate corrosion.
1595.	(SW) South Axle bearing, anchor bolt condition
1596.	SE Axle bearing, lubrication leakage from bearing split
1597-99	mounting bolts and cap bolt condition on SE axle bearing.

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Project: Sarah Mildred Long Bridge	Computed:	Date: / /
Subject: Mechanical Inspection	Checked:	Date: / /
Task: Photo Log	Page: 4	of: 8
Job #:	No:	

Photo No.	Description
1600	SW lifting screw, South screw, isolated light corrosion on screw
1601	" " " " " " " "
1602	SW lifting screw, North screw, isolated light corrosion on screw
1603	" " " " " " " " " "
1604.	SW live load shoe moderate to severe corrosion.
1605.	" " " " " " " "
1606.	Surface corrosion on SW live load shoe
1607.	SW Guide rail light corrosion at top of rail
1608.	SW lifting screw motor housing condition
1609.	SW span seated limit switch
1610.	Surface corrosion and scaling on SW lifting screw support
1611.	" " " " " " " " "
1612.	Lifting platform pack rust
1613-15	General corrosion and paint failure on lifting platform surface.

Appendix E
NBIS Rating Sheets

NBIS NUMERICAL REPORT - SARAH MILDRED LONG BRIDGE
MAIN SPAN MECHANICAL COMPONENTS

COMMON COMPONENTS		BASCULE SPANS		LIFT SPANS	
COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*
OPEN GEARING	4	RACK & RACK PINION		RING GEARS	5
REDUCERS	6	TRUNNION ASSY.		SHEAVES	5
SHAFTS	7	SPAN LOCKS		DRUMS	N
BEARINGS	7	TAIL LOCKS		SHEAVE TRUNNION ASSY.	5
COUPLINGS	6	CURVED TREAD PLATES		DRUM BEARING ASSY.	N
FASTENERS	8	STRATE TREAD PLATES		WIRE ROPES & FITTINGS	5
MACHINERY SUPPORTS	7	**SWING SPANS**		SPAN GUIDES	2
CENTERING DEVICE ASSY	5	CENTER BEARING ASSY.		BALANCE CHAINS	N
BUFFER CYLINDERS	N	CIRCULAR RACK		**MISC. COMPONENTS**	
STRIKE PLATES	N	BALANCE WHEEL ASSY.			
EMERGENCY DRIVES	N	CIRCULAR TRACK			
LIVE LOAD SHOES	N	RIM-BEARING ASSY.			
BRAKES	6	CENTER WEDGE ASSY.			
MOTORS	8	END WEDGE ASSY.			

MECHANICAL CONDITION OVERALL RATING: 2

***NCR IS AN ACRONYM FOR NUMERICAL CONDITION RATING; SEE BELOW:**

NUMERICAL CONDITION RATING INFORMATION

Condition	AASHTO BMS CODE	FHWA NBIS BITM/90
EXCELLENT	1	9
GOOD	2	7 (or 8)
FAIR	3	5 (or 6)
POOR	4	4 (or 3)
CRITICAL	5	2 (or 1 or 0)

- Excellent – No defects noted, component appears to be in new condition and functions as designed. Less than 15% of predicted component life has been expended.
- Good – Minor deterioration or wear noted, component appears to be functional. 15% to 35% of predicted component life has been expended.
- Fair – Obvious deterioration or wear noted, component appears to be functional, but no longer operating like new. Component has useful remaining life. 35% to 65% of predicted component life has been expended.
- Poor- Significant deterioration or wear noted, component appears to be generally functional, but exhibits signs that failure may result from continued wear or deterioration. Component is nearing the end of its useful life. 65% to 85% of predicted component life has been expended.
- Critical - Significant deterioration or wear noted, component appears to be marginally functional and exhibits signs that failure will result from continued wear or deterioration. Corrective action is required as soon as possible to avoid failure. More than 85% of predicted component life has been expended.

NBIS NUMERICAL REPORT - SARAH MILDRED LONG BRIDGE
SECONDARY SPAN MECHANICAL COMPONENTS

COMMON COMPONENTS		BASCULE SPANS		LIFT SPANS	
COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*
OPEN GEARING	N	RACK & RACK PINION		RING GEARS	
REDUCERS	6	TRUNNION ASSY.		SHEAVES	
SHAFTS	7	SPAN LOCKS		DRUMS	
BEARINGS	5	TAIL LOCKS		SHEAVE TRUNNION ASSY.	
COUPLINGS	N	CURVED TREAD PLATES		DRUM BEARING ASSY.	
FASTENERS	6	STRATE TREAD PLATES		WIRE ROPES & FITTINGS	
MACHINERY SUPPORTS	6	**SWING SPANS**		SPAN GUIDES	
CENTERING DEVICE ASSY	N	CENTER BEARING ASSY.		BALANCE CHAINS	
BUFFER CYLINDERS	N	CIRCULAR RACK		**MISC. COMPONENTS**	
STRIKE PLATES	N	BALANCE WHEEL ASSY.		LIFTING SCREW ASSEMBLY	3
EMERGENCY DRIVES	N	CIRCULAR TRACK		LIFTING PLATFORM	3
LIVE LOAD SHOES	3	RIM-BEARING ASSY.		SPAN GUIDES	6
BRAKES	N	CENTER WEDGE ASSY.		CHAIN DRIVES	4
MOTORS	5	END WEDGE ASSY.		DRIVE WHEELS	7

MECHANICAL CONDITION OVERALL RATING: 3

***NCR IS AN ACRONYM FOR NUMERICAL CONDITION RATING; SEE BELOW:**

NUMERICAL CONDITION RATING INFORMATION

Condition	AASHTO BMS CODE	FHWA NBIS BITM/90
EXCELLENT	1	9
GOOD	2	7 (or 8)
FAIR	3	5 (or 6)
POOR	4	4 (or 3)
CRITICAL	5	2 (or 1 or 0)

- Excellent – No defects noted, component appears to be in new condition and functions as designed. Less than 15% of predicted component life has been expended.
- Good – Minor deterioration or wear noted, component appears to be functional. 15% to 35% of predicted component life has been expended.
- Fair – Obvious deterioration or wear noted, component appears to be functional, but no longer operating like new. Component has useful remaining life. 35% to 65% of predicted component life has been expended.
- Poor- Significant deterioration or wear noted, component appears to be generally functional, but exhibits signs that failure may result from continued wear or deterioration. Component is nearing the end of its useful life. 65% to 85% of predicted component life has been expended.
- Critical - Significant deterioration or wear noted, component appears to be marginally functional and exhibits signs that failure will result from continued wear or deterioration. Corrective action is required as soon as possible to avoid failure. More than 85% of predicted component life has been expended.

Appendix E
Cost Estimate

1. 0 Main Span

1.1 High Priority Repairs and Safety Issues $92,506 (with 15% contingency)

Task: Live Load Bearings, Span Guides, and Centering Devices

Materials

Item	Quantity	Cost per Unit	Item Cost
Misc steel for South Span Guide Rail and Span Guide repair	2	$2,500	$5,000
Misc cleaning supplies	1	$1,000	$1,000
Paint for Live Load Bearings, Span Guides, and Centering Devices	1	$5,000	$5,000
		Materials Subtotal	**$11,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Repair of South Span Guides and Rails - 4 IW, 4 days each rail	256	$115	$29,440
		Labor Subtotal	**$29,440**

Equipment

Item	Days	Cost per Day	Item Cost
MPT			$15,000
Spider Bucket Rental to repair span guide rail	5	$5,000	$25,000
		Equipment Subtotal	**$40,000**
		Task Total	**$80,440**

1.2 Intermediate Priority Repairs $1,669,593 (with 15% contingency)

Task: Operating Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Gear coupling seal sets	8	$100	$800
Paint for operating machinery	1	$5,000	$5,000
New Rack Gear	4	$175,000	$700,000
New Pinion Shaft	4	$30,000	$120,000
		Materials Subtotal	**$825,800**

Labor

Item	Hours	Cost per Hour	Item Cost
Replace Gear Coupling Seals - 2 MW, 2 days ea. Tower	184	$115	$21,160
Misc. operating machinery painting work - 4 Lab 2 Days, ea. Tower	360	$115	$41,400
Replace racks on counterweight sheaves, demolition, clean and prep, drill and ream mounting bolts- 5MW, 10 days ea rack	1920	$115	$220,800
Replacement of pinion shafts - 2 MW, 2 Days ea. Shaft	256	$115	$29,440
Misc machinery alignment work - 2 MW, 5 days ea. Tower	320	$115	$36,800
		Labor Subtotal	**$349,600**

Equipment

Item	Days	Cost per Day	Item Cost
MPT			$20,000
Crane and Flat Bed Truck Rental	4	$5,000	$20,000
		Equipment Subtotal	**$20,000**

Task Total **$1,195,400**

Task: Span Lock Work

Materials

Item	Quantity	Cost per Unit	Item Cost
New Span Lock Operators, Supports	2	$50,000	$100,000
Misc Equipment, Shims and Fasteners	1	$10,000	$10,000
New Span Lock Cover, Bar, Guides, and Receiver	2	$15,000	$30,000
		Materials Subtotal	**$140,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Installation of Span Lock Operators, Covers, Bars, Guides, and Receivers - 2MW, 14 Days	224	$115	$25,760
Shop Fabrication	60	$115	$6,900
Mounting of Span Lock Limit Switches - 2 MW, 3 Days	48	$115	$5,520
		Labor Subtotal	**$38,180**

Equipment

Item	Days	Cost per Day	Item Cost
Misc Rigging			$20,000
		Equipment Subtotal	**$20,000**

Task Total **$198,180**

Task: Counterweight Assembly Work

Materials

Item	Quantity	Cost per Unit	Item Cost
Misc Cleaning Supplies	1	$1,000	$1,000
Engineering for Tensioning Work	1	$12,000	$12,000
Misc Rods and Shims for Tensioning Counterweight Ropes	1	$10,000	$10,000
		Materials Subtotal	**$23,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Cleaning Rope Connections (to be done as part of maintenance)	N/A	N/A	N/A
Tensioning of Counterweight Ropes - 4 Lab, 2 Day ea. Corner	256	$115	$29,440
Check of Rope Tension - 2 Engineers, 2 days	32	$150	$4,800
		Labor Subtotal	**$34,240**

Equipment

Item	Days	Cost per Day	Item Cost
Jack Rental for Tensioning	10	$100.00	$1,000
		Equipment Subtotal	**$1,000**

Task Total **$58,240**

1.3 Long Term Reliability Repairs ***$186,852*** (with 15% contingency)

Task: Operating Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Reducer	2	$300,000	$600,000
Fasteners - Turned Bolts	12	$150	$1,800
Miscellaneous Matls and Shims	1	$4,000	$4,000
		Materials Subtotal	**$605,800**

Labor

Item	Hours	Cost per Day	Item Cost
Rigging, Demolition, and Istallation 4MW, 5 Days Per Tower	320	$180	$57,600
		Labor Subtotal	**$57,600**

Task Total **$663,400**

Task: Live Load Bearings, Span Guides, and Centering Devices

Materials

Item	Quantity	Cost per Unit	Item Cost
Misc cleaning supplies	1	$1,000	$1,000
Paint for Live Load Bearings, Span Guides, and Centering Devices	1	$5,000	$5,000
		Materials Subtotal	**$6,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Clean and paint Live Load Bearings, Span Guides and Centering Devices - 4 Lab, 3 Days ea. Pier	192	$115	$22,080
Reset Live Load Bearings and Centering Devices on new anchor bolts - 4 IW, 5 Days ea. Pier	320	$115	$36,800
		Labor Subtotal	**$58,880**

Equipment

Item	Days	Cost per Day	Item Cost
Spider Bucket Rental to repair span guide rail	5	$5,000	$25,000
		Equipment Subtotal	**$25,000**

Task Total **$89,880**

Task: Warning and Barrier Gates

Materials

Item	Quantity	Cost per Unit	Item Cost
Gear Lubricant	4	$200	$800
Seals for Reducer Housings and Bearings	4	$100	$400
		Materials Subtotal	**$1,200**

Labor

Item	Hours	Cost per Hour	Item Cost
Change Reducer Seals 2 MW, 1 Day per Gate	60	$115	$6,900
Change Gear Lubricant 2 MW .5 Day per Gate	32	$115	$3,700
		Labor Subtotal	**$10,600**

Equipment

Item	Days	Cost per Day	Item Cost
Misc Equip			$3,200
		Equipment Subtotal	**$3,200**

Task Total **$15,000**

1. 0 Secondary Span

1.1 High Priority Repairs and Safety Issues **$94,323** (with 15% contingency)

Task: Lifting Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Misc steel for diagonal strut	4	$3,750	$15,000
Misc cleaning supplies	1	$1,000	$1,000
Paint for Lifting Screw Support Assemblies	1	$5,000	$5,000
		Materials Subtotal	**$21,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Painting Lifting Screw Supports, 2 Laborers 2 days per Support	128	$115	$14,720
Repair of Diagonal Struts - 2 IW, 2.5 days each strut	160	$115	$18,400
		Labor Subtotal	**$33,120**

Equipment

Item	Days	Cost per Day	Item Cost
High Rail Vehicle with Boom	8	$200	$1,600
		Equipment Subtotal	**$1,600**

Task Total **$55,720**

Task: Translational Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Misc steel for Table Top Support	1000	$5	$5,000
Turned Bolts	6	$150	$900
		Materials Subtotal	**$5,900**

Labor

Item	Hours	Cost per Hour	Item Cost
Removal, Reinstallation, Alignment of Machinery, 2 MW 5 days	80	$115	$9,200
Demolition and Reinstallation of Table Top Support, 2 IW 5 days	80	$115	$9,200
		Labor Subtotal	**$18,400**

Equipment

Item	Days	Cost per Day	Item Cost
High Rail Vehicle with Boom	10	$200	$2,000
		Equipment Subtotal	**$2,000**

Task Total **$26,300**

1.2 Intermediate Priority Repairs *$143,120* (with 15% contingency)

Task: Lifting machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Misc equipment, paint and cleaning supplies	1	$12,000	$12,000
Replacement Flexible Hydraulic Piping	200	$10	$2,000
Replacement Rigid Hydraulic Piping	400	$10	$4,000
Replacement Cable Reels, Supports	2	$15,000	$30,000
Replacement Hydraulic Seals	4	$600	$2,400
		Materials Subtotal	**$50,400**

Labor

Item	Hours	Cost per Hour	Item Cost
Replacement of Hydraulic Piping and Hoses, 2 MW 5 Days	80	$115	$9,200
Installation of Cable Reels for Hydraulic Hose, 2 IW 2 Days per Reel	64	$115	$7,360
Installation of Hydraulic Seals, 2 MW 4 Days	64	$115	$7,360
Clean and Paint all Machinery, Supports, and Lifting Platform, 4 Laborers, 10 Days	320	$115	$36,800
		Labor Subtotal	**$60,720**

Equipment

Item	Days	Cost per Day	Item Cost
High Rail Vehicle with Boom	10	$200	$2,000
		Equipment Subtotal	**$2,000**

Task Total **$113,120**

Task: Translational Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Replacement Seals For Operating Machinery	1	$1,600	$1,600
Misc paint and Cleaning Supplies	1	$5,000	$5,000
		Materials Subtotal	**$6,600**

Labor

Item	Hours	Cost per Hour	Item Cost
Replace Operating Machinery Seals, 2 MW 5 Days	80	$115	$9,200
Clean and Paint all Machinery and Supports 2 Laborers, 5 Days	80	$115	$9,200
		Labor Subtotal	**$18,400**

Equipment

Item	Days	Cost per Day	Item Cost
Misc Equipment and Rigging			$5,000
		Equipment Subtotal	**$5,000**

Task Total **$30,000**

1.3 Long Term Reliability Repairs ***$1,138,400*** (with 15% contingency)

Task: Lifting Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Reducers	4	$90,000	$360,000
Screw Assemblies	4	$50,000	$200,000
Lifting Platforms	20000	$5	$100,000
Fasteners - Turned Bolts	60	$150	$9,000
Miscellaneous Matls and Shims	1	$4,000	$4,000
		Materials Subtotal	**$673,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Rigging, Demolition, and Istallation 20 Days Per Side			$250,000
		Labor Subtotal	**$250,000**

Task Total $923,000

Task: Translational Machinery

Materials

Item	Quantity	Cost per Unit	Item Cost
Machinery Supports	2000	$5	$10,000
Gearmotor	1	$90,000	$90,000
Chain Drive Assemblies	2	$10,000	$20,000
Bearings	8	$1,500	$12,000
Paint for Live Load Bearings, Span Guides, and Centering Devices	1	$5,000	$5,000
		Materials Subtotal	**$137,000**

Labor

Item	Hours	Cost per Hour	Item Cost
Rigging, Demolition, and Istallation 4MW, 20 Days	640	$115	$73,600
		Labor Subtotal	**$73,600**

Equipment

Item	Days	Cost per Day	Item Cost
High Rail Vehicle with Boom	24	$200	$4,800
		Equipment Subtotal	**$4,800**

Task Total $215,400

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ELECTRICAL INSPECTION

1.0 Executive Summary

An in depth inspection of the Sarah Mildred Long Bridge electrical facilities was conducted on November 6, 7, and 8 of 2013. The scope of work included visual inspection, observation of operation, and electrical testing. Testing included insulation resistance testing and recording of span drive voltage and current during bridge operation. Electrical equipment associated with both the primary and secondary operable spans was inspected and tested.

Most of the bridge electrical system was in good condition.

Recommended repairs are listed in Section 6.1. **Immediate attention, however, is advised for the following:**

> **Verification of or installation of an appropriate safety system into the PLC and span motor drive system design to prevent surprise operation of the span drive in response to a PLC failure. Concern is expressed due to the absence of input or output contactors in the drive cabinets.**

2.0 Description of systems

This bridge is a tower drive vertical lift bridge with a primary double level movable span and a secondary single (lower) level movable span. The upper level carries US Route 1 Bypass highway and the lower level carries a railroad track going into the Portsmouth Naval Shipyard.

The bridge is manned 24/7 year round. The primary span is operated from the operator house located on the west side near the south tower.

Each end of the bridge has its own utility power feeder, emergency power system and motor control center. The bridge is controlled using a Programmable Logic Controller (PLC) based control system. There is one master PLC within the south side electrical room with a Remote Terminal Unit (RTU) in each machinery room and the north side electrical room. The communication between both ends of the bridge is done through redundant aerial fiber optic cables. A back up wireless communication link is set up between the towers.

The primary span operating machinery, drive motors, brakes and height transmitters are located in the tower machinery rooms.

There are two ways to access the machinery rooms. The first is the most commonly used and requires riding the movable span, and then lifting the bridge until the movable span meets the top of the counter weight. Passengers then cross over to the top of the counter weight and ride the counterweight as the movable span is lowered to the seats. Access to the machinery room from the counter weight is through a hatch in the machinery room floor. The second method to access the machinery rooms is by climbing the ladder inside the tower legs. The ladder goes all the way from the top of the pier to the machinery room without rest platforms or cages. A

safety harness is required to climb these ladders. A hoist is provided in one leg of each tower to move equipment.

There is a span lock for each end of the primary movable span. The span locks are located at the rest piers under the railroad track. The span locks are accessible via a set of stairs from the north approach sidewalk.

The secondary span is located north of the primary span. The secondary span machinery consists of screw jacks and associated limit switches located at the south end of the north approach to the secondary span. An electrical cabinet in this area houses equipment to support the lube pump for the screw jacks. Additional cabinets housing motor starters and controls are located immediately to the south of the secondary span channel. The inner portion of the retractable span structure housed the secondary span "translation motor," electrical box, and resistors.

Warning and barrier gates are located on the approach spans at the upper roadway level. The gates provide a visual warning and physical barrier for the motorists when lowered.

Other ancillary systems such as navigation, aviation, access and egress lighting are located at various locations about the bridge and structures.

3.0 Inspection approach and methodology

A visual inspection of the bridge electrical and control systems components was conducted. Accessible cabinets and enclosures were opened and inspected. Insulation resistance values and span drive current measurements were recorded.

The primary and secondary movable spans were also observed during operation. The current poor condition of the secondary span limited test operation to a few feet of travel.

4.0 Primary Movable Span Inspection findings

4.1 Main Electric Service

There are two utility feeders supplying power to the bridge. The system voltage is 480 / 277V three phase.

4.1.1 North Approach:

The utility feeder is from the local utility at the Maine side of the bridge. This feeder enters the fenced generator area at the north end of the river, just below the approach span, which contains the outdoor mounted main disconnect switch. The main disconnect switch appears to be in a good condition.

4.1.2 South Approach:

The utility feeder is from the local utility at the New Hampshire side of the bridge. This feeder enters the fenced generator area at the south end of the river in the Port Authority facility just below the approach span. The fenced generator area contains the outdoor mounted main disconnect switch and the transient voltage surge suppressor (TVSS).

4.2 Back up Electric Service

Each utility feed is provided with a dedicated back up Electrical Diesel Generator. Since each generator feeds only one end of the bridge, it is possible to run the bridge using the utility feeder on one end and the back up Electrical Diesel Generator on the other end.

4.2.1 North Tower:

The north generator rating is 218KVA /175KW, 480/277V, 3 Phase, 60 cycles. The load side of the ATS is connected to the north tower MCC fusible disconnect switch which is located next to the ATS in the fenced generator area. The generator was operated with no problems noted.

4.2.2 South Tower:

The generator at the south approach is 187.5KVA /150KW, 480/277V, 3 Phase, 60 cycles. The generator was operated with no problems noted.

4.3 Motor Control Centers (MCC)

4.3.1 North Tower:

The north tower MCC is located in an electrical room on the east side of the north pier at track level, below the roadway. Access to the north tower electrical room is from stairs on the west side of the roadway, as well as the north approach (if the retractable railroad span is closed). This MCC is fed from the north ATS thru a disconnect switch that is also located in the north generator area. The power and control cables are routed through conduits supported below the upper level of the approach span. For the most part, the conduits and supports appear to be in good condition. The MCC feeds the north traffic gates, the north span locks, north tower brakes, north motor drives and the north side control system transformer. The MCC appeared to be in good condition. The electrical room also contains a Remote Terminal Unit (RTU) that interfaces with the MCC and span drives. The electrical room is well lit, and has provisions for heating and cooling. A sensor is installed on the door to signal the operator that the door is open.

4.3.2 South Tower:

The south tower MCC is located in the electrical room on the west side of the south pier just next to the control house. This MCC is fed from the south shore ATS thru a disconnect switch that is also located in the south shore generator area. The power and control wires are routed through conduits supported below the upper level of the approach span. The MCC feeds the south traffic gates, the south span locks, south tower brakes, south motor drives and the south side control system transformer. This MCC is in good condition. The electrical room contains the span drives, is well lit and has provisions for heating and cooling.

The east motor drive enclosure in the south tower electrical room is rusted through at the front area under the enclosure door near the floor. There was also much corrosion of the bottom of this enclosure. The west drive enclosure in this area was somewhat less corroded.

4.4 Motors and Drives

The machinery room on each end of the bridge contains two 460V, 100 HP vector duty wound rotor type motors. Only one motor from each side is required to lift the span. The control automatically alternates between the motors after every lift in order to maintain equal wear on both motors. The operator has the capability to use either motor. These motors are controlled by the Allen-Bradley Powerflex 700 flux vector drives that are located in the electrical rooms.

The motors are connected directly to the load side of the drive. There are no safety disconnect switches within sight of the motors. The lack of disconnect switches within sight of the motors violates NEC code and is a safety hazard. The only way to disconnect the power is from the MCC's in the electrical rooms located at the bases of the towers. Since the easiest and typically used method of getting to the machinery room is by riding the span and counterweight, the maintenance personnel will need to rely on someone in the electrical rooms to disconnect and lock out power to the motors. This violates the OSHA requirements as per standard 1910.147 section (c)(8) "Energy isolation. Lockout or tagout shall be performed only by the authorized employees who are performing the servicing or maintenance." If maintenance personnel decide to disconnect and lock out power by themselves, they will need to climb approximately 160ft on a ladder in the tower leg using Personnel Protective Equipment (PPE) to get to the machinery rooms. To assure safety during maintenance, safety disconnect switches for the motors in the machinery rooms should be installed.

In addition to the lack of disconnect switches, the flux vector drive cabinets lacked either input or output contactors to securely disconnect the drive from the motors. It is unknown whether power is removed from the PLC outputs and or the drives between bridge operations. Since as Allen Bradley describes in their literature, the primary failure mode of a PLC output is in the "on" state, immediate measures should be taken to verify that a PLC output failure will not result in surprise activation of the vector drives.

The primary motors were not megger tested as there were no installed disconnect switches or output contactors to isolate the motors from the drive electronics.

4.5 Brakes

There are two thruster actuated machinery brakes and two solenoid motor brakes in each tower. The motor brakes are 460V, 3 phase solenoid brakes and are mounted to the backs of the span motors. The machinery brakes are 460V, 3 phase thruster brakes. All the brakes were megger tested. No problems were noted. All brakes were operational and in good condition.

The machinery brakes are connected directly to the MCC'S in the electrical rooms. There are no safety disconnect switch within sight of the brakes. To assure safety during maintenance, safety disconnect switches for the brakes in the machinery rooms should be installed.

Three lever arm limit switches are mounted on each brake for brake set, brake released and brake hand released indication. These limit switches were operational but covered with grease.

4.6 PLC System

The bridge is controlled using GE Fanuc PLC'S. The master PLC is located in the south side electrical room. Additional PLC's are mounted in the machinery rooms and the north tower electrical room. These PLCS act as RTU's (remote terminal units) to transmit/receive data from the master PLC. The tower PLC's receive input from redundant height transducers. The electrical and control room PLC's communicate with the MCC's, Span Drives and field limit switches.

The primary connection between the towers is done through fiber optic cables. A back up wireless communication link is set up between the towers. The PLC system appeared to be in good condition.

Cables entering the top of the PLC cabinet in the machinery rooms are routed to these cabinets via cable trays. A cable entering the top of the PLC cabinet in the south machinery room suffered insulation damage due to contact with the cable tray (see photo E-1). This cable was

moved by the NHDOT electrician on site to avoid further damage. The damaged area on the cable should be repaired. These cables should also be secured to prevent contact with sharp metal edges.

4.7 Aerial cables

No submarine cable is used between the towers. The only hard connection between the north and south towers is done through redundant fiber optic aerial cables. The cables provide the primary communication mean between the master PLC in the south tower electrical room and the remote PLC in the north machinery room and north electrical room. These cables appeared to be in good condition. A backup Ethernet radio system is available to provide communication in the case of a failure of the aerial cables.

4.8 Control Desk

The control desk is located in the control house. The desk is a combination of a touch screen and control switches and indicator lights. The desk appeared to be in good condition.

During test operations, control permissives and bypass functionality was observed. Due to difficulties with the log in function at the touch screen, not all functionality could be tested. All testing completed demonstrated proper functionality.

4.9 Indication and Measuring Devices

4.9.1 Height and skew indication:

The bridge uses resolvers to compute the bridge height and skew. Two Hengstler type resolvers are used in each tower. The first resolver is driven directly from the main sheave trunion without any gear reduction. As the bridge moves, the trunion rotates and drives the resolver at the same speed. As the resolver rotates, it sends pulses to the PLC. The PLC counts the pulses to determine height and skew.

Even though this height indication system appeared to be functioning properly, the mounting of the resolvers appeared not to be substantial, and subject to damage or misalignment. Considering that the area where the resolvers are located are accessible to authorized personnel only, consideration of the delicate nature of the installation should be sufficient to avoid damage.

The second resolver is set up into the control cabinet inside the machinery rooms. The resolver is driven by a piano wire on a spring loaded reel that runs through the machinery room floor and connects to the top of the counterweight. As the bridge is opening the piano wire is pulled and drives the resolver in one direction. When the bridge is closing, the piano wire retracts driving the resolver in the opposite direction. As the bridge is moving the resolver feeds the counterweight position into the control system. The default settings use the trunion mounted resolvers as the primary system for height and skew indication but the operator in the control room has the option to choose the either feedback system.

The thin wire connected to the counterweight is almost invisible and since the counterweights are used to transfer personnel into the machinery rooms, there is a risk of the wire being damaged and cut during the process. This risk is mitigated by the fact that only authorized maintenance people familiar with the piano wire have access to this area.

The resolver cabinet inside the north machinery room PLC cabinet was wrapped with electrical tape. It was not apparent why.

4.9.2 Span Seated Limit Switches:

The span is provided with one heavy duty, plunger operated, limit switch on each pier for the span seated indication. The switches are in serviceable condition. The cover was open on the switch on the north pier.

From field experience the plunger switches are problematic. If they are not adjusted properly, they can be easily damaged. Magnetic proximity switches such as the Topworx Go Switch are a more reliable design since they have no external moving parts and don't have to make contact to perform their required task. The scope of a major rehabilitation approach should include the replacement of the plunger switches with proximity sensors to enhance the reliability of the control system.

4.10 Traffic Gates

4.10.1 Warning Gates:

Warning gates and traffic lights are installed on each approach.

Both warning gates are in fair condition with dust and grease generally present in the interiors. The northwest outboard gate housing is covered with minor rust over a large area (see photo E-2). A minor rehabilitation should include the cleaning and painting of the gate housing.

The insulation resistance reading for the south traffic gate was much lower than recorded in 2009. This can be due to moisture in motor windings or deterioration of wiring between the MCC and the gate (since readings were recorded from the MCC). Follow up testing is recommended due to the low reading.

4.10.2 Barrier Gates:

The barrier gates are used to provide a physical barrier for traffic when the bridge is moving. One barrier gate is located at each end of the bridge. The gate housings are showing some minor to moderate corrosion over a large area. A gong is installed on each gate to provide an audible warning that gate is moving.

The insulation resistance reading for the north barrier gate is much lower than recorded in 2009. This can be due to moisture in motor windings or deterioration of wiring between the MCC and the gate (since readings were recorded from the MCC). Follow up testing is recommended due to the low reading.

4.11 Span Locks

Span locks are installed at the rest piers on either end of the movable span to ensure that the movable span is fully seated and locked in place when the span is in the closed position. The close proximity of the span lock to the water has accelerated the corrosion process. The span locks were megger tested and the insulation resistance was found to be lower than recorded during the 2009 inspection. The span locks appeared to be operating as intended, however. Future testing should be done to monitor the trend in changes in insulation resistance values. The limit switches inside the actuator are used to provide indication of the position of the thruster.

The motor termination box on the north span lock is moderately corroded over most of its surface (see photo E-3) but is intact.

Most of the exterior of the south span lock is mildly to moderately corroded over most of its surface (see photo E-4).

4.12 Navigation Lights

Navigation lights are installed on the piers and on either end of the movable span to provide visual guidance for marine traffic.

The base of the southwest navigation light at the secondary movable span is heavily corroded (see photo E-5).

The west center channel light on the primary movable span is not operating.

The southwest pier navigation light is misaligned (see photo E- 6). The conduit serving this fixture needs to be secured in place.

Aviation beacons atop each tower were accessible from the respective machinery room via a permanent ladder. No problems were noted for either beacon.

4.13 Miscellaneous

The south counterweight alarm is not operating.

The signal on the east side of the roadway at the north abutment was missing a shroud.

The circuit breaker schedule in lighting panel STL in the south tower machinery room conflicts with the labels placed next to the individual circuit breakers. It appears clear, however, that the labels next to the circuit breakers supersede the schedule on the door of the enclosure. Updating the schedule on the door is recommended so as to avoid possible confusion.

The southeast torque monitoring system cabinet in the south machinery room appeared to be missing a light bulb apparently used to heat the interior of the cabinet.

5.0 Secondary Movable Span Inspection Findings

5.1 Limit Switches

Fork type limit switches were found at the west side of the north end of the channel at the secondary (retractable) span. These appeared to be in good condition. Limit switch rollers were slightly rusty (see photo E- 7).

The southwest lever arm type limit switch on the secondary span is misaligned (see photo E- 8).

5.2 Electrical Cabinets

A lube pump cabinet was located on the east side of the south end of the north approach to the secondary movable span. A cabinet behind the northwest screw-jack motor was dented but intact and in otherwise good condition (see photo E- 9).

The electrical enclosure and resistor enclosure inside the secondary (retractable) span structure is in good condition with just minor rust on the exterior. The interior of the span motor electrical enclosure had debris accumulated in the bottom and moderate rusting of terminals.

The motor control cabinets at the north end of the south approach to the secondary (retractable) span were stainless steel and in good condition inside and out.

Liquid-tight conduit fittings at electrical boxes serving the northwest screw-jack machinery was moderately corroded (see photo E- 10).

5.3 Motors

The exterior housing of the northwest lifting screw motor had mild to moderate rust. The exterior housing of the northeast lifting screw motor had moderate rust (see photo E- 11).

6.0 Recommendations

6.1 Recommended Repairs

Recommended repairs are listed below. Considering the plan to replace the Sarah Mildred Long Bridge within the next seven years, the NHDOT may elect not to perform all of these repairs. Failure to perform most of these repairs is not expected to significantly impact reliable bridge operation during the next seven years.

HDR recommends immediate attention, however, to the issue of verifying that a PLC failure will not result in inadvertent operation of the span drive system.

- Motors and drives
    - Install safety disconnect switches for the motors in the machinery rooms.
    - **Verify that PLC failure will not inadvertently result in operation of the primary span drives. Immediate attention is recommended for this.**
- Brakes
    - Install safety disconnect switches for the machinery and motor brakes in the machinery rooms.
- Limit Switches
    - Replace existing span seated plunger switches with proximity sensors.
- Traffic gates
    - Clean and paint housing of the warning and barrier gates.
- Span locks
    - Install new span locks systems including new limit switches and wiring systems.
- Navigation lights
    - Secure the southwest navigation light and its associated conduit.
    - Install new conduits and wiring for all the pier navigation lights.

Appendix A
Electrical Photos

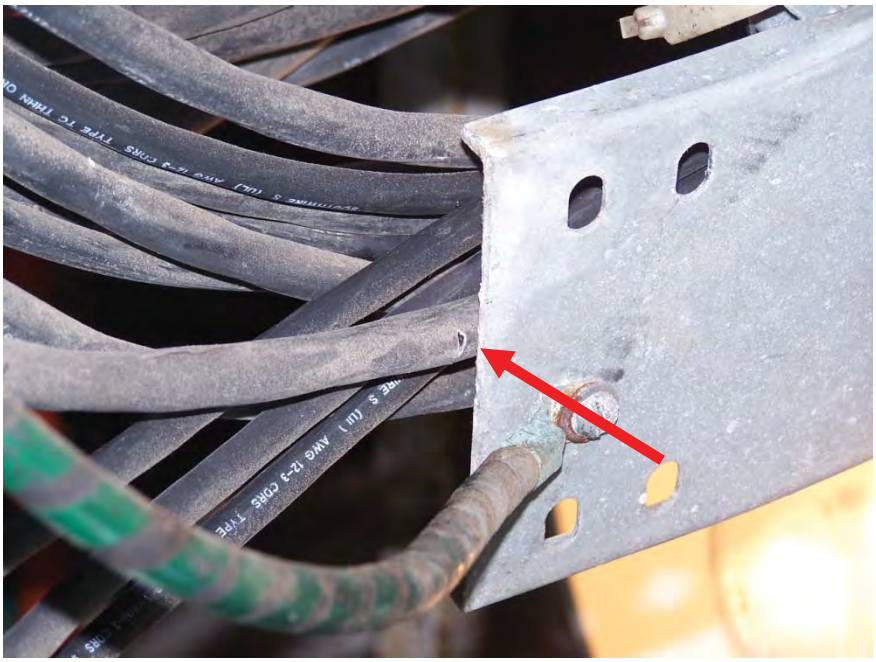

Photo E-1: Southwest Machinery Room: A cable exiting the cable tray and entering the PLC cabinet has been damaged by contact with the sharp metal edge of the tray.

Photo E-2: Northwest Warning Gate: The gate exteriors are covered with minor rust over a large area.

Photo E-3: North Span Lock Motor: The motor lead terminal box is corroded.

Photo E-4: South Span Lock Motor: Most of the exterior of the motor is mildly to moderately corroded.

Photos E-5: Southwest Navigation Light: The base is very corroded.

Photo E-6: Southwest Pier Navigation Light: Fixture and associated conduit is misaligned and inadequately supported.

Photo E-7: Secondary Span Limit Fork Type Limit Switch: The fork type limit switches at the west side of the north end of the channel at the secondary span are moderately rusty.

Photo E-8: Secondary Span Lever Limit Switch: The southwest lever arm type limit switch on the secondary span appears misaligned and not securely mounted.

Photo E-9: Cabinet at Northwest Screw Jack: A cabinet behind the northwest screw-jack motor was dented but intact and in otherwise good condition.

Photo E-10: Northwest Screw-jack Machinery: Liquid tight fittings at the electrical boxes serving the northwest screw-jack machinery were moderate corroded.

Photo E-11: Northwest Screw-jack: The northwest screw-jack motor enclosure is moderately corroded.

Appendix B
Field Measurements and Data

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Page No: of

Bridge Name: Sarah Mildred Long Time: Date:11/7/13

Location: Portsmouth, NH Temp:

Type of Measurement: Insulation Resistance Humidity:

Inspector:

Motor	2009	Location	2013	Location
North West Machinery Brake	>550MΩ	MCC	>550MΩ	MCC
South West Machinery Brake	>550MΩ	MCC	>550MΩ	MCC
North East Machinery Brake	>550MΩ	MCC	>550MΩ	MCC
South East Machinery Brake	>550MΩ	MCC	>550MΩ	MCC
North West Motor Brake	>550MΩ	MCC	>550MΩ	MCC
South West Motor Brake	>550MΩ	MCC	>550MΩ	MCC
North East Motor Brake	>550MΩ	MCC	>550MΩ	MCC
South East Motor Brake	>550MΩ	MCC	>550MΩ	MCC
North (Warning) Traffic Gate	>550MΩ	MCC	240MΩ	MCC
South (Warning) Traffic Gate	>550MΩ	-	10MΩ	MCC
North Barrier Gate	>550MΩ	-	9MΩ	MCC
South Barrier Gate	>550MΩ	-	>550MΩ	MCC
SW Lifting Motor (M2)	N/A	-	>550MΩ	Cabinet just south of secondary span channel

Motor	2009	Location	2013	Location
SE Lifting Motor (M3)	N/A	-	>550MΩ	Cabinet just south of secondary span channel
NE Lifting Motor (M4)	N/A	-	>550MΩ	Cabinet just south of secondary span channel
NW Lifting Motor (M5)	N/A	-	>550MΩ	Cabinet just south of secondary span channel
Secondary Span Translation Motor (M1)	N/A	-	>550MΩ	Cabinet inside secondary span structure
North Span Lock	N/A	>550MΩ	63MΩ	MCC
South Span Lock	N/A	>550MΩ	340MΩ	MCC

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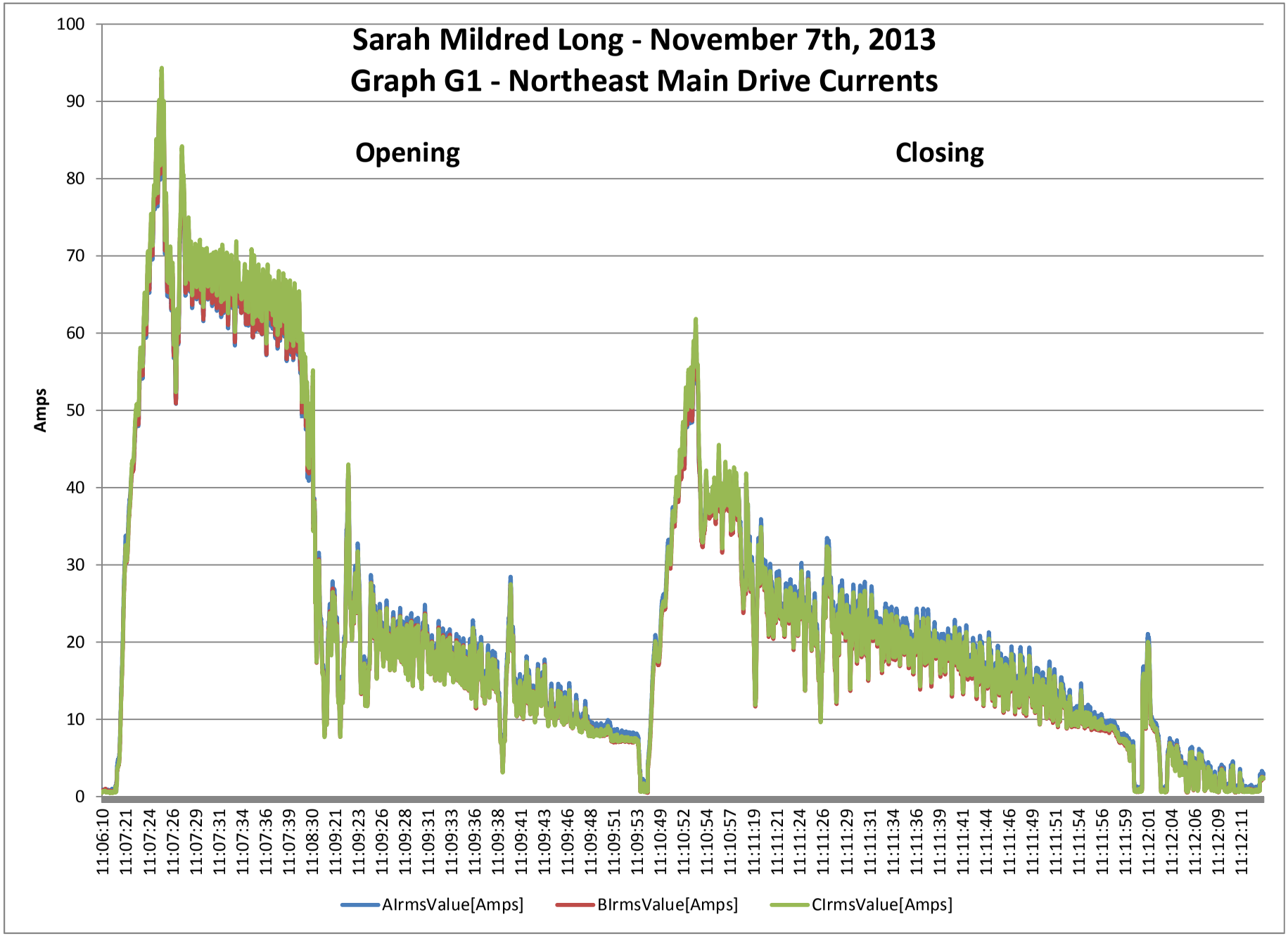
Page No: of

Bridge Name: Sarah Mildred Long Time: Date:
Location: Portsmouth, NH Temp:
Type of Measurement: Motor Current Humidity:
Inspector:

Motor	2009				2013			
	North		South		North		South	
	Raise	Lower	Raise	Lower	Raise	Lower	Raise	Lower
West Drive	30-45A	*	0-50A	0-30A	**	**	**	**
East Drive	15-65A	*	5-50A	0-30A	**	**	**	**
West Machinery Brake	1.6A	-	1.58A	-	1.6A	-	1.9A	-
East Machinery Brake	0.61A	-	1.48A	-	1.6A	-	1.8A	-
West Motor Brake	1.6A	-	0.43A	-	0.6A	-	0.6A	-
East Motor Brake	0.58A	-	0.47A	-	0.6A	-	0.6A	-
Warning (Traffic) Gate	0.57A	0.57A	0.6A	0.59A	0.6A	0.6A	0.6A	0.6A
Barrier Gate	1.3A	1.2A	1.2A	1.2A	1.2A	1.2A	1.2A	1.1A
	North		South		North		South	
	Raise	Lower	Raise	Lower	Raise	Lower	Raise	Lower
Span Lock	1.18A	1.26A	1.1A	1.2A	1.2A	1.2A	1.3A	1.2A

*No Amps, 1 span heavy (stated from previous report)
**Dranetz testing was used for the drive and the data is displayed in the report.


Sarah Mildred Long - November 7th, 2013
Graph G1 - Northeast Main Drive Currents
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70
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20
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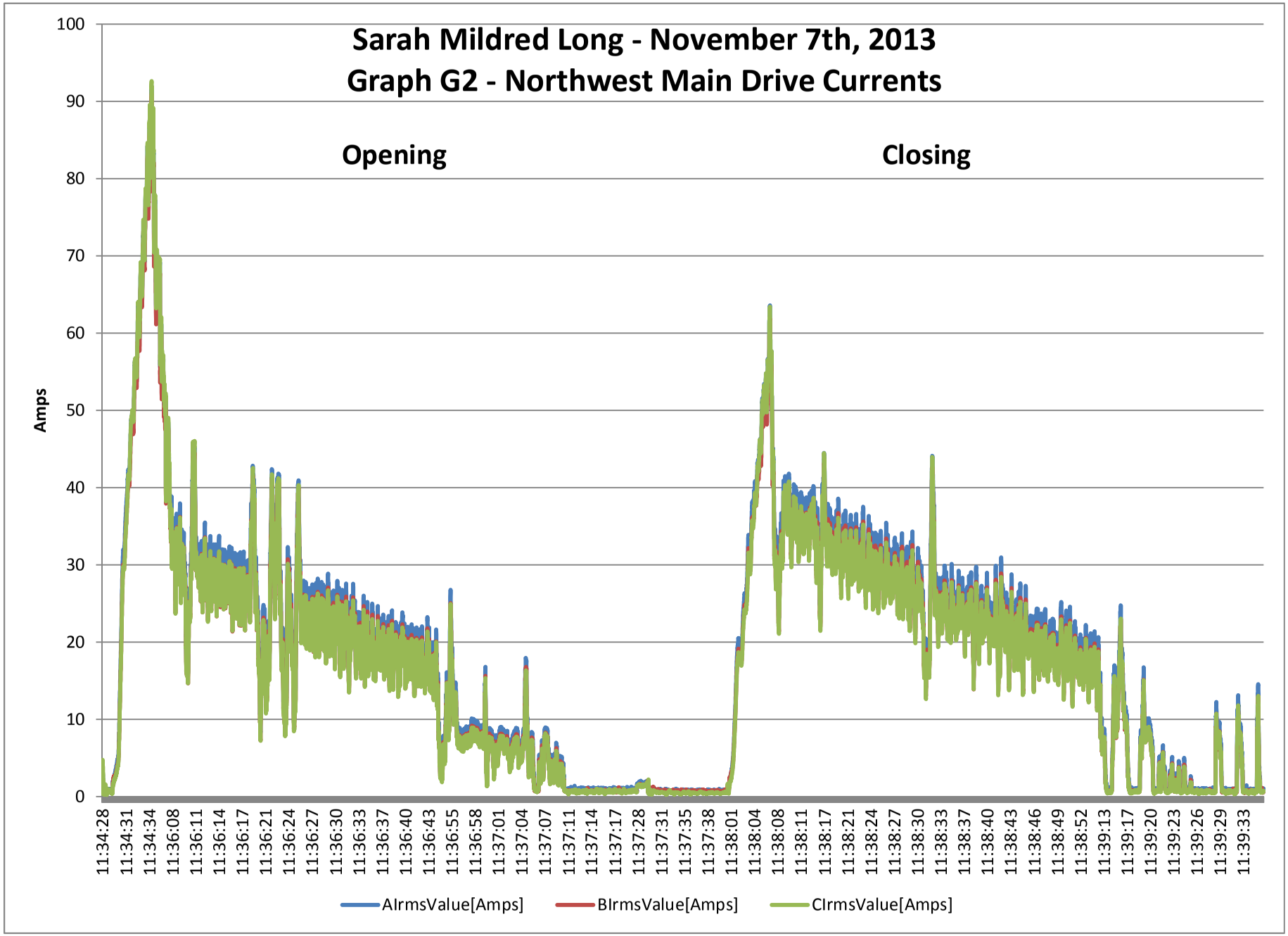
Sarah Mildred Long - November 7th, 2013
Graph G2 - Northwest Main Drive Currents
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Closing
Amps
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70
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20
10
0
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11:36:08
11:36:11
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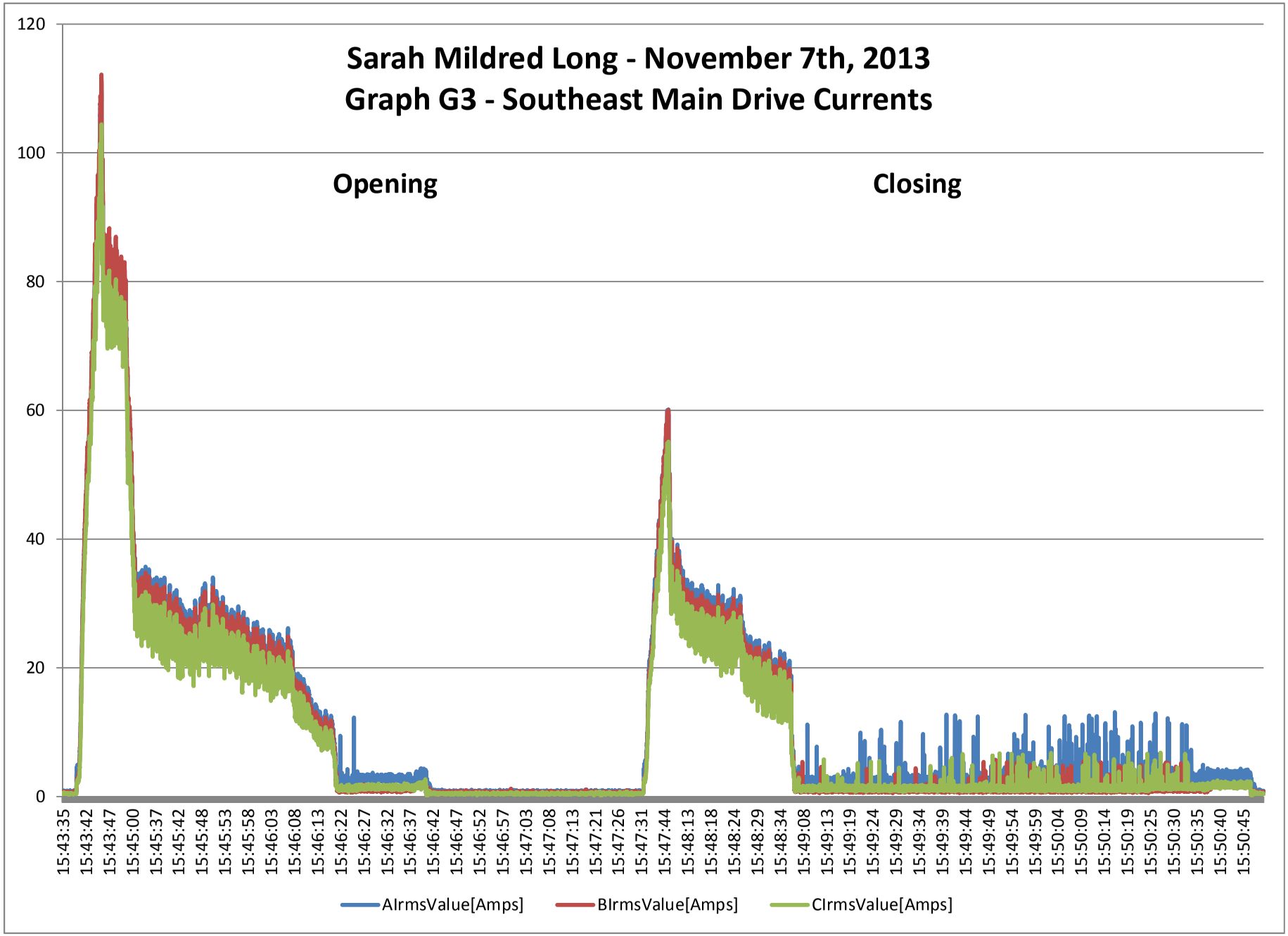
Sarah Mildred Long - November 7th, 2013
Graph G3 - Southeast Main Drive Currents
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Closing
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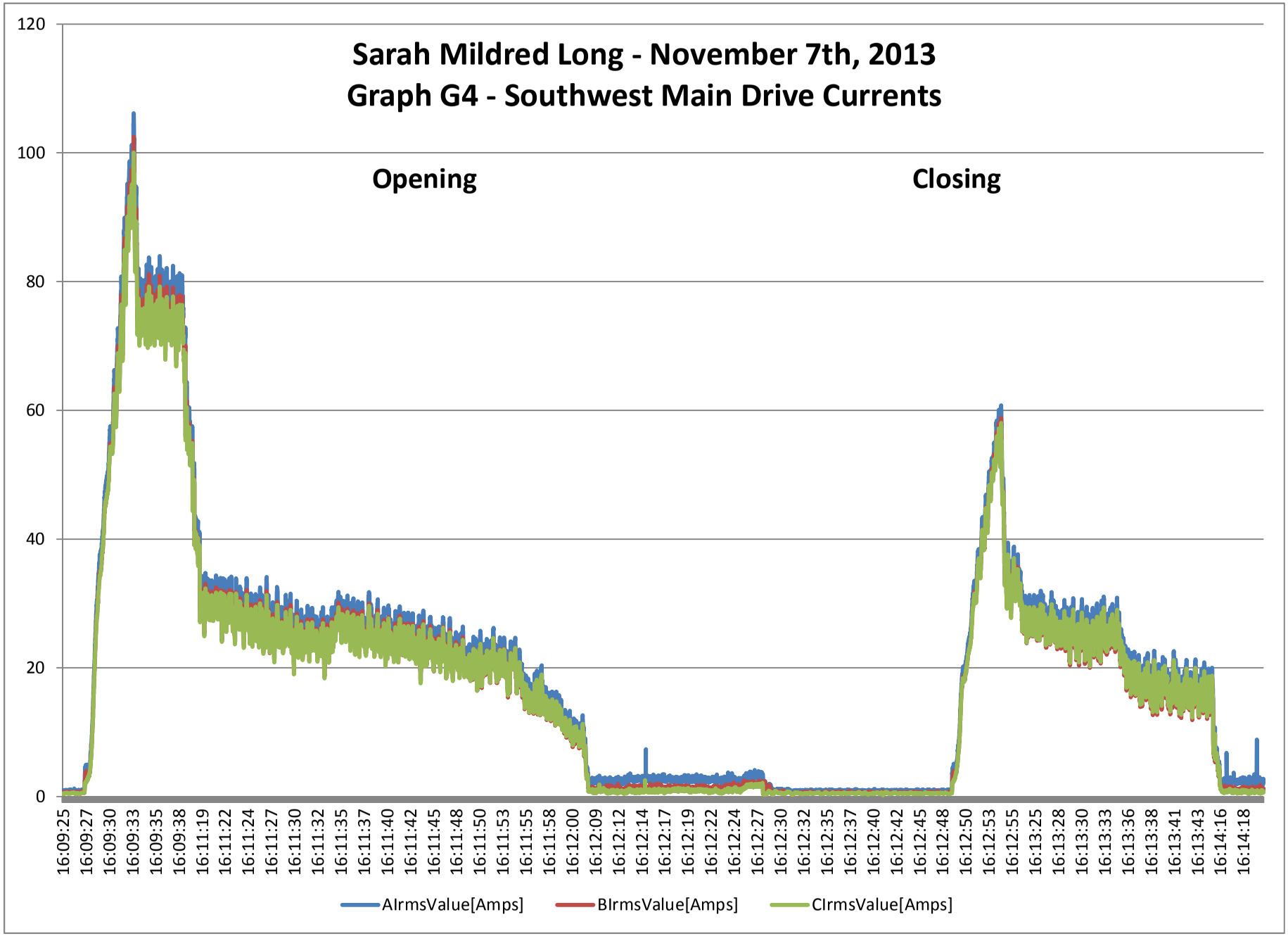
Sarah Mildred Long - November 7th, 2013
Graph G4 - Southwest Main Drive Currents
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16:12:09
16:12:12
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16:13:33
16:13:36
16:13:38
16:13:41
16:13:43
16:14:16
16:14:18
AIrmsValue[Amps]
BIrmsValue[Amps]
CIrmsValue[Amps]

17035 Westview Avenue
South Holland, IL 60473
Phone: 800-373-1759
www.callabco.com
il@callabco.com

CAL LAB

Calibration Certificate

#1210365

(Level 1) Standard Calibration with no Measurement Data

Customer

Protec Equipment Resources (940428)
1001 Nicholas Blvd.
Unit M
Elk Grove Village, Illinois 60007
PO Number: INVENTORY CALIBRATION

Instrument Profile

Manufacturer: *Dranetz*
Model: *PX5*
Asset ID: *PX5-001*
Serial: *PX50HA066*
Description: *Power Analyzer*

Calibration Information

†Requested Interval: *12 Months*
Calibration Date: *04/24/2013*
†Due Date: *04/24/2014*
Temperature: *70.3 °F (21.3 °C)*
Batch #: *1192730*
Calibration Location: *Illinois Lab*
Calibration Procedure: *CP-0003*
Relative Humidity: *36.4 %*

Instrument Condition

As Received: *In Tolerance*
As Returned: *In Tolerance*
Tolerance(s): *Manufacturer specification(s) unless otherwise specified.*
Phys. Damage: *No apparent evidence of physical or cosmetic damage noted during this calibration.*

Quality & Traceability Statements

Level 1 Calibration

The results reported herein apply only to the calibration of the item described above. All calibration standards used in this calibration are traceable to the International System of Units (SI) through NIST or equivalent National Measurement Institute signatories to the CIPM MRA. Supporting documentation relating to this traceability is initiated by the Trace Number listed in the Calibration Standards section of this certificate. Additional documentation is available for review by a scheduled appointment. Our Quality System is accredited to ISO/IEC 17025:2005, ANSI/NCSL Z540-1:1994 and ANSI/NCSL Z540.3:2006 via the Laboratory Accreditation Bureau. Details of our scope of accreditation are available at www.L-A-B.com.

Although Cal Lab Co., Inc. is an accredited laboratory, the results of this calibration and customer requested reporting is NOT considered an accredited calibration and therefore does not meet the requirements of ISO-17025:2005. With a Level 1 Calibration, the actual calibration data points are verified, however, these values are not recorded at the customer's request. A Level 1 calibration cannot be converted to any other level (2 through 4) without performing a re-calibration and recording the data. Additional fees may apply.

†Per the requirements of ISO-17025:2005, Cal Lab Co., Inc. does not make recommendations for recall therefore the listed Calibration Due Date is dictated by the owner of this equipment. Although the item calibrated meets the conditions or specifications at the time of the calibration, due to a number of factors the due date of the item calibrated does not imply continuing conformance during the calibration interval.

Jasen Mabus
Jasen Mabus
Metrology Technician
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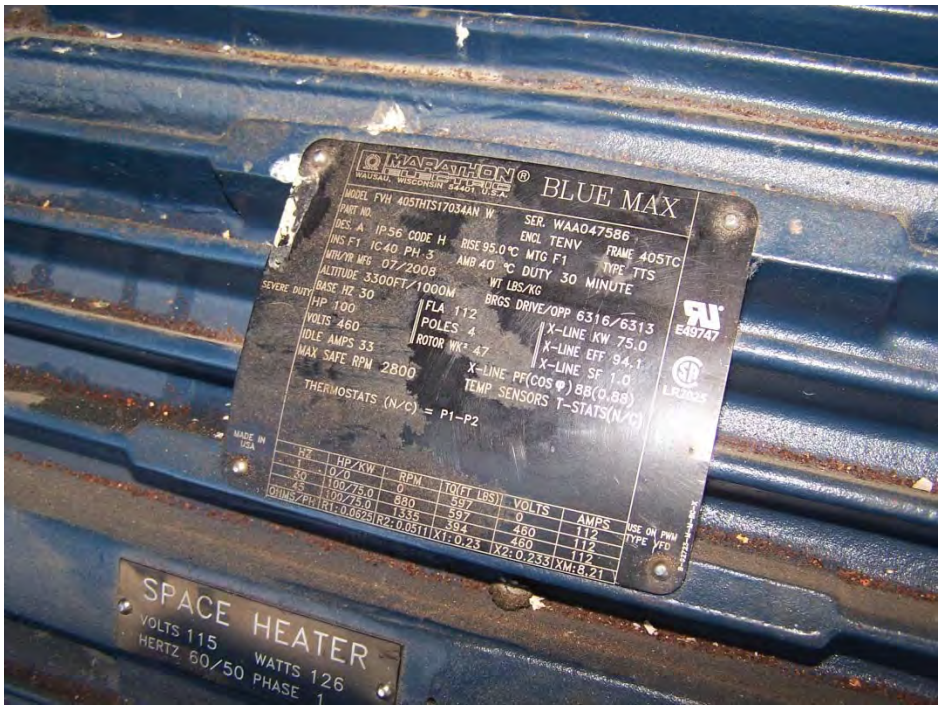
J. Brent Snoddy
Metrology Manager Review & Approval
metrology@callabco.com

This certificate, ***#1210365*** issued on ***04/24/2013***, *at* ***14:00.50***, may not be reproduced except in its entirety without the written permission of Cal Lab Co, Inc.

Appendix C
Nameplate Information



Main Motor: (SW Motor Shown, others similar)

Motor Brake: (NW Motor Brake shown, others similar)

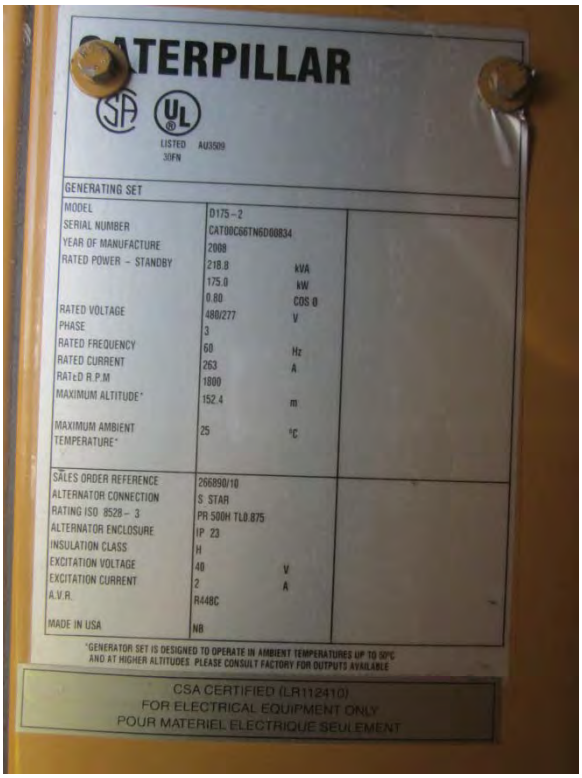
Machinery Brake: (NE Motor Brake shown, others similar)

Auxiliary Span Hydraulic Motor (NW motor shown, others similar)

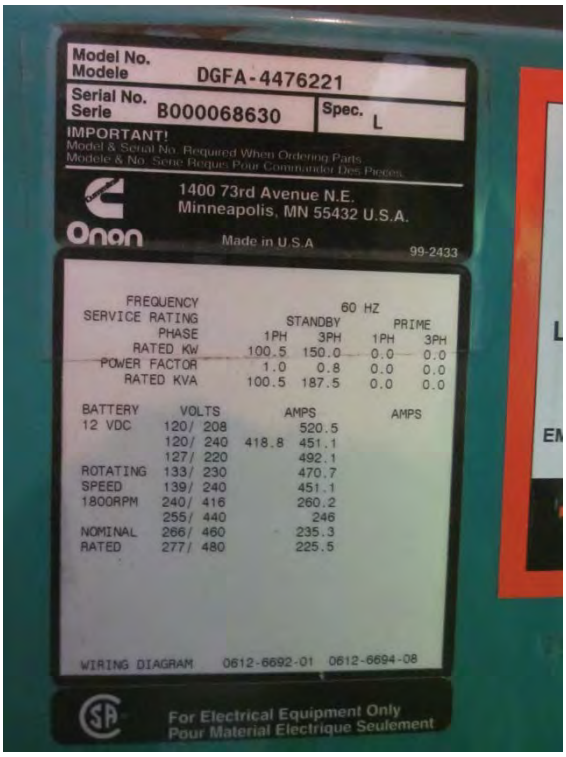
Auxiliary Span Translation Motor

South Span Lock Motor (Normal Span Lock Motor Similar)

Motor Drive (NE Driver shown, others similar)



North Electric Diesel Generator

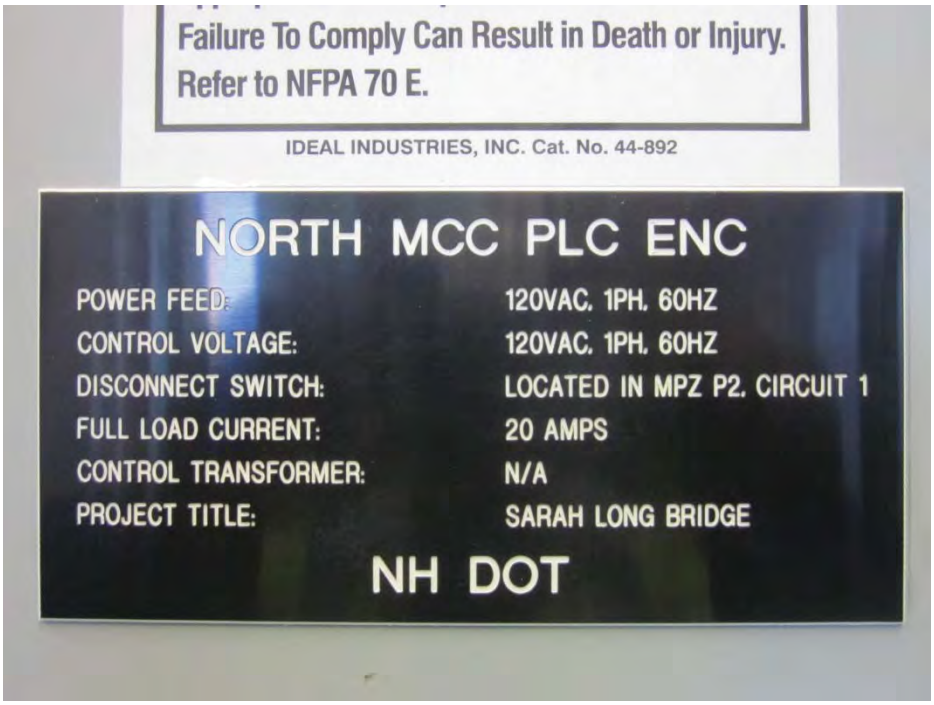


South Electric Diesel Generator

Oil Pump Motor

Auxiliary Span Translation Motor Resistor Bank

North Motor Control Center (MCC)



North MCC Programmable Logic Controller (PLC)

North MCC Main Breaker

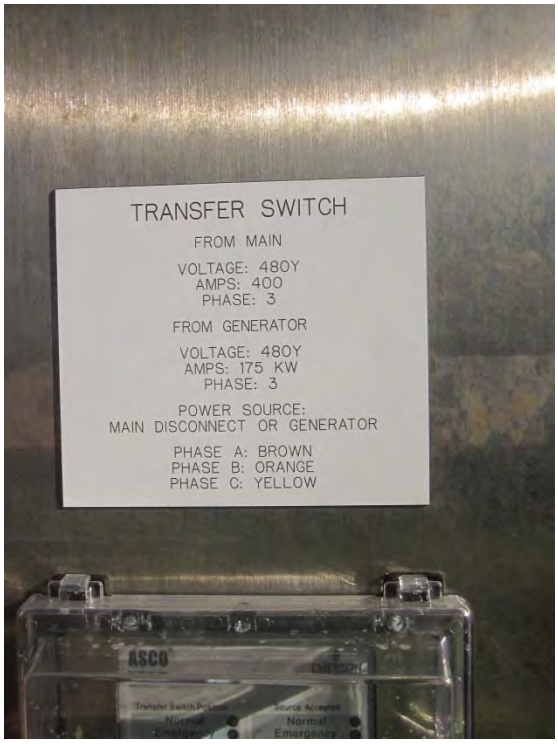
Machinery Brake Hand Release Limit Switch

Machinery Brake Hand Fully Set Limit Switch

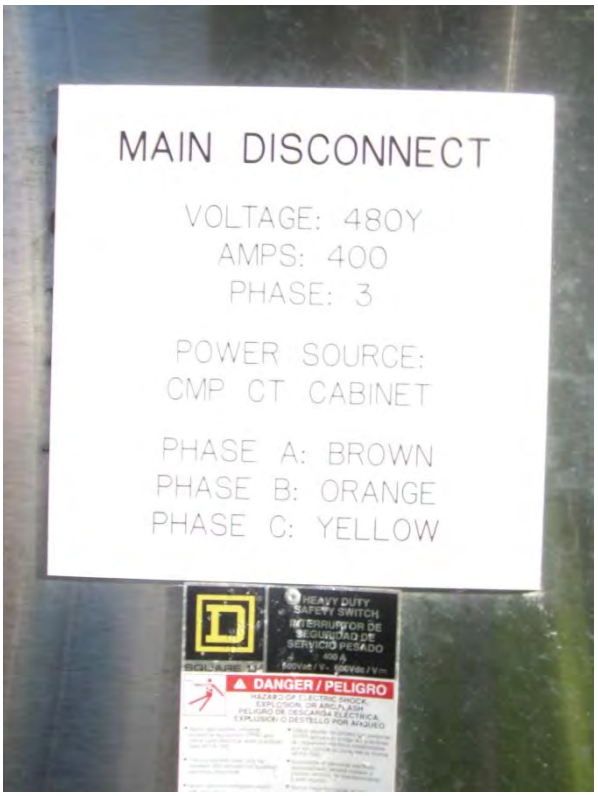
Machinery Brake Hand Fully Released Limit Switch

North Sheave Transducer

North TVSS

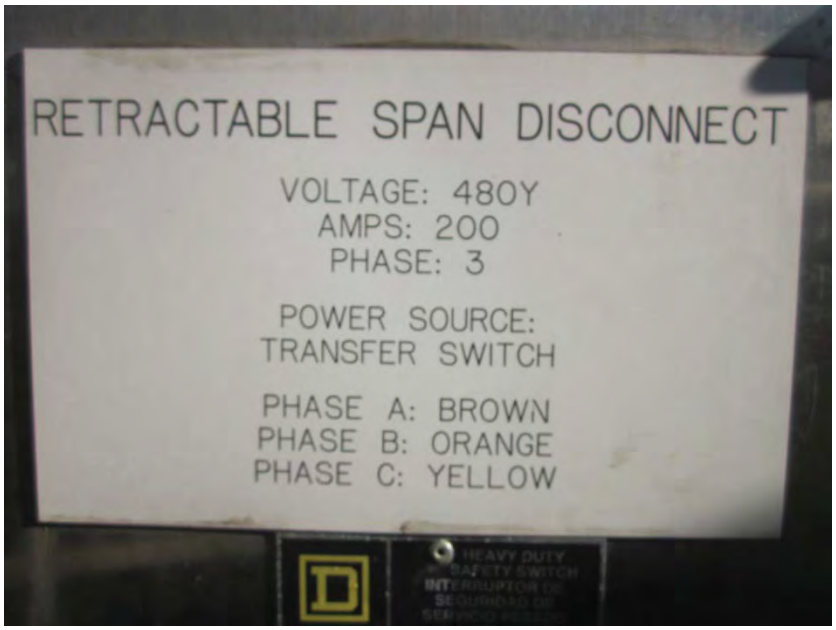


North Transfer Switch

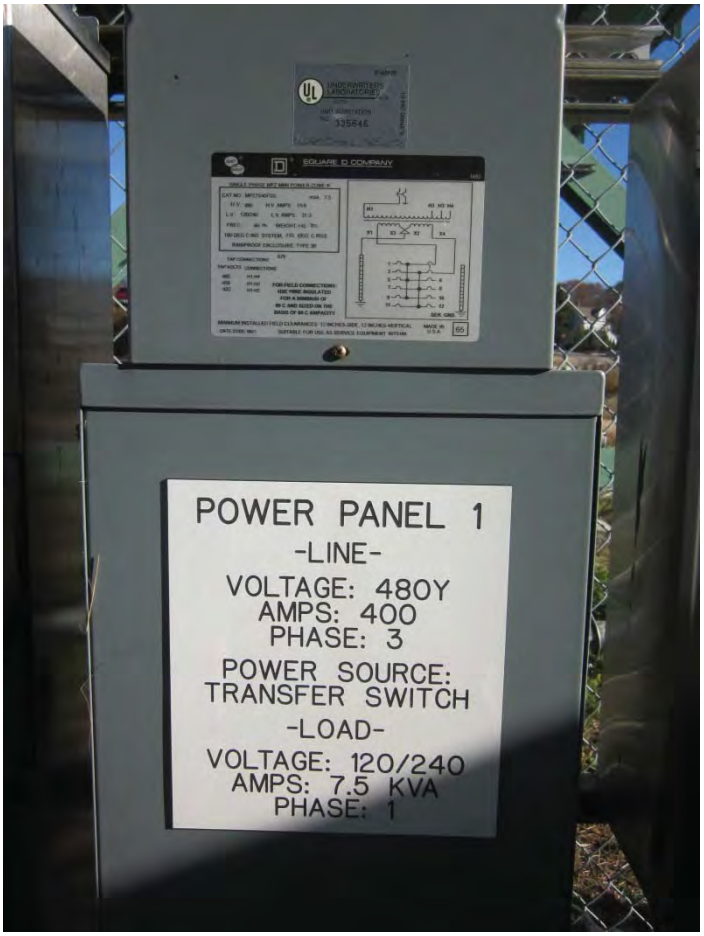


North Main Disconnect

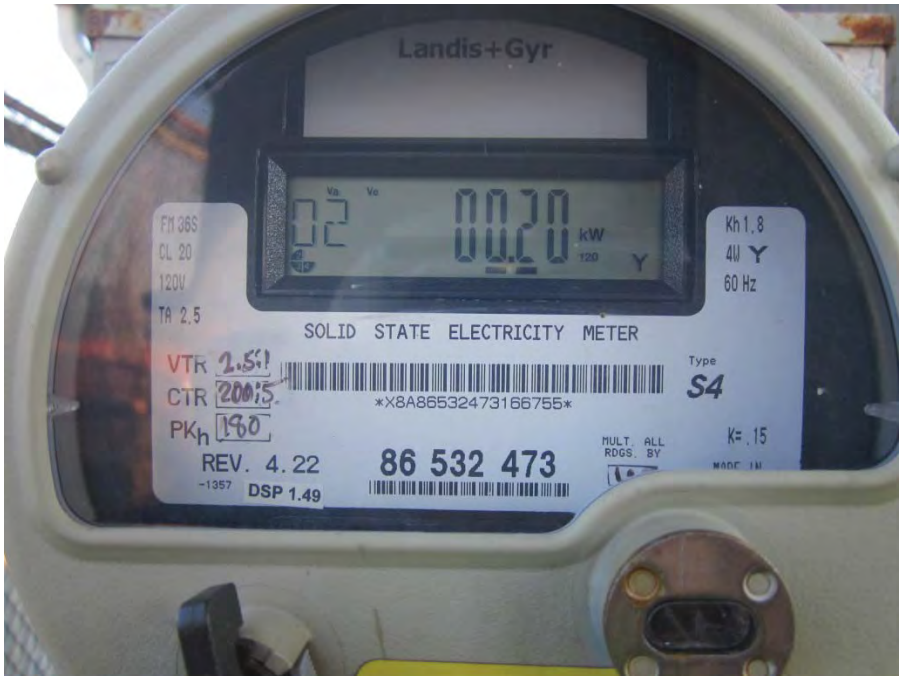
North MCC Disconnect



Retractable Span Disconnect



Power Panel 1



South Utility Meter

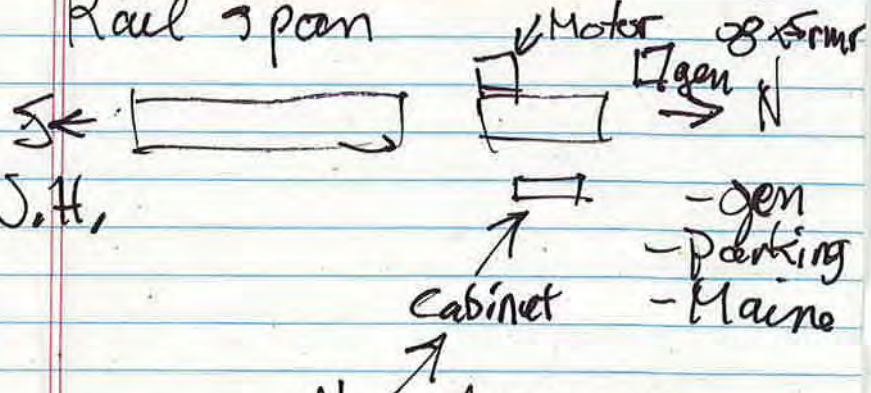
South Transfer Switch

Appendix D
Field Notes

SML 11-5-13

①

Rail span



Electric service transformers @ West side of north end @ parking area.

Generator also at parking area.

Conduits running from North parking area across approach span are PVC's in good condition.

SML
retractable span

11-5-13

(2)

2 Fork type limit switches at west side at north end of channel at retractable span.

Open cover on small box inside lube pump cabinet.

Stainless steel boxes and lube cab't in good condition.
- Rust staining on SS boxes may be rust staining from structure rather than rusting of the boxes themselves.

SS strut ~~supp~~ and rods supporting PVCABS appear in good condition.

MAW SML 11-5-13

(3)

P65 View looking north ~~towar~~ from retractable span area.

66 looking north from retract span area. - PVCARS good.

67 " closeup of conduit - looking north

68 Farther closeup - conduit looking north

69 General view looking ~~tow~~ south - retractable span retracted

70 looking south at screw jack machinery on west side

71 "

MAW SML 11.5.13

(7)

~~Ea~~ SOUTH SIDE OF RETRACTABLE SPAN

Megger Testing

M2 SW
M3 SE
M4 NE
M5 NW
} all ∞ ph to gnd

M1 Translator

Interior of retract Span has "translation" motor, box, & resistors - all good condition. minor rust.

North end of Main Span

Underside of North end of main span area - ladder access from West side.

SML

(5)

lunch - Buzzy's
603-436-1682

Gillies - closer to br.

72 overhead view @ north end of north approach to retract span area

73 N. end N. approach - retract span area.

74 View looking south at retract span (retracted).

75 Pier 1t. @ north end of north approach to retractable span area

76 N. end of N. approach near retract span area - west side near west screw jack motor

SML 11·5·13 (6)

77 Close up of box in pic 76

78 Area to left of box in pic 76

79 N. end of N. approach fork type limit switches for end of travel and near end of travel for retract span.

80 Closeup LS in pic 79

81 "

82 N. end of N. approach to retract span - looking down through track level to pier area.

SML 11.5.13. (7)

83 LS on pier in view from pic 82

84 View looking S - S.E.act retract ~~open~~ Span screw jack machinery

85 View looking S - S.W retract Span screw jack machinery

86 N. end of N approach to retract span - overhead box west side.

87 Closeup of view in pic 86

SHL

(8)

88 Pier Nav It - ~~west~~ east side ~~N~~ Sord of N approach.

Roadway level electrical room -
"East motor Drive Enclosure" is rusted through at front area under door near floor - Much rust of interior bottom of cabinet also.

"West mtr Drv Enc" was not as rusted.

---

89 Wider view of view in P 88

SML 11.5.B (9)

90 View to right of P 89

91 Base of nav lt Support.

SML 11.7.13

1

West center channel on main movable span not operating.

South counterweight alarm not operating.

All barrier gate arm lights are operational.

Photo Log

Photo No.	Description
1-17	Oil Pump Cabinet
18-23	NW Aux Span Motor
24	Recept. on left side of Oil Pump Cabinet
25	Cabinet long NW Aux. Span Motor
26-29	NW Upper Aux Span L.S Roller Arm
30-34	NE Upper Aux Span L.S Roller Arm
35	Center Aux Span Light
36-37	NE Aux Span Light
38-39	NW Aux Span Light
40, 42	NE Aux Span Light, Cabinet on right side of Oil pump Cabinet
43-49	NE Aux Span Motor
50-51	NE Aux Span Light
52-54	
55	Cabinet on NE Aux Span Motor
56-59	NE Lower Aux Span L.S Roller Arm
60-62	South Center Aux Span Lights
63-67	NW Lower Aux Span L.S Roller Arm
68	Cabinet behind Oil Pump Cabinet
69-73	Disconnects made of Oil Pump Cabinet
	70-71 DS Pump Monitor 72-73 DS Pump Motor

Photo Log

Photo No.	Description
74-75	Pull Box
76-77	D.S and Pump Monitor in Oil Pump Cabinet
78-82	Light Pole and Camera NE
83-88	Service Utility and Pole
89-91	Cabinet above EDG, North side
92-94	Light Pole on NW side
95	Conduits and J.Bs under North Approach
96-101	" "
102-104	Lightning Signals, NE side
105-106	Bridge, from North side
107-112	Aux Span MCC and Cabinets
113-114	Shot Upper Aux Span L.S.R A
115-121	Cabinet, Behind Skew Indicators and Aux Control Console, Left of Aux Span MCC
122-126	Upper Right Cabinet of Aux Span Control Console
127-134	Skew Indicator Cabinet and Controls for Aux Span
135	Side of " " " " " "
136-137 142-162	Aux Span MCC
138-141 163	Conduits above Aux Span MCC
164-166	Upper right cabinet on Aux Span MCC
167-178	Aux Span MCC Schematics

2

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NHDOT Bridge Inspection — HDR Inspection Team

Structure: Sarah Mildred Long

Milepost:

Location: Portsmouth, NH — Inspection Date: 11/6/2013

Photo Log

Photo No.	Description
178-180	Motor behind Aux Span, NW side
181	Cabinet behind Motor behind Aux Span, NW
182	N/A
183-186	Cabinet and Conduits on West side of Aux Span
187-189, 191-193	Cable and Cable Reel
190	Light on West Side of Aux Span
194-195	Center West Light on Aux Span
196-197	Facing South, Conduits
198	Inside Aux Span
199-203	Aux Span Translation Motor Cabinet
204	N/A
205, 226-228	Aux Span Translation Motor Nameplate
206-212	Aux " " Resistor
213-216	Inside Aux Span Translation Motor
217, 220-224	Aux Span Translation Motor D.S
218-219	" " " "
225	Video of inside Aux Span
229-232	Camera and Light, North Side
233-238	Video/Data Cabinet and North Submarine Cabinet
234-236	Cabinet left of North Submarine Cabinet

3

Photo Log

Photo No.	Description
239-243	Video/Data Cabinet next to North Submarine Cabinet
244	Underneath " " " " " " "
245-246	Above North Submarine Cabinet
247	Cabinet " " "
248-260	North Submarine Cabinet
261	Conduit in North West tower
262	North West Door under North Tower
223	Cabinets underneath North Submarine Cabinet
264	Conduits " " " "
265-266	Cabinet under North Tower, West Side, under North Electrical Room
267	Heat Sinks underneath North Electrical Room
268-270	North Span Lock Motor, Nameplate
272, 273	
271	N/A
274-279	Cabinet under North Submarine Cabinets,
280-283	North Electrical Room
284	NW & NE Drives
285-286	~~[illegible]~~ Cabinet on Right Side of ~~[illegible]~~ North Drives
287	Comm Box
288-290	North Drives

Photo Log

Photo No.	Description
291	North MCC PLC Cabinet
292-298	Transformer in N. Elec. Room
299-300	N. MCC
301-314	NW Motor Drive
315	N/A
316-325	NE Motor Drive
326-332	N. MCC PLC
331	No Mach Room Fan
333-335	Panel under XFMR in N. Elec Room
336-340	Phase Box under " " " "
341	Thermostat in N. Elec Room
342-345	SW L.S.R.A on Aux Span
346-350	S. Span Lock Motor, Nameplate
351-353	Cabinets under South Submarine Cabinets
354-357	South L.S under Lift Span, near South span Lock motor
358-360	Cabinet under South Submarine Cabinets
361-366	North L.S under Lift Span, near North Span Lock Motor
367	NW Nav Light, " " " "
368	NE " " " "
369-370	N/A

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NHDOT Bridge Inspection — HDR Inspection Team

Structure: Sarah Mildred Long

Milepost:

Location: Portsmouth, NH — Inspection Date: 11/6/2013

Photo Log

Photo No.	Description
371-372	North MCC West Drive Cabinet
373-375	" " East " "
376-377	" " West Motor Brake "
378-379	" " " Mach. " "
380-381	" " East Motor " "
382-383	" " " Mach " "
384-385	" " Span Lock Cabinet
386-387	" " Barrier Gate "
388-390	" " Spare Cabinet, Bottom Left of N. MCC
391-392	" " Tactor Gate
393-394	" " N. Tower PB, Mini Power Zone PZ, Unit Heater, Gate Heat
395	" " N. Tower PB
396	" " Mini Power Zone PZ
397	" " Unit Heater
398	" " Gate Heat
399-402	" " Main Breaker
403-404	South Electrical Room
405-406	S. Drives
407-418 420	SE Drive, Corrosion at bottom inside + outside
419	SE Drive Resistors

6

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NHDOT Bridge Inspection — HDR Inspection Team

Structure: Sarah Mildred Long

Milepost:

Location: Portsmouth, NH — Inspection Date: 11/6/2013

Photo Log

Photo No.	Description
421-433	SW Drive, Corr. at bottom
434	SW " Resistor above
435-436	Receptacle on South Wall of S. Elec Room
437-442	Main Control Console
443-446	CCTV'S
447-448	Operator's Phone
449	Span Control Circuit + Receptacle, North Wall of Control Room, left of control console
450-454	Inside Control Console
455-459	Inside Control House, Left PLC Cabinet, Some Corrosion on bottom
460-463	" " " , Right PLC Cabinet,
464	Above PLC Cabinets in Control House
465	Comm. Box
466-467	Lighting Panel LP, Control House
468-470	On Right side of LP, Junction Box, Wire nuts
471	N/A
472-475	Panelboard inside Bathroom, 2nd Floor of Control House
475	Corroded Conduit Hub underneath Panel in Bathroom
476	2nd Floor Telephone

11/6/2013

Box 1

NW Upper Aux. Span LS Roller Arm — Corroded
" Lower " " " " " — Corroded
NE Upper " " " " " " — Corrosion
" Lower " " " " " " — Corrosion

North Upper Aux Span Lights Green — OFF
" Lower " " " " — OFF
North Lower Aux " " Red — ON

Oil Pump Cabinet — Corrosion

Disconnects Inside Oil Pump Cabinet

—

Insulation Resistance of Aux Span Motors and Translation Motor

11/6/2013

		Tags		
SW	Lifting Motor	(M2)	> 550	MΩ
SE	" "	(M3)	> "	"
NE	" "	(M4)	> 550	MΩ
NW	" "	(M5)	> 550	MΩ

Translation Rail Motor > 550 MΩ

11/7/2013

North Mach. Room

NE Motor 460V, 112 FLA, 100 HP, Marathon No. 405THTS1763AN/W
Photo. No 1-

NW Motor 460V, 112FLA, 100 HP, " No 405THTS17034AN
Ph. No 8-12
- No local disconnect

North Tower Control Cabinet Photos 13-16 Exterior
17-21 Interior

- Debris on Floor
- Duct tape on Piano Wire Transducer
- Slight Corrosion Ph. No. 22

NE Motor Brake 460V, 0.4 FLA, Model. No, 108 204 202204A, Photo. 23-24
NW Motor Brake 460V, 0.4 FLA, " " " 61-62

NW Mach Brake 460V, 1.2 FLA, Mondal Engineering Limited, Model No. 29480
Photos 25-27

- Grease on all L.S

1 Hand Release L.S No, 28-29 LS-NWMB1
2 Fully Set " 30 " " 2
3 Fully Released " 31 " " 3 Contact on

North Machinery Room

11/7/2013

MEL

NE Mach. Brake Photos. 32-35, 46 ~~0~~V, 1.2 FLA, 28843

Hand Release LS - LS-NEMB1, Photo. 36-37

Fully Set 2.S - LS-NEMB2, " 38-39

Fully Retarded L.S - LS-NEMB3, " 40-41, Contact OK

- Grease on all ~~motors~~ L.Ss

NE Fully Up Elevator L.S, Photos. 42-43, Corrosion

~~44~~ 44, Above Junction Box, Corrosion

NTL Cabinet, Photo. 44-46, Corr. on Enclosure, Electric tape is used as wire ends

NTB Cabinet, Photo 47-49, Corr. on Enclosure

Fiber Optic Cabinet, Ph. 50-51, OK

NW Torque Monitoring System, Photos. 52-55

- Corr. on box, debris inside, Plastic wire nuts + duct tape, mounting of equip. is off.

NE Torque Monitoring System, Photos. 56-59

- Corr. on box, dirt inside,

Abandoned Elevator Hoist Motor - ~~60~~ Photo. 60

NW Transducer on Shaft of Shear Photo. 63-65, Manu. Hengster, No. 0566 266

~~Missing NE Transducer~~ ~~66-67 - N/A~~

N. Mach. Room, Layout Photos. 66-67, Facing West
68-69, " East

Dometz

Start 11:08 am NE Drive, Raised ~~to Lowered~~
start 11:10 am " " , Lowered } One file

Start 11:34 am NW Drive, Raised
Start 11:38 am " " , Lowered

Start 3:43 pm SE Drive, Raised
Start 3:47 pm " " , Lowered

Note: None of the Drives have output contacts

NW Center Nav Light off, All others on

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Page No: 1 of

Bridge Name: Sarah Mildred Long Time: Date: 11/7

Location: Portsmouth, NH Temp: ~~60~~ 60°F

Type of Measurement: Insulation Resistance Humidity: 50%

Inspector:

Motor	2009	Location	2013	Location
North West Drive Motor	163MΩ	MCC	~~240MΩ~~	~~MCC~~
South West Drive Motor	415MΩ	MCC	—	—
North East Drive Motor	80MΩ	MCC	—	—
South East Drive Motor	370MΩ	MCC	—	
North West Machinery Brake	>550MΩ	MCC	>550	North MCC
South West Machinery Brake	>550MΩ	MCC	>55	MCC
North East Machinery Brake	>550MΩ	MCC	>550	MCC
South East Machinery Brake	>550MΩ	MCC	>550	MCC
North West Motor Brake	>550MΩ	MCC	>550	MCC
South West Motor Brake	>550MΩ	MCC	>550	MCC 11/8
North East Motor Brake	>550MΩ	MCC	>550	MCC
South East Motor Brake	>550MΩ	MCC	>550	MCC 11/8
North (Warning) Traffic Gate	>550MΩ	MCC	240MΩ	MCC
South (Warning) Traffic Gate	>550MΩ	—	10MΩ	MCC

11/8 46°F 40% Hum

HDR Engineering, Inc.
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Newark, NJ 07102-5418
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Fax: (973) 474-5055
www.hdrinc.com

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Page No: 2 of

Motor	2009	Location	2013	Location
North Barrier Gate	>550MΩ		9 MΩ	MCC
South Barrier Gate	>550MΩ		>550MΩ	MCC
North Tower ATS	N/A	-	N/A	—
North Tower ATS	N/A	-	N/A	—
North Tower ATS	N/A	-	—	—
South Tower ATS	N/A	-	—	—
South Tower ATS	N/A	-	—	—
South Tower ATS	N/A	-	—	—
North Tower Disconnect	N/A	—		—
North Tower Disconnect	N/A	—		—
South Tower Disconnect	N/A	—		—
South Tower Disconnect	N/A	—		—
North Spar Lock			63 MΩ	MCC
South Spar Lock			340MΩ	MCC

2009 Meggar Readings: 500V (525 actual)

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Page No: of

Bridge Name: Sarah Mildred Long Time: Date: 11/7
Location: Portsmouth, NH Temp:
Type of Measurement: Motor Current Humidity:
Inspector:

Motor	2009				2013			
	North		South		North		South	
	Raise	Lower	Raise	Lower	Raise	Lower	Raise	Lower
West Drive	30-45A	*	0-50A	0-30A	—	—	—	—
East Drive	15-65A	*	5-50A	0-30A	—	—	—	—
West Machinery Brake	1.6A	-	1.58A	-	1.6A	—	1.9A	—
East Machinery Brake	0.61A	-	1.48A	-	1.6A	—	1.8A	—
West Motor Brake	1.6A	-	0.43A	-	0.6A*	—	0.6A	—
East Motor Brake	0.58A	-	0.47A	-	0.6A	—	0.6A	—
Warning (Traffic) Gate	0.57A	0.57A	0.6A	0.59A	0.6A	0.6A	0.6A	0.6A
Barrier Gate	1.3A	1.2A	1.2A	1.2A	1.2A ~~1.2A~~	1.2A	1.2A	1.1A
	North		South		North		South	
	Raise	Lower	Raise	Lower	Raise	Lower	Raise	Lower
Span Lock	1.18A	1.26A	1.1A	1.2A	1.2A	1.2A	1.3A	1.2A

*No Amps, 1 span heavy (stated from previous report)

* Single Phase.

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14th Floor
1037 Raymond Blvd
Newark, NJ 07102-5418

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Photo Log

All North Mach. Room

Photo No.	Description
1-7	NE Motor
8-12	NW Motor
~~13-20~~	
13-21,22	N. Tower PLC Cabinet
23-24	NE Motor Brake
25-27	NW Mach. Brake
28-29	NW Mach. Brake Hand Release L.S
30	" " " Fully Set L.S
31	" " " Fully Released L.S
32-35	NE Mach Brake
36-37	" " " Hand Release L.S
38-39	" " " Fully Set L.S
40-41	" " " Fully Released L.S
42-44	NE Fully Up Elevator L.S
44-46	NTL Cabinet
47-49	NTP Cabinet
50-51	Fiber Optic Cabinet
52-55	NW Torque Monitoring System
56-59	NE " " "
60	Abandoned Elevator Hoist Motor

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NHDOT Bridge Inspection

HDR Inspection Team

Structure:

Milepost:

Location:

Inspection Date: 11/7/2013

Photo Log

Photo No.	Description
61-62	NW Brake
63-65	NW Transducer on Shaft of Sheave
66-67	N. Mach Room Layout, Facing West
68-69	" " " " , Facing East
70-74	South MCC

HDR | ONE COMPANY Many Solutions™

NHDOT Bridge Inspection — HDR Inspection Team

Structure: Sarah Mildred Long

Milepost:

Location: Portsmouth, NH — Inspection Date: 11/8

Photo Log

Photo No.	Description
6	North Tower
7-11	SLW Torque Monitoring System
12-19	PLC Cabinet, South Mach. Room
20-23	Sheave Transducer, Screw Conveyor on W. side of S. Mach Room
24-26	S. Mach. Room Comm. Box F/O
27-28	S. Tower Nav Light on Top
29, 32-34	N. Gen. Area, ~~JUSS~~
30-31	" " " , ~~EDG~~, JUSS
33-34, 35-42, 65	" " " , ~~Transfer Sw~~ EDG
43-46, 49-50	" " " , ~~Main D.S~~, Trans. Sw
47-48, 51-54	" , ~~MCC D.S~~, Main D.S
55-57	, ~~Aux Spm D.S~~, MCC D.S
58-61	, ~~Power Panel 1~~, Aux. Spm. D.S
62	, Power Panel 2
63-64	" , Conduits underneath Trans Sw + D.S
66-67	South ~~Gen~~ Gen. Area, EDG, Outside
100-112	" " " " " , Inside
68-70	" " " , XFMR
71-73	" " " , ~~Safety S~~ Old ATS now J.B
76-77	" " " , ~~Contacts~~ Safety Sw.

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NHDOT Bridge Inspection
Structure: Sarah Mildred Long
Milepost:
Location: Portsmouth, NH
Inspection Date: 11/8

Photo Log

Photo No.	Description
78	S. Gen. Area, Conduits above Safety Sw
79	Safety Sw, J.B, + Panel
80	Panel
81-83	Meter
84-88	400A Trans. Sw
89-93	J.B on right of Trans. Sw
94-97	Main. Sw
98-99	Surge Protection Device
113-118	S. Traffic Drawbridge Signals
116-119	S. Lift Span Traffic Signals

- North Tower, Ph. 6

11/8/2013

- North West ~~South~~ Outward Gate — Photo. 92 - 101 (MW)
  - Corr. on enclosure, duct tape, debris inside
  - Lights + Gauges OK
- North Traffic Signals, OK on Approach before traffic gate

South Mach. Room — Elevator on East side, Ladder on West side

SE Torque Monitoring System — Photo (MW)
- Corrosion on Enclosure

SW Torque Monitoring System — Photo. 7-11 (MM)
- Corrosion on enclosure

PLC Cabinet on West side — Photo 12-19 (MM)
- Corrosion on enclosure, Debris, Duct tape
  Cable routing on tray above

Sheave Transducer, Skew Control on West side — Photo No 20-23 (MM)
- Mounting corroded, duct tape on box

Comm Box F/O on SW side of room - OK — Photo 24-26 (MM)

Nav Light on South Tower — Photo 27-28 (MM)

North EDG and Main DS + ATS Ph. 29 32, 34 ~~[illegible]~~ 11/8/2013 Pg 2

TVSS Ph. 30-31

EDG Ph 35-42, 33-34, Corr. on Mounting. Ph 65

Trans. Sw Ph 43-46, 49-50

Main DS Ph 47-48, 51-54

← Corr. ~~on~~ on conduit at bottom Ph. 48

MCC DS Ph 55-57

Aux Span DS Ph 58-61

Power Panel 1 Ph-62

Conduits entering from bottom Ph. 63-64

All M.M Photos

- South Traffic Drawbridge signals - OK Ph. 113-115
- south Lift Span Traffic signals - Ph. 116-119
  - Southeast signal on South Tower
    - Green light off
      on both right signal,

South EDG and Main D.S and ATS

- EDG Housing Ph 66-67, Inside Housing Ph. 100-112, Slight Corrosion
- ~~X~~ RMR Ph 68-70
  - Corr. on enclosure
- Old ATS, Now just Junction Box Ph 71-75
  - Corr. inside
- Safety Switch Ph 76-77
  - Corr. and inaccessible
- Conduits above Ph 78
  Safety Sw & Old ATS J.B
- Safety Sw, ~~Trans~~ O.B, and Panel Ph 79
  Ph 80
- Utility Meter Ph-81-83
  - Corr.
- ~~Emerg~~ Transfer Sw. Ph 84-88
  - Slight Corr.
- O.B on right of Trans Sw Ph. 89-93
- Main Sw Ph. 94-97
  - Inaccessible, couldn't open, Corr. on enclosure and conduits entering
- Surge Protection Device Ph. 98-99 Corr.

- South Tower, Facing North, NW Column
  Catenary system for Lift-Span Nav Lights Ph 122-124

- Under South Tower, Light, " Ph 125-128
  Slight Corr. on Conduit leaving

Appendix E
Cost Estimate

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
Subject:	Sarah Mildred Long Bridge	Checked:		Date:	
Task:	Recommended Electrical Repairs	Page:	1	of:	1
Job #:	112954	No:			

Electrical Repairs

Assumptions:

1) Unrestricted access with high rail truck
2) Owner to provide Track protection for work on railroad track and Maintenance protection of traffic (MPT) for work on roadway
3) Owner will provide vehicles and police protection during period that warnning gates are out of service and bridge must be opened

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
Subject:	Sarah Mildred Long Bridge	Checked:		Date:	
Task:	Recommended Electrical Repairs	Page:	1	of:	1
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Electrical Repairs

Task: Install Safety Disconnect Switches for Motors and Brakes In the Machinery Rooms and New brake limit switches

Materials

Item	Quantity	Unit	Cost per Unit	Item Cost
HSS 3"X3"X1/4"	32	L.F.	$95.00	$3,040.0
HSS 2"X2"X1/4"	32	L.F.	$58.00	$1,856.0
1/2"x9"x9" steel plate	4	EA	$125.00	$500.0
1/4"X48"X84" Steel Plate	2	EA	$3,100.00	$6,200.0
100 A Disconnect switch	4	EA	$770.00	$3,080.0
30 A Disconnect switch	8	EA	$350.00	$2,800.0
Rigid galvanized steel conduit, 2 1/2" diameter, incl couplings	40	L.F.	$12.0	$480.0
Lever arms limit switch	8	EA	$270.0	$2,160.0
Misc	1	EA	$1,200.0	$1,200.0
			Materials Subtotal	**$21,316**

Labor

Item	Hours	Cost per Hour	Item Cost
Wire new limit switches ,2 Electrician,2 days	32	$125	$4,000
Hoist the equipment and racks to the tower ,4 Electrician,2 days	64	$125	$8,000
Install disconnect switch racks, 4 electrician, 3 days	96	$125	$12,000
Install new conduits, disconnect existing wires and reconnect through the disconnect switches, 4 Electrician, 4 days	128	$125	$16,000
		Labor Subtotal	**$40,000**

Equipment

Item	Days	Cost per Day	Item Cost
None.			$0
		Equipment Subtotal	**$0**

Task Total **$61,316**

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Electrical Repairs

Task: Verify Drive Safety

Materials

Item	Quantity	Unit	Cost per Unit	Item Cost
None				$0.0
			Materials Subtotal	**$0**

Labor

Item	Hours	Cost per Hour	Item Cost
Standby Electricians during drive field investigation, 1 electrician, 1 days	8	$125	$1,000
Modify PLC Logic and/or Drive system, 1 Control System Technician - 2 days	16	$270	$4,320
Acceptance testing - 1 control system technician, 1 day	8	$270	$2,160
Acceptance testing - 2 electrician, 1 day	16	$125	$2,000
		Labor Subtotal	**$9,480**

Equipment

Item	Days	Cost per Day	Item Cost
None			$0.0
		Equipment Subtotal	**$0**

Task Total **$9,480**

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
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Electrical Repairs

Task: Modify Indication and Measuring Devices

Materials

Item	Quantity	Unit	Cost per Unit	Item Cost
Nema 4x, Proximity Switch (Span seated)	2	EA	$110.00	$220.0
New supports for proximity switches	2	EA	$1,075.00	$2,150.0
Misc Couplings and supports	4	EA	$2,675.00	$10,700.0
			Materials Subtotal	**$13,070**

Labor

Item	Hours	Cost per Hour	Item Cost
Remove existing plunger switches and install new proximity switches, 2MW,2 days	32	$125	$4,000
Wire the new proximity switches, 2 electricians,1 day	16	$125	$2,000
Modify PLC Logic, Control System Technician - 1 day	8	$275	$2,200
Testing and set up, 1 Control System Technician - 1 day	8	$275	$2,200
Testing and set up, 2 electricians - 1 day	16	$125	$2,000
		Labor Subtotal	**$12,400**

Equipment

Item	Days	Cost per Day	Item Cost
High rail truck	2	$535	$1,070
		Equipment Subtotal	**$1,070**

Task Total **$26,540**

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
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Electrical Repairs

Task: Traffic Gates Repairs

Materials

Item	Quantity	Unit	Cost per Unit	Item Cost
Misc paint & cleaning supplies	1	LS	$500.00	$500.0
			Materials Subtotal	**$500**

Labor

Item	Hours	Cost per Hour	Item Cost
Clean and paint gates enclosures (2 barrier gates), 2 Painters, 2 days	32	$125	$4,000
		Labor Subtotal	**$4,000**

Equipment

Item	Days	Cost per Day	Item Cost
None	0	$0	$0
		Equipment Subtotal	**$0**

Task Total **$4,500**

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
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Electrical Repairs

Task: Span Lock Work

Materials

Item	Quantity	Unit	Cost per Unit	Item Cost
Nema 4x, Proximity Switch	4.0	EA	$110.00	$440.0
Rigid galvanized steel conduit, 1" diameter, incl couplings only	300.0	L.F.	$2.90	$870.0
Conduit Supports	16.0	EA	$110.00	$1,760.0
flexible metal conduit (FMC)	30.0	L.F.	$2.60	$78.0
			Materials Subtotal	**$3,148**

Labor

Item	Hours	Cost per Hour	Item Cost
Install conduits and wiring, 5 electricians, 5 Days	200	$125	$25,000
		Labor Subtotal	**$25,000**

Equipment

Item	Days	Cost per Day	Item Cost
High rail truck	10	$535	$5,350
		Equipment Subtotal	**$5,350**

Task Total **$33,498**

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
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Electrical Repairs

Task: Navigation Lights Work

Materials

Item	Quantity	Unit	Cost per Unit	Item Cost
Rigid galvanized steel conduit, 1" diameter, incl couplings only	300.0	L.F.	$2.90	$870.0
Supports	24	EA	$110.00	$2,640.0
			Materials Subtotal	**$3,510**

Labor

Item	Hours	Cost per Hour	Item Cost
Install new conduits and wiring, 3 electricians, 5 Days	120	$125	$15,000
		Labor Subtotal	**$15,000**

Equipment

Item	Days	Cost per Day	Item Cost
High rail truck	1	$535	$535
		Equipment Subtotal	**$535**

Task Total **$19,045**

Project:	NHDOT Bridge Inspection	Updated:	TK	Date:	12/24/13
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Task:	Recommended Electrical Repairs	Page:	1	of:	1
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Electrical Repairs

Alternative Totals

	Material	Labor	Equipment		
Subtotal	$41,544	$105,880	$6,955		
With 15% Contingency	$47,776	$121,762	$7,998		
Total Electrical		$177,536		**Say**	**$177,600**

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