REHABILITATION STUDY REPORT

State Bridge Program

State Project No. 40-141
Bridge No. 01138 in East Haddam
Route 82 over Connecticut River

Prepared For:

State of Connecticut
Department of Transportation
Newington, Connecticut

Submitted: April 2017
Resubmitted: June 2017

860.290.4100
www.cmeengineering.com
333 East River Drive, Suite 400, East Hartford, CT 06108

Table of Contents

Approved Repair Code |

Recommended Primary Repair Code | **D, F, G, J, N, Q, U, X, KK, LL**

EXECUTIVE SUMMARY

Scope of Structural Rehabilitation Work

Based upon the inspection and evaluation of Bridge No. 01138, CME recommends Alternate B2 consisting of the following:

- Addition of a cantilevered, 6' wide ADA compliant sidewalk on the south side of the bridge and installation of a new counterweight.
- Strengthening of structural steel members to carry HL-93 Operating design loads and Legal truck loads and the additional load of the sidewalk.
- Rivet replacement with high-strength bolts at locations of missing rivets and at some gusset plate connections.
- Relocation of the electrical house and operator house staircase.
- Concrete patching in the deck grids in Spans 1 and 2 and deck replacement in-kind over the machinery pit in the swing spans.
- Placement of 1" thick polyester polymer concrete overlay on the deck in Spans 1 and 2 and the half-filled grid section over the machinery pit. Consideration should be given during design to making sure there is a smooth transition in the swing span from open grid deck to the half-filled grid deck section'
- Replacement of bridge rail with a bridge rail system that meets current standards.
- Replacement of Span 1 Floorbeam U9 disc bearings and cleaning and lubricating of other bearings.
- Spot painting of repair locations, bearing plates and other areas starting to show rust (approximately 10% of superstructure steel surface area).
- Replacement of the contraction splice joint in Span 2 with a preformed compression seal.
- Substructure patching (especially on Pier 3) and masonry repointing.

Scope of Mechanical Rehabilitation Work

The following rehabilitation work is proposed for the mechanical system if a sidewalk is added to the bridge (refer to Appendix A for an overview of the mechanical system deficiencies and the three alternates that were evaluated):

- Conduct a full mechanical system analysis to ensure all systems will be adequately sized for the additional sidewalk dead load.
- Replacement of all mechanical span drive machinery from the motors to the rack/balance wheel track segments (includes tachometer drive stub shafts and couplings, reducer lubrication system gearmotor, pump and coupling). All machinery needs to be sized to meet AASHTO requirements with the additional sidewalk dead load. The machinery layout will need to be reconfigured to improve auxiliary drive engagement to the main drive train.

- Redesign/replacement of the barrier gate hydraulic cylinders, cylinder connections to the gate, cylinder mounts and supports, live load shoes, and gate guides. Repair or reinforcement of the damaged floorbeam web adjacent to the west barrier gate.
- Adjustment of span balance and balance wheel shims.
- Adjustment of balance wheel liner shims.
- Analysis of the existing center pivot bearing capacity to support the additional sidewalk dead load. Repair of the center pivot bearing fill port leak.
- Replacement of the center wedge motors, motor couplings, reducer packing seals, and protect the submarine cable from contact with the center wedges during span swinging operations.
- Analysis of the end wedge machinery to determine required improvements for adequate driving capacity to operate with the extra span reactions and droop deflection resulting from the sidewalk dead load. Replacement of the end wedge motors, primary reducers, linkages, levers, cross shaft coupling seals and deteriorated housing bolts.
- Cleaning and painting of all machinery, associated supports, and fasteners.
- Installation of machinery covers to protect from deck leakages.
- Development of an Operation and Maintenance Manual and conduct training for maintenance personnel.

Scope of Electrical Rehabilitation Work

The following rehabilitation work is proposed for the electrical system if a sidewalk is added to the bridge (refer to Appendix B for an overview of the electrical system deficiencies and the three alternates that were evaluated):

- Replacement of all limit switches
- Replacement of the automatic Programmable Logic Controller (PLC) system including new control console with integrated maintenance screens
- Replacement of the manual relay control
- Replacement of all control conduit and conductors
- Removal of all abandoned equipment and conduit
- Replacement and relocation of approach traffic control devices on south side of roadway (warning gates, flashing warning lights, audible gong, and traffic signals) for new approach sidewalk
- Installation of new pedestrian gates for new sidewalk
- Replacement of camera system including additional cameras for viewing the new sidewalk
- Replacement of the Motor Control Center (MCC)
- Replacement of span drives and motors
- Replacement of submarine cables and supports
- Replacement of all power panels
- Replacement of all power conduit and conductors
- Replacement of all maintenance lighting and receptacles
- Replacement of all wedge motors, barrier gate HPU motors, and speed reducer lubrication pump motors

Reasons for the recommended rehabilitation work:

- The most recent load rating analysis found that numerous locations rate below 1.0 for the HL-93 design load. Strengthening the steel members to achieve a rating factor of 1.0 for HL-93 Operating and Legal Loads will eliminate the need to load post the bridge.
- The addition of a sidewalk along the south side of a bridge will provide one of few pedestrian crossings over the Connecticut River and will be very beneficial to the residents and businesses of East Haddam and Haddam.
- Repairing the recurring deterioration on the bridge such as the deck in Spans 1 and 2, the concrete portions of the piers, and paint system will increase the service life of the bridge.
- The disc bearings under Span 1 Floorbeam U9 are not properly centered and therefore not functioning as they should.
- The motor is currently undersized for the swing span load and parts of the mechanical system are unreliable. The addition of a sidewalk will require a new motor, modifications to the end wedges and other mechanical system upgrades in order to ensure that the swing span is operable.
- The electrical and control systems are antiquated, not functioning as designed and are unreliable.

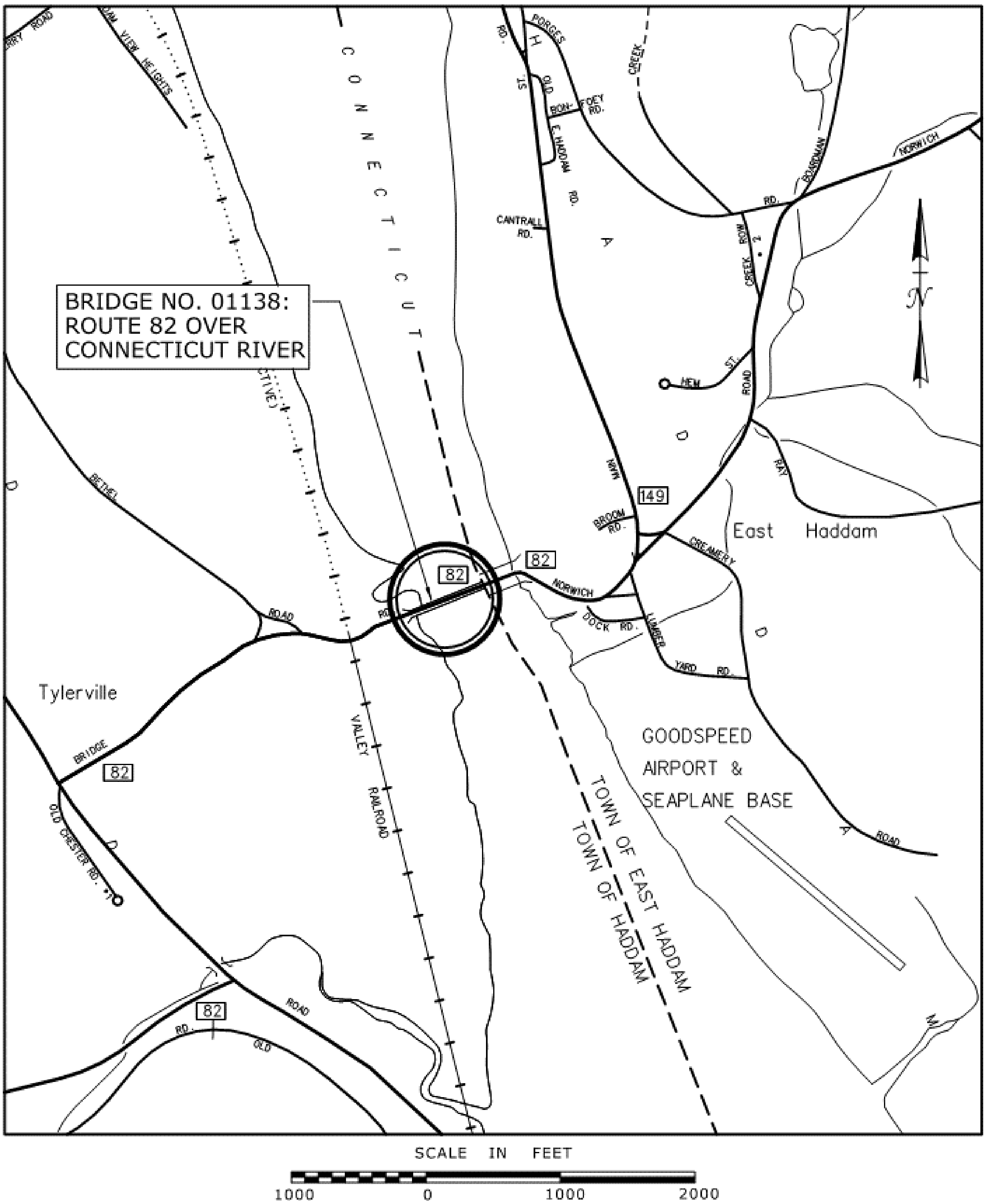
Maintenance and Protection of Traffic

Maintenance and protection of traffic on Route 82 shall be accomplished for most of the construction duration with an alternating one-way traffic operation that is limited to one span at a time. The alternating traffic flow will be maintained with temporary signalization. A pedestrian pathway will not be provided on the bridge during construction. A full closure of the bridge roadway for a half -day period for a minimum of three weeks will be needed to replace the span drive. A swing span operation outage for a minimum of four weeks will be necessary to install the new electrical system and part of the mechanical system.

Notable Facts

Estimated Total Construction Cost:	$49,600,000
Estimated Construction Duration:	Two Construction Seasons
ROW Involvement:	Construction Easement for Access to Span 1 and Span 2 Underside
Utilities Impacted:	Bridge Luminaires, Navigation Lights, and Associated Conduits
Permits Required:	OLISP Structures Dredging & Fill, WQC, Flood Management Certificate, ACOE PCN, Rare Species coordination, US Coast Guard
Design Exceptions:	Bridge Width
Qualifies for HBP Funds:	Yes
Sufficiency Rating:	25.2 (2013 inspection report), 34.0 (CME calculated, see App. F)
Load Rating after Repairs:	HL-93 Operating
Recorded 2015 ADT:	9,200 (from State of Connecticut DOT 2015 Traffic Log)

LOCATION MAP



INTRODUCTION

CME Associates, Inc. has been retained by the Connecticut Department of Transportation (ConnDOT) to perform the rehabilitation evaluation for this bridge as part of the State Bridge Program. Modjeski and Masters, as a sub-consultant to CME has performed the rehabilitation evaluation for the mechanical and electrical systems on the bridge. Site visits were conducted by CME and field inspections were conducted by Modjeski and Masters in November 2015 and in March 2017 respectively.

This report describes the findings of the comprehensive evaluation of this bridge and presents our recommendations for rehabilitation to ensure its structural and functional adequacy, as well as extend its service life.

DESCRIPTION

General

Bridge No. 01138 is a four span superstructure which consists of a fixed deck truss in Span 1, a fixed through truss in Span 2, and a moveable through truss swing span in Spans 3 and 4. The overall length of the bridge is 885' and carries one westbound and one eastbound lane of Route 82 over the Connecticut River between the Towns of Haddam and East Haddam. To remain consistent with the latest ConnDOT inspection report, the bridge is logged from west to east with trusses labeled from north to south.

The bridge was built in 1913 and was rehabilitated in 1988, 1999, and 2007. An emergency declaration (ED) project was initiated to repair the bridge's mechanical and electrical systems until the bridge rehabilitation project, State Project No. 40-141, is in construction. Repair work under the ED project was performed in 2016.

The structure span lengths from west to east are 99' (center-to-center of bearings between west abutment and Pier 1), 325'-11" (center-to-center of bearings between Piers 1 and 2), 230' (center-to-center between Piers 2 and 3), and 228' (between center of Pier 3 and face of east abutment backwall). The bridge has no skew. The distance between the centerlines of the deck truss is 15' and the distance between the centerlines of the through-trusses is 27'. The travelway width is 24'-6" and is confined by the 4' high bridge rail, the posts of which are bolted to the floorbeams in Span 1 and bolted to the bottom chord in Spans 2-4. The bridge rail is not a FHWA crash-tested rail system.

There is a compression joint seal within steel armored headers at the west abutment, a strip seal at Pier 1, an open end joint at Pier 2 and the east abutment to allow movement of the swing spans. There is also a pourable seal joint at mid-span of Span 2 over the contraction splice in the stringers. There are no approach slabs.

The decks in Spans 1 and 2 consist of a 5" steel grid that is filled to half-depth with concrete. In each span, the deck is topped with bituminous overlay and the bottom of the deck grid is covered by stay-in-place forms. The deck in each span is supported by five steel stringers which are rolled beams with the exception of the center stringer, which consists of back to back channels bolted together.

In Span 1, the stringers are supported by ten rolled floorbeams, spaced at 11' on center. The stringers are bolted to the top flange of the floorbeams. The stringers are continuous over the floorbeams with web splices every other floorbeam. Floorbeams in this report are labeled U0 to U9 from west to east to match the deck truss top chord panel points as labelled in the inspection report. The floorbeams are riveted to the top of the north and south deck truss top chords which are spaced at 15’, center to center. The top chord panel points are spaced at approximately 11’. Bottom chord nodes are present only at odd numbered top chord panel points and are spaced at approximately 22’. The deck truss system consists of: riveted built-up top and bottom chords, vertical, diagonal, and lateral bracing members; and lateral angle bracing.

In Span 2, the stringers are bolted to the top flanges of 31 riveted built-up floorbeams, which are spaced from 10’-6” to 11’-6”. Floorbeams in this report are labeled to match the inspection report and the as-built drawings. Since the truss and floor system are symmetrical about bottom chord node L9, the floorbeams are labeled from west to east, starting with L0 and ascending to L9 at midspan and descending from L8’ to L0’ after midspan. The prime symbol (’) after the floorbeam numbering indicates the location is east of the midspan. The letter A after some floorbeam numbering indicates that the floorbeam is located between panel points. In the panel between truss nodes L6 and L7, there are two floorbeams that do not align with the panel points. These are labeled Floorbeam L6A and Floorbeam L6B. Floorbeams are supported by the north and south through trusses which are spaced at 27’, center to center. Each through truss consists of: a riveted built-up bottom chord into which the floorbeams frame; riveted built-up top chord, vertical, diagonal, and strut members; and an upper bracing system consisting of angles. The approximate panel point spacings are symmetrical about L9 as follows: L0L1 and L1L2 are each 22’, L2L3 and L3L4 are each 13’-6”, L4L5 and L5L6 are each 16’, L6L7 and L7L8 are each 19’ and L8L9 is 22’.

There are fixed steel pin bearing assemblies supporting the trusses at the west abutment for Span 1 and at Pier 2 for Span 2. There are steel pin assemblies resting on top of elastomeric expansion bearing pads supporting the Span 1 deck trusses and Span 2 through trusses at Pier 1. Floorbeam U9 of Span 1 is supported by sliding bronze disc bearings under each end of the floorbeam which rests on Pier 1. This floorbeam supports the deck truss stringers but is not supported by the trusses. The swing span is supported at Pier 3 by a single plain spherical center pivot thrust bearing, which is comprised of a base casting, hardened steel disc with concave spherical surface, and bronze disc with convex spherical surface, top castings, oil box and dust cover. Eight balance wheels are distributed radially about the center bearing in four pairs, centered at each center wedge and drive pinion location, to provide stability. The east abutment and Pier 2 each have wedge seats which transfer the dead and live load to the substructure when the bridge is in the closed position.

The swing span is 456’ long between bearing centerlines of Pier 2 and the east abutment, inclusive of Spans 3 and 4. Floorbeams are supported by the north and south trusses spaced at 27’, center to center. Machinery is identified by compass direction and is referenced to the center pivot bearing. The bridge pivots approximately 90 degrees about Pier 3 to allow passage of marine traffic. Although the span is capable of rotation in both directions, current practice is to open only in the clockwise direction and close counterclockwise to its original position. The moveable through truss swing span has a 5” thick open steel grid deck. Over the piers and the east abutment the steel grid deck is half filled with concrete and the deck underside is covered by SIP forms to protect machinery below the roadway. Stringers sit on top of 22 riveted built-up floorbeams in each span, typically spaced at 11’-3”. The floorbeam spacing varies from the typical spacing throughout, with 6’ spacing at Pier 3 and 18’-4.5” near the ends of the swing span. Floorbeams are labeled in ascending order west to east from 1 to 22 in Span 3 and descending order west to east from 22 to 1 in Span 4. Floorbeams are supported by the north and south trusses. The trusses are similar to those in Span 2 except that the top chord transitions from a riveted built up member to eye bars from panel point U5 in Span 3 to U5 in Span 4.

The swing spans are controlled from the operator’s house located above the roadway on the moving swing span superstructure, and slightly west of Pier 3. Vehicular traffic control is also controlled from the operator’s house when the bridge needs to be opened. All bridge operations including warning lights, barrier gates, traffic light controls and bridge control are performed from consoles in the operator’s house with the help of a CCTV system to ensure a better line of sight of vehicles traveling onto or off of the bridge. The electrical room is located at roadway level on the south side of the swing span over Pier 3. The mechanical room is located below the roadway within Pier 3. The standalone generator/service equipment house is located on the northeast approach adjacent to the traffic signal. This generator provides back-up emergency power for the electric motors.

Two methods of span operation are provided; main drives and auxiliary drives. The main drives are powered by wound-rotor electric motors and the auxiliary drives consist of a compressed air motor powered by an air compressor. The air motor arrangement is present as a backup in the event that the primary system fails, mechanically or electrically.

Traffic control devices located on the approaches include; two three-aspect type traffic signals on each approach, two traffic warning gates on each approach, a hydraulically operated barrier gate which rises from a pit below the roadway on the west approach and near the eastern end of Span 2, and a "Swing Bridge Ahead" sign approximately 0.2 miles west of the west abutment.

The bridge was most recently rehabilitated in early 2015 as part of a maintenance project which included the removal of over-poured concrete from the deck over Pier 3 and the east abutment from previous installation, welding the deck grid seams to increase rigidity, repair of spalled sections within grid deck, application of a high molecular weight methacrylate crack sealer and polysulfide epoxy coat to act as a deck membrane and overlay.

The 2007 rehabilitation project included the blast cleaning and painting of the entire superstructure, installation of a new access ladder assembly and inspection platform, installation of new warning gates at each approach, replacement of navigation lights, and the lube pump.

The 1999 rehabilitation included patching of concrete in steel grid decking, installation of new steel plate headers at joints, installation of a woven glass fabric waterproofing membrane and new (approximately) 1" thick bituminous overlay in Spans 1 and 2; strengthening of isolated floorbeams and truss members, replacement of rivets with galvanized bolts and substructure repairs including underwater concrete. Additionally, the deck and stringers in the swing span were replaced with galvanized 5" open steel grid deck panels and galvanized steel stringers because the additional dead load of the concrete in-fill that was installed during the 1988 rehabilitation overloaded of the superstructure and swing span machinery. Over the piers and the east abutment, the installed steel grid deck was half filled with concrete and the deck underside covered by SIP forms to protect the machinery below the roadway.

The 1988 rehabilitation included: the replacement of the fascia and first interior stringers with W12x35 beams and replacement of the center stringer with two C12x25 channels except in the swing spans where the center stringer is replaced by a W12x35 or, within the end 21' (approximate), by two W12x35 offset 1'-4" from the centerline; installation of a new steel open bridge rail; replacement of the deck in all spans with 5" steel grid decking half-filled with concrete due to noise complaints from residents; replacement of the end floorbeams and diaphragms in Span 1; the relocation of the operator house to the west of the centerline of Pier 3; strengthening of the top chord members U5-U10 and diagonal member L6U8 on the swing span trusses with new U-bars installed between eyebars; strengthening of the bottom chord in Spans 2 through 4 with the addition of steel angles; bearing replacement including the installation of elastomeric bearings under the deck truss in Span 1 at Pier 1; repairs to the wedge drive supports; installation of the barrier resistance gates near each abutment; substructure repairs.

The machinery was rehabilitated in the 1980s, 1995, 1999, and 2007. The span drive was rehabilitated in the 1980s and all of the machinery was replaced except for the rack, which is still original. In 1995, the east end wedge and center latch machinery failed and resulted in an emergency rehabilitation. In 1999, the center bearing was replaced while the balance wheels and track were rehabilitated. Replacement of the motor control center, PLC, and control console, installation of new lube pump systems and machinery painting was included in the 2007 project.

The substructure consists of a reinforced concrete spill-through west abutment, a full height reinforced concrete east abutment and three reinforced concrete piers. The west abutment foundation consists of a reinforced concrete footing on timber piles. The east abutment foundation consists of a reinforced concrete spread footing founded on rock. There are reinforced concrete U-type wingwalls at the west abutment and flared wingwalls at the east abutment. The reinforced concrete piers consist of a reinforced concrete pier cap supported by a solid pier wall. Piers 2 and 3 have stone masonry facing surrounding the concrete piers around the waterline. All three piers are supported by timber piles; Pier 1 has a concrete pile cap and Piers 2 and 3 are on timber cribbing.

Highway Geometrics

The roadway across Bridge No. 01138, Route 82, has a functional classification of Two-Lane Rural Minor Arterial. It is not on the National Highway System (NHS) and is not part of the Strategic Highway Network (STRAHNET); however Route 82 is considered a Scenic Road in the vicinity of the bridge. Route 82 has a posted speed limit of 25 mph approximately 0.2 miles west of the bridge, on the bridge in Spans 2 and 4, and 0.1 miles east of the bridge. The design speed for a Two-Lane Rural Arterial in an open area ranges from 50-60 mph, according to the ConnDOT Highway Design Manual.

The bridge is located within limits of vertical tangent gradients. There is a 130' long horizontal curve with a radius of 572.96' on the west approach to the bridge which transitions to a horizontal tangent 40.3' before the west abutment bearings. The 932' long horizontal tangent includes the bridge and extends 6.7' east beyond the east abutment bearings which transitions to a 50' long horizontal curve with a 63.66' radius followed by another horizontal tangent.

The bridge deck in all four spans has a cross slope of 3/16" per foot. The curb-to-curb roadway width of this bridge is 24.5', which is consistent with the approach roadway width. Based on the Federal Highway Administration (FHWA) Coding Manual, the minimum curb-to-curb width to avoid functional obsolescence is 28' for bridges longer than 200'. Current ConnDOT Two-Lane Rural Arterial design criteria specify a minimum paved width of 32', comprised of two 12' lanes with 4' shoulders. Therefore the overall curb-to-curb width does not meet the FHWA Coding Manual criteria or the ConnDOT Two-Lane Rural Arterial design standards.

The minimum vertical clearance over the roadway is 15'-7" which is greater than the current ConnDOT design criteria of 14'-3" for existing bridges and the FHWA criteria of 14'-0".

Accordingly, considering that the NBIS appraisal rating of: structure evaluation is a "4", deck geometry is a "2", waterway adequacy is an "8", approach roadway alignment is a "3", the bridge is considered structurally deficient based on condition of superstructure and functionally obsolete based on deck geometry and approach roadway alignment.

Traffic

According to the ConnDOT 2015 Traffic Log, the 2015 Average Daily Traffic (ADT) on the bridge is approximately 9,200 vehicles per day with 4% truck traffic.

FIELD OBSERVATIONS

Considering the NBIS condition ratings for a deck rated "5", superstructure rated "4" and substructure rated "5", the bridge is considered structurally deficient based on the condition of the superstructure. The following information is based on the Routine and Special Bridge Inspection Report dated December 14, 2015 (by others) and additional observations made during the 2015 site visit conducted by CME Associates. For information about the condition of mechanical and electrical components of the bridge, refer to Appendices A and B.

Deck

The bituminous concrete overlay in Spans 1 and 2 is in satisfactory condition (6) with longitudinal and map cracks up to 1/4" wide. The epoxy chip seal that District 2 Maintenance installed on the swing span half-filled concrete sections in summer 2015 is in satisfactory condition with small areas where the overlay has worn away and the outline of the deck grid is visible.

According to the inspection report dated December 2015, the deck is in fair condition (5). SIP forms on the deck underside exhibit minor to moderate rust with some areas of section loss and rust holes up to 5' long by 6" wide. There is an open steel grid deck in Spans 3 and 4 for the movable swing span with sections that are half-filled with concrete near the piers and east abutment. The open steel grid deck exhibits minor surface rust.

The painted steel traffic rails are in fair condition (5) and exhibit areas of moderate rust, scrapes, bent brackets, and areas of minor impact damage. In Span 4 at the southeast corner, a steel plate attached to the bridge rail is deformed and torn with broken welds up to 1' long.

The expansion joints are in satisfactory condition (6) and exhibit minor to moderate debris build up, minor scrapes in steel headers, and evidence of leakage at the underside. The compression seal joint at the west abutment is depressed for the full length by ½" deep. No significant deterioration of the strip seal joint at Pier 1 was noted. The pourable seal joint at midspan of Span 2 exhibits up to 20' long by 1/4" wide adhesion cracks near the northern half of the bridge deck. The open end joints of the swing span at Pier 2 and the east abutment exhibit vertical misalignment up to 3/8" high in the closed wedged position.

Superstructure

The bearings are in fair condition (5). The deck truss fixed bearings at the west abutment exhibit severe painted over section loss up to 3/16" deep on the bearing plates. At the west abutment there are areas of recurring rust developing around the pins of the fixed bearings. There is a ¼" gap between the south pin head and bottom chord near the west abutment due to section loss on pin nuts and bearing plates.

The deck truss elastomeric expansion bearing pads at Pier 1 are tilted 1/4" in expansion mode at 45 degrees Fahrenheit. The north and south sliding bearing discs for Floorbeam U9 at Pier 1 are not centered. These bearings exhibit gaps up to 1/4" between the sole plate and disc, and the sole plate is in contact with the keeper angle. The steel bolster for the Floorbeam U9 south bearing, at Pier 1 in Span 1, is welded to the sole plate and both tilt toward the east likely due to the uncentered discs and pack rust between the bottom of the sole plate and the disc. The truss pins that connect the bottom chord, diagonal member and bearing assembly typically exhibit gaps up to 1/4" between the pin heads and bottom chords.

The expansion bearings of the Span 2 fixed through truss, exhibit minor areas of pitting losses with light to moderate rust, and minor splitting of horizontal seams in elastomeric pads. The elastomeric bearing pads at Pier 1 are expanded ½" at 45 degrees Fahrenheit.

The through truss swing span anchor bolt nuts for the main rack at Pier 3 exhibit up to 100% loss. All section loss areas have been previously painted over.

The shim plates that were added between the stringer bottom flanges and floorbeam top flanges during the 1988 rehabilitation project are missing, resulting in gaps up to 1/4" at numerous locations in Span 2. There are gaps up to 5/16" along the front edges of the top flange of the floorbeams and bottom flange of the stringers in Spans 3 and 4. The stringers exhibit 50% loss of bearing area; however no evidence of pumping under live load was found during the 2015 inspection.

According to the 2015 inspection report, the stringers are in satisfactory condition (6). The stringers in Spans 1 and 2 exhibit moderate to severe corrosion with painted over pitting and section losses up to 1/8” deep throughout, primarily along the top flanges.

Stringers S1, S2, and S5 in Spans 1 and 2 at Pier 1 have horizontal cracks up to 1-1/2” long in the web ends adjacent to the flanges and coped diaphragm channel that is welded to the stringer ends. Since the 2013 inspection, stop holes have been drilled and bolts inserted in the holes to prevent further propagation of the cracks. There is a 3/8” long crack in the weld at the top between Stringer S5 and the diaphragm on Floorbeam 10 in Span 3 and a 1/2" long crack at Stringer S1 and the diaphragm on Floorbeam 10 in Span 3. These two cracks have also been repaired since the 2013 inspection.

The floorbeams are in poor condition (4). Floorbeams in Span 1 exhibit painted over pitting up to 1/16” deep throughout with a few areas of severe section loss up to 1/4" deep on the webs and flanges. The bottom flanges of Floorbeams U1, U4 and U6 have up to 22.9% section loss near floorbeam midspan. Floorbeams in Span 2 exhibit painted over section loss up to 3/16” deep in the webs and flanges. The worst Span 2 floorbeam bottom flange loss noted is 12.8% section loss near midspan of Floorbeam L0’. The web exhibits section loss up to 30.5% at floorbeam ends over Piers 1 and 2 with up to 3” long by 2” wide perforations. Floorbeams in Spans 3 and 4 typically exhibit section losses up to 49% on the flanges at mid-length and 25% of the webs near connections to the trusses. Floorbeams flanges under stringer connections exhibit painted over full width section loss up to 45.5%. Vertical stiffeners typically exhibit painted over section losses and perforations up to 3” high by 3” wide. There are missing bolts in the connections throughout the structure. There are gaps up to 1” due to pack rust between the floorbeam bottom flange and the gusset plate at isolated locations in Spans 3 and 4. Some of the fiberglass covers for floorbeam top flanges are missing.

The trusses are in poor condition (4) with areas of section loss up to 5/16” deep in the bottom chord web and angles throughout. Bottom chord batten, lacing bars, tie plates and rivet heads throughout have section loss or rust holes. The fixed deck truss in Span 1 exhibits areas of knife edging, and rust holes up to 3” diameter in the top chord top cover plate. The maximum section loss was found in the South Truss bottom chord between panel points L3 and L5 near midspan with 7.2% section loss and 53% section loss between panel points L7 and L9. Strengthening retrofit bars were added to the L7-L9 member of both trusses. The fixed through truss in Span 2 exhibits pitting loss up to 1/4" deep in the top chord and bracing members. The bottom chords along both trusses typically exhibit painted over section loss up to 3%, with a maximum section loss of 4.1% on L7’-L8’ at the South Truss. Truss vertical members exhibit up to 26.5% section loss in the east half of the North Truss. There are perforations in the vertical gusset plates at the top chord and bracing connections.

The through trusses in Spans 3 and 4 exhibit areas of pack rust up to 1/4" thick between all bottom chord and connecting members with minor distortion of plates up to 1/2" wide. The maximum amount of section loss found on the vertical members is approximately 21.5% at U7’-L7’ in the South Truss of Span 4. There are areas of knife edging, perforations up to 3” long by 2” wide and loss of width to the bottom flange angles of the bottom chord in the machinery pit. The bottom chord of the North Truss between Floorbeams 20 and 21 in Span 3 and Floorbeams 21 and 22 in Span 4 exhibits painted over section loss up to 7.8%. The gusset plates at panel point L6, L8, and L9 on the South Truss adjacent to the bottom chord in Span 3 have section losses up to 2” high by 1/4" deep. Eyebars exhibit painted over section loss up to 1” wide by full perimeter by 5/16” deep at the ends, primarily adjacent to their connections at the top and bottom chords. Tension diagonal eyebars have maximum section losses up to 17.6% for one bar and up to 12.9% of the total cross sectional area including the retrofit eyebars. The truss pins exhibit painted over pitting, light rust and minor gaps. No significant deficiencies have been found on the pins during the ultrasonic testing for the last three inspection cycles.

The truss portals are in satisfactory condition (6). The bottom angle of the east end portal of the truss in Span 2 is bent 3/4" high by 10" long at centerline of the bridge. The east portal in Span 4 and several intermediate truss sway bracing members exhibit areas of minor collision damage.

The truss bracing is in fair condition (5) with areas of pitting loss up to 1/4" deep in bracing angles and rust holes in gusset plates up to 2" long by 3" wide. Several bracing members throughout are bent out of plane.

The paint system is in fair condition (5) with areas of minor to moderate corrosion with recurring rust developing through the repainted areas. Rust is rated (4) with spots of painted over, laminated rust and pack rust developing.

Rivets and bolts are in fair condition (5). The splice connection of Stringer S4 over Floorbeam 17 in Span 3 exhibits one missing bolt, and one of six bolts is loose in the connection and exhibits slight movement under heavy live load. There are deteriorated rivet heads and anchor bolts throughout with section loss up to 95%.

The welds in the vertical stiffener plate connection to the bottom tension chord angles between panel points L7 and L9 on both trusses in Span 1 are poor quality welds but do not exhibit cracking. Member L10-M9' on both trusses of Span 4 have three plug welds at lattice bar connection in place of the rivets on the diagonal member. All fracture critical details on truss members and floorbeams exhibit no evidence of cracking.

Substructure

The reinforced concrete abutments are in fair condition (5) with 1/16" wide hairline vertical and map cracks with efflorescence, light honey combing and spalls up to 5' by 3' by 3" deep. The backwalls are in satisfactory condition (6) exhibiting hairline cracks and areas of punky concrete. The east abutment backwall has spalls up to 1'-6" by 1' by 1-1/2" deep. The east abutment platform footing on the north side is exposed 1'-10" high due to erosion. Based on the visible portion at the east abutment, the abutment footings are considered to be in good condition (7). The reinforced concrete wingwalls are in satisfactory condition (7) with vertical, diagonal and map cracks up to 1/16" wide with efflorescence in the northeast and southeast wingwalls.

The reinforced concrete pier cap and pier column stems are in satisfactory condition (6) with cracking up to 1/16" wide on the cap and 1/4" wide on columns. Pier caps have areas of light scale and spalls up to 1' by 1' by 8" deep with exposed rebar on Piers 2 and 3. Pier column stems have moderate scale and delamination up to 8' wide by 3' high. The stone masonry on the Pier 3 column stem exhibits cracked, loose and missing mortar and up to 10' long by 11" deep penetrations at areas of missing mortar above the water surface in the splash zone. The Pier 3 column stem has epoxy filled vertical cracks, voids up to 3'-6" by 1'-6" by 3' deep, and 50% mortar loss at the noses. District 2 Maintenance observed that the concrete portion of Pier 3 has extensive cracking and needs significant substructure repair.

Erosion is rated to be in satisfactory condition (6). There is an eroded area under the west abutment backwall up to 42" deep at the north and south ends and the center of the abutment. At the east abutment, there is a 30' long by 6' wide by 2'-6" deep area of erosion approximately 6' from the abutment face.

Approaches

According to the 2015 inspection report, the approach guide rail is in satisfactory condition (6), exhibiting minor scrapes and random bent posts. During the March 2017 field visit, CME observed that the guide rail has been replaced since the 2015 inspection with R-B 350 metal beam rail that meets current standards. The guide rail ends have also been replaced to meet standards.

The approach pavement was found to be in satisfactory condition (6) with longitudinal cracks up to 1/2" wide. The approach pavement is settled 1” along the west abutment joint.

Drainage

There are rectangular free fall drains along the curblines of Spans 1 and 2 spaced halfway between floorbeams. These drains extend just below the lowest adjacent member (fascia stringers in Span 1 and truss bottom chords in Span 2). According to the 2015 inspection report, these drains are clear and functional. Spans 3 and 4 have open grid decking.

Utilities

The luminaires which are attached to truss vertical members, alternating between being on the North Truss and the South Truss, are in satisfactory condition (6). In Span 4 at the east portal mid-point and Span 3 west portal at mid-point, the abandoned light poles are missing one of four bolts at the base plate. There are also luminaires at the underside of the bridge along the inspection platform at the east abutment. A junction box and conduit are attached to the east abutment backwall at the south end.

There are conduits with outlets attached in Spans 3 and 4 that appear to be abandoned. In Span 3, the North Truss at the top of Panel Point U1, the conduit is separated from the bracket. In Span 3, the east portal near the North Truss exhibits an abandoned conduit with exposed wires.

There are traffic warning gates on both approaches between the traffic signals and the bridge ends. There are two utility poles near the guide rail end at the northeast corner of the bridge that carry electric wires and communication conduit. At the northeast corner of the bridge, there are also three manholes, a ground marker for high voltage utilities, and a black covered box near the USGS bench mark.

Eversource Energy owns an abandoned submarine cable south of the bridge at an unknown distance from the bridge. Frontier has a submarine cable that starts at a utility pole that is adjacent to Lumberyard Road and just south of Succor Brook and is buried underground approximately 400’ south of the bridge.

Property

The width of the Route 82 right-of-way at the site is approximately 140 feet based on the Haddam and East Haddam Town Assessor maps. Based on their proximity, private property owners may be adversely affected by traffic impacts and noise related to repair activities.

Cultural Resources

Goodspeed Opera House and the Gelston House restaurant are located at the southeast corner of Bridge No. 01138. The swing bridge generator house and the East Haddam Town Office Building are located at the northeast corner of the bridge. The town office building houses the offices of the first selectman and the resident state trooper. Further east on Route 82/Main Street, there are several restaurants and shops. Andrews Marina is located at the northwest corner of the bridge and Eagle Landing State Park and its large parking lot are located at the southwest corner of the bridge. Goodspeed Airport is located approximately 0.2 miles to the south of the bridge along the east shore. The Valley Railroad, which operates recreational passenger service, crosses Route 82 approximately 0.1 miles west of the bridge and the tracks run parallel to the Connecticut River.

Environmental Resources

The bridge is within a NDDB area; however it is not located in an aquifer protection area. The bridge crosses the main stem of the Connecticut River (4000) regional drainage basin. At the bridge, the banks of the river are armored with stone. No inland or coastal wetlands were present at the bridge beyond the watercourse limits. The limit of jurisdiction for wetlands in the immediate vicinity of the bridge is defined by the Coastal Jurisdiction Line (CJL) which is 3.0 feet NAVD88 in Haddam and East Haddam.

A platform for osprey nesting was installed in 2015 at the top of the south truss at Pier 3. The ospreys typically return to the bridge in March to build their nests.

HYDRAULICS

Based on the hydraulic data shown on the 1998 rehabilitation plans, the current opening is adequate with the low chord approximately 12' above the 100 year design flood elevation. The recommended rehabilitation work for this bridge will maintain the current opening, with temporary impacts to vertical clearance when work on the underside of the bridge is performed. According to the 2015 Underwater Inspection Report, the navigable vertical clearance is 25' over the Connecticut River with a maximum measured water depth of approximately 40' in Span 2. The maximum measured water depth in Span 3 was 38.8'.

SCOUR

The 2001 *Scour Reevaluation of Level II Bridges Report* assessed the scour potential at the bridge and confirmed the 1994 Scour Evaluation Report's recommended NBIS Item 113 rating of 3. The reevaluation determined that predicted scour will completely expose the piles of Piers 2 and 3 for all storm events studied and that there is a high probability of foundation failure. Though the reevaluation found the riprap around Piers 2 and 3 to be adequate, the riprap was not considered to be a permanent countermeasure in the scour analysis. The report notes that the bridge has endured at least one 500 year storm event in 1936 and four 100 year storm events without significant damage due to scour.

A meeting was held on July 6, 2016 with the Hydraulics and Drainage and Bridge Safety and Evaluation units to discuss scour concerns. Continued monitoring was recommended at the meeting instead of scour mitigation. CME has prepared a report summarizing the history of scour mitigation and channel changes and concluded that the average streambed elevations have remained relatively the same for the last 80 years. It is recommended that the Scour Critical Rating, Item 113, be increased to a "5", meaning that the bridge is "Scour Susceptible".

According to the most recent Underwater Inspection Report, dated December 18, 2015, overall channel scour and local scour at Pier 2 and 3 are rated "6" due to minimal changes in the channel profile since the 2011 and 2013 inspections. No footing or pile exposure was noted during the inspection, with a minimum of 15' of cover above the bottom of the footing. The report notes that there is standard rip rap around Pier 3 which is slightly less intact at the noses of the pier. The rip rap around Pier 2 is placed intermittently. The rip rap at both piers is in fair condition and is not adequate to protect against scour at the piers.

LOAD RATING

The existing bridge is not posted for live load restriction. An independent LRFR load rating was performed by Hardesty & Hanover in February 2017, and the following are the governing HL-93 rating factors for the as-inspected condition of the members:

- Inventory Rating 0.40
- Operating Rating 0.52

Floorbeam 40 in the swing span is the controlling member, controlling in Strength I flexure. Several truss members in Spans 1 and 2 also have HL-93 rating factors that are very similar. Numerous members will need to be strengthened to achieve HL-93 rating factors above 1.0; refer to Appendix D for a summary of the number strengthening repairs needed in each span to achieve rating factors greater than 1.0 for the following four alternates: HL-93 Inventory (Includes all legal vehicles and permit vehicles) without sidewalk, HL-93 Inventory with sidewalk, HL-93 Operating (Includes all legal vehicles) without sidewalk, and HL-93 Operating with sidewalk.

The independent load rating also includes the evaluation of the gusset plates in their as-built condition. Based on the as-built condition ratings, 26 gusset plates would need to be strengthened to achieve HL-93 Inventory rating factors above 1.0.

SEISMIC CONSIDERATIONS

The recommended alternative for this bridge involves repairing the superstructure steel, and patching the substructure concrete and bridge deck. Consultant Engineering General Memorandum 08-08 states that engineers shall defer to the latest AASHTO revisions that supersede the current ConnDOT Bridge Design Manual. Therefore, per AASHTO LRFD Section 4.7.4.1, bridges in Seismic Zone 1 shall not be analyzed for seismic loads, regardless of their operational classification and geometry, but the minimum requirements specified in Articles 3.10.9 and 4.7.4.4 shall apply. These requirements are generally limited to correcting deficiencies in support length and providing adequate restraint for seismic forces at the bearings in order prevent superstructure collapse.

REHABILITATION ALTERNATES

Based on field inspections, engineering analysis, and a review of ConnDOT's Bridge Inspection Reports, Bridge No. 01138 was found to be structurally deficient. The deficiency is primarily a result of deteriorated steel floorbeams and truss bottom chord members. The bridge was also found to be functionally obsolete due to the inadequate curb-to-curb width. CME has evaluated five possible rehabilitation options and one rehabilitation elective measure to ensure its structural adequacy, extend its service life and accommodate the request from the Towns of East Haddam and Haddam to add a sidewalk. The functional obsolescence cannot be corrected without a superstructure widening, and significant modifications to the mechanical and electrical systems and substructure or an entirely new structure. Due to the historic importance of this structure, neither option was considered as a feasible alternative.

The five alternatives considered for the structural rehabilitation of the bridge are: Alternate A (10-year extended service life) consisting of the milling and filling of the wearing surface, minimum structural steel repairs to achieve HL-93 Operating ratings and substructure repairs; Alternate B1 (25-year extended service life) consisting of the repairs included under Alternate A plus patching the concrete in the half-filled deck grids and adding a new polymer overlay (also acts as waterproofing membrane) in Spans 1 and 2, replacement of grid decking in-kind over the machinery pit in Spans 3 and 4, replacement of bridge rail, replacement of disc bearing under Floorbeam U9 at Pier 1; Alternate B2 (25-year extended service life) consisting of the repairs included in Alternate B1 plus the addition of a cantilevered sidewalk on the south side; Alternate B3 (25-year extended service life) consisting of the repairs included in Alternate B1 and additional structural steel strengthening repairs so that all members rate above 1.0 for HL-93 Inventory; Alternate B4 (25-year extended service life) consisting of the rehabilitation measures and sidewalk construction included in Alternate B2 and additional structural steel strengthening repairs so that all members rate above 1.0 for HL-93 Inventory.

The Towns of Haddam and East Haddam have requested that a pedestrian crossing be provided on the bridge. A sidewalk feasibility study was completed by Hardesty and Hanover in November 2016 and it was determined that, with additional steel strengthening repairs, overhaul of the mechanical system and modifications to the operator house staircase, a sidewalk can be added to the bridge. The installation of a cantilevered sidewalk on the south side of the bridge is included as part of Alternates B2 and B4. The sidewalk feasibility study recommends an FRP sidewalk structure which is supported by a new steel stringer-floorbeam system which frames into the existing structure. The estimated costs for sidewalk alternates do not include the cost to construct the approach sidewalks or relocate warning gates along the north side of the roadway and utilities in the approaches; the towns will be responsible for the design, construction and maintenance of the approach sidewalks.

The most recent painting project was completed in 2007 and the paint system on the entire superstructure was replaced. Based on the latest ConnDOT inspection report, the existing paint condition is considered fair “5” with areas of minor to moderate corrosion typically on the underside of the deck near the deck joints and on swing span floorbeams. Fully painting the steel superstructure will extend the service life of the bridge further; however the high cost is not justifiable at this time as the paint system on the superstructure above the deck is in good condition. Repairing and waterproofing the deck and spot painting steel repairs and other deteriorated areas will effectively protect the steel from further deterioration. The cost associated with containing and collecting debris, and fully painting the steel girders versus spot painting is shown in the table below.

Rehabilitation of Bridge No. 01138: Full vs. Spot Paint Comparison		
Action Code	**Item**	**Rounded Cost**
H	Full Field Painting	$11,118,000
Q	Field Touch Up Painting (HL-93 Inv repairs)	$1,850,000

An elective for the in-kind replacement of the half-filled steel grid decking for Spans 1 and 2 has also been evaluated. The stay-in-place forms on the undersides of the Span 1 and 2 decks exhibit areas of heavy rust and active leakage typically between the fascia stringers and trusses. There have been potholes in the deck topside and, though they have been patched, the waterproofing membrane may not be as effective if it did not bond well to the patched surface. If an alternative overlay is used on new grid decking, the service life of the deck in Spans 1 and 2 would likely be extended another 30 years. Included in this elective are materials and work associated with replacing the Span 1 stringers S1 and S2 and Span 2 stringers S1 and S5 that have cracks at Pier 1.

Rehabilitation of Bridge No. 01138: Elective Measure 1		
Action Code	**Item**	**Rounded Cost**
E	Deck Replacement (Spans 1 and 2)	$3,460,000

Includes 20% Minor Items, 25% Incidentals and 10% Contingencies

Cost Considerations

Appendix C contains an itemized cost estimate for all of the structural rehabilitation alternatives. The table below provides a summary of the total structure costs and total costs including rehabilitation of the electrical and mechanical systems. Refer to Appendices A and B for itemized cost estimates for the recommended electrical and mechanical work.

Rehabilitation Alternates	**Cost of Bridge Only**	**Additional Costs**	**Rounded Total Costs**
Alternate A – Min. Rehabilitation Measures with Strengthening to Achieve HL-93 OPER	$10,997,520	$20,983,100	$31,981,000
Alternate B1 – Min. Rehabilitation Measures with Strengthening to Achieve HL-93 OPER with Deck Patching and Overlay (No Sidewalk)	$12,225,020	$22,198,900	$34,500,000
Alternate B2 - Min. Rehabilitation Measures with Strengthening to Achieve HL-93 OPER with Deck Patching and Overlay and Sidewalk	$16,700,620	$32,829,300	$49,600,000
Alternate B3 - Min. Rehabilitation Measures with Strengthening to Achieve HL-93 INV with Deck Patching and Overlay (No Sidewalk)	$16,108,420	$26,018,500	$42,200,000
Alternate B4 - Min. Rehabilitation Measures with Strengthening to Achieve HL-93 INV with Deck Patching and Overlay and Sidewalk	$21,254,620	$37,308,400	$58,600,000

Additional Costs - Breakdown	**Alternate A**	**Alternate B1**	**Alternate B2**	**Alternate B3**	**Alternate B4**
Roadway	$0	$4,300	$4,300	$4,300	$4,300
Traffic	$100,000	$100,000	$100,000	$100,000	$100,000
Mechanical Work (Includes Bridge Balancing)	$1,215,000	$1,215,000	$3,870,000	$1,215,000	$3,870,000
Electrical Work	$3,810,000	$3,810,000	$4,295,000	$3,810,000	$4,295,000
Minor Items	$4,030,700	$4,338,600	$6,242,500	$5,309,500	$7,381,000
Clearing and Grubbing	$403,100	$433,900	$624,300	$531,000	$738,100
Maintenance and Protection of Traffic	$806,200	$867,800	$1,248,500	$1,061,900	$1,476,200
Mobilization	$1,511,500	$1,627,000	$2,341,000	$1,991,100	$2,767,900
Construction Staking	$201,600	$217,000	$312,200	$265,500	$369,100
Incidentals and Contingencies	$5,769,000	$6,209,700	$8,934,700	$7,599,300	$10,564,200
Escalation to Year of Construction 2020	$3,136,000	$3,375,600	$4,856,800	$4,130,900	$5,742,600

Alternate A – Minimum Rehabilitation Measures (Mill & Fill, Substructure Repairs) with Strengthening to Achieve HL-93 Operating and Legal Loads

This alternative consists of the following work: minimum structural steel repairs so that all members rate above 1.0 for HL-93 Operating and Legal Loads (gusset plates, floorbeams, truss bottom chord members and swing span distribution girder specifically), localized painting at repaired locations, cleaning and painting of fixed bearings and steel plates for elastomeric bearings; replacement of disc bearings under Floorbeam U9 at Pier 1, mill the top 0.5" of the overlay in Spans 1 and 2 and over the mechanical house in the swing spans, and place new ultra-thin 0.5" wearing surface, joint replacement at the contraction splice in Span 2, and Pier 3 substructure patching and masonry repointing. With routine maintenance of the expansion joints and wearing surface, these structural repairs are estimated to extend the service life of Bridge No. 01138 approximately 10 years at which time the deck will likely need a new waterproofing membrane.

This alternate includes the cost associated with the minimum recommended mechanical and electrical system repair alternates, which includes a major overhaul of the electrical system. Refer to Appendices A & B for a detailed list of the repairs.

The work below the roadway included in Alternate A will likely be performed from the ground in Span 1 and using barges to access the underside in Spans 2-4. One-way alternating traffic during off-peak hours will be required to perform work above the roadway which could be limited to one span at a time. In addition, temporary full closures of the bridge may be needed when jacking the trusses and end floorbeam for bearing replacement and doing some steel member strengthening repairs. Regional detour routes using advanced signing are proposed for truck traffic throughout construction and are a recommended alternate route for passenger vehicles in order to avoid traffic delays. A 4 week long swing span operation outage for marine traffic will be required for the electrical system replacement requiring coordination with the US Coast Guard.

Advantages

- Lowest cost in comparison with other alternates.
- The majority of the deck work can be done using temporary lane closures during off-peak hours at night, minimizing impacts to traffic.

Disadvantages:

- The existing waterproofing membrane that is over 15 years old will remain and water will continue to leak through the deck onto the SIP forms and the superstructure steel.
- The extended service life of this alternate is 15 years which is shorter than that of Alternates B1-B4.
- The bridge will still not provide a safe pedestrian crossing over the Connecticut River as requested by the towns of Haddam and East Haddam.
- This alternate does not correct the non-crash tested bridge railing so that it meets current standards.
- The service life of the bridge steel members may be shortened if unlimited vehicles use the bridge designed to an HL-93 Operating Level though the risk is somewhat mitigated since the percentage of truck traffic is not significant, there is more certainty on the weights of trucks utilizing the crossing and permit vehicles are not allowed on the bridge.

Alternate B1 – Minimum Rehabilitation Measures with Strengthening to Achieve HL-93 Operating and Legal Loads, Deck Patching and New Overlay, Bridge Rail Replacement (No Sidewalk)

This alternative consists of the minimum repairs described in Alternate A plus deck patching and placement of a new polymer concrete overlay in Spans 1 and 2, replacement of the deck in-kind over the machinery pit in Spans 3 and 4 and addition of new polymer concrete overlay, and bridge rail replacement. Similar to Alternate A, this alternate includes the cost associated with the minimum recommended mechanical and electrical system repair alternates, which includes a major overhaul of the electrical system. Refer to Appendices A and B for a detailed list of the repairs. With routine maintenance of the expansion joints and wearing surface, these structural repairs are estimated to extend the service life of Bridge No. 01138 approximately 25 years at which time the steel superstructure will likely need to be repainted and the grid decking in Spans 1 and 2 will likely need to be replaced.

The work included in Alternate B1 will likely be performed using barges for access to the underside of Spans 2-4 (underside of Span 1 can be accessed from the ground below) and one-way alternating traffic at all times that is regulated by temporary traffic signals. Temporary full closures of the bridge may be needed when jacking the trusses and end floorbeam for bearing replacement and doing some steel member strengthening repairs. Regional detour routes using advanced signing are proposed for truck traffic throughout construction and are a recommended alternate route for passenger vehicles in order to avoid traffic delays. Detouring with regional advanced construction signing will significantly reduce the added mileage and time for vehicles to get from major state routes to Haddam and East Haddam if the bridge is temporarily closed. Similar to Alternate A, a 4- week long swing span operation outage for marine traffic will likely be required for the electrical system replacement requiring coordination with the US Coast Guard.

Advantages:

- Lower cost in comparison with Alternates B2, B3 and B4.
- The service life is longer than that for Alternate A.
- The new bridge rail will meet current standards.

Disadvantages:

- The bridge will still not provide a safe pedestrian crossing over the Connecticut River as requested by the towns of Haddam and East Haddam.
- More significant traffic impacts are anticipated to complete the work compared to Alternate A.
- There is a higher probability of failure if unlimited vehicles use the bridge designed to a HL-93 Operating Level rather than a HL-93 Inventory Level though the risk is somewhat mitigated since the percentage of truck traffic is not significant, there is more certainty on the weights of trucks utilizing the crossing and permit vehicles are not allowed on the bridge.

Alternate B2 – Minimum Rehabilitation Measures with Strengthening to Achieve HL-93 Operating and Legal Loads, Deck Patching and New Overlay, Bridge Rail Replacement, Installation of Cantilevered Sidewalk on South Side

This alternative consists of the minimum repairs described in Alternate B1 plus a cantilevered sidewalk will be constructed along the south side of the bridge. Besides the labor and materials needed for the new sidewalk, this alternate also includes the cost of the counterweight needed to offset the weight of the new sidewalk, modifications to the operator house landing and staircase, and relocation of the electrical house to the north side of the bridge to accommodate a sidewalk on the south side. With routine maintenance of the expansion joints and wearing surface, these structural repairs are estimated to extend the service life of Bridge No. 01138 approximately 25 years at which time the steel superstructure will likely need to be repainted and the grid decking in Spans 1 and 2 will likely need to be replaced.

This alternate includes the cost associated with the replacement of the mechanical and electrical systems. The full replacement of the electrical control and power systems is recommended for all five alternates. However, full replacement of the mechanical system is recommended only for the alternates where a sidewalk is installed since a larger motor is required to move the swing span with the additional sidewalk dead load. Refer to Appendices A and B for a detailed list of the recommended mechanical and electrical repairs.

The work included in Alternate B2 will likely be performed using barges for access to the underside of Spans 2-4 (underside of Span 1 can be accessed from the ground below) and one-way alternating traffic at all times that is regulated by a temporary traffic signal. Temporary full closure of roadway for half-day periods for a minimum of three weeks will likely be required to replace the mechanical span drive machinery. Temporary full closures of the bridge may also be needed when jacking the trusses and end floorbeam for bearing replacement. Some steel member strengthening repairs should be combined with the full roadway closure for mechanical system replacement to minimize the impact to traffic. Regional detour routes using advanced signing are proposed for truck traffic throughout construction and are a recommended alternate route for passenger vehicles in order to avoid traffic delays. Detouring with regional advanced construction signing will significantly reduce the added mileage and time for vehicles to get from major state routes to Haddam and East Haddam if the bridge is temporarily closed. Similar to Alternate A and B1, a 4-week long swing span operation outage for marine traffic will be required for the electrical system replacement requiring coordination with the US Coast Guard. It may be possible to reduce the swing span outage duration by operating the bridge with the existing electrical system while the new electrical equipment and house are installed at the north side of the bridge.

Advantages:

- Lower cost in comparison with Alternate B4.
- The bridge will now provide a safe pedestrian crossing of the Connecticut River.
- The service life is longer than that for Alternate A.
- The new bridge rail will meet current standards
- The swing span outage duration may be reduced since the bridge can operate on the existing electrical system while the new electrical equipment and house are installed at the north side of the bridge.

Disadvantages:

- This alternate has the most significant impact because the bridge roadway needs to be closed for half-day periods for three weeks in order to replace the span drive. Also, an alternating one-way traffic operation will need to be maintained for the entire duration of the project.
- There is a higher probability of failure if unlimited vehicles use the bridge designed to a HL-93 Operating Level rather than a HL-93 Inventory Level though the risk is somewhat mitigated since the percentage of truck traffic is not significant, there is more certainty on the weights of trucks utilizing the crossing and permit vehicles are not allowed on the bridge.
- Maintenance of sidewalk by state forces including need for snow removal prior to opening during winter periods

Alternate B3 – Minimum Rehabilitation Measures with Strengthening to Achieve HL-93 Inventory and Legal Loads, Deck Patching and New Overlay, Bridge Rail Replacement (Without Sidewalk)

This alternative consists of: minimum structural steel repairs so that all members rate above 1.0 for HL-93 Inventory and Legal Loads (gusset plates, floorbeams, truss bottom chord members and swing span distribution girder specifically), localized painting at repaired locations, cleaning and painting of fixed bearings and steel plates for elastomeric bearings, replacement of disc bearings under Floorbeam U9 at Pier 1, patching of the deck and placement of new polymer concrete overlay in Spans 1 and 2, replacement of the deck in-kind over the machinery pit in the swing spans, joint replacement at the contraction splice in Span 2, and Pier 3 substructure patching and masonry repointing. Similar to Alternate A, this alternate includes the cost associated with the minimum recommended mechanical and electrical system repair alternates, which includes a major overhaul of the electrical system. Refer to Appendices A and B for a detailed list of the repairs. With routine maintenance of the expansion joints and wearing surface, these structural repairs are estimated to extend the service life of Bridge No. 01138 approximately 25 years at which time the steel superstructure will likely need to be repainted and the grid decking in Spans 1 and 2 will likely need to be replaced.

The work included in Alternate B3 will likely be performed using barges for access to the underside of Spans 2-4 (underside of Span 1 can be accessed from the ground below) and one-way alternating traffic at all times that is regulated by a temporary traffic signal. Temporary full closures of the bridge may be needed when jacking the trusses and end floorbeam for bearing replacement and doing some steel member strengthening repairs. Regional detour routes using advanced signing are proposed for truck traffic throughout construction and are a recommended alternate route for passenger vehicles in order to avoid traffic delays. Detouring with regional advanced construction signing will significantly reduce the added mileage and time for vehicles to get from major state routes to Haddam and East Haddam if the bridge is temporarily closed. Similar to Alternate A and B1, a 4-week long swing span operation outage for marine traffic will be required for the electrical system replacement requiring coordination with the US Coast Guard.

Advantages:

- Lower cost in comparison with Alternates B2 and B4.
- The service life is longer than that for Alternate A.
- The new bridge rail will meet current standards.
- With the strengthening repairs, the probability of structural failure will be reduced and the bridge will have the capacity to safely carry the design load and legal loads.

Disadvantages:

- The bridge will still not provide a safe pedestrian crossing of the Connecticut River as requested by the towns of Haddam and East Haddam.
- More significant traffic impacts are anticipated to complete the work compared to Alternates A and B1.

Alternate B4 – Minimum Rehabilitation Measures with Strengthening to Achieve HL-93 Inventory and Legal Loads, Deck Patching and New Overlay, Bridge Rail Replacement, Installation of Cantilevered Sidewalk on South Side

This alternative consists of the repairs described in Alternate B3 plus a cantilevered sidewalk will be constructed along the south side of the bridge. Besides the labor and materials needed for the new sidewalk, this alternate also includes the cost of the counterweight needed to offset the weight of the new sidewalk, modifications to the operator house landing and staircase and relocation of the electrical house to the north side of the bridge. With routine maintenance of the expansion joints and wearing surface, these structural repairs are estimated to extend the service life of Bridge No. 01138 approximately 25 years at which time the steel superstructure will likely need to be repainted and the grid decking in Spans 1 and 2 will likely need to be replaced.

This alternate includes the cost associated with the replacement of the mechanical and electrical systems. The full replacement of the electrical control and power systems is recommended for all five alternates. However, full replacement of the mechanical system is recommended only for the alternates where a sidewalk is installed since a larger motor is required to move the swing span with the additional sidewalk dead load. Refer to Appendices A & B for a detailed list of the recommended mechanical and electrical repairs.

The work included in Alternate B4 will likely be performed using barges for access to the underside of Spans 2-4 (underside of Span 1 can be accessed from the ground below)and one-way alternating traffic at all times that is regulated by a temporary traffic signal. A full closure of the bridge will be needed for half day periods for a minimum of three weeks while the span drive is replaced. Some steel member strengthening repairs could be done during the three week closure for the replacement of span drive machinery to minimize the duration of the impact. Temporary full roadway closures will likely be needed while jacking the trusses and end floorbeam for bearing replacement. Regional detour routes using advanced signing are proposed for truck traffic throughout construction and are a recommended alternate route for passenger vehicles in order to avoid traffic delays. Detouring with regional advanced construction signing will significantly reduce the added mileage and time for vehicles to get from major state routes to Haddam and East Haddam if the bridge is temporarily closed. Similar to other alternates, a 4- week long swing span operation outage for marine traffic will be required for the electrical system replacement requiring coordination with the US Coast Guard. It may be possible to reduce the swing span outage duration by operating the bridge with the existing electrical system while the new electrical equipment and house are installed at the north side of the bridge.

Advantages:

- The bridge will now provide a safe pedestrian crossing of the Connecticut River.
- The service life is longer than that for Alternate A.
- The new bridge rail will meet current standards.
- With the strengthening repairs, the bridge will have the capacity to carry the design load and legal loads.
- The swing span outage duration may be reduced since the bridge can operate on the existing electrical system while the new electrical equipment and house are installed at the north side of the bridge.

Disadvantages:

- This cost associated with the work included in this alternate is almost twice the cost of Alternate A which includes the minimum repairs needed to correct the structural deficiency.

- This alternate has the most significant impact because the bridge roadway needs to be closed for half-day periods for three weeks in order to replace the span drive.
- Maintenance of sidewalk by state forces including need for snow removal prior to opening during winter periods

RECOMMENDATIONS FOR REHABILITATION

Based on engineering analysis of this structure and deliberation of the above alternatives while also considering the request of the regional government and towns of East Haddam and Haddam, CME recommends Alternate B2, which includes structural repairs to deteriorated elements and strengthening members to achieve HL-93 Operating and Legal Loads and the addition of a new cantilevered sidewalk on the south side of the bridge.

Replacement of the deck in Spans 1 and 2 is not recommended at this time. The stay-in-place forms between stringers S2 and S4 are typically in satisfactory condition while the stay-in-place forms between stringers S1 and S2 and S4 and S5 exhibit moderate corrosion and forms between the fascia stringers and truss chords typically exhibit heavy corrosion and active leakage. The stringers in Spans 1 and 2 are still in satisfactory condition and a new overlay which acts as a waterproofing membrane will help prevent active leakage onto the stringers. The grid decking is approximately 30 years old and likely has another 20-30 years of service life remaining. Therefore it is recommended that the Span 1 and 2 deck replacement be done with the full painting of the steel superstructure in a future rehabilitation project.

RISK ASSESSMENT

The addition of a sidewalk on the bridge is beneficial to the towns of East Haddam and Haddam and promotes pedestrian and bicycle travel through the region. While it is possible to engineer almost anything, there are numerous risks and concerns associated with major modifications of a 100+ year old moveable bridge to accommodate the addition of a cantilevered sidewalk on the structure. The additional load may increase fatigue of the truss and floorbeam elements and reduce their remaining fatigue life. The additional load of the sidewalk and counterweight may overload the center pivot bearing and/or the cross girders (if strengthening repairs cannot be added to the already repaired cross girder) under the swing span and their replacement if deemed necessary will add significant dollars to the construction cost and require additional outage time of the swing span. Based on preliminary analysis, end wedges can likely be modified to accommodate the increased deflection of the swing span due to the sidewalk load; however there is a possibility that Pier 2 and east abutment seats may need modification. It is assumed that the piles and piers can support the additional loads; however an analysis is needed to confirm this assumption. Constructability is also a concern, including the complicated process of retrofitting the existing floorbeam system and trusses to accommodate the new sidewalk. Finally, there are concerns associated with the maintenance of the sidewalk on the bridge including snow removal and protection of the cantilevered floorbeam sections from de-icing chemicals. Removal of snow from the sidewalk prior to opening the swing span will likely be necessary to mitigate any risks associated with opening an unbalanced span.

UTILITY / DRAINAGE / ENVIRONMENTAL / PROPERTY IMPACTS

All utilities will need to be protected during deck patching, painting, bearing replacement and other construction activities. The nature of the proposed repair work and the necessary equipment will not require moving the light standards, overhead wires, or utility poles in the approaches; however, depending on the approach sidewalk layout proposed by the Towns, traffic signals may need to be replaced and utility poles may need to be relocated. The submarine cables will be replaced and electrical house will be relocated. Impacts to luminaires, navigation lights and swing span movement are anticipated.

The bridge is within a mapped NDDB area and affected species of plants or animals will be determined during the Environmental Review Phase (initial documents sent December 2015). Coordination around osprey nest building will likely be necessary. Coordination with NOAA and US Coast guard will also be necessary, OLISH Dredging permit??

A construction easement on the marina property at the northwest corner of the bridge will likely be acquired for access to the undersides of Span 1 and the west end of Span 2.

SUBSTANDARD FEATURES & POTENTIAL DESIGN EXCEPTIONS

The rehabilitation of Bridge No. 01138 is assumed to be a Spot Improvement (Non-Freeway) project. Based on a preliminary review of the Controlling Design Criteria defined in Section 6-6.02 of the ConnDOT *Highway Design Manual* for a Spot Improvement project on a Rural Two-Lane Arterial, **a design exception will be needed for bridge width**. According to the manual, the required width is the approach traveled way width plus 4'. The required 28' travel way cannot be achieved without replacing the structure. The existing bridge meets the other controlling criteria for a Spot Improvement project (vertical clearance and underpass width).

Per the ConnDOT *Highway Design Manual* Subarticle 3-2.02-1, the numerical criteria for these projects are determined by the level of improvement that will most likely be used to upgrade the highway in the future. Considering the site conditions and development patterns, the most likely level of future improvement along the corridor has been deemed to be 3R Non-Freeway. Based on a preliminary review of the Controlling Design Criteria defined in Section 6-6.02 of the ConnDOT Highway Design Manual for a 3R project on a Rural Two-Lane Arterial, the following substandard features have been identified: **design speed, shoulder width, shoulder typical cross slope and roadside clear zones.**

The project was not initiated to improve highway geometrics and it will not create substandard secondary impacts. Therefore, modifications to improve the above mentioned substandard features are not included in the recommended rehabilitation scope.

CONSTRUCTION SEQUENCE & MAINTENANCE AND PROTECTION OF TRAFFIC

Maintenance and protection of traffic on Route 82 shall be accomplished for most of the construction duration using an alternating one-way traffic pattern that is limited to one span at a time. Temporary traffic signalization is proposed for maintaining one way alternating traffic. A full closure of the roadway for half-day periods will be needed for a minimum of three weeks to replace the span drive. The proposed detour route uses all state roads: Route 82, Route 9, I-95 and Route 156. The total detour length is approximately 29.6 miles. There is another detour route, approximately 33.8 miles long, that directs traffic north of the bridge, using Route 9, Route 66, Route 151, Route 149 and Route 82. The Towns of East Haddam and Haddam requested that both lanes be open to traffic during the day so it is recommended that work be done at night as much as possible.

The bridge is one of three bridges that span the lower Connecticut River valley. Due to the relatively high ADT, proposed use of alternating one way traffic and limited alternative Connecticut River crossings in the vicinity, a series of regional warning signs and advisories is recommended to direct traffic to cross the river at different points, which will hopefully reduce traffic within the project limits. Proposed detour routes can be found in Appendix F.

A Transportation Management Plan is necessary for this project. This plan will consist of a Temporary Traffic Control Plan, a Transportation Operations Plan, and a Public Outreach Plan. Advance signing of the work zone location will help to divert traffic around the work zone and reduce the potential back-up of traffic when the one-way alternating pattern is in place.

APPENDICES

Appendix A – Mechanical System Rehabilitation Study
Appendix B – Electrical System Rehabilitation Study
Appendix C – Cost Comparisons
Appendix D – Photographs
Appendix E – Existing Bridge Plans and Proposed Sidewalk Details
Appendix F – Proposed Regional Detours
Appendix G – ConnDOT Inspection and Maintenance Reports

Appendix A: Mechanical System Rehabilitation Study

EXECUTIVE SUMMARY

Scope of Mechanical Rehabilitation Work

After the initial scoping approach of machinery reliability and condition evaluation has been considered, recommendations for the mechanical rehabilitation scope considered the decision to install a cantilevered sidewalk at Bridge No. 01138. If a sidewalk is installed, Alternative C is recommended as most of the scope items will be required to ensure proper operation of all mechanical systems is possible with the increased deadload. This work consists of the following:

- Conduct a full mechanical system analysis to ensure all systems will be adequately sized for the additional sidewalk deadload.
- Replace all mechanical span drive machinery. Size all machinery to meet AASHTO requirements with the additional sidewalk deadload. Reconfigure the machinery layout to improve auxiliary drive engagement to the main drive train. Replace tachometer drive stub shafts and couplings. Install brake covers. Replace reducer lubrication system gearmotor, pump and coupling.
- Redesign/replace the barrier gate hydraulic cylinders, cylinder connections to the gate, cylinder mounts and supports, live load shoes, and gate guides. Repair or reinforce the damaged floorbeam web adjacent to the west barrier gate.
- Adjust span balance and balance wheel shims.
- Adjust balance wheel liner shims.
- Analyze the existing center pivot bearing capacity to support the additional sidewalk deadload. Repair the center pivot bearing fill port leak.
- Replace center wedge motors, motor couplings, reducer packing seals, and protect the submarine cable from contact with the center wedges during span swinging operations.
- Analyze the end wedge machinery to determine required improvements for adequate driving capacity to operate with the extra span reactions and droop deflection resulting from the sidewalk deadload. Replace the end wedge motors, primary reducers, linkages, levers, cross shaft coupling seals and deteriorated housing bolts.
- Clean and paint all machinery, associated supports, and fasteners.
- Install machinery covers to protect from deck leakages.
- Develop an Operation and Maintenance Manual and conduct training for maintenance personnel.
- Modify the approach pier machinery and supporting structure as required to avoid interference during swing span operations due to the additional span droop deflection from the sidewalk deadload.

Reasons for the recommended rehabilitation work:

- After the 1985 rehabilitation, several of the mechanical systems proved to be inadequate with the additional partially filled grid deck deadload. Estimated weights for the proposed sidewalk, counterbalance weight, and structural reinforcing members are comparable to the partially filled grid deck deadload. Therefore, significant mechanical system upgrades will be required to ensure proper operation.
- The existing conditions of several machinery components warrant replacement to provide extended service life.

- Conditions at the barrier gates include accelerated deterioration of the cylinders, causing a maintenance burden.

If a sidewalk is not installed at the bridge, the rehabilitation scope proposed in Alternate B would be recommended to provide the most cost effective extension of bridge service life based upon the mechanical system inspection and evaluation.

DESCRIPTION

General

The Bridge No. 01138 through truss swing span is 456' long between bearing centerlines of Pier 2 and the east abutment, inclusive of Spans 3 and 4. Machinery is identified by compass direction and is referenced to the center pivot bearing, located on Pier 3. The bridge opens approximately 90 degrees to allow passage of marine traffic. Although the span is capable of rotation in both directions, current practice is to open only in the clockwise direction and close to its original position. The moveable through truss swing span consists of a 5" open steel grid deck. Over the piers and the east abutment the steel grid deck is concrete filled to half-depth with SIP forms on the underside.

Two methods of span operation are provided; main drives and auxiliary drives. The main drives are supplied with wound-rotor motors and the auxiliary drives consist of electric gearmotors.

The movable swing span is rotated by two mechanically independent span drives, with electrically controlled load sharing, located 180 degrees opposite each other on the east and west sides of the center pivot bearing. Each drive consists of 60 HP, 883 RPM electric motor, coupled to a right angle enclosed gear reducer and then to a rack-engaging pinion. The bridge is rotated when motor rotation and torque are transferred through the right angle reducers and pinions. The pinion torque reacts with the rack causing the span to rotate about the center bearing. Both the rack, which is comprised of 16 segments creating a complete circle, and the center bearing are anchored to the top of the pivot pier, Pier 3. Motor brakes act on brake wheels mounted to the rear shaft extensions of the motors. Machinery brakes act on brake wheel couplings mounted between the front ends of the motor and the input shafts of the right angle reducers. The span drive machinery is located on the swing span above Pier 3, below the roadway and truss members. The space available for the machinery is limited, resulting in difficult access for maintenance and inspection. All of the machinery is protected from direct exposure to the weather by an enclosure than surrounds the center of the bridge below the roadway.

During rotation, the approximately 4,000,000 lb swing span is supported by the single plain spherical center pivot thrust bearing, which is comprised of a base casting, hardened steel disc with concave spherical surface, and bronze disc with convex spherical surface, top casting, oil box and dust cover. The steel and bronze are secured to the base and top castings, respectively, with keys. The base casting is secured to the top of Pier 3 and the top casting to a pair of main cross girders supporting the truss. During operation, the convex surface of the bronze disc nests in and rotates on the concave surface of the steel stationary disc. Eight balance wheels are distributed radially about the center bearing in four pairs, centered at each center wedge and drive pinion location, to provide stability. The balance wheels are not intended to support either dead or live loads in the bridge closed position. The circular track for the balance wheels is integral with the rack gear segments.

In the closed position, for stability under live loads there are four end wedge assemblies, one at each corner of the movable span. Each end wedge assembly consists of a wedge base, which is secured to the movable structure and a powered wedge, which is driven or retracted from between the base and guide to facilitate the operation of the movable span. All of the wedges are made of cast steel. The tops of the base and driven wedges are fitted with bronze wear strips. Each end wedge assembly includes two wedges powered by a single 7-1/2 HP, 900 RPM, squirrel cage AC induction motor with integral electromagnetic brakes.

In the engaged position, the four end wedges are driven between the bases and guides to level the road surfaces of the swing span with the road surfaces of the approaches, and transfer the live and dead loads to Pier 2 and the east abutment. When withdrawn, the wedges retract from their bases so that the span can rotate. Each end wedge is located directly beneath the lower chord of the movable span truss. The same machinery that operates the end wedges actuates the centering latches. A lever mounted on one of the output shafts of the speed reducer is connected to the centering latch machinery with a rod assembly. The centering latches are mechanically raised above the functional detent of the receiver pockets, and lowered into position by gravity.

An electric gearmotor is present at each main motor as a backup. Installation of a chain is required to engage the gearmotors with the main drive train. The bridge can be operated by one gearmotor at a time or both simultaneously.

Traffic control devices located on the approaches include; two three-aspect type traffic signals on each approach, a single flashing red light prior to the traffic signals, two traffic warning gates on each approach, a single hydraulically operated barrier gate on each approach and one single “Swing Bridge Ahead” sign approximately 0.2 miles west of the west abutment.

The most recent 2016 machinery rehabilitation included new auxiliary drive gearmotors, new brake pads, new grids, seals and gaskets for the machinery brake wheel couplings, restoring functionality of the each machinery brake, and operational improvements to the warning and barrier gates.

Major machinery rehabilitations occurred in the 1980s, 1995, 1998, and 2007. The span drive was rehabilitated in the 1980s and all of the machinery was replaced except for the rack, which is original. In 1995, the east end wedge and center latch machinery failed and resulted in an emergency rehabilitation. In 1998, the center bearing, balance wheels, and track were rehabilitated. The 2007 rehabilitation included new warning gates, rehabilitating traffic barriers and access platforms, and replacing the span drive reducer lubrication pump. The motor control center, PLC, and control console were also replaced in 2007. Machinery painting was included in the 2007 work.

In 1985, the open grid deck was partially filled with concrete to address local complaints regarding noise from vehicles travelling over the steel deck. SIP forms and a bituminous overlay were also installed. However, the extra weight immediately caused operational issues and the deck was returned to open grating circa 1998.

MECHANICAL FIELD OBSERVATIONS

The following information is based on the Mechanical Inspection Report dated January 2016 (by others) along with additional findings from the 2015 scoping inspection and 2016 emergency design conducted by Modjeski and Masters, Inc.

Span Drive

Engineering analysis performed for this scoping report has revealed that the current span drive system may have been undersized for the swing span operation. Each drive system is powered by a 60 Hp, 883 RPM wound rotor motor that is directly coupled to a right angle reducer with a 112.37:1 ratio. The reducer output shaft is coupled to the main pinion shaft which engages the rack mounted on the center pivot pier. Theoretically, if the motor was to operate at or near the normal full load speed of 883 RPM, the pinion shaft would turn at a speed near 8 RPM and the swing span would turn at a speed of 0.37 RPM. This is significantly faster than typical swing span speeds and very unrealistic considering the size of the East Haddam swing span. The 60 Hp motor is significantly undersized to overcome the inertia of the span and turn at such speeds. A drawing from the 1985 rehabilitation confirms this to be the original intent of the drive system with a note saying the pinion was to turn at 8 RPM. To fix this issue, it appears that the motor speed was decreased to a more realistic speed, thereby decreasing inertial forces. Strain gage testing of the span drive machinery was performed during the 2015 scoping inspection. Results from this test reveal that the span is operating at about one quarter of the original intended speed. The motors turn at or near 225 RPM instead of the nameplate 883 RPM. While this modification has allowed the span to operate, the current drive system does not appear to meet operating requirements of the American Association of State Highway and Transportation Officials (AASHTO). In addition, operating at a slower speed causes the motor drives to operate inefficiently requiring much more electrical current. This can overheat electrical components.

The bridge has three current modes of normal operation consisting of power supplied from the east motor only (east pinion), west motor only (west pinion), or both motors together in a load sharing configuration. Strain gage testing data was collected for all three modes of operation. Testing was conducted on a calm day with no notable wind loads. Analysis of the test data revealed that both motors operating simultaneously require 20 seconds to accelerate the span up to constant velocity (225 RPM motor speed). Similarly, operating with only one motor required a time of 60 to 70 seconds to accelerate to constant velocity (225 RPM motor speed).

The main drive motors are generally in fair condition. There is an accumulation of light debris from the deteriorating underside of the filled deck overhead and there is accelerated corrosion on the motors and their ancillary components. At the west motor, the tachometer/over speed limit switch is misaligned and has a severely corroded shaft. Bolts in the cover of the west tachometer have backed out and rub against the coupling during operation.

The motor brakes are in fair condition and the thrusters on both brakes have been replaced since the 2009 inspection. The oil level in the west brake was good but the fill cap for the east could not be removed so the oil level could not be checked. The non-contacting surfaces of the east and west motor brake wheels exhibit moderate corrosion with no paint on the web and stub shafts. The east motor braking surface exhibits moderate scoring and the west has minor grooving. The released limit switch piston wheel is missing from the west motor brake. Brake covers are not installed. Minor corrosion is present on the brake linkages and pivot pins.

The machinery brakes are in poor condition. The east and west manual brake release will not securely lock in the released position. On both machinery brakes, the linings are slightly misaligned with the brake wheel. The east shoe on the west brake remained in contact with the brake wheel when manually released. The machinery brakes appear to date back to the 1980s rehabilitation. Brake covers are not installed. The brake linkages, bolts and other components have minor to moderate corrosion.

The pinion shaft couplings are in fair condition and both exhibit minor to moderate grease leakage at the lower hub seal. The gasket material is being displaced at the housing split. The pinion shaft couplings and bolts were never painted and display minor corrosion. The lubrication purge ports are oriented 180 degrees from the grease fittings and do not appear to be in use. The brake wheel couplings are in fair condition. The reducer input shaft keys are loose and can be moved axially in the keyway by hand. Both brake wheel couplings are leaking lubrication that is accumulating on the brake wheel contact surfaces.

The pinion shafts are in good condition but were never painted and exhibit minor surface corrosion. The pinion shaft bearings are in good condition. All pinion bearing housings exhibit minor to moderate surface corrosion.

All bearing mounted bolts lack double nuts or lock washers and are all unpainted. Minor seal leaks exist at the lower shaft seals of all bearings.

No inspection hatches are available to examine the internal components of the enclosed gear reducers; however, they appear to be in acceptable condition. Minor oil leakages are present at the vertical output shaft seals of both reducers. Several intermediate shaft cover plates and the top cover plates have evidence of minor oil seepage. Isolated paint failure and minor corrosion is typical on the reducer housings. The input shaft keys are loose and can be slid in the keyway by hand. The open gearing of the rotary cam limits on both units requiring lubrication or paint protection. The reducer lubrication systems are in fair condition but the pump bases are severely corroded. The gearmotor and coupling exhibit up to moderate corrosion. The west reducer lubrication pump has a moderate oil leak.

The main pinion gears are in satisfactory condition and both exhibit minor wear. The east and west pinion gears are axially misaligned by 5/8" and 1/4" downward, respectively, relative to the top of the rack teeth. There is only ¼" vertical clearance between the top of the rack teeth and the bottom of the east pinion bearing support during swinging operations. The west pinion support has approximately 3/8" clearance. The pinions typically exhibit minor pitting and scuffing in the addendum and moderate plastic flow with minor fins in the dedendum into the root on the opening and closing face. Chordal tooth thickness measurements were taken near the top and bottom of the main pinion tooth faces and little to no wear has occurred since 2001.

The concrete deck above the span drive machinery was recently resealed to eliminate rainwater leakage onto the machinery. No active dripping onto the machinery was witnessed during the inspection.

Auxiliary Span Drive

New auxiliary drive gearmotors were installed at each main motor in 2016 to replace the existing pneumatic drives. The auxiliary drive chains are being stored in storage containers near the machinery.

Rack/Balance Wheel Track

Choral tooth measurements were taken at rack tooth faces which exhibit moderate wear. Moderate plastic flow is typical on most of the rack teeth with some areas of more significant plastic flow. In the past, maintenance personnel have ground down the rack teeth top lands to remove excessive tip flow. Minor tip flow is again present on a few teeth.

The track is generally in satisfactory condition but the anchoring bolts and nuts are in poor condition. There are six drainage holes within each segment and all are open. Of the 128 anchors that secure the circular rack and track, about 30% exhibit more than 80% section loss and a total of 70% exhibit more than 30% section loss. The rack and track segments exhibit moderate to severe corrosion with minor to moderate section loss. The track surface has minor corrosion with a thin layer of metal flakes due to balance wheel contact.

Bridge Balance and Balance Wheels

The balance wheels exhibit improper clearances with the track. Essentially all of the balance wheels are in contact with the track during operation with the wedges retracted and the four north and west balance wheels remain in contact with the track after the wedges are driven. Only minor clearances of less than 1/32" can be measured at the east wheels with the wedges driven. The south wheels exhibit a minimum of 1/16" clearance with the wedges driven. The 1998 rehabilitation drawings call for a 1/16" clearance between the balance wheels and the track with the wedges driven and do not give a clearance requirement during operation when the wedges are retracted. Instead, a 1/32" clearance between the balance wheels and track during operation would be recommended. The north span connection balance wheel housing shims are approximately ½" thicker than the south. The west wheel shims are approximately 1/16" thicker than their corresponding east wheels.

Additionally, unequal driving forces are apparent between the north and south center wedges during operation. While no vertical movement occurs at the north center wedges, 1/8" of vertical span droop can be measured at the south center wedges between the driven and retracted positions. Springs are installed in the center wedges which compress as the wedges drive. The gap between a nut on the spring rod adjustment sleeve and the wedge can be observed to contract as the spring is compressed. At the north center wedges, a ¼" gap remains at this location with the wedges fully driven. The gap completely closes as the south wedges drive and the wedge can be observed to continue approximately ½" further into the wedge seats after the gap closes. In the driven position, the north wedges drive an average of 4-5/8" beyond the upper wedge guide compared to the south wedges only driving 3-1/4" past the same component, resulting in a 1-3/8" difference in stroke.

Determination of the span balance condition is difficult since all balance wheels contact the track during operation. Therefore, it is unknown whether the issues stated above are a result of improper span balance, improper balance wheel shim adjustment, or both.

The balance wheel assemblies are in acceptable condition. Several balance wheel axle bearing clearance measurements exceed the original RC6 fit but remain within the recommended RC9 fit for in service bearings. The east and west balance wheels exhibit minor crevice corrosion between the top of the housings and the shims at the span connection. The outboard bearing at Wheel 7 lacks proper lubrication.

Center Pivot Bearing

The center bearing assembly is in good condition with isolated paint failure. A minor oil leak exists at the fill port elbow.

Center Wedges

The center wedges are in good condition and exhibit light debris with minor surface corrosion. The oil levels in both reducers appear adequate and the desiccant in the breathers on each reducer requires replacement. The brake motors are in fair condition with paint failure on the motor housings and mounting bolts and moderate surface corrosion on the rear mounted disc brakes. The couplings between the brake motors and reducers are inaccessible due to protective guards. The couplings have a light coating of oil and no lubrication fittings. The rotary cam jaw couplings and adjacent shafts have moderate surface corrosion and no paint protection. The reducer packing seals are at or near the end of their compression adjustment. The north reducer input shaft and the south reducer output shaft exhibit minor oil leaks.

The south center wedge scrapes on the submarine cable during swinging operation.

End Wedges

The end wedge brake motors are in fair condition. The west wedge motor has significant deterioration around its base, and a section on the motor mounting foot exhibits 100% section loss. The southeast mounting bolt on the east end wedge motor is broken. The east motor rear shaft cover latch is missing and other latches are corroded and hard to operate. The end wedge reducers are in fair condition with typical isolated paint failure and minor corrosion. The reducer channel side mounting bolts exhibit moderate corrosion and delamination. The main cross shaft gear couplings are in fair condition and exhibit minor to moderate surface corrosion. Minor grease leakage is typical at the cross shaft couplings. Many of the couplings have two grease fittings instead of a grease fitting and a purge port plug to be opened during proper lubrication procedures. The wedge assemblies are in good condition and all linkages are tight and well lubricated. Lubrication is satisfactory and fresh and the wedge seat bearing plates show minimal wear but are in good condition. There are counterweight materials placed within the chord above the east wedges. Damp roadway debris is trapped around these blocks, resulting in deterioration to the chord member.

The protective cover above the northwest cross shaft is missing, exposing the shaft to roadway salt and debris.

Water is able to accumulate next to the northwest end wedge lower casting which will promote advancement of corrosion.

Centering Devices

Both centering latch assemblies are in acceptable condition. The receiver springs were recently replaced. There is minor corrosion and minor section loss on the receiver components, anchor bolts, and retainer plates. Debris accumulation is typical.

Barrier Gates

The barrier gates do not fully seat on the live load shoes in the lowered position. The fully seated limit switch is mounted on one end of the gate and lowering operation stops immediately when it is tripped. If the far hydraulic cylinder lags behind the near one, the far end of the gate will not be fully seated when the seated limit switch is tripped. When the gates do not seat properly, live load impact is transferred directly to the hydraulic cylinders, which they were not designed to support, and the gate is free to bounce side to side against the guides. Pulsing can be felt back through the hydraulic lines. In this condition, the gate will fully seat on the live load shoes only if pressure in the hydraulic lines is manually released at the HPU. Maintenance personnel report that the cylinders require frequent replacement.

Maintenance personnel stated the gates are currently bypassed in the control system since they will occasionally fail to maintain the fully raised position and deactivate the limit switch. The gates currently activate a plunger type limit switch at the fully raised position. This limit switch has a short stroke that would require only a slight drop of the gate to deactivate. The gate was observed during the site visit and the limit switch appeared to remain activated during the entire bridge operation. Previous inspection reports indicate hydraulic fluid leaking from the cylinders which may have allowed them to sag from the fully raised position. Maintenance personnel reported that the hydraulic cylinders were recently replaced with new cylinders. No leaks were found at the cylinders or hydraulic lines.

The stroke of the existing cylinders does not appear to raise the barrier gate as high as intended by the original gate operating machinery. The hydraulic cylinders do not have protective bellows. Several gate live load shoes are deteriorated and in need of replacement.

Various deficiencies exist with the cylinder mounts and clevis pins. The mounting plate below the south cylinder of the east gate is bent as a result of ½” thick washers installed below the plate without providing full bearing. The plate has deflected in the center due to the weight of live load when the gate is not fully seated. There is a partial bearing, ½” thick shim below the north cylinder mount at the west gate that exposes all of the mounting bolts. Several pins appear to be undersized. The nut on the clevis bolt at the top of the west gate north cylinder is not fully seated.

The west barrier gate guide roller wheels appear to be new but are not functional as they do not contact the gate or provide any guidance support during operation. Without properly installed or adjusted guides, vertical struts in the gate have worn grooves into the adjacent floorbeam web. The worn grooves in the floorbeam web are 3/16” deep at one location and 1/8” deep at another.

Warning Gates

Several gate anchor bolts are covered with debris. Minor surface corrosion can be found on the machinery components.

MECHANICAL REHABILITATION ALTERNATIVES

Bridge Maintenance Memo 14-764 (dates 10/27/2014) makes note of some of the above mechanical deficiencies and lists the appropriate repairs to be performed by state forces. Additional recommendations for items not included in the BMM are described below.

Based on field inspections, engineering analysis, and a review of ConnDOT’s Bridge Inspection Reports, the mechanical systems on Bridge No. 01138 were found to be generally in fair condition with several deficiencies that should be addressed. Three possible rehabilitation options have been evaluated to correct current issues and extend the service life of each system.

The three alternatives considered for this bridge are: Alternate A consisting of minimum rehabilitation measures that are focused on work items generally considered to be advanced maintenance of the existing components, Alternate B which includes a greater scope of work to the advanced maintenance in Alternate A and improvements through minor redesigns of some mechanical systems where component replacement is recommended, and Alternate C which seeks to maximize machinery service life with the addition of a few items to those proposed in Alternate B.

The addition of a cantilevered sidewalk installed on the south side of the bridge is being considered as part of the rehabilitation study. Corresponding counterbalance weight and span truss strengthening members would also be installed to accommodate the sidewalk. The resulting increase in deadload is estimated to be 230 kips at the center bearing and 19 kips at each end wedge. Span deflection at each end wedge is estimated to increase by 1.2 inches. This extra deadload would have considerable impact on several bridge mechanical systems. Scope items in Alternative C address mechanical system improvements that would be required to accommodate erection of a sidewalk. Alternatives A and B are not intended to coincide with the sidewalk option as they do not address the resulting mechanical system needs.

Cost Considerations

Appendix B contains an itemized cost estimate for all of the mechanical alternatives. The table below provides a summary of the total costs.

Rehabilitation Alternates	Cost
Alternate A – Advanced Machinery Maintenance	$467,000
Alternate B – Machinery System Improvements	$1,215,000

Alternate C – Maximum Machinery Life & Sidewalk Addition $3,870,000

Alternate A – Advanced Machinery Maintenance

The recommendations within this alternative are considered items slightly more advanced than regular maintenance. These are intended to address immediate concerns with the goal of prolonging the life of existing machinery components instead of recommending replacement alternatives. This alternative consists of the following work listed in prioritized order:

- Span Drive Machinery – Address the oil leak at the west span drive reducer lubrication pump. Install brake covers. This work can be accomplished without impact to roadway traffic or bridge operations.
- Barrier Gates – Replace the damaged or poorly assembled cylinder supports and mounting plates. Install proper clevis pins at all cylinders. Replace all deteriorated gate live load shoes. Adjust existing gate guides to provide proper restraint of the gate during operation and prevent contact of the west gate with the adjacent floorbeam web. Repair or reinforce the damaged floorbeam web adjacent to the west barrier gate as required due to the worn grooves from contact with the gate. This work should have minimal impact to roadway traffic and bridge operations. A crash truck or other temporary barriers may be required to maintain public safety for bridge operations while work on the gate cylinders is performed.
- Bridge Balance and Balance Wheel Shims – Adjust span balance as necessary to achieve proper balance. Adjust balance wheel shims so that all balance wheels have 1/32” clearance with the track during operation when the wedges are fully retracted. This may be an iterative process since proper shimming will not be able to be achieved until the bridge is balanced but determination of bridge balance will require reduction of the existing balance wheel shims. Include adjustments to the center wedge springs if necessary. This work should be able to be performed in between bridge operations with minor impact to roadway traffic for extra operations to determine bridge balance conditions.
- Rack/Balance Wheel Track Segments – Replace all of the deteriorated bolts securing the steel flanges of adjacent segments together. This work should be able to be performed in between bridge operations with minimal impact to roadway traffic. The deteriorated anchor bolts are not addressed in this alternative.
- Submarine Cable – Protect the submarine cable from contact with the center wedges during span swinging operations. This work can be accomplished without impact to roadway traffic or bridge operations.
- Center Pivot Bearing – Fix the leak in the bearing fill port. This work can be accomplished without impact to roadway traffic or bridge operations.
- End Wedges – Replace the broken east wedge motor mounting bolt. Replace the deteriorated motor rear shaft cover latches. Replace missing cross shaft protective cover. Prevent water from accumulating next to the northwest lower casting. This work can be accomplished without impact to roadway traffic or bridge operations.
- Painting – Generally clean and apply touch up paint for all machinery components and mounting bolts exhibiting isolated paint failure and corrosion. Blast clean and paint the pinion shafts, pinion shaft couplings, and non-contact surfaces of the rack/balance wheel track segments. This work should be able to be performed in between bridge operations with minimal impact to roadway traffic; however, a short bridge operational outage may be beneficial to ensure proper blast cleaning and painting of the pinion shafts and couplings and protection of adjacent components.

- Machinery Covers – Install covers to protect machinery from deck leakages. This work can be accomplished without impact to roadway traffic or bridge operations.

All the items listed can be accomplished with minimal impact to roadway traffic or bridge operations. Most of the work that would affect operations can be completed in between regular openings. Short bridge operational outages for the paint blast cleaning work may be beneficial. If so, this work can be accomplished during off peak hours.

Advantages:

- Lowest cost in comparison with other alternates.
- Shortest construction duration and lowest impact to roadway traffic and bridge operations.
- Extends the life of existing components.

Disadvantages:

- Scope items do not include mechanical improvements required for the addition of a sidewalk.
- Swing span operation will continue to be powered with the existing improperly sized span drive machinery.
- Improvements to machinery systems are limited by keeping existing components.
- Issues not addressed or corrected in this alternative could become greater problems with time, keeping a higher burden on maintenance personnel.

Alternate B – Machinery System Improvements

This alternative seeks to make improvements to existing machinery configurations where necessary to eliminate current issues. Several recommendations listed above in Alternate A are superseded by those in this section. Where appropriate for clarity, items from Alternate A have been referenced or repeated. This alternative consists of the following work listed in prioritized order:

- Span Drive Machinery – Replace span drive motors, motor brakes, machinery brakes, and brake wheel couplings (electrical motor replacement is covered in the Electrical Alternate B). Replacement of the motors should not be in-kind but rather resized to allow the new motors to operate at an optimum speed. The new design should provide an operating speed acceptable to ConnDOT and preferably similar to the existing swing span operating speed. The motors shall be selected to meet AASHTO capacity requirements. New brake capacities shall also be evaluated to meet AASHTO requirements. The Engineer of Record shall verify that the new design does not exceed torque capacities of all other existing drive system components under loading situations required by AASHTO. Replace loose reducer input shaft keys. Replace tachometer drive stub shafts and couplings. Install brake covers. Replace seals and gaskets in the pinion shaft couplings, reducer output shafts, and pinion shaft bearings. Address oil seeping issues at the intermediate shaft and top cover plates. Replace reducer lubrication system gearmotor, pump and coupling (lubrication gearmotor replacement is covered in the Electrical Alternate B). This work can be accomplished at one of the two drive systems without impact to roadway traffic or bridge operations since span operations can be sustained by the other main motor drive train.
- Auxiliary Drive – With the replacement of the main motors and brakes listed above, a redesign of the machinery configuration can be considered to optimize the engagement of the recently installed auxiliary drive gearmotors with a disconnect coupling or clutch to eliminate the existing chain drive system. This would greatly reduce time required to engage the auxiliary drive in an

emergency situation or for test operations. This work can be accomplished without impact to roadway traffic or bridge operations.

- Barrier Gates – In addition to the appropriate items described in Alternate A, redesign/replace hydraulic cylinders to provide the originally intended full lift height of the gate. Install protective bellows on the new cylinders. Redesign the cylinder to gate connection to eliminate transfer of live load into the cylinders in the seated position. Redesign and replace existing gate guides to provide proper restraint of the gate during operation and prevent contact of the west gate with the adjacent floorbeam web. Consider incorporating limit switches at each cylinder as well as the gate for the control system to ensure all cylinders are fully retracted. This work should have minimal impact to roadway traffic and bridge operations. A crash truck or other temporary barrier may be required to maintain public safety for bridge operations while work on the gate cylinders is performed.
- Bridge Balance and Balance Wheel Shims – Adjust span balance as necessary to achieve proper balance. Adjust balance wheel shims so that all balance wheels have 1/32" clearance with the track during operation when the wedges are fully retracted. This may be an iterative process since proper shimming will not be able to be achieved until the bridge is balanced but determination of bridge balance will require reduction of the existing balance wheel shims. Include adjustments to the center wedge springs if necessary. This work should be able to be performed in between bridge operations with minor impact to roadway traffic for extra operations to determine bridge balance conditions.
- Rack/Balance Wheel Track Segments – Core out and grout in replacements for all deteriorated anchor bolts in addition to the replacement all of the deteriorated bolts securing the steel flanges of adjacent segments described in Alternate A. This work should be able to be performed in between bridge operations with minimal impact to roadway traffic as long as care is given to stagger the work to ensure all segments remain properly anchored for operation.
- Center Pivot Bearing – Fix the leak in the bearing fill port. This work can be accomplished without impact to roadway traffic or bridge operations.
- Center Wedges – Replace reducer packing seals. Replace motor couplings along with the motor replacement listed in the Electrical Alternate B. Protect the submarine cable from contact with the center wedges during span swinging operations. This work should have minimal impact to roadway traffic and bridge operations with manual operation of the center wedges or brief operational outages to replace the motor and coupling components. The acceptability of manually operating the wedges with reduced levels of oil during the packing seal replacement would also need to be verified.
- End Wedges – In addition to items in Alternative A, replace the reducer packing seals. Replace motor couplings along with the motor replacement listed in the Electrical Alternate B. This work should have minimal impact to roadway traffic and bridge operations with manual operation of the end wedges or brief operational outages to replace the motor and coupling components. The acceptability of manually operating the wedges with reduced levels of oil during the packing seal replacement would also need to be verified.
- Painting – Generally, clean and apply touch up paint for all machinery components and mounting bolts exhibiting isolated paint failure and corrosion. Blast clean and paint the pinion shafts, pinion shaft couplings, and non-contact surfaces of the rack/balance wheel track segments. This work should be able to be performed in between bridge operations with minimal impact to roadway traffic; however, a short bridge operational outage may be beneficial to ensure proper blast cleaning and painting of the pinion shafts and couplings and protection of adjacent components.

- Machinery Covers – Install covers to protect machinery from deck leakages. This work can be accomplished without impact to roadway traffic or bridge operations.
- Operation and Maintenance Manual – Develop a full operation and maintenance manual. Delivery of the manual should include training for the maintenance personnel on electrical and mechanical troubleshooting and maintenance. A movable bridge expert should either give the training or aid in development of the training syllabus and details.

All of the items listed above will have minimal impact to roadway traffic. Repair work on the center wedge and end wedge systems may require short bridge operational outages if manual operation of the systems is not feasible. Short bridge operational outages for the paint blast cleaning work may be beneficial. All of this potential operational outage work could be accomplished during off peak hours.

Advantages:

- Maximum value of improvements for the corresponding cost compared to the other alternatives
- Increases span drive reliability with properly sized components operating at their designed speeds.
- Lower cost in comparison to Alternate C.
- Shorter construction duration and lower impact to bridge operations than Alternate C.

Disadvantages:

- Scope items do not include mechanical improvements required for the addition of a sidewalk.
- The extended service life of this alternate is shorter than Alternate C and eventual rehabilitation of Alternate C items should be expected although not in the near future.
- Longer construction duration and slightly more impact to roadway traffic and bridge operations than Alternate A.

Alternate C – Maximum Machinery Life & Sidewalk Addition

This alternative is intended to maximize machinery life and address all mechanical improvements that would be required to accommodate the extra deadload resulting from the addition of a cantilevered sidewalk. Several recommendations listed above in Alternate B are superseded by those in this section. Where appropriate for clarity, items from Alternate B have been referenced or repeated. This alternative consists of the following work items:

- Mechanical System Analysis – Require the Engineer of Record to conduct a full mechanical system analysis to adequately support the additional sidewalk deadload.
- Span Drive Machinery – Replace all mechanical span drive machinery from the motors to the rack/balance wheel track segments (electrical motor replacement is covered in the Electrical Alternate B). Require the Engineer of Record to size all machinery to meet AASHTO requirements with the additional sidewalk deadload. Replacement of the motors should not be in-kind but rather resized to allow the new motors to operate at an optimum speed. The new design should provide an operating speed acceptable to ConnDOT and preferably similar to the existing swing span operating speed. Design the auxiliary drive to be engaged by a disconnect coupling or a clutch to greatly reduce the time required to engage the auxiliary drive in an emergency situation or for test operations. Replace tachometer drive stub shafts and couplings. Install brake covers. Replace reducer lubrication system gearmotor, pump and coupling (lubrication gearmotor replacement is covered in the Electrical Alternate B). This work can be accomplished at one of the two drive systems while span operations are sustained by the other main motor drive train. The rack replacement work will have some impact to bridge operations but should be able to be accomplished in a sequence that will allow for bridge operations in between the replacement of each segment. ConnDOT personnel report that the bridge deck had to be opened to remove and reinstall the primary reducers during a previous rehabilitation. It should be assumed that a similar effort would be required to remove the existing reducers and install the new span drive machinery. Opening the deck will require complete roadway outages. A contractor may be able to open the grid to work at night or off peak hours and temporarily cover the opening for roadway traffic during the day. Approximately 1.5 weeks of, at minimum, half day complete road closures should be assumed for each drive system, 3 weeks total. This work should be able to be accomplished simultaneously with some of the electrical work requiring road closures.
- Barrier Gates – Perform all work described in Alternative B for the barrier gates.
- Bridge Balance and Balance Wheel Shims – Perform all adjustment work described in Alternative B for the bridge balance and balance wheel shims.
- Balance Wheel Axle Bearings – Adjust liner shims at the balance wheel bearings as necessary to achieve RC6 clearance fits at all bearings. This work should be able to be accomplished in between bridge operations with no impact to roadway traffic.
- Center Pivot Bearing – Require the Engineer of Record to analyze the existing center pivot bearing to confirm adequate capacity exists to support the additional sidewalk deadload. Replacement of the center pivot bearing is not anticipated and is not included in the Alternative C cost summary. Fix the leak in the bearing fill port. This work can be accomplished without impact to roadway traffic or bridge operations.
- Center Wedges – Perform all work described in Alternative B for the center wedges.
- End Wedges – Require the Engineer of Record to analyze the end wedge machinery to determine required improvements for adequate driving capacity to operate with the extra span reactions and deflection resulting from the sidewalk deadload. Replacement of the end wedge motors, primary reducers, linkages, and levers is anticipated. Also, replace end wedge cross shaft coupling seals

and deteriorated housing bolts. This work will require bridge operation outages while the couplings are disassembled. Roadway traffic may be affected during replacement unless temporary means can be developed to secure the wedges in the driven position.

- Painting – Generally, clean and apply touch up paint for all machinery components and mounting bolts exhibiting isolated paint failure and corrosion. This work should be able to be performed in between bridge operations with minimal impact to roadway traffic.
- Machinery Covers – Install covers to protect machinery from deck leakages. This work can be accomplished without impact to roadway traffic or bridge operations.
- Operation and Maintenance Manual – Develop a full operation and maintenance manual as described in Alternative B.
- Approach Pier Machinery – Require the Engineer of Record to inspect and analyze the existing end wedge machinery clearances to the approach pier mounted machinery with the addition of anticipated span deflection from the sidewalk dead load. Modify the approach pier machinery and supporting structure as required to avoid interference during swing span operations. This work may require bridge operation and roadway traffic outages if modifications must be made to the end wedge bases.

A few items in Alternative C will impact bridge operations and roadway traffic as discussed above. All of these items should be done simultaneously to minimize the outage period. The span drive replacement work will require 3 weeks of, at minimum, half day complete roadway closures. If worked on simultaneously, the end wedge and center wedge work should be able to be accomplished during the same period but will also require bridge operational outages. These outages can be concurrent with any required electrical or structural outages.

Advantages:

- This alternate has the longest anticipated service life for all alternates.
- Scope items include mechanical improvements required for the addition of a sidewalk.

Disadvantages:

- The cost of this alternate is the greatest, leaving fewer funds for other projects.
- This alternate will create the highest impact on bridge operations.

MECHANICAL RECOMMENDATIONS FOR REHABILITATION

Recommendations for the mechanical rehabilitation scope are largely dependent upon the decision to install a cantilevered sidewalk at Bridge No. 01138. If a sidewalk is installed, Alternative C is recommended as most of the scope items will be required to ensure proper operation of all mechanical systems is possible with the increased deadload. Alternative C will provide the maximum service life to the bridge machinery.

If a sidewalk is not installed at the bridge, the rehabilitation scope proposed in Alternate B would be recommended to provide the most cost effective extension of bridge service life based upon the mechanical system inspection and evaluation. This alternative would satisfactorily extend the life of the mechanical systems, increasing bridge operational reliability, and addressing issues that have historically been a routine burden to bridge maintenance.

APPENDIX B: COST COMPARISONS

Alternate A – Advanced Machinery Maintenance

Description	Cost
Span Drive Machinery - Install brake covers and address reducer pump oil leak.	$ 50,000
Barrier Gates - Replace cylinder support mounts, install proper clevis pins, replace live load shoes, adjust gate guides, repair floorbeam web adjacent to the west gate	$ 121,000
Correct bridge balance and balance wheel shims	$ 36,000
Replace deteriorated rack/balance wheel track segment bolts	$ 36,000
Protect the submarine cable	$ 18,000
Fix center pivot bearing fill port leak	$ 18,000
End Wedges - replace motor mounting bolt, replace motor rear shaft cover latches, replace shaft cover, prevent water accumulation	$ 18,000
Paint repairs	$ 90,000
Machinery covers	$ 80,000
Total for Alternate A	**$ 467,000**

Alternate B – Machinery System Improvements

Description	**Cost**
Span Drive Machinery - Replace brakes, brake wheel couplings, brake covers, reducer input shaft key, and tachometer drive shafts and couplings	$ 210,000
Span Drive Machinery - Replace seals and gaskets in the pinion shaft couplings, reducer output shafts, and pinion shaft bearings. Address oil seeping issues at reducer cover plates	$ 40,000
Span Drive Machinery - Replace the reducer lubrication pumps and couplings	$ 50,000
Reconfigure the auxiliary drive gearmotor's engagement with span drive machinery	$ 80,000
Barrier Gates - redesign/replace hydraulic cylinders, redesign cylinder to gate connection, redesign/replace gate guides, and install cylinder bellows. Cost includes appropriate items from Alternate A.	$ 197,000
Correct bridge balance and balance wheel shims	$ 36,000
Replace deteriorated rack/balance wheel track anchor bolts and segment bolts	$ 116,000
Fix center pivot bearing fill port leak	$ 18,000
Center Wedges - replace reducer packing seals, replace motor couplings, and protect submarine cable.	$ 40,000
End Wedges - Incorporate Alternate A items plus replace reducer packing seals and replace motor couplings	$ 58,000
Paint repairs	$ 90,000
Machinery covers	$ 80,000
Operation and Maintenance Manual and training	$ 200,000
Total for Alternate B	**$ 1,215,000**

Alternate C – Maximum Machinery Life & Sidewalk Addition

Description	Cost
Span Drive Machinery - Replace all mechanical span drive machinery from the motors to the rack/balance wheel track. Reconfigure the auxiliary drive gearmotor's engagement with span drive machinery	$ 2,671,000
Barrier Gates - redesign/replace hydraulic cylinders, redesign cylinder to gate connection, redesign/replace gate guides, and install cylinder bellows as described in Alternative B. Cost includes appropriate items from Alternate A	$ 197,000
Correct bridge balance and balance wheel shims	$ 36,000
Adjust balance wheel bearing liner shims	$ 20,000
Fix center pivot bearing fill port leak	$ 18,000
Center Wedges - replace reducer packing seals, replace motor couplings, and protect submarine cable	$ 40,000
End Wedges - Replace end wedge motors, primary reducers, linkages, levers, cross shaft coupling seals and housing bolts, as required	$ 418,000
Paint repairs	$ 90,000
Machinery covers	$ 80,000
Operation and Maintenance Manual and training	$ 200,000
Modify approach pier mounted machinery to avoid interference from increased dead load	$ 100,000
Total for Alternate B	**$ 3,870,000**

Appendix B: Electrical System Rehabilitation Study

EXECUTIVE SUMMARY

Scope of Electrical Rehabilitation Work

Based upon the electrical system inspection, evaluation of Bridge No. 01138, and the addition of a cantilevered sidewalk on the south side of the bridge, the rehabilitation scope proposed in Alternate B is recommended. This work consists of the following:

- Replace all limit switches
- Replace the automatic PLC system including new control console with integrated maintenance screens
- Replace the manual relay control
- Replace all control conduit and conductors
- Remove all abandoned equipment and conduit
- Replace and relocate approach traffic control devices (warning gates, flashing warning lights, audible gong, and traffic signals) for new sidewalk
- New pedestrian gates for new sidewalk
- Replace camera system including additional cameras for viewing the new sidewalk
- Replace MCC
- Replace span drives and motors
- Replace submarine cables and supports
- Replace all power panels
- Replace all power conduit and conductors
- Replace all maintenance lighting and receptacles
- Replace all wedge motors, barrier gate HPU motors, and speed reducer lubrication pump motors

Reasons for the recommended rehabilitation work:

- The electrical system is outdated and not working which makes troubleshooting more difficult for maintenance personnel.
- Multiple rehabilitation projects have left abandoned equipment and conduits in place making maintenance more difficult.
- Maintenance lighting and receptacles are inadequate and some are nonfunctioning.
- The wedge, barrier gate and speed reducer lubrication pump motors will be near the end of their life for the proposed life extension of the rehabilitation.
- The addition of the sidewalk to the south side of the bridge requires traffic control devices to be replaced and relocated, new pedestrian gates, and new camera system for operator to view the sidewalk.

DESCRIPTION

General

The Bridge No. 01138 through truss swing span is 456' long between bearing centerlines of Pier No. 2 and the east abutment, inclusive of Span Nos. 3 and 4. The bridge is oriented west to east and carries a single lane of traffic in both directions. Machinery is identified by compass direction and is referenced to the center pivot bearing, located on Pier No. 3. The bridge opens approximately 90 degrees to allow passage of marine traffic. Although the span is capable of rotation in both directions, current practice is to open only in the clockwise direction and close to its original position. The moveable through truss swing span consists of a 5" open steel grid deck. Over the piers and the east abutment the steel grid deck is concrete filled to half-depth with SIP forms.

The bridge is provided 480/277 volt, 3 phase, 60 hertz electrical service through pole mounted utility transformers on the north side of the east approach near the generator shed. The generator shed houses a 288KVA diesel backup generator, 400A automatic transfer switch (ATS), utility disconnect and metering equipment. The generator is sized to run all functions of the bridge and the ATS provides automatic weekly testing of the generator. A manual transfer switch was added during the 2016 rehabilitation to allow for quick connection of a roll up generator that could run the entire bridge, or a small generator sized to run only the auxiliary drive system.

Power is supplied to the bridge via submarine cables routed from the generator shed, under the channel, up the south side of the center pier, terminating in a transfer switch located in the power pit on the west side of the center pier. Three submarine cables have been run across the channel. Two are connected and can be switched using the manual transfer switch in the power pit on the center pier. The third cable is a spare to be used for future needs or as a replacement if one of the other two cables should fail. Submarine cables are also used to distribute control and power from the center pier to the east abutment and pier 2 for the barrier gates, warning gates, traffic control, and navigation lights (pier 2 only).

Power is distributed throughout the bridge systems from the motor control center (MCC) located in the electrical room on the south side of the bridge. The MCC houses circuit breakers and motor starters for all the bridge systems, a panelboard for heaters, control power, operator's house panelboard, pit lights and receptacles, and the relay portion of the control system with a remote I/O rack for the PLC control. The operator's house panel board provides power for lights and receptacles throughout the bridge, traffic control lights, navigation lights, and miscellaneous electrical loads in the operator's house.

Two methods of span operation are provided; main drives and auxiliary drives. The main drives are supplied with wound-rotor motors and control is provided through a PLC system and backup relay system both provide automatic operation controlled from the control console located in the operator's house. The auxiliary drives consist of electric gear motors that are controlled by a motor starter located in the electrical room and controlled from one of three pushbutton pendants: one in the electrical room and one at each gear motor.

The movable swing span is rotated by two mechanically independent main drives, with electrically controlled load sharing, located 180 degrees opposite each other on the east and west sides of the center pivot bearing. Each drive consists of 60 HP, 883 RPM electric motor, coupled to a right angle enclosed gear reducer and then to a rack-engaging pinion. The motors are speed controlled from silicon-controlled rectifier (SCR) drives located in the electrical room.

The bridge is equipped with two sets of center wedges, north and south, each powered by a 2 ½ horsepower, 1800 RPM, squirrel cage induction motor with electromechanical brake. The bridge is also equipped with end wedges on the east and west ends of the bridge. Each end wedge assembly includes two wedges powered by a single 7-1/2 HP, 900 RPM, squirrel cage AC induction motor with integral electromagnetic brakes.

Traffic control devices located on the approaches include; two three-aspect type traffic signals on each approach, a single flashing red light prior to the traffic signals, two traffic warning gates on each approach, a single hydraulically operated barrier gate on each approach and one single “Swing Bridge Ahead” sign approximately 0.2 miles west of the west abutment.

The most recent 2016 machinery rehabilitation included new auxiliary motor control, repaired the east machinery brake starter in the MCC, and operational improvements to the warning and barrier gates.

The 2007 rehabilitation included new warning gates at each approach, rehabilitating traffic barriers and their platforms as well as the access platform at the end lift, and replacement of the lube pump. The machinery was rehabilitated in the 1980s, 1995, 1998, and 2007. The span drive was rehabilitated in the 1980s and all of the machinery was replaced except for the rack, which is original. In 1995, the east end wedge and center latch machinery failed and resulted in an emergency rehabilitation. In 1998, the center bearing, balance wheels, and track were rehabilitated. In 2007, the motor control center, PLC, and control console were replaced. Machinery painting was included in the 2007 work as well as work performed at the span drive reducers including new lube pump systems. Concrete, SIP forms, and a bituminous overlay over the swing span were installed circa 1985 due to local complaints regarding noise from vehicles travelling over the open grate steel deck. However, the deck was returned to open grating circa 1998 because of issues with overloading of the swing span machinery.

ELECTRICAL FIELD OBSERVATIONS

The following information is based on the Electrical Inspection Report dated February 6 and 19, 2014 (by others) and subsequent scoping inspections on June 22-24 and November 10-11, 2015, conducted by Modjeski and Masters, Inc.

Electrical Service

The bridge’s incoming electrical service is rated a 480/277 V, three phase, 60Hz. Electrical service to the bridge is protected by a 400A main circuit breaker located in the generator room. Backup power is provided by a 230kw diesel generator fed to a recently replaced ATS. The bridges electrical service is in good condition with no visible signs of deterioration.

Motors

The drive motors are in fair working condition with some signs of deterioration due to the motors’ exposed environmental condition and motors’ aging process. The motors are wound rotor design which is obsolete and becoming difficult to source an in kind replacement. Collector rings and motor brushes are in fair condition with a buildup of carbon dust and metal shavings present inside the motors and minor normal discoloration on the collector rings. Due to environmental exposure and poor maintenance, both motors are showing signs of frame and motor shaft corrosion.

Limit Switches

The peripheral electrical equipment and components for positioning/feedback purposes are in fair condition with signs of deterioration and deficiencies. The wedge rotary cam limit switches are in good condition with some signs of moderate corrosion to the enclosures. Proximity switches mounted on the center latches are in good condition with some minor signs of surface corrosion on their mounting hardware. The tachometers appear to be in good condition. The span position lever arms are in poor condition with corroded arms and rollers and the span fully closed switch is misaligned with its respective target.

Brakes

The thruster units for the machinery and motor brakes are in good condition with no visual deficiencies. The west machinery brake terminal housing is missing a cover and the connections are made using wire nuts. The brake limit switches are in good condition with minor corrosion on the limit switch rollers and the west motor brake released limit switch is missing the roller.

Wedges

The end and center wedge electrical components are in good condition with signs of surface rust on the motor's frame and shaft.

Drives

The bridge is provided with two SCR thyristor drive controllers dating from the 1990's. Independent span drive thyristor controllers control each drive motor. The Hubbel drives control system is configured so that the bridge can be operated in three different modes. A load sharing mode which allows both drives to evenly share mechanical loads or single motor operation on either drive A or drive B. The master drive and slave drive both have to be independently selected via two switches on the control console. If slave drive A and master drive B or slave drive B master drive A combinations are selected, the bridge will not operate and no error warning is indicated on the control console.

The intent of the original design was to operate the bridge in a load sharing configuration to reduce any potential mechanical degradation of the gear train system. The 2014 electrical report noted that the bridge was being operated on Mode "A", which results in a situation where the drive/motor "B" configuration was not getting exercised. During the 2015 scoping inspection, the bridge was run on both motors in a load sharing configuration, only motor A, and only motor B. The current standard operating procedure for the bridge is to run on only one motor and periodically switch which motor is being used as a district maintenance preference.

The current transformers in both drive cabinets are improperly mounted. The controllers are in good condition and exhibit minor deficiencies within the drive enclosures including corrosion, disorganized wiring and improper wire splicing. A shutdown occurred in May of 2015 due to overheating of contactors in the drive cabinet. This is a result of many bridge operations in a short period of time on the day of the shutdown and no ventilation in the drive cabinets. This may also be related to having the main drives run the motors at a significantly reduced speed causing the electrical components to create excess heat. The current main motor operating speed is approximately 225 RPM. The rated speed of the motors is 883 RPM. While this does not appear to be the original intent of the 1985 rehabilitation, it does correlate well with limiting the span inertial loads on the 60 HP motors.

Disconnect Switches

Local disconnect switches are in good condition with some exterior corrosion forming on a few switches. The oil sump motor local disconnect switches are in excellent condition.

Traffic Control

The LED type traffic signals are in good condition and signals during bridge operation were observed to be operating with satisfactory results. The traffic warning gates are in good condition with some minor deficiencies that have been addressed in the 2016 rehabilitation. The barrier gate limit switches are in excellent condition with some minor corrosion on the HPU reservoirs but no oil leaks or corrosion are present.

The warning gates, flashing warning signals lights, audible gong, and traffic signals will need to be replaced and relocated to allow for the addition of the sidewalk. New pedestrian gates will be required for the sidewalk on the approaches before the movable span.

The bridge navigational light system is in fair condition with minor corrosion on the light fixture enclosures and supports. The marine radio, the anemometer base unit readout, and the Closed Circuit Television (CCTV) are in good condition and the floodlights in excellent condition.

The CCTV system will need to be replaced and additional cameras installed to provide the operator complete views of the sidewalk. A total of ten cameras are required to provide adequate coverage of the sidewalk and roadway: 3 on the east approach providing view of the east warning gate, the east roadway approach looking west, and the east approach sidewalk looking west; 1 on the east end of the movable span providing a view of the east pedestrian gate; 2 under the operator’s house providing overlapping complete views of the roadway on the movable span; 2 at the middle of the movable span on the south side providing overlapping complete views of the sidewalk on the movable span; 2 on the west end of the movable span providing view of the west approach gates and the west pedestrian gate and approach sidewalk.

Lighting

All roadway lights were functioning properly at time of the 2014 inspection. Circuit #38 within Panel “PPB” serving the west side roadway light has indication that the lighting circuit breaker trips every so often and has to be reset. Some of the conduit runs, powering the fixtures, are missing conduit supports and are being supported by wire ties. Maintenance lighting on the end and center piers is in fair condition and the water tight light switch mounted at roadway level, adjacent to the service stair serving the operator’s house, is installed in the wrong orientation. Emergency lighting on the movable span is operational and in satisfactory condition. The wall mounted fixture in the center pier machinery enclosure at the east side is not properly connected and wiring splices are exposed to the environment. Incandescent fixtures within the machinery enclosure are not intact and some of the cage guards are broken or missing. Flood lights are provided at the operator house level. The west flood light is operational, but the switch is connected in reverse (when switch is in the “on” position the light is off and when it is in the “off” position the light is on). The east flood light is not operational.

Operator’s House Equipment

The operator’s house lighting, receptacles, air conditioning, and electric baseboard heating systems are in excellent condition. None of the receptacles in the operator’s house are GFCI. The maintenance receptacle at the south center wedge motor is not properly mounted and the receptacle in the electrical room is missing its cover plate.

Control Console

The control console is in good condition and exhibits an out of service touch screen, wiring not properly routed, exposed wiring, a wire nut splice which represents a violation, and wire way covers are missing or not installed within the console.

PLC System

The PLC system is in fair condition and is not used to control the bridge – bridge is currently operated in manual mode using the relay control system. The installed PLC system is listed as having an "active mature" status by the manufacturer and is in the process of being discontinued. The heaters in the main PLC cabinet are not functioning and the thermostatically controlled heater in the wall mounted cabinet was functioning. The 2014 inspection report noted that some control relays were bypassed. All bypasses were removed during the 2016 rehabilitation. There is not adequate NEC workspace in front of the PLC cabinet.

Motor Control Center

The MCC is in good condition with no signs of deterioration, arcing, overheating, or corrosion. Motor starters are in good condition with moderate dust accumulation. Wiring within the MCC is not organized or properly laced. The motor starter for brake 2 has been removed and the brake is tied back in the released position. The motor starter was repaired and put back into service as part of the 2016 rehabilitation. The drive controller module #2, located in the MCC is out of service. There is not adequate NEC workspace in front of the MCC. The interface modules used in the MCC are no longer available from the manufacturer.

The panel boards and transformers within the bridge are in good condition with no visible signs of corrosion, overheating, abnormal noises, or loose wire within the devices.

Submarine Cables

The submarine cables are in fair to poor condition, based on the visible portions. A section of submarine cable in the center span has been crushed with no visible damage noted. The cables are missing their outer protective heavy duty rubber jacket, the cables' steel reinforcement is showing signs of corrosion, cables are not properly supported on the east abutment and pier 2, and the cables' enclosures have signs of corrosion and distress due to environmental conditions and lack of maintenance.

Conduit System

The conduit system on the bridge is in fair condition. There is a 4"x4" junction box adjacent to the east machinery brake that is being held in place by electrical tape. The conduits are in need of repair with some exhibiting deteriorated paint and missing supports as well as corrosion which is evident in most conduits and junction boxes at pier 2 and the east abutment. There is a conduit at the east end, under the roadway, that is missing a conduit strap near where it passes behind the centering pin and utilizes a rope as a support. There are abandoned conduits and junction boxes throughout the electrical installation.

ELECTRICAL REHABILITATION ALTERNATES

Bridge Maintenance Memo 14-764 (dates 10/27/2014) makes note of some of the above electrical deficiencies and lists the appropriate repairs to be performed by state forces. Additional recommendations for items not included in the BMM are described below.

Based on field inspections, engineering analysis, and a review of ConnDOT's Bridge Inspection Reports, the electrical systems on Bridge No. 01138 were found to be generally in fair to poor condition with several deficiencies that should be addressed. Three possible rehabilitation options have been evaluated to correct current issues and extend the service life of each system.

The three alternatives considered for this bridge are: Alternate A consisting of replacing the outdated control system, Alternate B consisting of the repairs in alternate A and replacing the power system of the bridge , and Alternate C includes alternate A & B and replaces the remaining electrical components that have not been recently replaced.

Cost Considerations

Appendix B contains an itemized cost estimate for all of the alternatives. The table below provides a summary of the total costs.

Rehabilitation Alternates	Cost
Alternate A- Control Replacement	$2,420,00
Alternate B - Control and Power Replacement (excluding ATS & generator)	$4,295,000
Alternate C – Full Electrical Replacement	$4,745,000

Alternate A – Control Replacement

This alternative consists of replacing and updating the control system to provide maintenance better information when a probable occurs for quicker troubleshooting, repair, and return to service.

- Replace all limit switches.
- Replacement of the PLC system including new control console with integrated maintenance screens. The current PLC system is no longer being supported by the manufacturer making replacement parts harder to obtain. The new system should integrate the HMI maintenance screens with the control console.
- Replacing backup relay control with a new system compatible with the new PLC system.
- Replace all control conduit and conductors.
- Removal of all abandoned equipment and conduit.
- Replace and relocate approach traffic control devices (warning gates, flashing warning lights, audible gong, and traffic signals) for new sidewalk.
- New pedestrian gates for new sidewalk.
- Replace camera system including additional cameras for viewing the new sidewalk.

All the items listed above should be done simultaneously to minimize the outage period. There will need to be additional testing time for integration to the existing MCC and drives if alternate B is not included in the rehabilitation. Staging the new components of the control system, while still running on the existing system, will be difficult due to the limited space available in the electrical room. However, the conduit and conductors can be run to the new equipment locations in preparation for the change out of the control system.

There will be a minimum 3 week outage for the change over period and testing. The outage can be concurrent with any required mechanical or structural outages and the bridge can be positioned open to marine or vehicular traffic. The installation of new conduit along the span will require a lane closure if the work is not performed from the water.

Advantages:

- Lowest cost in comparison with other alternates.
- Addresses immediate needs of the electrical system.
- Will aid in troubleshooting the electrical bridge systems.
- Shortest outage period.

Disadvantages:

- MCC not replaced and spare parts are no longer available for current MCC.
- Non-replaced components in the drive or MCC could fail and disable the bridge.
- New control would have to be designed to work with obsolete MCC.
- Not feasible with a sidewalk mounted on the south side of the bridge.

Alternate B – Control and Power Replacement (excluding ATS & generator)

In addition to the above described control replacement in Alternate A, this alternative consists of replacing the power system of the bridge.

- Replace the MCC. The current MCC is obsolete and replacement parts are unavailable.
- Replace both span motor drives and motors.
- Replace submarine cables and supports as they are nearing the end of their useful life.
- Replace power panels grouping circuits in a logical order to aid in troubleshooting.
- Replace all power conduits and supports.
- Replace all maintenance lighting and receptacles and install new maintenance lighting and receptacles where needed.
- Replace the barrier gate HPU, center wedge, end wedge, and speed reducer lubrication motors.

All the items listed above should be done simultaneously to minimize the outage period. Performing the control and power system replacement at the same time will allow for shop testing the all the components together to minimize start up troubleshooting time. With the addition of the sidewalk on the south side, a new electrical house is required on the North side which allows installation and connection of the new power and control equipment, except the new console, without disrupting operations using the existing system.

A one week outage, in addition to what was listed in Alternative A, is required due to the replacement of the power equipment. Total outage time for Alternative B is a 4 week minimum.

Advantages:

- Lower cost in comparison to Alternate C.
- All electrical components new and replacement parts available.
- Complete control integration with MCC and drive.
- Efficiencies gained in replacing the control and power systems at the same time.
- Allows for installation of sidewalk on the south side of the bridge.

Disadvantages:

- ATS & generator are not replaced.
- The extended service life of this alternate is shorter than Alternate C.
- Longer outage time then Alternate A.

Alternate C – Full Electrical Replacement (excluding ATS)

This alternative consists of the work described in Alternate B in addition to complete replacement of generator. This will include removing the existing buried diesel fuel tank and the day tank in the generator shed. The new generator will have a sub base tank sized to provide a minimum of 24 hours run time at full load. No additional outage time is required from what is listed in alternative B.

Advantages:

- This alternate has the longest anticipated service life all alternates.
- No additional outage period required over what is needed for alternate B as the generator can be replaced at the same time the control and power systems are replaced on the bridge.

Disadvantages:

- The cost of this alternate is the greatest leaving less funds for other projects.
- This alternate will have the highest impact to traffic.

ELECTRICAL RECOMMENDATIONS FOR REHABILITATION

The rehabilitation scope of Alternate B is recommended based on the inspection findings and analysis of the proposed alternatives. Alternate B consists of complete electrical system replacement with the exception of the ATS and generator. The existing PLC and MCC are no longer supported by their manufacturers which make replacements parts hard to source, if not impossible. The current system is also difficult to troubleshoot due to the nonfunctioning maintenance screen on the control console and the abandoned equipment and conduits from previous repairs. Alternative A is not feasible with a side walk mounted on the south side of the bridge due to the required relocation of the existing electrical room. The new sidewalk additionally requires traffic control devices to be replaced and relocated, new pedestrian gates, new camera system for operator to view the sidewalk.

Alternate C will also replace the generator, however the additional cost is not justified at this time because the generator is currently in good condition with many functional years remaining.

APPENDIX B: COST COMPARISON

Alternate A – Control Replacement

Description	Cost
Replace all limit switches	$50,000
Replace PLC system including new control console with integrated maintenance screens	$1,100,000
Replace relay control	$650,000
Replace all control conduit and conductors	$175,000
Remove all abandoned equipment and conduit	$10,000
Replace & relocate approach traffic control devices	$320,000
New pedestrian gates	$70,000
Replace camera system	$45,000
Total	$2,420,000

Alternate B – Control and Power Replacement (excluding ATS & generator)

Description	Cost
Replace MCC	$600,000
Replace span drives and motors	$250,000
Replace submarine cables and supports	$700,000
Replace power panels	$50,000
Replace all power conduit and conductors	$225,000
Replace all maintenance lighting and receptacles	$30,000
Replace wedge, barrier gate, and speed reducer lubrication pump motors	$20,000
Alternate B Subtotal	$1,875,000
Alternate A Subtotal	$2,420,000
Total	$4,295,000

Alternate C – Full Electrical Replacement (excluding ATS)

Description	Cost
Replace generator	$450,000
Alternate B Subtotal	$1,875,000
Alternate A Subtotal	$2,420,000
Total	$4,745,000

Appendix C: Cost Comparisons

COMPUTATION BY	DATE	SHEET	OF
MJG	2/17/17	1	1
CHECKED BY	DATE	CME PROJECT NO.	
TAB	3/20/17	2011658	
CLIENT		CLIENT PROJECT NO.	
ConnDOT State Liaison Bridge Project		40-141	

ITEM
Bridge # 01138 Alternate A -Minimum Rehabilitation Measures

ALTERNATE A - MINIMUM REHABILITATION MEASURES WITH STRENGTHENING TO ACHIEVE HL-93 OPERATING

1. Mill 0.5" depth of existing overlay and place new wearing surface.
2. Strengthening repairs to structural steel members designed to achieve HL-93 Operating above 1.0. Replace rivets with high strength bolts.
3. Replace the disc bearings for Span No. 1 Floorbeam U9 bearings at Pier No. 1. Clean and paint at other bearing locations.
4. Spot paint repaired locations.
5. Substructure patching.
6. Replacement of joints at west abutment and Pier No. 1.

STRUCTURE ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
MICRO-MIILING OF BITUMINOUS CONCRETE (0" TO 2")	SY	1,390	$2.00	$2,800.00
UTLRA-THIN BONDED HMA PAVEMENT (TYPE B)	SY	1,390	$5.40	$7,600.00
PREFORMED JOINT SEAL (SPAN 2 CONTRACTION SPLICE JOINT)	LF	30	$115.00	$3,500.00
CLASS "S" CONCRETE	CY	75	$12,000.00	$900,000.00
EPOXY INJECTION CRACK REPAIR	LF	510	$131.00	$66,900.00
BOLT AND RIVET REPLACEMENT	EA	100	$182.40	$18,300.00
STRUCTURAL STEEL REPAIRS (SITE 1)	LS	1	$7,624,100.00	$7,624,100.00
LOCALIZED PAINT REMOVAL AND FIELD PAINTING OF EXISTING STEEL	LS	1	$1,100,000.00	$1,100,000.00
MASONRY REPOINTING	SY	140	$188.00	$26,320.00
TEMPORARY SUPPORT COSTS	LS	1	$1,030,000.00	$1,030,000.00
JACKING FOR BEARING REPLACEMENT	LS	1	$80,000.00	$80,000.00
BEARING REPLACEMENT WITH DISC BEARINGS (SPAN 1)	EA	2	$65,000.00	$130,000.00
CLEAN AND LUBRICATE/PAINT EXISTING BEARINGS	EA	6	$1,325.00	$8,000.00
			STRUCTURE TOTAL:	$10,997,520.00

TRAFFIC ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
TEMPORARY SIGNALIZATION FOR BRIDGE PROJECTS (PER INTERSECTION)	EA	2	$50,000.00	$100,000.00
			TRAFFIC TOTAL:	$100,000.00

MECHANICAL/ELECTRICAL

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
MECHANICAL WORK (INCLUDES BRIDGE BALANCING)	LS	1	$1,215,000.00	$1,215,000.00
ELECTRICAL WORK	LS	1	$3,810,000.00	$3,810,000.00
			M/E TOTAL:	$5,025,000.00
			SUBTOTAL 1:	$16,122,520.00

MINOR ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Minor Items (25% of Subtotal 1)	LS	1	$4,030,700.00	$4,030,700.00
			SUBTOTAL 2	$4,030,700.00

LUMP SUM ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Clearing & Grubbing	LS	1	$403,100.00	$403,100.00
M & P of Traffic	LS	1	$806,128.80	$806,200.00
Mobilization (7.5% of Subtotal 1 and 2)	LS	1	$1,511,491.50	$1,511,500.00
Construction Staking	LS	1	$201,550.00	$201,600.00
			SUBTOTAL 3	$2,922,400.00

ENGINEERING PERCENTAGES		TOTAL
Incidentals (15% of Subtotal 1, 2, and 3)	15% INCIDENTALS	$3,461,400.00
Contingency (10% of Subtotal 1, 2, and 3)	10% CONTINGENCY	$2,307,600.00
	SUBTOTAL 4	$5,769,000.00

ESCALATION TO START OF CONSTRUCTION		TOTAL
Say 3.5% per Year to 2020	SUBTOTAL 5	$3,136,000.00
	TOTAL	$31,980,620.00
	GRAND TOTAL	**$31,981,000.00**

COMPUTATION BY	DATE	SHEET	OF
TAB	1/26/17	1	1
CHECKED BY	DATE	CME PROJECT NO.	
AS	1/29/17	2011658	
CLIENT		CLIENT PROJECT NO.	
ConnDOT State Liaison Bridge Project		40-141	

ITEM
Bridge No. 01138, Route 82 over the Connecticut River

ALTERNATE B1 - ACHIEVE HL-93 OPERATING AND LEGAL LOADS WITHOUT SIDEWALK

STRUCTURE ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
REMOVAL OF BITUMINOUS TYPE PAVEMENT	SY	1,390	$4.80	$6,700.00
1" POLYESTER POLYMER CONCRETE OVERLAY	SY	1,390	$160.00	$222,400.00
PREFORMED JOINT SEAL (SPAN 2 CONTRACTION SPLICE JOINT)	LF	30	$115.00	$3,500.00
CLASS "S" CONCRETE[1]	CY	75	$12,000.00	$900,000.00
CLASS "F" CONCRETE (FOR PATCHING GRID IN SPANS 1 & 2)	CY	10	$805.20	$8,100.00
EPOXY INJECTION CRACK REPAIR	LF	510	$131.00	$66,900.00
BOLT AND RIVET REPLACEMENT	EA	100	$182.40	$18,300.00
STRUCTURAL STEEL REPAIRS (SITE 1) [2]	LS	1	$7,624,100.00	$7,624,100.00
DECK REMOVAL OVER MECHANICAL HOUSE IN SWING SPAN	SF	1,615	$50.00	$80,750.00
STEEL GRID DECKING (HALF-FILLED W/CONCRETE) OVER MECHANICAL (SWING SPAN)	SF	1,615	$130.00	$209,950.00
JACKING FOR BEARING REPLACEMENT (SPAN 1)	LS	1	$80,000.00	$80,000.00
LOCALIZED PAINTING (10% OF SUPERSTRUCTURE STEEL SURFACE)	LS	1	$1,100,000.00	$1,100,000.00
OPEN BRIDGE RAIL	LF	1,770	$400.00	$708,000.00
BEARING REHABILITATION/REPLACEMENT OF SPAN 1 DISC BEARINGS	LS	1	$140,000.00	$140,000.00
MASONRY REPOINTING	SY	140	$188.00	$26,320.00
TEMPORARY SUPPORT COSTS	LS	1	$1,030,000.00	$1,030,000.00
BRIDGE SIDEWALK CONSTRUCTION (INCLUDES COST OF COUNTERWEIGHT)				$0.00
STRUCTURAL MODIFICATIONS (OPERATOR HOUSE LANDING & STAIRS, ELECTRICAL HOUSE FRAMING & ROOF)				$0.00
			STRUCTURE TOTAL:	$12,225,020.00

ROADWAY ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
FINE MILLING OF HMA	SY	300	$2.00	$600.00
HMA S0.5	TON	35	$103.00	$3,700.00
			ROADWAY TOTAL:	$4,300.00

TRAFFIC ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
TEMPORARY SIGNALIZATION FOR BRIDGE PROJECTS (PER INTERSECTION)	EA	2	$50,000.00	$100,000.00
			TRAFFIC TOTAL:	$100,000.00

MECHANICAL/ELECTRICAL

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
MECHANICAL WORK (INCLUDES BRIDGE BALANCING)	LS	1	$1,215,000.00	$1,215,000.00
ELECTRICAL WORK	LS	1	$3,810,000.00	$3,810,000.00
			M/E TOTAL:	$5,025,000.00
			SUBTOTAL 1:	$17,354,320.00

MINOR ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Minor Items (25% of Subtotal 1)	LS	1	$4,338,600.00	$4,338,600.00
			SUBTOTAL 2	$4,338,600.00

LUMP SUM ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Clearing & Grubbing (2% of Subtotals 1 & 2)	LS	1	$433,858.40	$433,900.00
M & P of Traffic (4% of Subtotals 1 & 2)	LS	1	$867,716.80	$867,800.00
Mobilization (7.5% of Subtotals 1 & 2)	LS	1	$1,626,969.00	$1,627,000.00
Construction Staking (1% of Subtotals 1 & 2)	LS	1	$216,929.20	$217,000.00
			SUBTOTAL 3	$3,145,700.00

ENGINEERING PERCENTAGES		TOTAL
Incidentals (15% of Subtotals 1, 2, and 3)	15% INCIDENTALS	$3,725,800.00
Contingency (10% of Subtotals 1, 2, and 3)	10% CONTINGENCY	$2,483,900.00
	SUBTOTAL 4	$6,209,700.00

ESCALATION TO START OF CONSTRUCTION		TOTAL
Say 3.5% per Year to 2020	SUBTOTAL 5	$3,375,600.00
	TOTAL	$34,423,920.00
	GRAND TOTAL	**$34,500,000.00**

1. Repairs based on 2015 Inspection and D2 Maintenance observations on need for extensive repairs to Pier 3.
2. Repair cost based on As-built conditions to achieve desired ratings and section losses documented in current inspection report. Repair costs for section losses increased by 25% to account for a future detailed in-depth inspection. Cost includes distribution girder repairs and jacking.

COMPUTATION BY	DATE	SHEET	OF
TAB	1/26/17	1	1
CHECKED BY	DATE	CME PROJECT NO.	
AS	1/29/17	2011658	
CLIENT		CLIENT PROJECT NO.	
ConnDOT State Liaison Bridge Project		40-141	

ITEM
Bridge No. 01138, Route 82 over the Connecticut River

ALTERNATE B2 - ACHIEVE HL-93 OPERATING AND LEGAL LOADS WITH SIDEWALK ON SOUTH SIDE

STRUCTURE ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
REMOVAL OF BITUMINOUS TYPE PAVEMENT	SY	1,390	$4.80	$6,700.00
1" POLYESTER POLYMER CONCRETE OVERLAY	SY	1,390	$160.00	$222,400.00
PREFORMED JOINT SEAL (SPAN 2 CONTRACTION SPLICE JOINT)	LF	30	$115.00	$3,500.00
CLASS "S" CONCRETE[1]	CY	75	$12,000.00	$900,000.00
CLASS "F" CONCRETE (FOR PATCHING GRID IN SPANS 1 & 2)	CY	10	$805.20	$8,100.00
EPOXY INJECTION CRACK REPAIR	LF	510	$131.00	$66,900.00
BOLT AND RIVET REPLACEMENT	EA	100	$182.40	$18,300.00
STRUCTURAL STEEL REPAIRS (SITE 1) [2]	LS	1	$8,709,700.00	$8,709,700.00
DECK REMOVAL OVER MECHANICAL HOUSE IN SWING SPAN	SF	1,615	$50.00	$80,750.00
STEEL GRID DECKING (HALF-FILLED W/CONCRETE) OVER MECHANICAL (SWING SPAN)	SF	1,615	$130.00	$209,950.00
JACKING FOR BEARING REPLACEMENT (SPAN 1)	LS	1	$80,000.00	$80,000.00
LOCALIZED PAINTING (10% OF SUPERSTRUCTURE STEEL SURFACE AREA)	LS	1	$1,100,000.00	$1,100,000.00
OPEN BRIDGE RAIL	LF	1,770	$400.00	$708,000.00
BEARING REHABILITATION/REPLACEMENT OF SPAN 1 DISC BEARINGS	LS	1	$140,000.00	$140,000.00
MASONRY REPOINTING	SY	140	$188.00	$26,320.00
TEMPORARY SUPPORT COSTS	LS	1	$1,030,000.00	$1,030,000.00
BRIDGE SIDEWALK CONSTRUCTION (INCLUDES COST OF COUNTERWEIGHT)	LS	1	$3,090,000.00	$3,090,000.00
STRUCTURAL MODIFICATIONS (OPERATOR HOUSE LANDING & STAIRS, ELECTRICAL HOUSE FRAMING & ROOF	LS	1	$300,000.00	$300,000.00
			STRUCTURE TOTAL:	$16,700,620.00

ROADWAY ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
FINE MILLING OF HMA	SY	300	$2.00	$600.00
HMA S0.5	TON	35	$103.00	$3,700.00
			ROADWAY TOTAL:	$4,300.00

TRAFFIC ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
TEMPORARY SIGNALIZATION FOR BRIDGE PROJECTS (PER INTERSECTION)	EA	2	$50,000.00	$100,000.00
			TRAFFIC TOTAL:	$100,000.00

MECHANICAL/ELECTRICAL

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
MECHANICAL WORK (INCLUDES BRIDGE BALANCING) [3]	LS	1	$3,870,000.00	$3,870,000.00
ELECTRICAL WORK (INCLUDES APPROACH SIDEWALK GATE)	LS	1	$4,295,000.00	$4,295,000.00
			M/E TOTAL:	$8,165,000.00
			SUBTOTAL 1:	$24,969,920.00

MINOR ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Minor Items (25% of Subtotal 1)	LS	1	$6,242,500.00	$6,242,500.00
			SUBTOTAL 2	$6,242,500.00

LUMP SUM ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Clearing & Grubbing (2% of Subtotals 1 & 2)	LS	1	$624,248.40	$624,300.00
M & P of Traffic (4% of Subtotals 1 & 2)	LS	1	$1,248,496.80	$1,248,500.00
Mobilization (7.5% of Subtotals 1 & 2)	LS	1	$2,340,931.50	$2,341,000.00
Construction Staking (1% of Subtotals 1 & 2)	LS	1	$312,124.20	$312,200.00
			SUBTOTAL 3	$4,526,000.00

ENGINEERING PERCENTAGES		TOTAL
Incidentals (15% of Subtotals 1, 2, and 3)	15% INCIDENTALS	$5,360,800.00
Contingency (10% of Subtotals 1, 2, and 3)	10% CONTINGENCY	$3,573,900.00
	SUBTOTAL 4	$8,934,700.00

ESCALATION TO START OF CONSTRUCTION		TOTAL
Say 3.5% per Year to 2020	SUBTOTAL 5	$4,856,800.00
	TOTAL	$49,529,920.00
	GRAND TOTAL	**$49,600,000.00**

1. Repairs based on 2015 Inspection and D2 Maintenance observations on need for extensive repairs to Pier 3.
2. Repair cost based on As-built conditions to achieve desired ratings and section losses documented in current inspection report. Repair costs for section losses increased by 25% to account for a future detailed in-depth inspection. Cost includes distribution girder repairs and jacking.
3. Assumes center pivot bearing can adequately support new sidewalk load.

CME	COMPUTATION BY: TAB	DATE: 1/26/17	SHEET 1 OF 1
	CHECKED BY: AS	DATE: 1/29/17	CME PROJECT NO. 2011658
	CLIENT: ConnDOT State Liaison Bridge Project		CLIENT PROJECT NO. 40-141
ITEM: Bridge No. 01138, Route 82 over the Connecticut River			

ALTERNATE B3 - ACHIEVE HL-93 INVENTORY AND LEGAL LOADS WITHOUT SIDEWALK

STRUCTURE ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
REMOVAL OF BITUMINOUS TYPE PAVEMENT	SY	1,390	$4.80	$6,700.00
1" POLYESTER POLYMER CONCRETE OVERLAY	SY	1,390	$160.00	$222,400.00
PREFORMED JOINT SEAL (SPAN 2 CONTRACTION SPLICE JOINT)	LF	30	$115.00	$3,500.00
CLASS "S" CONCRETE[1]	CY	75	$12,000.00	$900,000.00
CLASS "F" CONCRETE (FOR PATCHING GRID IN SPANS 1 & 2)	CY	10	$805.20	$8,100.00
EPOXY INJECTION CRACK REPAIR	LF	510	$131.00	$66,900.00
BOLT AND RIVET REPLACEMENT	EA	100	$182.40	$18,300.00
STRUCTURAL STEEL REPAIRS (SITE 1) [2]	LS	1	$10,697,500.00	$10,697,500.00
DECK REMOVAL OVER MECHANICAL HOUSE IN SWING SPAN	SF	1,615	$50.00	$80,750.00
STEEL GRID DECKING (HALF-FILLED W/CONCRETE) OVER MECHANICAL (SWING SPAN)	SF	1,615	$130.00	$209,950.00
JACKING FOR BEARING REPLACEMENT (SPAN 1)	LS	1	$80,000.00	$80,000.00
LOCALIZED PAINTING (15% OF SUPERSTRUCTURE STEEL SURFACE)	LS	1	$1,850,000.00	$1,850,000.00
OPEN BRIDGE RAIL	LF	1,770	$400.00	$708,000.00
BEARING REHABILITATION/REPLACEMENT OF SPAN 1 DISC BEARINGS	LS	1	$140,000.00	$140,000.00
MASONRY REPOINTING	SY	140	$188.00	$26,320.00
TEMPORARY SUPPORT COSTS	LS	1	$1,090,000.00	$1,090,000.00
BRIDGE SIDEWALK CONSTRUCTION (INCLUDES COST OF COUNTERWEIGHT)				$0.00
STRUCTURAL MODIFICATIONS (OPERATOR HOUSE LANDING & STAIRS, ELECTRICAL HOUSE FRAMING & ROOF				$0.00
			STRUCTURE TOTAL:	$16,108,420.00

ROADWAY ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
FINE MILLING OF HMA	SY	300	$2.00	$600.00
HMA S0.5	TON	35	$103.00	$3,700.00
			ROADWAY TOTAL:	$4,300.00

TRAFFIC ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
TEMPORARY SIGNALIZATION FOR BRIDGE PROJECTS (PER INTERSECTION)	EA	2	$50,000.00	$100,000.00
			TRAFFIC TOTAL:	$100,000.00

MECHANICAL/ELECTRICAL

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
MECHANICAL WORK (INCLUDES BRIDGE BALANCING)	LS	1	$1,215,000.00	$1,215,000.00
ELECTRICAL WORK	LS	1	$3,810,000.00	$3,810,000.00
			M/E TOTAL:	$5,025,000.00
			SUBTOTAL 1:	$21,237,720.00

MINOR ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Minor Items (25% of Subtotal 1)	LS	1	$5,309,500.00	$5,309,500.00
			SUBTOTAL 2	$5,309,500.00

LUMP SUM ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Clearing & Grubbing (2% of Subtotals 1 & 2)	LS	1	$530,944.40	$531,000.00
M & P of Traffic (4% of Subtotals 1 & 2)	LS	1	$1,061,888.80	$1,061,900.00
Mobilization (7.5% of Subtotals 1 & 2)	LS	1	$1,991,041.50	$1,991,100.00
Construction Staking (1% of Subtotals 1 & 2)	LS	1	$265,472.20	$265,500.00
			SUBTOTAL 3	$3,849,500.00

ENGINEERING PERCENTAGES		TOTAL
Incidentals (15% of Subtotals 1, 2, and 3)	15% INCIDENTALS	$4,559,600.00
Contingency (10% of Subtotals 1, 2, and 3)	10% CONTINGENCY	$3,039,700.00
	SUBTOTAL 4	$7,599,300.00

ESCALATION TO START OF CONSTRUCTION		TOTAL
Say 3.5% per Year to 2020	SUBTOTAL 5	$4,130,900.00
	TOTAL	$42,126,920.00

GRAND TOTAL	**$42,200,000.00**

1. Repairs based on 2015 Inspection and D2 Maintenance observations on need for extensive repairs to Pier 3.
2. Repair cost based on As-built conditions to achieve desired ratings and section losses documented in current inspection report. Repair costs for section losses increased by 25% to account for a future detailed in-depth inspection. Cost includes distribution girder repairs and jacking.

COMPUTATION BY	DATE	SHEET	OF
TAB	1/26/17	1	1
CHECKED BY	DATE	CME PROJECT NO.	
AS	1/29/17	2011658	
CLIENT		CLIENT PROJECT NO.	
ConnDOT State Liaison Bridge Project		40-141	

ITEM
Bridge No. 01138, Route 82 over the Connecticut River

ALTERNATE B4 - ACHIEVE HL-93 INVENTORY AND LEGAL LOADS WITH SIDEWALK ON SOUTH SIDE

STRUCTURE ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
REMOVAL OF BITUMINOUS TYPE PAVEMENT	SY	1,389	$4.80	$6,700.00
1" POLYESTER POLYMER CONCRETE OVERLAY	SF	1,389	$160.00	$222,300.00
PREFORMED JOINT SEAL (SPAN 2 CONTRACTION SPLICE JOINT)	LF	30	$115.00	$3,500.00
CLASS "S" CONCRETE[1]	CY	75	$12,000.00	$900,000.00
CLASS "F" CONCRETE (FOR PATCHING GRID IN SPANS 1 & 2)	CY	10	$805.20	$8,100.00
EPOXY INJECTION CRACK REPAIR	LF	510	$131.00	$66,900.00
BOLT AND RIVET REPLACEMENT	EA	100	$182.40	$18,300.00
STRUCTURAL STEEL REPAIRS (SITE 1) [2]	LS	1	$12,453,750.00	$12,453,800.00
DECK REMOVAL OVER MECHANICAL HOUSE IN SWING SPAN	SF	1,615	$50.00	$80,750.00
STEEL GRID DECKING (HALF-FILLED W/CONCRETE) OVER MECHANICAL (SWING SPAN)	SF	1,615	$130.00	$209,950.00
JACKING FOR BEARING REPLACEMENT (SPAN 1)	LS	1	$80,000.00	$80,000.00
LOCALIZED PAINTING (15% OF SUPERSTRUCTURE STEEL SURFACE AREA)	LS	1	$1,850,000.00	$1,850,000.00
OPEN BRIDGE RAIL	LF	1,770	$400.00	$708,000.00
BEARING REHABILITATION/REPLACEMENT OF SPAN 1 DISC BEARINGS	LS	1	$140,000.00	$140,000.00
MASONRY REPOINTING	SY	140	$188.00	$26,320.00
TEMPORARY SUPPORT COSTS	LS	1	$1,090,000.00	$1,090,000.00
BRIDGE SIDEWALK CONSTRUCTION (INCLUDES COST OF COUNTERWEIGHT)	LS	1	$3,090,000.00	$3,090,000.00
STRUCTURAL MODIFICATIONS (OPERATOR HOUSE LANDING & STAIRS, ELECTRICAL HOUSE FRAMING & ROOF	LS	1	$300,000.00	$300,000.00
			STRUCTURE TOTAL:	$21,254,620.00

ROADWAY ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
FINE MILLING OF HMA	SY	300	$2.00	$600.00
HMA S0.5	TON	35	$103.00	$3,700.00
			ROADWAY TOTAL:	$4,300.00

TRAFFIC ITEMS

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
TEMPORARY SIGNALIZATION FOR BRIDGE PROJECTS (PER INTERSECTION)	EA	2	$50,000.00	$100,000.00
			TRAFFIC TOTAL:	$100,000.00

MECHANICAL/ELECTRICAL

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
MECHANICAL WORK (INCLUDES BRIDGE BALANCING) [3]	LS	1	$3,870,000.00	$3,870,000.00
ELECTRICAL WORK (INCLUDES APPROACH SIDEWALK GATE)	LS	1	$4,295,000.00	$4,295,000.00
			M/E TOTAL:	$8,165,000.00
			SUBTOTAL 1:	$29,523,920.00

MINOR ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Minor Items (25% of Subtotal 1)	LS	1	$7,381,000.00	$7,381,000.00
			SUBTOTAL 2	$7,381,000.00

LUMP SUM ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL
Clearing & Grubbing (2% of Subtotals 1 & 2)	LS	1	$738,098.40	$738,100.00
M & P of Traffic (4% of Subtotals 1 & 2)	LS	1	$1,476,196.80	$1,476,200.00
Mobilization (7.5% of Subtotals 1 & 2)	LS	1	$2,767,869.00	$2,767,900.00
Construction Staking (1% of Subtotals 1 & 2)	LS	1	$369,049.20	$369,100.00
			SUBTOTAL 3	$5,351,300.00

ENGINEERING PERCENTAGES		TOTAL
Incidentals (15% of Subtotals 1, 2, and 3)	15% INCIDENTALS	$6,338,500.00
Contingency (10% of Subtotals 1, 2, and 3)	10% CONTINGENCY	$4,225,700.00
	SUBTOTAL 4	$10,564,200.00

ESCALATION TO START OF CONSTRUCTION		TOTAL
Say 3.5% per Year to 2020	SUBTOTAL 5	$5,742,600.00
	TOTAL	$58,563,020.00
	GRAND TOTAL	**$58,600,000.00**

1. Repairs based on 2015 Inspection and D2 Maintenance observations on need for extensive repairs to Pier 3.
2. Repair cost based on As-built conditions to achieve desired ratings and section losses documented in current inspection report. Repair costs for section losses increased by 25% to account for a future detailed in-depth inspection. Cost includes distribution girder repairs and jacking.
3. Assumes center pivot bearing can adequately support new sidewalk load.

Appendix D: Photographs

Span 2 Fixed Through Truss North Elevation

Spans 3 and 4 Swing Span in open position

Traffic signals and warning gates in east approach to bridge

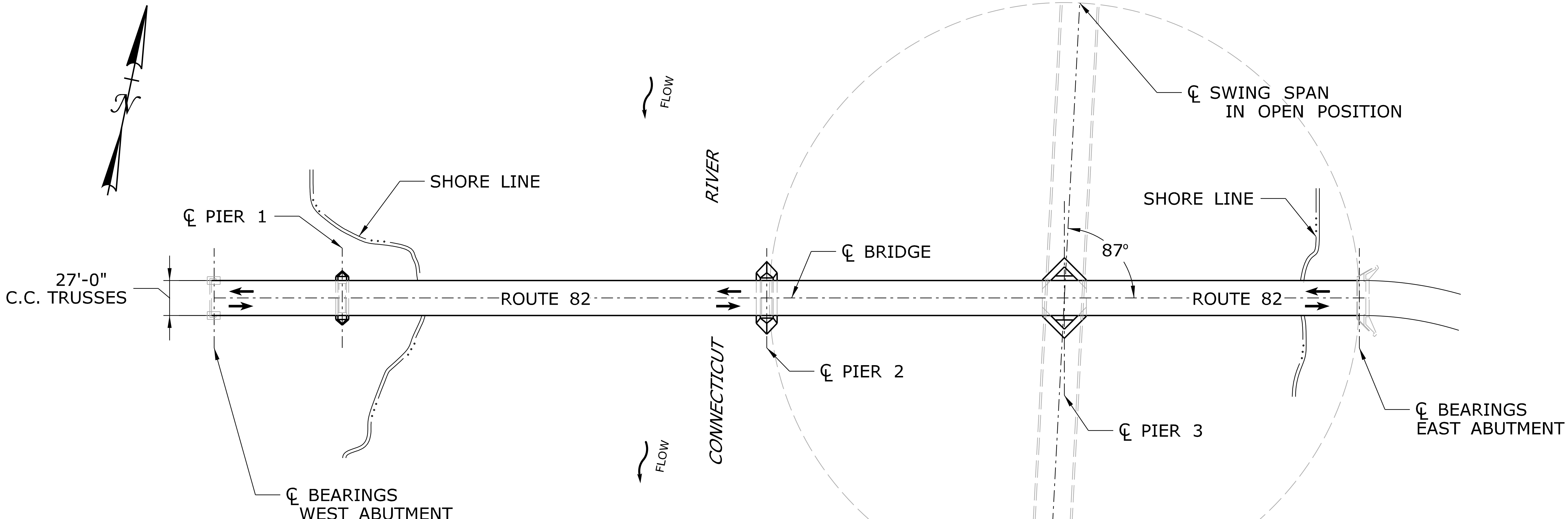
Stay-in-place (SIP) forms cover the deck underside in Spans 1 and 2. Note there are areas of moderate rust on the SIPs.

Typical painted over pitting loss in floorbeams and truss members and evidence of additional corrosion.

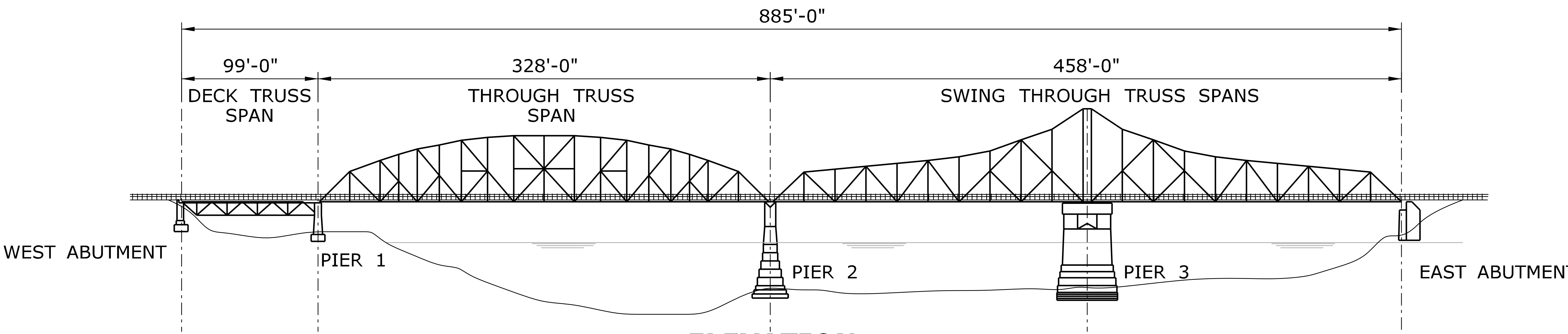
Pier 2 West Elevation. There is extensive map cracking with efflorescence.

West Abutment. Slope protection in front of spill through abutment and some evidence of erosion.

Appendix E: Existing Bridge Plans and Proposed Sidewalk Details



PLAN



ELEVATION

SCALE 1" = 80'

160 80 0 160

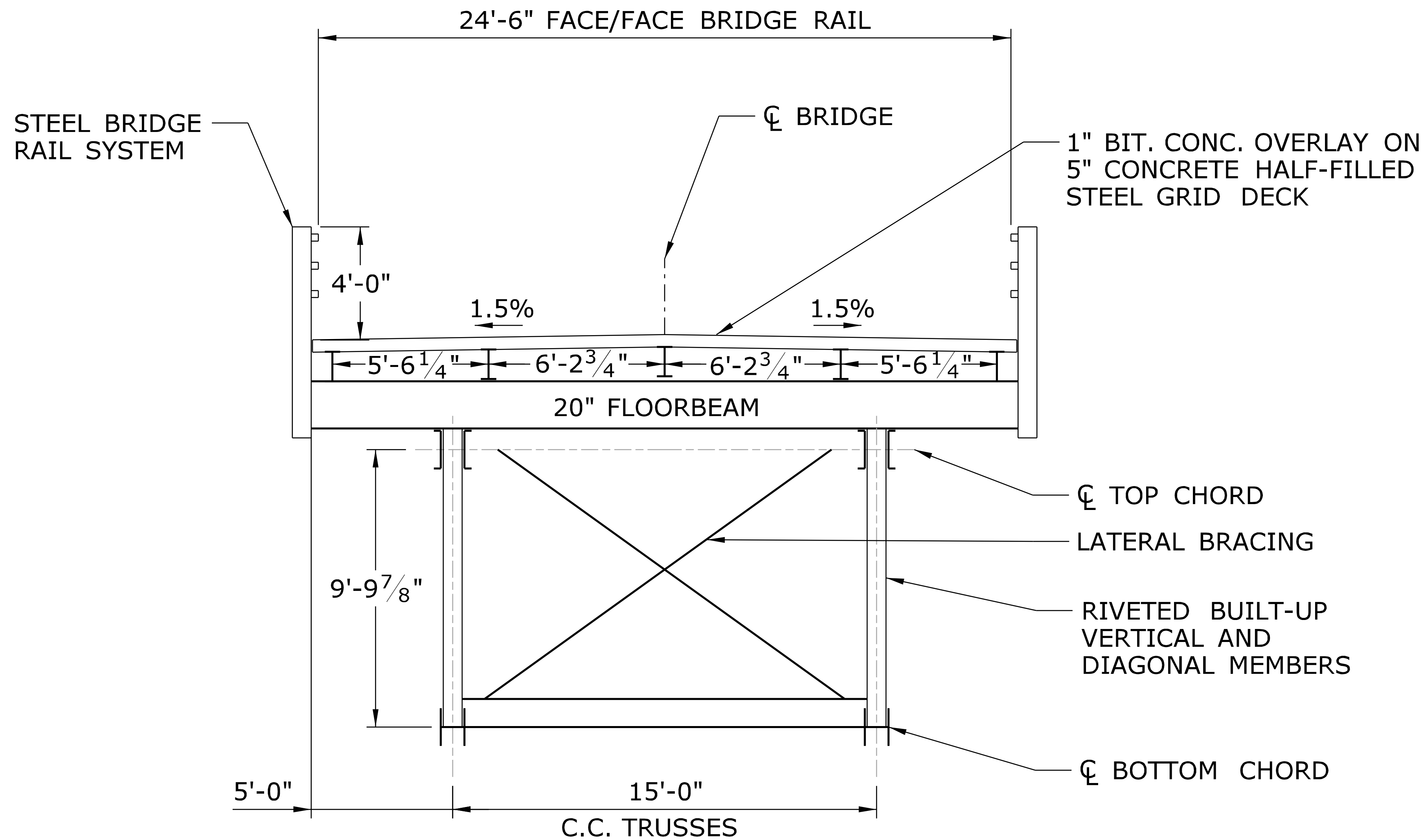
STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

CME Associates, Inc.
CONSULTING ENGINEERS & ENVIRONMENTAL PLANNERS
333 E. RIVER DR., SUITE 400
EAST HARTFORD, CT 06108

CITY/TOWN:	BRIDGE NO.:	SCALE:
EAST HADDAM/HADDAM	01138	1"=80'

DRAWING TITLE:
EXISTING PLAN AND ELEVATION

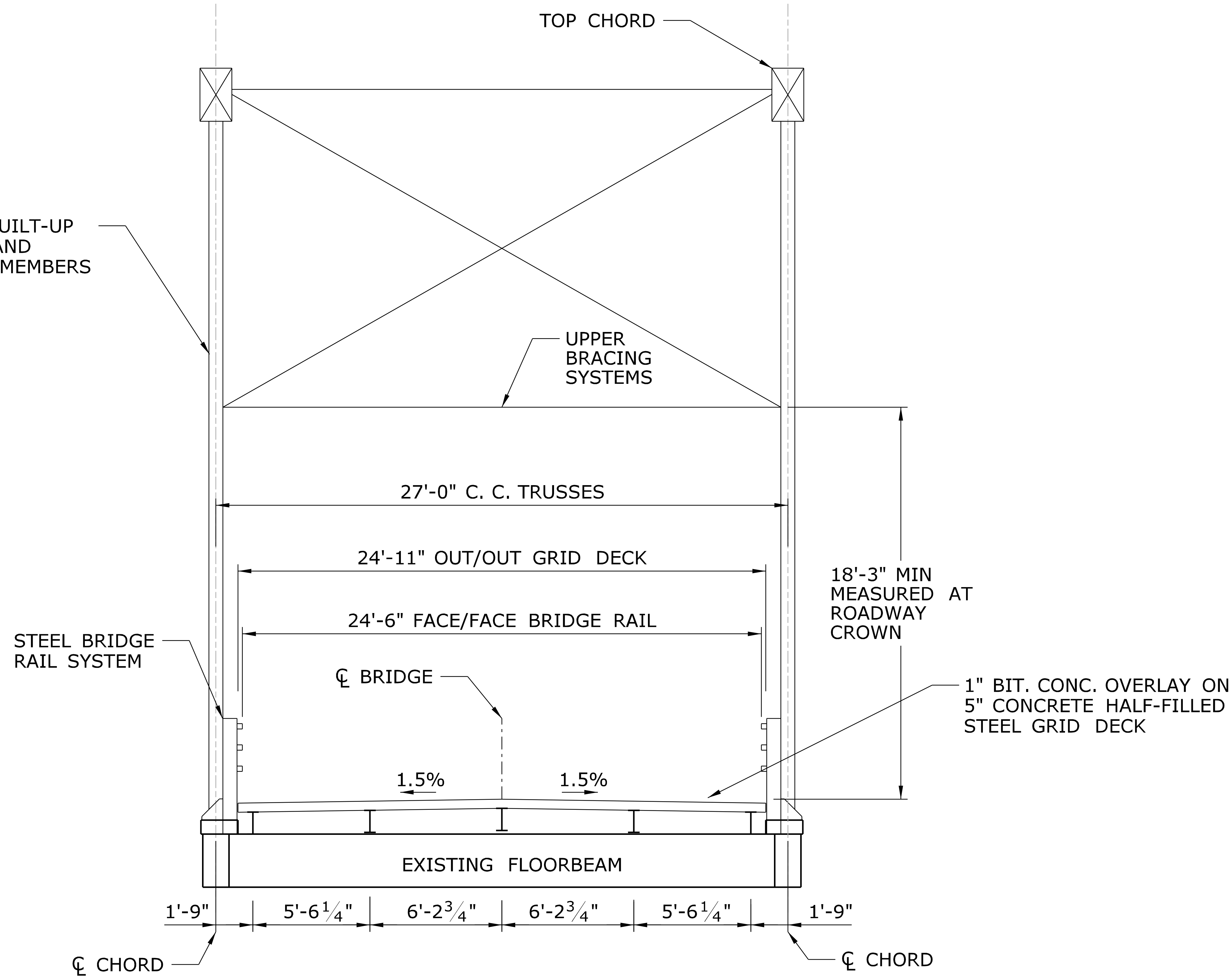
STATE PROJECT NO.: 40-141
DATE: 03/06/2015
SHEET NO.: 1 OF 4



TYPICAL CROSS SECTION
DECK TRUSS

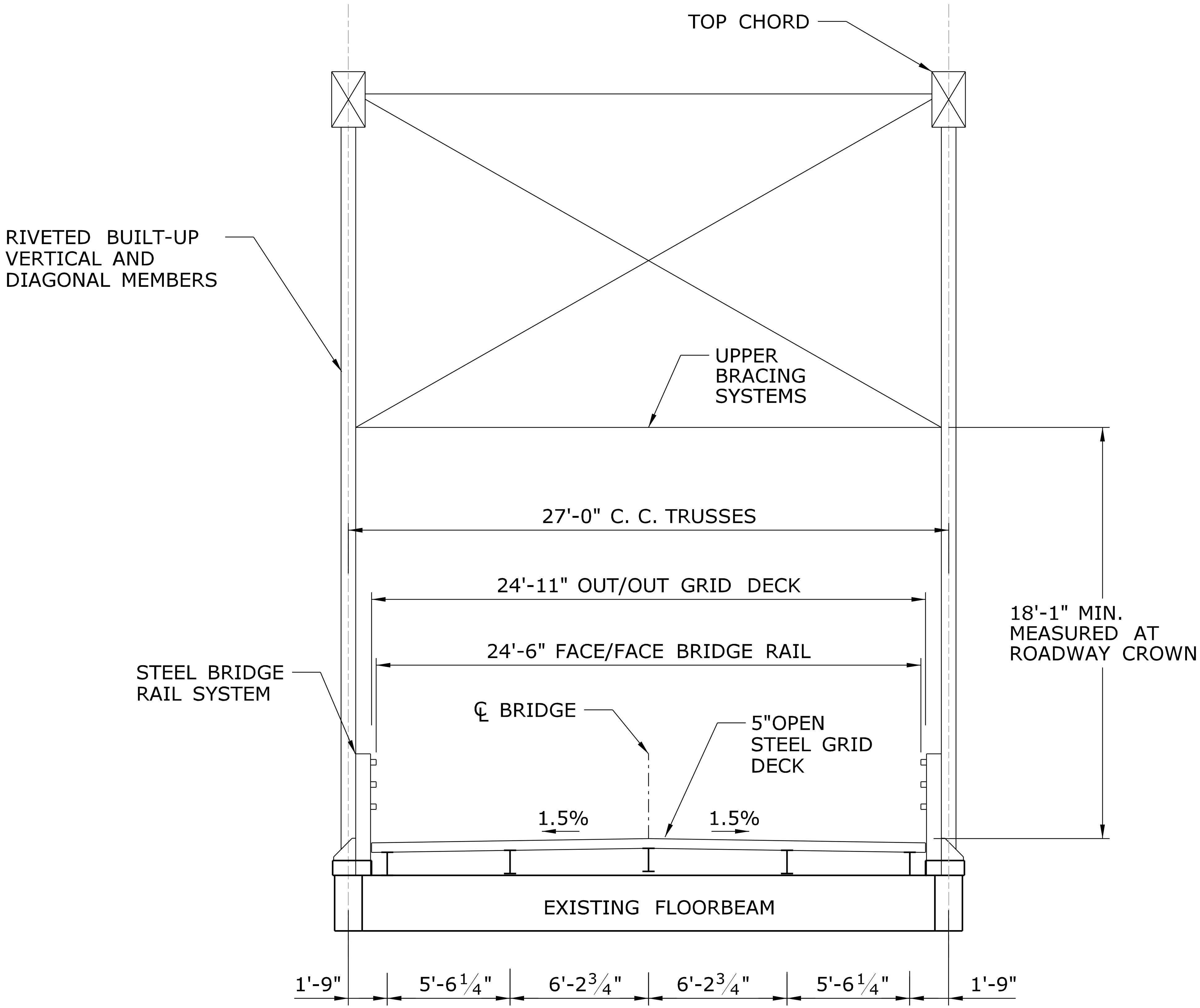
STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION			DRAWING TITLE: **SPAN 1 EXISTING SECTION**	STATE PROJECT NO.: 40-141
				DATE: 03/06/2015
CITY/TOWN: EAST HADDAM/HADDAM	BRIDGE NO.: 01138	SCALE: $\frac{3}{16}$"=1'-0"		SHEET NO.: 2 OF 4

CME Associates, Inc.
CONSULTING ENGINEERS & ENVIRONMENTAL PLANNERS
333 E. RIVER DR. SUITE 400
EAST HARTFORD, CT 06108



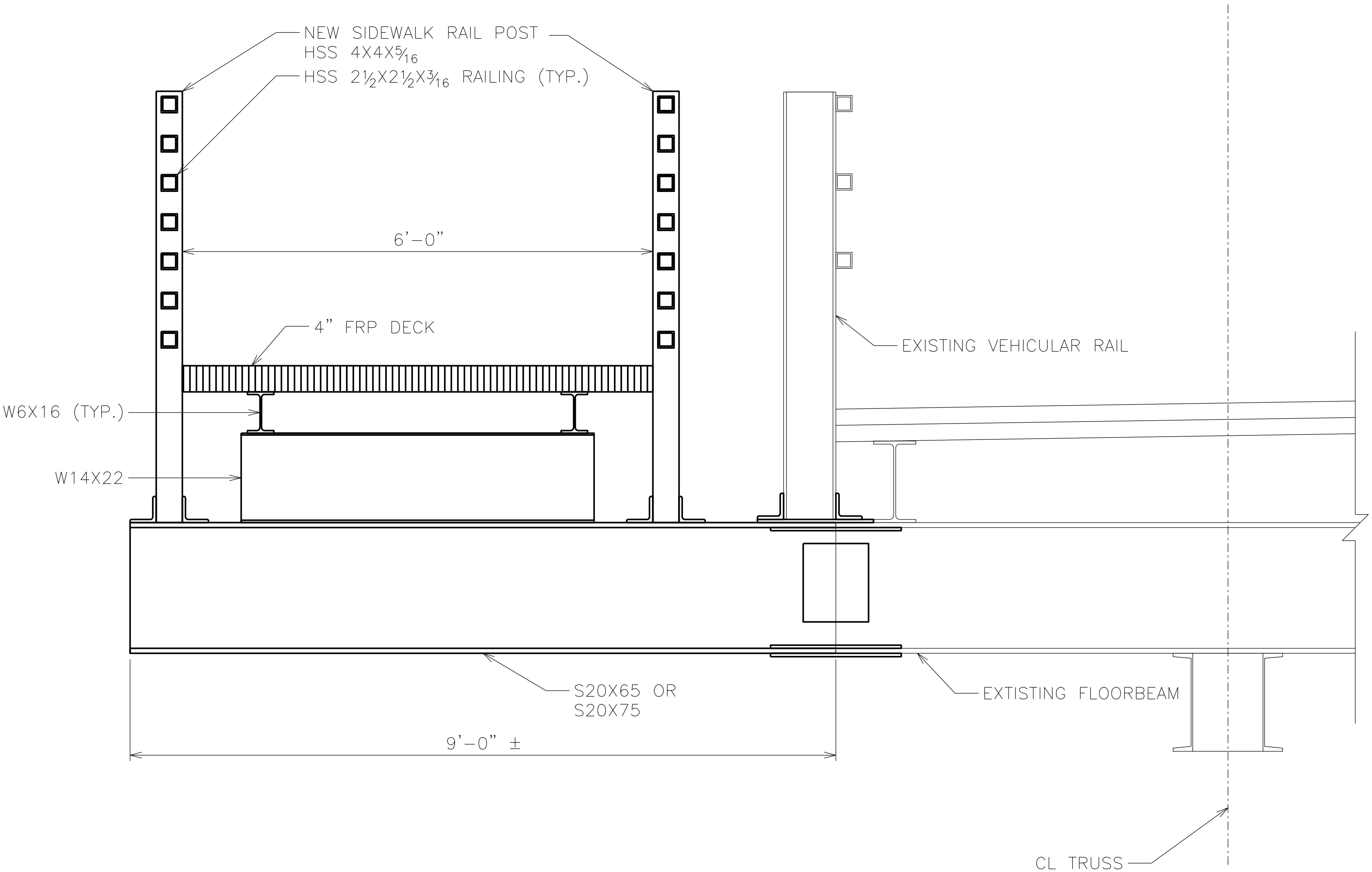
TYPICAL CROSS SECTION - THROUGH TRUSS

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION			CME Associates, Inc. CONSULTING ENGINEERS & ENVIRONMENTAL PLANNERS 333 E. RIVER DR., SUITE 400 EAST HARTFORD, CT 06108	DRAWING TITLE: SPAN 2 EXISTING SECTION	STATE PROJECT NO.: 40-141
					DATE: 03/06/2015
CITY/TOWN: EAST HADDAM/HADDAM	BRIDGE NO.: 01138	SCALE: 3/16 "=1'-0"			SHEET NO.: 3 OF 4

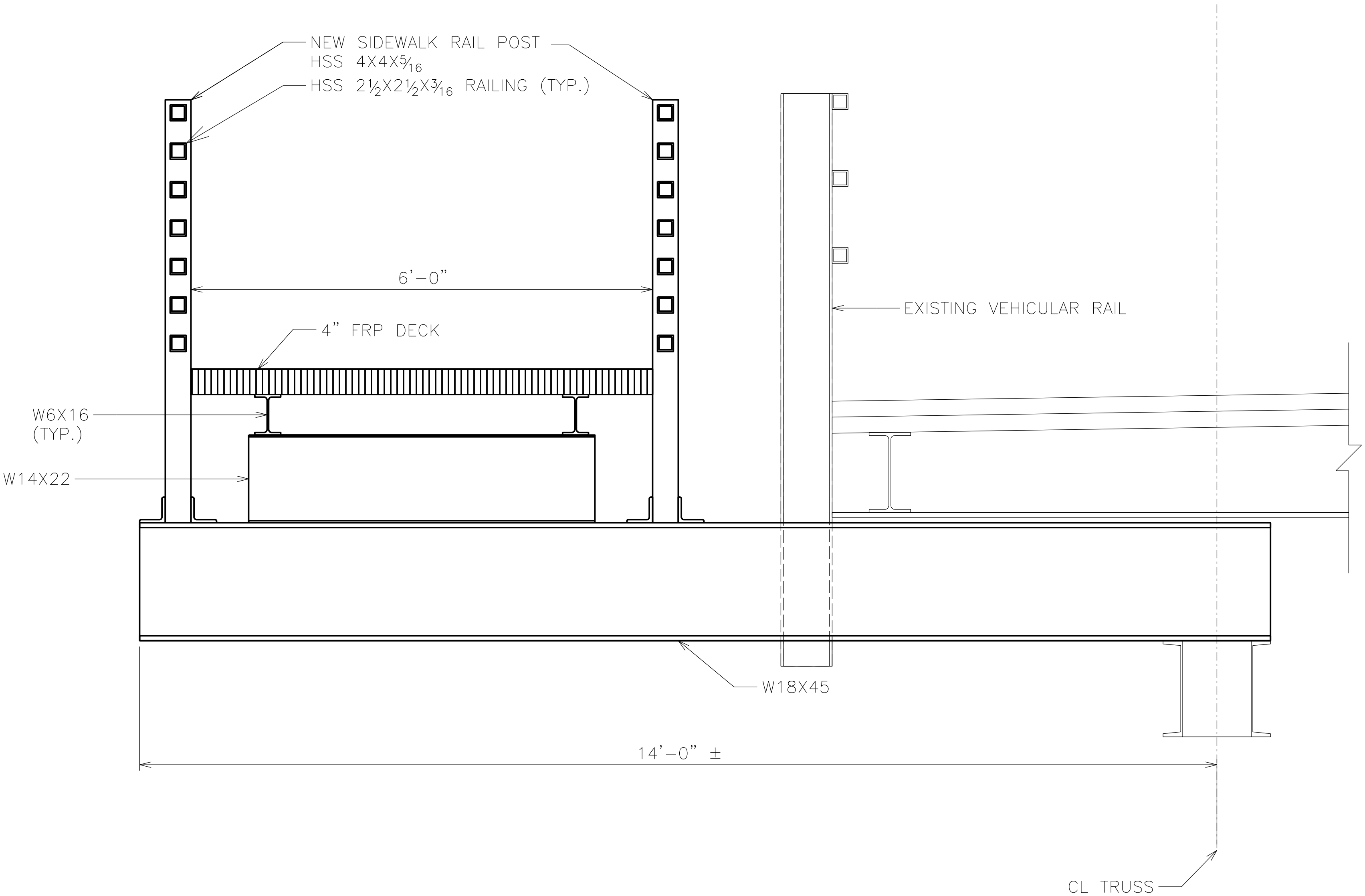


TYPICAL CROSS SECTION - SWING TRUSS

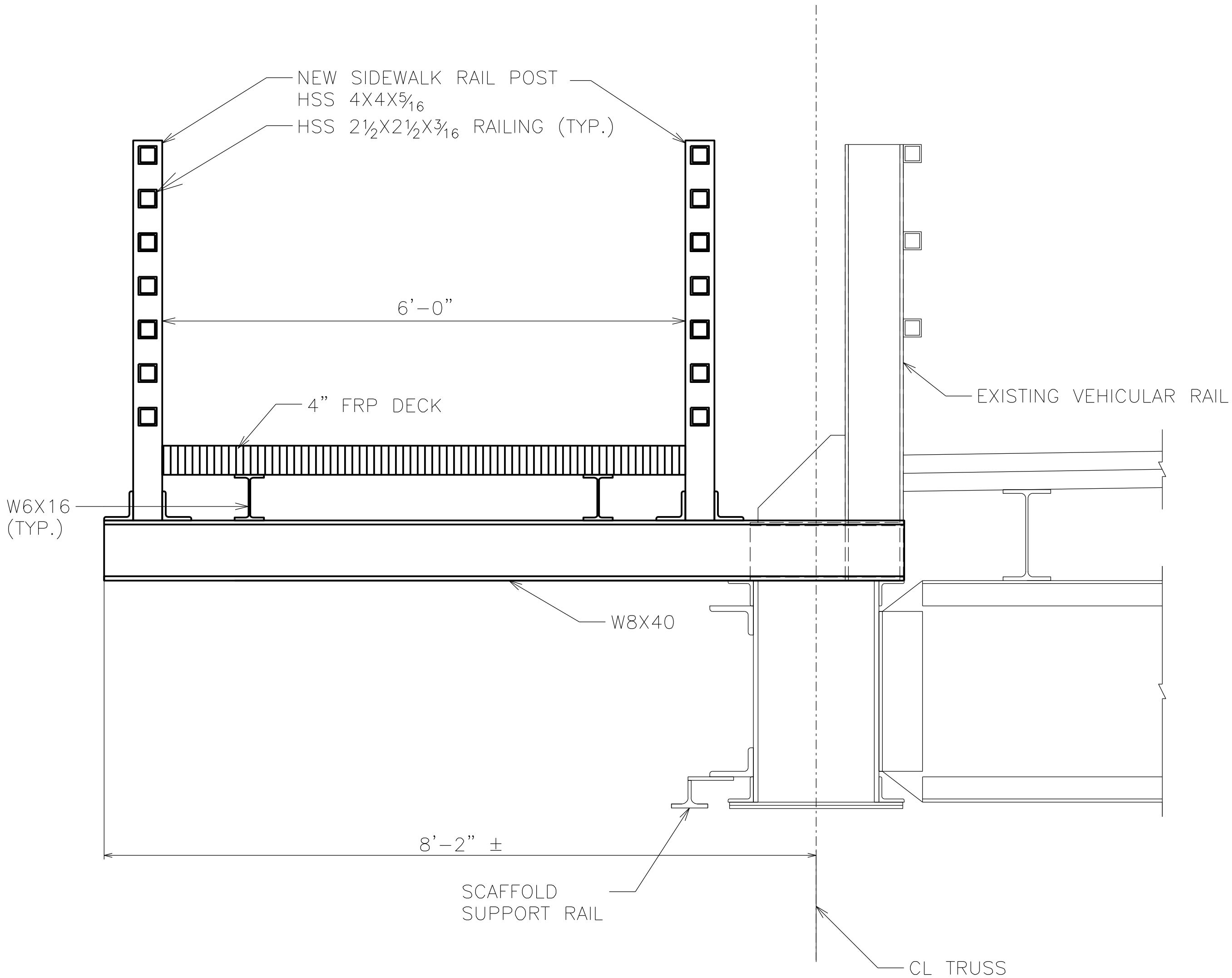
STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION			CME Associates, Inc. CONSULTING ENGINEERS & ENVIRONMENTAL PLANNERS	DRAWING TITLE: SPAN 3 AND 4 EXISTING SECTION	STATE PROJECT NO.: 40-141 DATE: 03/06/2015 SHEET NO.: 4 OF 4
CITY/TOWN: EAST HADDAM/HADDAM	BRIDGE NO.: 01138	SCALE: 3/16 "=1'-0"			



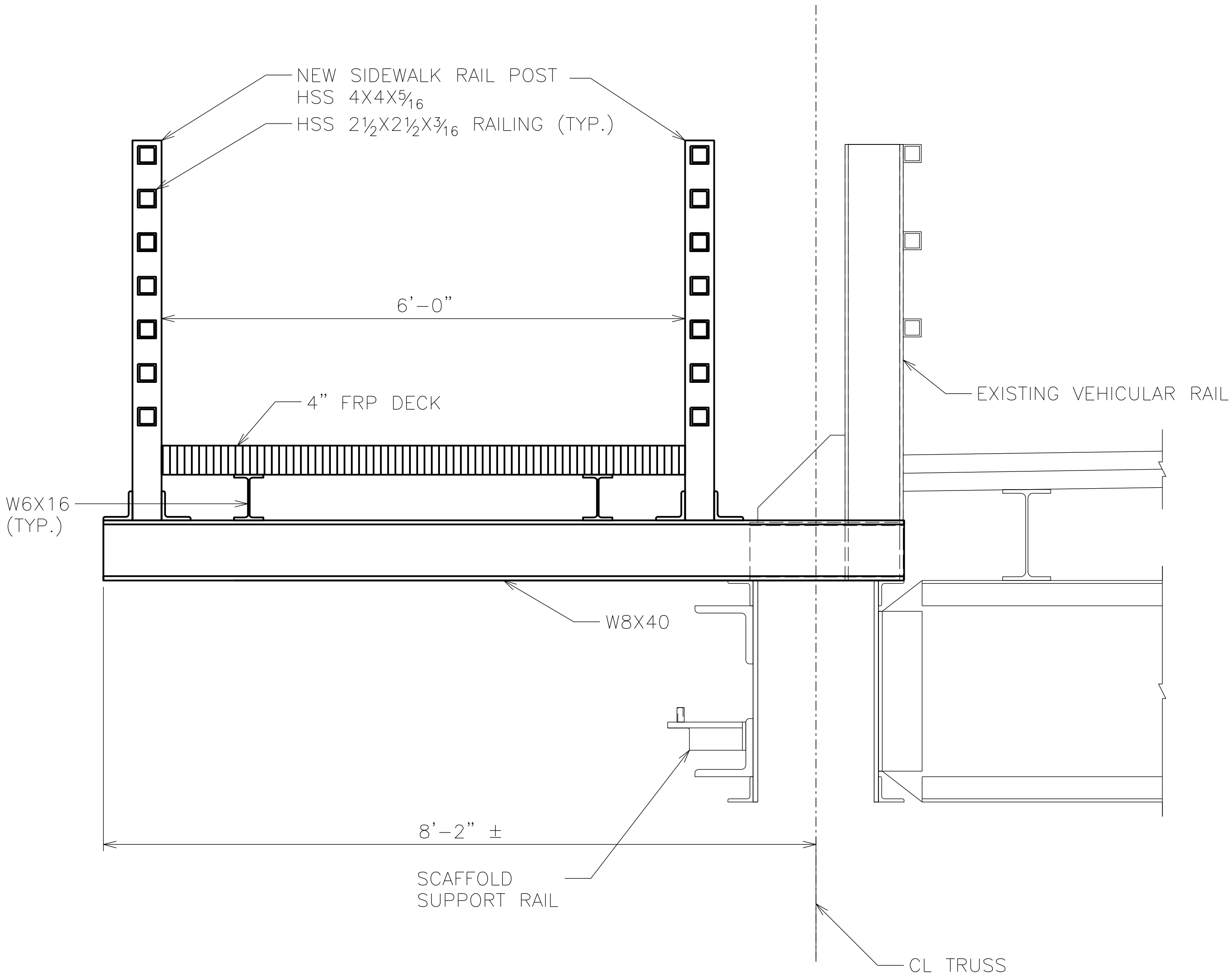
DECK TRUSS SPLICE OPTION Figure 1	Drawn By LN HELDERMAN Checked By KZ SMITH	Project # 2887.04 East Haddam Bridge Br. No. 01138	Hardesty &Hanover



DECK TRUSS CANTILEVER OPTION Figure 2	Drawn By LN HELDERMAN Checked By KZ SMITH	Project # 2887.04 East Haddam Bridge Br. No. 01138	Hardesty &Hanover

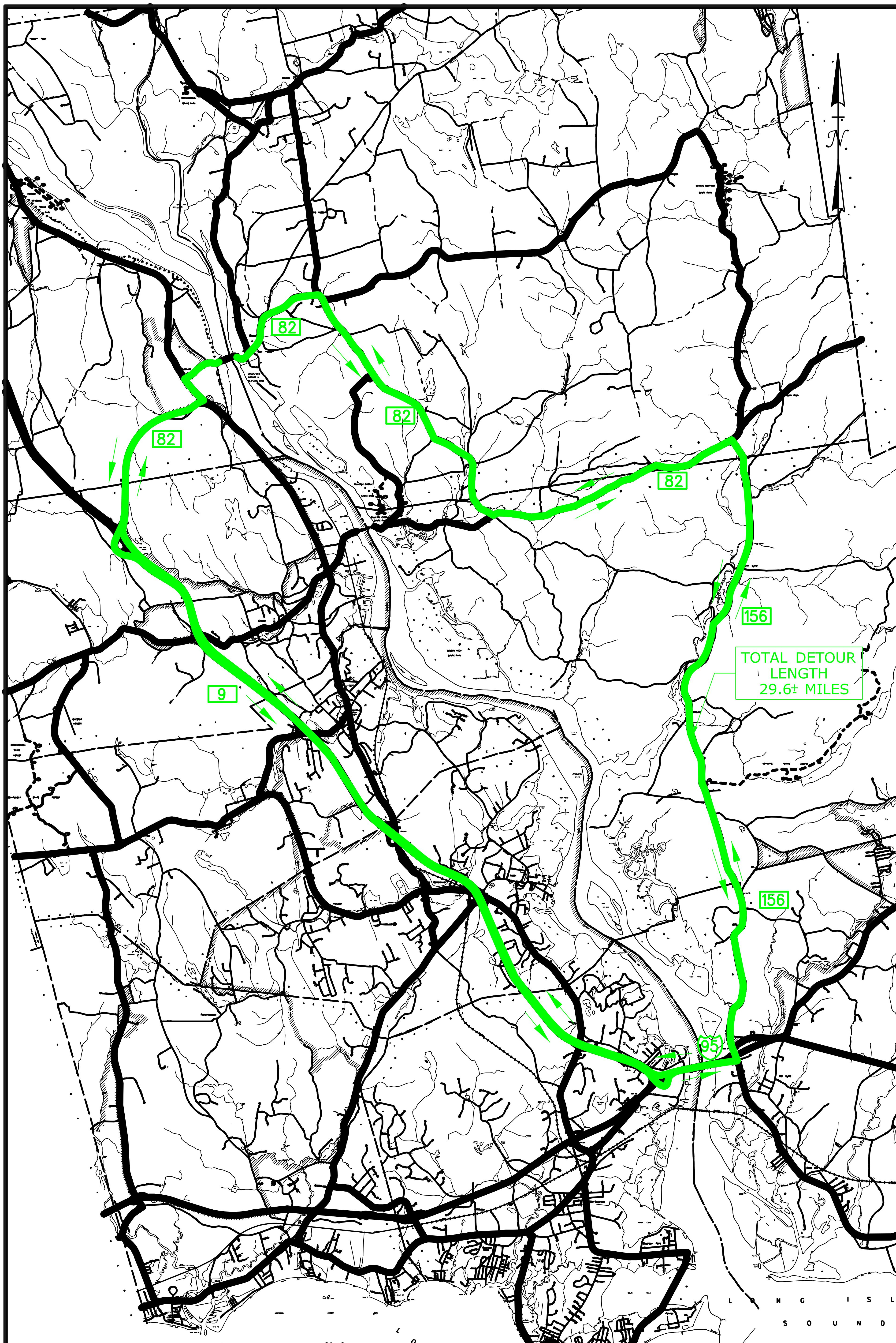


FIXED THROUGH TRUSS Figure 3	Drawn By LN HELDERMAN Checked By KZ SMITH	Project # 2887.04 East Haddam Bridge Br. No. 01138	Hardesty &Hanover

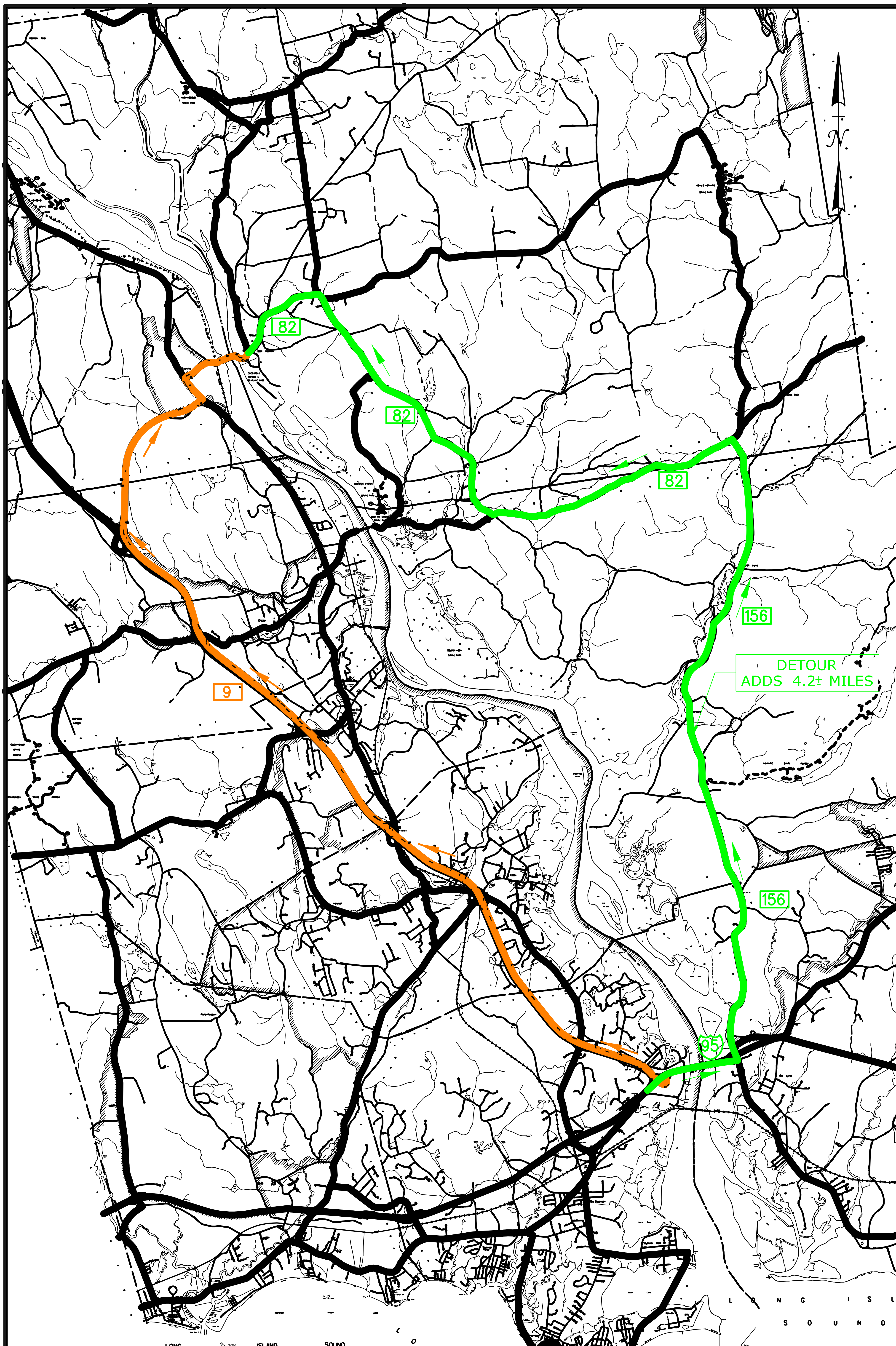


SWING TRUSS Figure 4	Drawn By LN HELDERMAN Checked By KZ SMITH	Project # 2887.04 East Haddam Bridge Br. No. 01138	Hardesty & Hanover

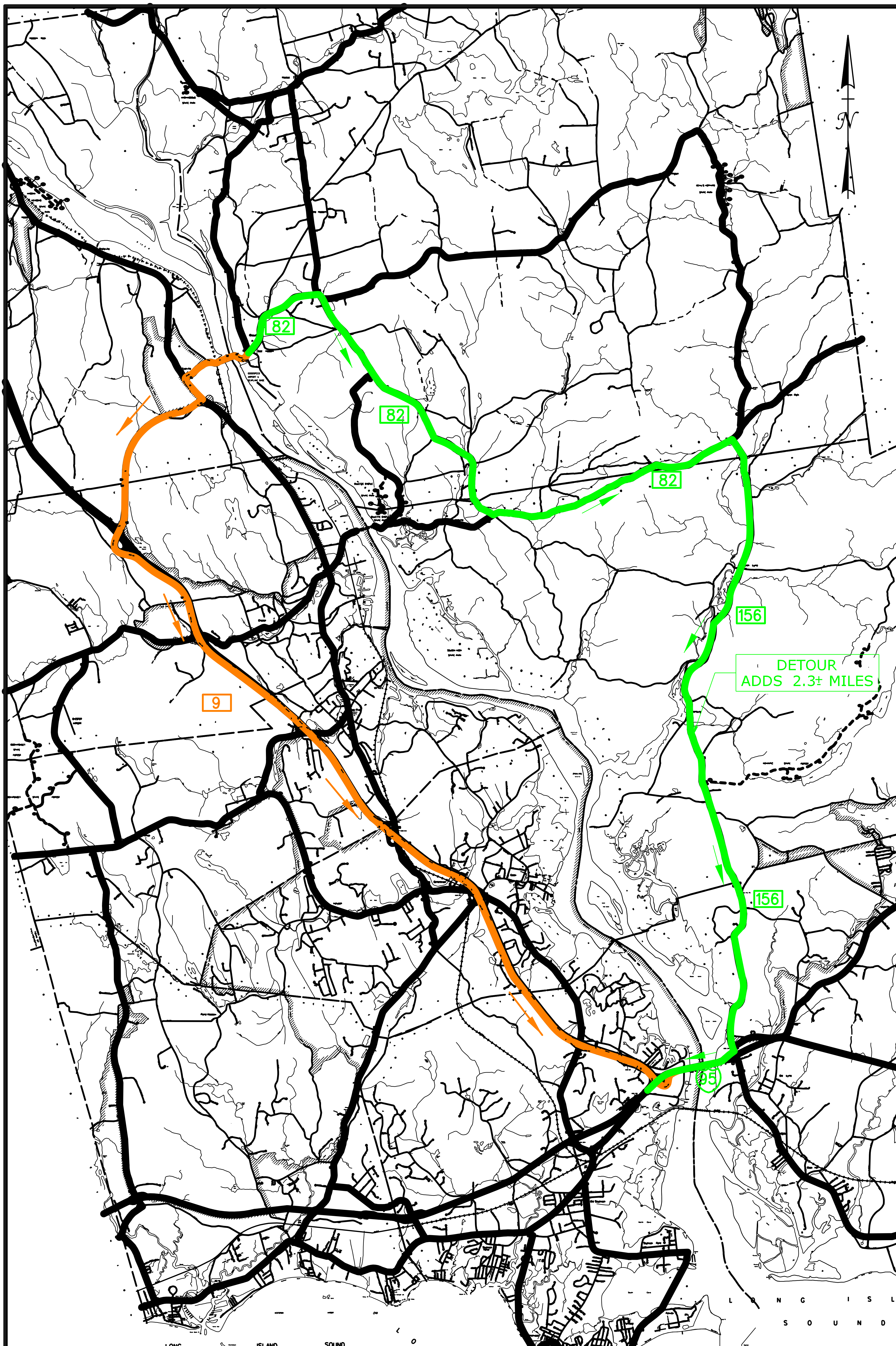
Appendix F: Proposed Regional Detours



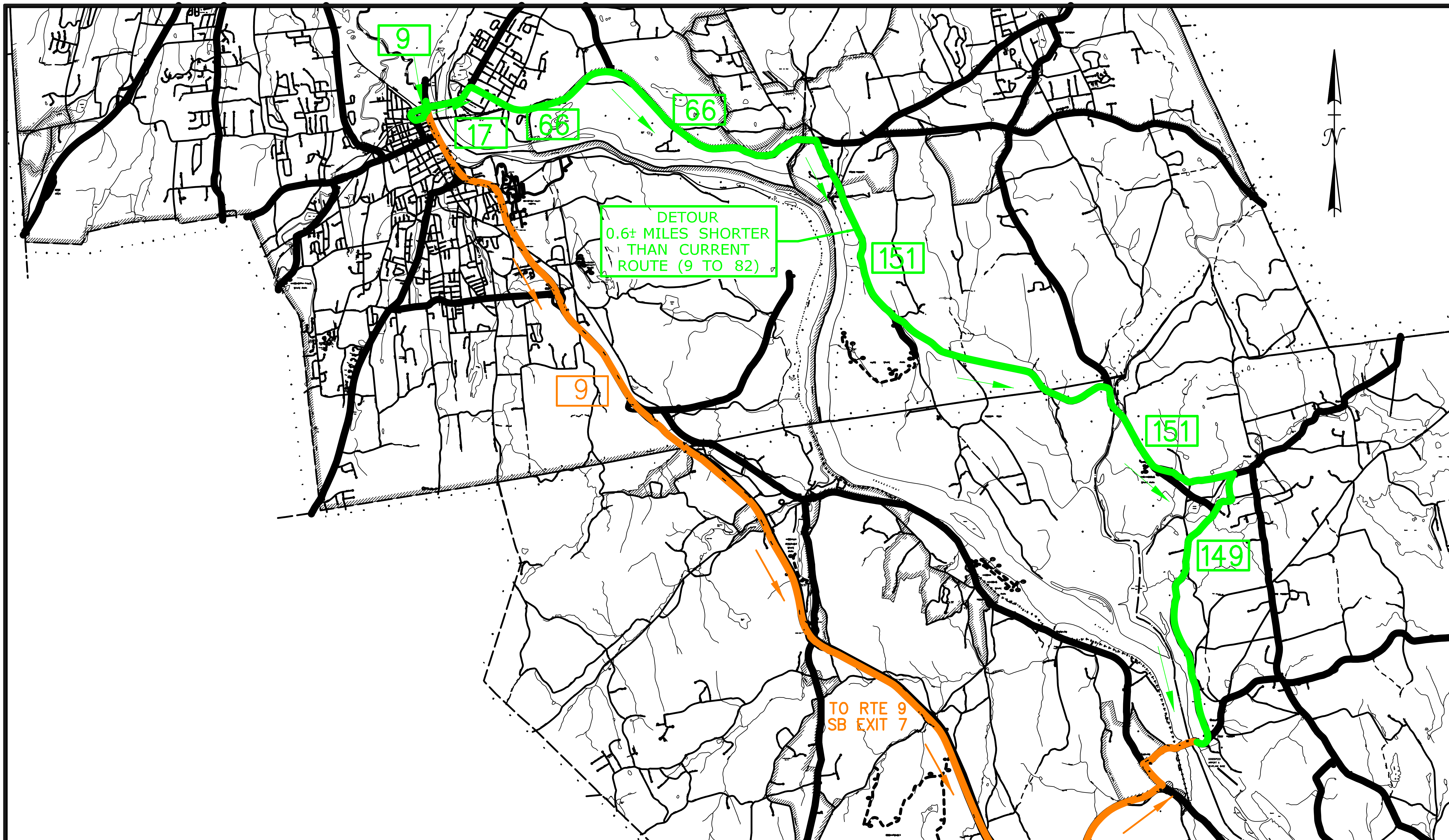
STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION			
CITY/TOWN: CONNECTICUT	BRIDGE NO.: 01138	SCALE: 1" = 6000'	CME ASSOCIATES, INC.
DRAWING TITLE: FULL DETOUR	STATE PROJECT NO.: 40-141	DATE: 04/2017	SHEET NO.: 1 OF 4



STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	CME CME ASSOCIATES, INC.	DRAWING TITLE: **REGIONAL DETOUR #1** **I-95 NB TO** **EAST HADDAM**	STATE PROJECT NO.: 40-141 DATE: 04/2017 SHEET NO.: 2 OF 4
CITY/TOWN: CONNECTICUT BRIDGE NO.: 01138 SCALE: 1" = 6000'			



STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	CME CME ASSOCIATES, INC.	DRAWING TITLE: REGIONAL DETOUR #2 EAST HADDAM TO I-95 SB	STATE PROJECT NO.: 40-141 DATE: 04/2017 SHEET NO.: 3 OF 4
CITY/TOWN: CONNECTICUT BRIDGE NO.: 01138 SCALE: 1"=6000'			



STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	CME ASSOCIATES, INC.	DRAWING TITLE: **REGIONAL DEOUR #3 ROUTE 9 SB TO EAST HADDAM**	STATE PROJECT NO.: 40-141
CITY/TOWN: EAST HADDAM	BRIDGE NO.: 01138	SCALE: 1"=6000'	DATE: 04/2017
			SHEET NO.: 4 OF 4

Appendix G: ConnDOT Inspection and Maintenance Reports

Inspection Type: Fracture Critical and Special and Routine

BRIDGE NO. 01138

22280 - EAST HADDAM

ROUTE 82

over

CONNECTICUT RIVER

Fracture Critical and Special and Routine Inspection

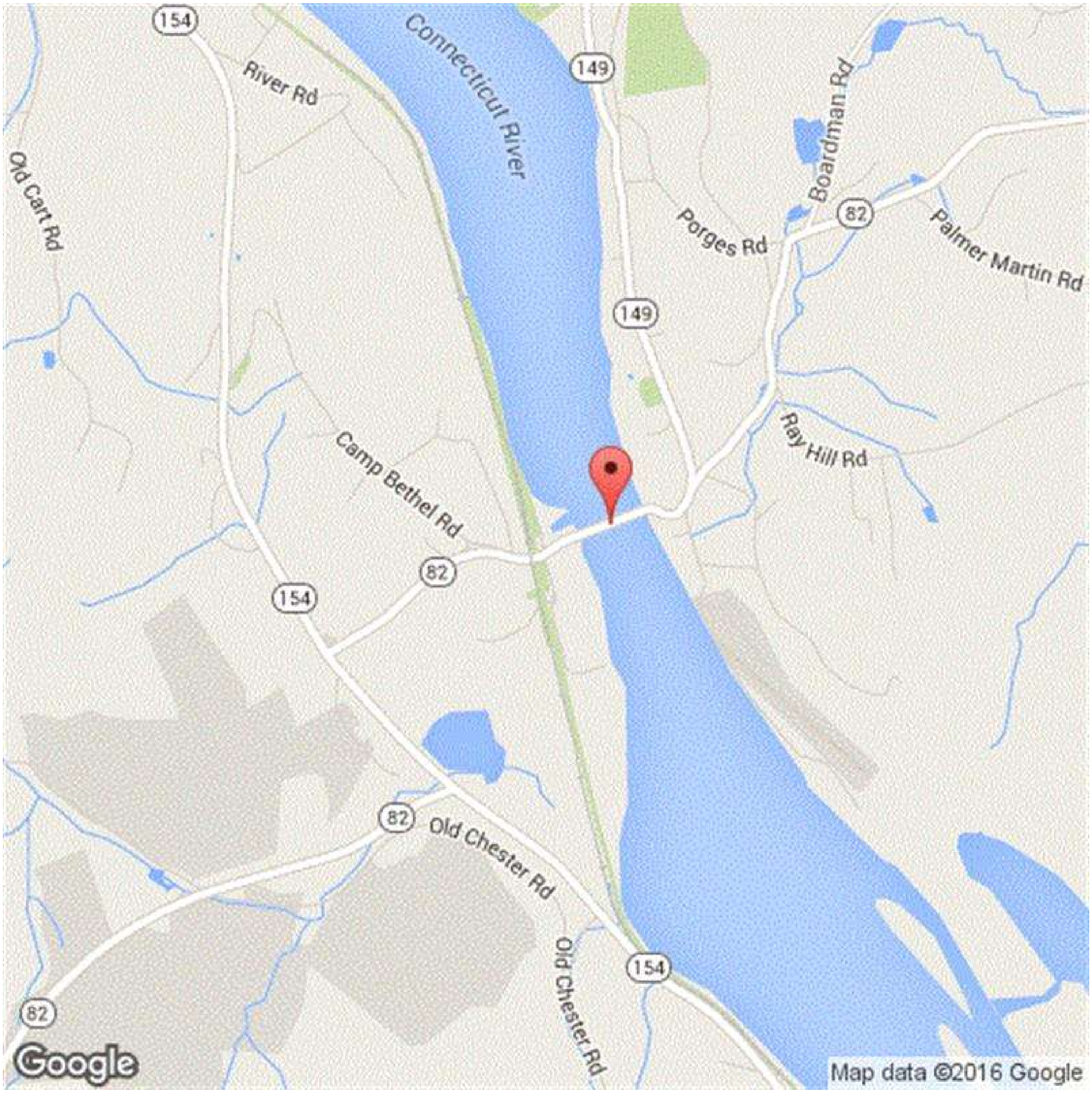
12/14/2015

Inspected by: AI Engineers

TABLE OF CONTENTS

Form: Location
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



Location Map # 1

EXECUTIVE SUMMARY
12-14-2015

Bridge No. 01138 carries Route 82 over Connecticut River in East Haddam, Connecticut. The four span simply supported superstructure consists of a fixed deck truss span (Span 1), a fixed through truss (Span 2), and a moveable through truss swing spans (Spans 3 and 4) with a reinforced concrete deck (concrete filled steel grid for the swing spans) supported by reinforced concrete abutments and piers. The bridge was originally built in 1913 and rehabilitated in 1987, 1999 & 2007. The overall length of the bridge is 885' with a curb-to-curb width of 24.5'. According to a Load Rating on file with the Connecticut Department of Transportation completed in 2011 using the Load Factor Method, the bridge has an AASHTO HS-20 Inventory Rating of 26.1 tons. Since no significant deterioration was noted, a re-evaluation is not required at this time.

A routine, special and fracture critical inspection completed on January 13, 2016 found the bridge to be in poor condition (Rating = 4). The deficiencies found on the bridge are as follows:

Deck

The deck is in fair condition. (Rating =5).

Reinforced concrete deck with S.I.P. forms in spans 1 and 2. Open steel grid with concrete filled section and S.I.P. forms in spans 3 and 4 near the piers and east abutment.

- In span 3 (west half) and span 4 (east half), between floorbeams 1 and 2 the stay-in-place forms exhibit severe rust and rusted through holes up to 5' long x 6" wide exposing the deck that exhibits spalls up to 2" deep. There are isolated areas of moderate to severe corrosion with approximately 1/16" deep section loss in the stay-in-place forms under the operator's house.

Approaches

The approaches are in satisfactory condition. (Rating =6).

Superstructure

The superstructure is in poor condition. (Rating =4).

- Deck Truss in span 1 - The truss members exhibits numerous areas of pitting/section loss up to 5/16" deep throughout. Random batten plates exhibit section loss up to 1/4" deep and perforations up to 2" long x 5.5" wide (top chord near U2 in south truss). The gusset plates at the top panel points typically exhibit areas of pack rust up to 1" deep and there is a 6" diameter perforation in the gusset plate at panel point U3 in south truss. The bottom chords and diagonal members exhibit loss of width up to 3-3/4" on the back-to-back angles (average loss up to 2.5" wide) with section losses up to 1/8" deep on the remaining areas of the horizontal legs. The worst case section losses were found in the bottom (tension) chords between panel points L7 & L9 in the south truss (53% section loss) and in the north truss (23.5% section loss).
- Fixed Through Truss in span 2 - The top chord and bracing members of the truss exhibit painted over pitting loss up to 1/4" deep. The back-to-back angles in the diagonal members

on both trusses exhibit areas of pitting/section loss at edges up to 4" long x 1 1/2" wide with up to knife edge remaining and isolated perforations up to 2" diameter (typical on vertical back-to-back angles and vertical channel flanges just above the bottom chord). The maximum section loss in the truss vertical members is noted in the east half of the north truss, member U7'-L7' (26.7% section loss). There are random perforations in the vertical gusset plates at the top chord and bracing connections.

- Swing Span Truss in spans 3 and 4 - The vertical and diagonal truss members exhibit random areas of painted over pitting/section loss, primarily along the edges adjacent to the gusset plate connections with maximum noted at member U7'-L7' of south truss in span 4 (21.5% section loss). The bottom chords exhibit isolated areas of knife edging with perforations up to 3" long x 2" wide and loss of width to the bottom flange angles in the machinery pit. The bottom chords of the north truss between floorbeams 21 and 22 in span 4 and south truss between floorbeams 20 and 21 in span 3 exhibit painted over section loss up to 7.8% (no change). There are areas of section loss up to 6" long x 6" wide x 1/4" deep to the bottom chord webs at bearing areas in the machinery pit.
- Random eye bars exhibit painted over pitting/section loss up to 1" wide x full-perimeter x 5/16" deep at the end, primarily adjacent to their connections at the top and the bottom chords. The tension diagonal eyebars exhibit section loss of up to 17.6% for one (1) bar and up to 12.9% of the total cross sectional area including the retrofit eyebars (north truss, span 3). There are random nuts in the pin connections with gaps up to 5/16" between the nut and connection plate (nuts are tight in connection).

Substructure

The substructure is in fair condition. (Rating =5).

- The concrete abutment stems exhibit areas of light scaling throughout with an isolated area of punky concrete with a 5' x 3' x 3" deep spall on top of east abutment bridge seat.

Channel and Channel Protection

Per the 2013 underwater inspection report, the channel is in satisfactory condition. (Rating =6).

See Underwater Inspection Dated 11/13/13.

STATE OF CONNECTICUT
ASLAM H. SIDDIQUI
22856
LICENSED
PROFESSIONAL ENGINEER

P.E. Signature: ____________

Date: 2/12/16

STRUCTURE INVENTORY & APPRAISAL

INSPECTION

Structurally Deficient Y **Functionally Obsolete** N
Sufficiency Rating 25.7
(90) Inspection Date 12/14/2015 **(91) Frequency** 24
Indepth Insp No **Proposed next Indepth Year**
Deck Survey Date **Class** 03
Access 99 - Other (specify in comments of BRI-19) **Flagman** 0

	Frequency	Date	Type
Fracture	24	12/14/2015	G Truss Systems, riveted trusses
Underwater	24		
Special	24	12/14/2015	F Crack Growth

IDENTIFICATION

Bridge Name: EAST HADDAM SWING BRIDGE
Town Code - Name: 22280 - EAST HADDAM
(5) Inventory Route
(A) Record Type: 1: Route carried "on" the structure
(B) Signing Prefix: 3 - STATE HIGHWAY
(C) Level of Service: 1 - MAINLINE
(D) Route Number.: 00082
(E) Dir Suffix: 0 - NOT APPLICABLE
(6A) Featured Intersected: CONNECTICUT RIVER
(6B) Critical Facility Indicator:
(7) Facility Carried: ROUTE 82
(9) Location: 0.1 MILE WEST OF RTE. 149
(11) Mile Post: 3.7 Miles
(16) Latitude: 41 Deg. 27 Min. 6.05 Sec.
(17) Longitude: 72 Deg. 27 Min. 51.79 Sec.
(98) Border Bridge
(A) State Code: (B) Percent Responsibility: %
(C) Border Town Name:
(99) Border Bridge Structure No.:

STRUCTURE TYPE & MATERIALS

(43) Structure Type, Main
A) Material: 3 - Steel
B) Design Type: 17 - Movable - Swing
(44) Structure Type, Approach
A) Material: 3 - Steel
B) Design Type: 09 - Truss - Deck
(45) Number of Spans, Main Unit: 2
(46) Number of Approach Spans: 2
(107) Deck Structure Type: 3 - Open Grating
(108) Wearing Surface/Protection Systems
A) Type of Wearing Surface: 0 - None
B) Type of Membrane: 0 - None
C) Type of Deck Protection: 0 - None
Substructure
A) Material:
B) Design Type:
Paint
Type:
Year:
Comment:

GEOMETRIC DATA

(48) Length of Maximum Span: 461 ft.
(49) Structure Length: 885 ft.
(50) Curb or Sidewalk Widths
A) Left 0 ft. 0 in. B) Right 0 ft. 0 in.
(51) Bridge Roadway Width Curb to Curb: 24 ft. 6 in.
(52) Deck Width, Out to Out: 24 ft. 10 in.
(32) Approach Roadway Width: 29 ft.

Form: BRI-19, Rev. 2/15
Inspection type: Fracture Critical,Special,Routine
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Bridge No: 01138

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

(33) Bridge Median	0 - No median
Deck Area	22037 sq. ft.
(34) Skew Angle	0 deg.
(35) Structure Flared	0 - No flare
(10) Inv. Rte. Min. Vert. Clearance	17 ft. 9 in.
(47) Inv. Rte. Total Horiz. Clr.	24 ft. 6 in.
Log Inv. Rte. Total Horiz. Clr.	24 ft. 6 in.
RLog Inv. Rte. Total Horiz. Clr.	0 ft. 0 in.
(53) Min. Vert. Clearence Over Bridge	15 ft. 7 in.
(54) Log-Min. Vert. Underclearance	N ref. 0 ft. 0 in.
(55) Min. Lat Underclearance on Right	N ref. 0 ft. 0 in.
(56) Min. Lat Underclearance on Left	0 ft. 0 in.

AGE AND SERVICE

Year Built	1913
(106) Year Reconstructed	1999
(42) Type of Service	
A) On	1 - Highway
B) Under	5 - Waterway
(28) Number of Lanes	
A) On	02
B) Under	00
(29) Average Daily Traffic	11300
Is Above Half ADT?	No
(109) Precent Truck	4 %
(30) Years of ADT	2014
(19) Bypass, Detour Length	40 Miles

CONDITION

(58) Deck	5
(59) Superstructure	4
(60) Substructure	5
(61) Channel & Channel Protections	6
(62) Culverts	N
(36) Traffic Safety Features	
A) Bridge Railings	0
B) Transitions	0
C) Approach Guardrail	0
D) Approach Guardrail Ends	0

APPRAISALS

(67) Structural Evaluation	4
(68) Deck Geometry	2
(69) Underclearances, Vert. & Horiz.	N
(71) Waterway Adequacy	8
(72) Approach Roadway Alignment	3
(113) Scour Critical	3

COMMENTS

Superstructure painted under Project 60-150 in 2007.
BMM NO. 12-499 dated 09/04/12 should address poor rating. (05/22/14 - AG).
Item 48 = 461 ft (Do Not Change): Swing span measured wingtip to wingtip. (KMR per RCVA 10/6/13). Third largest swing span in North America.

Consider removing the special inspection for crack growth as the cracks have been repaired since the last inspection.

WATERWAY

Drainage Basin Waterway	4000 - Connecticut River
(38) Navigation Control	1 - Navigation control on waterway (bridge permit required)
(39) Navigation Vertical Clearance	25 ft.
(40) Navigation Horiz. Clr.	160 ft.

CLASSIFICATION

(112) NBIS Bridge Length	Yes
(104) Highway System	0 - Structure/Route is NOT on NHS
(26) Functional Class	06 - Rural - Minor Arterial
(100) Defense Highway	0 - Not a STRAHNET route

(111) Pier/Abutment Navigation	4 - In place but reevaluation of design suggested	(101) Parallel Structure	N - No parallel structure
(116) Vert-Lift Brg Nav Min	ft. In.	(102) Direction of Traffic	2 - 2-way traffic

(103) Temporary Structure	
(110) Designated National Network	0 - Inventory route not on network
(20) Toll	3 - On Free Road
(21) Maintain	01 - State Highway Agency
(22) Owner	01 - State Highway Agency
Report Class	S - STATE
(37) Historical Significance	1 - On National Register

POSTED SIGNS

Other Posted Sign 1	1 - Speed limit lower than the Inventory route
Other Posted Sign 2	8 - Other warning signs

	Actual	Recomended	
Posted Load Single Unit Truck			tons
Posted Load Semi-Trailer Truck			tons
Posted Load 4 Axle Truck			tons
Posted Load 3S2 Truck			tons
All Vehicles			tons
Posted Vert. Clearance on Bridge	ft.	in.	
Posted Vert. Underclearance	ft.	in.	
Posted Speed Limit on Bridge	25 m.p.h.		

OTHER FEATURES

Fence Required	No
Fence Present	No
Fence Type	
Fence Height	
Fence Material	
Fence Top Type	
Barrel Ladders	Yes
Stand Pipes	No
Catwalks	No
Moveable Inspection System	No
Haunches Present over Roadway	NO

PROPOSED IMPROVEMENTS

(75A) Type of Work Proposed	
(75B) Work Done By	
(76) Length of Structure Improvement	ft.
(94) Bridge Improvement Cost	$
(95) Roadway Improvement Cost	$
(96) Total Project Cost	$
(97) Year of Improvement Estimate	
(114) Future ADT	15899
(115) Year of Future ADT	2032
DOT Bridge Program List No	28
Project No	0040-0141
Advertised Date	09/19/2018

LOAD RATING & POSTING

(31) Design Load	5 - HS 20
(63) Operating Rating Type	1 - Load Factor (LF)
(64) Operating Rating	43.4
(65) Inventory Rating Type	1 - Load Factor (LF)
(66) Inventory Rating	26.1
Evaluation Code	L - Load Factor
Year of Evaluation	2011
(70) Bridge Posting	5 - Equal to or above legal loads
(41) Structure Status	A - Open

Utilities	0 | Other
	3 | Electric

INSPECTOR'S SIGNATURES:

1) S. Pawan Gill Date: 01/29/2016

2) Ydnpprasad Date: 01/29/2016

3) Date: 01/29/2016

4) Date: 01/29/2016

P.E. SIGNATURE: Date: 02/18/2016

P.E. # 22856

Reviewed By: Date: 03/02/2016

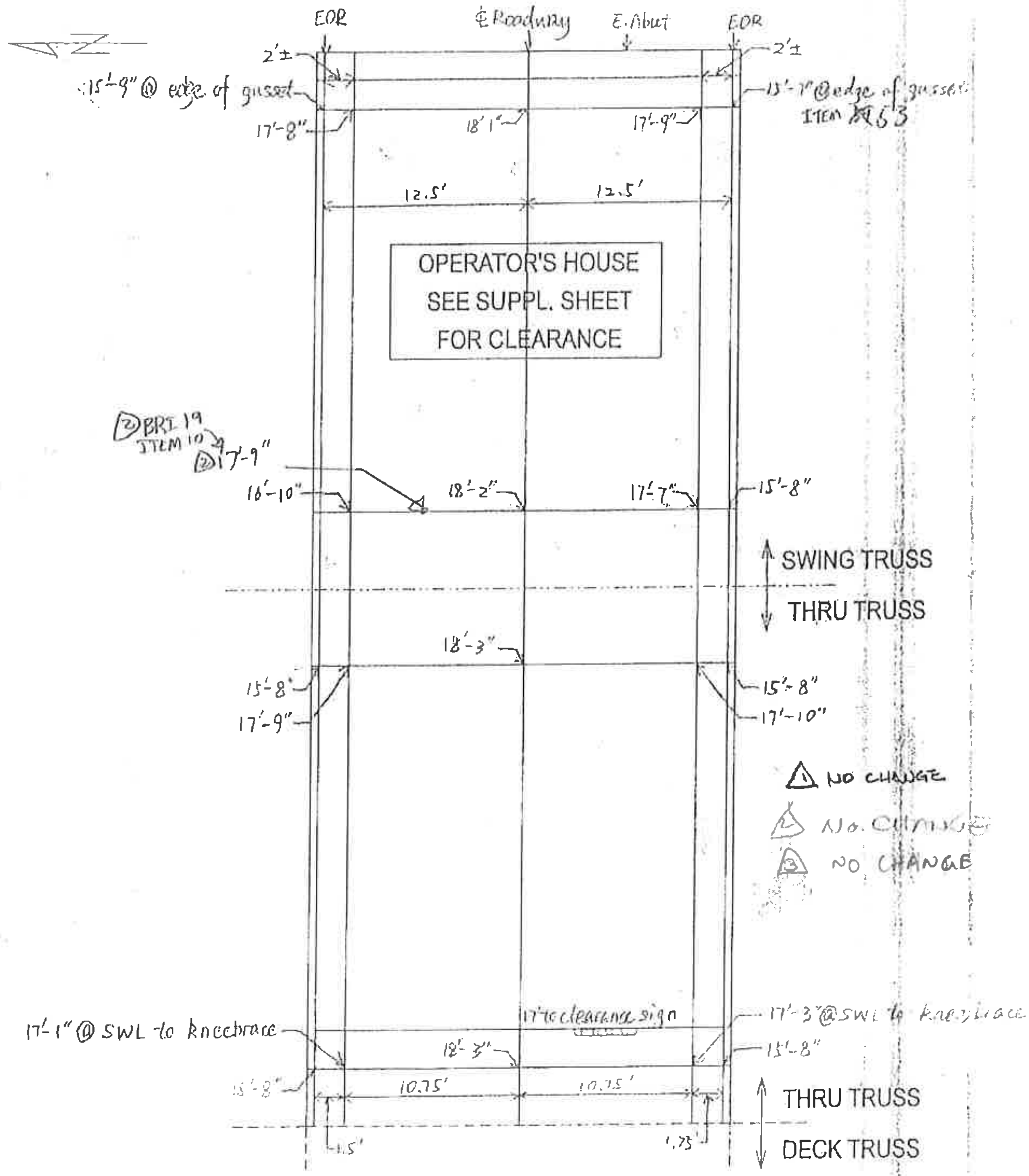
(1)

Baker

~~6~~/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: [illegible]
] FIELD ORIGINAL ☑ TRANSCRIBED BY: RL	CREW: MJC, JAC	SHEET ~~30/162~~ 25/231

DESCRIPTION: VERTICAL CLEARANCE



GENERAL NOTES:

- All clearances were taken w/ ~~level~~ clearance rod
- All E.O.R. clearances are to the edge of the portal lower ℞.

UPDATE NO.	DATE	COMPANY	CREW
1	12/13/11	PAI	TJP/RDM/MDS
2	2/17/14	AI	[illegible]
3	12/14/15	AI ENG	MRS, PS, ZRI, EJC
4			

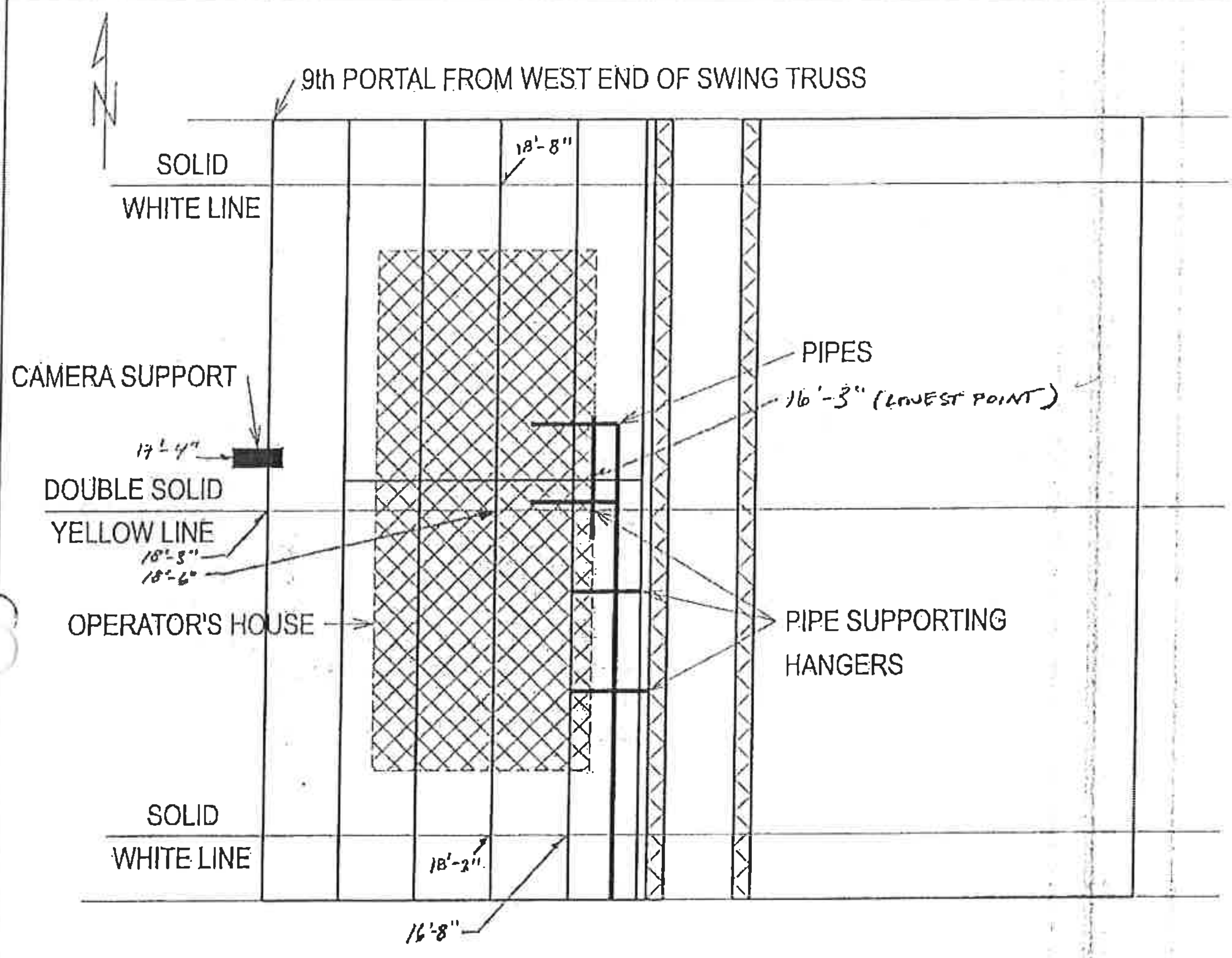
Baker

7/156

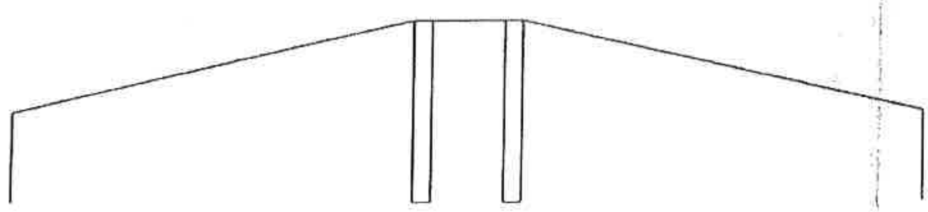
SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 12/10/09
FIELD ORIGINAL ☑ TRANSCRIBED BY: JAC	CREW: MJO, JAC	SHEET ~~2~~ ~~1 of 2~~

DESCRIPTION: VERTICAL CLEARANCES @ OPERATOR'S HOUSE

21 ~~26~~/231



PLAN



ELEVATION

2 NO CHANGE
3 NO CHANGE

UPDATE NO.	DATE	COMPANY	CREW
1	12/13/11	PAI	DP/RDM/MJS
2	2/17/14	AI	TRI/JD/DAC
3	12/14/15	AI ENG	MRS, PS, ZRI, EJC

FIELD INSPECTION REPORT

Location:	0.1 MILE WEST OF RTE. 149	Year Built:	1913	Snooper Required:	☐
Main Material:	3 - Steel	Year Rebuilt	1999	Snooper Used:	☐
Main Design:	17 - Movable - Swing				

Inspectors:

Lead Inspector: Pavan Seemakurty

Inspector:	Task:
Afzal, Hassan	BSE - Inspector
AI, BSE	BSE - Inspector
Aziz, Ali	BSE - Inspector
Cote, Ethan	BSE - Inspector
Elmakky, Hesham	BSE - Inspector
Ismail, Ziad	BSE - Inspector
Salehi, Mohammad	BSE - Inspector
Seemakurty, Pavan	BSE - Inspector
Yenuga, Durga	BSE - Inspector

Visits:

Visit Date:	Temp:	Start Time:	End Time:
12/14/2015	56	08:30 AM	02:30 PM
12/15/2015	59	08:30 AM	03:30 PM
12/16/2015	45	08:30 AM	03:00 PM
12/17/2015	45	08:30 AM	03:00 PM
12/18/2015	48	08:30 AM	03:00 PM
12/21/2015	53	08:30 AM	03:00 PM
12/22/2015	58	08:30 AM	03:00 PM
12/23/2015	50	08:30 AM	03:00 PM
12/24/2015	60	08:30 AM	02:30 PM
12/28/2015	38	08:30 AM	03:00 PM
01/12/2016	33	08:00 AM	03:30 PM
01/13/2016	40	08:30 AM	03:30 PM

58. DECK:

Reinforced concrete deck with stay-in-place (S.I.P.) forms and bituminous concrete overlay in spans 1 and 2, open steel grid in spans 3 and 4 with concrete filled sections and S.I.P. forms near the piers and east abutment.

The deck is in fair condition.

Overall Rating: 5

Rating

Overlay: 6

The bituminous concrete overlay in spans 1 and 2 of the fixed truss spans exhibit longitudinal and map cracks open up to 1/4" wide, mostly in the eastbound lane and random bituminous patches. See photos 5 and 6. The previously mentioned potholes have been patched since the last inspection. There is an isolated 3" diameter x 1" deep pothole with exposed steel grate in span 1. See photo 7.

There is an open steel grid deck in spans 3 and 4 for the movable swing span with concrete filled sections near the piers and east abutment. See photos 8 and 9. The open steel grid deck exhibits random minor surface rust. The concrete filled sections exhibit areas of light scaling throughout. The previously mentioned spalls and scaling areas in the concrete filled sections have been repaired since the last inspection.

See field notes sheets 5, 6 and 7.

Deck - Str. Condition: 5

Stay-in-place forms are present at the underside of deck truss and fixed through-truss spans (spans 1 and 2) with minor to moderate rust. The west half of span 1 has areas of active leakage at SIP with areas of heavy rust between U0 and U4. See photo 13. There are isolated areas where the stay-in-place forms have painted over section/pitting loss and rusted through holes up to 3" diameter, mostly between floorbeams L3A' and L1' in span 2. In span 2, south truss at floorbeam L8A', there is a 2' diameter rusted out area of SIP with 1" deep spall with exposed rebar in the exposed concrete deck. See photo 14.

In span 3, at the west half between floorbeams 1 & 2 and 20 & 21, the stay-in-place forms exhibit severe rust with up to 3' long x 6" wide rusted through holes and leakage through the exposed deck that exhibits spalls up to 1' x 6" x 1" deep with and without exposed rebar. See photo 15. In span 4, at the east half between floorbeams 1 and 2, the stay-in-place forms exhibit rusted through holes up to 5' long x 6" wide, exposing the deck that exhibits spalls up to 2" deep in the soffit. There are isolated areas of moderate to severe corrosion with approximately 1/16" deep section loss in the stay-in-place forms under the operator's house. In spans 3 and 4, the steel grid underside typically exhibits minor rust on stringer connection hardware and minor oxidation of galvanization.

See field notes sheets 25, 26, 31-38, 57-62, 65-68 & 72-78 and photos 10-12.

Curbs:	N	
Median:	N	
Sidewalks:	N	
Parapet:	N	
Railing:	5	The painted steel railings exhibit random areas of moderate rust, isolated scrapes, areas of minor impact damage and random areas of moderate rust on steel brackets. There are bent posts and brackets at random locations in the north railing in spans 2 and 3. See photo 17. At the southeast corner of span 4, there is a steel plate attached to the bridge rail that is deformed and torn, and exhibits broken welds up to 12" long. See photo 18. The previously mentioned sheared off and missing brackets and a tear in the post in spans 2 and 3 have been repaired since the last inspection. See field notes sheets 5, 6 and 7 and photo 16.
Paint:	N	
Fence:	N	
Drains:	7	Rectangular free-fall drains are clear and functional along the curblines with light surface rust. See photo 19.
Lighting Standard:	7	Light fixtures are attached to vertical members of the truss and the lights were not on at the time of inspection. See photo 20. The previously mentioned missing bolts at the base plate of abandoned light poles at the portals in spans 3 and 4 have been added since the last inspection. See field notes sheets 85 and 88. Rating upgraded from '6'.

Overall Utility Condition Rating: 5 - Fair

Utility Type/Size

0 | Other	In span 3, the north truss at the top of panel point U1, there is a conduit separated from the bracket. See photo 21. In span 4 (previously mistaken for span 3), the east portal near the north truss exhibits an abandoned conduit with exposed wires. See photo 22. There is a missing conduit access cover at panel point M9 in north truss of span 3. See photo 23. The previously noted message board with "SLOW" text in span 4 has been removed since the last inspection. See photo 24.
3 | Electric	There are two (2) 4" diameter electric conduits at pier 2 and do not exhibit any notable deficiencies. See photo 113.

Construction Joints: N

Expansion Joint:	6	The joint material for the compression seal joint at the west abutment is depressed for full length x up to 1/2" deep. See photo 25. The previously mentioned settled joint along the eastbound lane was not found during this inspection. The strip seal joint at pier 1 exhibits light to moderate accumulation of sand and debris. See photo 26. The pourable seal joint at mid-span in span 2 exhibits a 20' long x 1/4" wide adhesion failure in the north half of the joint. See photo 27. The swing span open end joints (at pier 2 and the east abutment) exhibit vertical misalignment up to 3/8" high in the closed wedged position. See photo 29. All the joints on the bridge exhibit light to moderate accumulation of sand/debris. There are minor scrapes and scratches in the steel headers throughout. There is evidence of previous leakage noted on the substructure below. See photo 28. See field notes sheets 5, 6 and 7.

Haunches Present over travelway? NO

APPROACH CONDITION:

Bituminous concrete approach pavement.

The approaches are in satisfactory condition.

Overall Rating: 6

Rating

Approach Slab:	N	
Relief Joints:	N	
Approach Guide Rail:	6	The approach metal beam rails exhibit minor scrapes and random bent posts. Metal beam rail end treatments also exhibit collision damage (tipped and twisted posts) at both approaches of the bridge. The guiderail is not attached to the bridge at either the east or west approaches. See photos 30 and 31. See field notes sheets 5, 6 and 7.
Approach Pavement:	6	The west approach pavement exhibits map cracking up to full width x 1' long with cracks open up to 1/2" wide along the west abutment joint. The pavement is settled for full width x up to 1" deep. See photo 33. The east approach pavement exhibits isolated longitudinal and transverse cracks, open up to 1/8" wide. See field notes sheets 5, 6 and 7 and photo 32.
Approach Embankment:	7	The approach embankments exhibit areas of minor erosion. See field notes sheets 5, 6 and 7.

Trafic Safety Features

Bridge Railings:	0	Does not comply with RB-350 safety standards. (Non-NHS)
Transitions:	0	Does not comply with RB-350 safety standards (Transition railings do not exhibit decreased post spacing for stiffness. Transitions are not properly connected to bridge railings). (Non-NHS)
Approach Guardrails:	0	Does not comply with RB-350 safety standards (no rubber blockouts). (Non-NHS)
Approach Guardrail Ends:	0	Does not comply with RB-350 safety standards. (Non-NHS)

59. SUPERSTRUCTURE:

Steel Deck Truss in Span 1, Steel Through Truss in Span 2, and Moveable Steel Through Truss Swing Span in Spans 3 and 4.

The superstructure is in overall poor condition.

Overall Rating: 4

Rating

Bearing Devices:	5	The fixed deck truss bearings at west abutment in span 1 exhibit painted over pitting and section loss up to 3/16" deep on the bearing plates. There are deteriorated rivet heads with complete section loss and anchor bolts with up to 90% section loss (painted over with light to heavy recurring rust). There are areas of recurring rust developing around the fixed pins at the west abutment. There is a 1/4" gap between the south pin head and bottom chord (south elevation) due to section loss on pin nuts and bearing plates. See photo 34. The elastomeric expansion bearing pads at pier 1 in span 1 exhibit painted over pitting up to 3/16" deep on the steel bearing plates with moderate to heavy recurring rust. See photo 35. The bearings were in expansion mode (expanded 1/4" at 45 degrees Fahrenheit) (No change since the last inspection). The pin nuts for these bearings exhibit painted over pitting loss up to 1/4" deep with laminated rust along the edges. There is up to 3/16" thick pack rust between the north pin nut and gusset plate. There is up to 50% section loss on the anchor bolts and up to 95% section loss on the rivet heads. The bolster for the south bearing for floorbeam 9 at pier 1 in span 1 is slightly leaning towards the east (no change since last inspection). The sliding bearing discs for both the north and south bearings of floorbeam 9 at pier 1 are not centered and exhibit gaps up to 3/8" between the front face of sole plate and disc. There is up to 1/4" thick pack rust with gap between the sole plate and disc for both bearings. Also, the sole plate is in contact with the keeper angle for both south and north bearings. See photo 36. The anchor bolt nuts are not fully snug with gaps up to 1/4" deep. The fixed bearings for fixed through truss at pier 2 in span 2 exhibit minor areas of painted over pitting losses with light to moderate recurring rust. See photo 37. The elastomeric bearings at pier 1 in span 2 exhibit minor splitting of horizontal seams in elastomeric pads and were in expansion mode (1/2" expanded) at 45 degrees Fahrenheit. See photo 38. The bearings for stringers in spans 1 and 2 exhibit isolated areas of light to heavy rust. The fill plates for the stringer bearing plates are missing between floorbeams and stringers resulting in gaps up to 7/16" at several locations in the spans 2, 3 & 4 (primarily noted in stringers S1 and S5). See photos 40, 41 and 42. The stringers exhibit approximately 50% loss of bearing area, however no evidence of pumping under live load was observed. See field notes sheets 10-12, 41, 55 & 72 and photo 39.
Stringers:	6	The stringers in spans 1 and 2 exhibit areas of painted over pitting and section loss up to 1/8" deep throughout, primarily along the top flanges. See photo 42. There are several areas of moderate to severe recurring rust in spans 1 and 2. The previously mentioned 1/4" diameter rusted through hole in web of stringer S2 on east side of floorbeam 3 in span 4 was not found during this inspection. The previously mentioned cracks in stringer webs at pier 1 in spans 1 and 2 have been repaired (with stop holes) since the last inspection. See items "Welds-Cracks" and "Rivets & Bolts" below. See field notes sheets 24-40 & 55-81. Rating upgraded from '5' due to repaired cracks in stringer webs since the last inspection. See item "Cracks-Welds" below.
Girders:	N	
Floor Beams:	4	Deck Truss (Span 1): The floorbeams exhibit areas of painted over pitting up to 1/16" deep throughout with a few areas of severe pitting/section loss up to 1/4" deep on the webs (maximum noted at floorbeam U4 in non-critical area). See photo 44. The bottom flange for floorbeam U4 has up to full width of bottom flange x 7/16" deep remaining near the mid-span (22.9% section loss). Also, the bottom flange for floorbeams U1 and U6 exhibit section loss up to full width x 9/16" deep remaining (original thickness: 0.843"), near the mid-span (19% section loss). All the above mentioned section losses have been painted over previously with no changes noted since last inspection. There is an isolated full width x 1" high perforation at the bottom of west web stiffener for floorbeam U1 near mid-span. See photo 45. Fixed Through Truss (Span 2): The floorbeams in span 2 exhibit painted over section/pitting loss up to 3/16" deep in the webs and both

flanges. There are areas of pack rust with gaps up to 1/2" between the floorbeam bottom flange and the gusset plate at random locations. These gaps are primarily due to the pack rust, which has been cleaned out previously. The floorbeam top flanges exhibit areas of section loss along the edges up to 6" long x 1" wide x 3/8" deep (11/16" original). Also, the floorbeams exhibit section loss with up to 1/2" thickness remaining to the bottom flange angles (11/16" original). These losses have resulted up to 12.3% section loss in the bottom flange of floorbeam L0' (near mid-span -Tension Zone). See photo 46. Also, the web exhibits section loss up to 30.5% in at the end floorbeams over piers 1 and 2 (in critical zones) and random perforations up to 3" long x 2" wide. See photo 47. These conditions have not changed since the previous inspection.

Swing Span (Span 3 and 4):
The floorbeams in spans 3 and 4 exhibit pitting/section loss up to 3/16" deep on the flanges and up to 1/8" deep on the webs. See photo 48 . The web of floorbeams 1 and 3 exhibit section loss up to 25% at the north end in span 4. Also, cut holes (up to 4" diameter) exist in random floorbeam webs in low shear areas. There are a few perforations up to 4" x 2" at the bottom of floorbeam web for FB 1 in span 4. See photo 49. The floorbeam top flanges exhibit painted over section loss along edges up to 6" long x 2" wide x 1/4" deep (11/16" original). See photo 50. Numerous floorbeams exhibit up to 7/16" remaining to bottom flange angles, (11/16" original). The bottom flanges of floor beams 1, 2 & 4 exhibits section loss up to 5' long x full width x 5/16" deep remaining (49.9% section loss) near midspan (critical areas) in span 4. See photo 51. Random floorbeams under stringer connections exhibit loss of width and 3/8" remaining to the top flanges (up to 45.5% section loss). Floorbeam webs to the bottom chord connections in the machinery pit exhibits section/pitting loss up to 3/16" deep (approximately 28.6% - FB 21 in span 4 connection to south truss). Random vertical stiffeners exhibit section loss with perforations up to 3" high x 3" wide, mostly in span 4. See photo 52. Also, there are random missing bolts in the connections throughout the structure. See photo 53. There are gaps up to 1" between the floorbeam bottom flange and the gusset plate at random locations in spans 3 and 4, due to pack rust. See photo 54. Also, the fiberglass covers for floorbeam top flanges are missing at random locations. See photo 55.

All the above mentioned section losses have been painted over and there has been recurring rust at isolated locations. There is light to moderate accumulation of pigeon debris on top of floorbeam flanges at random locations. See photo 52.

See field notes sheets 24-40 & 55-81.

Trusses - General: 4

The trusses in all spans typically have pack rust between the pin connections and angles that have been cleaned out and painted previously. There are random areas of pitting/section losses up to 3/16" deep in the web and bottom chord angles throughout. There is section loss and rusted through holes on the batten and tie plates of the bottom chords throughout. Random lacing bars are bent, (some bars replaced during previous rehab project) and have painted over section loss up to full-width x 3/16" deep throughout.

Deck Truss (Span 1):
The truss members exhibits numerous areas of pitting/section loss up to 5/16" deep throughout. Random batten plates exhibit section loss up to 1/4" deep and perforations up to 2" long x 5.5" wide (top chord near U2 in south truss). See photo 56. The gusset plates at the top panel points typically exhibit areas of pack rust up to 1" thick and there is a 6" diameter perforation in the gusset plate at panel point U3 in south truss.
The top chord exhibits painted over pitting loss up to 5/16" deep, knife edges, and rusted thru holes up to 3" diameter in the top cover plate. Also, there are areas of pack rust between the top chord plates up to 1/2" thick at random locations in south truss. See photos 57-59. The bottom chords and diagonal members exhibit loss of width up to 3-3/4" on the back-to-back angles (average loss up to 2.5" wide) with section losses up to 1/8" on the remaining areas of the horizontal legs. The worst case section losses were found in the bottom (tension) chords between panel points L7 & L9 in the south truss (53% section loss) and in the north truss (23.5% section loss). See photos 60 and 61. These conditions have not changed since the previous inspection. (Bottom chord from L7-L9 has been strengthened. See note below. TDL 3/10/16)

Random rivet heads exhibit section loss up to 100% and light rust at former rivet head edge locations (no evidence of cracking was found). Several repair plates were added to random areas of severe section loss during previous rehab project. Also, strengthening retrofit bars (Diwidag) have been added along the member L8-L9 in both trusses previously, as a repair of the section loss in the bottom chord. (TDL 3/10/16) See photo 62.

Fixed Through Truss (Span 2):
The top chord and bracing members of the truss exhibit painted over pitting loss up to 1/4" deep and there are a few areas of pack rust up to 1/4" thick between the top chord plates. See photos 63-65. The bottom chords along both trusses typically exhibit painted over section loss up to 3%, with a maximum section loss of 4.1% in L7'-L8' in the south truss. See photo 66. The back-to-back angles in the diagonal members on both trusses exhibit areas of pitting/section loss at edges up to 4" long x 1 1/2" wide with up to knife edge remaining and isolated perforations up to 2" diameter (typical on vertical back-to-back angles and vertical channel flanges just above the bottom chord). See photos 67-70. Also, the back-to-back angles in vertical and diagonal members typically exhibit pitting losses with up to 3/16" remaining (@panel point M6', north truss), bent angles and random areas of pack rust. See photo 71. The maximum section loss in the back-to-back angles of vertical member is noted at U1-L1 in south truss (16.8%) and the maximum section loss in the truss vertical members is noted in the east half of the north truss, member U7'-L7' (26.5% section loss) . In addition, there are 3 missing rivets at this location. Also, there are a few perforations up to 5" long x 1.5" wide in the horizontal legs of the diagonals at random locations.

There are random perforations in the vertical gusset plates at the top chord and bracing connections. The gusset plates typically exhibit painted over pitting loss up to 6" long x 2" wide x 5/16" deep with (2) mis-drilled rivet holes (North gusset plate at panel point M7, south truss). See photos 72 and 75. Random lacing bars are bent with light to moderate pack rust up to 1/4" thick and pitting up to full-width x 3/16" deep. See photo 74. There are 2 loose lacing bars in the diagonal member M9-L8' in the north truss which vibrate under live load.

Swing Span (Spans 3 and 4):
The vertical and diagonal truss members exhibit random areas of painted over pitting/section loss, primarily along the edges adjacent to the gusset plate connections with maximum noted at member U7’-L7’ of south truss in span 4 (21.5% section loss, no change). Random back-to-back angles exhibit painted over pack rust and with moderate to heavy recurring rust at a few locations. See photo 76. The bottom chords exhibit isolated areas of knife edging with perforations up to 3" long x 2" wide and loss of width to the bottom flange angles in the machinery pit. See photos 78, 79, 80 and 82. The bottom chords of the north truss between floorbeams 21 and 22 in span 4 and south truss between floorbeams 20 and 21 in span 3 exhibit painted over section loss up to 7.8% (no change). There are areas of section loss up to 6" long x 6" wide x 1/4" deep to the bottom chord webs at bearing areas in the machinery pit. See photos 77-79.

The gusset and batten plates (at floorbeams, truss members and eye bars) exhibit several areas of painted over pitting with up to knife edge remaining and perforations up to 6” diameter. Also, there are several areas of pack rust up to 3/8” thick under the gusset plates. See photos 80-84. In addition, there are minor dents and bends in the lacing bars for the top chords, vertical members and top flanges of bottom chord at isolated locations. See photos 85-88.

Random eye bars exhibit painted over pitting/section loss up to 1" wide x full-perimeter x 5/16" deep at the end, primarily adjacent to their connections at the top and the bottom chords. The tension diagonal eye bars exhibit section loss of up to 17.6% for one (1) bar and up to 12.9% of the total cross sectional area including the retrofit eye bars (north truss, span 3). There are random nuts in the pin connections with gaps up to 5/16" between the nut and connection plate (nuts are tight in connection). There are random areas of pack rust left in place between eye bar connections. No significant changes in section loss at all above locations. There are random gusset plates at panel points L6, L8 and L9 on the south truss adjacent to the bottom chord in span 3 with section loss up to 2" high x 1/4" deep. There are gusset plates with painted over section loss up to 2" high x 1/4" deep. There are gusset plates with painted over section losses up to 3/16" deep at the eye bar connections. The pins in the truss exhibit painted over pitting, light rust and minor gaps. See photos 89-94.

		There is a heavy accumulation of bird nest at panel point U10 in south truss, span 3. See photo 95. Per the BIM requirements for truss pin connections, Ultrasonic Testing (UT) of at least 20% of the truss pin connection is required. This inspection tested 10 pin connections [Six (6) on the south truss and four (4) on the north truss], which is 31% of the total, and found to be acceptable. Refer to the UT report. All the above mentioned section losses were painted over previously and there has been recurring rust at isolated locations. See field notes sheets 13-23, 41-54 & 82-99.
Trusses - Portals:	6	The bottom angle of end portal (along panel point U1') at east end of fixed through truss in span 2 is bent for 3/4" high x 10" long at centerline of bridge with a minor bend in the adjacent lattice bracing (no change since previous inspection). See photo 96. Also "See Collision Damage Item". See field notes sheets 13-23, 41-54 & 82-99.
Trusses - Bracing:	5	The lateral bracing angles and gusset plates in the underside of spans 2, 3 and 4 exhibit several areas of painted over pitting/section loss up to 1/4" deep with perforations up to 3" x 2" at isolated locations. See photo 98. Also, there are several areas of painted over pack rust up to 1" thick between the back-to-back angles of lateral bracing with random areas of moderate recurring rust. See photos 99 and 100. Deck Truss (Span 1): Areas of pitting loss up to 3/16" deep. Random gusset plates exhibit rust through holes up to 1" diameter. Fixed Through Truss (Span 2): The bracing angles exhibit isolated areas of painted over pack rust with pitting/section loss up to 1/4" deep in the back-to-back angles. There is a 1/2" sweep in upper lateral bracing at panel points U6, U7 & U8 of the south truss with a minor bend in the horizontal lateral bracing. Also, there are bent bracing angles at panel points M5, M6' and M8. See photo 101. Swing Span Truss (Spans 3 and 4): The bottom angle of sway brace at panel point M7 (centerline of roadway) has (2) minor dents up to 1/4" high x 6" long. Also, the sway brace at panel point U8' in span 4 has a 1' long x 1/4" out of plane bend in the bottom horizontal leg at the centerline of roadway. See photo 102. The bottom horizontal sway bracing exhibits out of plane bending up to 5' long x 1-1/2" deep at panel points U5, M6' and M7'. Also, there is an area of pitting loss 6' long x 2" wide x 1/4" deep and four (4) perforations up to 1" long x 3/4" wide at the bottom of sway bracing at M7' in span 4. See photo 103. See field notes sheets 13-23, 41-54 & 82-99 and photo 97.
Paint:	5	All the section loss areas have been painted over in the past. However, there is recurring rust developing at several areas. Also, see above items.
Rust:	4	There are random spots of painted over rust, laminated rust and pack rust developing at random locations. Also, see above items.
Machinery Movable Span:	6	Mechanical Inspection Rating: 6 Electrical Inspection Rating: 4 Refer to the 2016 Mechanical and Electrical Inspection Reports.
Rivets & Bolts:	5	There are random rivets throughout the truss connections with up to 100% section loss, numerous rivets with up to 50% section with light to moderate rust on isolated locations. There are missing rivets on the

		floorbeam webs and a few sheared off rivets at lattice bars and lacing bars in isolated locations. See photo 104. The splice connection of stringer 4 over floorbeam 17 in span 3 exhibits one missing and one loose of six (6) bolts in the connection. See photo 43. The previously mentioned stringer movement under live load was noted during this inspection. Also, see above items. See field notes sheets 13-99.
Welds - Cracks:	6	All the fracture critical truss members and floorbeams have been inspected hands-on and no cracks were found on these members. The previously mentioned cracks located at the web ends of stringers S1 and S2 in span 1 and S1 and S5 in span 2 at pier 1 have been repaired (with stop holes) since the last inspection. See photo 105. There were few scrapes with moderate rust at these locations (6 of 11). Also, the previously mentioned cracks in welds between stringer and diaphragm at floorbeam 10 in span 3 have been repaired since the last inspection. See photo 106. The welds (Fatigue Category C) in the vertical stiffener plates connection to the bottom (tension) chord angles between Panel Points L7 and L9 on both trusses in span 1 are of poor quality but exhibit no evidence of cracking. Also, the diagonal member L10-M9' on both trusses of the swing span (span 4) exhibits three (3) plug welds (Fatigue Category C) at lattice bar connection. The plug welds are in place of the rivets on the diagonal member. Rating upgraded from '5' due to repaired cracks since the last inspection. See field notes sheets 13-99.
Timber Decay:	N	
Concrete Cracking:	N	
Collision Damage:	6	There are a few random bent lacing bars and flanges of built up members. The east portal and several intermediate truss sway bracing members exhibit areas of minor collision damage. Also see above "TRUSS" & "PORTAL" items. See field notes sheets 13-99.
Member Alignment:	6	Rivets near the top pin connections of the swing span interfere with the outer tension eye-bars creating gaps up to 1/2" between the eye-bars and the top gusset plate of the connection. Member L9'-U9' at the north truss in span 4 is bent to the west by 1/2" out of plane over 20-feet (appears to be construction related). See photo 107. Also see above items. See field notes sheets 13-99 and photo 73.
Deflection Under Load:	N	Normal (N); Excessive (E)
Vibration Under Load:	N	Normal (N); Excessive (E)
Stand Pipes:	N	
Barrel Ladders:	6	Fixed barrel ladders to the crows nest are not OSHA compliant.

Are Barrel Ladders OSHA Compliant? No

60. SUBSTRUCTURE:

Reinforced concrete abutments and pier.

The substructure is in fair condition.

Overall Rating: 5

Rating		
Abutments - Stem:	5	The east abutment stem exhibits hairline vertical and map cracks with efflorescence and light honey combing. There are also areas of light scaling throughout with random areas of punky concrete with a 5' x 3' x 3" deep spall at east abutment bridge seat. See photo 110. The previously mentioned cracks and

		spalls at the west abutment have been repaired since the last inspection. There is evidence of previous leakage noted on the east abutment stem. See field notes sheets 100 & 101 and photos 108 & 109.
Abutments - Backwall:	6	The concrete abutment backwalls exhibit cracks up to 1/16" wide and areas of punky concrete and spalls up to 1.5' x 1' x 1.5" deep (east abutment backwall). See field notes sheets 100 & 101.
Abutments - Footings:	7	At the east abutment, the platform footing on the north side is exposed 22" high due to erosion (no change since the last inspection). See photos 109 and 116. See item "EROSION-SCOUR" below. See field notes sheet 101.
Abutments - Settlement:	8	No signs of settlement were observed at the time of inspection.
Abutments - Wingwalls:	7	The northeast and southeast wingwalls exhibit vertical, diagonal and map cracks, open up to 1/16" wide, with and without efflorescence. See field notes sheet 102 and photo 111.
Piers/Bents - Caps:	6	The reinforced concrete pier caps exhibit vertical, horizontal and map cracks open up to 1/16” wide, with and without efflorescence, light to heavy scaling and isolated spalls up to 1' x 3” x 3/4” deep. See photos 113 and 114. There is a 1' x 1' x 8" deep spall with (2) adjacent areas of scaling up to 2' x 1' x 1/2" deep at the southwest end of pier 3. See photo 115. The previously noted spalls and most of the cracking at pier 1 has been repaired since the last inspection. See field notes sheets 103-108 and photo 112.
Piers/Bents - Pile Bent:	N	
Piers/Bents - Columns:	6	The column stems at pier 1 exhibit isolated hairline vertical, diagonal and map cracks with and without efflorescence. The previously mentioned spalls, scaling and 1/4" wide cracks have been repaired since the last inspection. See photo 112. Piers 2 and 3 have stone masonry surrounding the concrete piers around the waterline. Both piers stone masonry exhibit less than 5% deteriorated mortar and efflorescence staining along the joints with penetration up to 2" deep (most prevalent along the water surface). Pier 3 stone masonry exhibits cracked, loose and missing mortar. There is up to 10' long x 11" deep of penetration in pier 3 (north nose) at areas of missing mortar between stones above the water surface in the splash zone. As per Underwater Inspection Report dated 11/13/13: Both piers 2 & 3 exhibit light scale with intermittent pockets of honeycombing, isolated areas of scale up to 6" deep at random locations. Pier 2 west elevation has a 3' x 1/4" wide diagonal crack associated with 4" x 5" deep edge spalling. Pier 3 exhibit four (4) epoxy coated filled vertical cracks extending from 1.5' below the coping down the mudline. In addition, there is a 3.5' x 1.5' x 3' deep concrete void on the northwest face just above first footing step and a 4" high x 1' long x 2" deep void in the bottom of the coping on the northeast corner. There is up to 1' deep of penetration due to mortar loss (50%) at the noses within the tidal zone. See field notes sheets 103-108 and photos 112-114.
Piers/Bents - Footings:	N	See the 2013 Underwater Inspection Report.
Piers/Bents - Settlement:	8	No signs of settlement were observed at the time of inspection.
Erosion - Scour:	6	Erosion: Rated - 6. There is erosion area adjacent/under the backwall and pedestal beval of the west abutment as follows: - South end of the abutment stem with undermining up to 24” deep. See photo 117. - Center of the abutment with a 12’ long x 9" high x 1-1/2’ deep with 38” deep undermining. - North end of the abutment with up to 42” deep undermining.

		Scour: Rated - 6. Channel bottom displays aggradation up to 3.7' (south east corner of pier 2 & north nose of pier 3). See the 2013 Underwater Inspection Report. Piers 3 exhibit scour up to 4-1/2' long. See field notes sheets 100 and 101.
Concrete Crack - Spall:	5	See items above.
Steel Corrosion:	N	
Paint:	N	
Timber Decay:	N	
Collision Damage:	8	
Debris:	6	There is a light to moderate accumulation of debris on top of abutment seats and pier caps. See field notes sheets 100, 101 & 103-108.

61. CHANNEL AND CHANNEL PROTECTION:

Per the Underwater Inspection Report Dated 11/13/2013, the channel is in satisfactory condition.

Overall Rating: 6

Rating		
Channel - Scour:	6	Per 2013 Underwater Inspection Report, the channel bottom exhibits aggradation and degradation around the piers up to 3.7' (south east corner of Pier 2 and north nose of Pier 3). See 2013 Underwater Inspection Report.
Embankment - Erosion:	7	Per 2013 Underwater Inspection Report, there is minor erosion due to run-off was observed.
Debris:	7	Per 2013 Underwater Inspection Report, intermittent steel debris occurs around Pier 2.
Vegetation:	8	Per 2013 Underwater Inspection Report, embankments are well vegetated.
Channel Change:	7	Per 2013 Underwater Inspection Report, no lateral migration noted.
Fender - System:	N	
Spur Dikes and Jetties:	N	
Rip Rap:	5	Per 2013 Underwater Inspection Report, scattered rip-rap around Pier 3 up to 4' in diameter. The rip rap coverage is slightly less intact at the corners of the pier.

62. CULVERTS AND RETAINING WALLS:

Overall Rating: N

Rating		
Barrel:	N	
Concrete:	N	
Steel:	N	
Timber:	N	
Headwall:	N	
Cutoff Wall:	N	
Debris:	N	
Retaining Wall System:	N	
Footing:	N	

LOAD POSTING:

Rating		
Single Unit (Tons):		

Semi Trailer (Tons):		
4 Axle (Tons):		
3S2 (Tons):		
All Vechicles:		
Advanced Warning:	N	
Warning At Bridge:		
Legibility:	N	
Visibility:	N	

VERTICAL CLEARANCE POSTING

Min. Vert Under Clearance:		Ft		In	Located over waterway.
Posted Clearence Under Bridge:		Ft		In	
Posted Clearence On Bridge:		Ft		In	The previously mentioned posting at the west side of the bridge has been removed since the last inspection. Actual clearance is 16'-3".

Advanced Warning:	False	
Warning At Bridge:		
Legibility:		
Visibility:		

NOTES / COMMENTS:

Character of Traffic: Moderate volume with mixed traffic.

Additional Notes:

1. No bridge I.D. on structure.
2. Bridge is logged from west to east, with trusses labeled from north to south and the Connecticut River flows from north to south which is consistent with the previous inspection report and bridge plans.
3. An 80' man lift and 40' lift truck were used to inspect the through truss (Span 2) and swing span truss (Spans 3 and 4).
4. Inspection of the floorsystem and truss bottom chords in Spans 2 through 4 above the roadway was performed using permanent rolling platforms.
5. Coast Guard should be notified in advance of the inspection. There are lane closure restrictions on the structure dependent on the schedule of operator's house.
6. Bridge operator (860-873-8106) was contacted for mechanical and electrical inspection access.
7. Electrical and Mechanical inspection and UT testing were performed as part of this structural inspection.
8. The information from 2015 underwater inspection report could not be updated as the report is still in progress.
9. BS&E was notified of an unstable navigation light at pier 2 in span 3 and was fixed during the time of inspection.

Additional Comments:

See report table of contents.

National Bridge Elements
Inspection type: Fracture Critical,Special,Routine
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Bridge No: 01138

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

	Environment	Total Quantity	Units	Condition State 1	Condition State 2	Condition State 3	Condition State 4
12 - Reinforced Concrete Deck	Mod.	7990	sq. ft.	7970	20		
1080 - Delamination/Spall/Patched Area		20			20		
28 - Steel Deck with Open Grid	Mod.	21683	sq. ft.	21243	440		
1000 - Corrosion		440			440		
29 - Steel Deck with Concrete Filled Grid	Mod.	2047	sq. ft.	1947	100		
1000 - Corrosion		100			100		
113 - Steel Stringer	Mod.	9902	ft.	7902	2000		
1000 - Corrosion		2000			2000		
120 - Steel Truss	Mod.	3552	ft.	3352	200		
1000 - Corrosion		200			200		
152 - Steel Floor Beam	Mod.	1857	ft.	1649	200	5	3
1000 - Corrosion		208			200	5	3
210 - Reinforced Concrete Pier Wall	Mod.	98	ft.	38	60		
1120 - Efflorescence/Rust Staining		40			40		
1130 - Cracking (RC and Other)		20			20		
215 - Reinforced Concrete Abutment	Mod.	66	ft.	40	26		
1090 - Exposed Rebar		1			1		
1120 - Efflorescence/Rust Staining		15			15		
1130 - Cracking (RC and Other)		10			10		
300 - Strip Seal Expansion Joint	Mod.	23	ft.	23			
301 - Pourable Joint Seal	Mod.	23	ft.	18	5		
2320 - Seal Adhesion		5			5		
302 - Compression Joint Seal	Mod.	2	ft.	2			
304 - Open Expansion Joint	Mod.	92	ft.	92			
311 - Movable Bearing	Mod.	8	each	4	4		
1000 - Corrosion		4			4		
313 - Fixed Bearing	Mod.	4	each	2	2		
1000 - Corrosion		2			2		
330 - Metal Bridge Railing	Mod.	1770	ft.	1030	740		
1000 - Corrosion		540			540		
7000 - Damage		200			200		

JOINT MEASUREMENTS

Inspectors:

Lead Inspector:	Pavan Seemakurty
Inspector:	Task:
Afzal, Hassan	BSE - Inspector
AI, BSE	BSE - Inspector
Aziz, Ali	BSE - Inspector
Cote, Ethan	BSE - Inspector
Elmakky, Hesham	BSE - Inspector
Ismail, Ziad	BSE - Inspector
Salehi, Mohammad	BSE - Inspector
Seemakurty, Pavan	BSE - Inspector
Yenuga, Durga	BSE - Inspector

Visits:

Visit Date:	Temp:	Start Time:	End Time:
12/14/2015	56	08:30 AM	02:30 PM
12/15/2015	59	08:30 AM	03:30 PM
12/16/2015	45	08:30 AM	03:00 PM
12/17/2015	45	08:30 AM	03:00 PM
12/18/2015	48	08:30 AM	03:00 PM
12/21/2015	53	08:30 AM	03:00 PM
12/22/2015	58	08:30 AM	03:00 PM
12/23/2015	50	08:30 AM	03:00 PM
12/24/2015	60	08:30 AM	02:30 PM
12/28/2015	38	08:30 AM	03:00 PM
01/12/2016	33	08:00 AM	03:30 PM
01/13/2016	40	08:30 AM	03:30 PM

Deck Joint	**Deck Joint Type**	**Effect Span (Ft.)**	**Comments**
W. Abut.	Compression Seal	0.00	Fixed

☑ **Winter Measurements** ☐ **Summer Measurements** **Differential**

Date			**Date**			**Actual**	
Temp oF	**Left(in.)**	**Right (in.)**	**Temp oF**	**Left(in.)**	**Right (in.)**	**Left(in.)**	**Right (in.)**
40	2	2 3/16					

Deck Joint	**Deck Joint Type**	**Effect Span (Ft.)**	**Comments**
Pier 1	Strip Seals	414.0	Expansion/Expansion

☑ **Winter Measurements** ☐ **Summer Measurements** **Differential**

Date			**Date**			**Actual**	
Temp oF	**Left(in.)**	**Right (in.)**	**Temp oF**	**Left(in.)**	**Right (in.)**	**Left(in.)**	**Right (in.)**
40	1 10/16	1 10/16					

Deck Joint	**Deck Joint Type**	**Effect Span (Ft.)**	**Comments**
Pier 2	Open	228.0	Fixed/Expansion

☑ **Winter Measurements** ☐ **Summer Measurements** **Differential**

Date			**Date**			**Actual**	
Temp oF	**Left(in.)**	**Right (in.)**	**Temp oF**	**Left(in.)**	**Right (in.)**	**Left(in.)**	**Right (in.)**
40	1	1					

Deck Joint	**Deck Joint Type**	**Effect Span (Ft.)**	**Comments**
Pier 3	Open	0.00	Fixed

☑ **Winter Measurements** ☐ **Summer Measurements** **Differential**

Date			**Date**			**Actual**	
Temp oF	**Left(in.)**	**Right (in.)**	**Temp oF**	**Left(in.)**	**Right (in.)**	**Left(in.)**	**Right (in.)**
40	3 8/16	2 12/16					

Deck Joint	**Deck Joint Type**	**Effect Span (Ft.)**	**Comments**
E. Abut.	Open	228.00	Expansion

☑ **Winter Measurements** ☐ **Summer Measurements** **Differential**

Date Temp oF	Left(in.)	Right (in.)	Date Temp oF	Left(in.)	Right (in.)	Actual Left(in.)	Right (in.)
40	3 14/16	2 3/16					

Note: The 'Effective Span' is the length contributing to expansion at the joint. This should be 0 at fixed joints of single span

Reviewer's Comments:

- All measurements double checked and taken at joint opening near the curb.
- 5/16" drop across joint from through -truss to swing span at south side and 5/16" at north side and gutter line.
- 3/8" drop at north gutter line and 3/8" drop at south adjacent to the east abutment.

FRACTURE CRITICAL MEMBERS / FRACTURE PRONE DETAILS

Inspectors:

Lead Inspector: Pavan Seemakurty

Inspector:	Task:
Afzal, Hassan	BSE - Inspector
AI, BSE	BSE - Inspector
Aziz, Ali	BSE - Inspector
Cote, Ethan	BSE - Inspector
Elmakky, Hesham	BSE - Inspector
Ismail, Ziad	BSE - Inspector
Salehi, Mohammad	BSE - Inspector
Seemakurty, Pavan	BSE - Inspector
Yenuga, Durga	BSE - Inspector

Visits:

Visit Date:	Temp:	Start Time:	End Time:
12/14/2015	56	08:30 AM	02:30 PM
12/15/2015	59	08:30 AM	03:30 PM
12/16/2015	45	08:30 AM	03:00 PM
12/17/2015	45	08:30 AM	03:00 PM
12/18/2015	48	08:30 AM	03:00 PM
12/21/2015	53	08:30 AM	03:00 PM
12/22/2015	58	08:30 AM	03:00 PM
12/23/2015	50	08:30 AM	03:00 PM
12/24/2015	60	08:30 AM	02:30 PM
12/28/2015	38	08:30 AM	03:00 PM
01/12/2016	33	08:00 AM	03:30 PM
01/13/2016	40	08:30 AM	03:30 PM

Fracture Critical Inspection Frequency: 24 Months

Fracture Critical Type Code: G Truss Systems, riveted trusses

Structure Type: Highway Bridges **Year Built:** 1913 **ADT:** 11300 **Year of ADT:** 2014 **% Truck:** 4

Access Equipment Needed: 80' Manlift, 45' Lift Truck, Safety Boat & Inspection Platforms

Traffic Control Required: Alternating one-way traffic on Route 82

Reference to Plans: Original Design Plans, 1912; Rehab Design 1985 (Project # 60-130) and Rehab Design 1998 (Project # 60-142)

MEMBER/DETAIL TYPE # 1

Member/Details Type: D Steel trusses **Fracture Critical:** Yes

Fatigue Category: D **Steel Type:** Other **Fatigue Prone:** Yes

Description: Riveted built-up steel trusses.

Inspection Procedure: Checked 100% hands-on.

Condition Comments: See BRI-18.

Procedure Followed This Inspection? Yes **If No please explain:**

AI Engineers, Inc.

FIELD TIME LOG

JOB NO: 170-3225 | BRIDGE NO: 01138
DATE: See below | SHEET 1 OF

DATE: 12/14/15		DESCRIPTION	TIME AT SITE
WEATHER: Cloudy 56° F	CREW:	P, ETC, MRS, ZRT	8:30 AM to 2:30 PM
EQUIP. LIST: 80' A&B Manlift	SNOOPER:	—	to
EL 45' Bucket Truck	TMA TRUCK:	EL	8:30 AM to 2:30 PM
AI White Truck	RR FLAGMAN:	—	to
VISITOR: None	TROOPER:	R Scavello #435 F. Curoca #500	8:30 AM to 2:30 PM

TC & NOTES: Alternate one way Traffic on Rte 82.
SP, 3 & 4 & Swing span truss (North truss)

DATE: 12/15/15		DESCRIPTION	TIME AT SITE
WEATHER: Sunny 59° F	CREW:	PS, MRS, HE, ZRS	8:30 AM to 3:30 PM
EQUIP. LIST: 8' A&B Manlift	SNOOPER:	—	to
EL 45' Bucket truck	TMA TRUCK:	EL	8:30 AM to 3:30 PM
AI White truck	RR FLAGMAN:	—	to
VISITOR: Hau Tockloma DOT	TROOPER:	Fowler #1341 Lato #1402	8:30 AM to 3:30 PM

TC & NOTES: Alternate one way traffic on Rte 82.
Span 2 & north truss inspected

DATE: 12/16/15		DESCRIPTION	TIME AT SITE
WEATHER: Sunny 45° F	CREW:	PS, HE, ZRJ, HA	8:30 AM to 3:00 PM
EQUIP. LIST: 80' A&B Manlift	SNOOPER:	—	to
EL 45' Bucket truck	TMA TRUCK:	EL	8:30 AM to 3:00 PM
AI White Truck	RR FLAGMAN:	—	to
VISITOR: None	TROOPER:	Fowler #1341 Fox #163	8:30 AM to 3:00 PM

TC & NOTES: Alt. one way traffic on Rte 82.
South truss, SP2 (75%); South truss Span 3 (50%)
inspected.

DATE: 12/17/15		DESCRIPTION	TIME AT SITE
WEATHER: Rainy 45° F	CREW:	CC, HA, ZRJ	8:30 AM to 3:00 PM
EQUIP. LIST: (2) AI White trucks	SNOOPER:	—	to
	TMA TRUCK:	—	to
	RR FLAGMAN:	—	to
VISITOR: None	TROOPER:	—	to

TC & NOTES: No TC, Span 1 Completed

1_ Field Time log

AI Engineers, Inc.	JOB NO: 170-3225	BRIDGE NO: 01138
FIELD TIME LOG	DATE: SEE BELOW	SHEET 2 OF

DATE: 12/18/15

			DESCRIPTION	TIME AT SITE
WEATHER: CLOUDY, 48 F	CREW:		PS, HF, ZRJ, MRS	08:30 AM to 02:00 PM
EQUIP. LIST: 80' MANLIFT (ARS)	SNOOPER:			to
45' (E-L)	TRAFFIC CONTROL ~~TMA TRUCK~~:		E-L (SINGH)	08:30 AM to 02:00 PM
AI WHITE TRUCK	SAFETY BOAT ~~RR FLAGMAN~~:		NE	to
VISITOR:	TROOPER:		MILLER (A 10AS) CARLIE (W 1KO)	08:30 AM to 02:00 PM

TC & NOTES: Alternating one-way traffic on Route 82.
Inspected south truss in spans 2,3 & 4 (100%). Inspected top of deck (100%)
ConnDOT maintenance fixed the navigation light in span 3.

DATE: 12/21/15

			DESCRIPTION	TIME AT SITE
WEATHER: CLOUDY, 53 F	CREW:		PS, DY, ZRJ, MRS	08:30 AM to 03:00 PM
EQUIP. LIST: (4) AI WHITE TRUCKS	SNOOPER:			to
	TMA TRUCK:			to
	SAFETY BOAT ~~RR FLAGMAN~~:		NE	08:30 AM to 03:00 PM
VISITOR:	TROOPER:			to

TC & NOTES: Inspected u/s of span 4 (80%) from rolling platform.

DATE: 12/22/15

			DESCRIPTION	TIME AT SITE
WEATHER: RAIN, [illegible]	CREW:		PS, DY, ZRJ, MRS	08:30 AM to 03:00 PM
EQUIP. LIST: (4) AI WHITE TRUCKS	SNOOPER:			to
	TMA TRUCK:			to
	SAFETY BOAT ~~RR FLAGMAN~~:		NE	08:30 AM to 03:00 PM
VISITOR:	TROOPER:			to

TC & NOTES: Inspected u/s of span 2 (80%) from rolling platform.

DATE: 12/23/15

			DESCRIPTION	TIME AT SITE
WEATHER: CLOUDY, 50 F	CREW:		PS, DY, ZRJ, MRS	08:30 AM to 03:00 PM
EQUIP. LIST: (4) AI WHITE TRUCKS	SNOOPER:			to
	TMA TRUCK:			to
	SAFETY VESSEL ~~RR FLAGMAN~~:		NE	08:30 AM to 03:00 PM
VISITOR:	TROOPER:			to

TC & NOTES: Inspected u/s of span 3 (80%) from rolling platform.

2_ Field Time log

AI Engineers, Inc.

JOB NO: 170-3225
BRIDGE NO: 01138

FIELD TIME LOG

DATE: SEE BELOW
SHEET 3 OF

DATE:	12/24/15		DESCRIPTION	TIME AT SITE	
WEATHER:	CLOUDY 60F	CREW:	PS, DY, JRS, MRS	08:30 AM	to 02:30 PM
EQUIP. LIST:	(2) AI WHITE TRUCKS	SNOOPER:			to
		TMA TRUCK:			to
		SAFETY BOAT ~~RR FLAGMAN:~~	NE	08:30AM	to 02:30 PM
VISITOR:		TROOPER:			to

TC & NOTES: inspected u/s of of span 2 (100%) from rolling platform & pit cover (spans 3 & 4) (100%)

DATE:	12/28/15		DESCRIPTION	TIME AT SITE	
WEATHER:	SUNNY 38F	CREW:	PS, JRS	08:30 AM	to 3:00 PM
EQUIP. LIST:	45' (E-L)	UT TESTING ~~SNOOPER:~~	TEAM INDUSTRIAL		to
	80' MANLIFT (A&R)	TMA TRUCK:	E-L (SINGLE)	08:30 AM	to 3:00 PM
	AI WHITE TRUCK	SAFETY BOAT ~~RR FLAGMAN:~~	NE	08:30AM	to 3:00 PM
VISITOR:		TROOPER:			to

TC & NOTES: UT testing performed on 10 pins in spans 3 & 4.

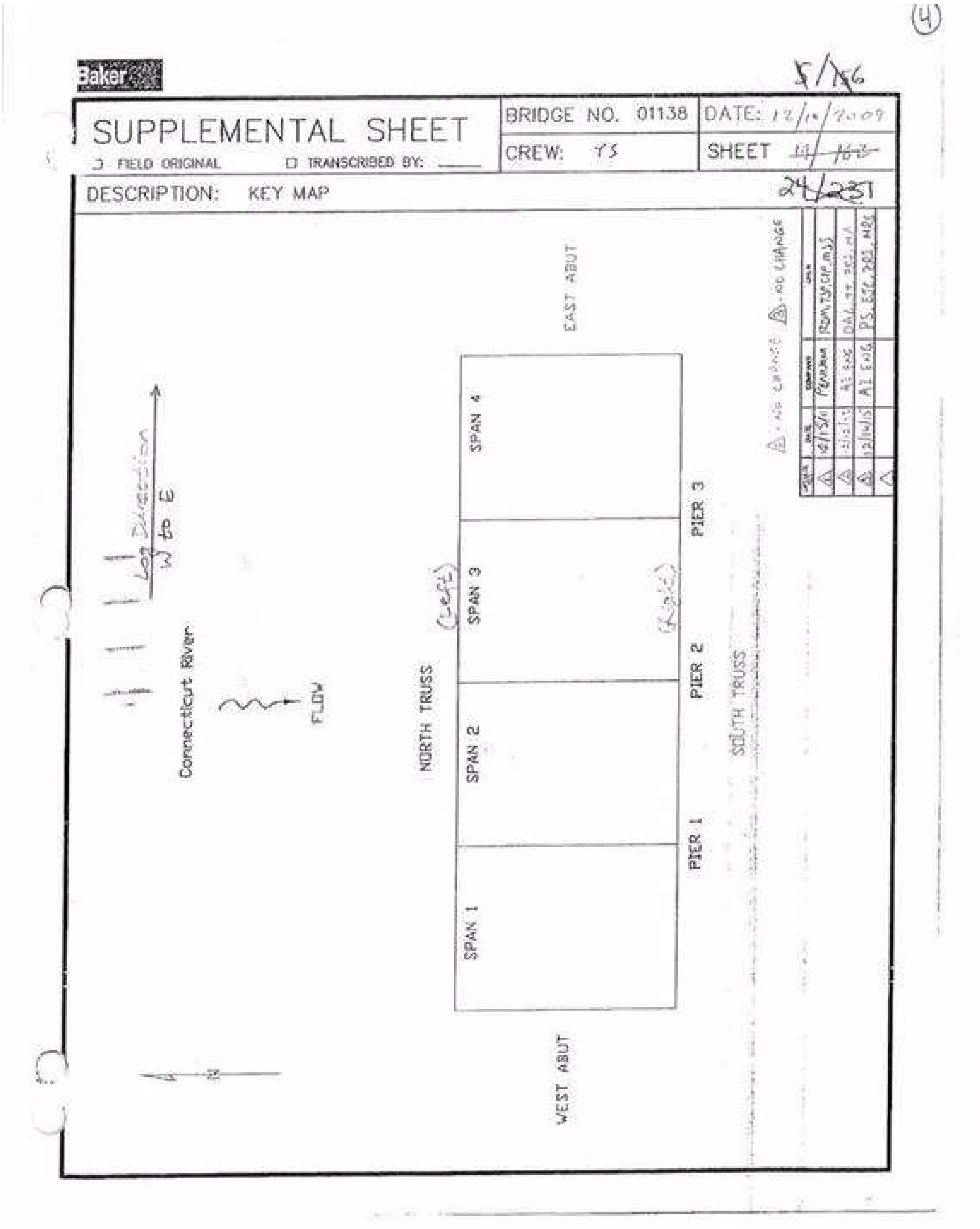
DATE:	01/12/16		DESCRIPTION	TIME AT SITE	
WEATHER:	Sunny 32°F	CREW:	PS	8:02 AM	to 3:30 PM
EQUIP. LIST:	AI White truck	SNOOPER:	—		to
		TMA TRUCK:	—		to
		RR FLAGMAN:	—		to
VISITOR:	A. Taddonio (DOT)	TROOPER:	—		to

TC & NOTES: No TC. Electrical & Mechanical inspection by (STV)

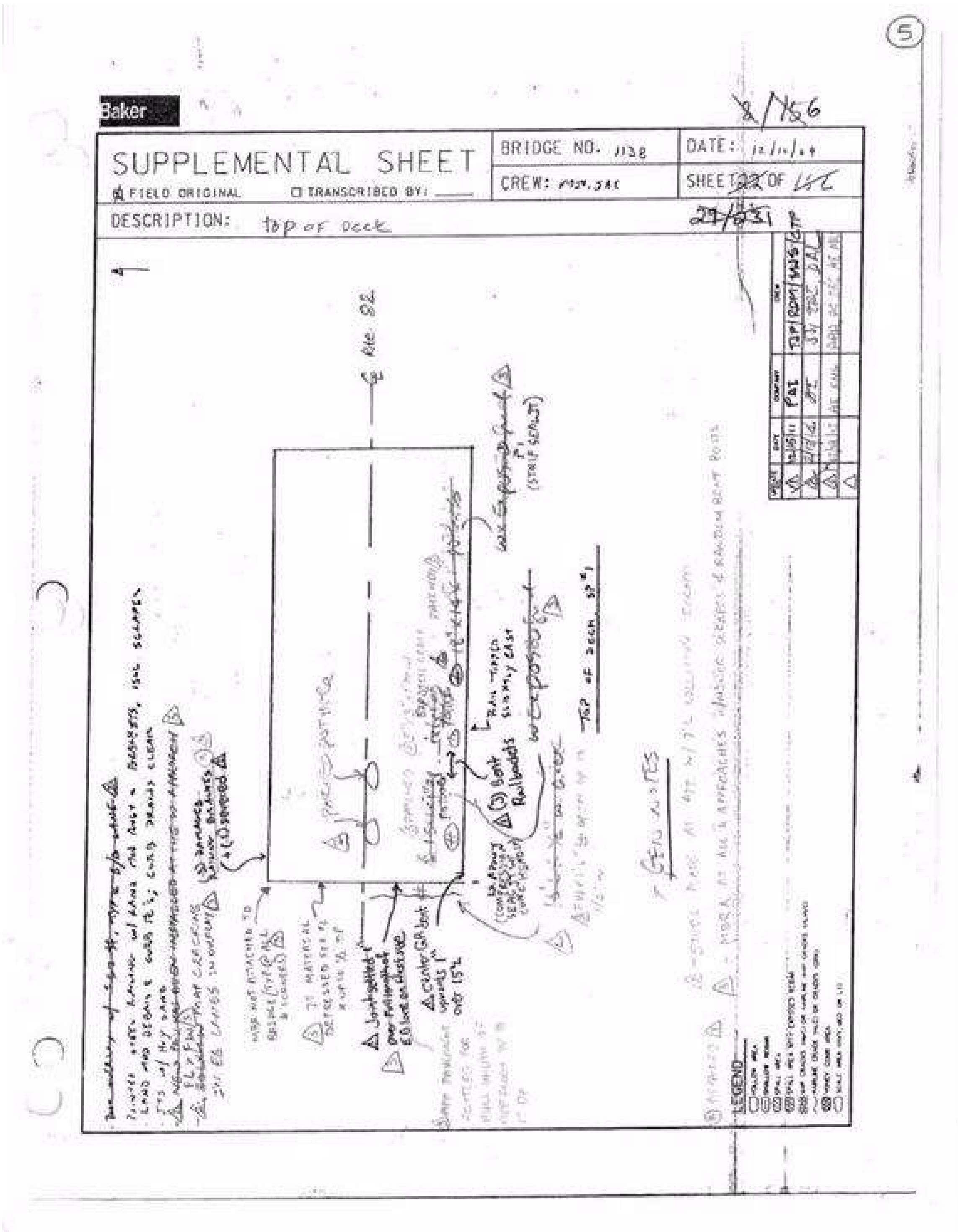
DATE:	01/13/16		DESCRIPTION	TIME AT SITE	
WEATHER:	Cloudy 40°F	CREW:	AAA	8:00	to 3:30 PM
EQUIP. LIST:	AI Toyota	SNOOPER:	—		to
	Corolla	TMA TRUCK:	—		to
		RR FLAGMAN:	—		to
VISITOR:	None	TROOPER:	—		to

TC & NOTES: No TC, Electrical & Mechanical inspection by (STV)

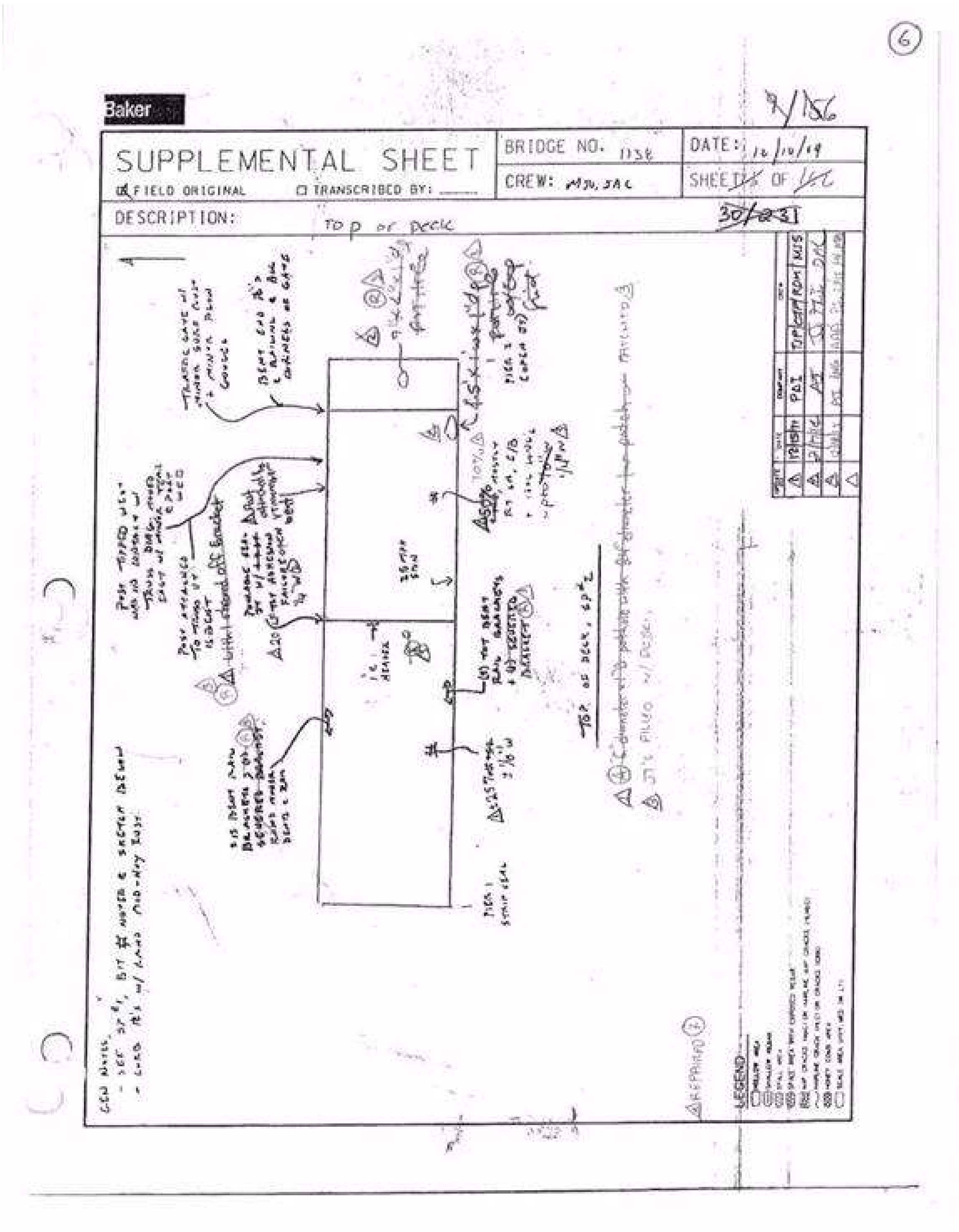
3_ Field Time log


(4)
Baker
5/16
SUPPLEMENTAL SHEET
FIELD ORIGINAL
TRANSCRIBED BY:
BRIDGE NO. 01138
DATE: 12/10/2009
CREW: YS
SHEET
24/231
DESCRIPTION: KEY MAP
EAST ABUT
SPAN 4
SPAN 3
SPAN 2
SPAN 1
PIER 3
PIER 2
PIER 1
NORTH TRUSS
SOUTH TRUSS
(Left)
(Right)
Log Direction W to E
Connecticut River
FLOW
WEST ABUT
N

4_Key Plan



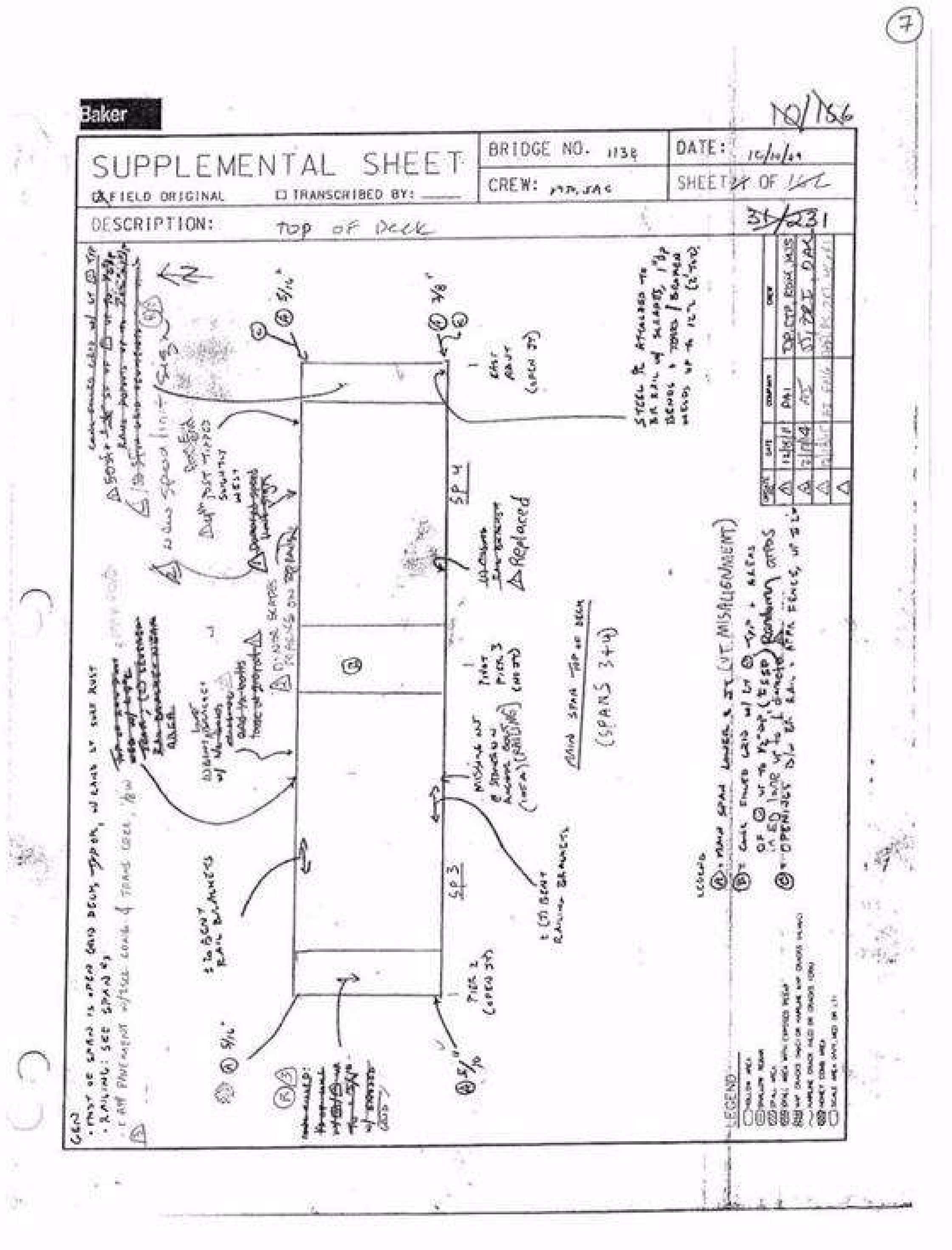
5_Top of Deck Span 1



6_Top of Deck Span 2

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



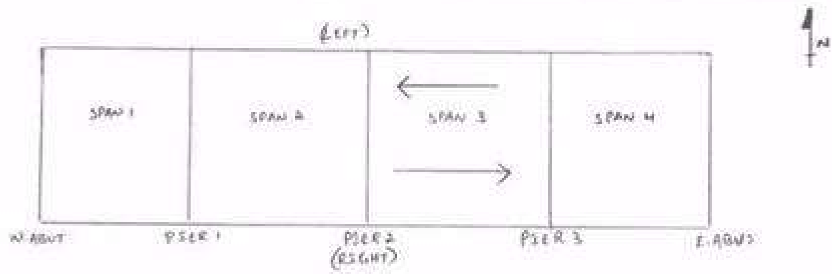
7_Top of Deck Span 3 & 4

AI Engineers, Inc.

FIELD NOTES

DESCRIPTION: PARAPET JOINT MEASUREMENTS

JOB NO: 170-3225
BRIDGE NO: 01138
DATE: 12/15/15
SHEET 8 OF
CREW: AAA, PS, HF, ERS, MRS



LOCATION	WINTER MEASUREMENT < 50° F				SUMMER MEASUREMENT > 50° F				JOINT TYPE
	LEFT	RIGHT	TEMP	DATE	LEFT	RIGHT	TEMP	DATE	
W. ABUT.	2"	2 9/16"	40°F	12/18/15					COMP SEAL
PIER 1	1 5/8"	1 15/16"							STRIP SEAL
PIER 2	1"	1"							OPEN JT
PIER 3	3 1/2"	2-1/4"							NONE
E. ABUT.	3 7/8"	2 3/4"							OPEN JT

GENERAL NOTES:
- All measurements were taken @ joint opening near curb & double checked.
- 5/16" drop across joint from through truss to swing span @ south side & 5/16" @ north side @ gutterline.
- 3/8" drop @ north gutterline & 3/8" @ south adjacent to East Abutment

8_ Field Parapet Joint Measurement

REGULAR INSPECTION X
Date: 12/18/2015

SUMMER / WINTER JOINT MEASUREMENTS ☐
Summer 20__ __ Winter 20__ __

JOINT MEASUREMENTS

Form BRI-17, Rev. 9/03

Bridge No.: 01138 Route 82 over Connecticut River East Haddam

Measurements Taken By: ZRI
Measurements Reviewed By: PS

Deck Joint Location	Deck Joint Type	Effect Span (ft.)	Current Measurements Temp °F	Current Measurements Date: 2/17/14 Left (in.)	Current Measurements Right (in.)	Previous Measurements Temp °F	Previous Measurements Date: 12/18/15 Left (in.)	Previous Measurements Right (in.)	Differential Movements Actual Left (in.)	Differential Movements Actual Right (in.)	Differential Movements by Formula	Comments	Difference Between Actual & Calc'd Mov't Left (in.)	Difference Between Actual & Calc'd Mov't Right (in.)
W. Abut	Comp	0.0	20	2	2- 4/16	40	2	2- 3/16	0	1/16	0	Fixed	0	- 1/16
Pier 1	Strip	414.0	20	1-10/16	1-11/16	40	1-10/16	1-10/16	0	1/16	10/16	Expansion/Expansion	10/16	9/16
Pier 2	Open	228.0	20	1	1- 1/16	40	1	1	0	1/16	6/16	Fixed/Expansion	6/16	5/16
Pier 3	None	0.0	20	3-10/16	2	40	3- 8/16	2-12/16	2/16	- 12/16	0	Fixed	- 2/16	12/16
E. Abut	Open	228.0	20	3-10/16	4- 6/16	40	3-14/16	2- 3/16	- 4/16	2 3/16	6/16	Expansion	10/16	-1 13/16

1. The "Deck Joint Type" should be "plug" for Asphaltic Plug joints, "strip" for Strip Seals, "seg." for Segmental Joints, etc.
2. The "Effective Span" is the length contributing to expansion at the joint. This should be 0 at fixed joints of single span bridges.

Reviewer's Comments: All measurements double checked and taken at joint opening near the curb.
5/16" drop across joint from through -truss to swing span at south side and 5/16" at north side and gutter line
3/8" drop at north gutterline and 3/8" drop at south adjacent to the east abutment.

Summer / Winter Joint Measurements: (IF ADDING OR REMOVING, SEND A COPY OF THIS FORM TO SUPERVISOR FOR REVIEW/APPROVAL WITH REASONS FOR CHANGE INDICATED)
☐ ADD TO SUMMER/WINTER LIST SUPERVISOR APPROVAL: ____
☐ REMOVE FROM SUMMER/WINTER LIST MASTER LIST ENTRY: ____

9

File: 01138 PARAPET JOINT TABLE (BRI-17 Form) 01138(English), Revised September 2003

9_BRI-17_Parapet Joint Comparions

(10)

Baker

13/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/6/2010
☐ FIELD ORIGINAL ☑ TRANSCRIBED BY: SAC	CREW: MJO, CD	SHEET 2-8/162
DESCRIPTION: BEARING NOTES		33/231

DECK TRUSS AT WEST ABUTMENT:

South Fixed Pin:

① There is up to ~~¼"~~ 3/16" ΔF section loss on bearing plates and areas of ⅛" ΔF section loss on pin nuts, ~~all painted over~~ Δ w/AREAS OF MOD RUST w/AREAS OF LAM. RUST ON SOUTH PIN Δ

② There are gaps up to ¼" between pin head and bottom chord at south elevation due to section loss on pin nuts and bearing plates

③ Rivet heads and anchor bolts show section losses up to 90%, painted over w/AREAS OF RECURRING RUST Δ (LT-TO MOD)

North Fixed Pin:

Δ w/AREAS OF RECURRING RUST (LT. TO MOD)

① There is ⅛" painted loss (isolated locations with greater) on bearing plates and assemblies

② Anchor bolt nuts with painted over 3/16" - ⅛" pitting

③ Some rivets with almost complete section loss, anchor bolts with up to 85% section loss at NW (30% typ) w/AREAS OF MOD. RUST Δ

DECK TRUSS EXPANSION BRG'S AT PIER 1:

North Expansion Bearing:

① Bearing plates and assemblies with painted over ⅛" - 3/16" ΔF pitting, ~~LT~~ MOD rust to HVY Δ

② Pin nut at north side with painted over ± ¼" deep pitting w/ LAM RUST @ EDGES Δ

③ Anchor bolts with up to ~~20%~~ 50% Δ section loss

④ Elastomeric bearing pad ~~in neutral position at 25 degrees F~~ Δ ¼" EXPANDED AT ~~43° F~~ 40° F Δ 45° F Δ

⑤ North pin nut with ⅛" - 3/16" Impact rust between nut and gusset plate

South Expansion Bearing:

① Bearing plates and assemblies with painted over with light reocurring rust

② Elastomeric bearing pad ~~in neutral position at 25 degrees F~~ Δ ¼" EXPANDED AT ~~43° F~~ 40° F Δ 45° F Δ

③ Anchor bolts with up to 20% section loss

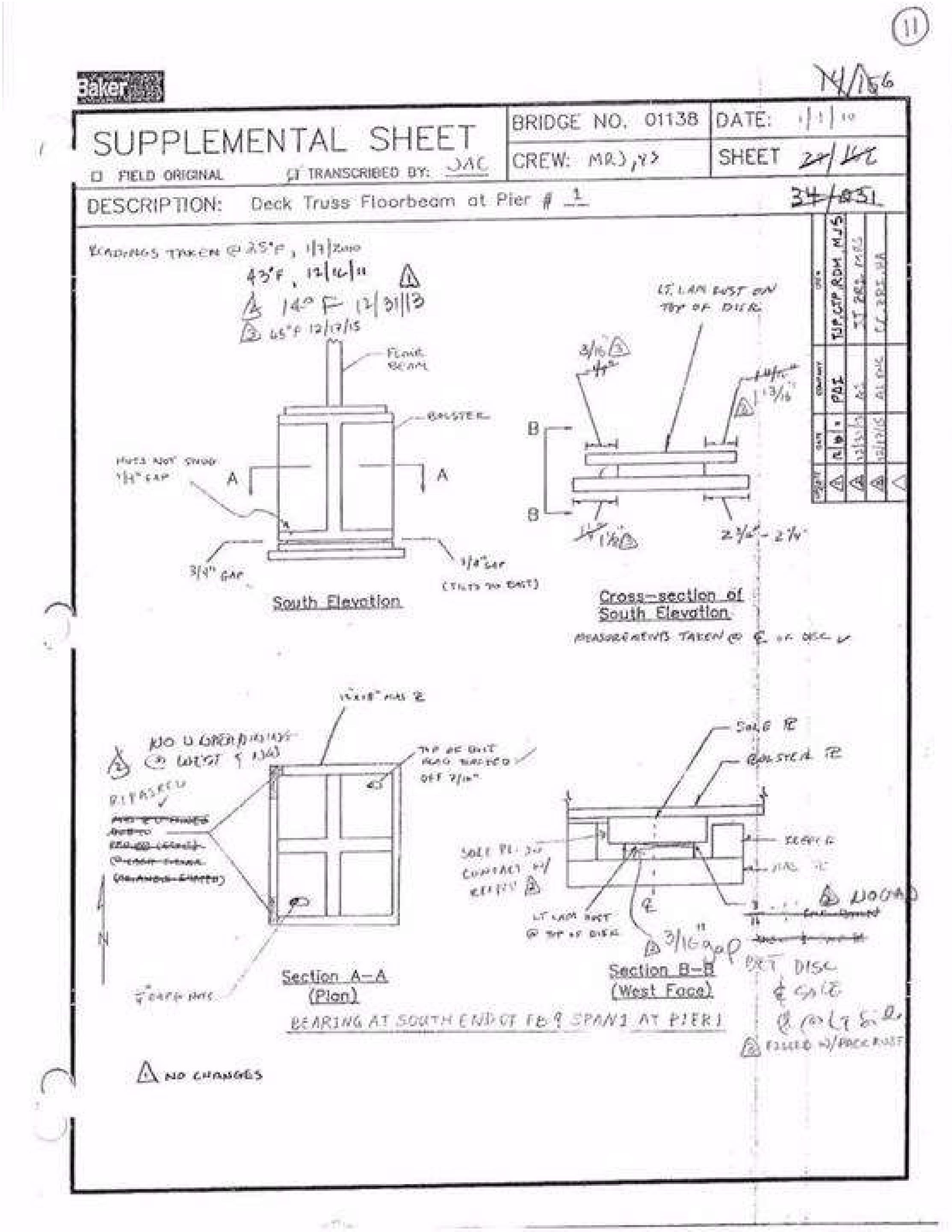
④ Painted over pitting losses up to ± 3/16" DF & RVT'S w/95% LOSS Δ

South Bearing for floorbeam over Pier 1:

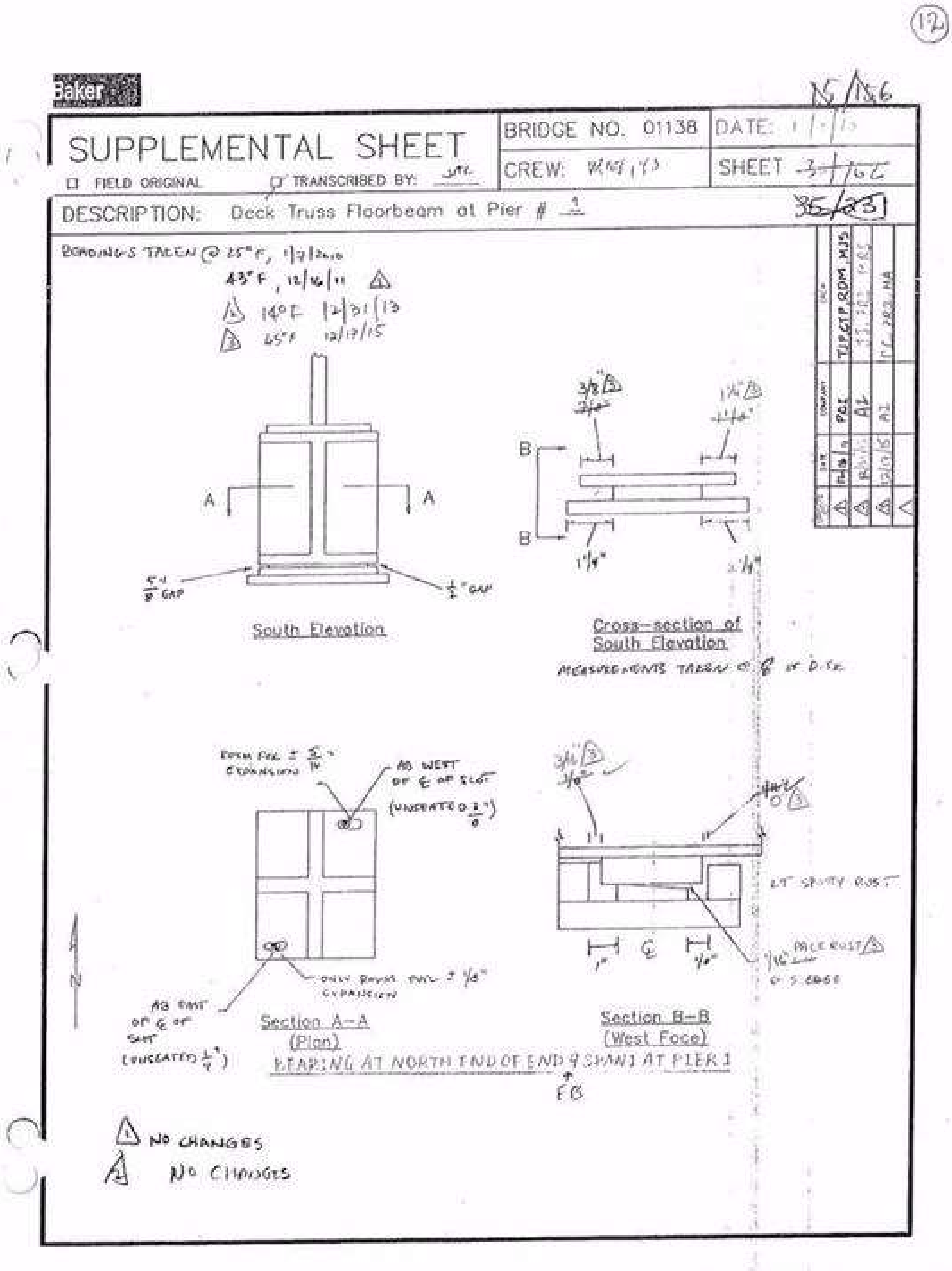
① See Sketches

UPDATE	DATE	COMPANY	CREW
Δ	1/6/11	P&I	DP, CSP, RDM, JMS
Δ	2/20/14	AI	JJ, PRD, [illegible]
Δ	[illegible]	AI ENG.	CC, PRD, HA
Δ			

10_ Bearing Notes



11_Deck Truss FB at Pier 1_Sheet 1



12_Deck Truss FB at Pier 1_Sheet 2

(13)

Baker

76/186

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/6/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY ____	CREW: MJO, CD, MVA	SHEET ~~31/157~~

DESCRIPTION: SPAN 1 TRUSS GENERAL NOTES 36/231

- Random batten plates and lacing bars with heavy losses and perforations
- FB's of trusses - ± 1/16" – 1/8" dp x FW loss to flanges and up to 4'L x ±4"H x 1/16" loss on web
- Bottom chord horizontal legs of angles with up to 1.5" loss of width per leg (2" total) with ¼" - 1/2 height pitting throughout with knife edge up to full thickness of vertical legs (See Sheet ~~3X~~ 21 Sec. Z-Z)
- Lower chord members with up to 1/8" section loss on cover plates
- Top chord cover plate with up to 5/16" x full width pitting with random knife edge and small perfs with up to 50% section loss to rivet heads
- Top chord north channel bottom flange with 1/8" loss x full width @ random locations'
- Random ~~1/16~~ 3/16 inch pitting on lateral bracing angles 1.5"H x 3.5"L
- Vertical gusset plates have 1/8" impacted rust at top corners, minor pitting of diagonal members
- Vertical stiffener plates welded to the bottom (Tension) chord between L7 - L9 ARE OF POOR QUALITY W/ NO EVIDENCE OF CRACKING WELDS ARE FATIGUE CATEGORY C DETAILS.
- 3 - Diagonals w/ up to 1" th. pack rust between legs @ lower nodes w/ areas of lam. rust (no additional SL) to legs of diagonal
- 3 - Lt. to mod. accum. of debris on top of bottom chord @ conns @ lower nodes

1 NO SIGNIFICANT CHANGES.

UPDATE	DATE	COMPANY	CREW
1	12/15/11	PAI	JJP, CP, RDM, MJS
2	12/31/13	AI	JJ, ZRL, MRS
3	12/17/15	AI	CC, ZRS, HA

13_ Span 1Truss General Notes

14

Baker

N/56

SUPPLEMENTAL SHEET ☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:_____	BRIDGE NO. 01138	DATE: 1/6/2010
	CREW: MJO, CD, MVA	SHEET ~~77/162~~
DESCRIPTION: TRUSS CONDITION LEGEND - SPAN 1 - SOUTH TRUSS		~~37~~/231

1. Vertical gusset plates inside connection with heavy loss (±75%) with small RTH's in area up to 1'L x 6"H. Gusset plate with other random pitting , ¼" deep P.O
2. L1-U0, both angles at underside of member with ± ¼" deep loss and 2½" total loss of width between adjacent angles horizontal legs w/pack rust up to 1" th. (P.O)
3. Bolted repairs to lateral bracing angles
4. Random upto FW x 3/16" dp pitting at horiz. leg of south angle typ, random lacing bars with heavy loss and perfs
5. Top angles with FW x ⅛" areas of loss 6" from L3 gusset plate, top south angle with 1 ½"W x 1" holes ± 2' from L3 gusset plate - FH x ⅛" average losses at vertical leg, top of north angle
6. Vertical legs of all angles adjacent to gusset plate with FH x 1"L x ⅛" deep loss; end 6" of angles inside connection with perfs upto 2"W x 7"L (3/16" section loss x FH on north vertical leg) (both legs)
7. Rivets with up to 90% head loss L3-U5 and at inside connection x FH of leg (P.O)
8. L7-U6, north angles each with upto 3"H x ⅛" deep losses on vertical leg, north elevation in ± 2' area; horizontal legs top angles with upto 2.5" diameter, 1/16" - ⅛" deep random pitting (P.O)
9. L7-U8 ± 1/16" average loss x 1" wide in vertical legs of angles adjacent to vertical gusset plate (P.O)
10. L7-L9 @ L7 upto 2 ½" loss of total width to horizontal legs; ± 1/16" losses @ rest of horizontal legs. Vertical legs adjacent to gusset plate with ± 6"H x 3/16" loss x 1.5" (typ) @ south elevation and 2"H x 3"L x 3/16" deep loss @ the north elevation
11. Bent gusset plate with ± 16"L x 1.5"H x upto ¼" deep loss (⅜" plate) at both sides of floorbeam
12. 1' x 1' x ¼" deep (±) loss at top chord, top plate top surface (2 areas)
13. (2) areas of heavy loss up to 5/16" deep x 3'L x FW at top of top chord; Eastern area of loss with several holes up to 3" diameter in a 1' diameter area and isolated small perfs (P.O)
14. U3-U4 with areas of heavy pitting (± ¼" - 5/16" deep) x upto FW of top plate throughout with knife edge at edges
15. ½" diameter hole at gusset plate with impacted rust (1") and heavy pitting on gusset plate
16. Random welded repair plates at gusset plates
17. Horizontal gusset plate with 2.5" x 2" hole, and 10% of area with up to ¼" section loss (P.O)
18. Losses to horizontal gusset plates up to 2'L x 1.5"W x 5/16" loss of section (P.O)
19. Diagonal chord legs with random 2"H x 4"W x ¼" loss and horizontal flanges with random 3/16" loss both legs w/up to ¼" loss of width (P.O)
20. Bearing gusset plate and angles with ⅜" pitting losses and 11 rivets with upto 75% section loss. some w/ rosebudding @ S-side areas of bleeding w/ rust @ S-side
21. Top cover PL / horiz gusset PL 11" x up to ½" gap.
22.

~~19~~, ~~20~~, 22 intentionally left vacant for new deterioration notes. P.O. PAINTED OVER

12/17/13 - AI CC, RRI, HA
12/13/13 - AI - JJ, ZFS
12/15/11 - PA1 - TJP, RDM, MJS

14_Legend Span 1- south truss- Sheet 1

(15)

Baker

78/166

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/6/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:_____	CREW: MJO, CD, MVA	SHEET ~~[illegible]~~

DESCRIPTION: TRUSS CONDITION LEGEND - SPAN 1 - SOUTH TRUSS 38/231.

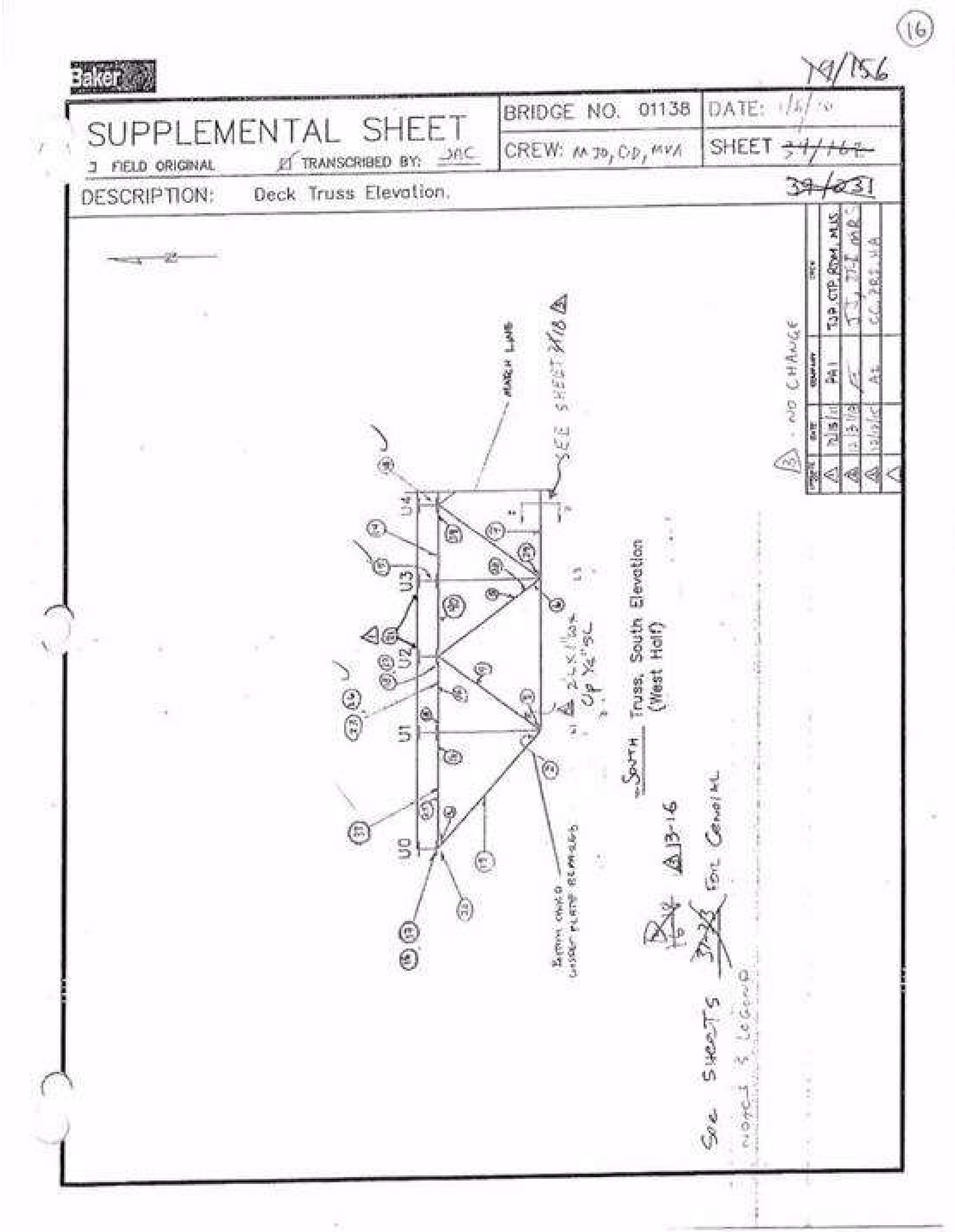
- (23) North top flange of top chord channel : 3"L x 2.5"W x 3/16" loss at edges (3/8" original) & up to 1/2" loss of width at random locations (P.O) Δ2
- (24) (P.O) Δ2 Heavy pitting up to 5/16" deep on top flange, 3'L x FW and an 8" x 8" area with up to 2" diameter (isolated) holes
- (25) Channel legs with 1/4" rem at rand locations (top and bottom flanges) and 1/4" x 3"H loss at web (top and bottom) (P.O) Δ2
- (26) Bottom 6" of both webs with upto 3/16" deep section loss and both top flanges with FW x upto 5/16" section loss.
- (27) Top batten plate; heavy losses and perfs up to 2" x 5.5", horiz. lateral bracing gusset plate with upto 50% loss
- (28) End 1.5' of diagonal horizontal legs with FW x 1/4" section loss and end 6" with ± 6" x 1.5"W rusted through holes painted over
- (29) (1) rivet head with up to 100% loss with edge of rivet at gusset plate exsposing bolt hole perimeter with light rust (No evidence of cracking) TOP CHORD Δ3 FOR BOT. CHORD Δ3
- (30) Top of vertical gusset plates with 6" x 4" x 1/8" loss; adj area vertical legs of diag with FW x 4"L x 1/8" section loss
- (31) Bottom lattice bar with FW x 3" x 3/16" remaining (painted over)
- (32) Horizontal leg @ top chord, FW x 2" x 3/16" loss
- (33) Up to 8" H x 3/16" section loss at webs inside channels. Bottom batten plates w/ K.E. and up to 70% section loss on (5) bottom, and (4) top lacing bars (P.O) w/ 80% SL TO (1) RIVET HEAD @ TOP Δ3
- (34) Top chord bottom angle at connection, with 2" x 1/2" perf on horizontal leg at edge
- (35) Top flange of strut between trusses with heavy losses up to 2" W x 6"L with small perfs
- (36)
- (37) 12" x 12" repair plate added to top plate of chord
- (38) 3/4" Impact rust between top flange and horizontal gusset plate
- (39) Maximum 3" x 4" holes and and 3/8" pitting loss on 50% of lattice bracing gusset plates and along edges
- (40) Typical heavy 5/16" pitting and up to 1/2" loss of width at edges, full length

Δ2 NO CHANGE
Δ NO SIGNIFICANT CHANGES.
36 intentionally left vacant for new deterioration notes.

P.O - PAINTED OVER Δ2

[illegible]	DATE	COMPANY	CREW
Δ1	12/15/11	PAI	TJP, CTP, RDM, RUS
Δ2	12/13/13	AI	[illegible]
Δ3	12/12/15	AI	CL, ZG3, HA
Δ			

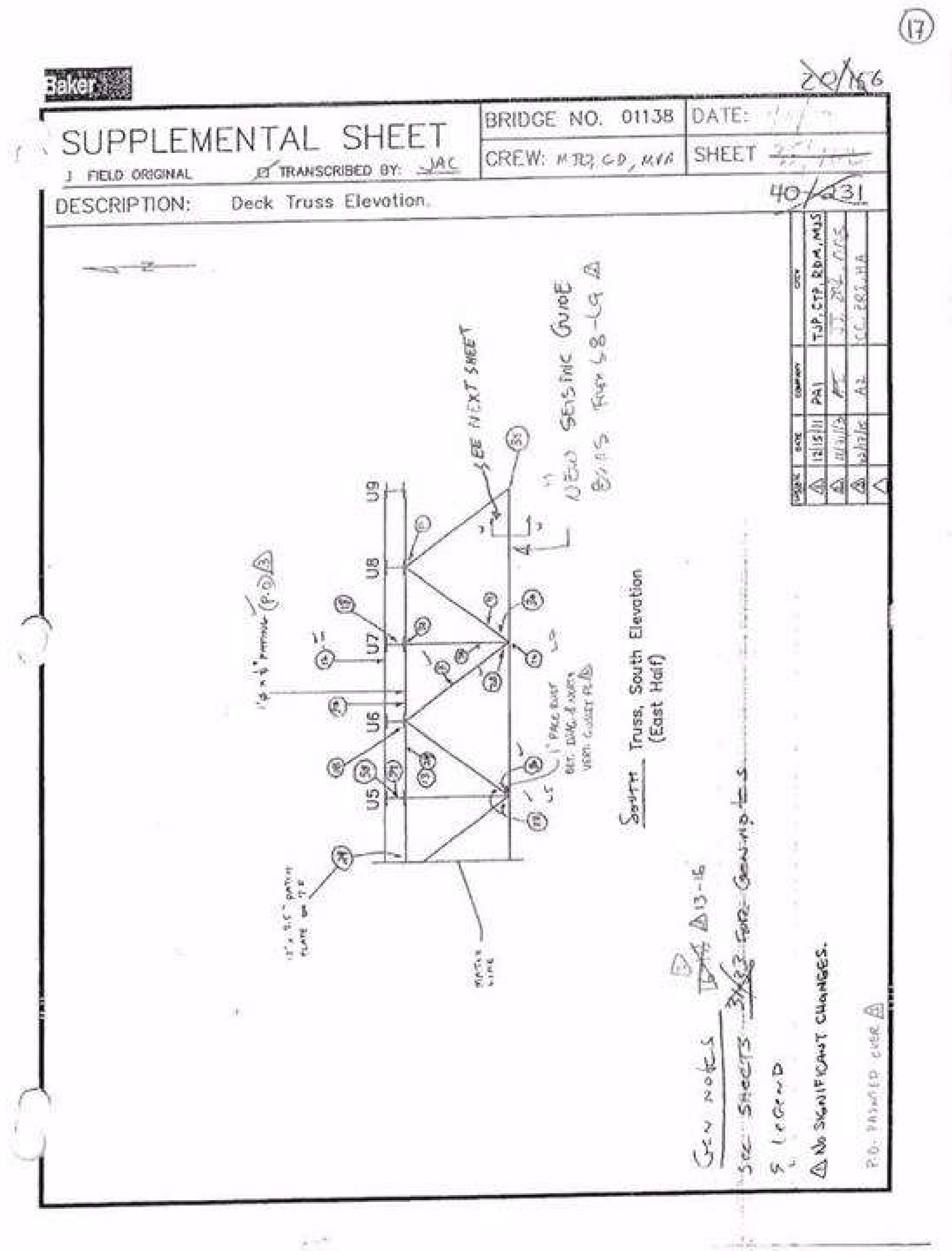
15_Legend Span 1- south truss- Sheet 2



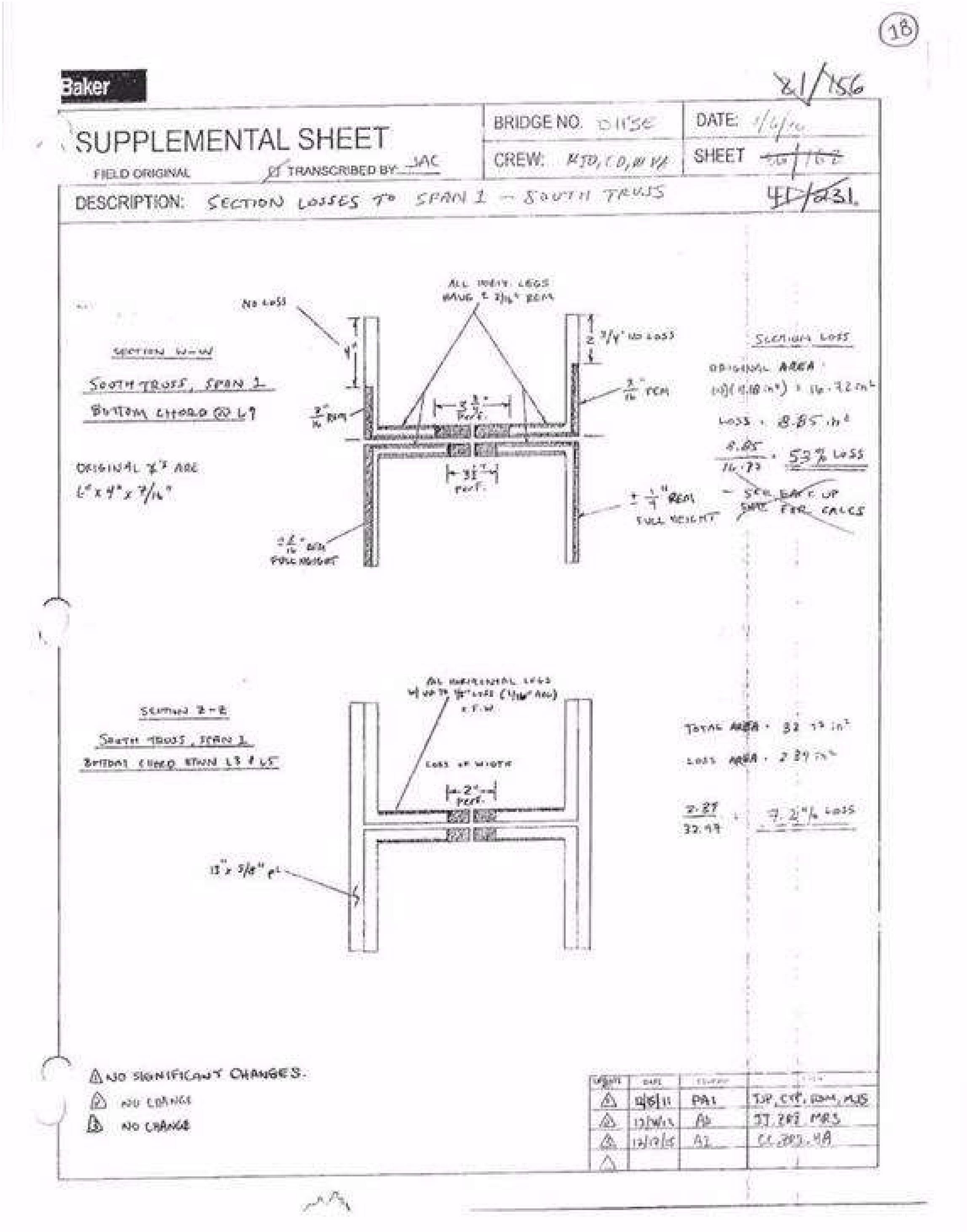
16_ South Truss, South Elev. (W. half)

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



17_ South Truss, South Elev. (E. half)



18_Sec. loss Span 1, S. Truss

(19)

Baker

22/156

SUPPLEMENTAL SHEET ☐ FIELD ORIGINAL ☐ TRANSCRIBED BY_____	BRIDGE NO. 01138	DATE: 1/6/2010
	CREW: MJO, CD, MVA	SHEET ~~37/161~~ 42/251

DESCRIPTION: TRUSS CONDITION LEGEND - SPAN 1 - NORTH TRUSS

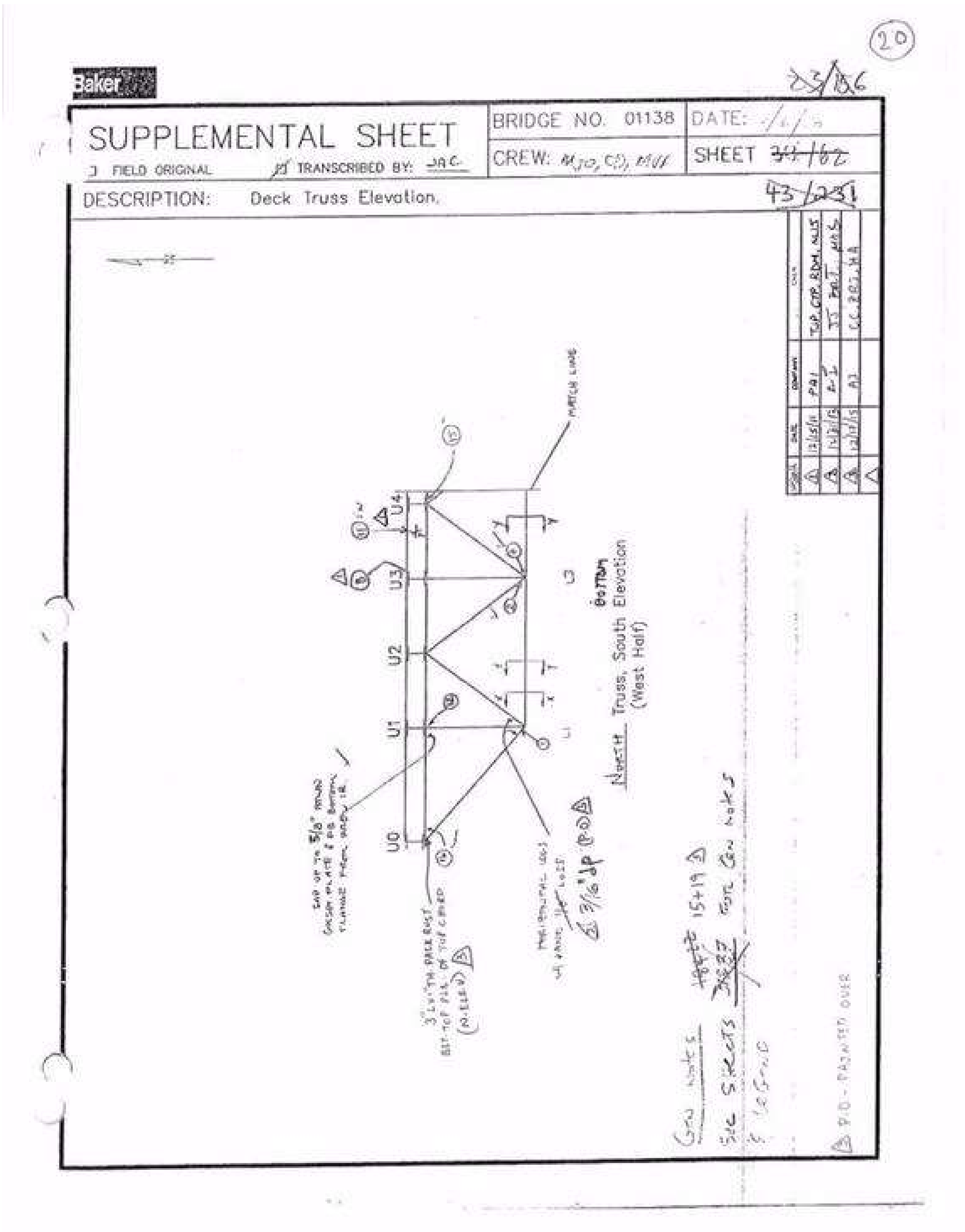
1. Bottom angles L1-U0 w/ ± ~~1.5"~~ 2" total loss of width (horizontal leg - 1.5" each angle, 3" total) and heavy pitting up to 2" wide, inside connection bottom angles vertical leg with 1/8" avg loss x 1" wide, adj to vertical gusset plates (ALL PAINTED OVER) △ 1/4"D, 1/8" DEEP.
2. 3 of 4 angles (L3-U2) with ± 1/8" average loss x 2" wide adjacent to vertical gusset plates; Horizontal legs, both north angles with 2" wide x 1.5' long x 50% section loss inside of connection
3. L5-U4 angles with ± 1/16" to 1/8" deep loss x 1/2" wide adjacent to vertical gusset plates at both elevations. L5-U4 south bottom angle horizontal leg rusted out 4"L x FW, South top angle w/(2) perfs @ end up to 1" diameter (Losses at ends of bottom angles inside connection)
4. L5-U6 angles vertical legs typically with 1/16" - 1/8" dp x 1" w loss adj. to gusset plate, typ 1/16" (both elevations)
5. L7-U6 horizontal legs of angles inside connection with heavy (50% x FW) losses to end 1.5' with perfs upto FW @ end 6". Also adjacent 1' of bottom two angles with upto 1" wide perfs @ horizontal legs; north angles vertical legs w/ 4"L x 1/2" x 1/8" - 3/16" dp loss in each angle adjacent to gusset plate W/AREAS OF LAM. RUST △
6. Bottom chord angle vertical legs adjacent to gusset plate w/ upto 9"H x 6"W x 3/16" loss (both elevations)
7. L3-U4 both south angles w/ ~~2"L~~ x 1"W x 3/16" avg loss on horiz. legs (bottom angle horiz. leg w/ (2) 1/8" perfs) inside the connection. W/LAM. RUST @ EDGE OF LEGS △
8. [illegible]
9. Top cover plate with heavy pitting ± 1/4" deep x upto FW x 50% of length ✓
10. Top cover plate with heavy pitting ± 1/4" deep, 4'L x FW with (2) 1" diameter perfs ✓ (P.O.) △
11. Top cover plate with 1/4" dp pitting x 15" wide, with random pinhole and 1" diameter perf @ numerous locations △ (P.O.)
12. Horizontal gusset plate with heavy pitting x upto 5/16" dp with knife edge x 1' wide w/5 RIVET HDS w/90% LOSS △ (P.O.) △
13. End of lateral bracing angle slightly bent
14. Horizontal legs of bottom chord angles are rusted out at toes (2" wide total) ✓
15. Rivet at diagonal connection is not seated
16. Batten plate with heavy losses ± 1/4" and rusted through holes up to 3" x 1.5" ✓ (P.O.) △

△ 4 E. VERT GUSS. PLA. W/UP TO 1/8" dp 1"Lx6"Hx75% SL NEAR PIN

UPDATE	DATE	COMPANY	CREW
△	12/15/11	PAI	DP/GTP/RDM/MJS
△	12/3/13	AI	[illegible], PRT, ARS
△	12/?/15	AI	CC, PRD, HA
△			

Intentionally left vacant for new deterioration notes.

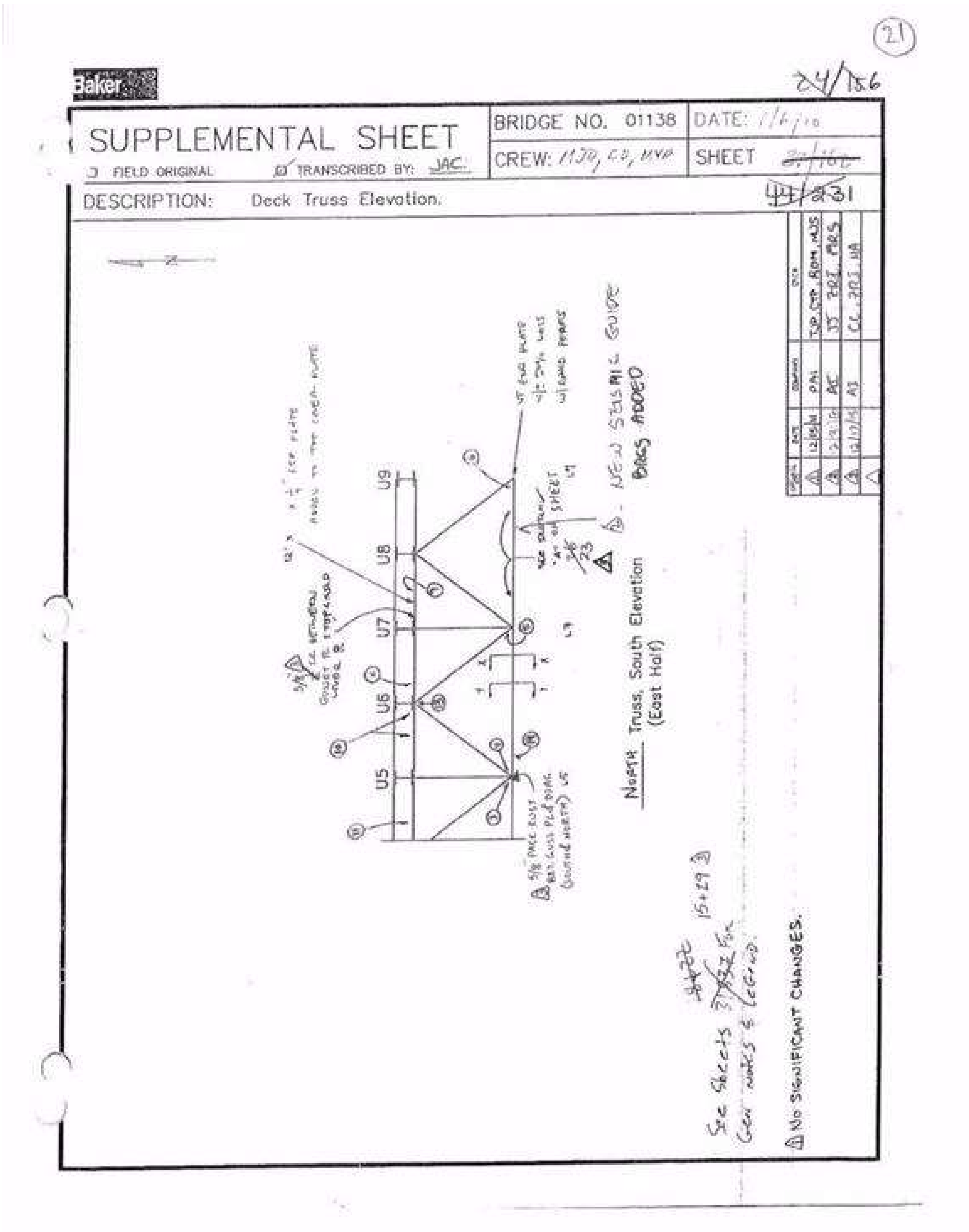
19_Legend Span 1 N. truss



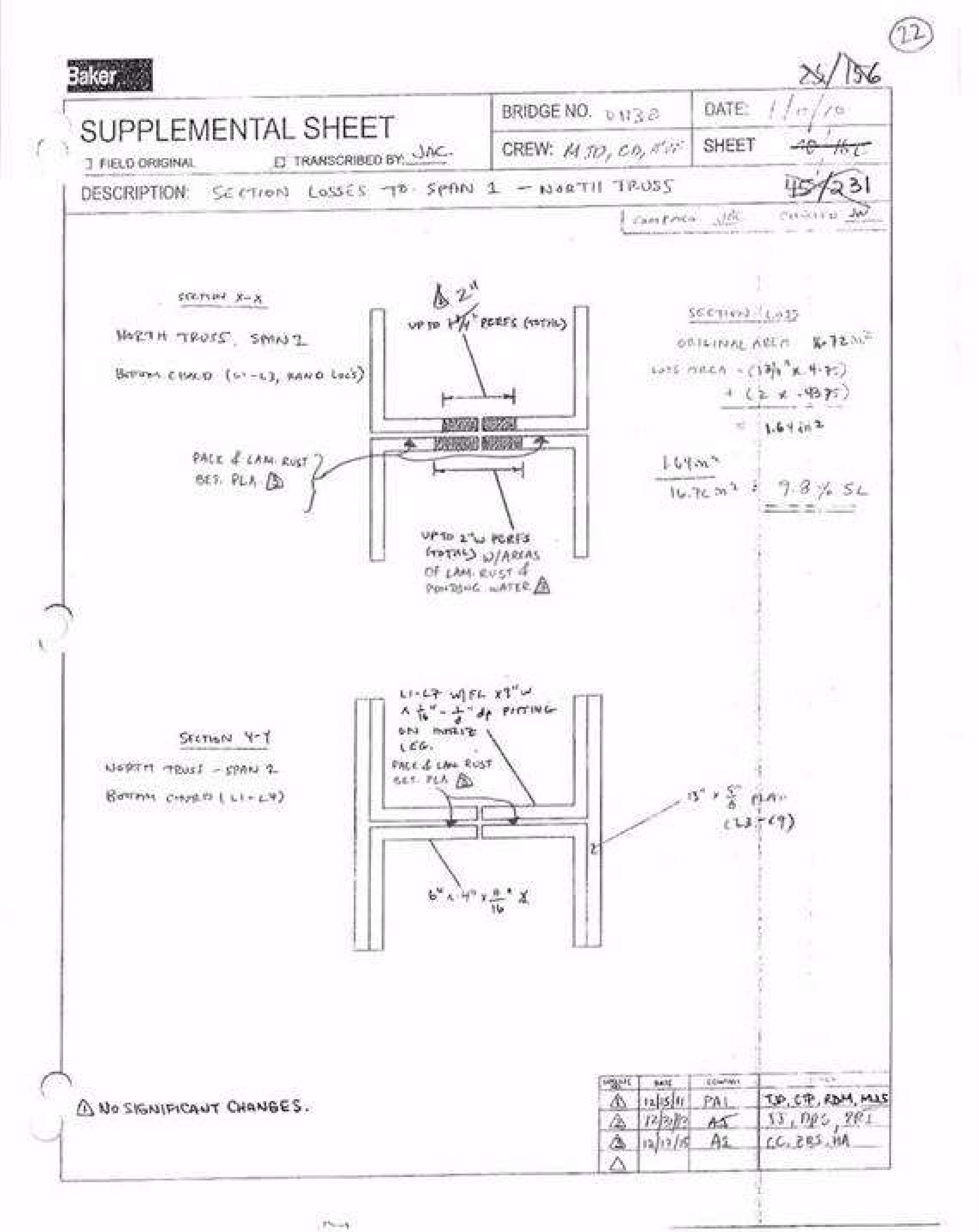
20_North truss, S. Bottom Elev. (W. half)

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



21_North truss, S. Bottom Elev. (E. half)



22_ Sec. Loss Span 1 N. Truss- Sheet 1

23

26/156

Baker

SUPPLEMENTAL SHEET

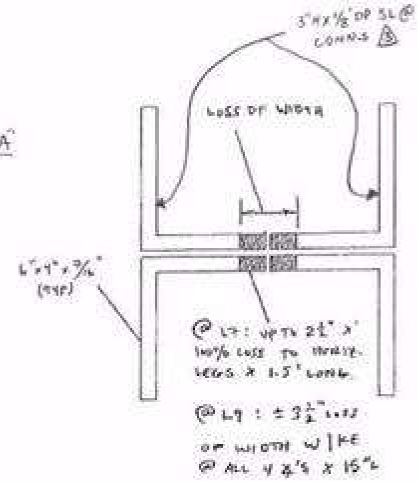
FIELD ORIGINAL ✓ TRANSCRIBED BY: JAC

BRIDGE NO: 01138 DATE:

CREW: MJD, CD, MWP SHEET: 46/231

DESCRIPTION: SECTION LOSSES TO SPAN 1 – NORTH TRUSS

SKETCH "A"



SECTION LOSS

ORIGINAL AREA = 16.72 in²

@ L7 LOSS AREA:
(4 LOC'S)(1.25" x .4375")
= 2.18 in²

$\frac{2.18 \text{ in}^2}{16.72 \text{ in}^2}$ = 13.1 % S.L.

@ L9 LOSS AREA:
(4 LOC'S)(1.75" x .4375")
+ (4 LOC'S)(1" x .4375"/2)
= 3.935 in²

$\frac{3.935 \text{ in}^2}{16.72 \text{ in}^2}$ = 23.5 % S.L.

– ASSUME KE TAPERS OVER 1" WIDTH TO ZERO SECTION LOSS

△3 – AREAS OF RECURRING LAM. RUST

△1 NO SIGNIFICANT CHANGES.

△2 NO CHANGE

INSPECTION	DATE	COMPANY	CREW
△1	12/15/11	PAI	TJP, CTP, ADM, MJS
△2	12/31/13	AI	JJ, ZRI, MA S
△3	12/17/15	AI	CC, ZRI, HA
△			

23_ Sec. Loss Span 1 N. Truss- Sheet 2

(24)

Baker

27/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE:
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	CREW: MSD, CO, MVA	SHEET ~~14/16~~

DESCRIPTION: SPAN 1 UNDERSIDE OF DECK AND AND STEEL FRAMING - GENERAL NOTES ~~47~~/231

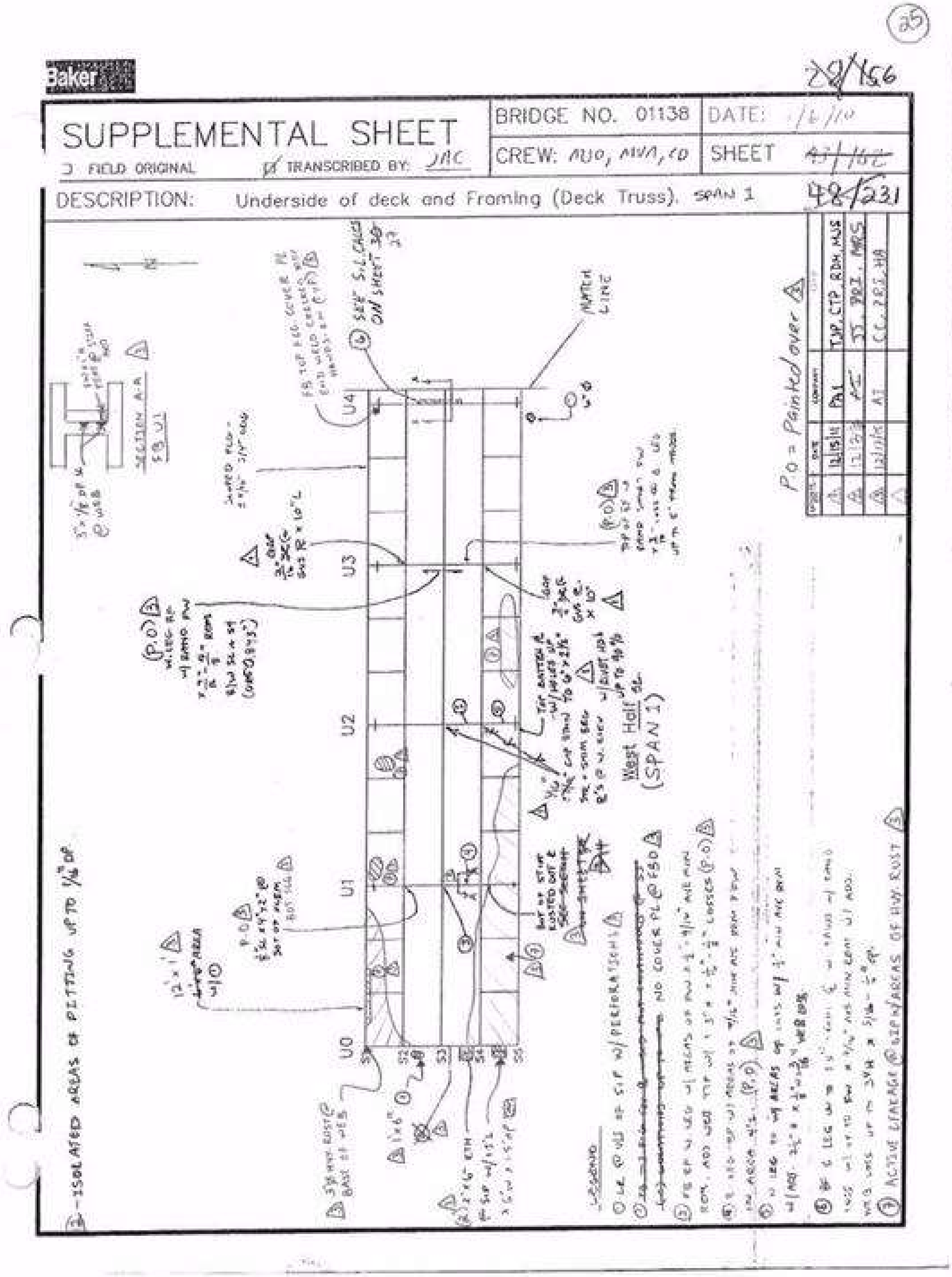
- All floorbeams are in good condition with random section loss up to ⅛" painted over on webs and bottom and top flanges, except where noted.
- A few rivet heads have up to 50% losses and are painted over.
- All floorbeams have added 10 x ½" cover plates to top flanges
- Floorbeam to stringer connections typically with (2) bolts.
- Up to 3/16" loss at horizontal gusset plates (orginally ⅜" thickness) between floorbeams and truss adjacent to floorbeams. gusset plates with random knife edge and ¼" loss of width. (F.O) 3
- Up to ~~⅜~~ ½ 3 impact rust at floorbeam and truss top chord connections.
- Moderate to heavy rust at S1 and S5 top flanges and SIP's and grip bars above with moderate to heavy rust with random efflorescence ± 3' wide.

3 - RANDOM AREAS OF HVY RUST @ FB ENDS @ FASCIAS.

1 NO SIGNIFICANT CHANGES.
3 NO CHANGE

UPDATE	DATE	COMPANY	CREW
1	12/15/11	PAI	TJP, CYP, RDM, MJS
2	11/14/13	AI	TJ, ZRZ, ARS
3	12/17/15	AI	CC, ZRZ, HA

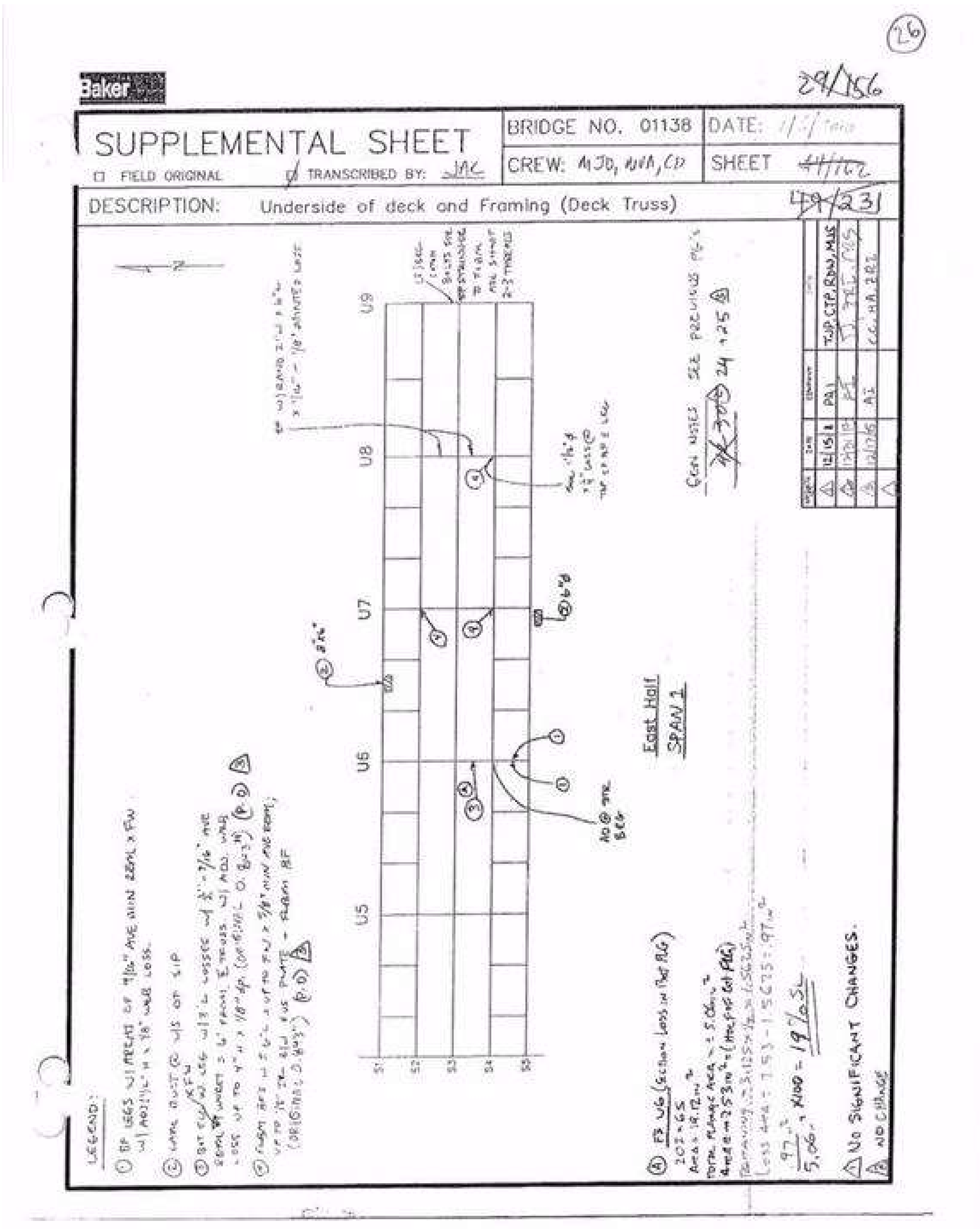
24_Span 1 Underside of Deck General Notes



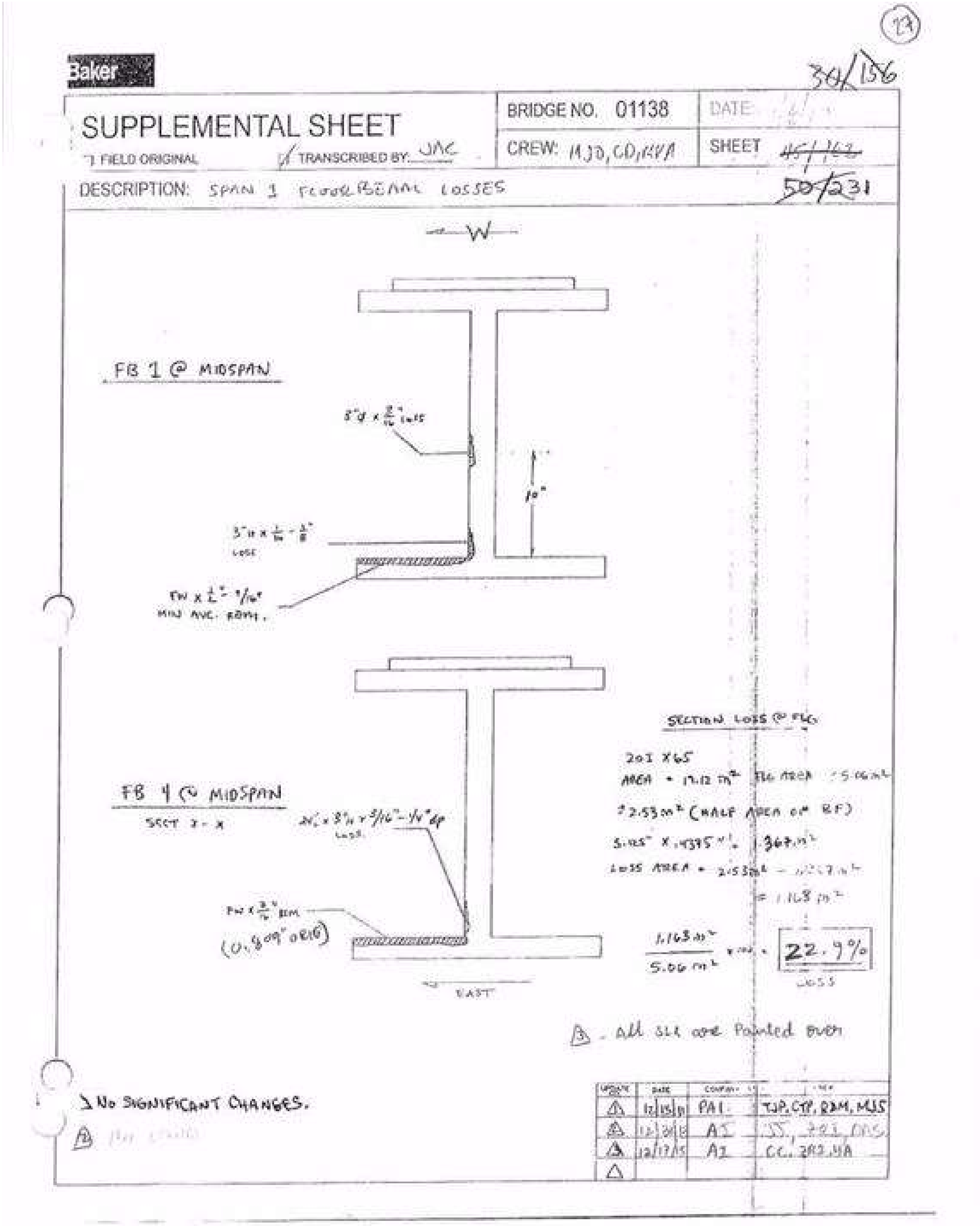
25_ Underside of Deck Span 1 (W. half)

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



26_ Underside of Deck Span 1 (E. half)



27_ Sec. Loss Span 1 FB

29

Baker

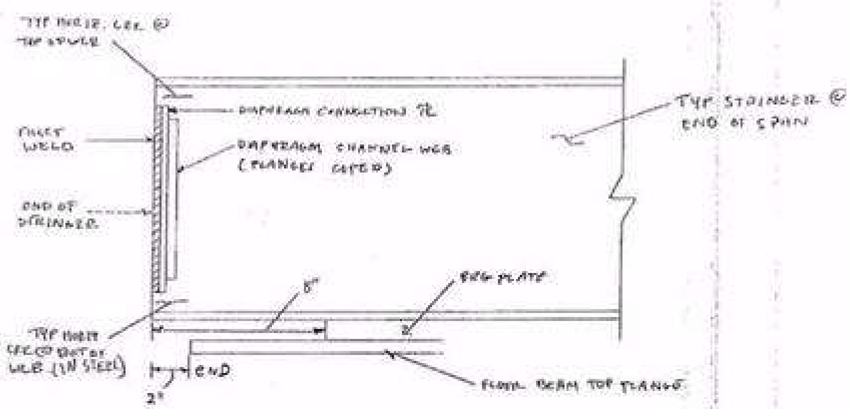
34/156

SUPPLEMENTAL SHEET

FIELD ORIGINAL ☑ TRANSCRIBED BY: JAC

BRIDGE NO. 01138 | DATE: 1/1/10
CREW: MJO, MVR, CO | SHEET ~~41/48~~ 51/531

DESCRIPTION: HORIZONTAL CRACKS IN WEBS @ ENDS OF STRINGERS



TYP STRINGER ELEV. @ ENDS OF SPAN
LOC'S A & B, SHEET ~~X~~ ~~34~~ 33

CRACK TABLE

CRACK LENGTH IN WEB ENDS

STRINGER LOCATION	NORTH ELEVATION: Horizontal Crk @ Top	NORTH ELEVATION: Horizontal Crk @ Bot	SOUTH ELEVATION: Horizontal Crk @ Top	SOUTH ELEVATION: Horizontal Crk @ Bot
STR #1 @ P1, S1	1" Ⓡ	1" Ⓡ	1/2" Ⓡ	—
STR #2 @ P1, S1	—	1 1/8" N/F	3/16" N/F	~~(X)~~ 5/8" N/F
STR #1 @ P1, S2	3/16" N/F	3/16" N/F	—	—
STR #5 @ P1, S2	—	~~3/8"~~ 1 1/2" Ⓡ		3/4" N/F 1 1/4" Ⓡ

NO CHANGE IN PROPOGATION NOTED SINCE LAST INSP.

– CRK LENGTH ESTIMATED USING VISUAL INSP. DUE TO TEMPS TOO COLD FOR DYE PEN (-3°F) ~~11°F~~ 55°F

Ⓡ - CRACK REPAIRED

N/F - NO CRACK FOUND; RUST IN STEEL

UPDATE	DATE	COMPANY	CREW
1	11/16/11	PAI	TJP, CFP, RDM, MJS
2	4/4/13	AI	TT, PPK, [illegible]
3	12/14/15	AI	PS, DV, JRJ, MRS
4			

28_Horizontal Cracks in Web at End of Stringers

29

32/166

Baker

SUPPLEMENTAL SHEET ☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	BRIDGE NO. 01138	DATE: 1/6/2010
	CREW: MDD, TK, JAC	SHEET ~~47/105~~
DESCRIPTION: FIXED SPAN 2 FRAMING GENERAL NOTES		52/231

FRAMING:

- Random floorbeam top and bottom flanges with losses up to ⅛" dp on horizontal legs, web plates with up to 1/16" losses.
- Random rivet heads have up to 50% section loss. (Isolated areas up to 60%)
- Random gusset plates with pitting upto 3/16" dp.
- Random gaps upto ¼" between stringer bottom flange and floorbeam top flange due to cleaned out Impacted rust. (Can be probed up to 3" max.) (No shim plates added.)
- Floorbeam top flanges with random ¾" drilled holes from previous stringer connections.
- Underside SIP forms with random minor pitting areas up to 6" dp with small pinhole perforations & SEVERAL AREAS OF UPTO 100% SL OVER STRINGER 51.
- Floorbeam top flanges with pitting type losses upto ¼" dp X FW X 8" L extending from cover plate end to under facsia stringers due to cleaned out impact rust (typically with reoccurring rust).
- Random bracing angles show pitting upto ⅛" dp from cleaned out impacted rust. Back-to-back LATERAL ~~latice~~ bracing angles with up to ½" impacted rust between angles.
- Stringer top flange with random locations of ⅛" dp pitting (1/16" average).
- Up to ½" gaps between gussets and LATERAL ~~latice~~ bracing due to cleaned out impacted rust.
- Up to ½" impacted rust between floorbeam bottom flange at gusset plate at truss connection.
- Continuous 10" W X ± 9/16" cover plate welded to top of floorbeam at fixed span.
- FLOOR BEAM TOP FLANGES W/ AREAS OF SECTION LOSS ALONG EDGES UP TO 6"L x 1"W x 3/8"D (11/16" ORIG)
- MOD. TO HVY ACCUM. OF PIGEON DEBRIS ON FB TOP FLG @ RANDOM LOCATIONS.

UPDATE	DATE	COMPANY	CHECK
2	12/19/11	PAI	CTP, JLC
3	2/20/14	AI	DAL, JJ, FL, ZPP
4	12/22/15	AI	PS, DL, ZPJ, MRS

1 - NO CHANGE

29_ Span 2 Framing General Notes

(30)

33/156

Baker

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/6/10
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	CREW: MDD, JK, TAC	SHEET ~~49/117~~

DESCRIPTION: DETERIORATION LEGEND FOR SPAN 2 FIXED TRUSS UNDERSIDE AND FRAMING 53/231

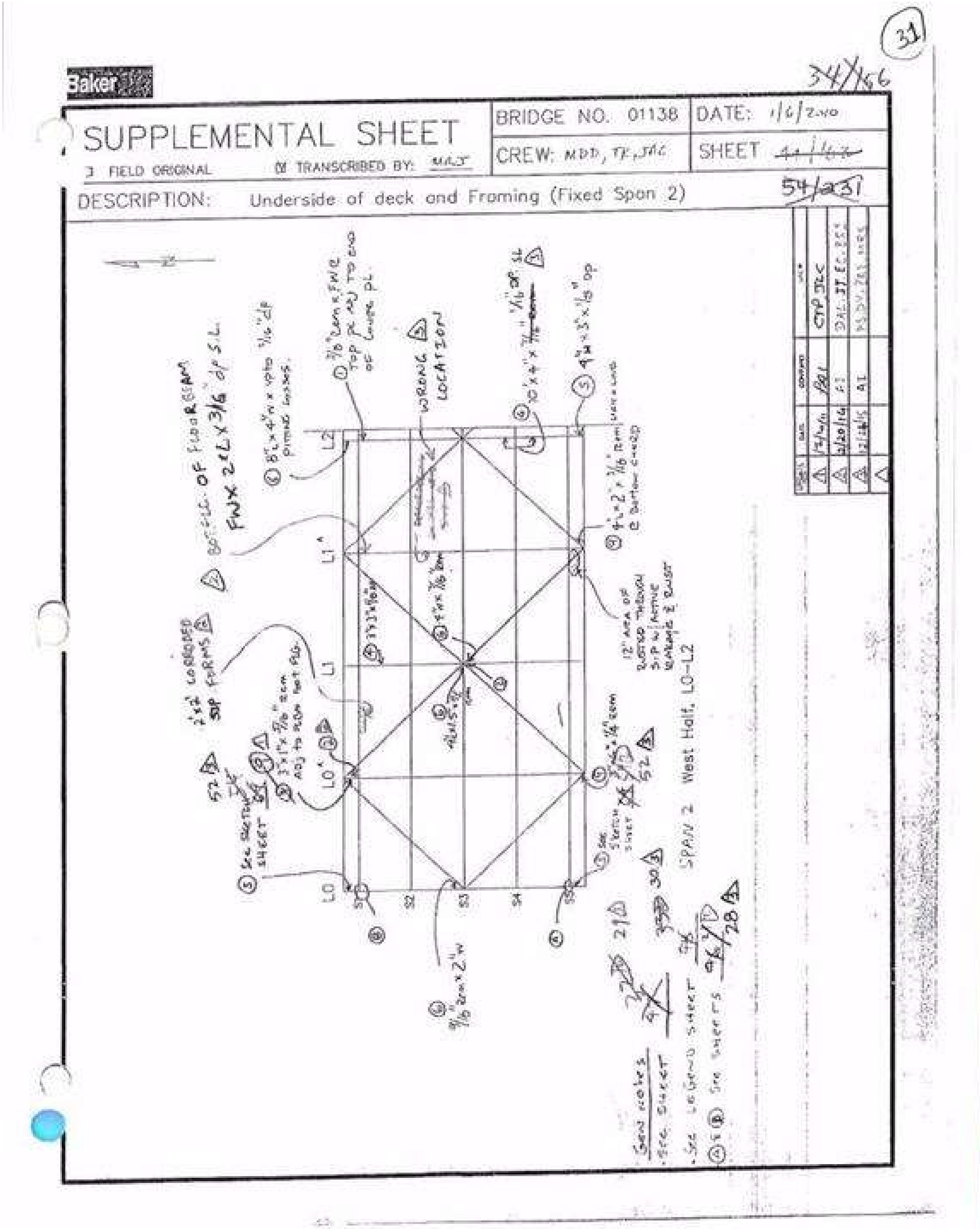
1. Top flange of floorbeam with section loss on horizontal leg.
2. Up to ¾" impacted rust between floorbeam bottom flange and gusset plate.
3.
4. Bottom flange of floorbeam with pitting and/or section losses.
5. Pitting and/or section loss in web of floorbeam.
6. Bottom flange of of floorbeam with section loss on horizontal leg.
7. Web of floorbeam with rusted through holes
8. Abandoned machinery connections with rough cut holes in web of floorbeam: (1) 4-¾" diameter and (2) ¾" diameter.
9. Gusset plates with pitting and/or section losses.
10. Floorbeam top flange with pitting losses (painted over).

A NO CHANGE

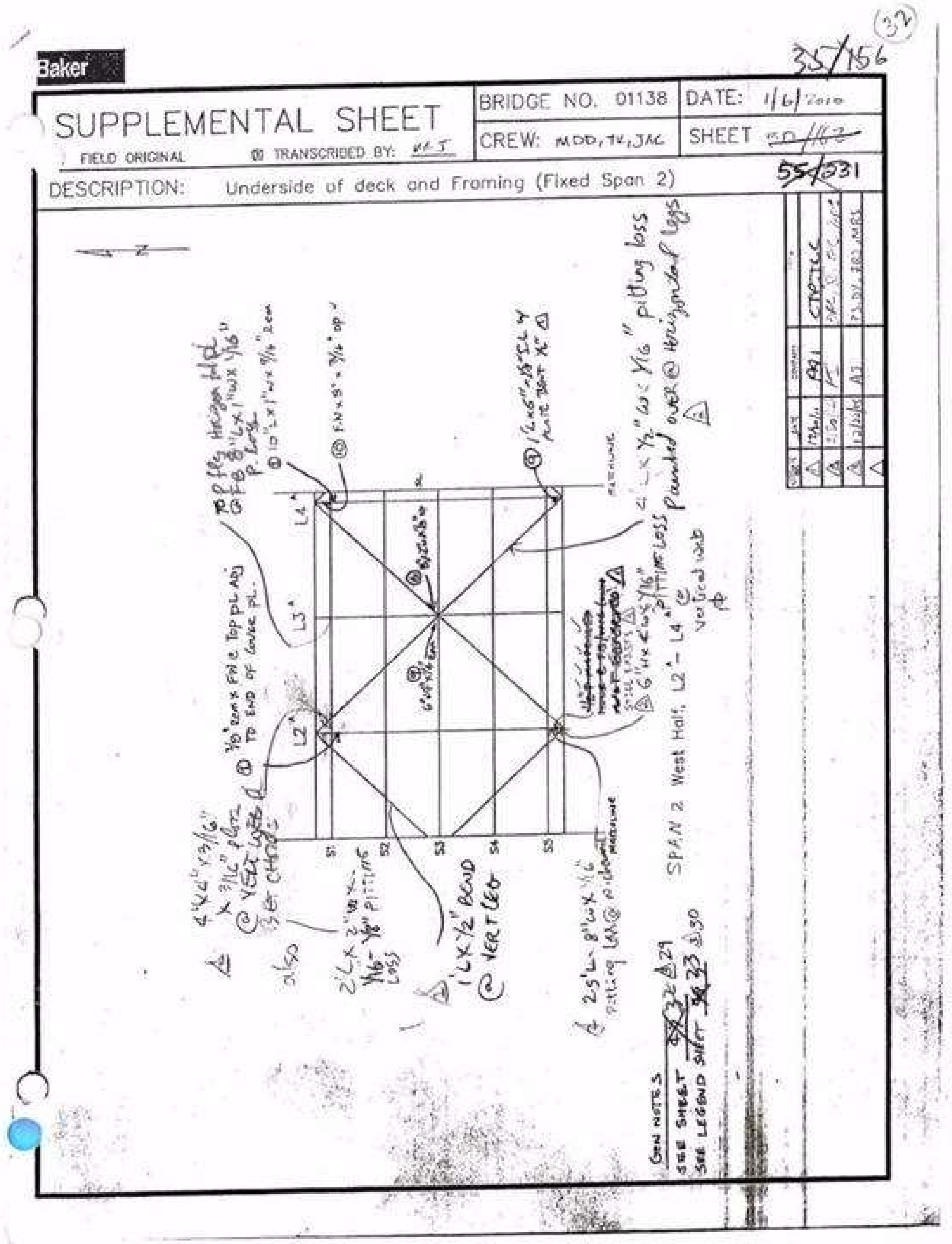
A NO SIGNIFICANT CHANGES

UPDATE	DATE	COMPANY	CREW
B	12/19/12	PB	CTP, JL, C
C	1/1/14	AI	DAC, JJ, FC, PRI
D	12/2/15	AI	PS, DY, 2KJ, MRS

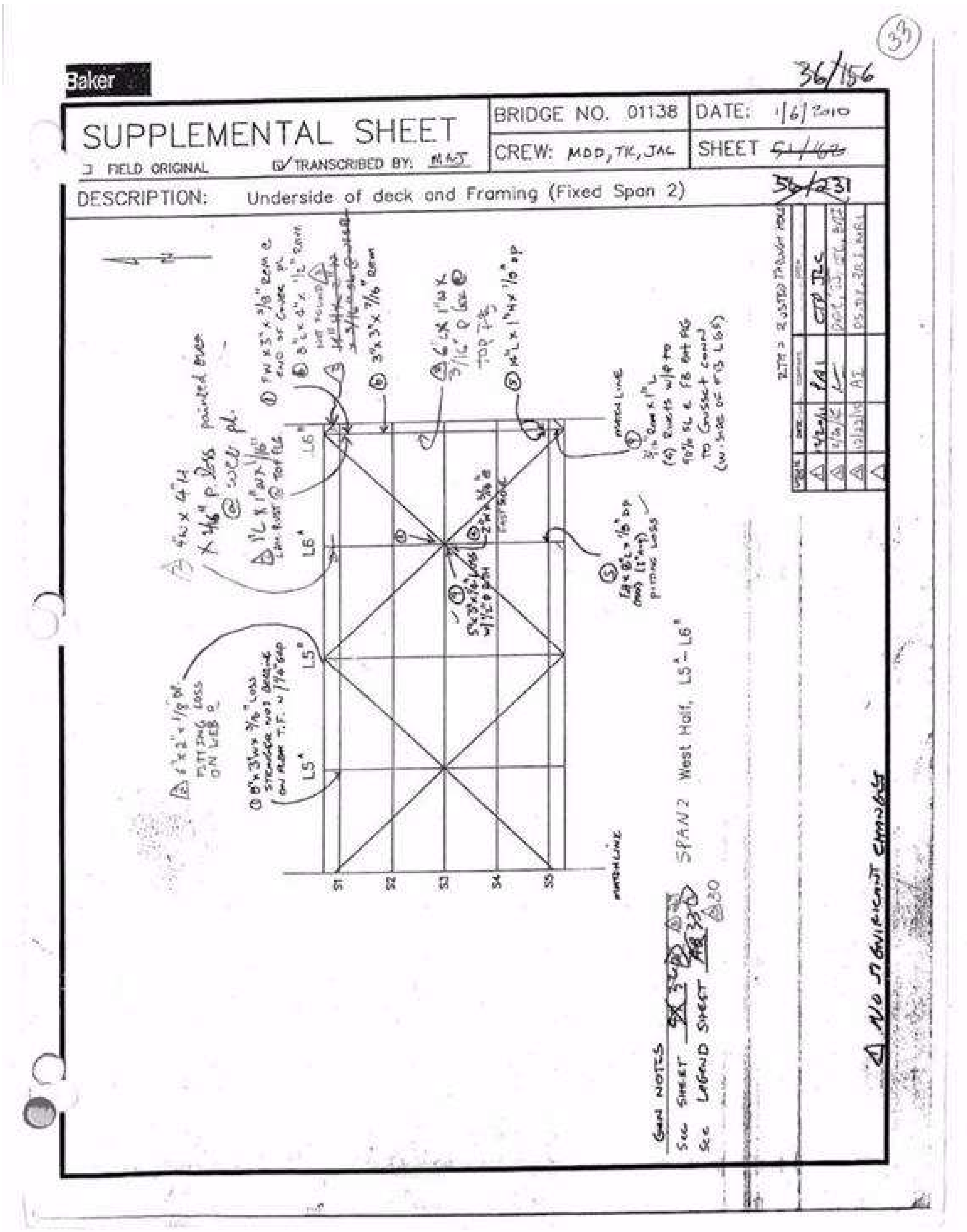
30_Legend Span 2 Framing and Underside



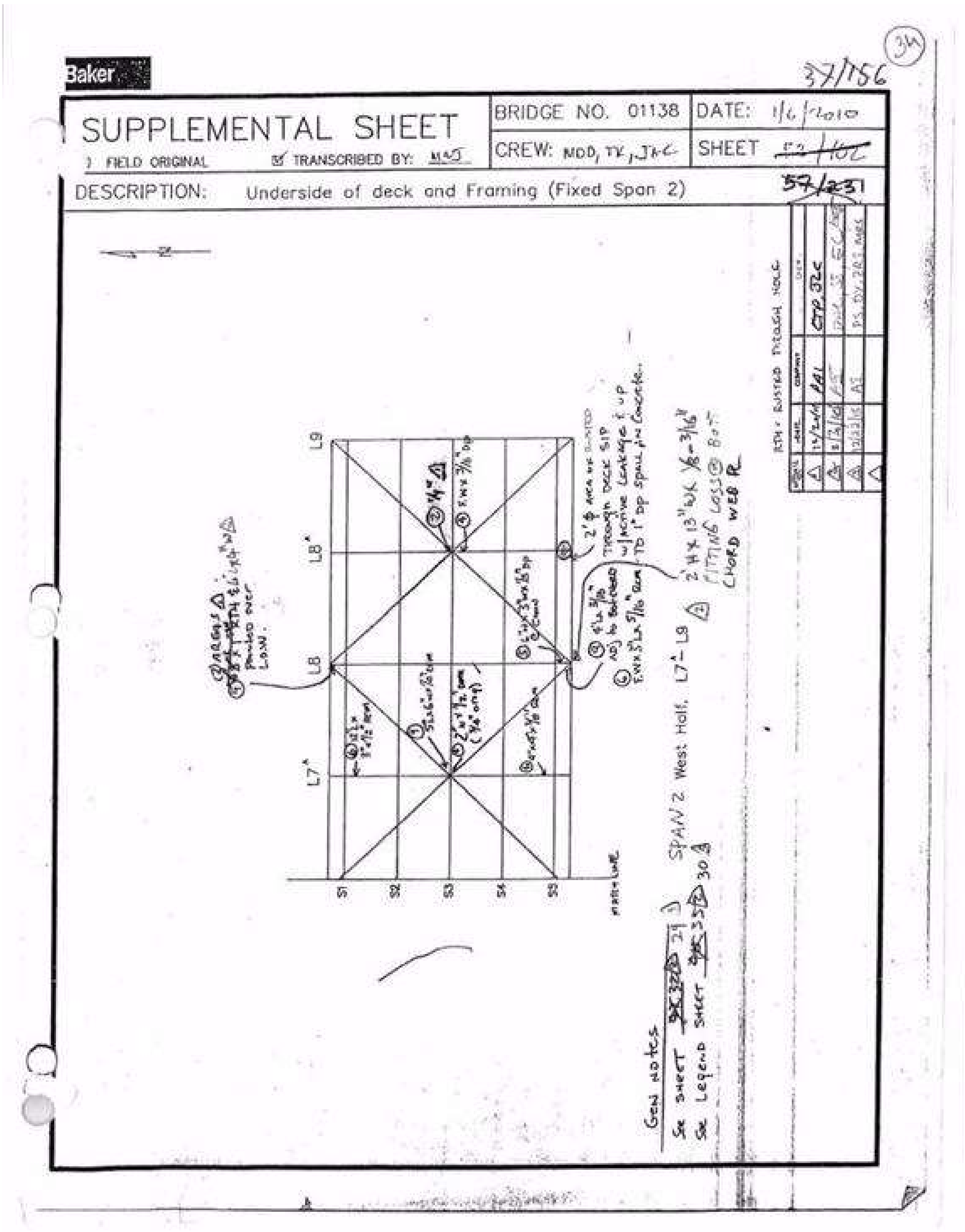
31_underside of Deck Span 2 (W. Half) L0-L2



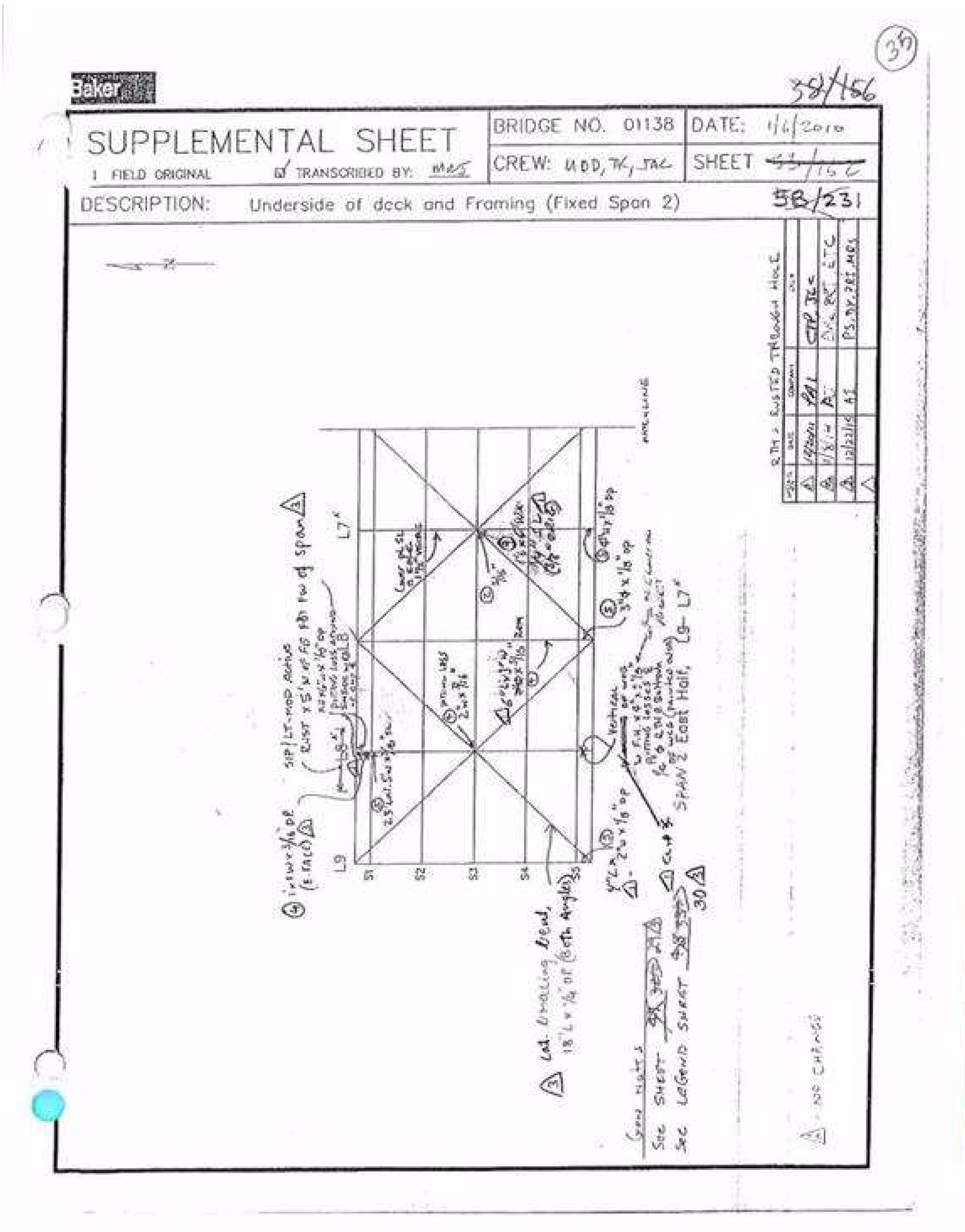
32_underside of Deck Span 2 (W. Half) L2-L4



33_Underside of Deck Span 2 (W. half) L5-L6



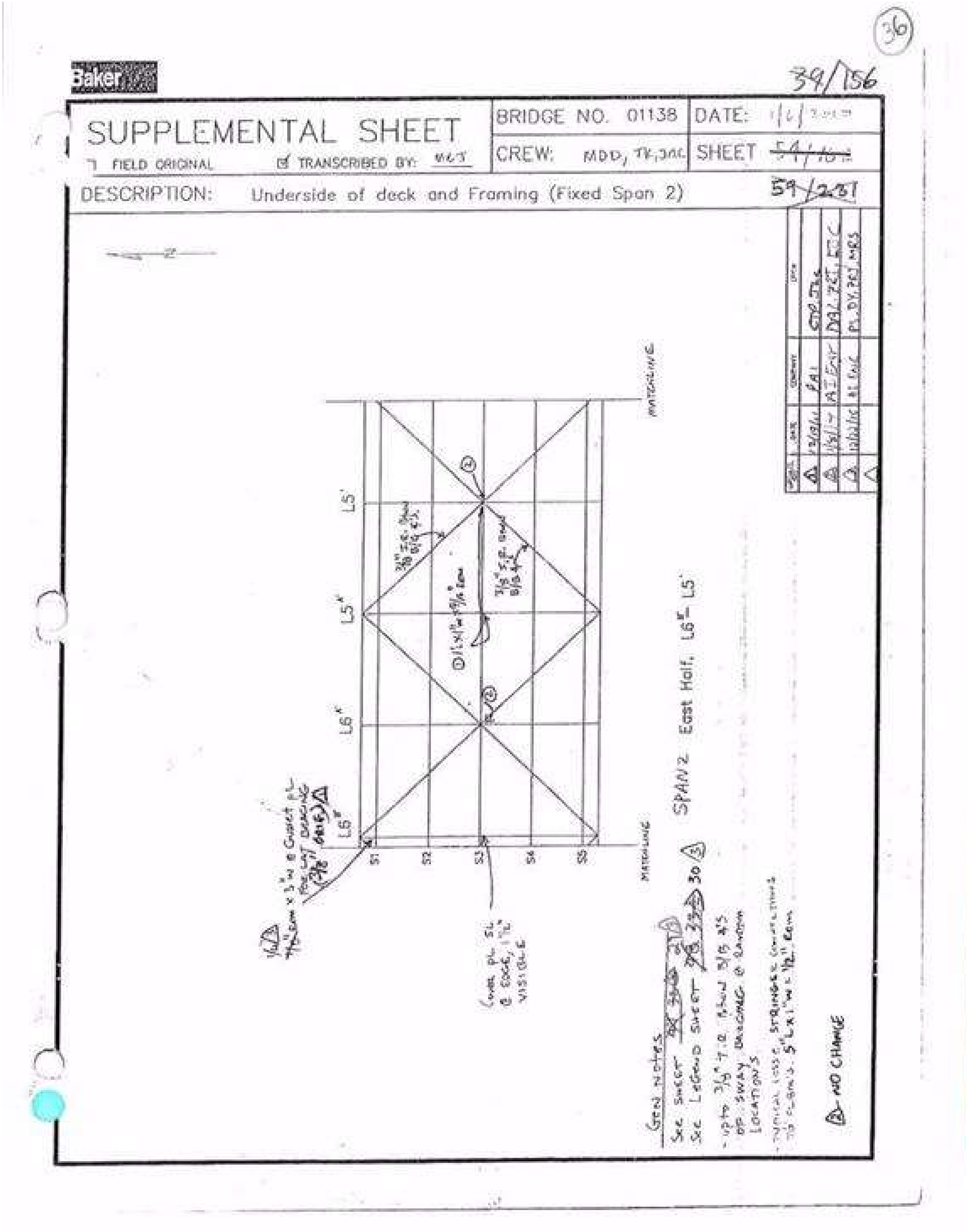
34_Underside of Deck Span 2 (W. half) L7-L9



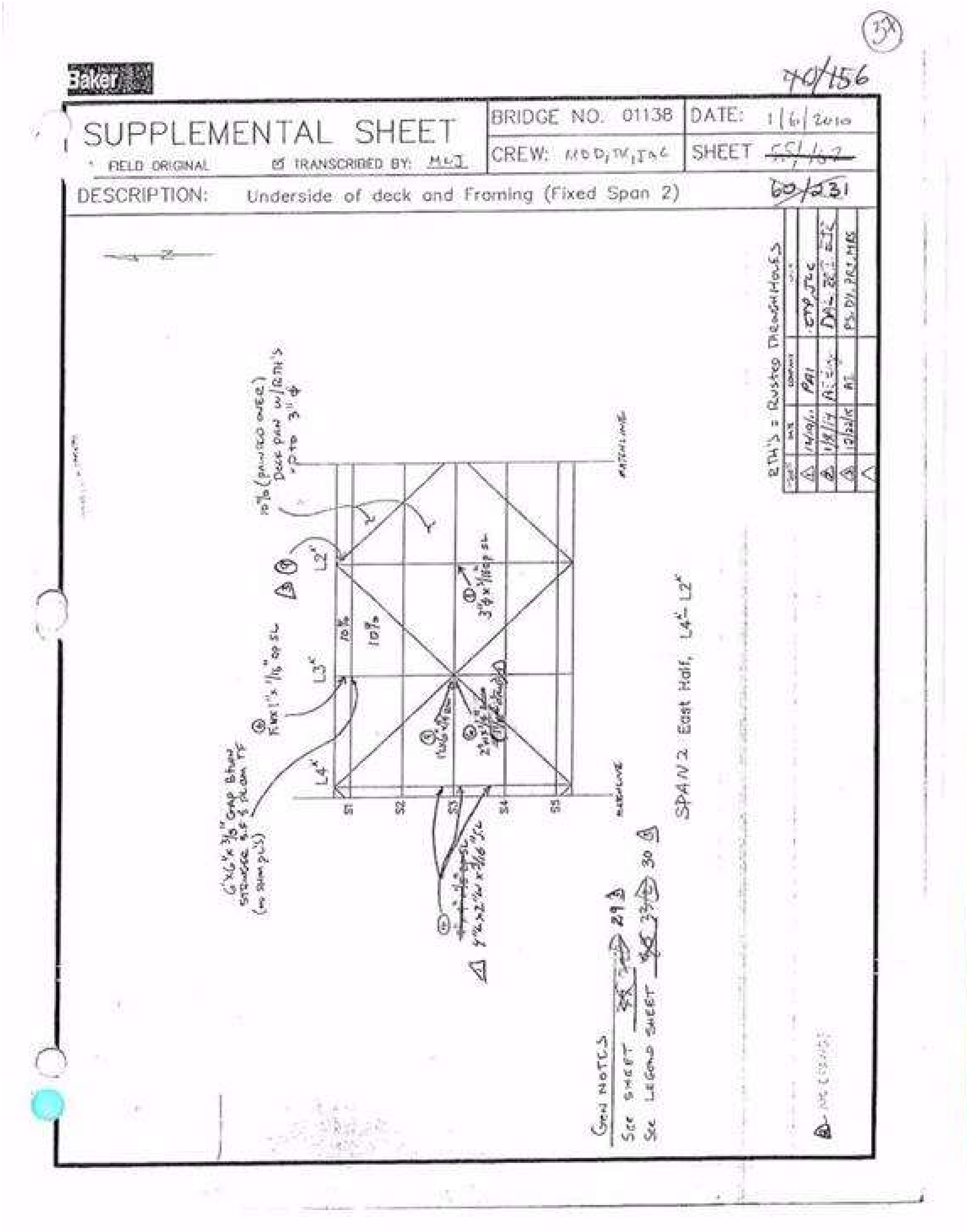
35_Underside of Deck Span 2 (E. half) L7- L9

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

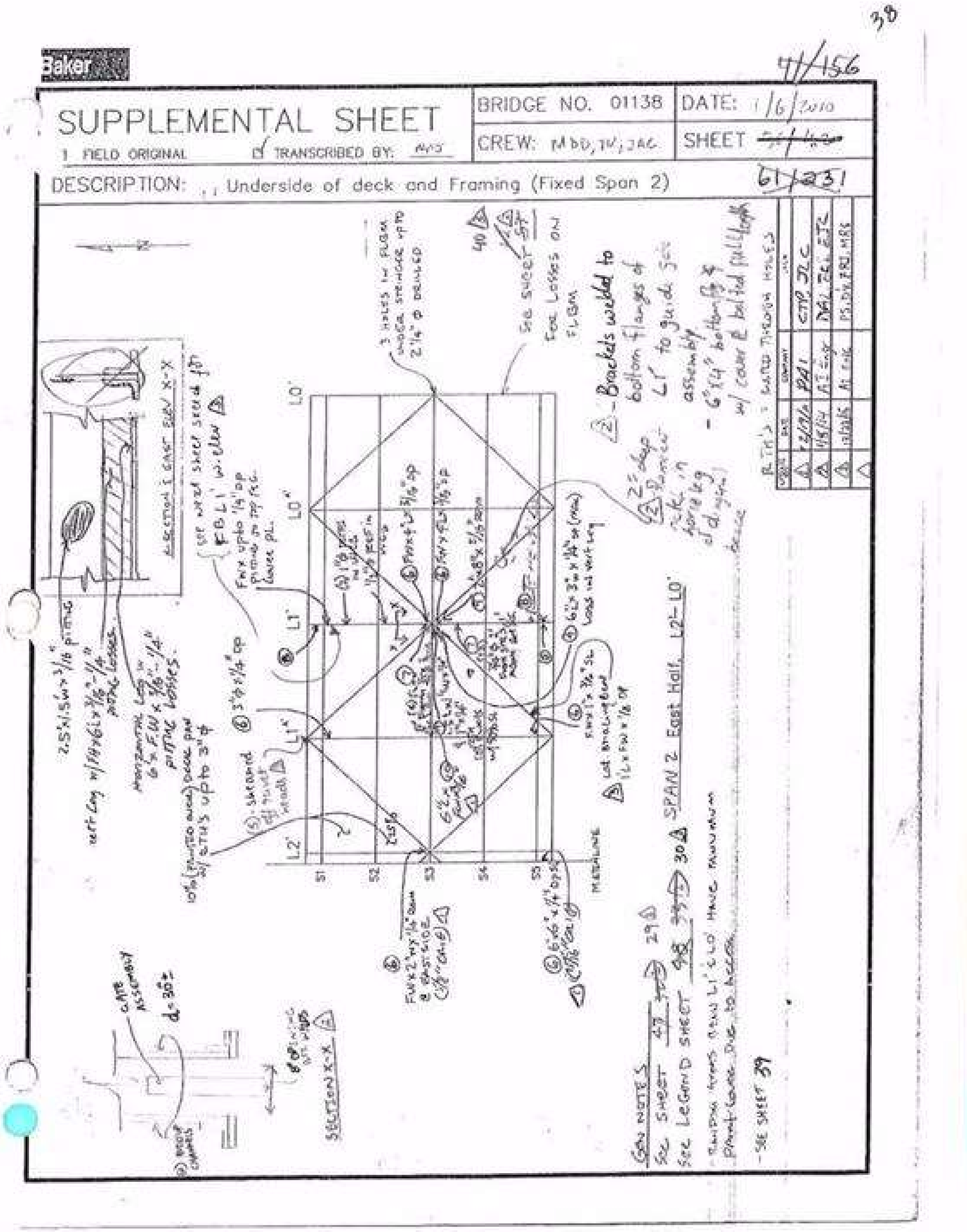
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



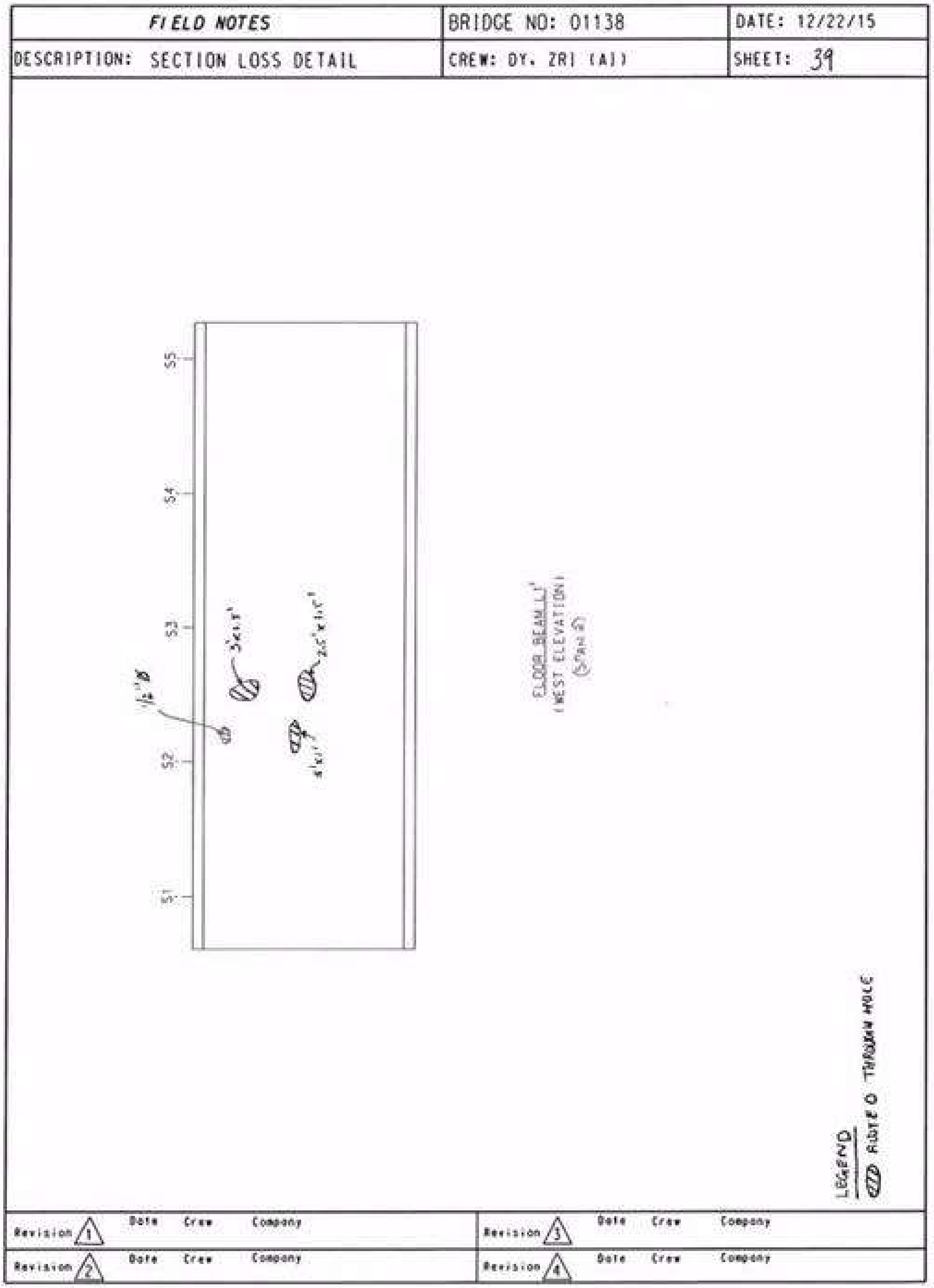
36_Underside of Deck Span 2 (E. half) L6-L5



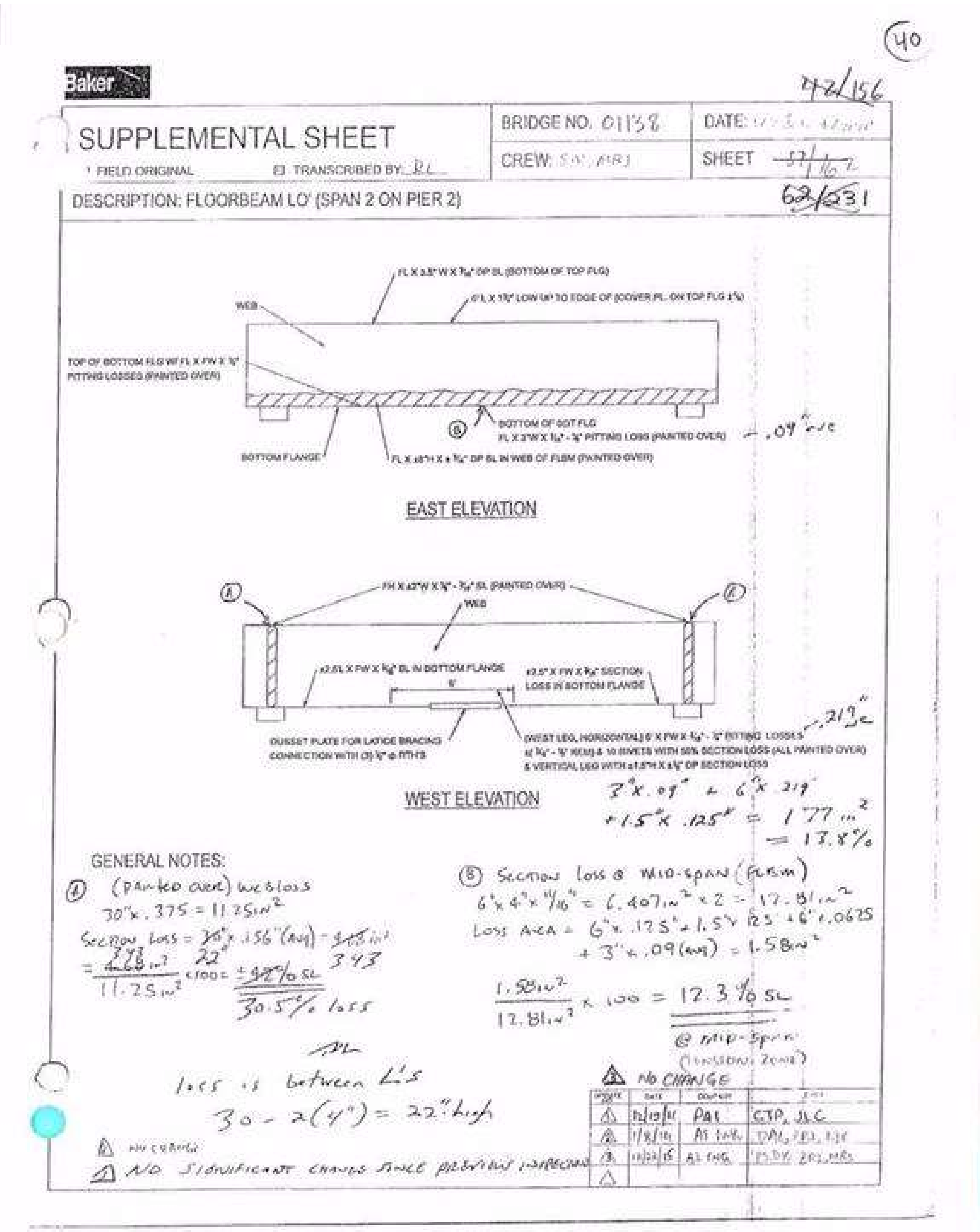
37_Underside of Deck Span 2 (E. half) L4- L2



38_Underside of Deck Span 2 (E. half) L2- L0



39_Sec loss FB L1 (W. Elev)



40_ Floor Beam L0 (Span 2 on Pier 2)

(41)

Baker

93/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE [illegible]
	CREW: MDD, TK, JAC	SHEET ———
DESCRIPTION: FIXED SPAN 2 GENERAL NOTES (TRUSS NOTES)		63/231

TRUSS

- Random lattice bars show pitting losses up to $\frac{1}{8}$". w/ [illegible] PART up to $\frac{1}{4}$" W.
- Random lacing bars are slightly bent. w/ [illegible] up to $\frac{1}{4}$" W & PITTING UP TO 3/16" D
- Sway bracing connection to upper gusset plate (horizontal) with minor pitting up to $\frac{1}{8}$" max (painted over)
- Truss plates connection angles show random minor pitting, negligible to $\frac{1}{16}$" loss.
- There are random gaps up to $\frac{1}{8}$" between gusset plates and chords due to cleaned out impacted rust.
- Random sway bracing horizontal struts with up to $\frac{1}{8}$" pitting on outstanding legs with minor bends/dents on angles.
- Random rivet heads exhibit section losses up to 50%. Isolated rivets with up to 90% section loss. [illegible] / MINOR TO [illegible] FAR BELOW [illegible] RIVETS.
- There are random areas of ~~light~~ MINOR T- MOD. [illegible] surface rust that have not been painted.
- Random locations at B/B angles show negligible to $\frac{1}{16}$" loss at gusset connections and sway bracing.
- Vertical gusset plates with $\frac{1}{16}$" - $\frac{1}{8}$" pitting losses adjacent to B/B angles at middle truss connections (painted over).
- Web plates of top chord with random areas of painted over pitting up to 1" H x upto $\frac{1}{8}$" dp (typically along bottom flange clip angle)
- Elastomeric bearings for both trusses at Pier # 1 ~~[illegible]~~ EXPANDED BY $\frac{1}{4}$" [illegible] ~~[illegible]~~ 40%
- Bearing components typically with light - moderate rust
- Bottom chord web plates at nodes and floorbeams [illegible] & RANDOMLY THROUGHOUT [illegible] 1" L X upto 8" H X upto $\frac{1}{16}$" pitting (painted over)
- Bottom chord horizontal leg at lattice bars 1" L X 1" H X $\frac{5}{16}$" remaining
- RANDOM AREAS OF MINOR TO MOD PITTING (P.O.) & ACTIVE CORROSION BOTTOM CHORD WEB & BATTEN/GUSSET PLATES [illegible]
- BOTTOM CHORD VERTICAL DIAPHRAGM PLATES W/ PAINTED OVER PITTING & ISOLATED RUST HOLES UP TO $\frac{1}{2}$" DIA
- BOTTOM CHORD LATERAL BRACING GUSSET PLATES W/ PITTING & MINOR CORROSION @ EDGES UP TO 3/16" D (3/16 REMAINING) X 1" [illegible]
- DIAGONALS (N & S TRUSSES) IN BOTTOM CHORD B-B ANGLES W/ PITTING & 100% SECTION LOSS @ EDGES UP TO 4" L X 1 1/2" W (TYP. ON VERTICAL B-B ANGLES & VERTICAL CHANNEL FLANGES) JUST ABOVE BOTTOM CHORD)

1	12/8/11	[illegible]	[illegible]
2	12/3/14	AS ENG	JJ, ZRJ
3	12/6/15	AS ENG	YS, HC, ZRJ, MRS

41_Span 2 General Notes Truss

42

Baker

44/156

SUPPLEMENTAL SHEET ☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	BRIDGE NO. 01138	DATE: 12/10/09
	CREW: YS, MRJ	SHEET ~~11/44~~

DESCRIPTION: DETERIORATION LEGEND FOR SPAN 2 TRUSS 64/231

① North top flange ~~angle~~ with △ 5" x 5" x ¼" pitting

② ~~Conduit for traffic light held in place with tie strap and clamps (conduit hung loosely).~~ Support frame for vertical clearance sign welded in place. ~~Sign with (2) cracks up to 3.5" long (secure)~~ - Sign Removed △

③ North elevation of gusset plate ~~chord web~~ w/ 6"L x 2"W x 5/16" OF △ ~~⅜"~~ pitting adjacent to diagonal. Both horizontal legs of diagonal with up to ~~2" x 3"~~ perfs. 5"L x 1½"W △

④ (△ ENDS OF PORTIONS OF GUSSET PLATE ARE CURLED AT ENDS FROM IMPACTED RUST) ½" shim plates under gusset plate rusted through and curled at ends from impacted rust.

⑤ Back to back angles with pitting on both legs adjacent to latice bars up to 43% section loss.

⑥ N. side of top flange with 24" ~~18"~~L x 4"W △ ~~2"W~~ x ¼" remaining (worst case) above bearing pin. (5/16" LOSS) 9/16" ORIGINAL △

⑦ ⅛" - 3/16" deep pitting to vertical gusset plates inside node (painted over)

⑧ Loss in web at gusset plate connection on bottom chord. UP TO 3/16" SEE F △.

⑨ Pitting losses on lacing bars in bottom chord up to 3/16" deep UNLESS NOTED OTHERWISE △

⑩ Pitting losses at bottom chord at bottom

⑪ Missing rivets in vertical horizontal △ gusset plate connection

⑫ Section loss in bottom chord horizontal legs bottom flange (painted over)

⑬ Section loss to web and horizontal gusset plate of bottom chord (interior)

⑭ Web plate with up to 1"L x 1"H x up to ⅛" deep losses (painted)

⑮ Up to ¼" impacted rust between gusset plate and horizontal lateral bracing angles

⑯ Luminaire attatched (bolted) to gusset plate, off at time of inspection

⑰ ¼" impacted rust between vertical member and gusset plate. Gusset plate with FH x ½"W x up to 3/16" deep

⑱ North web plate with 1"L x 3"H x up to ¼" deep (painted)

⑲ ¼" impacted rust between batten plate and bottom chord angles

⑳ Slight bend in end portal angle @ center line of bridge, most likely caused during erection. bend at adjacent lateral bracing △

㉑ Top double angles of sway bracing between south truss and center spine brace have loss on vertical legs ¼" deep x 1" long loss of width

㉒ Member U6 - M7, flange of angle member bent up to ¾" over 10"

㉓ 1"L x 8"H x up to 3/16" pitting on north web

㉔ Horizontal gusset plate 9"L x 3" x ¼" remaining and loss of width △ 7"L x 3/4"W ~~5"L x ½" wide~~.

㉕ ⅜" impacted rust between vertical gusset plate and vertical truss member

△ - NO CHANGE
△ NO CHANGE

VERSION	DATE	COMPANY	CREW
△	12/10/11	PAI	CTP, JLC
△	12/2/13	AI	JJ, ? RI
△	12/15/15	AI	PS, ART, HE, MRC
△			

42_Legend Span 2 Truss- Sheet 1

43

Baker

45/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 12/10/09
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	CREW: YS, MRJ	SHEET ~~60/142~~

DESCRIPTION: DETERIORATION LEGEND FOR SPAN 2 TRUSS 65/231

26 Top lattice with full width x full length x 3/16" remaining
27 7" x 3" x 3/16" remaining on north vertical gusset plate with ± 1/2" impacted rust between gusset plate and angle
28 12" x 1" x 3/16" loss to gusset plate at sway bracing connection and (2) missing rivets
29 12" long (total) x 1" x 3/16" deep pitting on △ bracing connection gusset plate.
30 Up to 12" long x up to 1/4" impacted rust between △ top plate and ~~back to back~~ angles of top chord, non-active
31
32 Bottom chord web with 1"L x 3"H x 1/8" deep pitting
33 North angle on diagonal (M5 - U4) with 6" x 3/8" x 3/16" loss
34 1/4" diameter perf in △ plate vertical gusset plate ~~adjacent to sway brace connection~~ (loss of edge)
35 Inside angle bent 2" long x 1/2" (NORTH TRUSS; BOTTOM FLANGE, INBOARD FACE) △
36 Loss on vertical gusset plate (painted over) adjacent to back to back angle connection
37 Bolted connection to vertical with chipping paint due to impact damage (no cracking noted)
38 (2) missing rivets in connection; horizontal lateral bracing gusset plate with 4"L x 1"W x ± 1/8" deep SL (painted)
39 Impacted rust between horizontal gusset plate and lateral support member
40 Section loss to bottom flange of bottom chord at gusset plate connection
△ 41 HORIZONTAL GUSSET PLATE TO FLOOR w/ PITTING (PAINTED OVER w/ MINOR ACTIVE CORROSION) 8"L x 18"W x UP to 1/8" REMAINING (1/4" DEEP LOSS) - SOUTH TRUSS, LOWER CHORD
△ 42 NORTH SOUTH TRUSS, LOWER CHORD, HORIZONTAL GUSSET PLATE TO FB LB w/ LOSS OF SECTION ALONG WEST & EAST EDGES UP TO 7"L x 1 1/4"W (UP TO SEVERAL LOCATIONS) w/ MINOR SURF. CORROSION
△ 43 pack rust bet. Gusset pl. & diagonal member.
△ 44 1/8" DP painted over pitting on Gusset pl @ lateral bracing conn
△ 45 Bot angle sway bracing bent, 6"L x 1/4" DP (@ 6' from truss)

△ - NO CHANGE

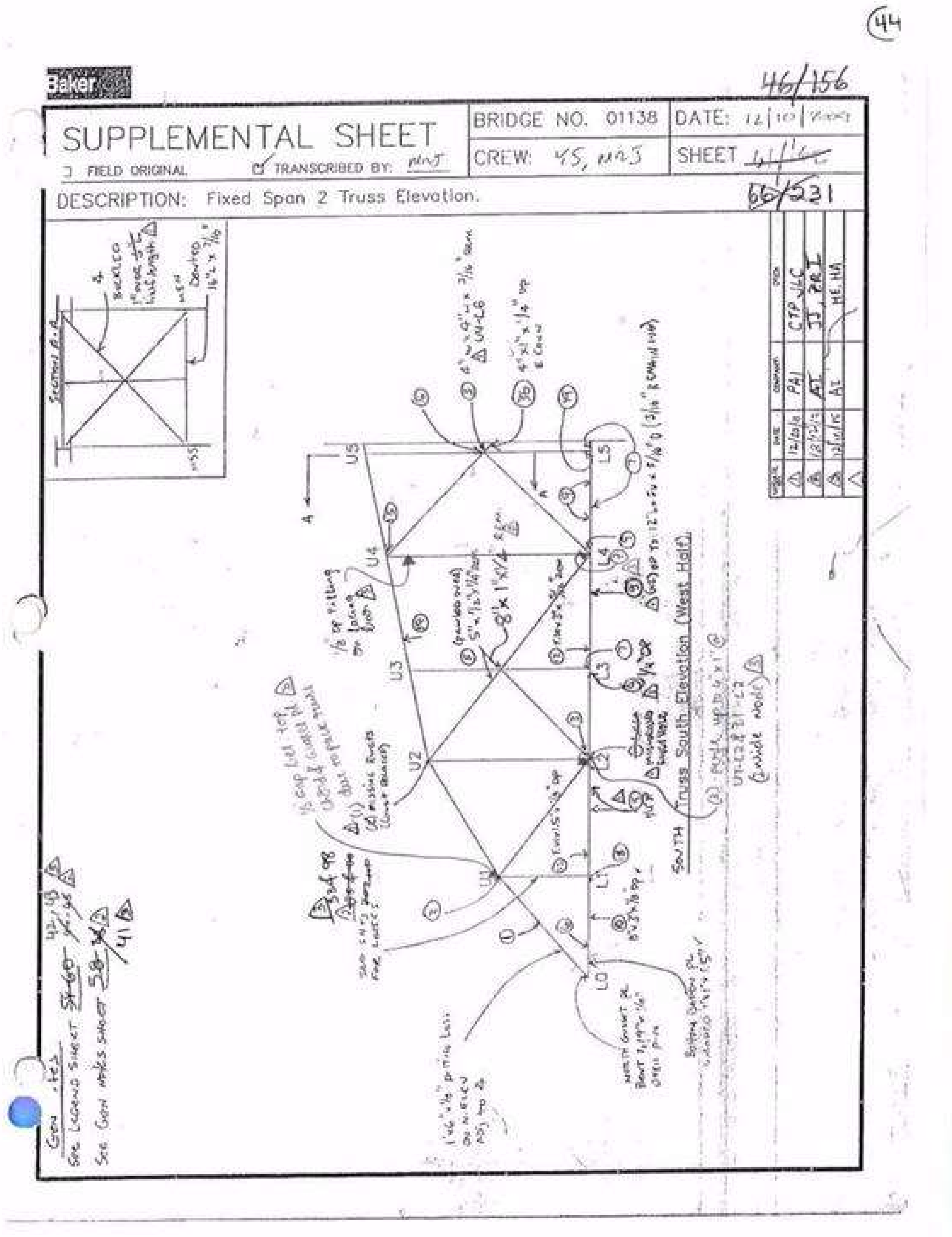
31 intentionally left vacant for new deterioration notes.

UPDATE NO.	DATE	COMPANY	CREW
△	12-15-11	PAI	CTP, JLC
△	12/12/13	AI Eng.	JJ, PES
△	12/12/15	AI	PS, HC, ZRG, NRS
△			

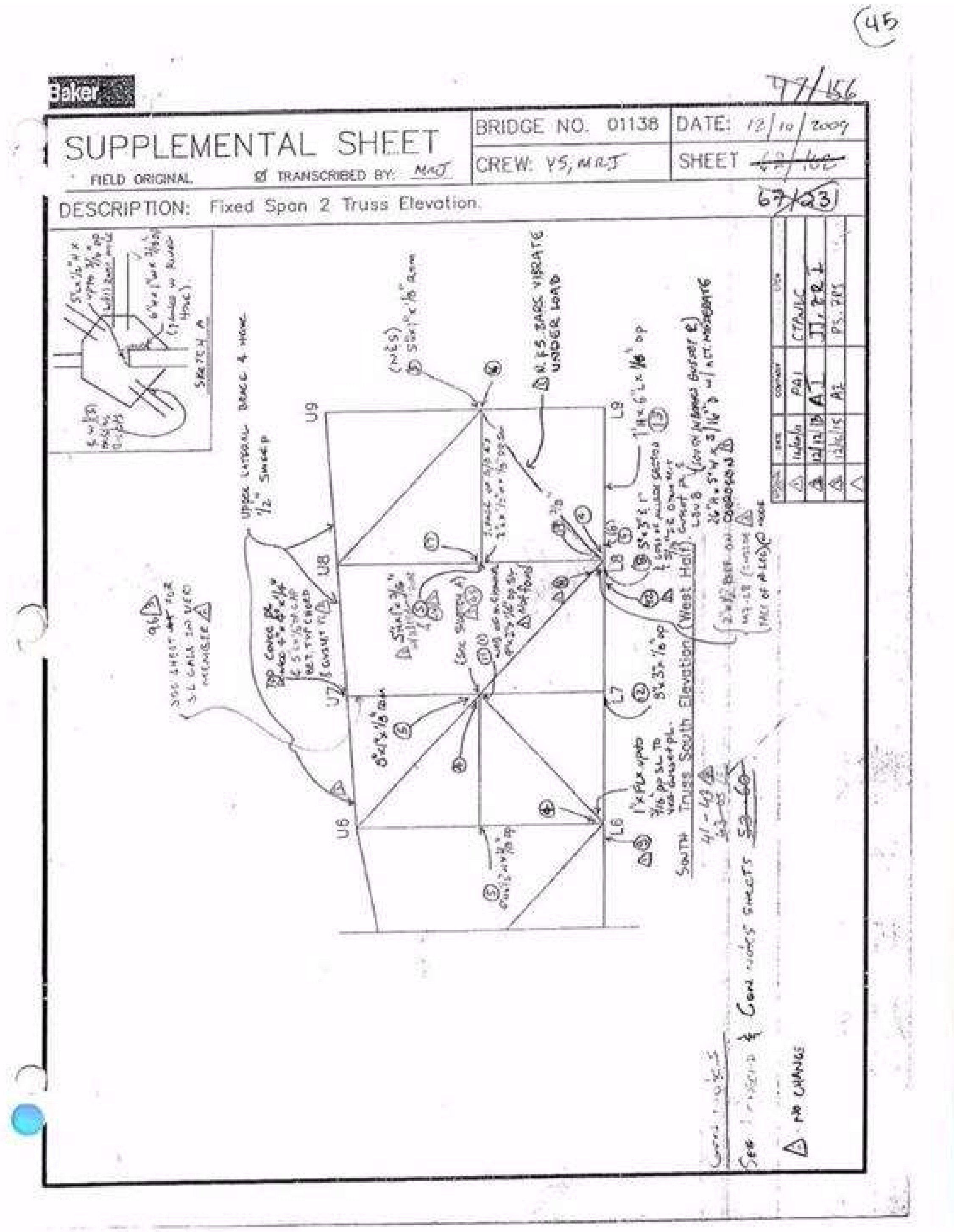
43_Legend Span 2 Truss- Sheet 3

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

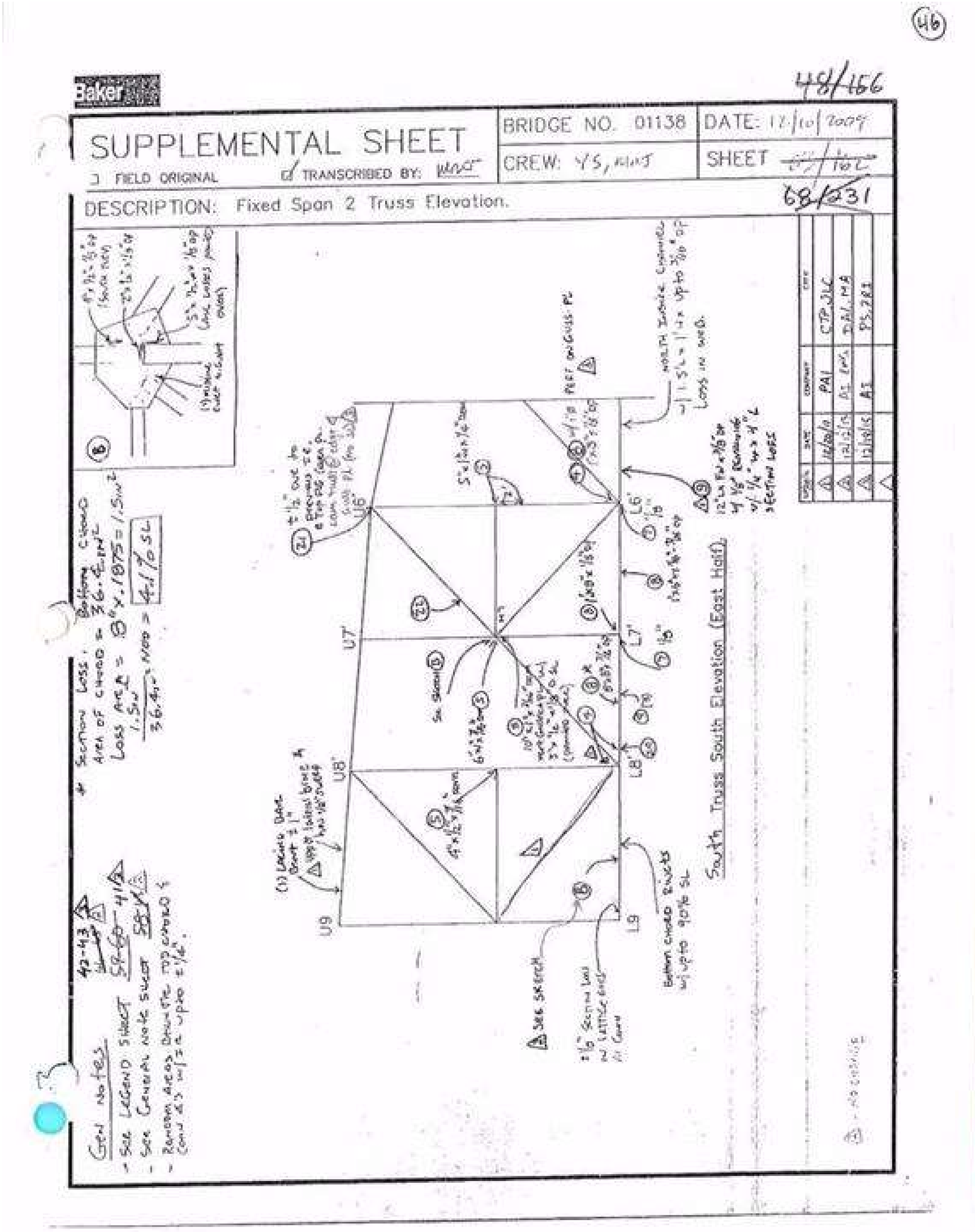
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



44_Span 2 South turss, S. elev. (w. half)



45_Span 2 South turss, S. elev. (w. half)

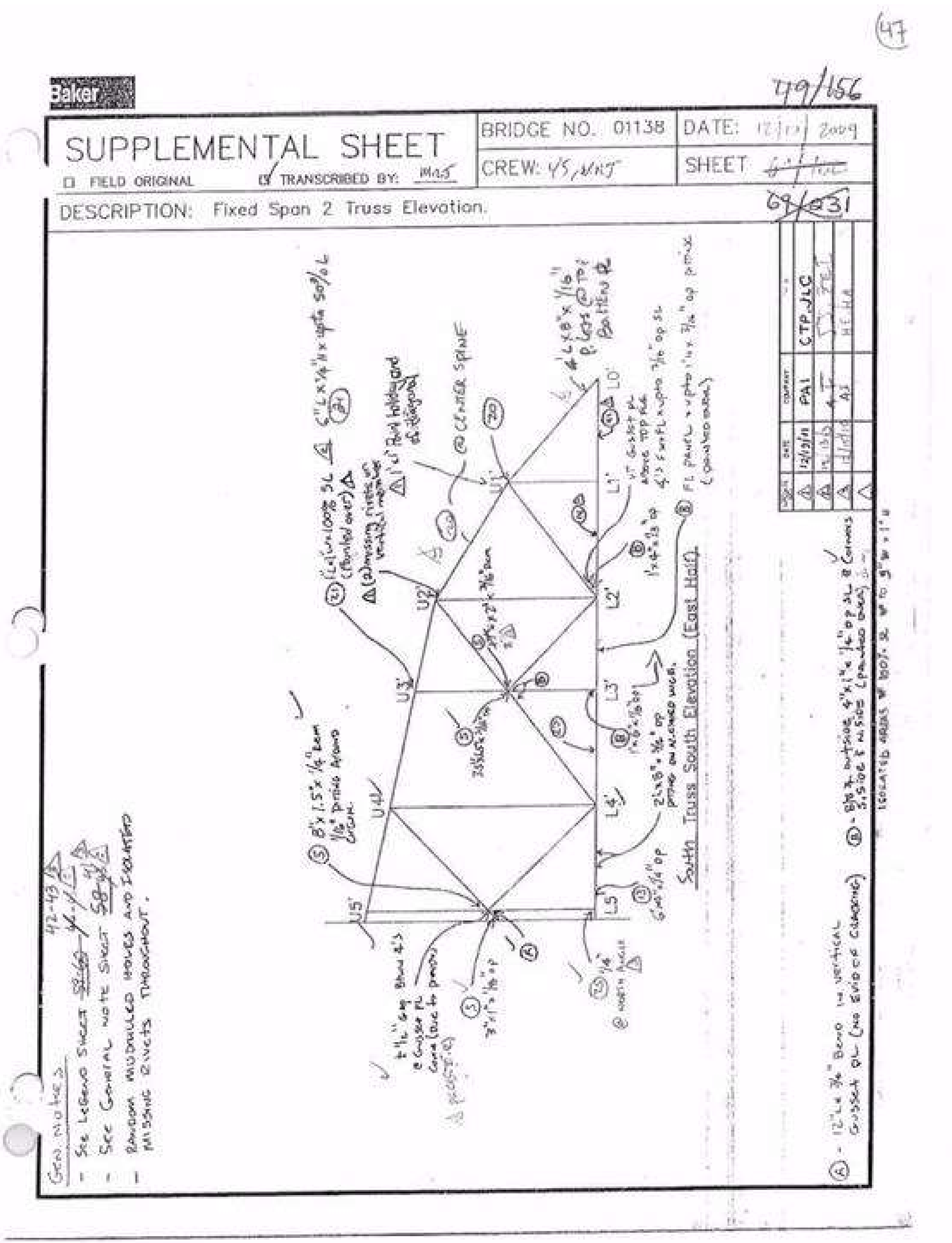


46_Span 2 South turss, S. elev. (E. half)

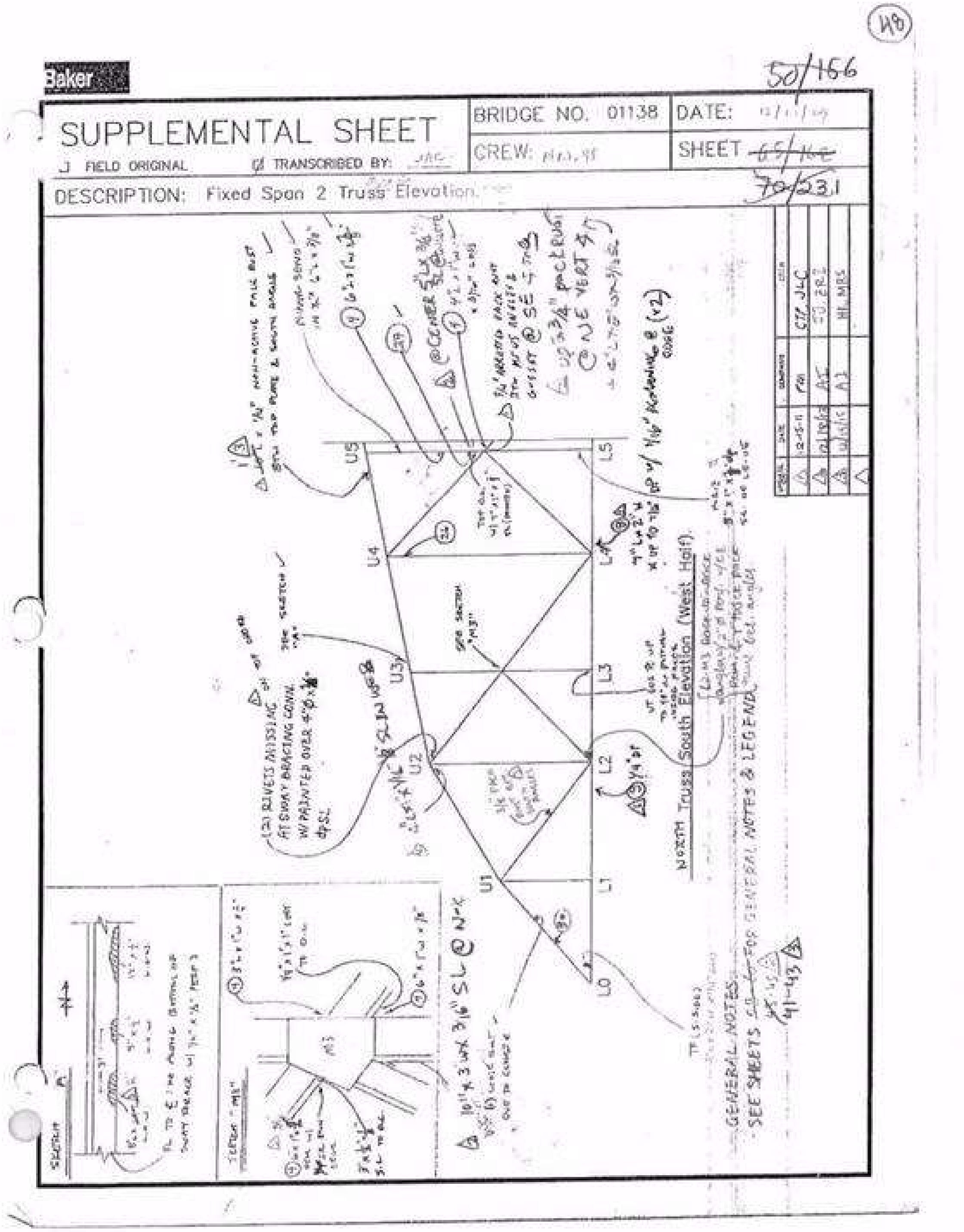
Sketches
Inspection type: Fracture Critical,Special,Routine
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Bridge No: 01138

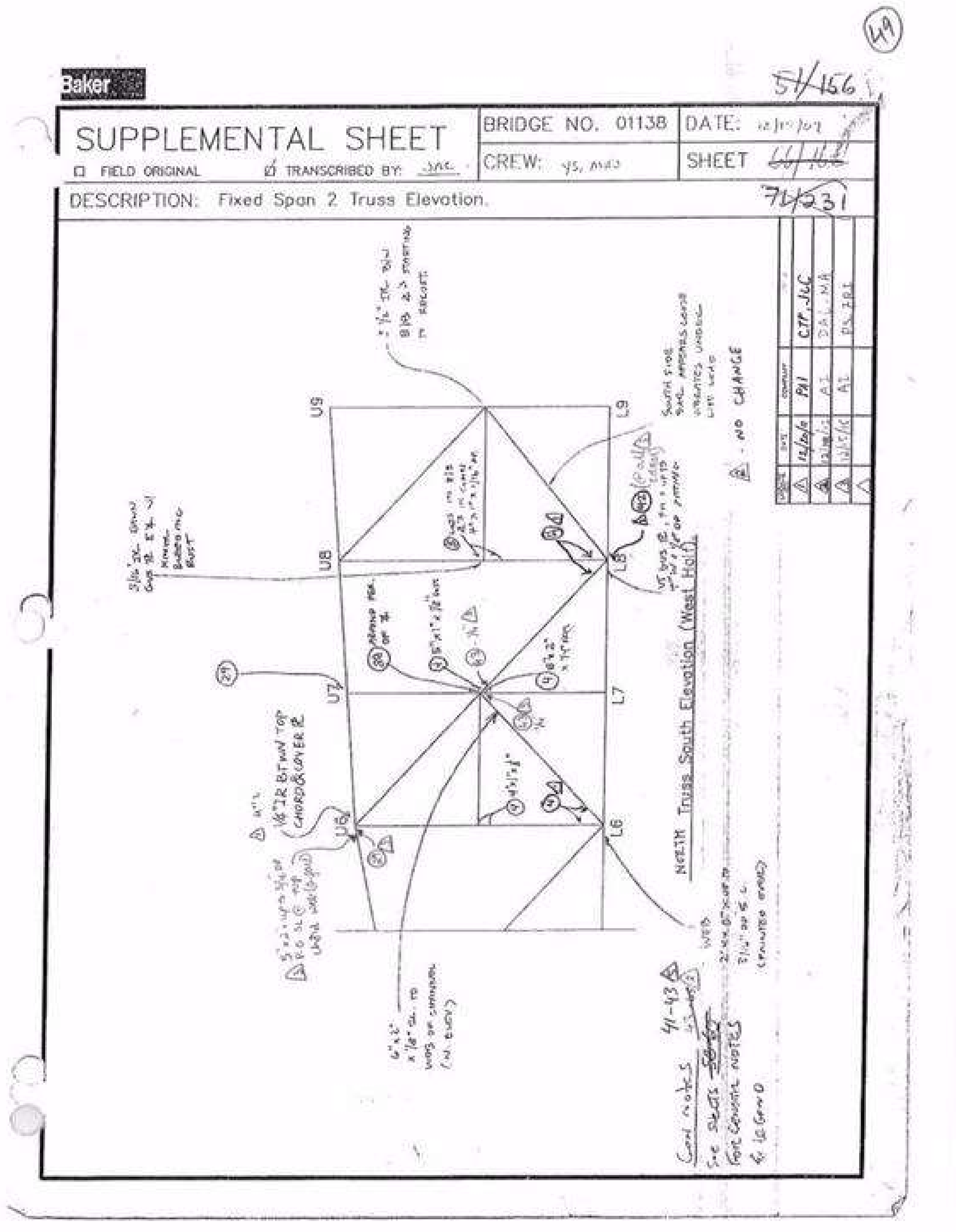
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



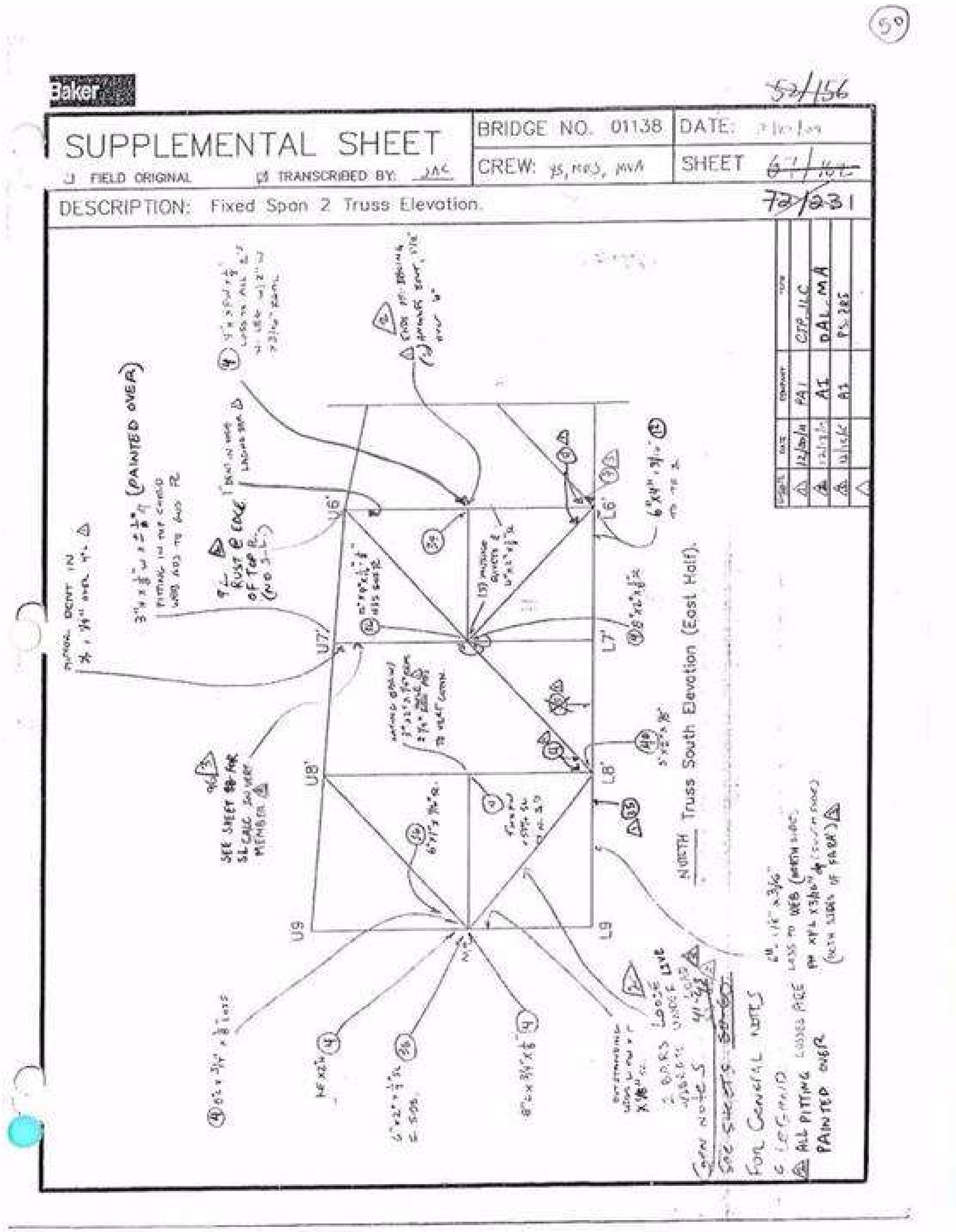
47_Span 2 South turss, S. elev. (E. half)



48_Span 2 North turss, S. elev. (W. half)



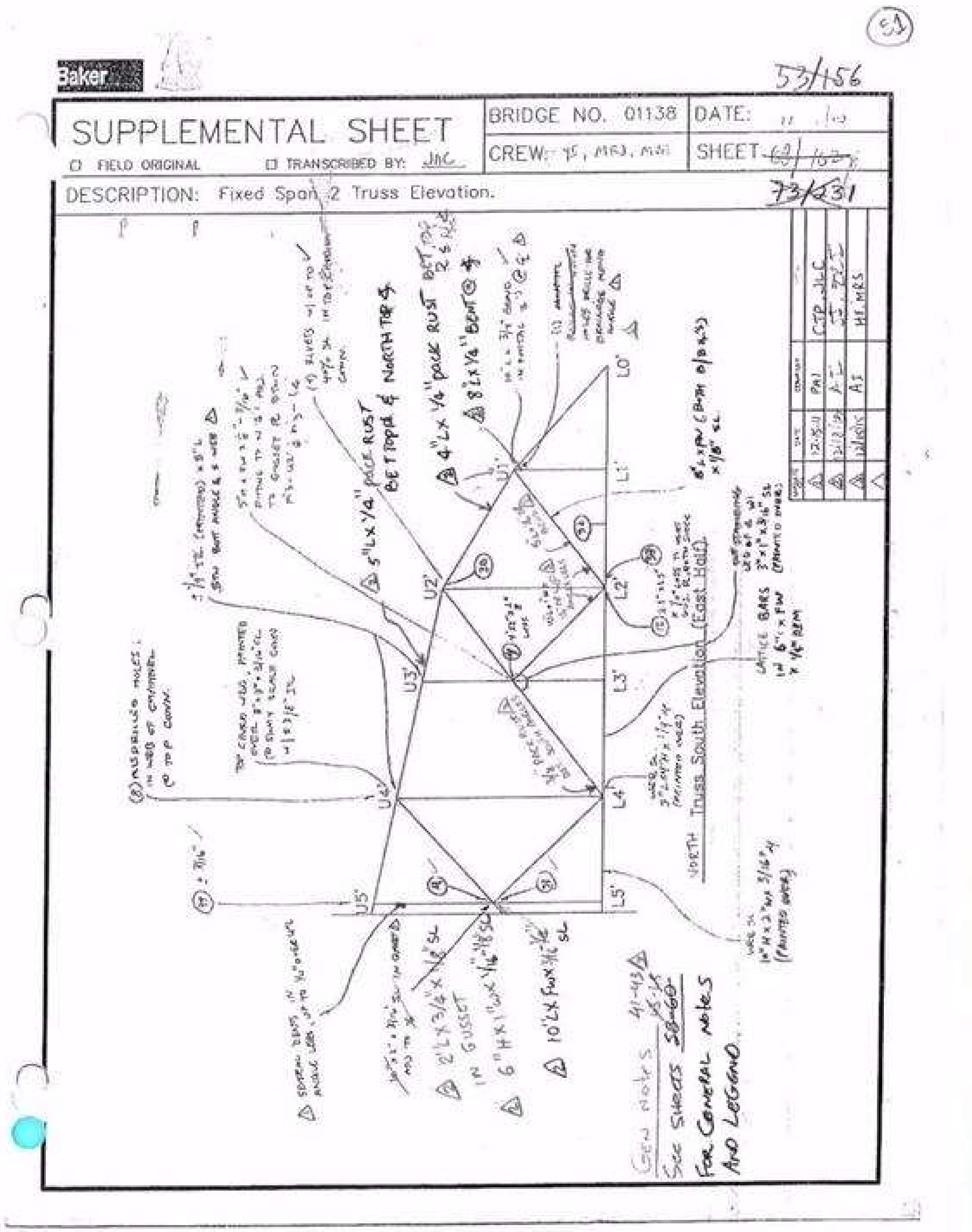
49_Span 2 North turss, S. elev. (W. half)



50_Span 2 North turss, S. elev. (E. half)

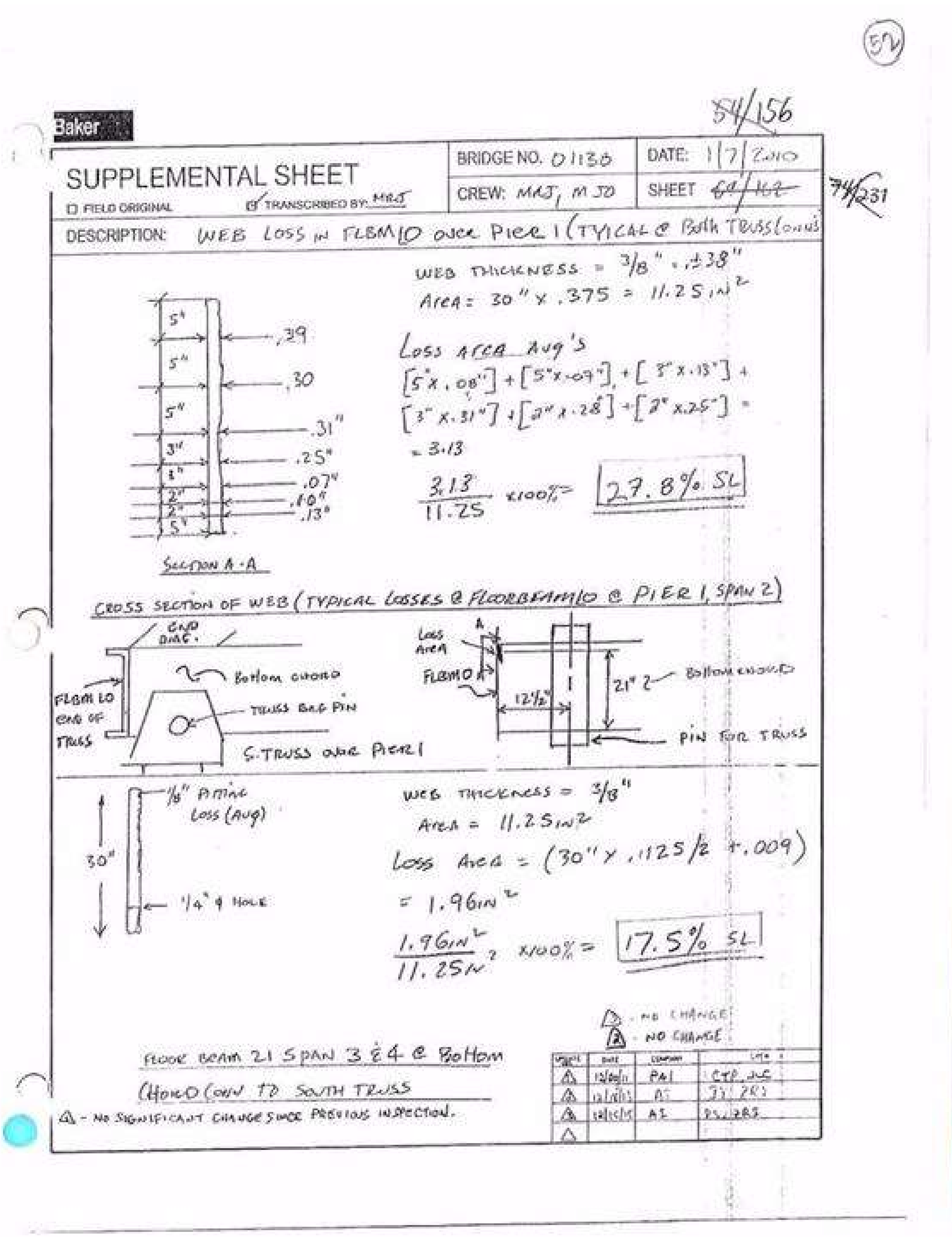
Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



51_44_Span 2 North turss, S. elev. (E. half)

Sketches | **Town:** EAST HADDAM
Inspection type: Fracture Critical,Special,Routine | **Bridge No: 01138** | **Carried:** ROUTE 82
Inspection Date: 12/14/2015 | **Crossed:** CONNECTICUT RIVER
Inspected by: AI Engineers | **Inventory Route:** Non-NHS


52

~~54~~/156

Baker

SUPPLEMENTAL SHEET

☐ FIELD ORIGINAL ☑ TRANSCRIBED BY: MRJ

BRIDGE NO. 01138	DATE: 1/7/2010
CREW: MAJ, MJD	SHEET ~~64/162~~

~~74~~/231

DESCRIPTION: WEB LOSS IN FLBM L0 OVER PIER 1 (TYPICAL @ BOTH TRUSSLINES)

WEB THICKNESS = 3/8" = .38"
AREA = 30" x .375 = 11.25 IN²

LOSS AREA AVG'S
[5" x .08"] + [5" x .07"] + [3" x .13"] +
[3" x .31"] + [2" x .28] + [2" x .25"] =
= 3.13

3.13 / 11.25 x100% = 27.8% SL

SECTION A-A

CROSS SECTION OF WEB (TYPICAL LOSSES @ FLOORBEAM L0 @ PIER 1, SPAN 2)

WEB THICKNESS = 3/8"
AREA = 11.25 IN²
LOSS AREA = (30" x .125/2 + .009)
= 1.96 IN²

1.96 IN² / 11.25 IN² x100% = 17.5% SL

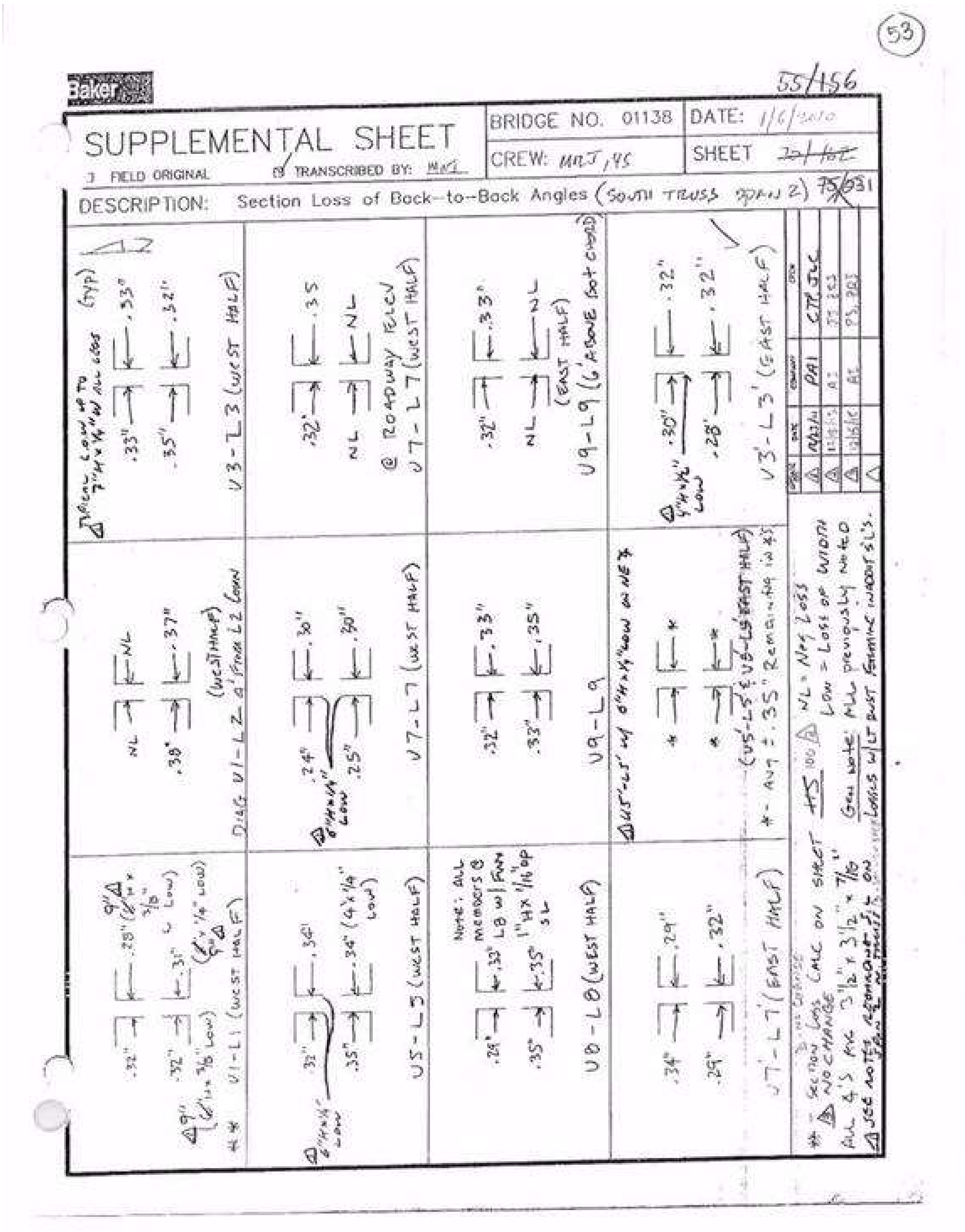
△ - NO CHANGE
△ - NO CHANGE

FLOOR BEAM 21 SPAN 3 & 4 @ BOTTOM CHORD CONN TO SOUTH TRUSS

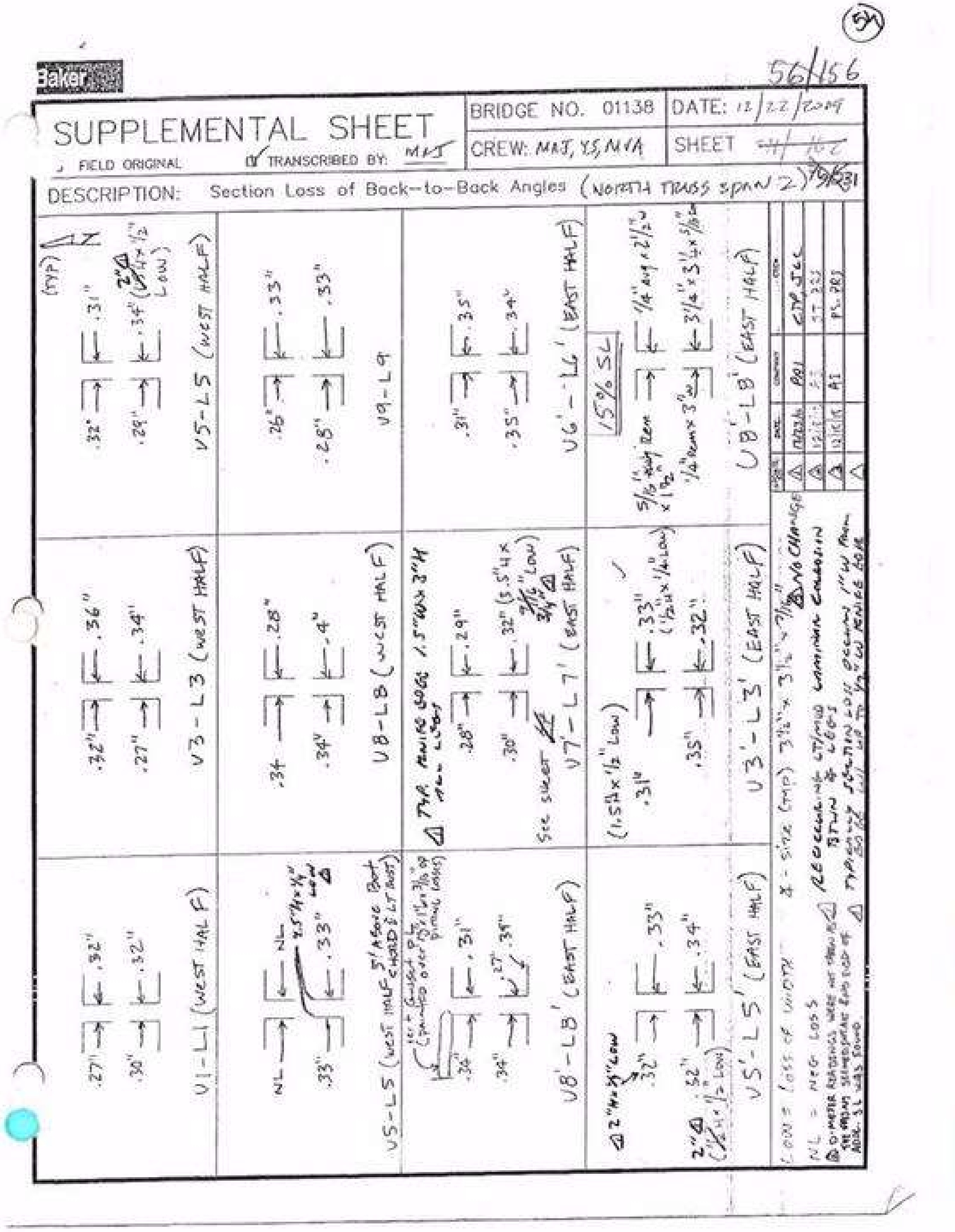
△ - NO SIGNIFICANT CHANGE SINCE PREVIOUS INSPECTION.

UPDATE	DATE	COMPANY	CT#
△	12/26/11	PAI	CTP, JLC
△	12/1/13	AI	JJ, JRS
△	12/15/15	AI	RS, JRS
△			

52_ Web loss in FB L0 over Pier 1



53_ Sec. loss of back to back angles S. turss Sp 2



54_ Sec. loss of back to back angles N. turss Sp 2

55

57/156

Baker	Bridge No. 01138	Date: 1/5/2010
SUPPLEMENTAL SHEET	Crew: MRJ, YS, MVA	Sheet ~~72/162~~ 73/231
Description: General Notes Swing Span Framing SPANS 3+4 △		

- Random floorbeam top and bottom flanges with losses up to 1/8" deep on horizontal legs (1/16" on web).
- Underside of deck grating with water staining and light surface rust up to 30% in some bays. FLOORBEAM CENTERS HAVE RANDOM LOOSE CONNECTION CLIPS △
- Random rivet heads show up to 50% section loss.
- Random LATERAL BRACING △ gusset plates with pitting up to ~~3/8"~~ 3/16" △ (3/16" ORIG) △ deep (U.O.N. SEE LOWER NOTE (6)) △
- Random rivets have been replaced by bolts.
- ~~Bottom chord with areas of negligible section loss at locations of previously painted over heavy rust.~~ SEE TRUSS NOTES △
- ~~Random areas of 1/8" pitting losses on horizontal gusset plates.~~ △ SEE ABOVE NOTE
- Floorbeam bottom flange angle's horizontal legs with random 4"ø x 5/16" deep max losses. Vertical legs bottom flange angle's with random losses up to full height x up to 1/8" deep.
- Floorbeam horizontal-legs with random 7/16" remaining x 4"W x 1.5'-2'L near connections to truss (less critical zones).
- Floorbeam top flange's with random ~~3/16"~~ 6"L x 3"W x UP TO 1/4" (3/8" ORIG) △ losses at horizontal legs near centerline of bridge at previous anchor bolt holes. Also, floorbeam top flange horizontal legs with random losses of width, ±1/4" (cover plates in place).
- Up to ½" impact rust between the horizontal gusset plates and the ends of the bracing angles. Up to 5/16" impact rust between the front edges of the horizontal gusset plates and the underside of bracing angles. Up to ¼" impact rust between the horizontal gusset plates and the floorbeam bottom flanges.
- Floorbeam webs below clip angles and connections to truss with heavy losses and UP TO 1/4" △ random ~~small~~ △ perforations, UP TO 2"ø △
- Random areas of loss of width in top flange angles of floorbeam (painted over), cover plate in place.
- There are up to 5/16" gaps at random locations between stringer bottom flanges and floorbeam top flanges. MOST NOTABLY AT STRINGERS 1 + 5 △
- ~~Section losses inside of bottom chord at nodes on web up to 1" x 4" x 1/8" deep (painted over)~~ SEE TRUSS NOTES △ random areas of debris on top of gusset pl. & bot. flg. @ rand. locations △
- ~~Section loss ≤ 1/8" at bottom 1' of truss diagonals (painted over)~~
- Random rivets with 1/8" gaps due to previous impacted rust.

△ – FLOORBEAM TOP FLANGES W/ PAINTED OVER SECTION LOSS ALONG EDGES UP TO 6"L x 2"W x 1/4"D (3/8" ORIG)
△ – FLOORBEAM CLIP ∠'S (CONNECTION TO TRUSS BOTTOM CHORD) W/ RANDOM PITTING LOSSES UP TO FH x FW x 1/8"D.
△ – LATERAL BRACING MEMBERS W/ RANDOM 1/8"-3/16" SECTION LOSS (PAINTED) NEAR FLOORBEAM TO TRUSS CONNECTIONS (U.O.N. SEE LOWER NOTE (6)) △
△ 12/21/11 PAI CTP, JLC △ 12/27/13 [illegible] (AI ENG) NO CHANGE
△ – 12/21/15 – PS, TV, [illegible], MRS (AT ENG)
△ – LT. ACCUM. OF DEBRIS ON TOP OF GUSSET PL. & TOP OF BOT. FLGS.

55_ General Notes Swing Span framing

56

Baker

58/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/5/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	CREW: MRJ, YS, MVA	SHEET ~~43/162~~ 78/231

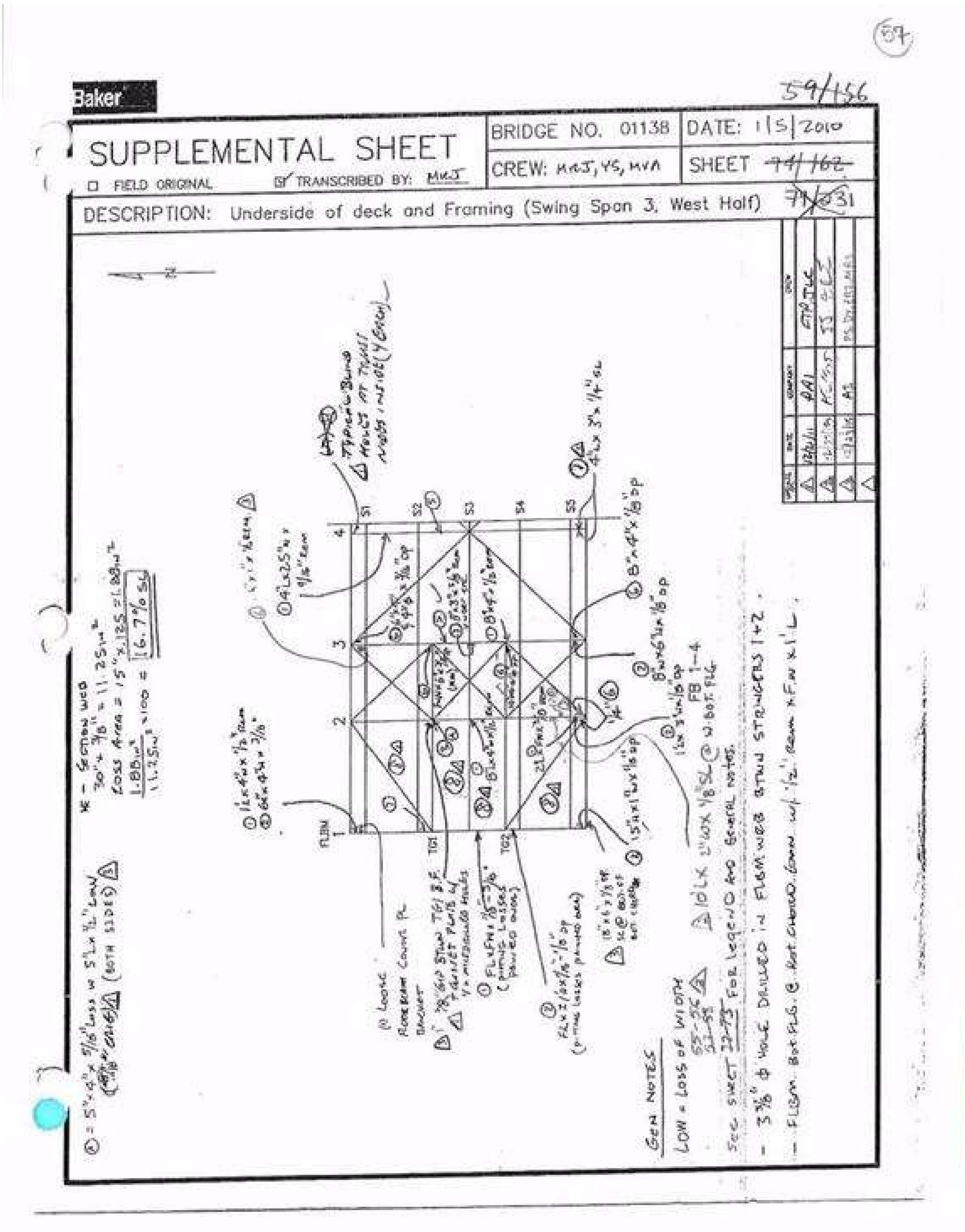
DESCRIPTION: DETERIORATION LEGEND FOR SPAN 3 (SWING SPAN) FRAMING

1. Bottom flange of floor beam with section losses on horizontal legs.
2. Web of floorbeam with section losses.
3. Top flange of floorbeam with section losses on horizontal legs.
4. ¼" gap between stringer bottom flange and floorbeam top flange (no shim plates).
5. 4" diameter hole in web (construction related)
6. Section loss to horizontal gusset plate lateral bracing connection (painted over).
7. Missing floorbeam cover bracket
8. SIP FORMS W/ HVY LAMINAR CORROSION & RUSTED THRU HOLES UP TO 3'L x 6"W EXPOSING CONCRETE DECK. DECK W/ SPALLS UP TO 1'L x 6"W x 1"D.
9. Random missing rivets
10. Horizontal gusset plate with section loss ± 3/16" deep (U.O.N.)
11. ⅛" gap between floorbeam top flange and stringer bottom flange. (NO SHIM PLATES) 2
12. Floorbeam web with section loss 1' x 8"H x 3/16 - ¼" deep at connection to bottom chord
13. Gusset plate to bottom chord connection with cut out hole and surrounding knife edge.
14. Floorbeam rivets ground down to ¼" to fit stringer anchor bolts.
15. Bottom flange angle legs with ⅛" section loss (full height - vertical leg, 3"W - horizontal leg) x 3' long. (6.8% section loss at midspan, painted over).
16. LATERAL BRACING MEMBER W/ SECTION LOSS (PAINTED OVER)

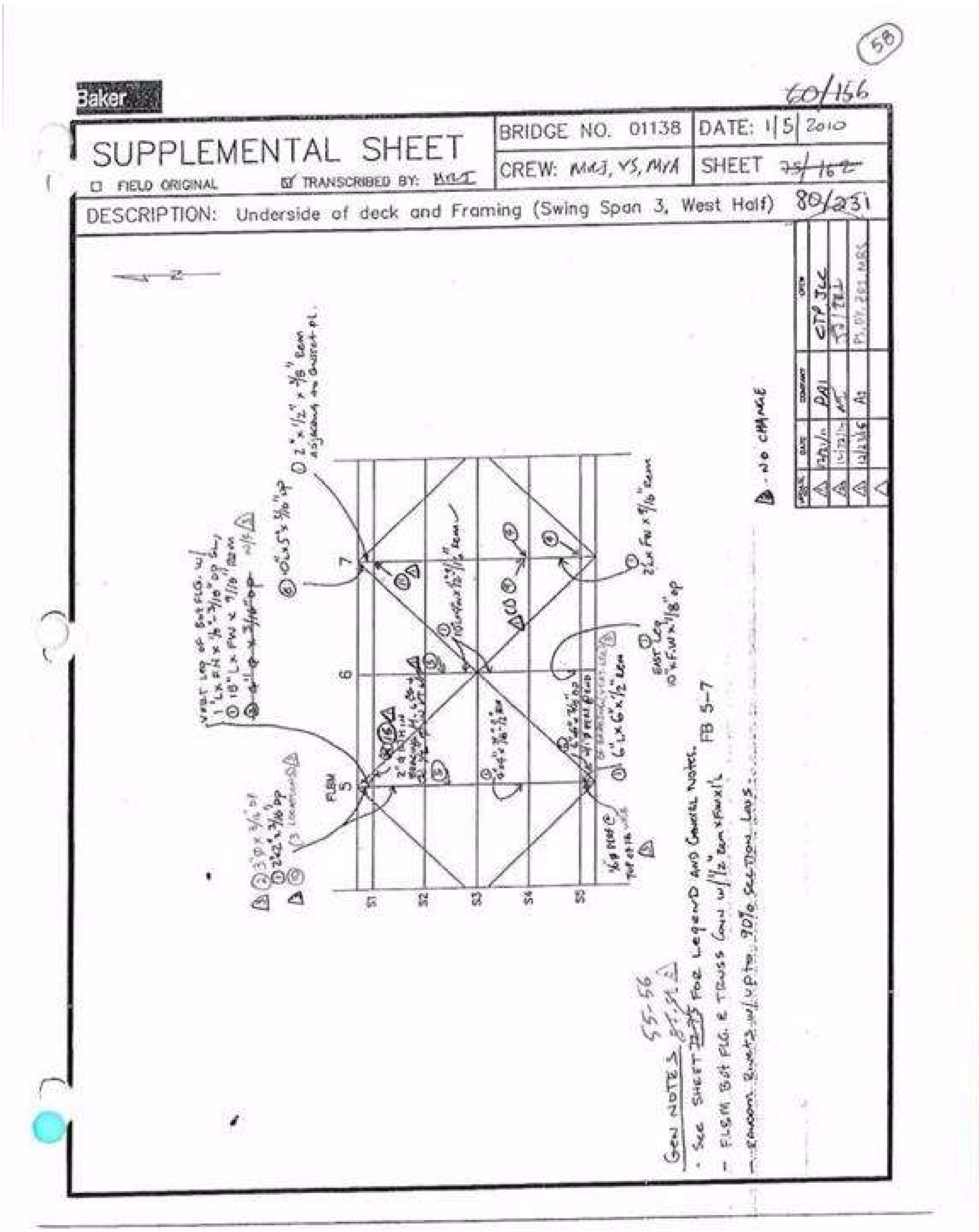
3 NO CHANGE

UPDATE	DATE	COMPANY	CREW
1	12/13/11	PBI	CTR, JLC
2	12/3/13	AI ENG	[illegible]
3	12/2/15	AI ENG	PS, DY, [illegible], MRJ

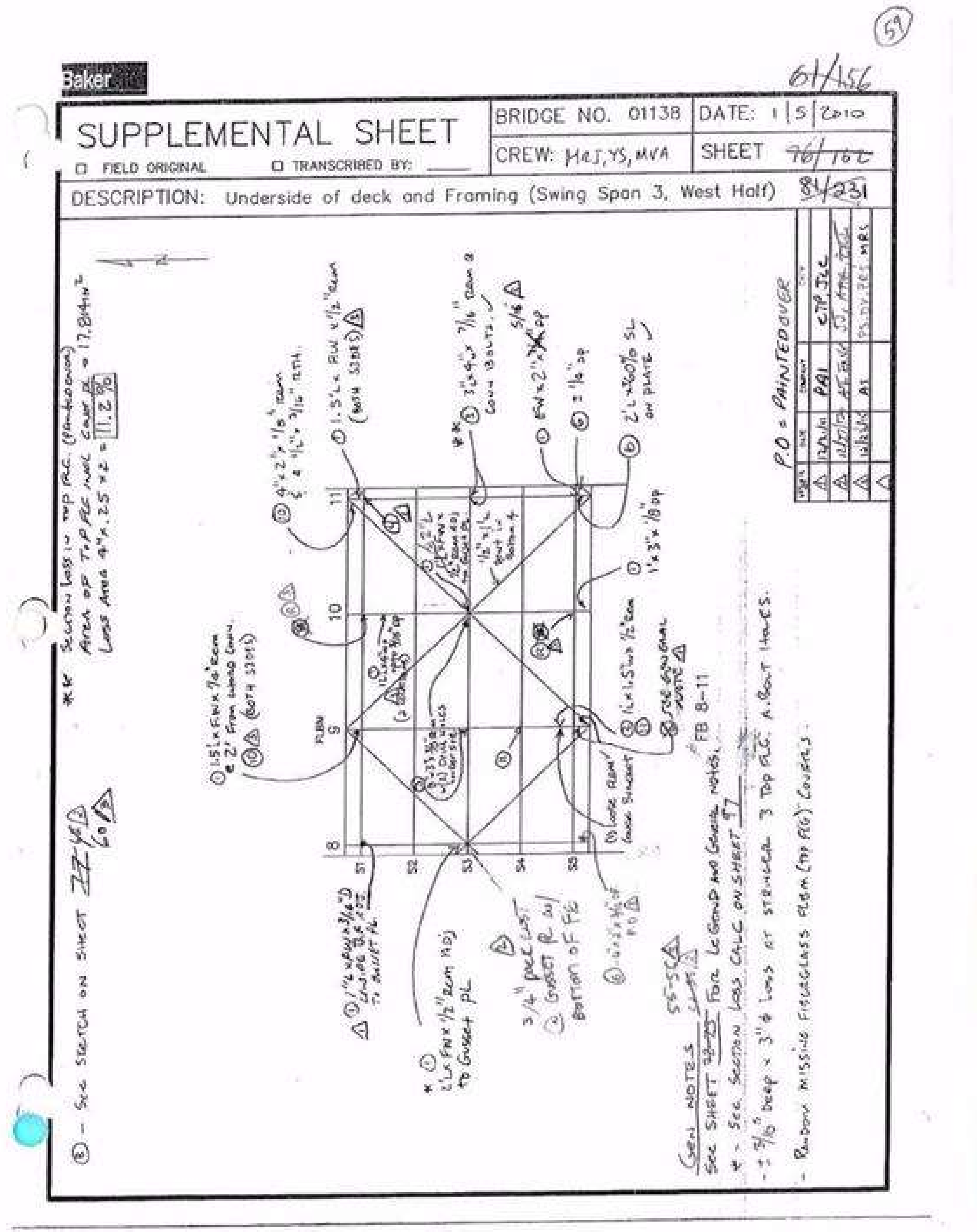
56_Legend span 3



57_Underside of Deck Span 3 W. half FB 1-4

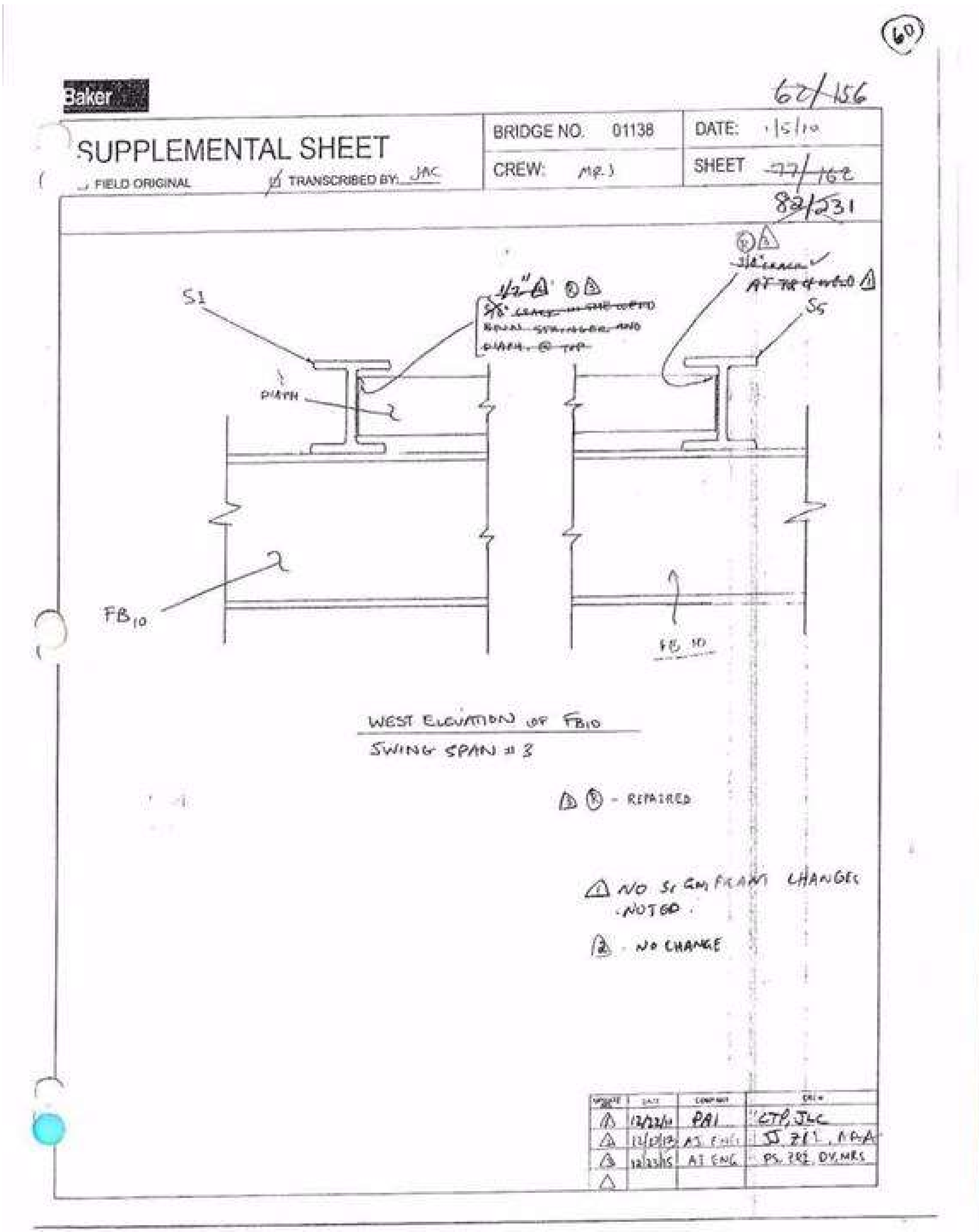


58_Underside of Deck Span 3 W. half FB 5-7

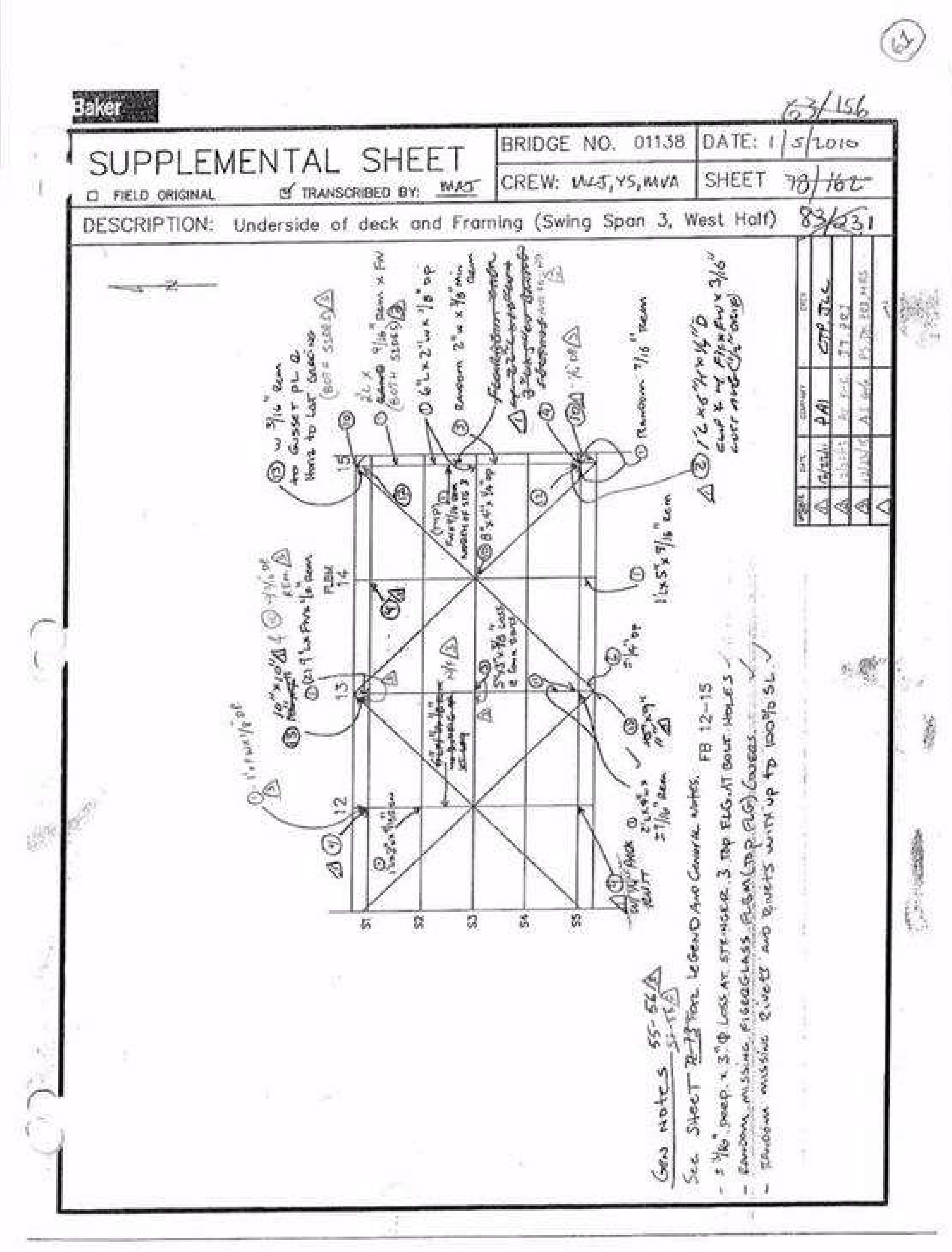


59_Underside of Deck Span 3 W. half FB 8-11

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



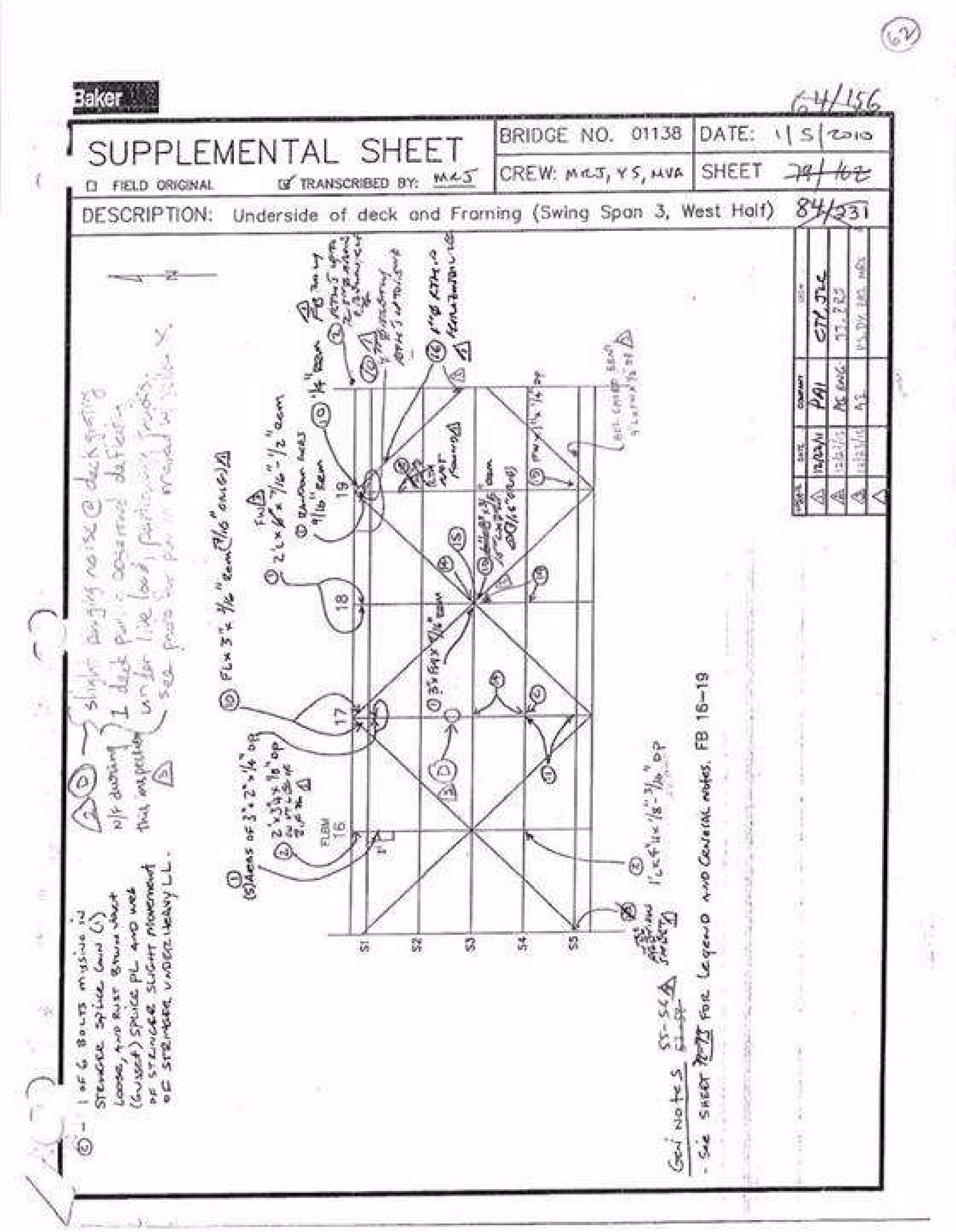
60_ West Elevation of W. half FB 10 Span 3



61_Underside Of deck Span 3 W. half FB 12-15

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



62_Underside Of deck Span 3 W. half FB 16-19

(63)

Baker

65/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/14/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY____	CREW: MRJ, YS	SHEET ~~[illegible]~~

DESCRIPTION: GENERAL NOTES: (SPAN 3 & 4 PIT ENCLOSURE AND OPERATOR'S HOUSE) ~~85~~/231

- Roller track anchor bolt nuts with 80% section loss
- All connections and members of operator house checked hands on (no deficiency noted)
- Random lacing bars bent up to 1" + up to 1/4" SL (1/2" over) △
- Random areas of paint failure w/ lt laminated corrosion all members inside pit enclosure due to water leakage from deck △
- S.I.P. forms w/ areas of heavy laminated corrosion w/ holes up to 2"x6" (exp. deck) and leaking onto steel + machinery below △

△ - NO CHANGE
△ - NO CHANGE

[illegible]	DATE	COMPANY	[illegible]
△	12/2015	PAI	KTP JLC
△	1/17/12	AI Eng	DAL [illegible]
△	1/14/10	AI Eng	PS, DY, JRS, MRJ
△			

63_General notes Span 3 & 4 Pit

(64)

66/156

Baker

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/14/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	CREW: MRJ, YS	SHEET ~~51/41~~ 80/131

DESCRIPTION: DETERIORATION NOTES LEGEND : (SPAN 3 & 4 PIT ENCLOSURE)

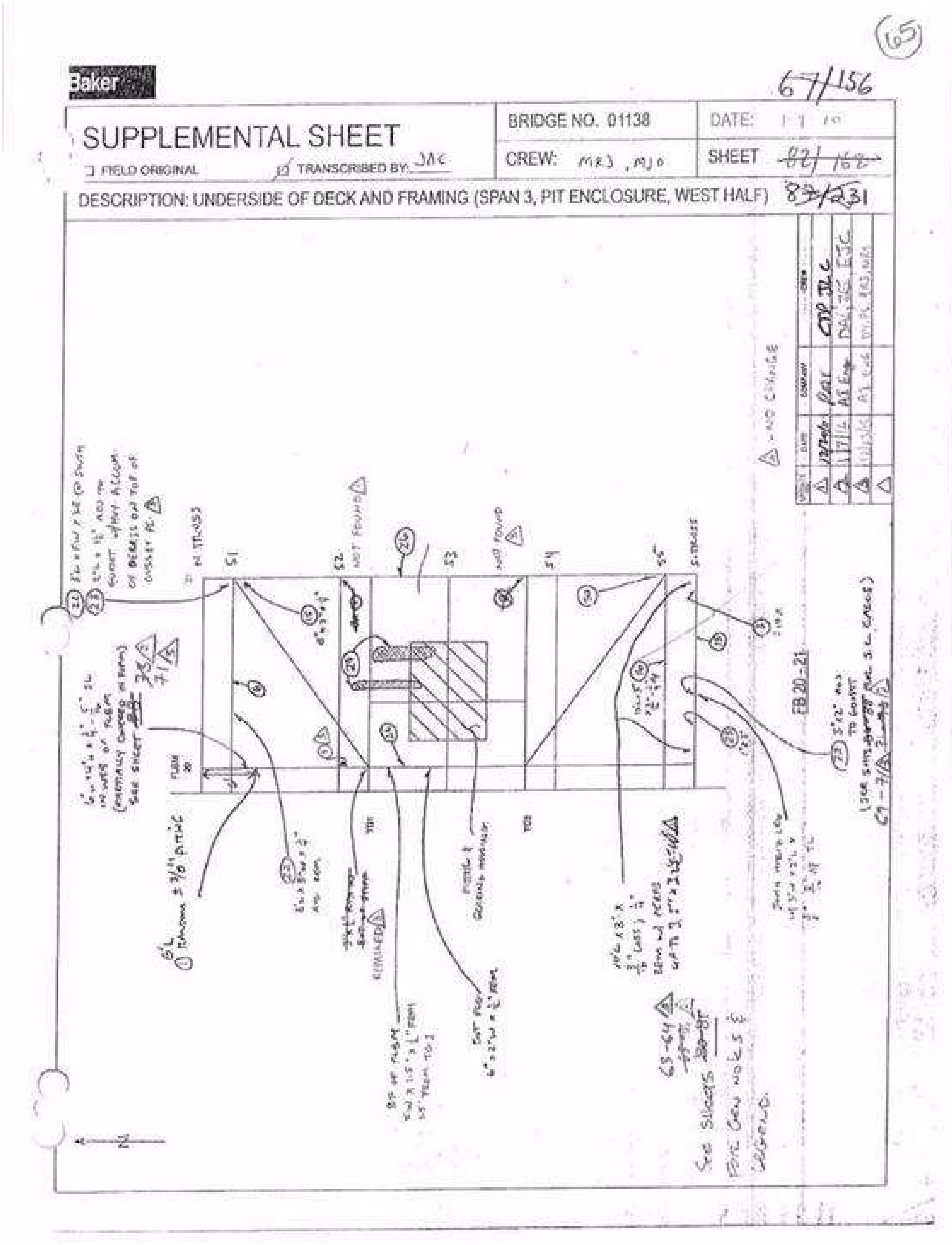
1. Web splice bolts on stringer ~~are loose~~ w/LT RUST
2. Bottom south angle horizontal leg with 12'L x KE with ~~3 ¾" average loss of width~~ up to 1/2" x 3.5" loss of width and active heavy rust
3. Rivet heads with up to 90% loss (±50% loss typical) w/ mod corrosion
4. Missing rivets at cover plate of cross - girder
5. Section loss at bottom flange 1'L x $\frac{7}{8}$" REM x FW
6. Curb splice bolts ~~missing~~ w/ few backed off nut & lam rust on AB nuts bracing
7. 3.5" x 3" rusted through hole at horizontal leg of ~~floorbeam~~ adjacent to gusset plate with up to $\frac{3}{16}$" pitting losses at random locations.
8. 6"L x 1" bend in bottom flange horizontal leg
9. Deck panel deflects under live load x $\frac{1}{8}$"
10. 16"L x FW x KE with 3" x 2" perf in S. bot angle horiz leg of chord, vert leg with 4'L x 3"H x $\frac{1}{8}$" loss (4.6% S.L.)
11. 4 missing rivets at bottom flange angle of pivot girder 22 connection to sole plate
12. ~~Bottom chord (bottom horizontal leg) from gusset plate at connection; 17" out with 100% SL (4"W x 3.5"L)~~ SEE NOTE (7)
13. Floorbeam bottom flange with FW x 6"L x $\frac{3}{8}$" REM; ($\frac{11}{16}$" REM) on gusset plate
14. Floorbeam web with full height x up to $\frac{1}{8}$" - $\frac{3}{16}$" pitting x 8" wide. West elevation with 14"H x 3"W x $\frac{1}{8}$" pitting losses (areas of LT rust)
15. Pitting losses on vertical angle of floorbeam bottom flange
16. Pitting on vertical leg of bottom chord
17. Pitting on gusset plates
18. New lacing bars
19. Top flange of bottom chord with ~~1'L x 3"W x $\frac{5}{16}$" REM and 1" at edge with $\frac{1}{16}$" REM (KE)~~ 30"L x FW x up to $\frac{3}{8}$" S.L. ($\frac{7}{16}$" orig)
20. East horizontal leg of bracing with 10"L x FW with KE and 2" diameter rusted through hole
21. 1" x $\frac{3}{4}$" RTH in bottom flange horizontal leg with 1'L x 3" x $\frac{1}{4}$" average REM; vertical leg with 1'L x 3" x $\frac{3}{16}$" loss
22. Pitting on bottom horizontal leg of angle
23. Rusted through hole on bottom horizontal leg of angle
24. Floorbeam bottom flange with 1.5'L x 3"W x $\frac{5}{16}$" remaining
25.
26. Areas of light to moderate rust on top flange and stringer bearings due to previous leakage
27. Moderate to heavy rust and ±$\frac{1}{16}$" section loss to SIP forms
28. Random 4"H x 2"W areas of $\frac{1}{8}$"-$\frac{3}{16}$" pitting losses in web & clip angles of floorbeam at connection (painted over) typical at south end of floorbeam adjacent to the south truss
29. Bottom chord with painted over section loss 3" x $\frac{3}{16}$" and 3" x $\frac{1}{8}$" — recommend mod. corrosion
30. Moisture on gusset plate w/ mod - hvy rust & $\frac{1}{8}$"-$\frac{3}{16}$" pitting losses

△ - no change

UPDATE	DATE	COMPANY	CREW
△	11/14/11	PQI	CTP, JLC
△	1/17/14	AI ENG	DAL, YRS, EJC
△	12/12/16	AI ENG	DS, DY, YRS, MRS
△			

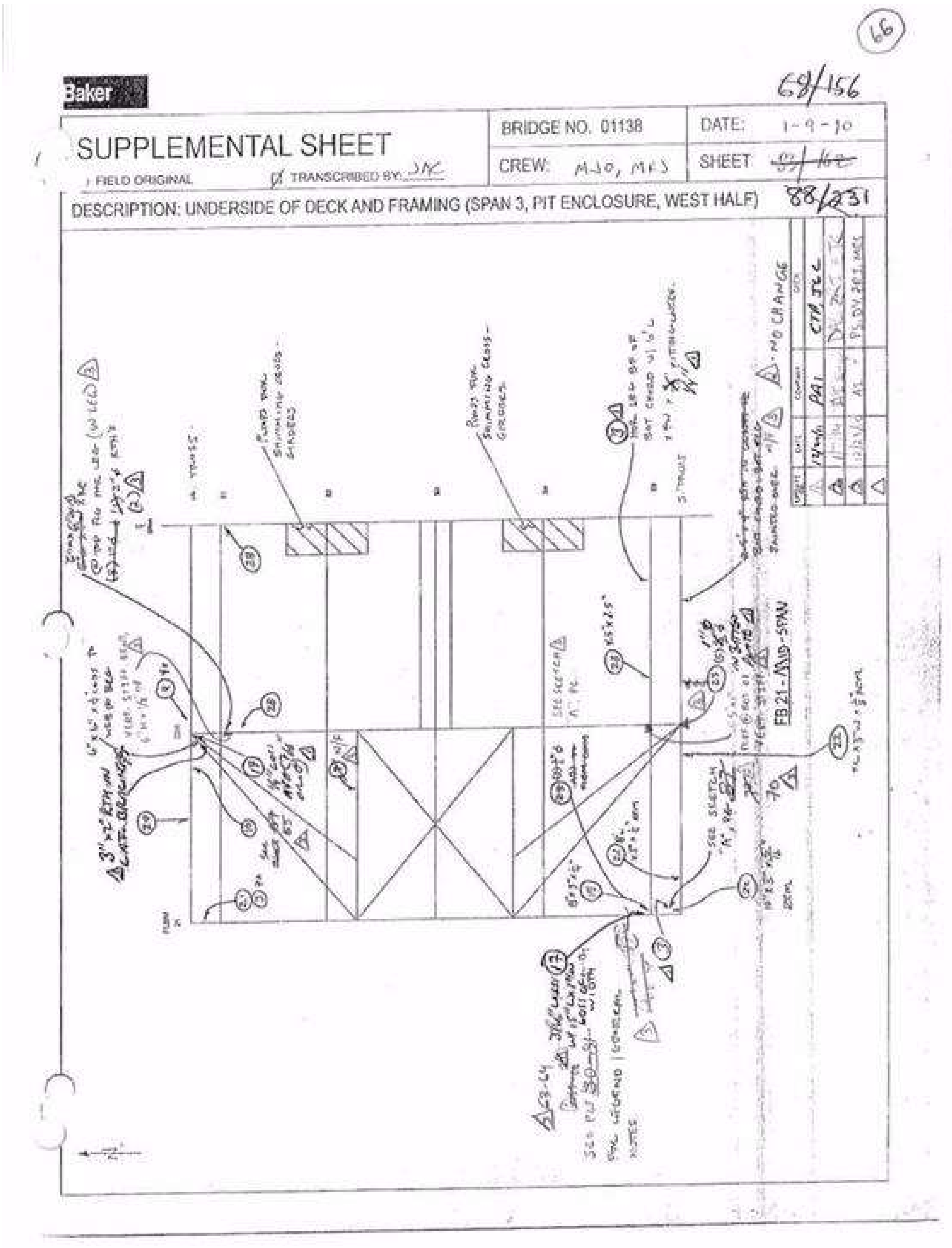
25 intentionally left vacant for new deterioration notes.

64_Legend Span 3 & 4 Pit

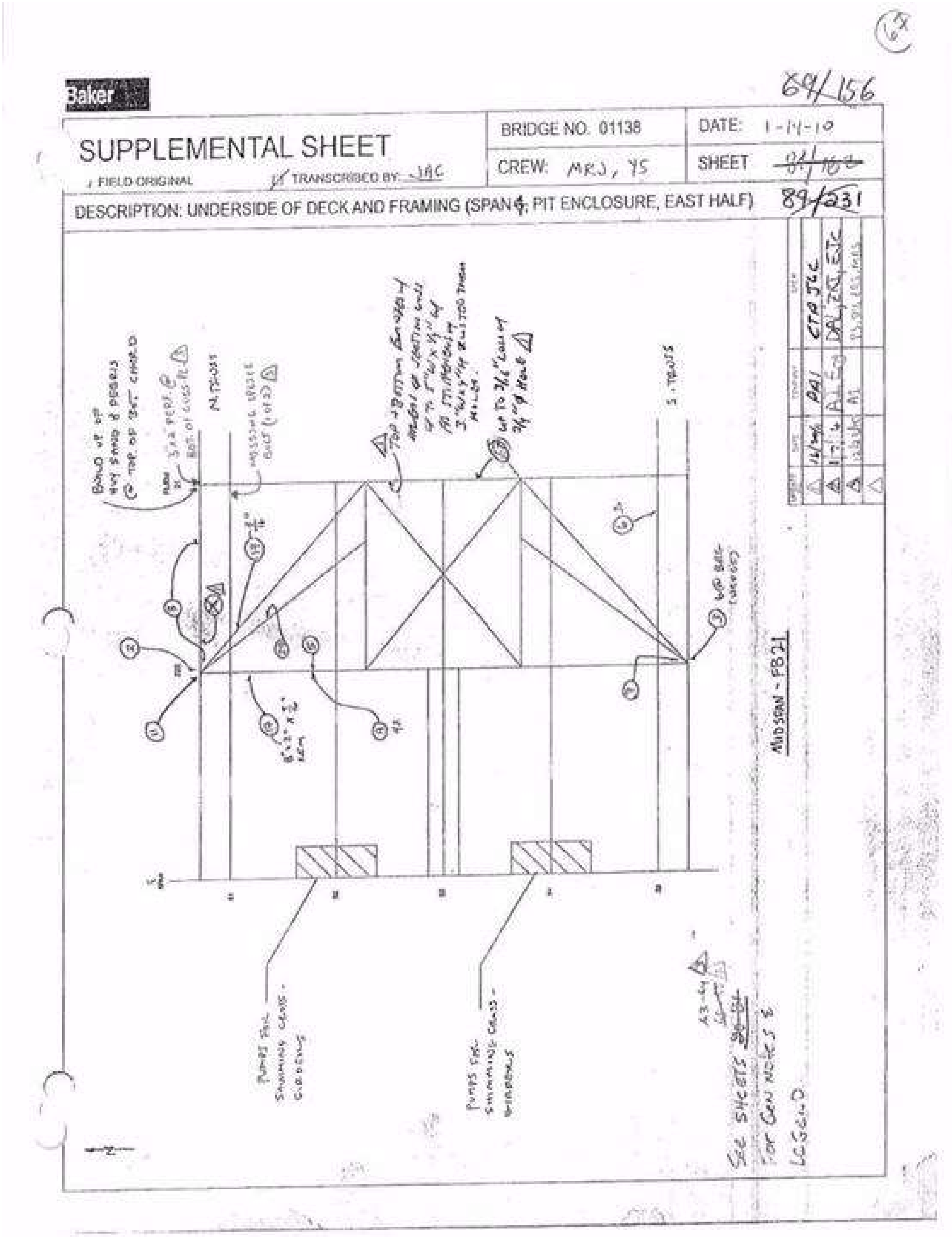


65_Underside of deck Span 3 Pit FB 20 -21 W. half

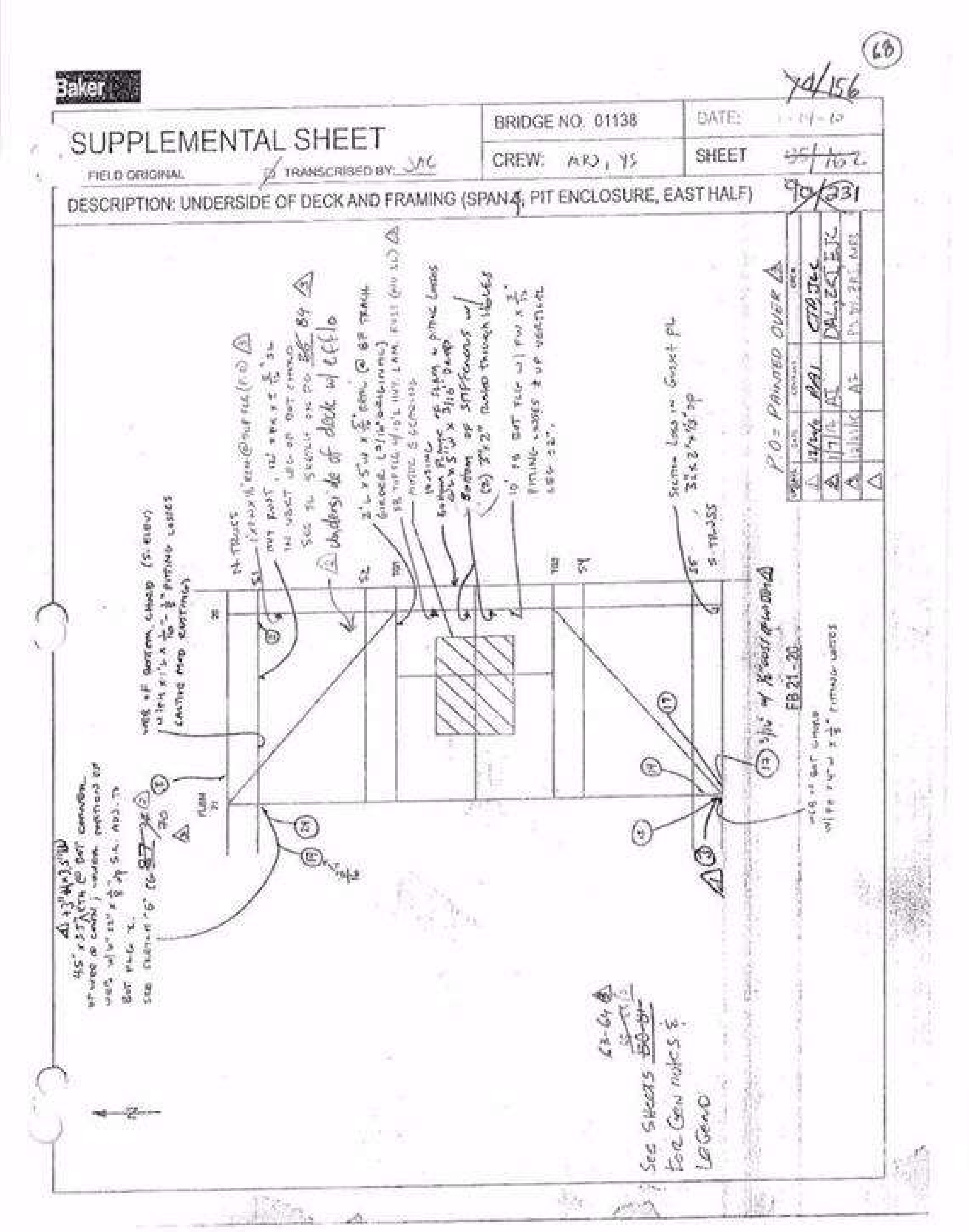
Sketches | **Town:** EAST HADDAM
Inspection type: Fracture Critical,Special,Routine | **Bridge No: 01138** | **Carried:** ROUTE 82
Inspection Date: 12/14/2015 | **Crossed:** CONNECTICUT RIVER
Inspected by: AI Engineers | **Inventory Route:** Non-NHS



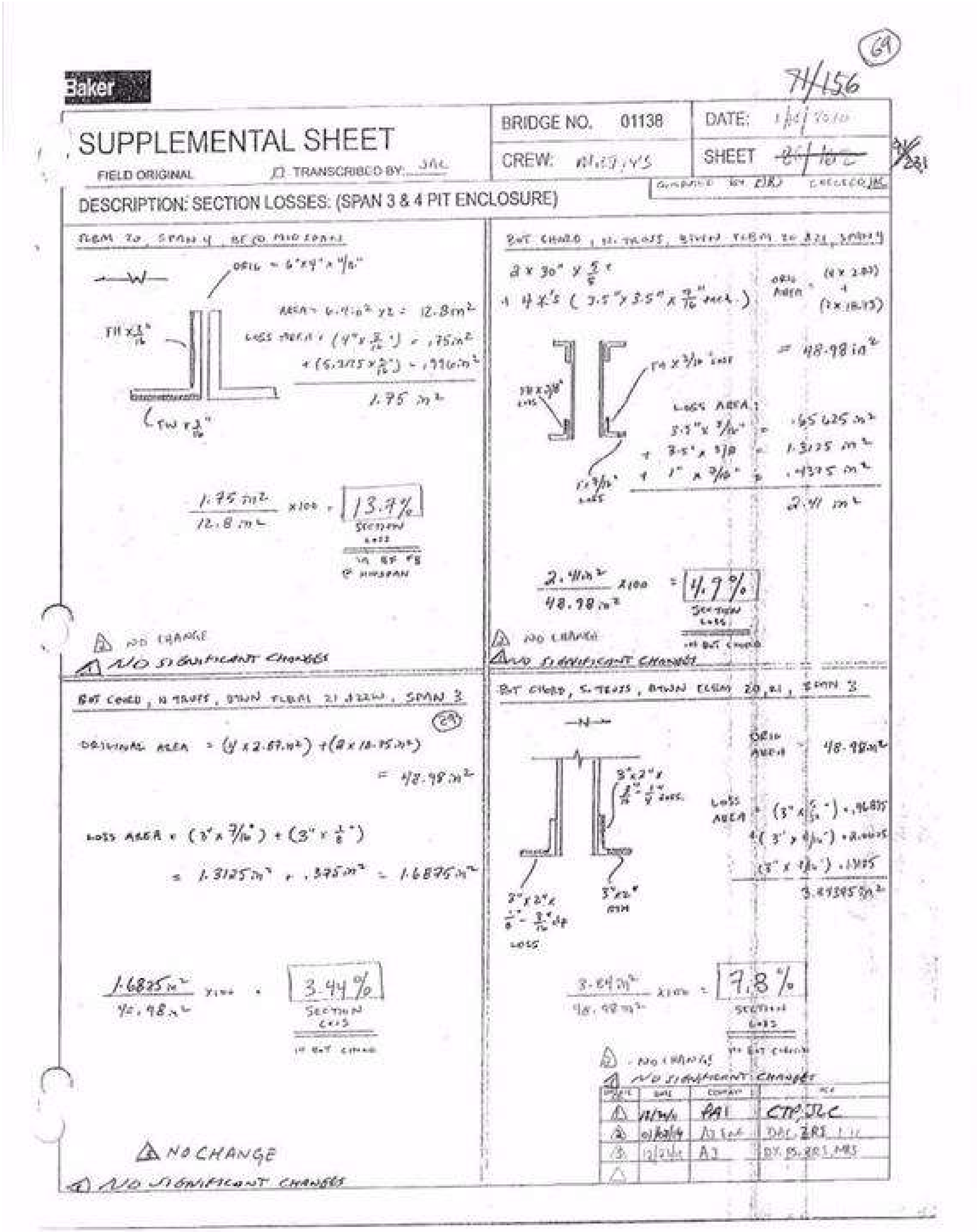
66_Underside of deck Span 3 Pit FB 21- mid span W. half



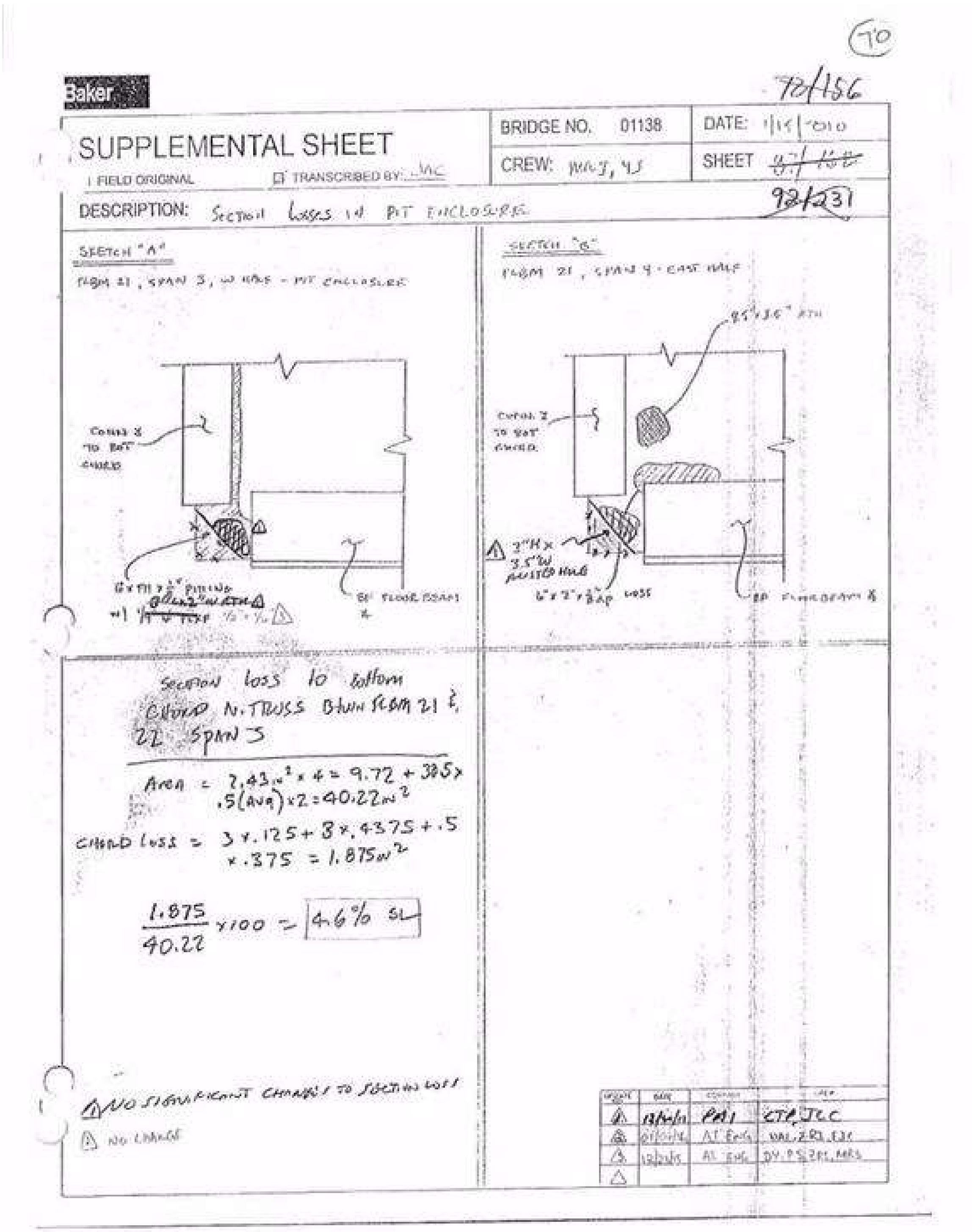
67_Underside of deck Span 3 Pit FB mid span - 21 E. half



68_Underside of deck Span 3 Pit FB 21-20 E. half



69_Sec. loss Span 3& 4 pit


70

70/156

Baker

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/15/2010
FIELD ORIGINAL / TRANSCRIBED BY:	CREW:	SHEET 92/231

DESCRIPTION: Section losses in pit enclosure

SKETCH "A"
FLBM 21, SPAN 3, W HALF - PIT ENCLOSURE

SKETCH "B"
FLBM 21, SPAN 4 - EAST HALF

Section loss to bottom chord N. Truss btwn FLBM 21 & 22 Span 3

Area = 2.43 in² x 4 = 9.72 + 30.5 x .5 (Avg) x 2 = 40.22 in²

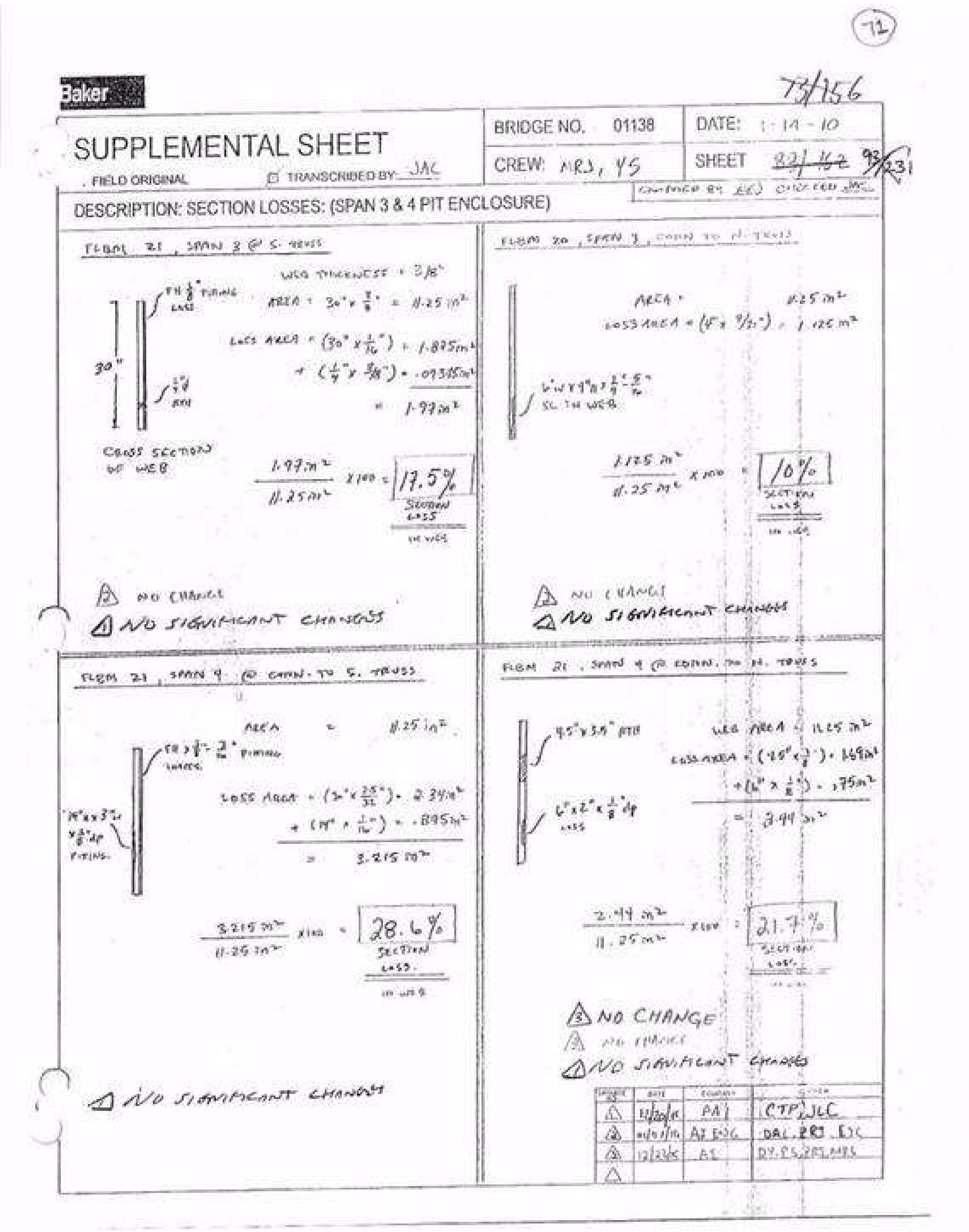
Chord loss = 3 x .125 + 3 x .4375 + .5 x .375 = 1.875 in²

$\frac{1.875}{40.22} \times 100 = \boxed{4.6\%\ SL}$

NO SIGNIFICANT CHANGES TO SECTION LOSS

NO CHANGE

70_Sec. loss Span 3& 4 pit


71

73/156

Baker

SUPPLEMENTAL SHEET

FIELD ORIGINAL ☐ TRANSCRIBED BY: JAC

BRIDGE NO. 01138	DATE: 1-14-10
CREW: MRJ, YS	SHEET ~~83/162~~ 93/231

CHECKED BY EEJ CHECKED JMC

DESCRIPTION: SECTION LOSSES: (SPAN 3 & 4 PIT ENCLOSURE)

FLBM 21, SPAN 3 @ S. TRUSS

WEB THICKNESS = 3/8"

AREA = 30" × 3/8" = 11.25 in²

LOSS AREA = (30" × 1/16") = 1.875 in²
+ (1/4" × 3/8") = .09375 in²
= 1.97 in²

CROSS SECTION OF WEB

30"

$\frac{1.97 \text{ in}^2}{11.25 \text{ in}^2} \times 100 = \boxed{17.5\%}$ SECTION LOSS IN WEB

⚠2 NO CHANGE
⚠1 NO SIGNIFICANT CHANGES

FLBM 20, SPAN 3, CONN TO N. TRUSS

AREA = 11.25 in²
LOSS AREA = (4" × 9/32") = 1.125 in²

SL IN WEB

$\frac{1.125 \text{ in}^2}{11.25 \text{ in}^2} \times 100 = \boxed{10\%}$ SECTION LOSS IN WEB

⚠2 NO CHANGE
⚠1 NO SIGNIFICANT CHANGES

FLBM 21, SPAN 4 @ CONN. TO S. TRUSS

AREA = 11.25 in²

PITTING

LOSS AREA = (2" × 25/32") = 2.34 in²
+ (14" × 1/16") = .875 in²
= 3.215 in²

PITTING

$\frac{3.215 \text{ in}^2}{11.25 \text{ in}^2} \times 100 = \boxed{28.6\%}$ SECTION LOSS IN WEB

⚠1 NO SIGNIFICANT CHANGES

FLBM 21, SPAN 4 @ CONN. TO N. TRUSS

4.5" × 3.5" PIT

WEB AREA = 11.25 in²
LOSS AREA = (4.5" × 3/8") = 1.69 in²
+ (6" × 1/8") = .75 in²
= 2.44 in²

6" × 2" × 1/8" dp LOSS

$\frac{2.44 \text{ in}^2}{11.25 \text{ in}^2} \times 100 = \boxed{21.7\%}$ SECTION LOSS IN WEB

⚠3 NO CHANGE
⚠2 NO CHANGE
⚠1 NO SIGNIFICANT CHANGES

CHANGE	DATE	COMPANY	SYSTEM
⚠1	11/20/11	PA	CTP, JLC
⚠2	10/11/13	AI ESC	DAL, PRJ, ESC
⚠3	12/23/15	AI	DY, PS, PRJ, MRS
⚠4			

71_Sec. loss Span 3& 4 pit

72

Baker

74/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/5/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY ___	CREW: MJD, TK, JAC	SHEET ~~44/44~~ 97/251

DESCRIPTION: DETERIORATION LEGEND : (SPAN 4 SWING SPAN FRAMING)

1. Bottom Flange of floorbeam with section losses on horizontal legs.
2. Top flange of floorbeam with section losses on horizontal legs.
3. Rivet heads with section loss up to 90%.
4. Rusted through hole in floorbeam vertical stiffener 3" high x full width (U.O.N.).
5. Floorbeam top flange under stringer with (2) 1-1/4" diameter drilled anchor bolt holes and rusted through hole (1-5/8" x 1-1/4") adjacent to one drill hole. Area at anchor bolt holes with 4" x 4" x 7/16" remaining, and full height x 1" wide x 3/8" max loss to web adjacent to chord. Average 25% section loss.
6. Floorbeam bottom flange with 7' long x 2" wide loss of width with 2" wide x 5/16" remaining.
7. Floorbeam (1) sheared rivet/bolt missing at the vertical stiffener connection.
8. Localized pitting losses up to 3/16" deep and 1" diameter rusted through hole in gusset plate.
9. (4) Missing bolts between support beams and bottom gusset plate, no bolt holes in support beam.
10. 6" x 2" loss of width with knife edge at edge of floor beam of top flange under stringer 3.
11. Vertical stiffeners between stringers 1 – 3 with up to 3" x 3" rusted through holes at base at west side and 3" x 2" rusted through holes at east end (2 locations).
12. Bracing from 1' away from gusset plate with 1' long x full height rusted through holes at back-to-back angles.
13. Floorbeam bottom flange 15" long x 3" loss of width with 5/16" remaining (east side) horizontal leg.
14. Floorbeam bottom flange 3' long x 3.5" loss of width with 5/16" remaining (east side) horizontal leg.
15. Floorbeam web with heavy section loss up to 5" high x 1.5' x up to ~~1/4"~~ 3/16" deep. w/ up to 1/2" ϕ RTH or square
16. Bottom flange east leg with 1' long x full width x 3/8"-7/16" average remaining at horizontal leg, vertical leg with 2.5" high x 3/16" deep adjacent loss.
17. S/P [illegible] w/ [illegible] + RUSTED THRU HOLES UP TO [illegible] W/ EXPOSED CONCRETE [illegible]. DECK W/ SPALLS UP TO 2"
18. 1" ϕ PERF. IN GUSSET PL w/ R.D [illegible] TO 1/8" REMAINING
19. PERF. IN LATERAL BRACING
20. Bottom Flange of floorbeam with pitting losses (per leg of flange, U.O.N.).
21. Section loss to gusset plate.
22. Vertical clip angle with full height x 2" wide x 1/16"-1/8" pitting on both legs.
23.
24. FLOORBEAM FIBERGLASS COVER SPLIT W/ MISSING CONNECTION HARDWARE (COVERS ARE LOOSE)
25.
26.

NO CHANGE
21, 23, 24

1	12/22/[illegible]	[illegible]	[illegible]
2	12/[illegible]	AS	DAL, JJ, [illegible]
3	12/[illegible]	AS	DY, PS, [illegible], MCJ
4			

72_Legend Span 4 Swing framing

73

Baker

95/156

SUPPLEMENTAL SHEET	BRIDGE NO 01138	DATE 1/5/2010
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY ___	CREW MJO, TK, JAC	SHEET

DESCRIPTION: DETERIORATION LEGEND : (SPAN 4 SWING SPAN FRAMING) ~~75/231~~

- Floorbeam web with 5" x 5" x 1/8" loss at connection to truss; web 1.5' to north with 1' L x 3" H x 3/16" loss.
- West leg of floorbeam BF with areas of pitting losses between stringers with 4" wide x 5/16"-3/8" remaining and 5" wide x 7/16"-1/2" remaining.
-
-
- 7/16" remaining x 4" wide at random locations (this stringer bay). 1/4 x △
- 6" long x 5" wide x 7/16"-1/2" remaining on bottom flange of floorbeam with section losses on horizontal legs.
- Bottom flange of floorbeam with section losses on horizontal legs, 3" wide x 4" x 3/8" remaining on the east and 2.5" diameter x 7/16" deep at the west.
- Floorbeam web with section loss up to 1/8" deep.
- Floorbeam top flange angle horizontal with section loss, full length of bay x 1.5" wide.
- Missing section of fiberglass floorbeam cover.
-
- Web with 5" long x 2" high x 3/16" loss and vertical leg of bottom flange with 1' long x 2" high x 3/16" deep loss.

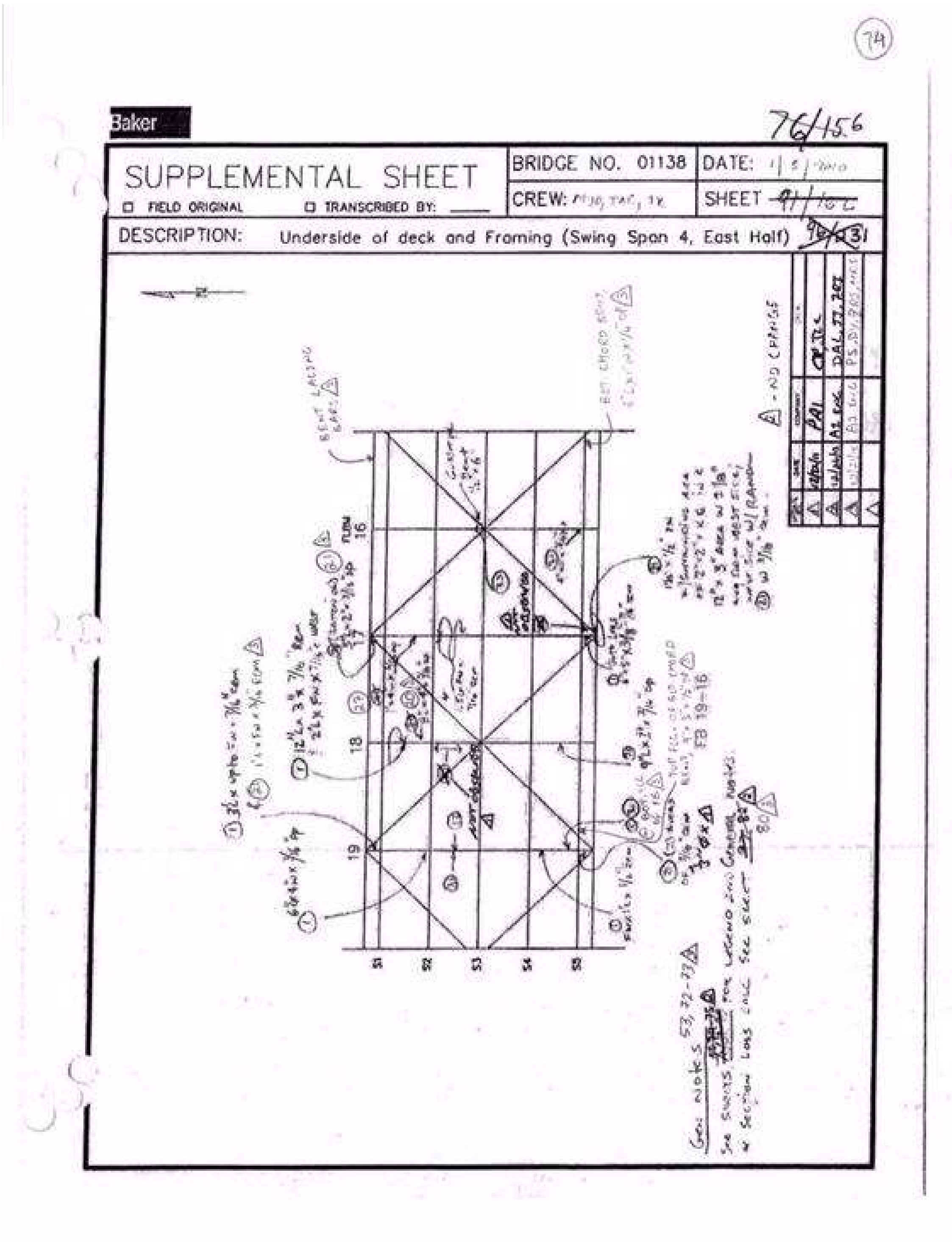
△ NO CHANGE
△ - NO CHANGE

△	[illegible]	[illegible]	[illegible]
△	12/2[illegible]	AI SNG	DAL, JJ, RRE
△	12/14/15	AI	PS, DY, JBI, MRS

73_Legend Span 4 Swing framing

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

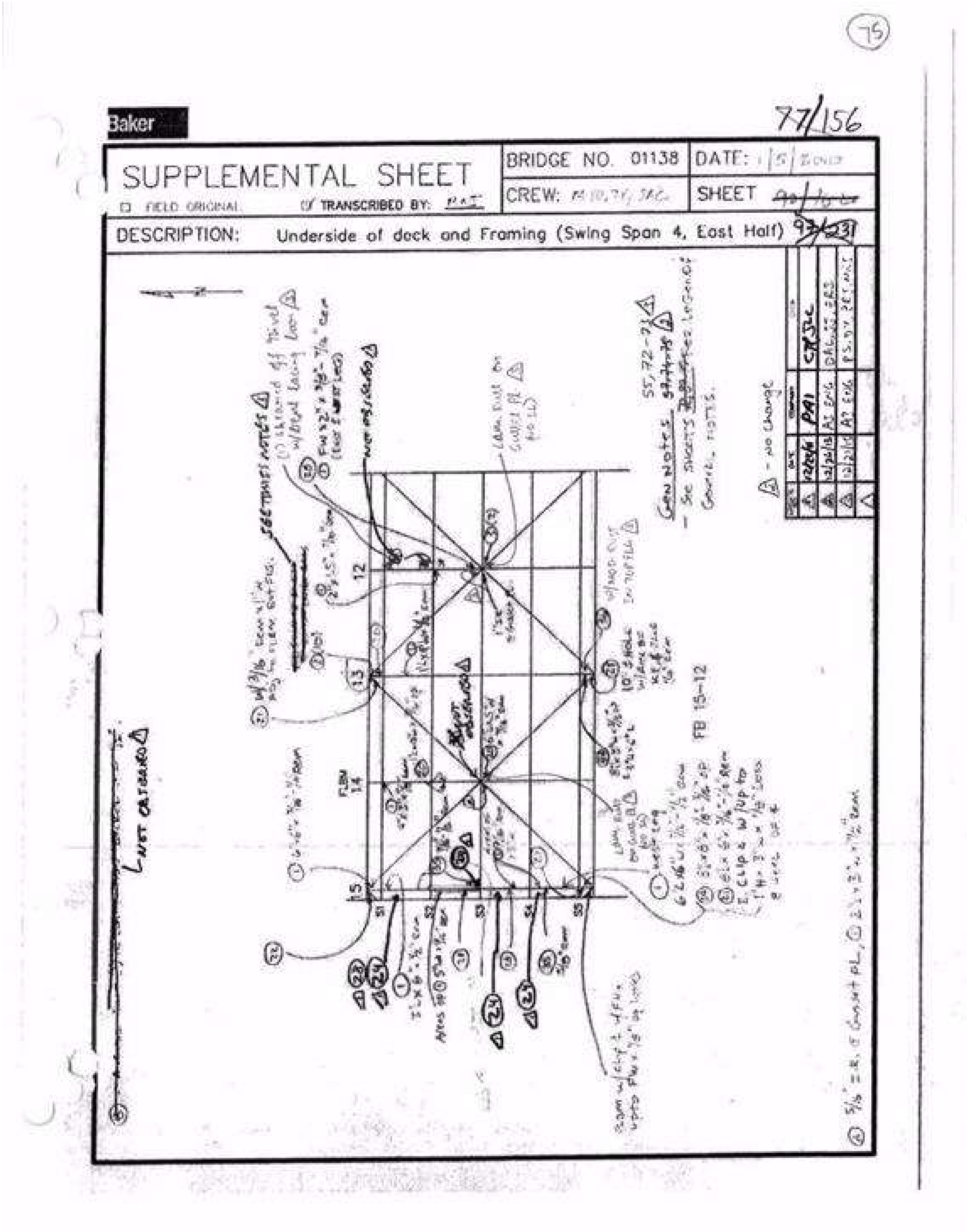


74_Underside of deck Span 4 E. half FB 19-16

Sketches
Inspection type: Fracture Critical,Special,Routine
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Bridge No: 01138

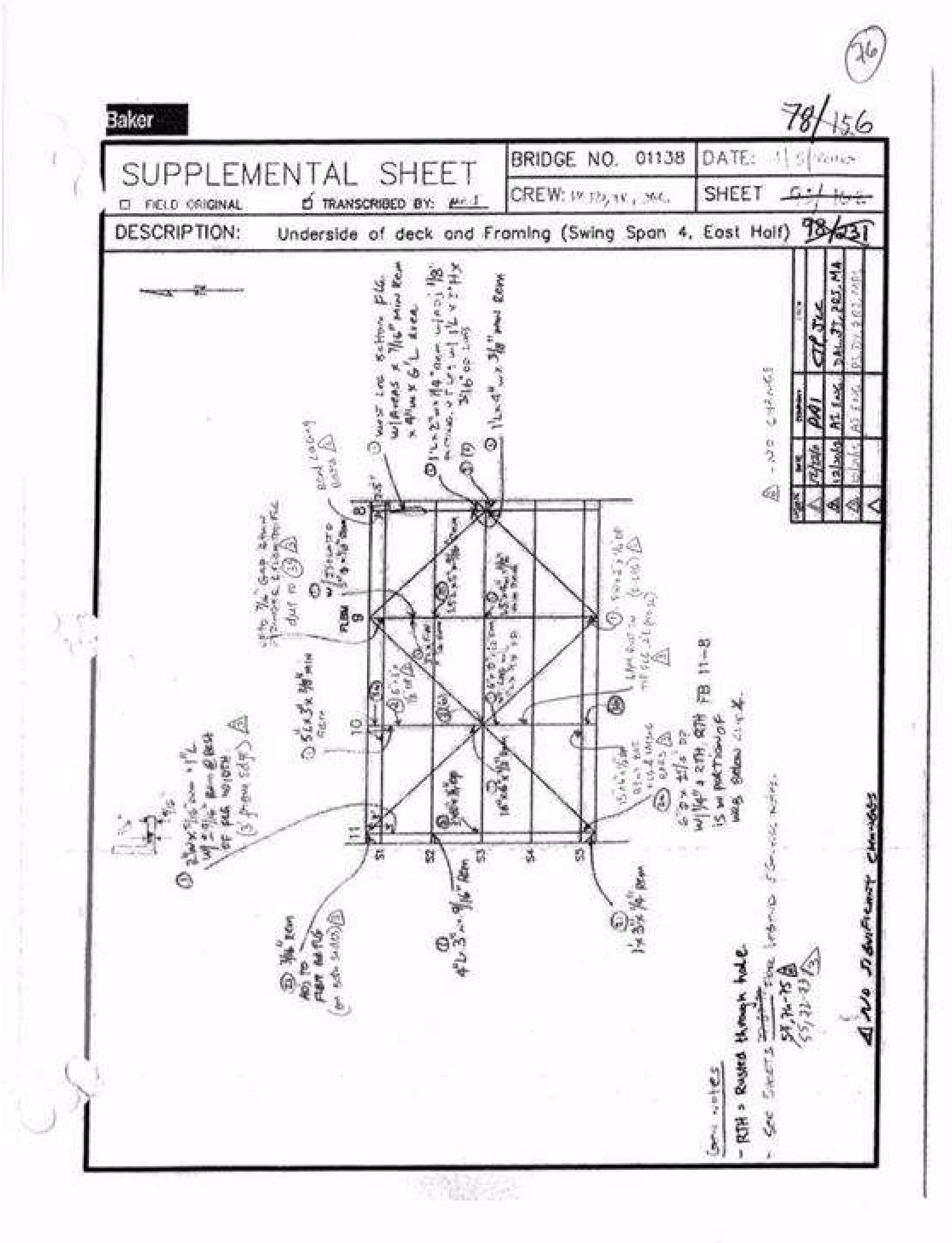
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



75_Underside of deck Span 4 E. half FB 15-12

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

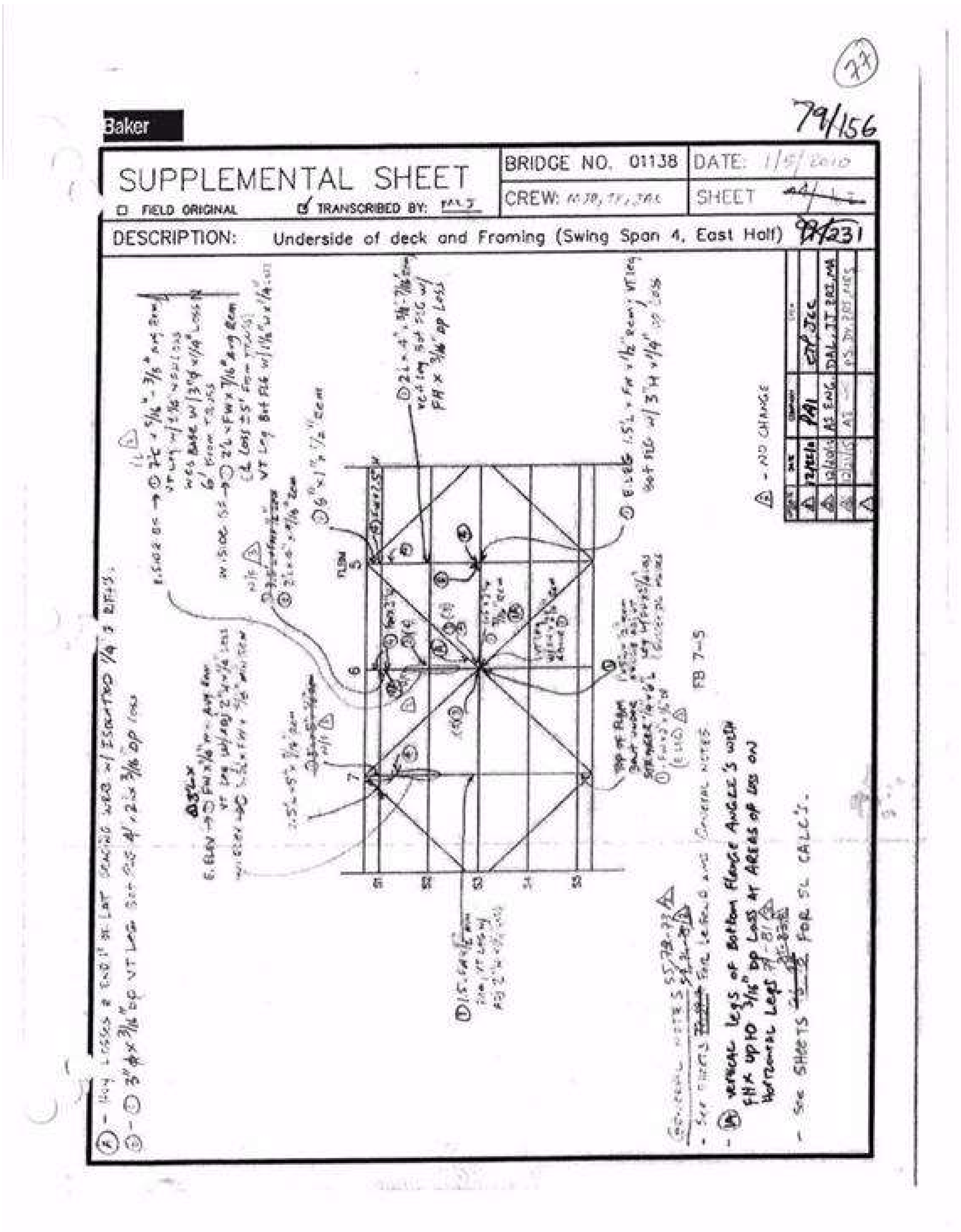
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



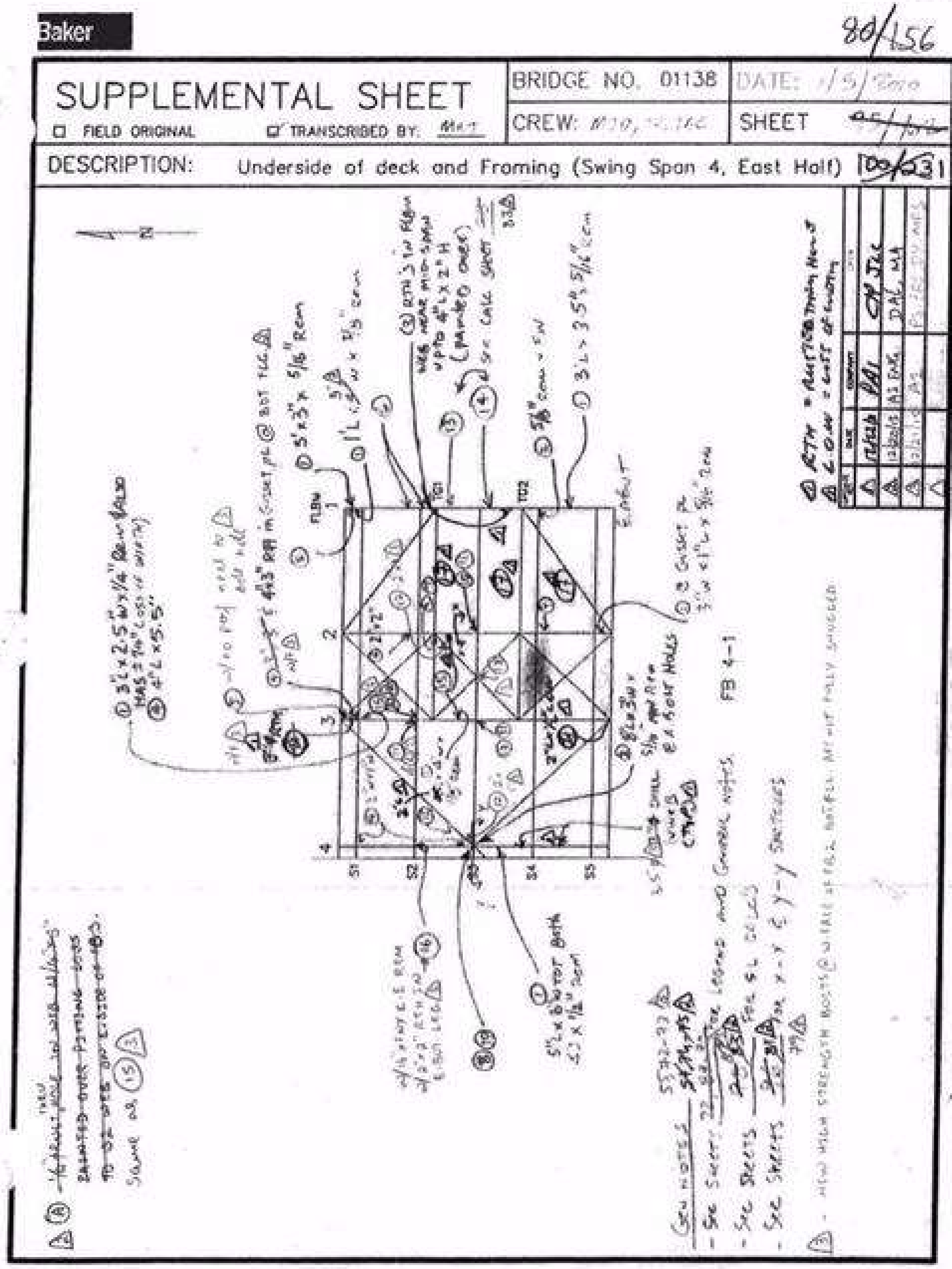
76_Underside of deck Span 4 E. half FB 11-8

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



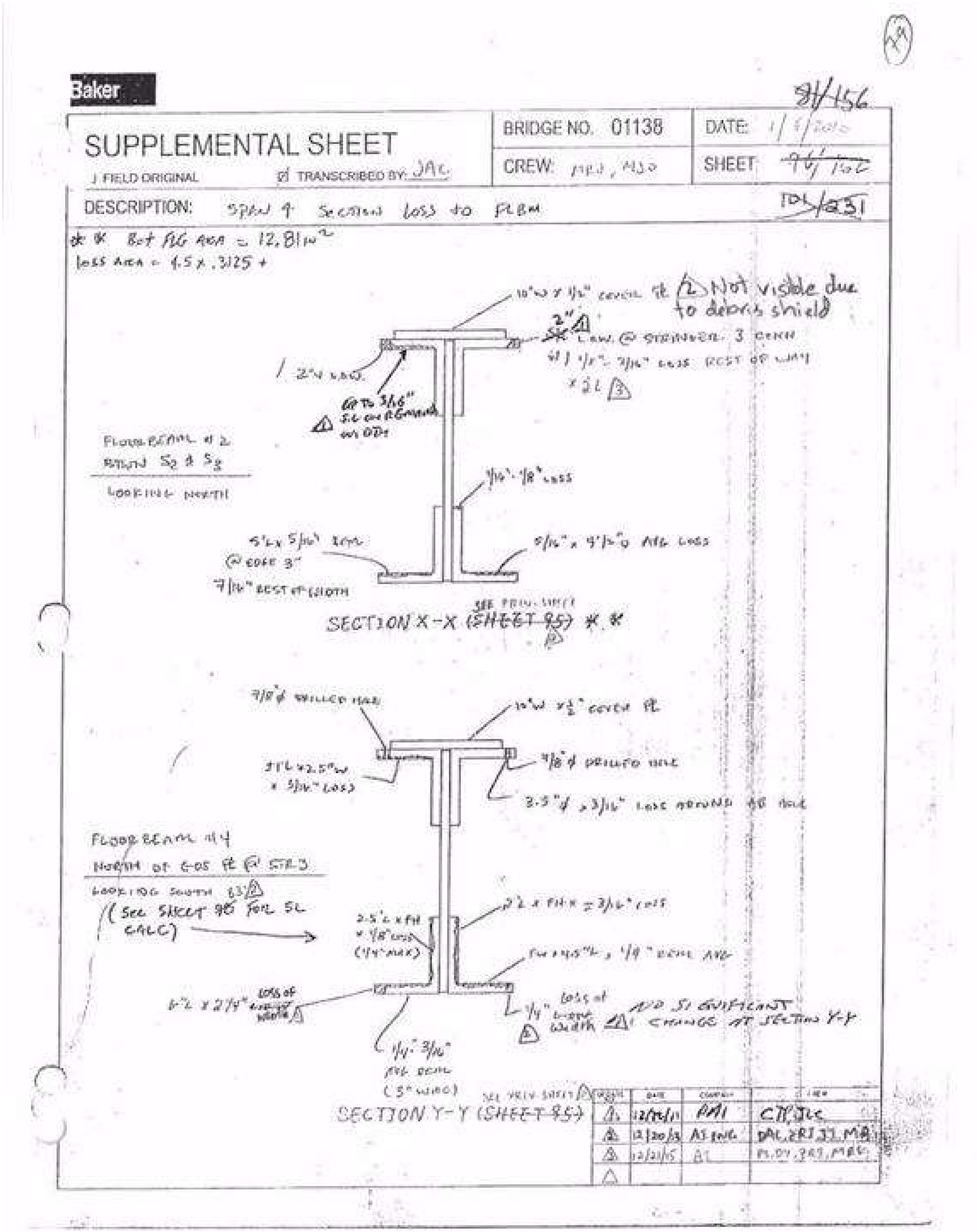
77_Underside of deck Span 4 E. half FB 7-5



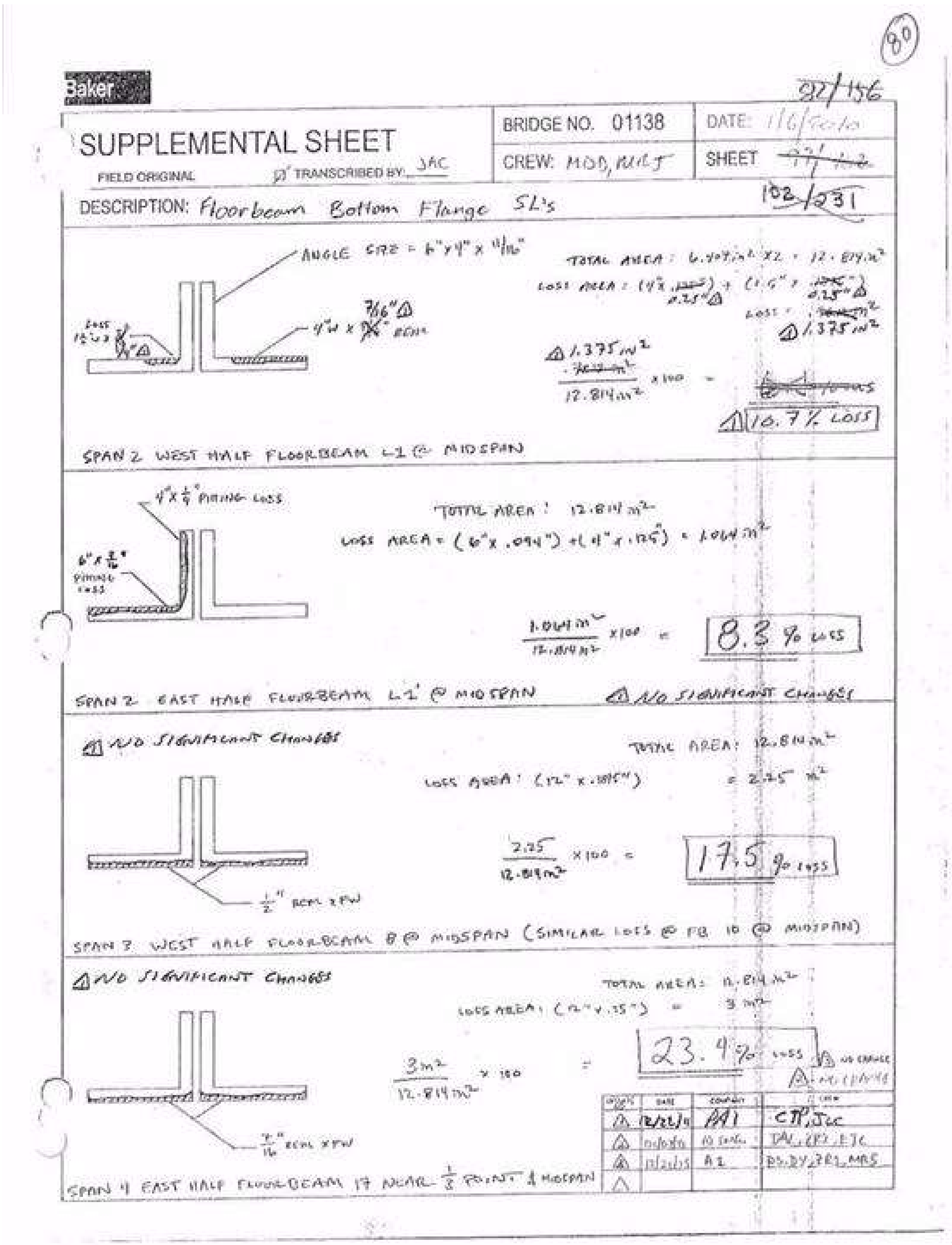
78_Underside of deck Span 4 E. half FB 4-1

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



79_ Sec. loss Span 4 FB


SUPPLEMENTAL SHEET

BRIDGE NO. 01138	DATE: 1/6/2010
CREW: MDD, MLJ	SHEET

FIELD ORIGINAL — TRANSCRIBED BY: JAC

DESCRIPTION: Floorbeam Bottom Flange SL's

ANGLE SIZE = 6"x4" x 11/16"

TOTAL AREA: 6.407 in² x 2 = 12.814 in²

LOSS AREA: 1.375 in²

1.375 in² / 12.814 in² x 100 = 10.7% LOSS

SPAN 2 WEST HALF FLOORBEAM L1 @ MIDSPAN

TOTAL AREA: 12.814 in²

LOSS AREA = (6"x .094") + (4"x .125") = 1.064 in²

1.064 in² / 12.814 in² x100 = 8.3 % LOSS

SPAN 2 EAST HALF FLOORBEAM L1' @ MIDSPAN — NO SIGNIFICANT CHANGES

NO SIGNIFICANT CHANGES

TOTAL AREA: 12.814 in²

LOSS AREA: (12" x .1875") = 2.25 in²

2.25 / 12.814 in² x 100 = 17.5 % LOSS

SPAN 3 WEST HALF FLOORBEAM 8 @ MIDSPAN (SIMILAR LOSS @ FB 10 @ MIDSPAN)

NO SIGNIFICANT CHANGES

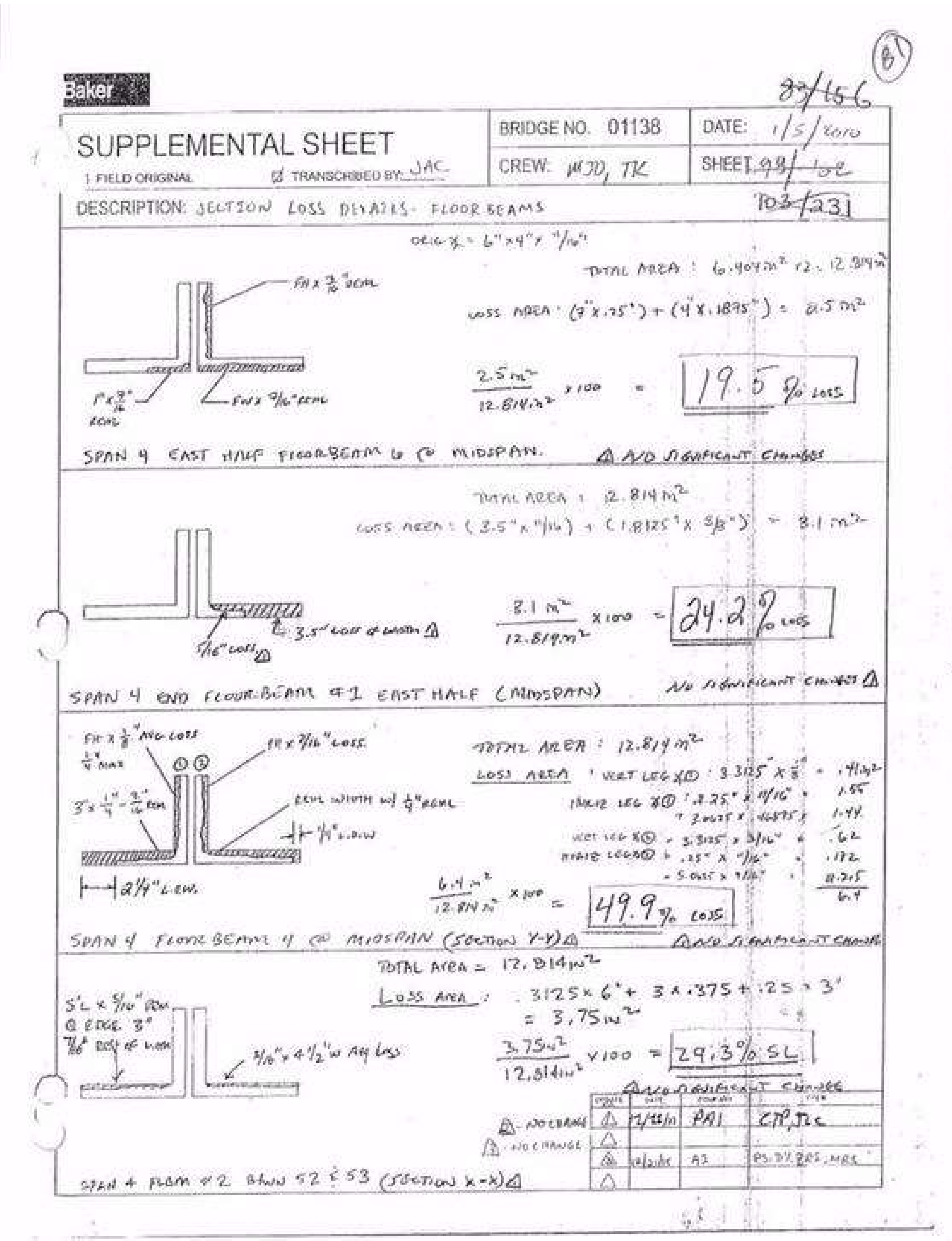
TOTAL AREA: 12.814 in²

LOSS AREA: (12" x .25") = 3 in²

3 in² / 12.814 in² x 100 = 23.4% LOSS

SPAN 4 EAST HALF FLOORBEAM 17 NEAR 1/3 POINT & MIDSPAN

80_ Floor beam Flange Sec. loss Span 4



Baker

SUPPLEMENTAL SHEET

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 1/5/2010
FIELD ORIGINAL ☑ TRANSCRIBED BY: JAC	CREW: MJD, TK	SHEET ~~98/192~~ 103/231

DESCRIPTION: SECTION LOSS DETAILS - FLOOR BEAMS

ORIG. ∠ = 6"x4"x 11/16"

TOTAL AREA: 6.407 in² x 2 = 12.814 in²

LOSS AREA: (7" x .25") + (4" x .1875") = 2.5 in²

2.5 in² / 12.814 in² x 100 = 19.5 % LOSS

SPAN 4 EAST HALF FLOORBEAM 6 @ MIDSPAN. △ NO SIGNIFICANT CHANGES

TOTAL AREA: 12.814 in²

LOSS AREA: (3.5" x 11/16) + (1.8125" x 3/8") = 3.1 in²

3.1 in² / 12.814 in² x 100 = 24.2 % LOSS

3.5" LOSS OF WIDTH △

7/16" LOSS △

SPAN 4 END FLOOR BEAM #1 EAST HALF (MIDSPAN) NO SIGNIFICANT CHANGES △

TOTAL AREA: 12.814 in²

LOSS AREA: VERT LEG X① : 3.3125" x 1/8" = .41 in²; HORIZ LEG X① : 2.25" x 11/16" = 1.55; 2.0625" x .6875 = 1.44; VERT LEG X② = 3.3125 x 3/16" = .62; HORIZ LEG X② = .25" x 11/16" = .172; = 5.0625 x 7/16" = 2.215; 6.4

6.4 in² / 12.814 in² x 100 = 49.9 % LOSS

SPAN 4 FLOOR BEAM 4 @ MIDSPAN (SECTION Y-Y) △ △ NO SIGNIFICANT CHANGES

TOTAL AREA = 12.814 in²

LOSS AREA: .3125 x 6" + 3 x .375 + .25 x 3' = 3.75 in²

3.75 in² / 12.814 in² x 100 = 29.3 % SL

△ NO SIGNIFICANT CHANGES

△ - NO CHANGE

	DATE	COMPANY	INITIALS
△	12/13/11	PAI	CRP, TLC
△			
△	12/2/15	AI	PS, DY, RRS, MRS
△			

SPAN 4 FLBM #2 BTWN 52 & 53 (SECTION X-X) △

81_ Section Loss Floor beam Span 4

82

84/156

Baker	Bridge No. 01138	Date: 1/5/2010
SUPPLEMENTAL SHEET	Crew: MJO, TK, JAC	Sheet ~~99/162~~ 104/531
Description: General Notes Swing Span Truss		

- Random lacing bars show pitting up to ~~1/8"~~. 1/4" DEEP △.
- Random lacing bars are bent up to 1" max.
- Random areas of pitting loss on gusset plate connections up to 6" x 3" x 1/8" deep (Also, up to 1/8" deep at perimeter of eye bars).
- Random areas of △MINOR TO MODERATE light surface rust. & LAMINAR RUST UP TO 1/4" WIDE △.
- Random rivets have been sheared off at lattice bars. & LACING BARS (ISOLATED LOCATIONS) △
- Truss members with random scrapes with minor surface rust from contractor work.
- Random batten plates with pitting up to 1/8" at nodes.
- Random eyebars show pitting up to 1"L x FW x 1/8" deep on top and bottom surfaces. Web plates with up to 1/8" pitting x up to 1.5"W around/adjacent to pin nuts.
- Rivets near top chord pin connections causing random gaps up to ½" between eyebar and gusset plates (as-built condition).
- There are random gaps up to 7/16" between anchor bolt nuts, eyebars and gusset plates at top chord pin connections (all connections secure).
- Outstanding horizontal legs at sway bracing struts show random pitting up to 1/8" deep from ponding water with random ½" drilled holes.
- Random rivet heads show section losses up to 50% △(TYPICAL) WITH ISOLATED SECTION LOSS UP TO 95%. W/ MINOR TO MODERATE SURF. CORROSION
- Random truss members plates and angles show pitting losses, negligible to ~~1/16"~~ △1/8" (up to △3/16" ~~1/8"~~ deep at node connection).
- Random back-to-back angles show up to 1/16" OR △ pitting.
- Random missing rivets replaced with bolts. (SOME BOLTS MISSING NUTS △)
- Random bottom chord angles are bent up to 1".
- Top chord nav. lights (3) on at time of inspection.
- Bottom chord web plates with random 3"H x 1/8" UP TO 3/16" DEEP △ deep. Painted losses above the bottom angles.
- Bottom chord web plates inside of chord with losses up to 4"H that are knife edging at bottom and full section 4" above. W/ ISOLATED RTH UP TO 2"L x 1"H △
- Bottom chord bottom angle outstanding legs with up to full height and full width x ~~3/16"~~ △ 5/16" (1/8" REMAINING) deep loss at floorbeam connection locations; random similar losses away from floorbeam connections, but only 3/16" deep.
- Bottom flange angle with 1/8"-3/16" pitting losses throughout (painted over).

△ – RANDOM AREAS OF PACK RUST, UP TO 1/4" TYPICAL △ WIDE, BETWEEN ALL BOTTOM CHORD & CONNECTING MEMBERS (WEBS, DIAPHRAGMS, BATTEN PLATES, GUSSET PLATES, LACING MEMBERS, SPLICE PLATES FLOORBEAMS, DIAGONAL & VERTICAL MEMBERS, & CONNECTION ANGLES) WITH MINOR DISTORTION OF PLATES, UP TO 1/4" WIDE.

△ – RANDOM LOCATIONS OF VERTICAL TRUSS, DIAGONAL TRUSS & FLOORBEAM GUSSET PLATES WITH 100% SECTION LOSS ALONG EDGES ADJ. TO TRUSS CONNECTION, UP TO 3/4" WIDE ((BATTEN PLATES & LACING MEMBERS ARE INCLUDED IN ABOVE NOTE). (DIAGONAL EYEBARS) △

△ - 12/14/15 . PS, 281 (AI ENG)
△ . 12/15/15 . TT, 281 (AI ENG)
△ NO CHANGE △ - 12/21/11 - PA1 - CTP, JLC

82_General Notes Swing span turss

(83)

Baker

95/156

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 12/10/09
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	CREW: MRJ, YS	SHEET ~~100/117~~ 105/231

DESCRIPTION: DETERIORATION LEGEND : (SWING SPAN SOUTH TRUSS)

(1) 2"L x 1"W tear in leg of x-bracing angle over eastbound lane & 5" x ½" dp. bend in vert. angle

(2) Up to ³⁄₁₆" gap between north eyebar and gusset plate.

(3) ~~Message board attached to sway bracing with 3 broken light cells (1 missing) and 16 non-functioning. Moderate rust on support frame, random cells are loose.~~ REMOVED

(4) Plug weld 3 lattice bars to channel in place of rivets.

(5) 5'L x 1.5" bend in bottom horizontal sway bracing angle near center line of bridge with 6'L x 2"W x ¼" loss with (1) ½ diameter rusted through hole in the vert leg and (2) 1" x ¾" rusted through holes in the horizontal leg.

(6) ¼" gap between pin head and eyebar (South side)

(7) Eyebars with 3" x 1"H x ⁵⁄₁₆" deep pitting on both surfaces

(8) Section loss on both eyebars, north and south full perimeter x 1 ½"W x ³⁄₁₆" deep.

(9) Top Gussel plate with 4 mis-drilled holes and navigation light tower with bend in support brace angle (constructed this way) abandoned wires exposed at top of portal (in 2 areas), (5) ½" diameter perforations in portal.

(10) North bottom horizontal angle legs with 1'L x 3"W x ³⁄₁₆" remaining

(11) East edge of bottom batten plate with 9" x 2" x ³⁄₁₆" loss with rough edges. west are

(12) Bottom chord: North web: North elevation with ±1"W x ⅛" - ³⁄₁₆" loss around 50% of pin nut circumference. vert. Guss. PL (or splice PL (north))
: South elevation with up to ⅛" loss up to 3" wide adjacent to eyebar
South Web: North elevation with ± ⅛" average loss (up to ³⁄₁₆" isolated) up to 3" from eyebar. vt. Guss. PL

(13) Inside of connection primed but not painted.

(14) Lateral sway brace east angle bent ½" over 1'

(15) Gusset plate with full length x 1" x ⅛" - ³⁄₁₆" pitting losses, painted over.

(16) ~~Laminated rust forming at outer edges of eyebars adjacent to edges of previously called out section losses.~~ up to ½" pack rust bet. eye bars & bet. pin & eyebars (S. node); minor bleeding rust @ center pin

(17) Top chord of interior north side with 2.5'L x 1"H x ¼" deep painted over section loss along the batten plate.

(18) Top horizontal gusset plate with ¼" impacted rust and full length x ½"W x ⅛" painted section loss along sway bracing member.

(19) Vertical plate inside node with 2 ¾"H x 3"L hole and debris accumulation. 5 ¾" moderate

(20) Gap up to ⅛" between vertical chord connection plate and top chord angles (from previous impacted rust).

(21) Back to back angles of bottom sway strut with 4"L x ½"W x ⅛" loss, (6" of west horizontal leg bent ¼" over 2').

(22) Batten plate is bent 1' long by ½" and North Top Flange of Channel bent 9"L x ½"H

(23) Bottom outstanding east horizontal angle leg is bent ½" over 12" at approximately 1' from center with 1.5'L x 3"W x ³⁄₁₆" pitting. on west vertical angle

(24) Eyebar with ⅛" pitting around perimeter of pin nut (painted over).

[illegible]	DATE	COMPANY	CREW
1	12/13/11	PENNONI	TJF, MJS, RDM
2	12/13/13	AI ENG	[illegible]
3	[illegible]	AI	[illegible]
4			

83_Legend Swing span south turss

(84)

Baker

86/156

SUPPLEMENTAL SHEET ☐ FIELD ORIGINAL ☐ TRANSCRIBED BY:____	BRIDGE NO. 01138	DATE: 12/10/09
	CREW: MRJ, YS	SHEET ~~[illegible]~~

DESCRIPTION: DETERIORATION LEGEND : (SWING SPAN SOUTH TRUSS) 106/183

25 North and south gusset plate with 7"L x 1" x 3/16" pitting. w/up to 1/4 dp. pack rust bet. eye bar & gusset pl. △3

26 North face of bottom chord bottom flange with 6" x 2" x 1/8" loss.

27 North face of bottom chord bottom flange with 10"L x FW x 1/4" remaining. w/ 1/8 dp pack rust under gusset pl. △3

28 North bottom flange horizontal leg with 8"L x FW x 1/4" remaining.

29 Missing ~~bolt~~ NUT △(BOLT REPLACED) on top flange of chord for railing.

△ 30 ~~Anchor bolt nuts with rosebudding with 1-20% loss, base plate down to chord.~~ N/A

△ 31 ~~Electrical conduit tied to bottom chord.~~

32 4"L x 4"W x 1/4" northwest corner of gusset plate bent (impacted rust removed) at cross bracing

33 Bottom of pin not painted.

34 Missing access cover on electrical conduit attached to operator house framing (exposed wires).

35 Heavy bird debris.

36 Tube support beam for navigation platform is 80% rusted out (outer tube beams are good).

37 Inside of node web full height x 1/2" wide x 1/4" deep loss at west side.

38 ~~Light fixture base plate with lower right (looking east) broken off corner; fixture held by a washer at this location.~~ △REPAIRED

39 See sketch pg ~~106~~/~~402~~△ 91△

40 South gusset plate w 1/16" - 1/8" pitting adjacent to eyebar up to 2" wide. & up to 1/4" dp pack rust bet eye bar & gusset pl △3

41 3/16" impacted rust between lattice bar and bottom flange of channel (painted over)

△ 42 SOUTH TRUSS BOTTOM CHORD INT DIAPHRAGM PLATE ANGLES @ MULTIPLE LOCATIONS, @ TOP, S.L. w/ KNIFE EDGING OF TOP FLANGE OF ANGLE, FW x 1"W (& 1 OF 3 BOLTS DISENGAGED ON EAST SIDE)

△3 43 10"L x 1/8" pack rust bet. S. top flg and web & SL @ bot. of web (10"L x 1/8"H x 1/8" [illegible])

△3 44 7"L x 3/8" H bend @ center pin bet nodes 2 & 3.

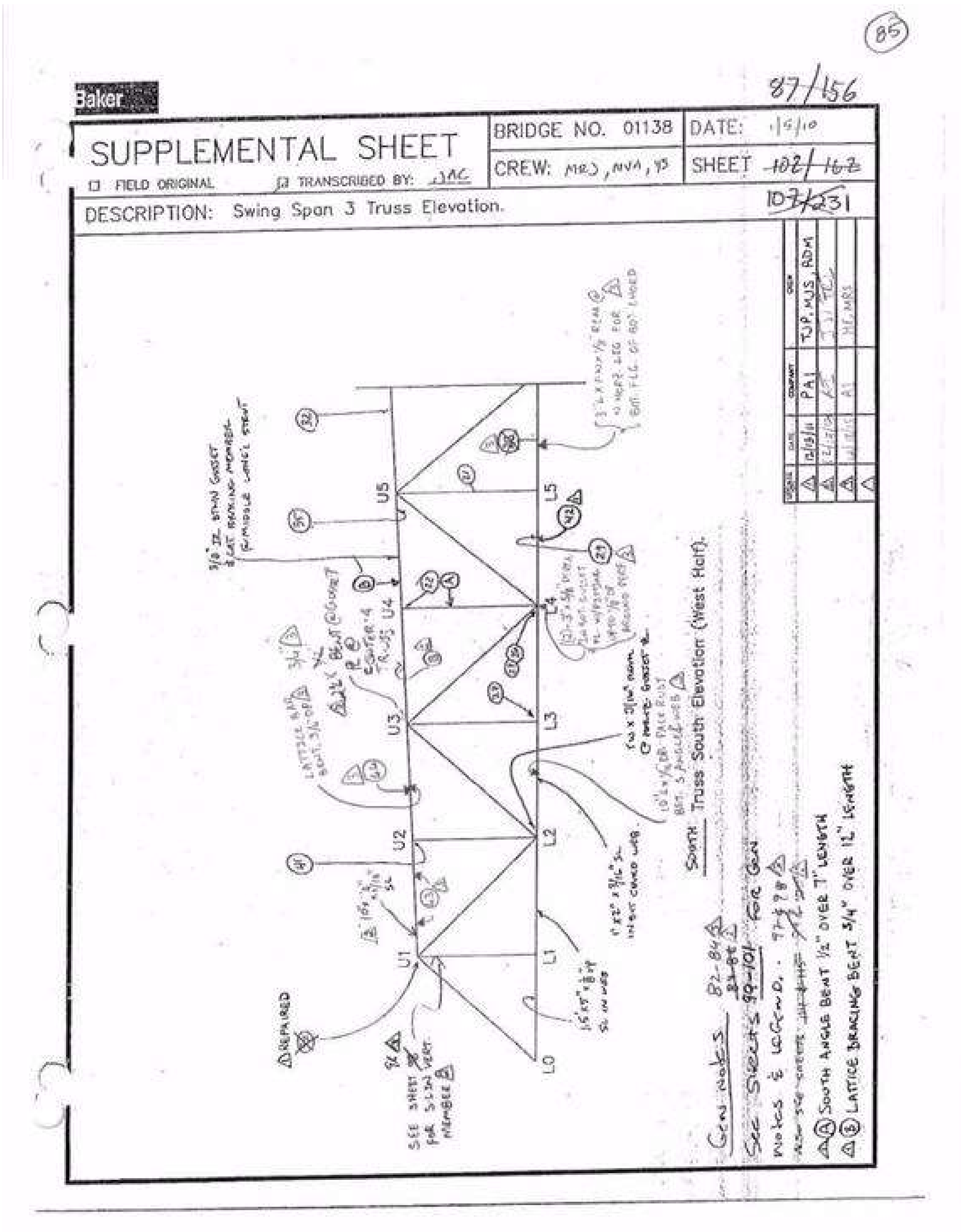
△3 no change

[illegible]	DATE	COMPANY	CREW
△	12/13/11	PENNONI	TJP, MJS, RDM
△	12/11/13	[illegible]	[illegible]
△3	12/14/15	AI	PS, [illegible], JAJ, MRS
△			

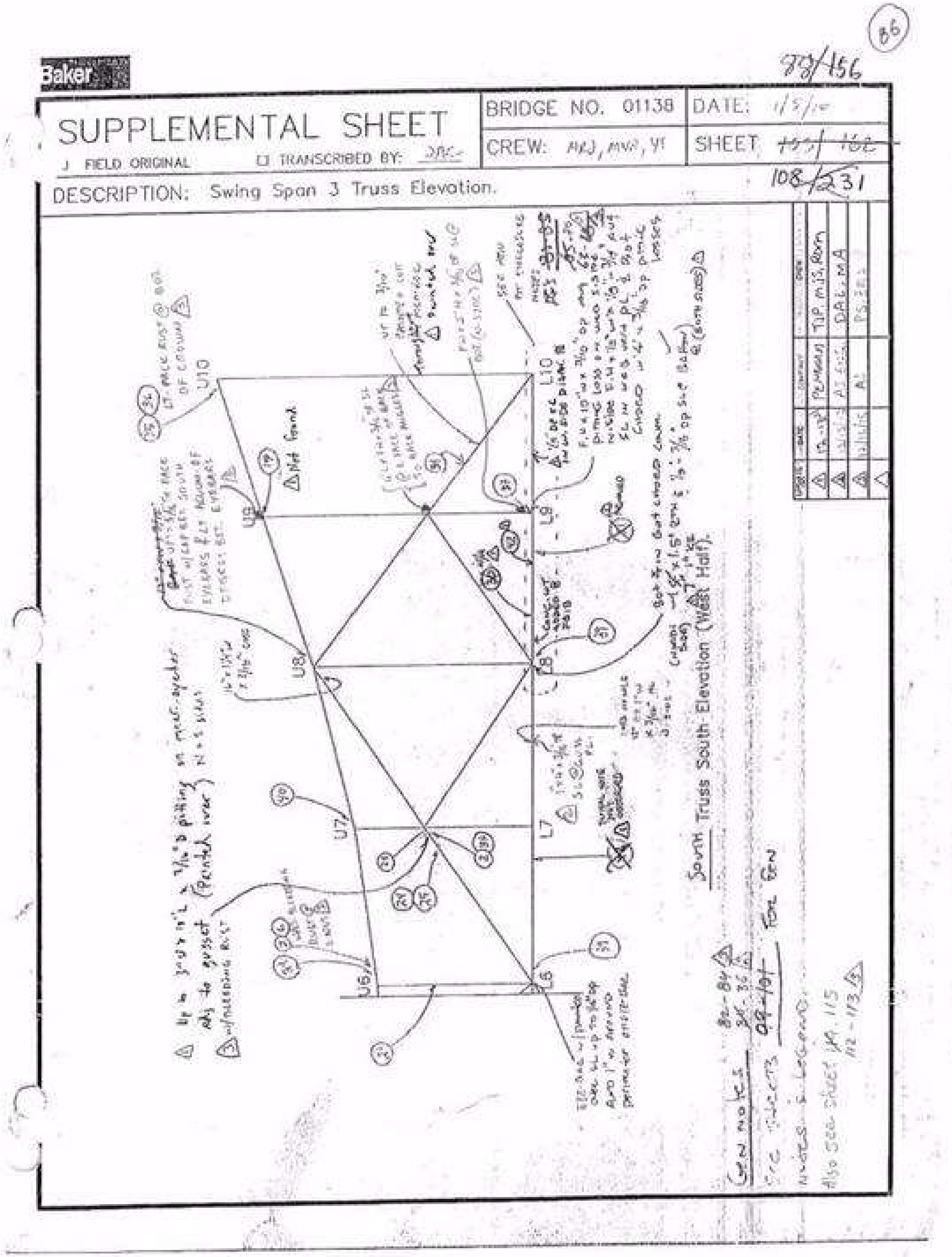
84_ Legend Swing span south truss

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

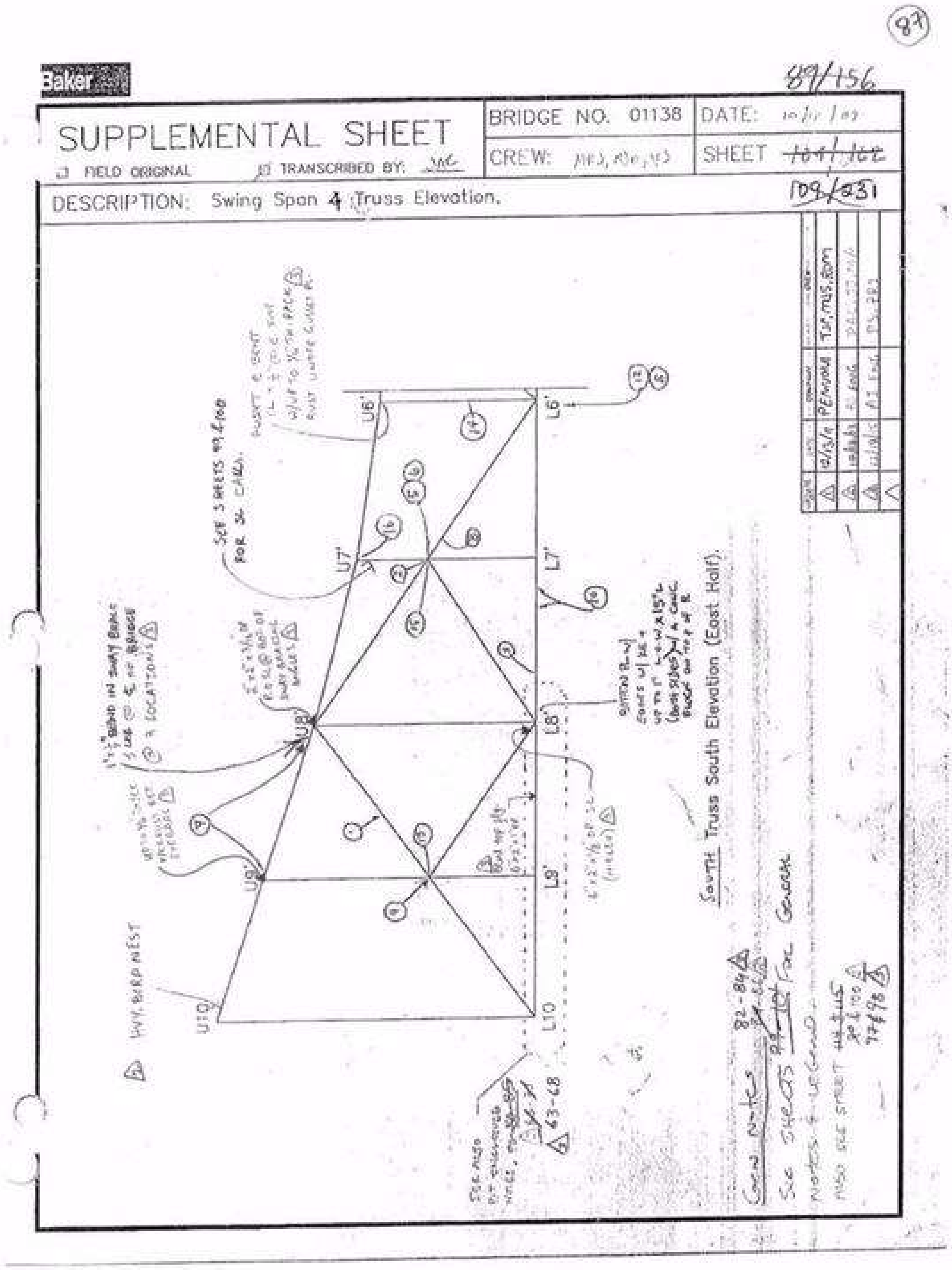
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



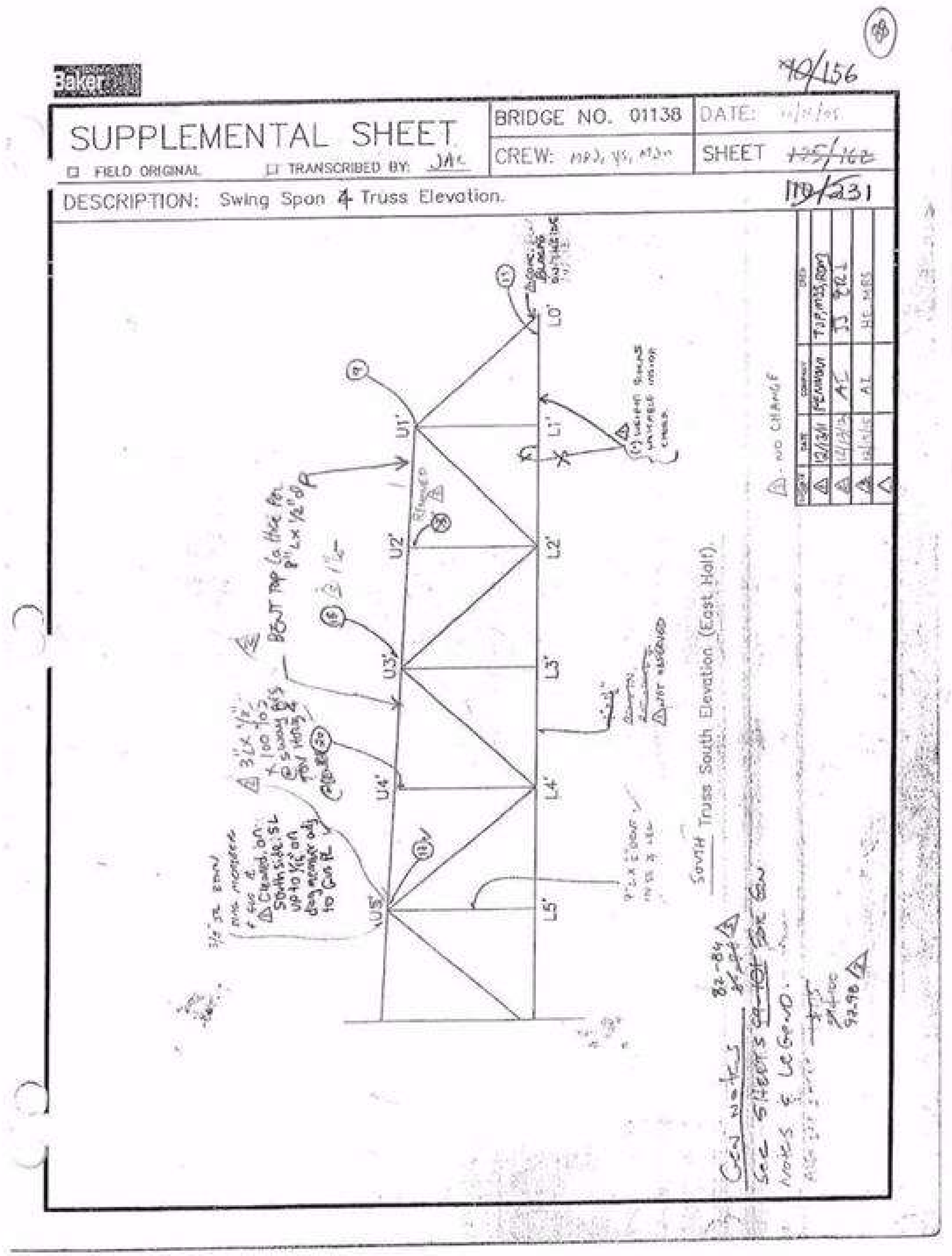
85_ Swing span 3South turss S. elev. (W. half)



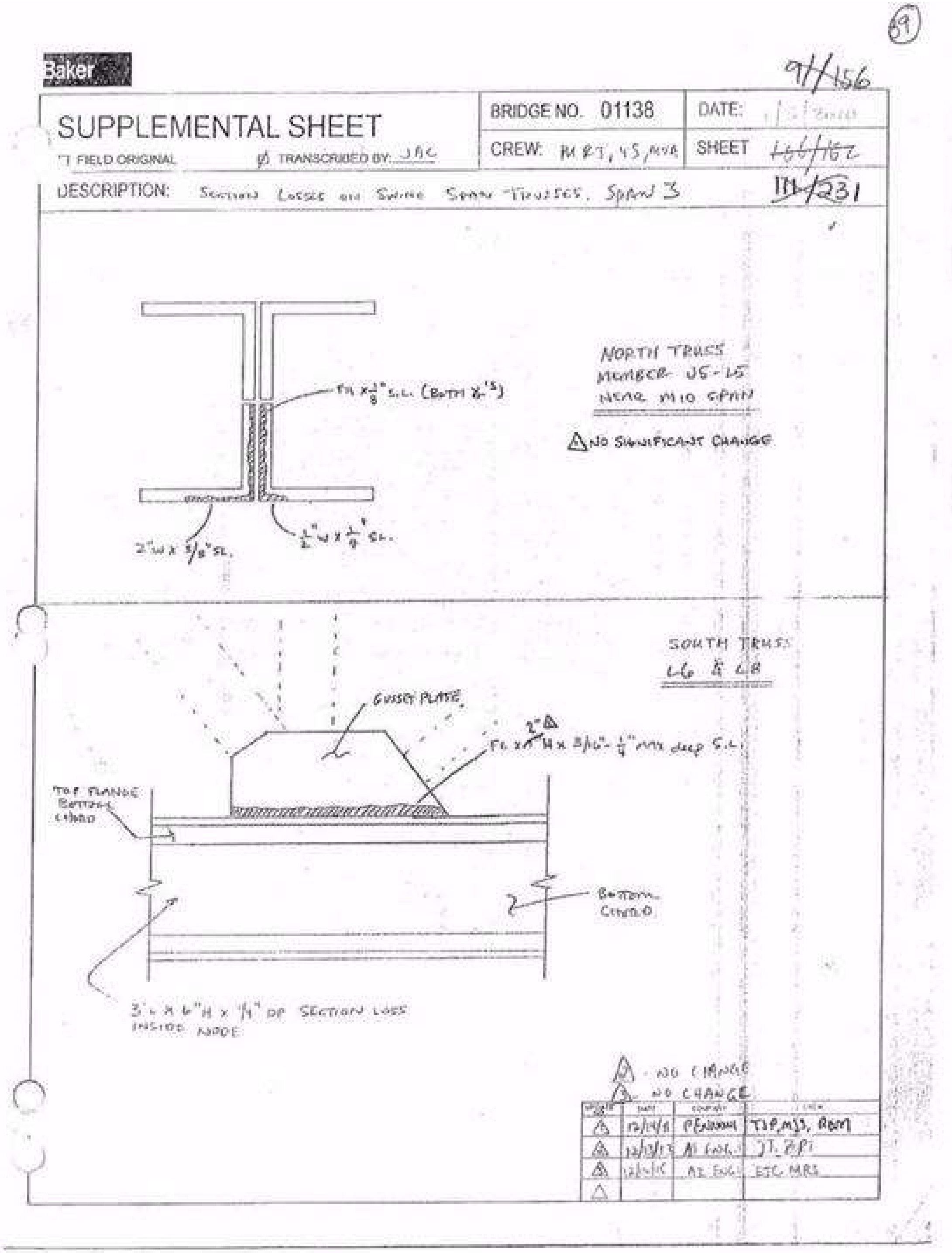
86_ Swing span 3South turss S. elev. (W. half)



87_ Swing span South turss S. elev. (E. half)



88_ Swing span South turss S. elev. (E. half)



89_Sec. loss on Swing span truss

90

92/156

Baker

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE: 12/10/09
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY ____	CREW: MRJ, YS	SHEET

DESCRIPTION: DETERIORATION LEGEND : (SWING SPAN NORTH TRUSS)

1. Up to ⅛ inch painted over impacted rust at top gusset plate for sway bracing angles.
2. Random ½" diameter rusted through holes at outstanding horizontal leg angles for sway bracing.
3. ~~East~~ LOWER WEST horizontal angle leg with ⅜" average remaining with ~~1"~~ SEVERAL diameter rusted through hole at center line, UP TO 3⅛" L x 1½" W
4. Gap up to ½" between ~~inside~~ OUTSIDE pin nut and connection plate. EYE BAR
5. 3/16" deep pitting on horizontal sway bracing angle leg.
6. Loss on bottom of eyebars
7. Section loss to gussel plate (FW adjacent to eyebar x 1" x ¼" remaining).
8. 6" long x ¼" dent in sway bracing angle.
9. Minor ¼" dent in gusset plate (6" long).
10. Lacing bars removed at tie plate at connection plate (as built).
11. Web with 6" diameter x ⅛" - 3/16" loss on both faces.
12. Anchor bolt nuts with rosebudding with 20% section loss at the railing post base down to chord.
13. Abandoned conduit with exposed wires.
14. Missing nut to navigation light to support plate (1 of 3), secure.
15. Abrasion dust typical at pin connections.
16. ¾" painted over impacted rust between eye bar and plates.
17. Missing conduit access cover with exposed abandoned wire.
18. Random areas on painted over pitting on ~~chords~~ CHANNELS and lacing bars up to 6" x 3" x 3/16" deep.
19. Gusset plate with 12" x 1" x ⅛" deep section loss adjacent to diagonal (painted over)
20. ~~Lattice~~ LACING bar is bent up to 1" due to previous construction damage.
21. Up to ¼" painted over impact rust at sway bracing connection angles.
22. 3/16" gap between pin nut and outside eyebar (connection secure) due to impacted rust.
23. North and south interior vertical gusset plates w/ up 2" x 1.5" x ¼" losses and 4" x 1" x 3/16" pitting on eyebar.
24. Outside of both gussel plates with ⅛" section loss: North: 10" x 2"W, South: 16" x 1" wide around eye bar.
25. Bottom lacing bar removed for fit of painters I-beam.
26. Bend in outstanding leg of angle.
27. Top of eyebar with loss.
28. ~~Outstanding horizontal~~ DIAGONAL sway bracing angle with FW x 1" x 3/16" section loss on east angle.
29. North horizontal bottom angle leg with 6" x ½" x ⅛" loss
30. Member bent to west ½" over 20 feet (construction related).
31. Section loss at bottom of web.
32. 6" long x ½" dent in north east angle.

90_Legend (swing span North turss)

(a1)

93/156

Baker

SUPPLEMENTAL SHEET	BRIDGE NO. 01138	DATE 12/10/09
☐ FIELD ORIGINAL ☐ TRANSCRIBED BY ____	CREW: MRJ, YS	SHEET ~~115/117~~

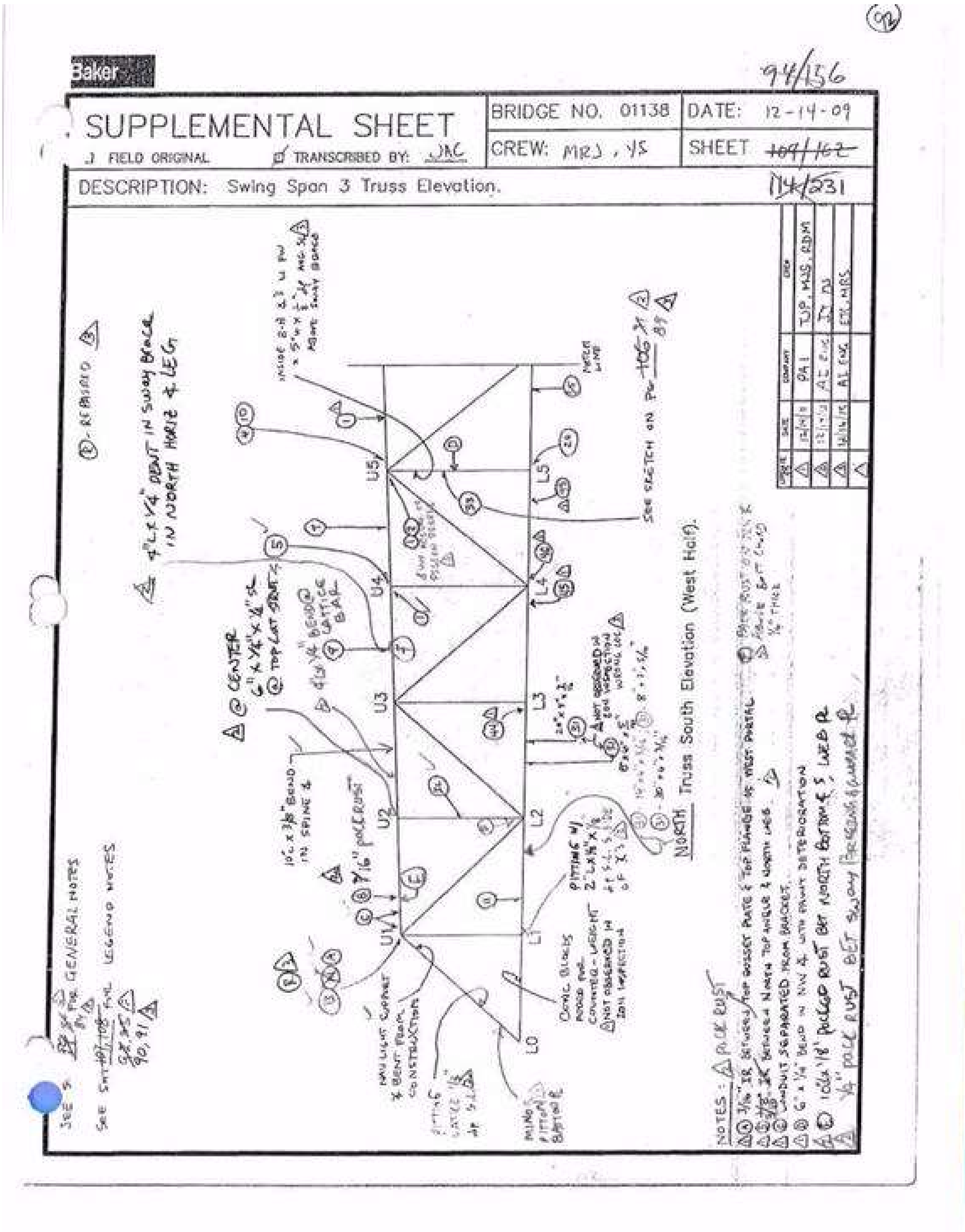
DESCRIPTION: DETERIORATION LEGEND : (SWING SPAN NORTH TRUSS) ~~115~~/123.1

- (33) See sheet ~~114~~ for sketch.
- (34) Plug weld 3 lattice bars to channel in place of rivets.
- (35) Section loss in bottom chord angle 14"L x full width x 3/16" deep.
- (36) 12" x 5" x 1/4" deep section loss in south side of web; east side with 8" x 5" x 3/16" loss.
- (37) L6 bottom chord web plates: South web plate, north elevation up to 1/8" web loss up to 6" from eye-bar North web plate, south elevation, up to 1/8" web loss up to 6" from eyebar; also up to 1/4" gap between bottom of pin nut and north elevation of north bottom chord web plate.
- (38) Batten plate with 3" x 1" hole in a 6" diameter heavily pitted area.
- (39) Max loss on eyebar typical in several locations up to FW x 1/4" deep, see pg 19 for section loss.
- (40) South elevation with 3"H x 6"L x 1/8" loss at web plate, south bottom angle with ± 50% loss to both legs x 1.5'L with up to 1/2" loss of width at horizontal leg.
- (41) FL x 1.5"W x 1/8" SL at bottom batton plate; 18"L x 1/2"H x 3/16" section loss at bottom of web in north channel.
- (42) Inside angle legs bent full width x 8" x 1 1/2" (both)
- △ (43) 1/2" of painted over pack rust btw eye bar & [illegible]
- △ (44) Top lacing bar on north truss bottom chord with rusted through hole, up to 1 1/2" dia., btwn FB 7 & node L3.
- △ (45) Bottom lacing bar on north truss bottom chord at various locations, 1/2" wide [illegible] displacement of bar due to pack rust.
- △ (46) Bottom batten plate on north truss bottom chord at node L4, east edge w/ rusted through hole up to 3"L x 1 1/2"W
- △ (47) North truss bottom chord interior diaphragm plate angle @ FB 15, east side @ top. S.L. w/ knife edging of top flange of angle, FW x 1"W
- △ (48) North truss, L6-U5 @ L6 bottom batten plate, south side line of bolts, flat w/ RTH. below each bolt up to 1 1/2" ϕ
- △ (49) Pack rust between eyebars

△ - No change

△	12-14-10	FA1	[illegible]
△	12/14/11	AI ENG.	JJ, DS
△	[illegible]	AI	PS, 2R3
△			

91_Legend (swing span North turss)



92_Swing span 3 North turss S. elev (W. half)

Sketches

Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**

Inspection Date: 12/14/2015

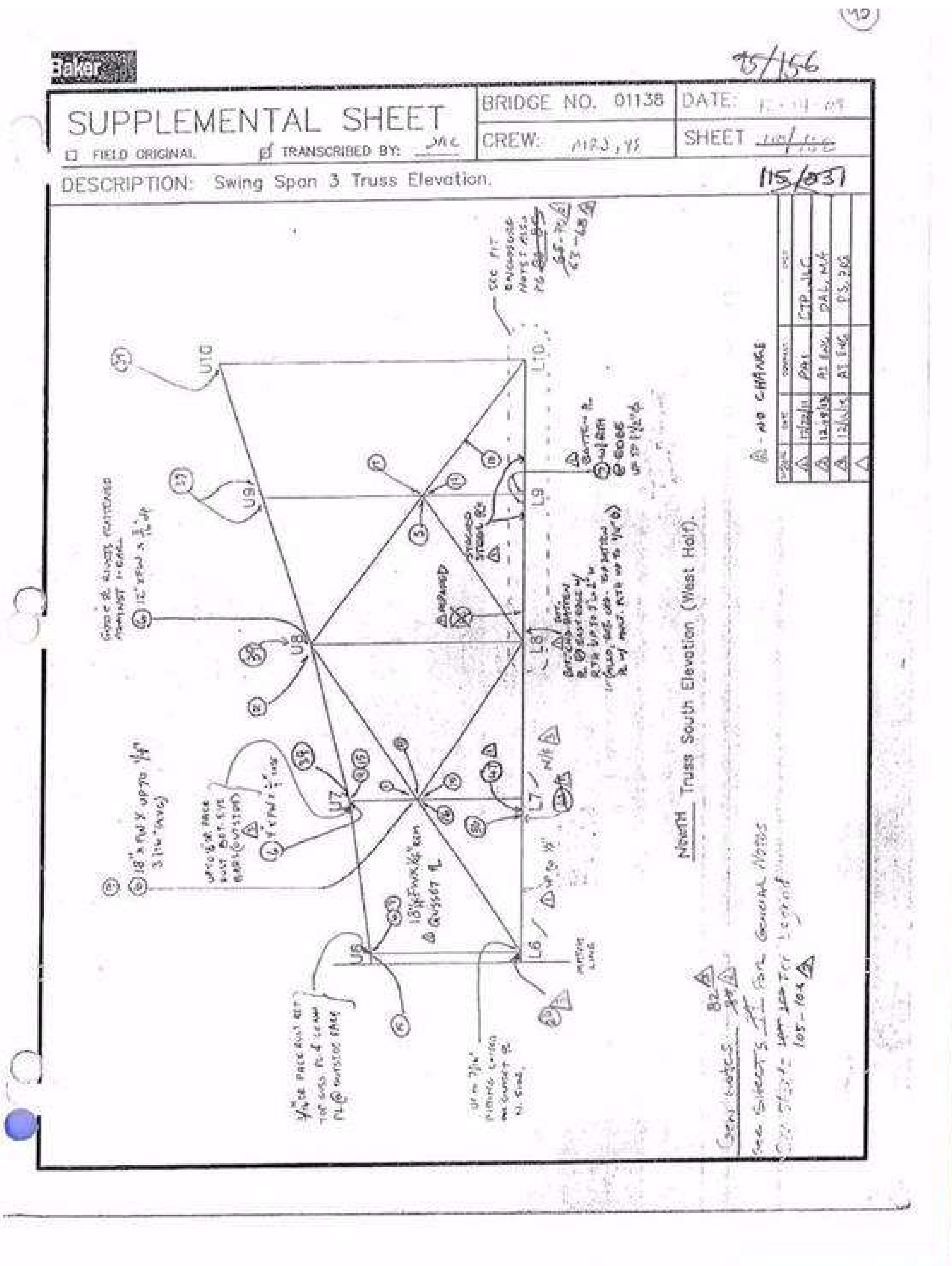
Inspected by: AI Engineers

Town: EAST HADDAM

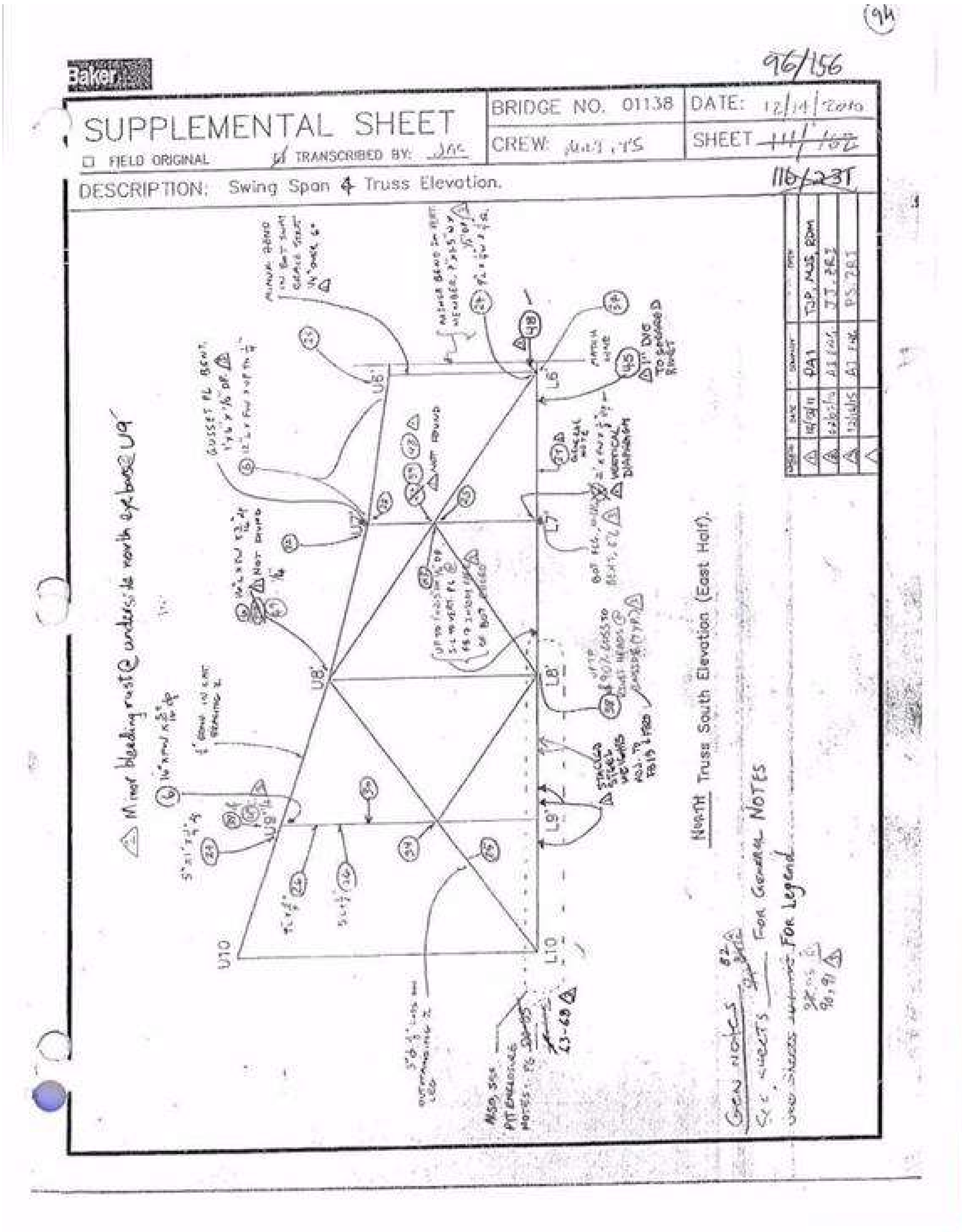
Carried: ROUTE 82

Crossed: CONNECTICUT RIVER

Inventory Route: Non-NHS



93_Swing span 3 North turss S. elev (W. half)



94_Swing span 3 North turss S. elev (E. half)

Sketches

Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**

Inspection Date: 12/14/2015

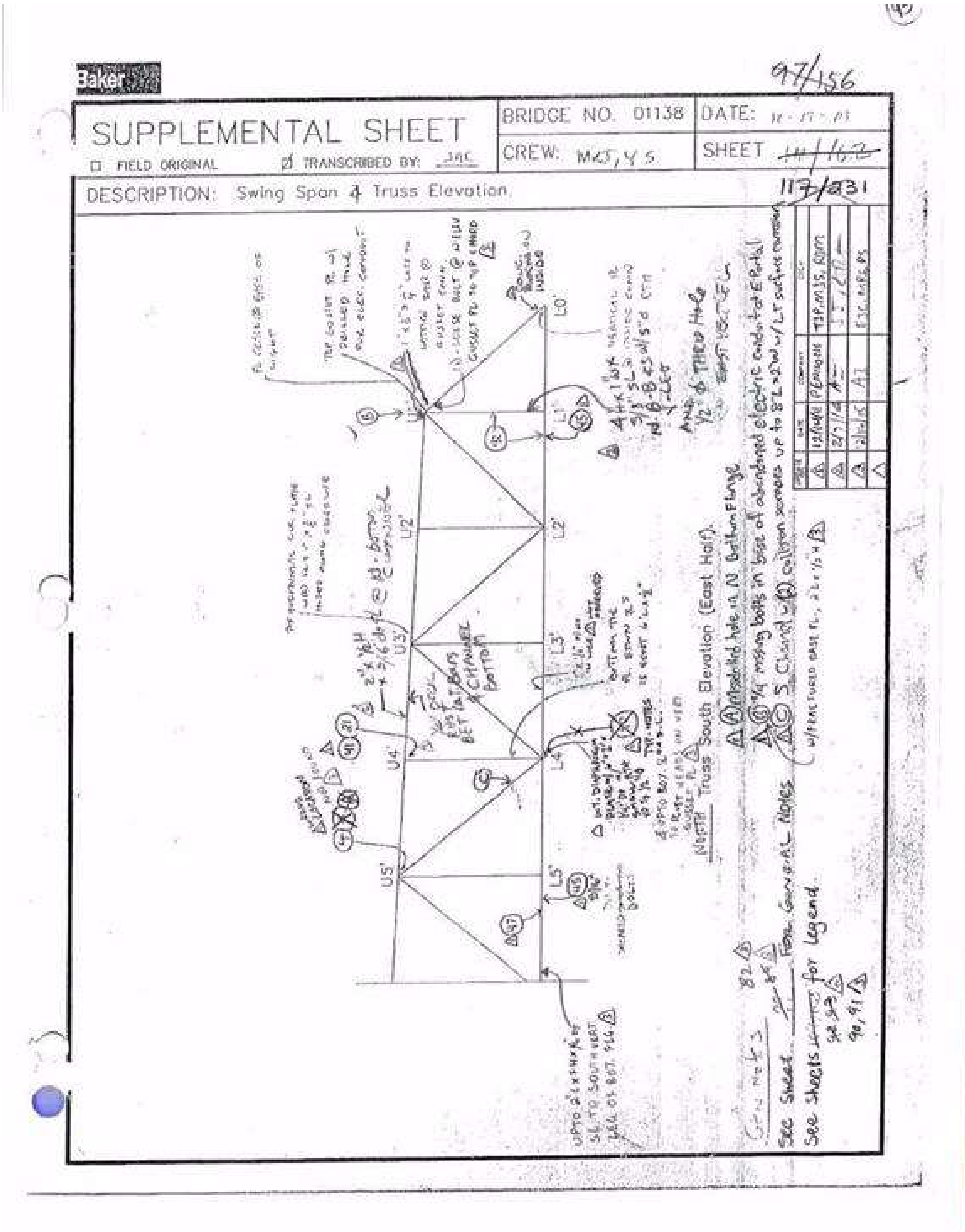
Inspected by: AI Engineers

Town: EAST HADDAM

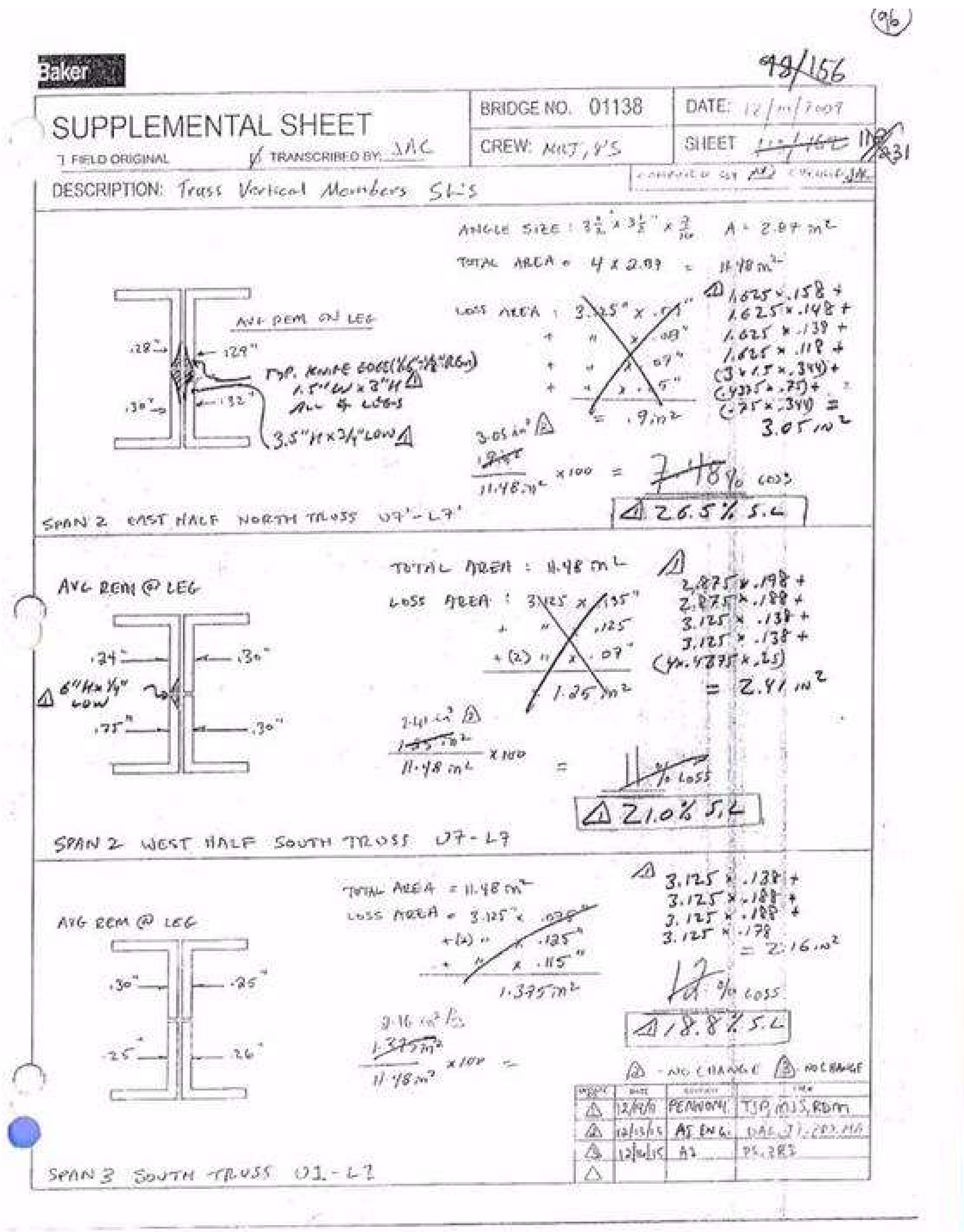
Carried: ROUTE 82

Crossed: CONNECTICUT RIVER

Inventory Route: Non-NHS



95_Swing span 3 North turss S. elev (E. half)


Baker
SUPPLEMENTAL SHEET
FIELD ORIGINAL ✓ TRANSCRIBED BY: JAC
BRIDGE NO. 01138
CREW: MKJ, RS
DATE: 12/10/2009
SHEET 119/231
DESCRIPTION: Truss Vertical Members SL'S

ANGLE SIZE: $3\frac{1}{2}" \times 3\frac{1}{2}" \times \frac{3}{16}$ A = 2.87 in²
TOTAL AREA = 4 × 2.87 = 11.48 in²
LOSS AREA: 3.125" × .1" + .08" + .07" + .5" = .9 in²
1.625 × .158 + 1.625 × .148 + 1.625 × .138 + 1.625 × .118 + (3 × 1.5 × .344) + (.4375 × .75) + (.75 × .344) = 3.05 in²
AVG REM ON LEG
TYP. KNIFE EDGES 1.5"W × 3"H ALL 4 LEGS
3.5"H × 3/4" LONG
3.05 in² / 11.48 in² × 100 = ~~7.48~~ % LOSS
26.5% S.L
SPAN 2 EAST HALF NORTH TRUSS U7'-L7'

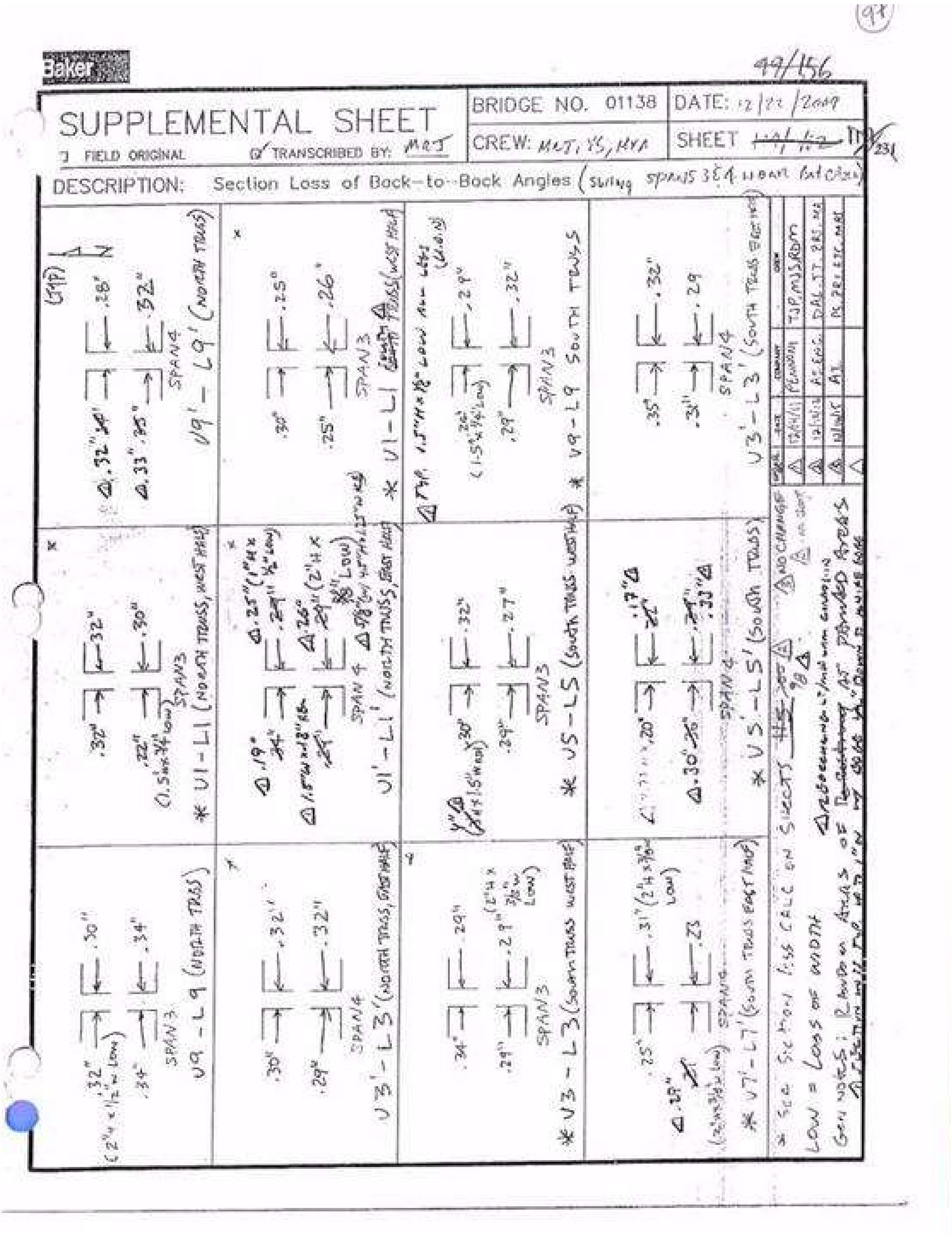
TOTAL AREA: 11.48 in²
LOSS AREA: 3.125 × .135" + .125 + (2) .07" = 1.25 in²
2.875 × .198 + 2.875 × .188 + 3.125 × .138 + 3.125 × .138 + (½ × .4375 × .25) = 2.41 in²
AVG REM @ LEG
6"H × ½" LONG
2.41 in² / 11.48 in² × 100 = ~~11~~ % LOSS
21.0% S.L
SPAN 2 WEST HALF SOUTH TRUSS U7-L7

TOTAL AREA = 11.48 in²
LOSS AREA = 3.125" × .125" + (2) .125" + .115" = 1.375 in²
3.125 × .138 + 3.125 × .188 + 3.125 × .188 + 3.125 × .178 = 2.16 in²
AVG REM @ LEG
2.16 in² / 11.48 in² × 100 = ~~12~~ % LOSS
18.8% S.L
NO CHANGE — NO CHANGE
SPAN 3 SOUTH TRUSS U1-L1

96_ turss vertical Sec. loss

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS



97_Sec. loss of back to back angle (swing span 3 & 4)

(98)

S.O. No. BR# 01138 ~~100/156~~
Subject: Section loss in B/B 4's near Roadway
@ Bottom Chord Sheet No. ~~115~~ of ~~162~~ 120/231
*All 3&4 unless otherwise noted. Drawing No.
Computed by MRJ Checked By JK Date 6/6/2010

Δ 12/23/11 AAI CTP, JLC

Section Loss in B/B 4
U1-L1 (West Half) (Span 2 South Truss)
$3\frac{1}{2}" \times 3\frac{1}{2}" \times \frac{7}{16}"$ Area = $2.87 in^2$
$2.67 in^2 \times 4 = 11.48 in^2$
Loss Area = (~~3.5~~ 3.125 Δ" × .11" + 3.125 × .15" + .43 × .375 + 3.125 × .11" + .43 × .375 + ~~3.25~~ 2.875 Δ" × .12 + .25 × .43) = $2.01 in^2$
$\frac{\text{~~2.01~~ } 1.93 in^2 Δ}{11.48 in^2} \times 100 =$ ~~17.5% SL~~ $\boxed{16.8\% SL}$ Δ
Δ No significant changes

Span 3, North Truss (West)
U1-L1
$3\frac{1}{2}" \times 3\frac{1}{2}" \times \frac{7}{16}"$ A = $2.87 in^2$
$2.67 in^2 \times 4 = 11.48 in^2$
Loss Area (3.5" × .11 + 3.5" × .11" + 3.5" × .13" + .75" × .43 + 2.75 × .21) = $2.13 in^2$
$\frac{2.13 in^2}{11.48 in^2} \times 100 = \boxed{18.5\% SL}$
Δ No significant change

U3-L3 (South Truss West) Span 3
$3\frac{1}{2}" \times 3\frac{1}{2}" \times \frac{7}{16}"$ Area = $2.87 in^2$
$2.67 in^2 \times 4 = 11.48 in^2$
Loss Area = 3.5" × .09 + 3.5" × .14" + 3.5" × .14" + 3.5" × .14" + .375 × .43 = $1.94 in^2$
$\frac{1.94 in^2}{11.48 in^2} \times 100 = \boxed{16.9\% SL}$
Δ No significant changes

U5-L5 (South Truss West) Span 3
B/B Angles Area = $2.87 in^2$
× 4 = $11.48 in^2$
Loss Area = 2" × .13 + 3.5" × .11 + 3.5" × .14" + 3.5 × .16" + 1.5" × .43" = $2.34 in^2$
$\frac{2.34 in^2}{11.48 in^2} \times 100 = \boxed{20.3\% SL}$
Δ No significant change

U9-L9 South Truss Span 3
B/B Angles Area = $2.87 in^2$
× 4 = $11.48 in^2$
Loss Area = .14 × ~~3.5~~ 3.375 Δ + .14" × ~~3.5~~ 3.375 Δ + ~~3.5~~ 3.375 Δ × .11 + .25 × .43 + 3.25" × .19" + (.125 × .43 × 3) Δ = ~~2.09~~ in^2 2.20 in^2 Δ
$\frac{\text{~~2.09~~ } 2.20 in^2 Δ}{11.48 in^2} \times 100 =$ ~~18.2%~~ SL
Δ 19.2% SL

U7'-L7' (South Truss East Half) Span 4
B/B Angles Area = $2.87 in^2$
× 4 = $11.48 in^2$
Loss Area = 3.5" × .18 + 3.125 × .12 + .375" × .43" + 3.125 × ~~.12~~ .14 Δ + .375 × .43" + 3.5 × .2 = ~~2.40~~ in^2 Δ $2.465 in^2$
$\frac{\text{~~2.4~~ } 2.465 in^2 Δ}{11.48 in^2} \times 100 =$ ~~20.9%~~ SL
Δ 21.5% SL

U5'-L5' (South Truss) Span 4
B/B Angles Area = $2.87 in^2$
× 4 = $11.48 in^2$
Loss Area = .23 × ~~3.5~~ 3.25" Δ + .21 × 3.5" + .07 × 3.5" + .04 × 3.5" + Δ (.375 × .25) = ~~1.92~~ in^2 $1.96 in^2$ Δ
$\frac{\text{~~1.92~~}}{11.48} \times 100 =$ ~~16.7~~ % SL
Δ $\boxed{17.1\% SL}$

Δ - FS, 2013 (AS) - 11/4/13 - NO CHANGE
Δ - 12/23/2015 (AS) - NO CHANGE

98_Sec. loss of back to back angle (swing span 3 & 4)

99

101/156

Baker

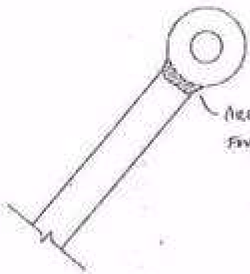
SUPPLEMENTAL SHEET

☐ FIELD ORIGINAL ☑ TRANSCRIBED BY: JAC

BRIDGE NO. 01138	DATE: 12/10/2009
CREW: MMS, YS	SHEET ~~46~~ / ~~176~~ ~~XX~~/231

NORTH TRUSS SPAN 3

TYPICAL MAX SECTION LOSS IN I-BAR (EXTERIOR ORIGINAL @ NODE CONN)



AREA OF SECTION LOSS 8"W x 3/16" dp.

AREA = 8" x 1.0625" = 8.5 in²

LOSS AREA = 8" x .1875 = 1.5 in²

$\frac{1.5 in^2}{8.5 in^2}$ x100 = $\boxed{17.6\ \%\ SL}$ (EXCL. ORIGINAL I-BARS ONLY)

TOTAL CROSS SECTIONAL AREA OF I-BARS @ NODE CONNECTION

TOTAL AREA = 8" x 1.0625" (4) + (2) 6 1/4" x 1" = 46.5 in²

TOTAL LOSS AREA ON I-BAR (EXTERIOR I-BARS)

= 8" x .1875 (4) = 6 in²

$\frac{6 in^2}{46.5 in^2}$ x100 = $\boxed{12.9\%\ SL}$ (MAX) (INCLUDING RETROFIT BARS)

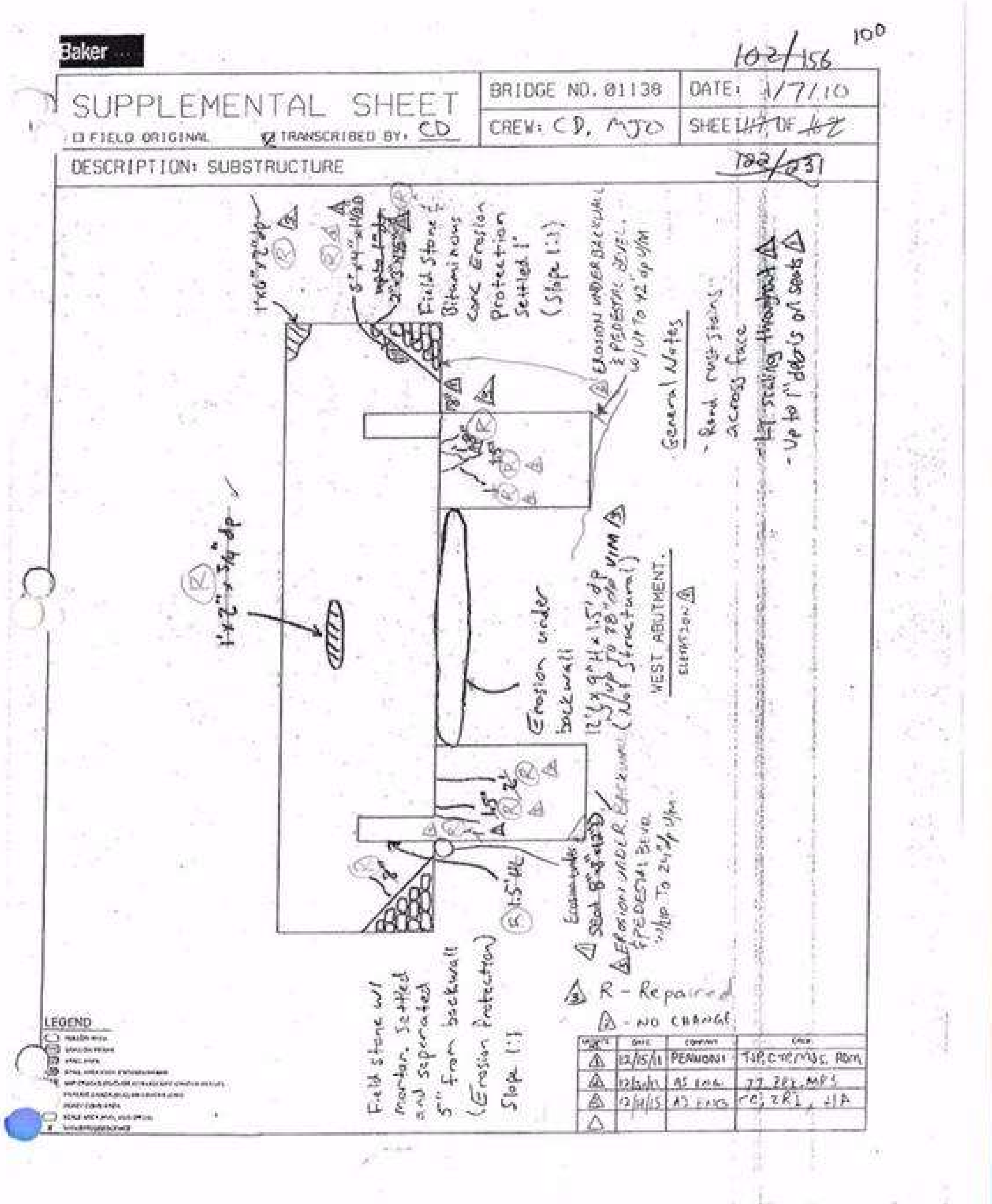
1 NO SIGNIFICANT CHANGE

2 No significant change

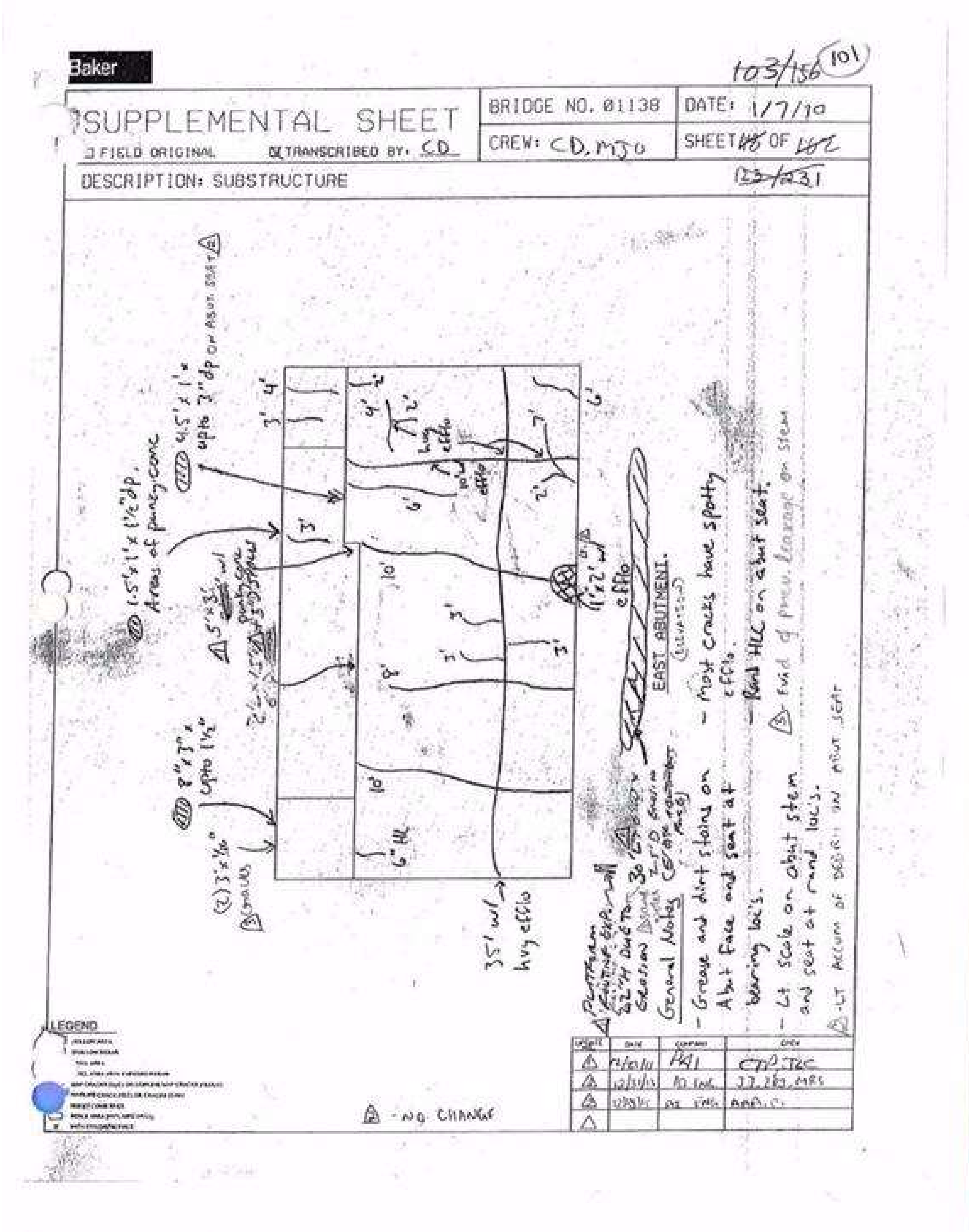
3 NO CHANGE

UPDATE	DATE	CONSULTANT	CREW
1	12/8/11	PENNONI	TJP, MJS, RDM
2	12/4/13	AI	DAL, SS, TMA, TS
3	12/14/15	AI	PS, TRJ, JTC, MRS
4			

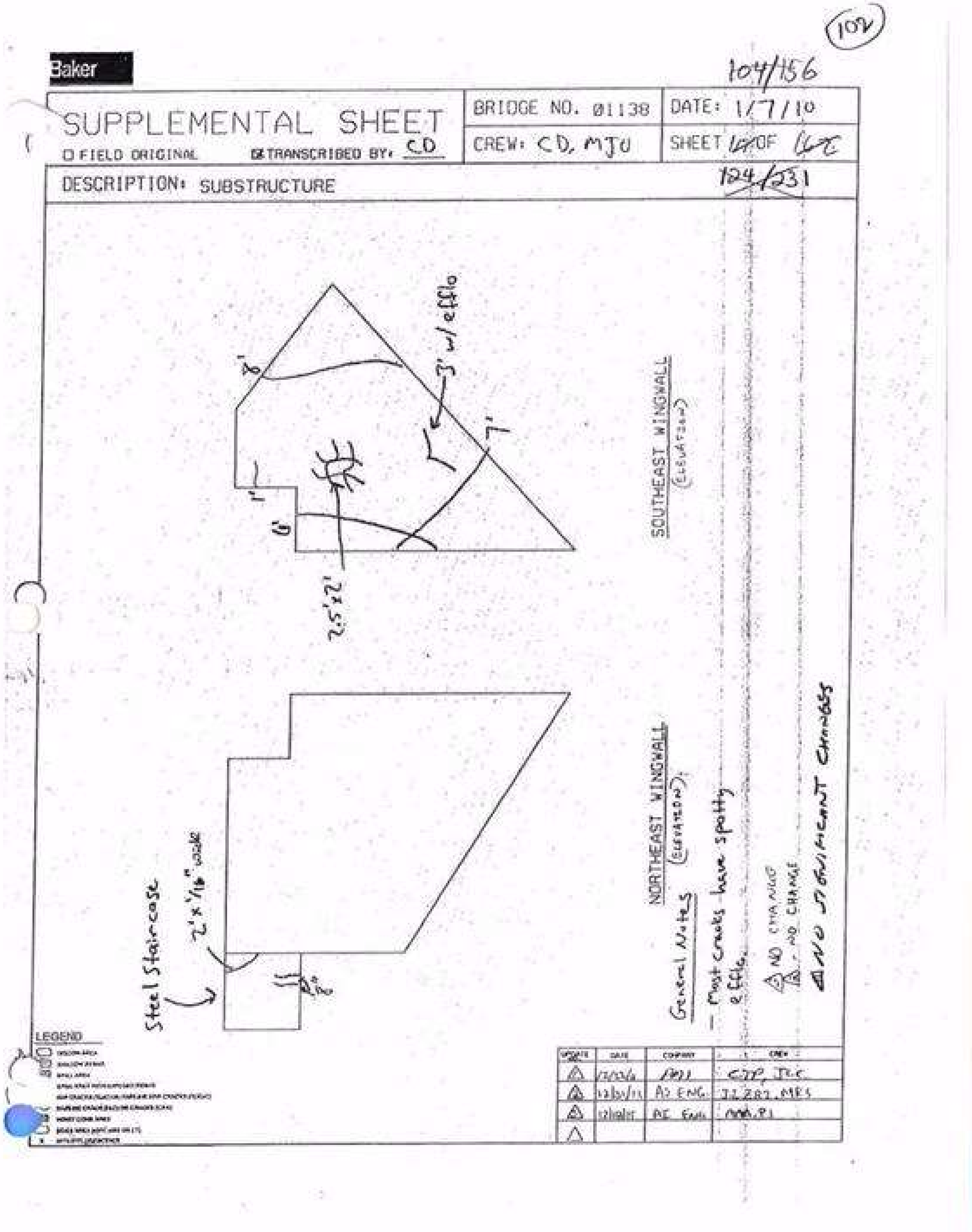
99_Sec. loss (swing span 3 & 4)



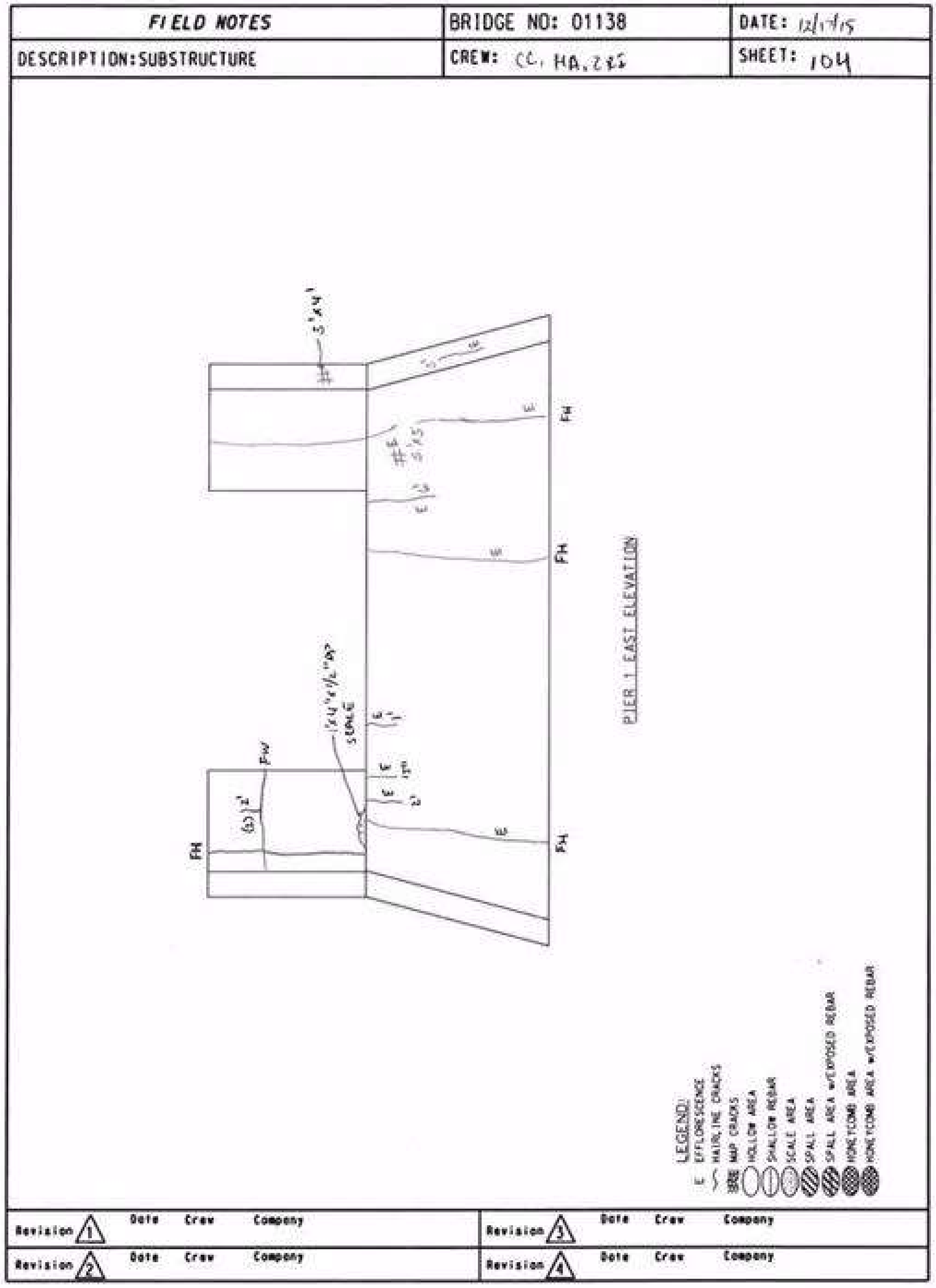
100_West Abutment



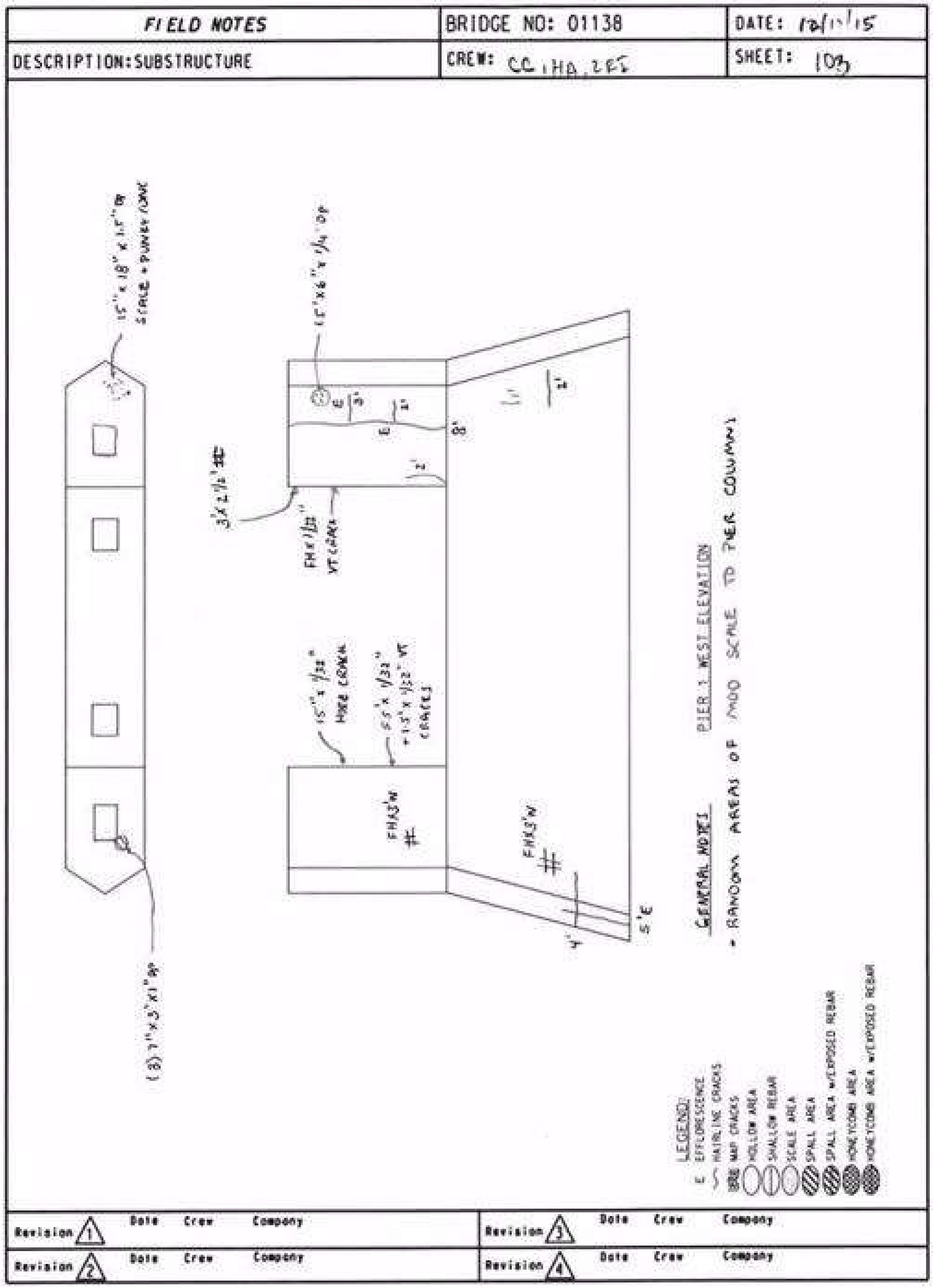
101_East Abutment



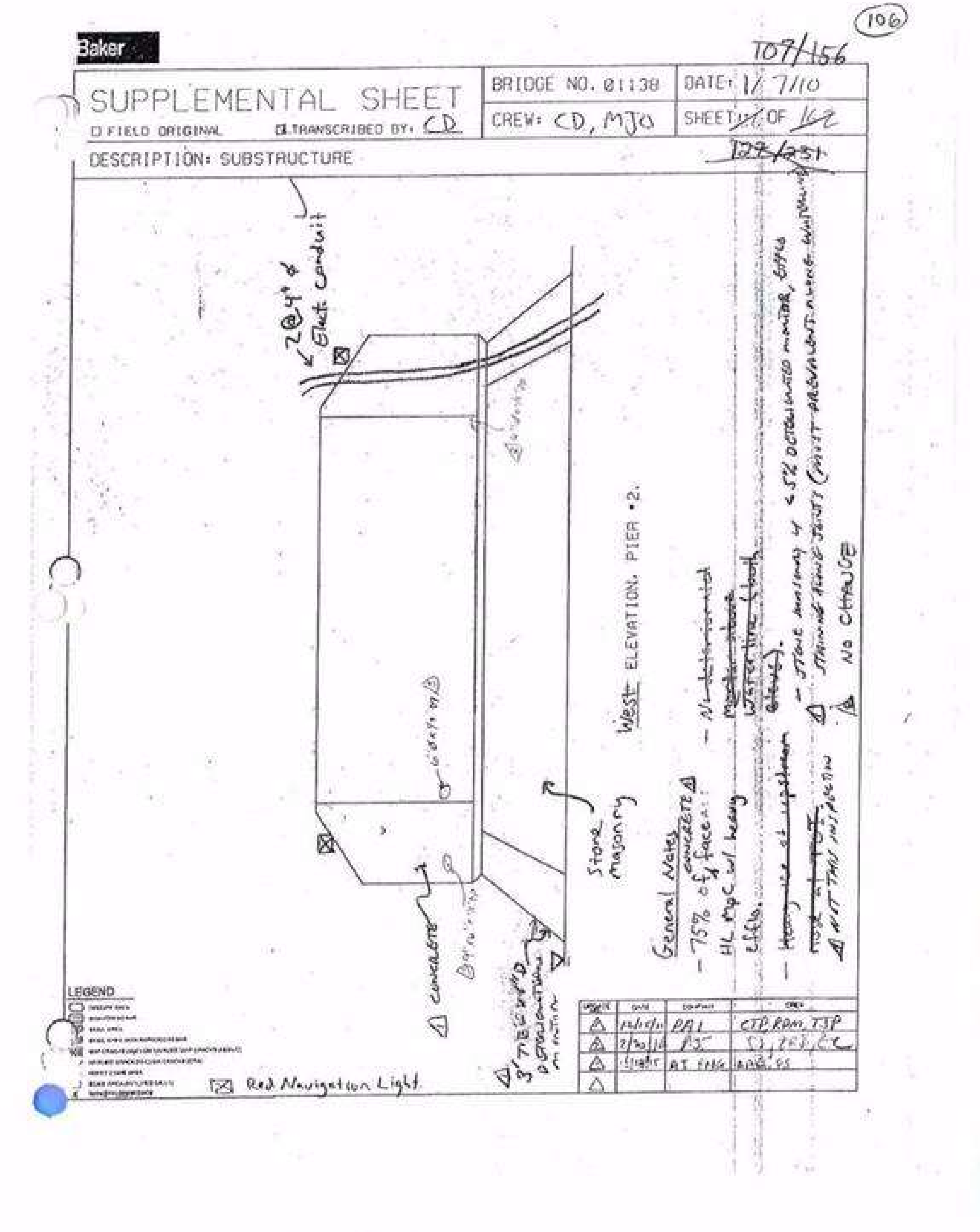
102_WingWalls



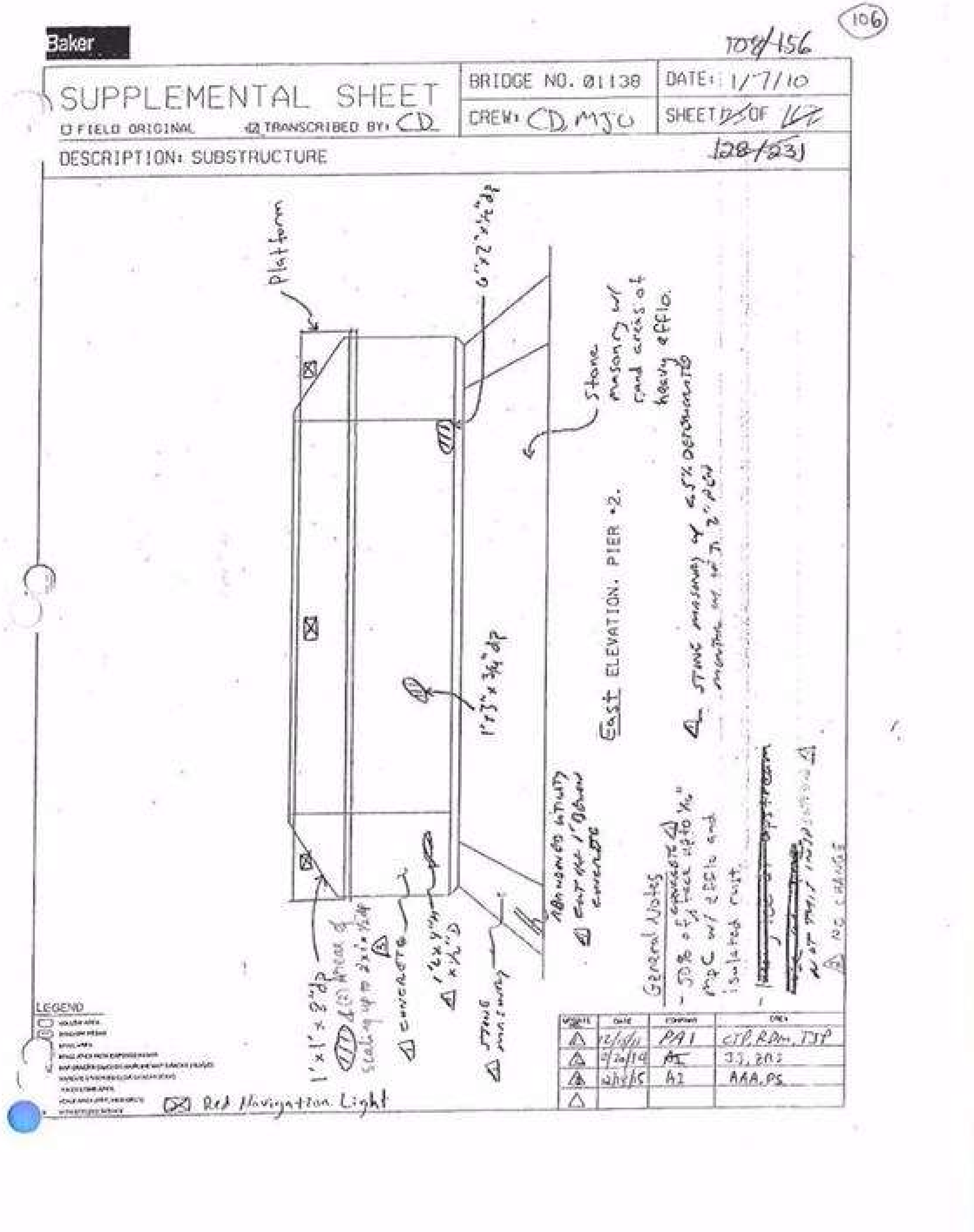
103_Pier 1 east elevation



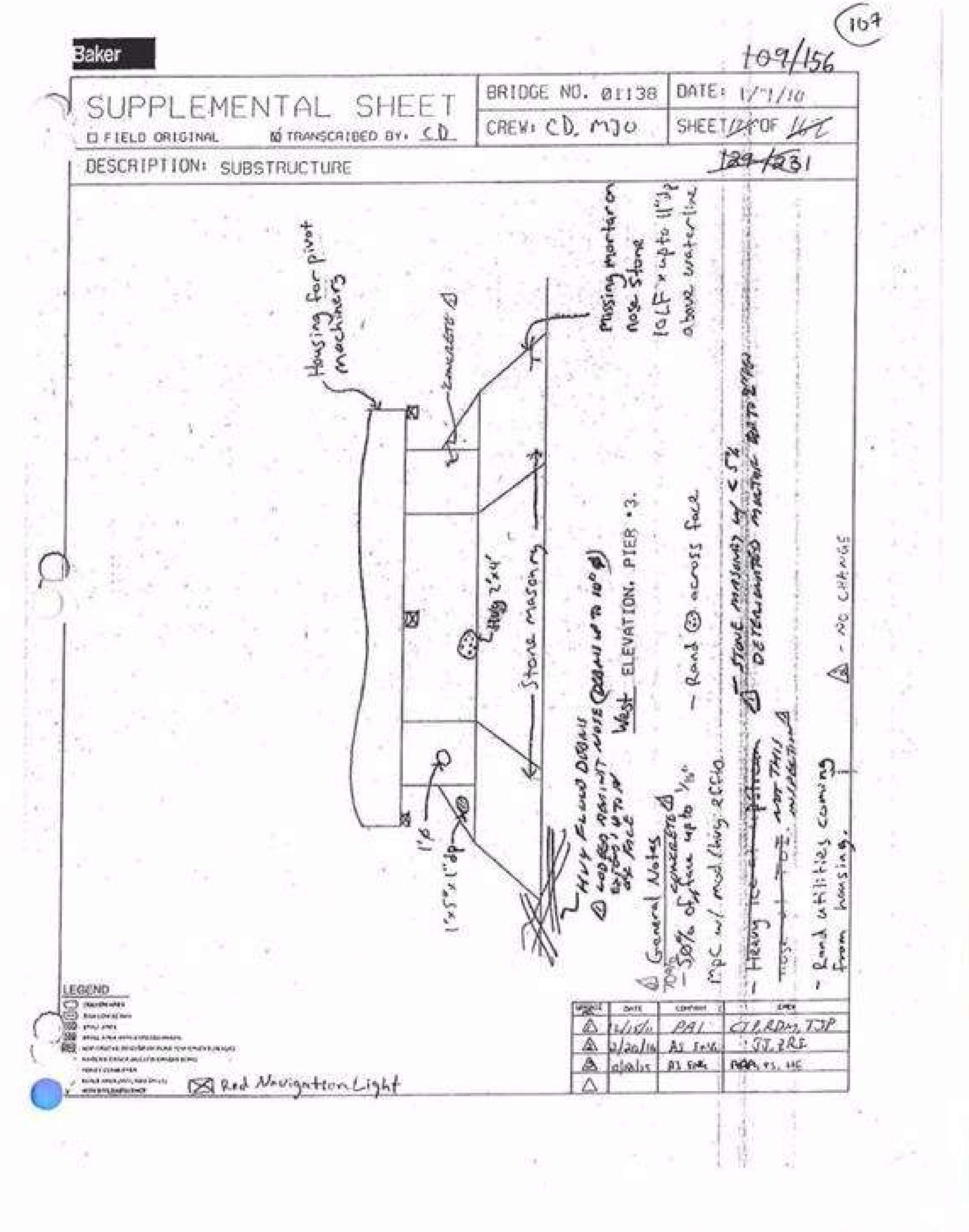
104_Pier 1 West elevation



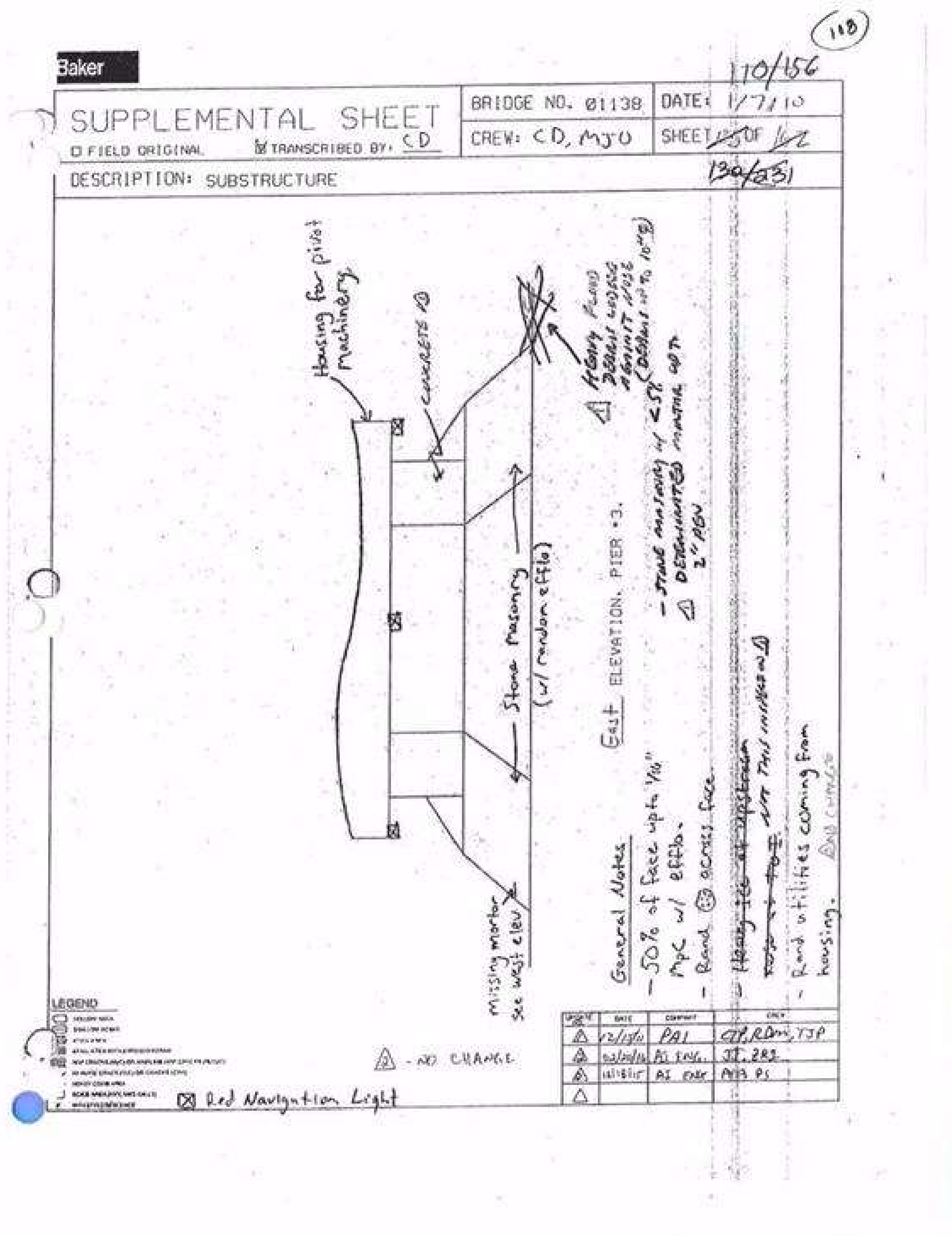
105_Pier 2 West elevation



106_Pier 2 East elevation



107_Pier 3 West elevation



108_Pier 3 east elevation

(109)

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

SPAN 4
N. TRUSS E. HALF

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/14/15
Town: EAST HADDAM Photographer: EJC
Carried / Crossed: RT 82 BRIDGERD / CT RIVER

Film Frame #	Image Description
1	SE CORNER PLAQUE
2	EAST END X-BRACE PORTAL TYP
3, 10	U1' GEN
4, 5	U1'-L0' @ L0 LATTICE SL PCS, HOLES
6	U1' U/S
7, 9	(112) U1'-L1' X'S BENT
11	E PORTAL LT FRAC BASE MISSING STRENGTH X'S, ABAN CONDUIT
12	U/S E PORTAL LT GUS PL HOLE
13	E. PORTAL LIGHT ABAN CON EXP SADDLES BENT BRACE
15	TOP TRUSS GEN
14	NAV LIGHT OFF TYP
16	U2'-U1' @ U1' LATTICE SL
17-19	U1'-L0' @ U1' NUTS & LOOSE BOLT
20	NE CORNER N TRUSS NICKED TYP
21	U3' X-BRACE GEN
22	U3' N. [illegible] GEN
23	U2'-L2' NEAR U2' TOP CHORD LATTICE BENT TYP
24	(111) U4' PL N. [illegible] BENT PL
25	(C) U5'-L4' DIAG COLL SCRAPES
26-28	U5' N. [illegible] GEN | U5 [illegible] | SPAN GEN [illegible]
29	U5' TOP & EYEBAR

109_Photo Log_ Sheet 1

AI Engineers, Inc.

1/0

PHOTO LOG

Form BRI-13, Rev. 9/97

SPAN 3
N. TRUSS W. HALF

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/14/15
Town: EAST HADDAM Photographer: EJC
Carried / Crossed: RT-82 (BRIDGE RD) / CT RIVER

Film Frame #	Image Description
30,32	US S. ELEV / N. ELEV
31	LS-US [illegible] TYP ST [illegible] RR CONN
33	D LS-US BEND, PAINT DET
34	US INSIDE WEST OF NODE BTM [illegible] NORTH HVY PIGEON DEBRIS
53, 36	TRUSS GEN VIEW [illegible] EAST / WEST [illegible] U4
37	L4 N. ELEV GEN
38	LIGHT TYP U3-L3
29	U3 N. ELEV TYP (NOTE REP BOLT @ LATTICE (RIGHT)
40	32 U2-L2 & NE BENT
41, 42, 51, 52	MARKETING
43, 44	E PORTAL LT EXP WIRES
45	C U1-U2 COND DISCONN BRACE ETC
46-48	U1 N. ELEV GEN / TOP B / S. ELEV
49	E. PORTAL BRACE LT, SIGN GEN
50	TYP NAV LT MISSING NUT LOOSE BOLT [illegible]
51-53	[illegible]

110_Photo Log_ Sheet 2

AI Engineers, Inc.

(111)

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/14/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82 / Conn River

Film Frame #	Image Description
1-4	U6' North truss, note the SL on gusset pl. [illegible] eye-bar. Span 4
5	Minor bend in L6-U6' @ bottom, North truss, Span 4
6,7	Eye bar [illegible] @ middle of U7-L7'
8-12	U7, N-truss note the pack rust btw gusset pl & diag member. [illegible] @ top
	of gusset pl. & pack rust btw pin and nut
13,14	U8, N-truss in Span 4
15	Minor pack rust bet eye-bars @ U8, N-truss, Span 4, outside face
16	Painted over pitting on the gusset pl @ vert. member to sway bracing conn
	@ M8. Span 4.
17	M9' North truss Span 4
18.	Lattice bars welded to L10-M9' @ M9, N-truss, Span 4
19,20	Minor bends in the outside leg of M9-U9, N-truss, Span 4
21	Painted over pitting @ btm of L10-M9', N-truss Span 3
22	Missing handhole cover @ M9, N-truss, Span 3
23,24	Typ [illegible] view of node M9
25	Bent lacing bars on M9-L8 [illegible] (typical)
26	U9 North truss Span 3
27	Gusset pl @ top of U9 N-truss Span 3
28	[illegible] & portal truss @ U9 Span 3
29	Gusset pl @ [illegible]
30	[illegible] connecting sway bracing bot. strut @ U9 [illegible] Span 3
31	Gusset pl @ [illegible] Span 3
32	[illegible] bot. strut @ U9 Span 3
34	[illegible] of bridge [illegible]

111_Photo Log_ Sheet 3

(112)

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/14/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82 / Connecticut River

Film Frame #	Image Description
35.	outside face of eyebar bet. U10 & U10', N-truss
36.	[illegible] face @ [illegible] edge of sway bracing @ U8, N-truss, span 3
37.	[illegible] in portal bracing bet. U9 & U9' [illegible], span 3
38-40	[illegible] @ gusset pl. & eye bars @ M9, N-truss, span 3
41-43	face twist bet. eye bars @ U7, " " , outside face
44-46	[illegible] @ gusset pl. & eye bars @ U6 " "
47.	face twist underside gusset pl. @ U6 " "

112_Photo Log_ Sheet 4

(113)

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/15/15
Town: East Haddam Photographer: DS
Carried / Crossed: Route 82 / Connecticut River

Film Frame #	Image Description
1-3	U9' North truss in span 2. Note the pack rust bet. eye bars
4.	U6 North truss in span 2.
5.	Typ top view of U7 & U8' in span 2
6-7	E face of Gusset pl. @ U7. N. truss. Note the P.O. pitting in web. Span 2
8	W. face " " @ U6'. N. truss Span 2.
9.	Pack rust bet. top flg pls @ U6' " "
10.	Bent angles @ M6'. N. truss. Span 2
11.	N. Gusset pl. " " " . Note the must perf. & P.O. SL in angles
12	U/S of framing @ Pit enclosure.
13&14	South Guss. pl. @ M9'. N. truss span 2 Note the missing rivets
15	North " " " " "
16	Bent back-to-back angles @ M7'. N. truss. Span 2.
17	" " " " @ M8' " "
18	South Guss. pl @ M9'. N. truss Span 2.
19-22	Bent back-to-back angles @ M9'. N. truss. Span 2. Note the SL
23-25	Guss. pl @ M8. N. truss. Span 2
26-27	" " @ M7 " "
28	Luminaire @ M7 " " Not ON @ time of inspection
29	S face of U6. N. truss Span 2. Note the P.O. SL
30	Pack rust bet top flg pls @ U6. N. truss Span 2
31	Guss pl bet. portal bracings @ U6 bet trusses. Span 2.
32	Bolts @ N face of U6 Span 2 N. truss (34) Typ top chord bet U7 & U8
33	W face of Guss pl @ U7 " " (35) Top of Guss pl bet portal bracings @ U6
36	" " " " U8 " "

113_Photo Log_ Sheet 5

AI Engineers, Inc.

(114)

Span 2 - North Truss - West Half

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/15/15
Town: East Haddam Photographer: HE
Carried / Crossed: Route 82 / CT River

Film Frame #	Image Description
1	Inside Top Chord U5-U4 in North Truss of Span 2
2	Bent at L5-U5 (NE angle) of North Truss in Span 2
3	Pack Rust betw GP & Angles at centre line of L5-U5 vertical
4	Bent at lateral member at M5- over East Direction
5	S-L at SW angle of L5-U5 vertical near L5 node
6	Typ sway Bracing at Node 2
7	Node M3, Looking SW, Note Pack Rust.
8	South GP at Node M3
9	North half of lateral member at U3, Note S-L at
	angle
10	Missing 2 rivits at Node U2
11	Pack Rust between South angles of diagonal U1-L2 near
	Node L2

114_Photo Log_ Sheet 6

AI Engineers, Inc.

(115)

Span 2 - North Truss - East Half

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/15/15
Town: East Haddam Photographer: HE
Carried / Crossed: Route 82 / CT River

Film Frame #	Image Description
1	Curled angles ends at gusset plate at Node M5'
2	View of M3' Gusset plate w/ small area of S-L
3 & 4	Typ view of U2-U1 Top Chord & close up of Pack Rust
	Betw Top plate & North Angle.
5	S-L at Angle legs of diagonals L2'-U1' & L2'-M2' near node
	L2'
6	S-L at L2'-U1' Diagonal @ Mid Point.
7	Bent at East Portal.
8	Typ view of East Portal.

115_Photo Log_ Sheet 7

AI Engineers, Inc.

116

Span 2 - South Truss - E-Half

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/16/2015
Town: East Haddam Photographer: HE
Carried / Crossed: Route 82 / Connecticut River.

Film Frame #	Image Description
1	S. Gusset plate at Node M5'. Note SL at GP & Angles.
2	S. Back to Back angles at Node M5', Note pack rust & S-L
3	S-L betw back to back angles in the sway brace betw U3' & center Pine
4	Typ views of Top chord U2'-U3' (North side)
5&6	S-L at S. angles edges near Node L4' (in the diagonal L4'-M3')
7&8	N. Gusset plate at Node M3' & close up showing S-L
9	S-L at N- back to back angles at diagonal L2'-M3' near Node M3'
10	Missing 2 rivits at Vertical member near Node U2' (Inside view)
11	Typ view inside of Top Chord U1'-U2'
12	Bent at East portal brace near the center pine.
13	S-L at Top patten plate near Node L0'
14	S. Elevation of Fixed S-Truss in span 2
15	Typ view of East portal of span 2

116_Photo Log_ Sheet 8

(117

AI Engineers, Inc.

Span 2 - S-Truss - W-Half

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/16/15
Town: E. Haddam Photographer: HE
Carried / Crossed: Route 82 / CT River

Film Frame #	Image Description
1	S-elevation of S-Truss in span 2
2	View of gap between top chord & top GP at Node U1
3	S-L at "N" back to back angles at Node L1 at vertical L1-U1
4	Typ connection at center pine at Node U2 (South side)
5	Typ view of diagonal U2-M3 (Inside view)
6	Buck Rust between "N" back to back angles at Node L2 @ diagonal L2-U1
	S-L at S. back to back angles at Node L1 at vertical L1-U1
8	Typ view of Lace bracing at top of bottom chord L1-L2
9	Buck Rust below Horz GP & Lateral bracing at U4
10	Bent at horz member of Lateral bracing @ M5
11	View of luminary Light at M5.
12	Typ view of Lace bracing at top of bottom chord L4-L5
13	S-L at N. back to back angles at Node L5 of Vertical L5-U5
	Note S-L at vertical Gusset plate.
14	bent at N- vertical Gusset Plate at Node L0

117_Photo Log_ Sheet 9

AI Engineers, Inc.

118

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/16/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82 / Connecticut River

Film Frame #	Image Description
1.	Minor bend in the lateral bracing bet. U6 (S. Truss) & U7 (center portal)
	in span 2
2	Minor dent in top chord of U7, S truss, span 2.
3	Top chord view @ U8, S truss, span 2.
4	Gusset pl @ top of center portal @ U7, span 2
5	L6-M7 @ S truss → E, span 2 Note the P.O pitting on lacing bars
6	N Gusset pl at M6, S truss span 2
7	Minor pack rust bet. lacing bars on M6-M7, S truss span 2
8, 9	N Gusset pl at M7, S truss, span 2
10, 11	Typ inside view " " "
12	S Gusset pl " " "
13.	Batten pl @ bot chord at L6 S truss, span 2 Note the missing rivets
14.	W face of Gusset pl @ M8 " " , Note the painted over pitting
15	S Gusset pl @ M8, S truss span 2 Note the pack rust
16	Bent bot angle for sway bracing @ M8 adj to South truss span 2
17	East face of bot Gusset pl @ M8, S truss span 2
18, 19	Gusset pl @ M9, S truss span 2
20	Painted over SL on lacing bars & rivets @ bottom of M9-L10, South truss span 3
21	Bent bot angle of sway bracing @ M6, span 3
22	W face of Gusset pl @ M6, South truss, span 3
23, 24	Eyebars @ U6, South truss span 3 Note the bleeding rust
25	Painted over SL @ west vertical sway bracing angle @ M7, span 3
26-29	Eye bars & Gusset pl @ M7, South truss, span 3
30	S. Eye bar @ U7 " " "

118_Photo Log_ Sheet 10

AI Engineers, Inc.

(119)

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/16/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82/ Connecticut River

Film Frame #	Image Description
31	Gusset pl. @ portal bracing conn. @ U8 bet. trusses. Span 3
32,33	Eyebars @ U8 S truss span 3. Note the pack rust.
34	W elev. of cross bracing bet. trusses @ Node 10, Span 3 @ Pier 3
35-38	Eyebars @ U9, S truss. Span 3
39,40	Rusted out box tubes (inside) for navigation platform @ node 10, span 3 @ Pier 3
41	W. half of bridge
42	Minor pack rust under crown @ U10, span 3
43	Heavy accum. of pigeon debris " "
44	Minor pack rust under crown @ U10' span 3
45	S elev. of eyebars bet. U10, U10' @ Pier 3
46	Missing access cover on electrical conduit @ M9-L10, Span 3, S truss
47	Top view of M9-L10, span 3, S truss
48	Mod. rust w/ SL on back to back angles @ M9 (E face), S truss, Span 3
49	Mod rust & painted over pitting on L7-L8 adj. to L7 " "
50	Lt to mod surface rust and painted over pitting on batten pl @ L7 S truss, span

119_Photo Log_ Sheet 11

AI Engineers, Inc.

120

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/17/15
Town: EAST HADDAM Photographer: CC
Carried / Crossed: ROUTE 82 / CT RIVER

Film Frame #	Image Description
1	N. ELEV. P1
2	W. ABUT.
34	S. TRUSS BRG (N. ELEV.) W. ABUT
5	" " " (INTERIOR) "
6	N. TRUSS BRG (S. ELEV) "
78	" " (N. SIDE) "
9	PACK RUST @ END OF TOP CHORD N. TRUSS U-0
1011	N. TRUSS BRG (INTERIOR) W. ABUT
12	TYP. PITTING @ TOP LAT BRACING &'s
13	TYP. TRUSS SP. 1
14	AREAS OF RUST @ STR. + DIAPH. ENDS (N. HALF) @ W. ABUT.
15	TOP OF N. TRUSS END @ U-0 + FBO N. END (W. SIDE)
16	" " S. " " " " " S. END "
17	SPALL @ DECK END BTWN S3 + S4 NEAR W. ABUT
18	RUST + ACT. LKG BTWN S5 + S4 NEAR W. ABUT
19,20	S. TRUSS BRG (S. ELEV.) W. ABUT
21	FB1 TO S. TRUSS CONN. (W. SIDE)
22	TOP CHORD S. TRUSS U0-U1
23	" " " " @ U1
24	FBO TO S. TRUSS CONN. (E. SIDE)
25	FB1 TO N. TRUSS " (W. SIDE)
26	N. FASCIA FBO E. SIDE
27	" " FB1 W. SIDE

120_Photo Log_ Sheet 12

AI Engineers, Inc.

121

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/17/15
Town: EAST HADDAM Photographer: CC
Carried / Crossed: ROUTE 82/CT RIVER

Film Frame #	Image Description
28	U/S FB1 TO N. TRUSS CONN. (SW SIDE)
29	EROSION @ N. END W. ABUT.
30	TYP. COV. PL. END WELD @ FB2 NEAR S1
31	U/S BOTT. CHORD BTWN L3+L5 N. TRUSS
32	TOP CHORD N. TRUSS BTWN U3+U4
33	L5 N. TRUSS
34	TOP CHORD N. TRUSS BTWN U5+U6
35	TYP. STR. CONN. TO FB5 N. FASCIA S1
36	L7 N. TRUSS
37	" " W. OF NODE TOP OF DIAG.
38	PACK RUST @ U7 N. TRUSS
39	TOP CHORD N. TRUSS BTWN U7+U6
40	" " " " U7+U8
41	N. FASCIA BRG FB9 P1
42	SSSP @ TOP OF P1 ALONG TRUSS KEEPER ℄
43,44	N. TRUSS L8-L9
45,46	N. TRUSS BRG P1
47,48	N. TRUSS BOTT. CHORD @ L8 BTWN L8+L9
49	" " " " BTWN L7+L5
50	DIAG @ L3 W. OF NODE S. TRUSS
51,52	100% TO RIVET W/ EXP. BOLT HOLE @ L3 S. TRUSS
53	S. TRUSS BOTT. CHORD BTWN L3+L5
54	S. TRUSS BOTT. CHORD @ P1
55	S. TRUSS BRG @ P1

121_Photo Log Sheet (13)

AI Engineers, Inc.

122

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/17/15
Town: EAST HADDAM Photographer: CC
Carried / Crossed: ROUTE 82 / CT RIVER

Film Frame #	Image Description
5657	FB9 S. FASCIA BRG P1
58	U/S SP. 1
59	U7 E. OF NODE S.1. TO HORIZ. GUSS PL S. TRUSS
60	TOP CHORD S. TRUSS BTWN U7+U6
61	" " " " U4+U3
62	U3 HORIZ. GUSS. PL S. TRUSS
63, 64	E. FACE FB4
65	TOP CHORD S. TRUSS BTWN U3+U2
66	FB2 E. FACE
67	TOP BATTEN PL S. TRUSS TOP CHORD W. OF U2
68	N. ELEV.

122_Photo Log Sheet (14)

AI Engineers, Inc.

(123)

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory TOP OF DECK + SUB

Bridge No. 01138 Date: 12/18/15
Town: EAST HADDAM Photographer: AMA
Carried / Crossed: ROUTE 82 OVER CT RIVER

Film Frame #	Image Description
1	W. APP FROM BR
2	W APP PAVEMENT
3	SW APP MBR
4	NW APP MBR
5	W. APP COMP SEAL JT
6	BR OVERLAY IN SPAN 1
7	S BRIDGE RAILING IN SPAN 1
8	N " " " " "
9,10	W APP PAVEMENT W/ SETTLEMENT
11	N BR RAILING IN SPAN 1
12	3" x 3" x 1" DP POTHOLE IN SPAN 1
13	PIER 1 JT
14	[illegible] JT IN SPAN 2 NEAR MIDSPAN
15	SPAN 2 OVERLAY W. HALF
16	" " " E HALF
17	N. RAIL W/ TIPPED TO 1"
18	N RAIL IN SPAN 2 AT TRAFFIC GATE W/ BENT [illegible]
19	SPAN 3 TOP OF GRID
20	S RAILING IN SPAN 3
21	3RD POST FROM PIER 2 IN SPAN 3 AT N RAILING W/ BENT RAIL BRACING
22	OVERLAY AT PIER 2
23,24	AT PIER 2 JT MAIN SPAN COUNT[illegible]
25	SPAN 3, S RAILING OVER PIER 3
26	CONC FILLED GRID OVER PIER 3

123_Photo Log Sheet (15)

AI Engineers, Inc.

124

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory
TOP OF DECK + SUB

Bridge No. 01139 Date: 12/18/15
Town: EAST HADDAM Photographer: PAA
Carried / Crossed: ROUTE 82 OVER CT RIVER

Film Frame #	Image Description
27	EAST APP FROM GK
28	E ABUT JT
29	E APP PAVEMENT
30 - 40	S. ELEV OF BRIDGE + MARKETING PICS
41 - 46	N - ELEV OF BRIDGE + " "
47	WEST ELEV OF PIER 2
48	N. NOSE OF PIER 2
49	" " " "
50	EAST ELEV OF PIER 2
51, 52	WEST ELEV OF PIER 3
53	EAST ELEV OF PIER 3
54	EAST ABUT
55	U/S OF SPAN 4
56	EAST ABUT SLOPE
57	SE WW
58	SE APP MBR
59	BRIDGE FROM E APP
60.	E ABUT BACKWALL
61	DOWN STREAM VIEW (LOOKING S)
62	UPSTREAM " (LOOKING N)
63	SPEED LIMIT SIGN IN SPAN 2 (N SIDE)
64	SPAN 2 N SIDE LT STD NEAR MIDSPAN
65	N RAIL IN SPAN 2 w/ COLLISION DAMAGE @ POST
66	SE [illegible] w/ COLLISION [illegible]

124_Photo Log Sheet (16)

AI Engineers, Inc.

125

PHOTO LOG

Form BRI-13, Rev. 9/97

S TRUSS

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/18/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82 / Connecticut River

Film Frame #	Image Description
1-3	Bent sway bracing angle @ ℄ of bridge @ M7'. span 4. Note the perf
	on the bottom of vertical angle.
4-7	Eyebar & pins @ M7'. Span 4. Note the SL on eyebars & gap under pin
8.9	" " @ U7'. Span 4 note the pack rust under S. pin & eyebar
10.11	" " @ U6'. Span 4 (S. face). Note the bent gusset pl. due to
	pack rust.
12.	S face of S truss (upper nodes). Span 4 → W
13	Bends in sway bracing @ ℄ of bridge @ U8'. Span 4 → N.
14-16	Minor tear & bend in the sway brace over EB lanes bet. U8' & U9'. Span 4.
17.18.	N face of U8'. Span 4. note the P.O SL @ bot. of sway bracing (back-to-
	back angles)
19.	Bent lacing bar @ bot. of M9'-L10'. Span 4
20-22	Eyebars & pin @ U9'. Span 4. Note the pack rust bet. eyebars
23.24.	P.O SL on gusset pl. for portal bracing @ U10' @ centerline of bridge. Span 4.
25.	P.O SL on " " sway " " M9' " " " " "
26.	Gusset pl. @ M9'. Span 4.
27.	P.O SL on lacing bars & vert. member L10'-M10'. Span 4
28.	Gusset pl. @ U6'. Span 2. Note the law rust @ edge of Guss. pl.
29.	SL in back-to-back angles of sway bracing over EB lanes @ U6'. Span 2.
30.	Gusset pl. conn. @ U7'. Span 2
31.	Gusset pl. @ center spine conn. (S face) @ U7'. Span 2
32.33.	M6' conn. Span 2. Note the SL @ back-to-back angles
34-36.38	Bent angle @ U6'-M7'. Span 2
37.39.40	N Gusset pl. @ M7'. Span 2
41.	SL in back-to-back angles @ M8'. Span 2.

125_Photo Log Sheet (17)

AI Engineers, Inc.

(126)

Span 4 - 5. Truss - East Half

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/18/15
Town: East Haddam Photographer: HE
Carried / Crossed: Route 82 / CT River

Film Frame #	Image Description
1	Dent at SE angle at Vertical chord L5'-U5'
2	Abandoned sign bracket at sway bracing @ Node U2'
3	Pack Rust at Node U3' betw the top GP & sway bracing
4	Navigation Light at west end of Span 4
5	Luminaire light at west end of span 4
6	West Portal at span 4
7	S-L at bottom lattice bar of diagonal L0'- U1' near node L0'

126_Photo Log Sheet (18)

AI Engineers, Inc.

127

PHOTO LOG

Form BRI-13, Rev. 9/97

Span 3 – S. Truss – West Half

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/12/2015
Town: East Haddam Photographer: HE
Carried / Crossed: Route 82/CT River

Film Frame #	Image Description
1	Navigation Light on the west end of span 3
2	" " " " " " " " " –
3	" " tower " " " " " " " –
4	Pack Rust & S-L at S. web of top chord U1-U2
5	Node U1 Connection, Looking South, Note Luminary.
6	Typ view of Lateral bracing at Node 3 L2-L3
7	Pack Rust Betw S-Angle & web of bottom chord
8	Bent at top of Center plate below Node 2&3
9	Bent at SE angle of vertical chord L4-U4.
10	Bent at lattice bar in top chord U2-U3 near Node U3
11	Bent at bottom horz Gusset Plate at Node U3 –
12	Bent at bottom lattice bar in top chord U3-U4 at mid-span
13	Bird debris inside Node U5.

127_Photo Log Sheet (19)

128

AI Engineers, Inc.

SPAN 4 - FRAMING

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/21/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82/Connecticut River

Film Frame #	Image Description
1.	East face of FB 3, span 4, N half. Note the perf @ bot of stiff
2.	Gusset pl for x-frame bet S3 & S4 to 3rd FB 2. Span 4. Note the SL & perf
3.	FO SL on bottom pl under L0-L1, South truss, span 4
4.	Gusset pl @ FB 3 under S Truss, Span 4. Note the SL
5.	" " FB 2 " " " . Note the SL on Guss pl & FB bot flg
6.	Weight block on bot chord of L0-L1, South truss, Span 4
7.	SL @ Guss pl on W side of FB 3, South end, span 4
8.	Pack rust bet guss pl & FB3 bot flg under bay 3, Span 4
9.	S face of lat bracing leg bet FB5 & FB6, S half. Note the SL. Span 4
10.	E face of FB 6 under S3. Note the SL on bot flg & pack rust under lat
	bracing angle
11	S3 brg @ FB 5, span 4 (W face)
12	S3 " FB6 " (E face)
13	N face of S3 @ FB 5, span 4. Note the splice pl
14	SL on bot flg of FB 6 @ N side of Guss pl under S3, span 4
15/16	SL on bot flg of FB8 (N of center) under S3, span 4
17.	N face of splice @ L4', S truss, span 4
18	SL inside bottom chord of L4'-L3' @ L4', S truss, span 4
19	" " " " L4'-L5' " " "
20	E face of FB 10, N end, span 4. Note the missing rivets @ FB top flange
21	SL @ bot flg of FB 10 (E side) under S3, span 4
22.	Lam rust w/ no SL @ top flg of FB 10 under S3 (E side), span 4
23-25	Rust bot flg & lacing pl bot chord bet FB 10 & FB 11, S truss, span 4
26.	E face of FB 11 @ N end, span 4. Note the SL w/ web perf

128_Photo Log Sheet (20)

(129)

AI Engineers, Inc.

SPAN 4 - FRAMING

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/21/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82/ Conn River

Film Frame #	Image Description
27.	Case rust in the gusset pl. fr. FB 12 under S3, span 4
28, 29	Perf in Guss pl @ FB 13 under south truss span 4 Note the SL w/ KE remaining
30, 31	N elev. of L6', south truss span 4 note the SL around pin
32-34	S elev " " " " " , span 4
35	N elev of Guss pl @ L6' " " "
36, 37	Case elev. of FB 15 (S & N halfs)
38, 39	E face of FB 15 @ S end span 4
40	W face " " "
41	Minor perf in Gusset pl. fr. FB 17 @ S truss, span 4
42	N face of L7'-L8' @ S truss, span 4 Note SL in bot. lg
43	Rough edges w/ KE mom along E edge of batten pl. @ L8' south truss span 4
44	N face of L8' S truss span 4
45	E face of pit enclosure, span 4
46	Bent top flg of bot. chord fr. L8'-L9', south truss, span 4
47, 48	Missing bolts @ bot. of Gusset pl. @ FB 2 to Conn. beam, span 4
49.	Mod. rust in SSP joint. Bay 4 bet. FB 1 & FB 2, span 4
50-52	Bridge fr. truss @ E Abut, span 4
53.	Cork/Punky conc. on E Abut seat, S half.
54	Perf in top flg of FB 1 under S1, Span 4
55	" " bot. " " " " " "
56	U/s of FB 1 bot flg. span 4 → S
57	Perf @ bot. of FB 1 web bet. S3 & S4, Span 4
58	E leg of FB 1, Span 4

129_Photo Log Sheet (21)

AI Engineers, Inc.

130

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/21/15
Town: Haddam Photographer: DY
Carried / Crossed: Rt 82 over CT. River span(4)

Film Frame #	Image Description
1	legend ① & ⑥ & 4"x3" RTH in gusset PL @ E Side of FB3 bott
	flg @ N. bott chord
2.	⑤ w/ no RTH @ top flg @ E Side of FB3 @ N. bott chord
3	⑮ to FB3 E Side below S_2
4)	⑫ to lateral bracing bet FB2 & FB_3 span 4
5	⑩ next to bolt holes @ top flg below S_3. W face of FB3
6	⑪ & ⑥ bet S_1 & S_2 W face of FB_3
7,8	bott E. leg w/ RTH bet S_2 & S_3 of FB4
9	Typ horz gusset PL @ FB4 N truss
10,11	⑧ & ③ @ E leg of bott flg FB6 @ N truss
12	upto ½" thick pack rust bet Vt ∠s of lateral bracing bet
	FB7 & FB8
13	Gap upto S_1 & FB9.
14	upto 1" thick pack bet Vt ∠s of lateral bracing bet
	FB_9 & FB9.
15	S loss to Rivet heads to Vt gusset PL & S loss w/ RTH to
	Vt diaph conn PL @ L4 N Truss
16	㉑ @ FB11 N Truss (E Side)
17,18	① @ FB_{11} w/ S loss in E bott flg bet S_1 & S_2
19	Same as photo 16 (W Side)
20,21,22	upto 1" pack rust bet Gusset PL & bott flg of FB12, 38 & ① bet
	S_2 & S_3
23	Sheared off rivet head w/ bent lacing bar @ E Side of FB_{12} N Truss
24	S loss to vt leg of N. Truss bott chord @ FB13 E. Side

130_Photo Log Sheet (22)

131

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 1138 Date: 12/21/15
Town: Haddam Photographer: DY
Carried / Crossed: Rt 82 over CT River

Film Frame #	Image Description
25.	21 @ W side of FB_{13} N. Truss
26	Sheared off lacing bar @ bott of bott chord N. Truss @ FB_{13}
27-28	Legend 57 for truss notes @ L_6 N. Truss
29	Legend 48 " " @ L_6 / FB_{13} & FB_{14} N. Truss
30	Pier 3 E. Elev
31.	bott of bott flg w/ pitting loss FB_{15}
32.	Vt clips at FB_{15} E. face @ N. Truss w/ S loss
33	" " " W. face " "
34	bent bracing gusset PL @ FB_{16} center E Side
35	S loss to Vt PL of inside bott chord @ L_7-L_8 @ FB_{17} N. Truss
36	RTH to batten PL @ N. Truss @ L_8
37	E face of FB_{20} @ N. Truss (pit enclosure)
38, 39	FB_2 W face bet str S_1, S_2 & S_3. W/ S loss & missing bolt
40	top flg w/ 2"W loss of width @ S_3 conn. FB_2 W face

131_Photo Log Sheet (23).jpg

AI Engineers, Inc.

(132)

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/22/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82 / Conn. River

Film Frame #	Image Description
1	Bent lateral bracing @ East of FB 1A', South end, span 2
2	Painted over pitting in the top flange of FB1A' btwn S2&S3, w. face, span 2
3	Pack rust under lat bracing @ [illegible] side of FB2' under S3, span 2
4	SL around gusset pl [illegible] L2'-U1' @ L2', [illegible], span 2
5	[illegible] face of L2', [illegible], span 2
6	w. face of L2' " " "
7	w. face of S4&S5 @ FB 3A' span 2 note the splice pl
8	w. face of S1 @ FB 3A' note the gap under bearing
9	w. face of FB4A' span 2 note the SL under bay 2
10	Mod. [illegible] of pigeon debris on top of FB4A' span 2 under S5
11	Gusset pl @ FB5A' conn. to south [illegible] bot chord span 2
12	clip angle @ conn. btw FB8A' [illegible] bot chord, span 2
13-15	[illegible] nail @ [illegible], span 2
16, 17	[illegible] of L3' node, S. truss, span 2
18, 19	N. elev of L6' " " " note the SL [illegible] gusset pl
20	S. elev " L6' " " " " " " " E post " "
21	[illegible] face of FB [illegible] under S3, span 2
22	[illegible] S3 [illegible] @ FB[illegible], span 2
23	[illegible] @ Pier 2, span 2
24, 25	Brg [illegible] S. truss @ Pier 2, span 2

132_Photo Log Sheet (24)

AI Engineers, Inc.

133

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/22/15
Town: Haddam Photographer: DY
Carried / Crossed: Rt 82 over CT River (span 2)

Film Frame #	Image Description
1	Pack rust bet bott flg / Gusset pl at lateral bracing gusset pl
	@ FB 18' N Truss span 2 Not cleaned off chcks
2	3" x 1/4" dp S loss on top of bott flg @ FB 18' near N Truss
3	Rusted [illegible] @ N Truss
4	(9) span 2 FB 22' N Truss east side
5	Pack rust betw lateral bracing & gusset pl @ center FB 5'
	E side span 2
6	Pack rust betw lateral bracing & bot FB 5' & FB 2'
	span 2
7, 8	S loss to gusset pl / lateral bracing @ [illegible] side of FB 8'
	to N Truss
9	Top flg S loss under S_3 FB 6' 2' [illegible]
10	[illegible] bott flg [illegible] of bott chord @ [illegible] FB 3' & FB 8' N Truss
11–14	W. FB 1' W/RTU between S_2 & S_3 / S_3 & S_4
15	Lat. bracing conn. to w/face of FB 1' under Bay 2.

133_Photo Log Sheet (25)

(134)

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory SPAN 3 FRAMING

Bridge No. 01138 Date: 12/23/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82/ connecticut River

Film Frame #	Image Description
1.	Brg. [illegible] N. truss @ Pier 2. Span 3.
2.	Brg. [illegible] S. truss " "
3.	Brg. [illegible] S3 @ FB 0. Span 3
4.	E. elev. of FB 0. N. end. Span 3 note the [illegible] & [illegible] [illegible] [illegible]
	FB top flg [illegible] pl
5,6	South end of FB 0. Span 3 note the [illegible] on [illegible] [illegible] chord welds
7.	Gusset pl @ W. side of FB 3 note the [illegible] of debris
8.	FB 3. W. face under S3 note the SL in top flg
9.	E. face of FB 2. S. end note the missing rivet @ bot of FB web
10.	Pack rust under Gusset pl @ FB 4 under S3. Span 3
11.	Brg. [illegible] S3 @ FB 5. W. side. Span 3
12.	Splice pl @ N. side of S4 @ FB 5. Span 3
13,14	Pack rust bet. lat. bracing angles bet. FB 5 & FB 6. S. half
15	Inside face of L2. S. truss Span 3
16	Gusset pl [illegible] @ S. end of FB 6. E. side. Note the [illegible] on lat. bracing
17	Pack rust bet. L2 [illegible] & Gusset pl @ L2. [illegible] face. Span 3
18	[illegible] S4 @ FB 9. W. side. Span 3. Note that [illegible] [illegible] on the pl
19	[illegible] top flg of FB 9 [illegible] under S3 note [illegible] w/drilled holes
20,21	[illegible] face of Gusset pl @ L4 S. truss Span 3 note the [illegible] & pack rust
	@ Gusset pl. S. truss
22	[illegible] & SL @ bot of Gusset pl. S. truss Span 3 @ L4
23	Repaired crack in weld @ S5 diaph @ FB 10. W. side. Span 3
24	Pack rust & SL bet. bracing angles bet. FB 10 & FB 11. S. half Span 3
25	[illegible]

134_Photo Log Sheet (26)

135

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/23/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82 / Conn. River

Film Frame #	Image Description
26	W.face of FB 12 bet. St. & S.S., Span 3
27	Gusset pl @ bot. of bot. chord @ S end of FB 13
28	SL @ bot. of vert. gusset pl @ L8 inside face, S truss
29	SL on bot. chord web @ inside node @ L8
30	Pin @ L8, S truss, Span 3
31	W.face of FB 15 conn. to S truss bot. chord note the SL on FS gusset pl & clip angle
32	E.face of FB 15 conn. to S truss bot. chord
33-36	N.face of L8, S truss
34	Loose bolt @ St. top flg., S face bet. FB 17 & 18, Span 3
35	S.face of St. @ FB 17
37	E.face of FB 18 under St. note the [illegible] down [illegible]
38	Vert. batten pl @ inside of L9, S truss
39-40	FB 20 to bot. chord conn., S truss
41	N.face of L9-U9 @ L9 S truss
42	Loose bolt @ St. top flg., S face bet. FB 19 & FB 20, Span 3
43	S end of Pier 3 cap, [illegible]

135_Photo Log Sheet (27)

136

AI Engineers, Inc.

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No.: 01138 Date: 12/23/15
Town: Haddam Photographer: DY
Carried / Crossed: Route 82 over CT River (Span 3)

Film Frame #	Image Description
1	4 holes upto 1" gap bet Gusset PL & channel conn at bet FB1 & FB2
	bet Stringers @ S_3 & S_2
2	top of bott flg for FB_2 W face under S_3
3	S loss on top of gusset PL @ S Truss conn bott chord to bracing
4	S loss on top flg after S_2 & before FB_1 FB_2 W face
5	" " " " " " E face
6	6 w/ 1/4" dp remaining on Gusset PL on W Side of FB_2 & N Truss
7	" " " E Side of FB_2 & N Truss
8	S loss of bott flg horiz leg @ W face of FB_4 under S_2
9	FB_4 W face pack rust bet bracing / Gusset PL / bott flg of
	FB_4 under S_3
10	S loss on bott chord conn @ S face of N Truss bet L_1 & L_2 @ FB_5 (W face of FB_5)
11	8 9 & 10 @ W face of FB_5 @ N Truss
12	5 & 6 @ E face of FB_5 @ N Truss
13	S loss on bott chord curb @ S face of N Truss bet L_1 & L_2
	@ E face of FB_5
14	Pier 2 E Elev
15	upto 3/4" pack rust bet bott flg of FB_6 & horiz gusset @
	center
16	FB_8 bott flg & N Truss bott chord gusset PL w/ pack rust
~~18~~ 17	S loss in top of bott flg @ W face of FB_9 below S_1 & S_2
19	43 for bott chord @ N Truss L_4
20	W gusset PL inside chord of N Truss w/ S loss @ bott flg
	@ L_4

136_Photo Log Sheet (28)

AI Engineers, Inc.

137

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/23/15
Town: Haddam Photographer: DY
Carried / Crossed: Rt 82 over CT River (Span 3)

Film Frame #	Image Description
21	Repaired weld @ top of FB_{10} diaph. crk @ S_1
22	(16) w/ RTH @ W. face of FB_{11} @ N. Truss
23	10"ϕ cut hole in horz gusset PL @ N. Truss/ FB_{12}
24	S loss on top of horz gusset PL @ FB_{13}/N. Truss.
25	(24) S loss around eyebar on S PL @ L_6 N. Truss
26, 27	W face Gusset PL w/ S loss @ FB_{15} / N. Truss - Note S loss
	on web @ FB_{15} & N. Truss
28	diap conn vt plate inside bott chord of N. Truss w/ pitting
	@ W side @ FB_{16}
29	(43) for N. Truss
30	Missing conn. bolt @ S_4 over FB_{17}
31	RTH @ bott batten PL @ N. Truss @ L_8
32	(1) @ E face of FB_{18} @ N Truss
33	4"ϕ RTH in horz gusset PL W Side @ N Truss/ FB_{19}
34	1"ϕ RTH in lateral bracing bet FB_{19} & FB_{20} under S_1
35	Gusset PL w/ typ loss @ E face of FB_{19} & N. Truss
36	" " " W face of FB_{20} & N. Truss
37	RTH in top & bott of web @ FB_{20}/N. TRUSS
~~38~~	~~[illegible]~~
39, 40	Lateral bracing S chord / FB_{21}
41	bott chord N face of S Truss
42	Repaired Vt Stiff @ W face of FB_{20} above TG_1
43	SIP w/ RTH
44	[illegible] top of Gusset PL N Truss [illegible]

137_Photo Log Sheet (29)

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

AI Engineers, Inc.

138

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 1138 Date: 12/23/15
Town: HADDAM Photographer: DY
Carried / Crossed: Rt 82 over CT River. (span 3)

Film Frame #	Image Description
45	A. bolts w/ lam rust @ curb adj to N. Truss (S face)
	betw FB20 & 21
46	Splice conn for S2 over FB21. Prev noted as loose
47	" " FB20 Rust
48	bott chord N. Truss S. Lg w/ RTH on E. Side of FB21
50, 49	" " " " " on W. Side of FB22 West
51	Gusset pl & lateral bracing @ FB22 West. N. Truss
	W face w/ S loss & RTH
52	Perf w/ knife edge @ top flg of FB22 West @ N. Truss
	W. face
53	bent Vt Stiff on W face of FB22 West
54	FB21 to S Truss conn on E. Side. (typ)
55	Perf @ bott of Vt Stiff for FB22 West S truss above
	Mechanical bearing
56.	Perf @ batten pl for S Truss bet FB21 & FB22
	West
57	batten pl w/ perf bet FB22 West & FB22 East. S Truss
58	Missing splice bolts @ N. Truss @ FB21 W. Side in span 4
59	Missing conn bolts @ E side of FB22 East under S4 sp 4
60.	TG1 bott flg S loss @ E End under FB20 span 4.
61.	N. Truss bott Chord S Lg @ FB20 E Side w/ RTH
62 - 64	Top flg of FB20 in place span 4 Note S loss & Stiff w/ RTH
65	Top of cross girder bet FB20 & FB21 @ N. Truss @ FB20

Span 4

138_Photo Log Sheet (30)

Sketches
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

AI Engineers, Inc.

(139)

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 01138 Date: 12/24/15
Town: East Haddam Photographer: PS
Carried / Crossed: Route 82/Conn. River

Film Frame #	Image Description
1	outside face of L9-L8, S-truss → W. Span 3.
2,3	U/S. of deck STP adj. to S5 @ FBBA'. Span 3
4	Batten pl @ L8, south truss span 3
5	[illegible] L8-L9 south truss span 3 → W. [illegible] basis.
6,7,?	inside face of L8, span 3 [illegible]
8,9	outside " " " " " "
11	H0/3. Gusset pl (B?) @ L? S-truss, Span 3
12	[illegible] perf @ [illegible] inside face of [illegible] S-truss span 3
13-17	Node [illegible] L6 S-truss span 3
18,19	L4 S-truss span 3
20	[illegible] inside L2, S-truss. Span 3
21	[illegible] gusset pl & FBL? under S3. Span 3
22,23	[illegible] S-truss @ Pier 1, Span 2
2?,2?	W/face of S5 @ Pier 1, Span 2
2?,2?	N/face of S? " "
30,31	S/face of S5 " "
32	N/face of S2 " Span 1
33	FBLO conn. to N-truss @ Pier 1, Span 2
34, 35	FBLO conn. to S-truss @ Pier 1, Span 2

139_Photo Log Sheet (31)

AI Engineers, Inc.

140

PHOTO LOG

Form BRI-13, Rev. 9/97

Bridge Information System
Image Inventory

Bridge No. 1138 Date: 12/24/15
Town: Haddam Photographer: DY
Carried / Crossed: Rt 82 over CT River (span 2)

Film Frame #	Image Description
1	FH x 1/4 x 3/16" dp Slice to S face of bott chord N truss
	@ FB8A' in L8'L9' member (E face of FB8A')
2	" " (W face of FB8A')
3	Legend (63) for N Truss @ L8 FB8
4	bott gusset PL @ W Side @ N Truss to FB8 conn w/ RTH
5	up to 2"x2" RTH at knife edge @ diag member of N truss @
	L2 inside bott chord
6	Brg over Pier 1 for Span 2 N Truss
7	S face of gusset PL above N Truss bott chord

140_Photo Log Sheet (32)

Form: Asset Photos
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

Photo Number: 1 Photo Taken: 12/18/2015

South elevation of the bridge.

Photo Number: 2 Photo Taken: 12/18/2015

North elevation of the bridge.

Photo Number: 3 Photo Taken: 12/18/2015

Bridge from east approach.

Photo Number: 4 Photo Taken: 12/18/2015

East approach from the bridge.

Photo Number: 5 Photo Taken: 12/18/2015

Bituminous concrete bridge overlay in span 1. Note longitudinal and map cracks and bituminous patches in overlay.

Photo Number: 6 Photo Taken: 12/18/2015

Bituminous concrete bridge overlay in span 2 (west half). Note longitudinal and map cracks and bituminous patches in overlay.

Photo Number: 7 Photo Taken: 12/18/2015

Minor pothole in the bituminous concrete overlay in span 1 with exposed grid. Note the bituminous patch in the overlay.

Photo Number: 8 Photo Taken: 12/18/2015

Concrete filled grid over pier 3 in span 3.

Photo Number: 9 Photo Taken: 12/18/2015

Steel grid deck in span 3.

Photo Number: 10 Photo Taken: 12/17/2015

Underside of deck truss and SIP in span 1.

Photo Number: 11 Photo Taken: 01/29/2016

Underside of deck and framing in span 2.

Photo Number: 12 Photo Taken: 12/18/2015

Underside of span 4 steel grid.

Photo Number: 13 Photo Taken: 12/17/2015

Underside of SIP with light rust and active leakage in span 1 between S4 & S5, adjacent to floorbeam U0.

Photo Number: 14 Photo Taken: 12/24/2015

Rusted through hole in SIP and spall with exposed rebar at underside of concrete deck in span 2 adjacent to S5 at floorbeam L8A'.

Photo Number: 15

Photo Taken: 12/23/2015

Underside of SIP in span 3 (PIT area) with rusted through hole.

Photo Number: 16

Photo Taken: 12/18/2015

South bridge railing in span 1. Note areas of moderate rust and isolated scrapes.

Photo Number: 17 Photo Taken: 12/18/2015

Bent post and bracket in the north railing of span 3.

Photo Number: 18 Photo Taken: 12/18/2015

Steel plate attached to the bridge railing at the southeast corner of span 4 which is deformed and torn and exhibits broken welds.

Photo Number: 19 Photo Taken: 12/24/2015

Rectangular free-fall drain along the curbline in span 3. Note light surface rust.

Photo Number: 20 Photo Taken: 12/15/2015

Light fixture attached to U7 in span 2. Note light not on at time of inspection.

Photo Number: 21 Photo Taken: 12/14/2015

In span 3, the north truss at the top of panel point U1 with a conduit separated from the bracket.

Photo Number: 22 Photo Taken: 12/14/2015

In span 4, the east portal near the north truss with an abandoned conduit with exposed wires.

Photo Number: 23

Photo Taken: 01/29/2016

Missing conduit access cover at panel point M9 in north truss of span 3

Photo Number: 24

Photo Taken: 12/18/2015

Removed message board with "SLOW" text in span 4 since the last inspection.

Photo Number: 25 Photo Taken: 12/18/2015

Compression seal joint with depressed joint material at the west abutment. Note light to moderate accumulation of sand debris in joint. Also, note minor scrapes and scratches to steel headers.

Photo Number: 26 Photo Taken: 12/18/2015

Strip seal joint at pier 1. Note light to moderate accumulation of sand and debris in joint.

Photo Number: 27 Photo Taken: 12/18/2015

Pourable seal joint at mid-span in span 2. Note the adhesion separation and light to moderate accumulation of sand/debris in joint.

Photo Number: 28 Photo Taken: 12/18/2015

East abutment open end joint. Note minor scrapes and scratches to steel.

Photo Number: 29 Photo Taken: 12/18/2015

Open joint at pier 2 with vertical misalignment.

Photo Number: 30 Photo Taken: 12/18/2015

Southwest approach metal beam rail (MBR). Note scrapes to railing and MBR not attached to bridge.

Form: Asset Photos
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

Photo Number: 31 Photo Taken: 12/18/2015

Southeast approach metal beam rail. Note guiderail is not attached to bridge. Also, note scrapes to railing.

Photo Number: 32 Photo Taken: 12/18/2015

West approach pavement. Noted map cracking in the pavement.

Photo Number: 33 Photo Taken: 12/18/2015

Settlement along the west approach pavement. Note the map cracking in pavement adjacent to the west abutment joint.

Photo Number: 34 Photo Taken: 12/17/2015

Fixed bearing for south truss at west abutment in span 1. Note the painted over section loss with recurring rust on the bearing plates and rivets. Also, note the pack rust under the south pin head causing a gap.

Photo Number: 35 Photo Taken: 12/17/2015

Elastomeric expansion bearing for north truss at pier 1 in span 1. Note the painted over pitting loss on the bearing steel plate and pack rust under the north pin.

Photo Number: 36 Photo Taken: 12/17/2015

Sliding disc bearing (north) for floorbeam 9 over pier 1 in span 1. Note that the sole plate is in contact with the keeper on right side. Also, note the gap between sole plate and disc.

Photo Number: 37 Photo Taken: 12/22/2015

Fixed bearing for the north truss at pier 2 in span 2.

Photo Number: 38 Photo Taken: 12/24/2015

Elastomeric bearing for south truss at pier 1 in span 2. Note that the bearing was in expansion mode.

Photo Number: 39 Photo Taken: 12/21/2015

Bearing for south truss at east abutment in span 4.

Photo Number: 40 Photo Taken: 12/22/2015

Bearing for stringer S3 at east side of floorbeam FB L1' in span 2. Note the moderate to heavy rust on the filler plates.

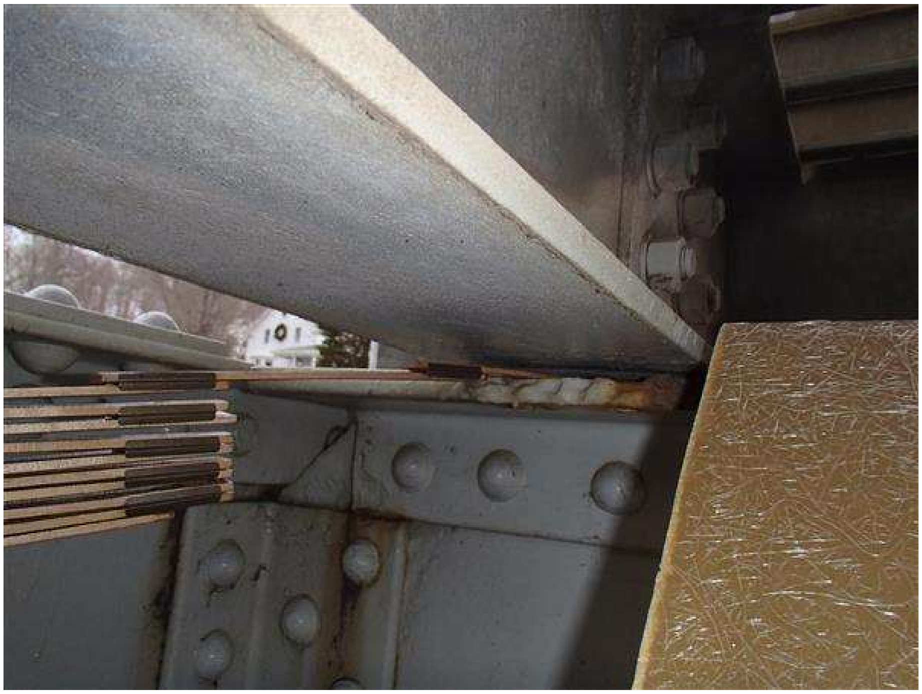


Photo Number: 41 Photo Taken: 12/21/2015

Bearing for stringer S1 at west side of floorbeam FB9 in span 4. Note the missing filler plates with gap under the stringer.

Photo Number: 42 Photo Taken: 12/22/2015

Connection between stringer S1 and floorbeam FB 3A' in span 2. Note the gap under bearing. Also, note the painted over pitting with recurring rust in the top and bottom flanges of stringer.

Photo Number: 43 Photo Taken: 12/23/2015

South elevation of stringer S4 at floorbeam 17 in span 3. Note the missing and loose bolts in the splice connection.

Photo Number: 44 Photo Taken: 12/17/2015

East elevation of floorbeam FB4 in span 1. Note the painted over section loss at the bottom of web and bottom flange.

Photo Number: 45 Photo Taken: 12/17/2015

West elevation of floorbeam FB1 connection to the south truss in span 1. Note the painted over section loss at the bottom of web and perforation at the bottom of stiffener.

Photo Number: 46 Photo Taken: 12/24/2015

Floorbeam FB L0' connection to north truss at pier 1 in span 2. Note the painted over section loss in web and bottom flange with recurring rust in the floorbeam web.

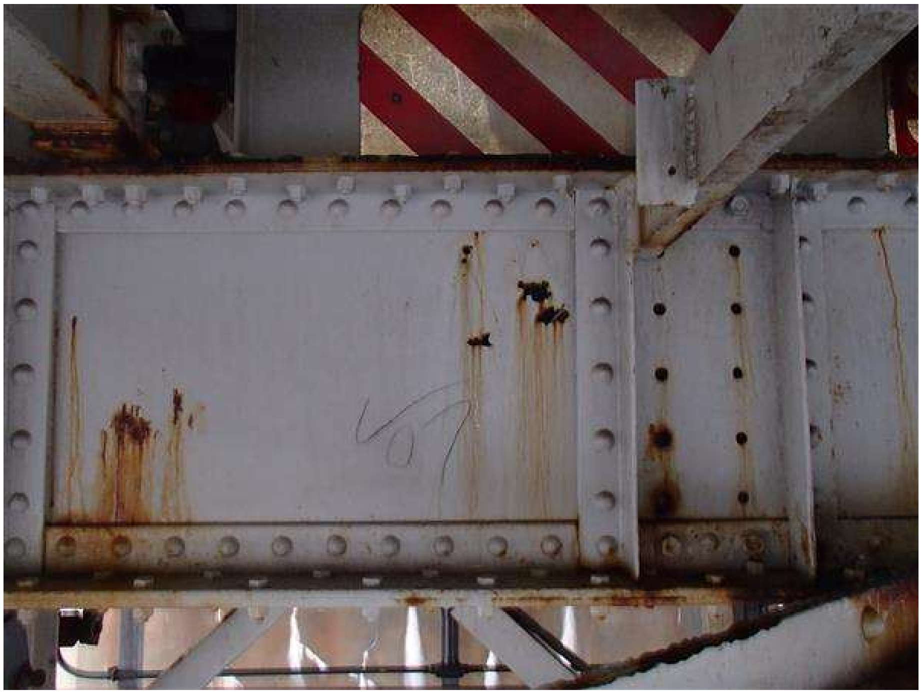


Photo Number: 47 Photo Taken: 12/22/2015

West elevation of floorbeam FB L1' under stringers S2 and S3 in span 2. Note the perforations in the web.

Photo Number: 48 Photo Taken: 12/23/2015

West face of floorbeam FB 15 connection to bottom chord of south truss in span 3. Note the painted over pitting/section loss on floorbeam web, gusset plate and clip angle.

Photo Number: 49 Photo Taken: 12/21/2015

Perforations at the bottom of floorbeam FB1 web between stringers S2 and S4 in span 4.

Photo Number: 50 Photo Taken: 12/21/2015

Heavy rust with section loss and loss of width in the top flange of floorbeam FB2 (west leg) at stringer S3 in span 4.

Photo Number: 51 Photo Taken: 12/21/2015

East elevation of floorbeam FB1 in span 4. Note the section loss in the east leg of the bottom flange.

Photo Number: 52 Photo Taken: 12/21/2015

West face of floorbeam FB 2 in span 4. Note the painted over section loss at the bottom of web and perforations at the bottom of stiffeners. Also, note the accumulation of debris on top of floorbeam bottom flange.

Photo Number: 53 Photo Taken: 12/23/2015

West elevation of floorbeam FB22W in span 3. Note the mis-drilled holes and bent vertical stiffener.

Photo Number: 54 Photo Taken: 12/21/2015

Pack rust with gap between the gusset plate and bottom flange of floorbeam FB12 (east elevation) in span 4.

Photo Number: 55 Photo Taken: 12/21/2015

East face of floorbeam FB10 (north end) in span 4. Note the missing fiberglass cover at the floorbeam top flange.

Photo Number: 56 Photo Taken: 12/17/2015

Painted over section loss with perforations in the batten plate for member U1-U2 in south truss, span 1.

Photo Number: 57 Photo Taken: 12/17/2015

Moderate to heavy rust with perforation in the horizontal gusset plate at panel point U3 in south truss, span 1.

Photo Number: 58 Photo Taken: 12/17/2015

Painted over pitting loss with pack rust between the top chord plates for member U3-U4 in south truss, span 1.

Photo Number: 59 Photo Taken: 12/17/2015

Painted over section loss at the top of top chord, U0-U1 in south truss, span 1.

Photo Number: 60 Photo Taken: 12/17/2015

Section loss with loss of width in the back-to-back angles for L5-L7 in north truss, span 1.

Photo Number: 61 Photo Taken: 12/17/2015

Section loss in the back-to-back angles at panel point L8 in member L8-L9 in north truss, span 1.

Photo Number: 62 Photo Taken: 12/17/2015

Strengthening retrofit bar in the bottom chord member of south truss at pier 1, span 1.

Photo Number: 63 Photo Taken: 12/15/2015

Typical view inside top chord for U5-U4 in north truss, span 2.

Photo Number: 64 Photo Taken: 12/15/2015

Typical view of top chord for U7-U8 in the north truss of span 2. Note the areas of painted over pitting loss.

Photo Number: 65 Photo Taken: 12/15/2015

Pack rust between the top chord plates at panel point U6 in north truss, span 2.

Photo Number: 66 Photo Taken: 12/22/2015

Painted over section loss with recurring rust at the bottom of panel point L8' in south truss, span 2.

Photo Number: 67 Photo Taken: 12/24/2015

Inside view of panel point L2 of south truss, span 3. Note the section loss with perforations in vertical and diagonal members.

Photo Number: 68 Photo Taken: 12/24/2015

Painted over section loss with knife edge remaining and perforations inside panel point L2 of north truss, span 2.

Photo Number: 69 Photo Taken: 12/24/2015

South face of panel point L8 of south truss, span 3. Note the section loss on gusset plate and perforations on truss members.

Photo Number: 70 Photo Taken: 12/24/2015

Heavy rust on the bottom chord at panel point L8 of south truss, span 3.

Photo Number: 71 Photo Taken: 12/15/2015

North gusset plate at panel point M6' in north truss, span 2. Note the painted over section/pitting loss and perforation in the back-to-back angles.

Photo Number: 72 Photo Taken: 01/14/2016

North gusset plate at panel point M7 in south truss, span 2. Note the painted over section loss and missing rivets in the gusset plate.

Photo Number: 73 Photo Taken: 12/15/2015

Minor dent in the back-to-back angle of L5-U5 of north truss, span 2.

Photo Number: 74 Photo Taken: 12/18/2015

Bent lattice bar in the bottom flange of top chord, U3-U4 of south truss, span 2.

Form: Asset Photos
Inspection type: Fracture Critical,Special,Routine
Bridge No: 01138
Inspection Date: 12/14/2015
Inspected by: AI Engineers
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

Photo Number: 75 Photo Taken: 12/18/2015

Bent gusset plate at panel point U3 of south truss, span 2.

Photo Number: 76 Photo Taken: 12/23/2015

North face of L9-U9 at panel point L9 in south truss, span 3. Note the painted over section loss in the back-to-back angles.

Photo Number: 77 Photo Taken: 12/21/2015

Inside view of panel point L4 in north truss, span 4. Note the section loss and perforations to the batten plate and section loss on the bottom chord members.

Photo Number: 78 Photo Taken: 12/23/2015

Perforations in the bottom flange of bottom chord (north leg) at floorbeam 21 of south truss inside machinery pit in span 3.

Photo Number: 79 Photo Taken: 12/23/2015

Connection between floorbeam FB5 and north truss in span 3. Note the painted over section loss in the bottom chord web.

Photo Number: 80 Photo Taken: 12/21/2015

Inside view of panel point L4' in south truss, span 4. Note the section loss and perforations on the bottom chord and gusset plate.

Photo Number: 81 Photo Taken: 12/23/2015

Perforation in the gusset plate at bottom of bottom chord at floorbeam 13 connection to south truss in span 3.

Photo Number: 82 Photo Taken: 12/23/2015

Perforations in the bottom chord (south leg) and batten plate of north truss at floorbeam FB 20, span 4 inside the machinery pit.

Photo Number: 83 Photo Taken: 12/23/2015

Perforation in the batten plate for south truss between floorbeams FB22 West and FB22 East inside the machinery pit, span 3.

Photo Number: 84 Photo Taken: 12/23/2015

Inside face of vertical gusset plate at panel point L6 of south truss in span 3. Note the painted over section loss.

Photo Number: 85 Photo Taken: 12/21/2015

Bent top flange of bottom chord, L8'-L9' of south truss, span 4.

Photo Number: 86 Photo Taken: 12/18/2015

Bent angle in the vertical member, L4-U4 of south truss, span 3.

Photo Number: 87 Photo Taken: 12/14/2015

Bent lacing bar on the diagonal member, M9-L8 of south truss, span 2.

Photo Number: 88 Photo Taken: 12/14/2015

Minor pack rust under the gusset plate for top chord at panel point U6 of north truss, span 3.

Photo Number: 89 Photo Taken: 01/14/2016

South elevation of eyebars at U10-U10' of south truss at pier 3.

Photo Number: 90 Photo Taken: 12/18/2015

Eyebar and pin at panel point U7' of south truss, span 4. Note the bleeding rust on the pin and pack rust between the eyebars.

Photo Number: 91 Photo Taken: 12/18/2015

Painted over section loss with pack rust between the eye bars at panel point U9' of south truss, span 4.

Photo Number: 92 Photo Taken: 12/21/2015

Painted over section loss with recurring rust on the eyebars at panel point L6' of north truss, span 4.

Photo Number: 93 Photo Taken: 01/14/2016

Painted over section loss on eyebars and pin at panel point M7 of south truss, span 3.

Photo Number: 94 Photo Taken: 12/21/2015

North elevation of panel point L6' of south truss, span 4. Note the bleeding rust and section loss around the pin.

Photo Number: 95 Photo Taken: 01/14/2016

Bird nest on platform adjacent to panel point U10 of south truss, span 3.

Photo Number: 96 Photo Taken: 12/15/2015

Minor dent along the bottom flange of east portal in span 2.

Form: Asset Photos
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

Photo Number: 97 Photo Taken: 01/14/2016

Typical view of sway bracing connection south and north trusses at pier 3, span 3.

Photo Number: 98 Photo Taken: 12/23/2015

Painted over section loss with perforation in the lateral bracing between floorbeams FB19 and FB20 under stringer S1 in span 3.

Photo Number: 99 Photo Taken: 12/21/2015

Painted over pack rust with recurring rust between the bracing angles between floorbeams FB8 and FB9 in span 4.

Photo Number: 100 Photo Taken: 12/23/2015

Pack rust with section loss in the bracing angles between floorbeams FB10 and FB11 in span 3.

Photo Number: 101 Photo Taken: 12/15/2015

Bent bracing angles adjacent to panel point M6' of north truss, span 2.

Photo Number: 102 Photo Taken: 12/18/2015

Bent areas over the centerline of bridge in the bottom flange of sway bracing at panel point U8' in span 4.

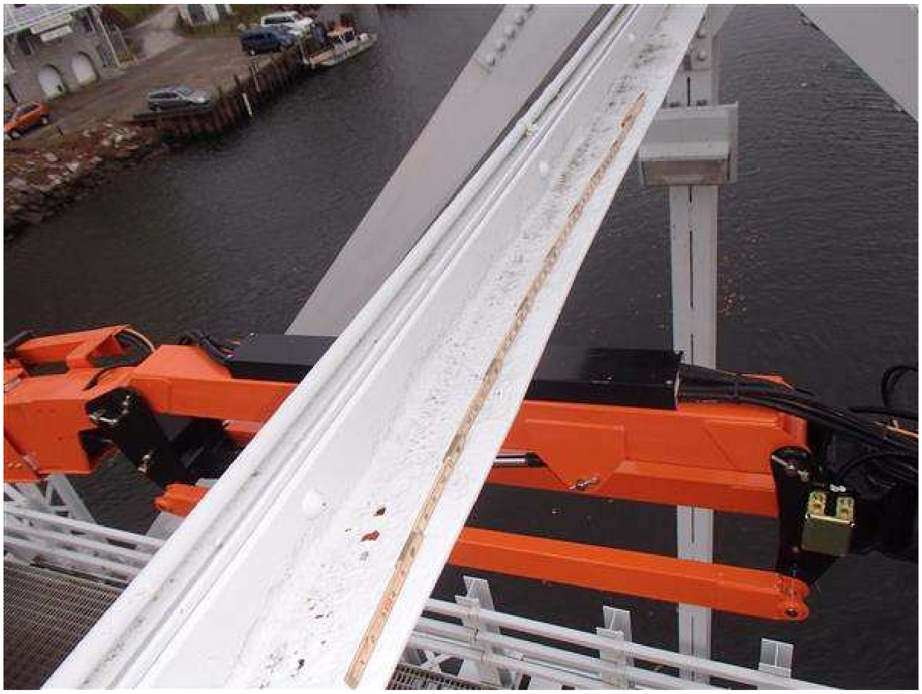


Photo Number: 103 Photo Taken: 12/18/2015

Bent bracing angles with perforations over the centerline of bridge in the sway bracing at panel point M7' in span 4.

Photo Number: 104 Photo Taken: 12/23/2015

East face of floorbeam FB2 in span 3. Note the missing rivet at the south end of floorbeam web.

Form: Asset Photos
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers

Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

Photo Number: 105 Photo Taken: 12/24/2015

North face of stringer S2 at pier 1 in span 1. Note the repaired crack with a stop hole and bolt since the last inspection.

Photo Number: 106 Photo Taken: 12/23/2015

Repaired crack in weld at stringer S1 to diaphragm connection at floorbeam FB10 connection in span 3 since last inspection.

Photo Number: 107 Photo Taken: 12/14/2015

Out-of-plane bending in the vertical member, L9'-U9' of the north truss, span 4 (Construction related).

Photo Number: 108 Photo Taken: 12/17/2015

West abutment elevation.

Photo Number: 109 Photo Taken: 12/18/2015

East abutment elevation. Note the evidence of previous leakage and rolling platform along the stem.

Photo Number: 110 Photo Taken: 12/21/2015

Spall with punky concrete on top of east abutment bridge seat.

Form: Asset Photos
Inspection type: Fracture Critical,Special,Routine **Bridge No: 01138**
Inspection Date: 12/14/2015
Inspected by: AI Engineers
Town: EAST HADDAM
Carried: ROUTE 82
Crossed: CONNECTICUT RIVER
Inventory Route: Non-NHS

Photo Number: 111 Photo Taken: 12/18/2015

Southeast wingwall.

Photo Number: 112 Photo Taken: 12/17/2015

West elevation of pier 1.

Photo Number: 113 Photo Taken: 12/18/2015

West elevation of pier 2. Note map cracking with efflorescence to concrete cap.

Photo Number: 114 Photo Taken: 12/18/2015

West elevation of pier 3. Note map cracking with efflorescence to concrete cap.

Photo Number: 115 Photo Taken: 12/23/2015

Spall with (2) adjacent areas of scaling at the southwest end of pier 3 cap.

Photo Number: 116 Photo Taken: 12/18/2015

Erosion area along the east abutment stem exposing the platform footing.

Photo Number: 117 Photo Taken: 12/17/2015

West abutment with erosion area at the north end of the stem.

Photo Number: 118 Photo Taken: 12/18/2015

Downstream view (looking south).

Photo Number: 119 Photo Taken: 12/18/2015

Upstream view (looking north).

BRIDGE SAFETY INSPECTION
STATE PROJECT NO. 170-3225 – Non-NHS

BRIDGE NO. 01138

ROUTE 82
OVER
CONNECTICUT RIVER

EAST HADDAM, CONNECTICUT

MECHANICAL & ELECTRICAL INSPECTION

Prepared by:

STV 100 Years

STV INCORPORATED
185 Plains Rd
Milford, CT 06461

Prepared for:

AI Engineers, Inc.

AI ENGINEERS
919 Middle Street
Middletown, CT 06457

January 2016

STATE OF CONNECTICUT
No. 15714
LICENSED
PROFESSIONAL ENGINEER

Routine Mechanical Inspection

For

CONNDOT Bridge No. 01138

Route 82 over the Connecticut River

East Haddam, Connecticut

Completed for Connecticut Department of Transportation and AI Engineers, Inc.

By

STV Incorporated

January 2016

TABLE OF CONTENTS

EXECUTIVE SUMMARY

A routine mechanical inspection of the East Haddam swing-span bridge over the Connecticut River was performed on January 12th and 13th, 2016 by Dennis Biegel, P.E.and Michael Camoscio, P.E. of STV Incorporated.

The AASHTO Movable Bridge Inspection, Evaluation and Maintenance Manual, 1998 Edition, and the ConnDOT Bridge Inspection Manual were utilized as the guidelines for the inspection. The "Routine Inspection" guidelines were utilized as the basis for equipment evaluation and testing. Equipment listed herein was examined and photographed, and observed deficiencies were documented. Additionally, items classified as deficient in the previous inspection report were inspected for compliance with the recommendations for repair and/or replacement listed therein.

This report is written from the perspective of the date of the inspection described herein; the use of present tense herein in no way implies that the descriptions presented are accurate as of any subsequent date.

The general condition of the mechanical systems is fair. There are several important items that should be addressed:

- The electrical controls presented operational issues and prevented test openings from occurring. Please see the electrical section of the report for additional information.
- The control system is currently set to use only one main pinion to open and close the bridge at a time.
- The east machinery brake is out of service and tied in the hand-released position.
- The machinery brake shoe linings are worn and not properly adjusted.
- A majority of the rack gear and balance wheel track anchor bolts and nuts exhibit severe corrosion and measurable section loss.
- The east barrier gate hydraulics are not fully releasing when the gate is seated.
- The emergency drive system is not functioning.
- Repairs were made to the deteriorated road deck above the pier machinery, but additional isolated repairs and/or protective shielding over various machinery areas is still recommended.

On the afternoon of January 12th, the swing span failed to open during a requested test operation. STV's inspectors assisted ConnDOT personnel in attempting to troubleshoot the issue, which was believed to be somewhere in the control system and its field devices. As a result, observation of the span drive mechanical equipment in operation was not performed during this inspection. Observations were made of the center and end wedge machinery, center latches, and barrier gate machinery while those systems were operating.

GENERAL DESCRIPTION

Bridge No. 01138 is a center bearing swing-span which carries one lane of vehicular traffic in each direction of Route 82 over the Connecticut River in East Haddam, Connecticut. The swing-span is 456-feet long between the centers of the rest piers. The swing-span is 27-feet between truss centers and is generally oriented east to west, with the east end being slightly north of the west end. Machinery in this report is identified by compass direction and is referenced to the center pivot bearing. Therefore, for example, the end wedges on the East Haddam end of the bridge are referenced as the east end wedges. The bridge opens approximately 90 degrees to allow passage of marine traffic. Though the control console selector switch labels suggest the span is capable of rotation in both directions, it is actually opened only in the counter-clockwise direction. This prevents snagging of the "drag" cables which bring power and control signals to the movable span at the center pier.

The machinery for this bridge consists of components assembled into the following major functional subsystems:

The Span Drive system, which includes:

- Main motors
- Motor brakes
- Machinery brakes
- Couplings
- Pinion shafts
- Pinion shaft bearings
- Enclosed gear reducers
- Open gearing

The Span Support and Alignment system, which includes:

- Center bearing
- Balance wheels and track
- Center wedges
- End wedges
- Centering latches

The movable span is rotated by two mechanically independent span drives (with electrically controlled load sharing) located 180-degrees opposite each other on the east and west sides of the center pivot bearing. Each drive consists of 60 HP, 900 RPM electric motor, coupled to a right-angle enclosed gear reducer and then to a rack-engaging pinion via a vertically mounted pinion shaft. Bridge rotation is realized when motor rotation and torque are transferred through the right-angle reducers and pinions. The pinion torque reacting on the rack segments (with integral track), which are fixed to the pivot pier (Pier 3), causes the span to rotate about the center bearing which is mounted to the pivot pier.

Motor brakes act on brake wheels mounted to the rear shaft extensions of the motors. Machinery brakes act on brake wheel couplings mounted between the front ends of the motor and the input shafts of the right angle reducers. Figures M-1 and M-2 of Appendix B present the machinery layout.

The span drive machinery is located below the roadway level and is accessible through a hatch in the electrical room on the south side of the bridge at mid-span. The space available for some machinery components is limited, resulting in difficult access for both maintenance and inspection.

Components on the output shaft side of the right angle reducers are more readily accessible than those on the respective input sides. All of the machinery is protected from the weather by an enclosure that surrounds the center of the bridge below the roadway and a solid deck system directly above the center pier.

As shown in Appendix B, the major span drive elements highlighted above are connected and supported by appropriate couplings and bearings.

The span drive system was rehabilitated in the 1980's and all of the machinery was replaced except for the rack, which is original and dates to 1912. In April 1995, a failure of the east end wedge and center latch machinery resulted in an emergency rehabilitation, which was completed in October of the same year. The center bearing, balance wheels and track were rehabilitated in 1998. In 2005, the traffic barriers and their access platforms were rehabilitated as well as the access platforms at the end machinery. Machinery painting was included in the 2005 work as well as work performed at the span drive reducers including new lubrication pump systems. New warning gates were provided for the off-going direction of traffic at each approach. The motor control center, PLC (programmable logic control), and control console were reported to have been replaced in 2005.

During rotation, the entire weight of the bridge is supported by the single plain spherical center pivot thrust bearing, which is comprised of a base casting, a hardened steel disc with concave spherical surface, a bronze disc with convex spherical surface, a top casting, an oil box and a dust cover. The steel and bronze discs are secured to the base and top castings, respectively, with keys. The base casting is secured to the center pier and the top casting to the span. During operation, the convex surface of the bronze disc nests in and rotates on the concave surface of the steel stationary disc. The sliding surfaces are immersed in oil bath contained by the oil box and the dust cover surrounds the entire assembly.

Eight balance wheels are distributed radially about the center bearing in four pairs, centered about each center wedge and drive pinion location, to provide stability during span operation for dead load imbalance and external loads such as wind and ice. The balance wheels are not intended to support either dead or live loads in the bridge closed position. The track for the balance wheels is integral with the rack gear segments.

For stability under live loads in the closed position, there are four end wedge assemblies, one at each corner of the movable span, and four center wedge assemblies at the center pier. Each end wedge assembly consists of a wedge base, which is anchored to the pier, a wedge guide, which is secured to the movable structure and a powered wedge, which is driven or retracted from between the base and guide to facilitate operation of the movable span. All of the wedges are made of cast steel. The tops of the base and driven wedge are fitted with bronze wear strips.

In the engaged position, the four end wedges are driven between the bases and guides to level the road surfaces of the swing span with the road surfaces of the approaches, and transfer the live loads to the piers. When withdrawn, the wedges retract from their bases on the rest piers so that the span can rotate. Each end wedge is located directly beneath the lower chord of the movable span truss. The same machinery that operates the end wedges actuates the centering latches. A lever mounted on one of the output shafts of the speed reducer is connected to the centering latch machinery via a rod assembly. In Figures 3 and 4 of Appendix B, schematic diagrams of the centering latch machinery are presented. The centering latches are mechanically raised above the functional detent of the receiver pockets, and lowered into position via gravity.

The four center wedge assemblies are oriented on a north-south line of action, 90º away from the main span drive pinions, with their seats located under the lower chords of the swing span trusses. They are operated through an enclosed gear reducer and a series of linkages and shafts.

Each approach to the bridge incorporates traffic barriers and warning gates. The barriers are hydraulically-powered, fabricated steel beams that are housed below the roadway at the approaches to the bridge. Two hydraulic cylinders raise each beam through apertures in the roadway prior to operation of the bridge, and lower the beam below the roadway following operation. The barriers block the entire roadway when raised. The warning gates are commercially manufactured units equipped with arms that extend to the middle of the roadway, located ahead of the barriers on the west and east approaches to stop traffic in the oncoming and off-going lanes.

INSPECTION RESULTS BY COMPONENT

Span Drive Components

Motors:

The main drive motors are generally in fair physical condition. Typical on both motors (and most components within the machinery room) was an accumulation of light debris (masonry type materials and road salts) that appears to have originated from the deteriorating overhead structure. There are signs that maintenance has painted some the supports since the previous inspection, which will help slow down the corrosion (see Photograph M01). As noted in the prior report, the overhead structure is the underside of the filled deck panels that form the machinery area roof. Periodic monitoring and painting will help to mitigate additional corrosion on the motors and their ancillary components and extend their service life. At the west motor, the tachometer / overspeed limit switch was reported to have been misaligned in the 2009 report has been corrected with a new coupling insert; however the shaft is still heavily rusted (see Photograph M02). Screws projecting from the west tachometer/overspeed switch cover are interfering with the adjacent jaw coupling (see Photograph M03). This condition may be the cause of the noisy operation of the span drive machinery. This condition could potentially lead to damage of the electrical instrumentation and should be corrected. Additional paint repairs / application is recommended on various components of these units.

Motor Brakes:

The motor brakes are in fair condition (see Photograph M04). As previously noted, light debris on these units is causing various levels of corrosion to them and their ancillary components. The thrustors on both brakes have exhibited surface corrosion since being replaced between the 2009 and 2014 inspections. Per previous reports, the non-contacting surfaces of the east and the west motor brake wheels exhibit moderate to heavy corrosion with no paint on the face of the wheels and stub shafts (see Photograph 05). The east motor brake wheel braking surface exhibits moderate scoring and the west motor brake wheel exhibits minor grooving on the braking surface. The west brake shoe of the east motor brake does not fully release when the manual release lever is actuated. The manual release levers do not lock in the released position. No brake covers are installed. Paint repairs / application are required on various components of these units. The brake linkages should be adjusted and the brake torques should be physically verified and reset as needed to match the settings indicated in the contract documents and so as to achieve desirable performance of the swing span.

Machinery Brakes:

The machinery brakes are generally in poor condition (see Photograph M06). As previously noted, light debris on these units is causing various levels of corrosion to them and their ancillary components. As noted in previous inspection reports, the east manual brake release is wire-tied in the released position. The east and west manual brake releases will not securely lock in the released position due to what appears to be some previous field modifications to the linkages. No brake covers are installed. As previously reported, on both machinery brakes, the linings exhibit wear depressions where the linings hang over the edge of the brake wheel (See Photograph M07). Brake pad wear should continue to be monitored as part of future routine inspections and the pads replaced once the wear has reached the replacement criterion established by the manufacturer. The east shoe on the west brake remained in contact with the brake wheel when manually released. Touch-up paint should be field applied to the brake assemblies. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Couplings:

The pinion shaft couplings are in fair condition. As noted during the past inspection, both east and west pinion shaft couplings exhibit minor to moderate grease leakage at the lower hub seal (see Photograph M08). The covers on both pinion shaft couplings are unpainted and exhibit light rust. The lubrication purge ports are oriented 180 degrees from the grease fittings. These ports appear to be in use by ConnDOT maintenance forces (see Photograph M09).

The brake wheel couplings are in fair condition. As previously noted, the reducer input shaft key can be moved axially in the keyway by hand. The west brake wheel coupling has a significant leak on the reducer side through the keyway (see Photograph M10) and the motor side hub seal is either missing or ineffective. Less grease appears to be purging onto the brake drum surface than compared to what was observed during the previous inspection (see Photograph M11). It appears the purged grease has been cleaned by ConnDOT maintenance forces. These couplings appear to be over-filled with grease. While the purge ports may be difficult to access, it is urgent that they be used during subsequent re-lubrication of these couplings. The gaps between the keyway and the coupling hub should be filled with an epoxy resin or similar compound to mitigate the purging of the grease. The east coupling was also observed to be purging grease onto its brakewheel. Paint should be field applied to the couplings. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning. Any solvent use should be investigated carefully for compatibility with the coupling seals. Hand tools should be used with care so as to prevent damage to the seals or contaminants from getting pasts the seals.

Pinion Shafts:

The pinion shafts are in good condition. No deficiencies were observed at keyways at the couplings. There are currently strain gauges applied to both shafts from a previous testing procedure. The shafts appear to lack paint protection, but grease and oil leakage from the coupling, bearings and gear reducer has prevented surface corrosion from developing (see Photograph M12). Paint should be field applied to these shafts. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Pinion Shaft Bearings:

The pinion shaft bearings are in good condition. Both upper and lower bearings on both shafts exhibit minor to moderate surface corrosion (see Photographs M13 and M14). The open holes in the lower bearing face should be sealed with a silicone sealant to prevent debris and moisture. None of the bearing mounting bolts have lock washers or double nuts and all are unpainted. Despite this, there are no indications of relative movement or loosening between the bearing housings and their mounting baseplates. Paint should be field applied to these bearings and their mounting and cap bolts. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning. As indicated in Photograph M15, the east bearings both have supplementary mounting/retaining bolts with a single nut, which were part of a prior repair. This hardware appears to be of unpainted stainless steel and is in good condition.

Enclosed Gear Reducers:

The reducers generally are in good condition (see Photograph M16). As previously noted, light debris on these units is causing various levels of corrosion to them and their ancillary components, particularly their mounting bolts. The desiccant breather on each reducer is brown-green in color and should be replaced (see Photograph M17).

The open gearing of the rotary cam limits on both units require lubrication or paint protection (see Photograph M18). These gears should also be protected from debris falling from the deteriorating ceiling above.

There are signs of possible oil seepage at the vertical output shaft lower seal at the east speed reducer (see Photograph M19). This condition does not appear to have worsened since the previous inspection. This condition should continue to be monitored by maintenance forces and as part of future inspections.

The reducer lubrication systems are in fair condition. The heat traces are working on both units. As previously noted, light debris on these units is causing various levels of corrosion to them and their ancillary components. The pump bases and their respective attachment bolts are severely corroded (see Photograph M20). There were also signs of oil seepage through the east circulating pump input shaft seals. The oil in the dial of the east unit has coagulated and the gage could not be read (see Photograph M21). At the west unit, the pressure gage needle was broken (see Photograph M22). Both these gage should be replaced. Touch-up paint should be field applied to pumps, gearmotors and other lubrication system components as needed. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Open Gearing:

The main pinion gears are in adequate condition. As noted in previous reports, both main pinions exhibit minor to moderate wear based on visual observations. The east pinion gear (8.0 inches wide) is axially misaligned 5/8 inch downward relative to the top of the rack teeth. The west pinion gear (8.5 inches wide) is axially misaligned 1/4 inch downward relative to the top of the rack teeth. This condition is unchanged from the prior report.

The east pinion exhibits minor pitting, tearing and scoring in the addendum and moderate plastic flow with light fins in the dedendum into the root on the opening face. The closing face exhibits minor pitting, tearing and abrasive scoring with isolated foreign matter impact defects in the addendum and moderate plastic flow with light fins in the dedendum into the root (see Photograph M23). The west pinion exhibits minor pitting and tearing with moderate scoring in the addendum and moderate plastic flow at the pitch line into the dedendum on the opening face. The closing face exhibits minor pitting, tearing and moderate abrasive scoring in the addendum and moderate plastic flow at the pitch line into the dedendum (see Photographs M24 and M25). Plastic flow and "finning" are generally an indication that the gear teeth are overloaded. The additional dead load added to the superstructure during previous rehabilitation work and the use of only one pinion to drive the bridge are the most likely contributing factors to this condition. The fact that fins are forming in the dedendum of the pinion opening face and the addendum of the rack tooth faces suggest the bridge is being slightly pulled off-center due to the single pinion operating mode.

Chordal tooth thickness measurements (at an addendum setting of 1 inch) were taken near the top and bottom of the main pinion tooth faces and compared to recent (2001, 2003, 2007,2009, 2011 and 2014) measurements.

MAIN PINION CHORDAL TOOTH THICKNESS MEASUREMENTS				
YEAR	**EAST PINION**		**WEST PINION**	
	TOP	**BOTTOM**	**TOP**	**BOTTOM**
2001	1.973"	1.984"	1.984"	1.990"
2003	1.970"		1.975"	
2007	1.973"	1.975"	1.980"	1.989"
2009	1.978"	1.975"	1.975"	1.985"
2011	1.975"	1.975"	1.988"	1.991"
2014	1.978"	1.975"	1.984"	1.990"
2016	**1.980"**	**1.975"**	**1.985"**	**1.990"**

Based on these measurements little to no wear has occurred since the 2001 inspection.

Chordal tooth thickness measurements (at an addendum setting of 1 inch) were taken near the top and bottom of the rack tooth faces. Measurements were taken at the eighth tooth away from the respective pinion end of six rack segments total.

RACK CHORDAL TOOTH THICKNESS MEASUREMENTS						
YEAR	WEST PINION TRAVEL REGION					
	Rack Segment No.					
	#12		#11		#10	
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
2011	1.912”	1.999”	1.943”	2.018”	1.935”	2.005”
2014	1.884”	1.975”	1.896”	2.010”	1.912”	1.980”
2016	**1.885”**	**1.985”**	**1.902”**	**2.018”**	**1.917”**	**2.004”**
YEAR	WEST PINION TRAVEL REGION					
	Rack Segment No.					
	#4		#3		#2	
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
2011	1.885”	1.964”	1.896”	1.975”	1.933”	1.931”
2014	1.890”	1.964”	1.895”	1.964”	1.935”	1.921”
2016	**1.886”**	**1.962”**	**1.892”**	**1.962”**	**1.935”**	**1.930”**

Differences in the above sets of measurements may be due to both surface condition of the teeth affecting the measurement and past maintenance practices of grinding away plastic flow at the topland of the rack gear teeth to alleviate possible binding with the pinion gear teeth. Since the topland of the gear tooth is a primary reference surface from which chordal tooth measurements are based, sets of measurements of rack gear teeth may not be readily comparable. However, given that the pinion teeth have exhibited little wear in recent years, it is probably not unreasonable to speculate that the rack teeth have similarly not experienced significant wear.

The gear teeth on the east and west sides of the rack assembly generally show signs of moderate wear and appear unchanged since the 2011 inspection. East rack teeth exhibit moderate plastic flow with the creation of metal ridges on the closing face near the fully closed position. West rack teeth near the fully closed position exhibit minor full face tip flow and minor to moderate plastic flow across the whole closing face. At the near fully open position, west rack teeth exhibit heavy full face tip flow with minor to moderate plastic flow across their entire face (see Photographs M26 and M27). Minor to moderate pitting is present in the dedendum.

Lubrication for the rack and pinions appeared adequate. However at isolated locations where the lubricant was wiped off for measurement, a few rack teeth were found to exhibit minor surface corrosion.

Span Support and Alignment

Center Bearing:

The center bearing assembly is in good condition overall (see Photograph M28). Paint system is in good condition with some minor areas of chipped paint. No oil level gage could be located. It is recommended that such a gage be installed. The previously noted oil leak on the north side of the fill elbow appears to have been fixed.

Balance Wheels and Track:

The track is generally in adequate condition. There are six drainage holes within each segment; including Segment 7 (see Photograph M29) which was indicated in the past report to be blocked with debris. It appears all segments were cleaned of debris buildup. Of the 128 anchors that secure the circular rack and track, rough 1/4 exhibit 80% or higher levels of section loss and a little over 1/3 exhibit 50% or higher levels of section loss. This condition is similar to the last report but should be monitored for any signs of further section loss. There are isolated indications of flaking of the track tread surface, suggesting high localized stresses due to intermittent contact between the balance wheels and the track.

The balance wheel assemblies are in good condition (See Photograph M30). Bearing clearances were checked and minimal wear was detected. Wheel clearances with the track were checked with an average clearance of approximately 1/16 inch except for Wheels 6 and 7 (east pair), these wheels have no clearance. Axle clearance measurements were taken at the inboard and outboard bearings of each wheel. A majority of the axle clearances were at or below an ANSI RC6 running class fit. Those few clearances which are greater than this fall within an ANSI RC9 running class fit, which is typically considered a maximum permissible limit for worn equipment.

The track surface itself has some very minor corrosion and has been cleaned of debris since the last inspection. As recommended in the prior report, paint should be field applied to rack/track segments after all debris is cleared away. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Center Wedges:

The center wedges are in good condition overall (see Photograph M31). In general, the paint protection on the majority of the center wedge components is in very good condition. In isolated areas, principally near the gearmotors, reducers, etc., light debris on components is causing various levels of surface corrosion.

The north and south wedges were observed to operate as intended with no deficiencies noted. Based on wedge base grease patterns and on feeler gage measurements, the tops and bottoms of the wedges were in full contact with their guides and bases. The connecting rods, cranks, turnbuckles, and other linkage components were all in good condition with no deficiencies noted (see Photographs M32 and M33). Isolated paint failure is beginning on several linkages. Mounting bolts were also observed with minor corrosion and exfoliating nuts (Photo M34). Bearing clearance measurements were taken for the outboard cross shafts at both locations and very minor wear was observed. All lubrication was fresh and adequate.

The oil levels in both reducers appeared adequate. The reducer housings are in good condition. Paint protection is in good condition, except for the bottoms and tops of the units (see Photograph M35), which appear to be primed only. The shaft bearing cover bolts also have minor corrosion. The desiccant in the breathers on each reducer (DES-CAS DC-3) were fully pink in color, indicating they are saturated, and should be replaced at this time (see Photograph M36).

The brakemotors are in fair condition, with isolated paint failure on the motor housings, mounting bolts and fittings. Moderate surface corrosion is present on the rear mounted disc brakes – no paint protection appears to be present on these components (see Photograph M37). Light surface corrosion is also developing on the brakemotor mounting bolts.

The couplings between the brakemotors and reducers are inaccessible due to protective guards. The couplings at both the north and south reducers have a light coating of oil and no lubrication fittings. As noted in the prior report, the rotary cam jaw couplings and adjacent shafts exhibit moderate surface corrosion and no paint protection (see Photograph M38).

End Wedges / Centering Latches:

The end wedge brakemotors are in fair condition, with the west motor being in a slightly more deteriorated condition (see Photograph M39). Typical on both motors (and most components within the bridge end machinery area) are various levels of minor debris (masonry type materials and road salts) that appears to have originated from the deteriorating overhead structure. It appears protective guards have been added over certain components and steps should continue to be taken to protect machinery by both installing guards and repairing the roadway decks. The west wedge motor has significant deterioration around its base; the north east connecting bolt upper end exhibits 100% section loss and a section on the motor mounting feet exhibits 100% section loss. In addition, there appears to be galvanic corrosion around the mounting bolts of the east and west brakemotors. The most likely cause for this appears to be a potential use of non-passivated stainless steel shims or other shim material with a high galvanic potential. This may also be a contributing factor to the observed moutning bolt corrosion. It is recommended that these brakemotors be temporarily removed, cleaned and realigned/remounted with proper passivated type 316 stainless steel shims under their mounting feet and with new ASTM A449 hex cap screw mounting hardware. The brake release on the west brakemotor does not remain in the released position. This should be repaired. All end wedge machinery was observed numerous times and was found to operate smoothly.

The end wedge reducers are in good condition. The oil level at the east end is good and the west end is ¾ inches low (see Photograph M40). The desiccant in both east and west reducer breathers (DES-CAS DC-3) has turned almost entirely pink in color and should be replaced (see Photograph M41). As previously noted, the channel side fasteners at both locations are heavily corroded.

The main cross shaft gear couplings are in fair condition, except for noted surface corrosion (see Photograph M42). The corrosion is worse on west end than when compared to the last inspection photographs. Typical on all couplings, the lubrication is fresh but the purge ports do not appear to be in use. These couplings should be locally cleaned and repainted with a suitable paint system. Cleaning should be limited to hand tools and solvent.

The wedge assemblies are in good condition (see Photographs M43 and M44), all linkages are tight and well-lubricated.

Both the centering latch assemblies are in fair condition. Clearances were checked on the latches and pivot shaft bearings with minimal wear detected. The latch bar receivers have spring loaded north and south sliding socket blocks. The displacement in the socket blocks on the east that was observed in 2014 was no longer present. However, the east latch did not appear to be lowered all the way (see Photographs M45). This does not appear to be a significant issue in terms of the machinery's ability to function, but it should be investigated whether this condition is having an effect on the control system interlocking. It is also suggested that the motor and machinery brake settings be evaluated and the main motor deceleration rates provided by the control system be evaluated with the intent being to slow the rate of deceleration of the swing span as it approaches its fully seated position. This would reduce the impact forces experienced by the centering latches. During the electrical room operation of the motors to close the bridge by ConnDOT staff during troubleshooting efforts, the main motor did not decelerate near closed. The ConnDOT maintenance staff stated that during a manual closure in May 2015, the motor entered creep speed during the same method of operation and expressed concern that the same did not occur during this manual motor operation.

In the intermediate to long term, it could be considered whether to eliminate the centering latches entirely and ensure the bridge is centered by driving the swing span into fixed bumpers. This seating methodology is generally more reliable than the use of centering latches.

Lubrication is adequate and fresh. During test openings, the latches and wedges functioned smoothly. The degree to which the latches retract requires them to roll along steel plates on the pier (see Photograph M46). The wedge seat bearing plates showed minimal wear and are in good condition.

The prior report made mention of counterweight materials (concrete blocks) placed within the chord above the east wedges. These blocks appear to have been removed and were not seen during our inspection near the east wedges.

Traffic Warning Gates and Resistance Barrier Gates

The traffic warning gates are in good condition. All function correctly and minor surface corrosion was observed within the units.

The resistance barrier gates are in adequate condition. The east barrier gate actuators are showing signs of minor to moderate corrosion at the base of the pistons (see Photograph M47).

The east barrier gate live load shoes at the bottom of the gate are in poor condition and should be rehabilitated or replaced (see Photograph M48). Cylinder rod protective boots were in place and functioning. The hydraulic cylinders were observed to be pumping with live load traffic and could be felt in the tubing (see Photograph M49). Note that the temperature gauge is broken on the east hydraulic power unit (See Photograph M50). The system operated smoothly during all observations.

Auxiliary Span Drive

The pneumatic drive back up system is in fair condition with progressive surface corrosion on numerous components (see Photograph M51). It was reported to be is currently disabled. It is unknown when / if this system was ever used – ConnDOT personnel questioned had no recollection of the system ever being used or tested. Given that the swing span was stuck in the open position in 2015, this appears to confirm the existing system is either inoperable and/or that ConnDOT maintenance forces are not adequately trained in its use. STV notes that typically pneumatic systems do not function reliably without regular and frequent use.

As noted during the prior inspection, the auxiliary drive chains are being stored in the open and surface corrosion is developing (see Photograph M52). Bearings do not appear to be lubricated. The east manual drive chain tensioner is heavily corroded and was found to be non-functional. The air line connections to the west air motor appeared to be loose. It is recommended the chains be stored removed from their sprockets in a bucket of motor oil to prevent corrosion and to keep them lubricated.

RECOMMENDATIONS

1 Week (Priority B):

1. Resolve control issues noted in electrical section of report regarding the ability to reliably close the bridge. Refer to Electrical section of this report for details and further discussion.

2 Months (Priority C):

1. Cover screws of the west tachometer/over-speed switch assembly cover are interfering with the adjacent shaft coupling. Adjust or tighten screws to eliminate this interference.

2. Re-establish the dual operation drive so both pinions are driving the bridge simultaneously. (Electrical recommendation item – see Electrical section for details) Mechanical portion of this item involves ensuring both sets of pinions are indexed to engage with the ring gear teeth simultaneously.

6 Months (Priority D):

1. The east machinery brake is out of service, with the manual release tie-wired open. The brake should be repaired and returned to service and the manual release lock mechanism should be repaired. **(D - previous recommendation)**

2. Add oil to the east wedge reducer gear box, as required. **(D - previous recommendation)**

3. Apply a rust-arresting type paint system to the track segments and all anchor and connecting bolts. **(D - previous recommendation)**

4. Provide protection from the overhead deteriorated deck slab debris at all motor, brake and reducer locations. **(D - previous recommendation)**

5. Repair paint systems throughout the mechanical systems, with emphasis on connecting bolts and machinery couplings. The paint system used should be suitable for the service environment and be applicable to rusted surfaces cleaned only with solvent and hand tools. **(D - previous recommendation)**

6. Replace desiccant breather filters, as required. **(D - previous recommendation)**

7. Verify lubrication procedures, including grease purging via the purge ports where applicable (miscellaneous couplings and main swing pinion bearings). **(D - previous recommendation)**

8. Replace the machinery brake linings **(E - previous recommendation)**

9. Span drive brakewheel couplings are not purging grease properly leading to contamination of the brakewheel tread surfaces. Replace the coupling seals, use purge ports during regular maintenance/re-greasing, and use epoxy resin to seal spaces around the west brakewheel coupling keyway.

10. Install an oil level sight glass for the center pivot bearing.

11. Temporarily remove, clean, re-align and re-mount the east and west end wedge brakemotors. Related supports should be thoroughly cleaned and re-painted. When re-aligning and re-mounting the brakemotors, use passivated type 316 stainless steel shims and ASTM A449 hex cap screw mounting bolts. Re-align such that the coupling manufacturer's recommended alignment tolerances are met.

12. The west end wedge brakemotor manual brake release lever does not remain in its released position. Repair this lever so that it functions properly.

13. The east end latch does not drop fully into its receiver. Adjust the travel of this end latch so that it does so while ensuring the bridge control system receives the proper indications.

14. Corrosion is progressing at the bases of the barrier gate hydraulic actuators. Re-paint or recondition the actuators.

15. The barrier gate live load shoes are heavily deteriorated. Replace these shoes in kind. Adjust the system so that the gate structures seat firmly on their live load shoes while at the same time the hydraulic system is fully de-pressurized. **(D – previous recommendation)**

16. Replace the temperature gage on the east barrier gate hydraulic power unit.

<u>2 Years (Priority E)</u>:

1. Replace or refurbish the west end wedge motor and all attachment bolts. **(E – previous recommendation)**

2. Reinstall the span drive motor and machinery brake covers **(E - previous recommendation)**

3. Replace the existing filled grid deck slabs that form the roof areas over the machinery spaces. **(E - previous recommendation)**

4. Replace the machinery brake shoe linings. **(E - previous recommendation)**

5. Study the replacement of the existing end latch system with fixed bumpers/stops.

6. Study the replacement of the existing pneumatic emergency drive system.

7. Perform measurements of balance wheel clearance at intermediate opening points as part of the next inspection.

The following recommendations from previous reports have been addressed:

- No deficiencies were noted at the east barrier gate hydraulic cylinder seals **(D – 2014)**
- Repairs were made to the most heavily deteriorated portions of the underside of the deck slab above the pier machinery **(D – 2014)**
- No deficiencies were noted at the east end latch receiver **(E – 2014)**
- No deficiencies were noted at the center pivot bearing fill piping **(E – 2014)**
- Counterweight material has been removed from the east end chords **(E – 2014)**
- No deficiencies were noted at the west barrier gate roller guide system **(E – 2014)**

Appendix A

Mechanical Photographs

Bridge No.	01138	Inspected by:	D. Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M01: Close-up view east span drive motor mounting foot showing signs of new paint when compared to prior report photographs. Still signs of minor corrosion and debris from overhead. Note minor debris buildup on motor housing cooling fins.

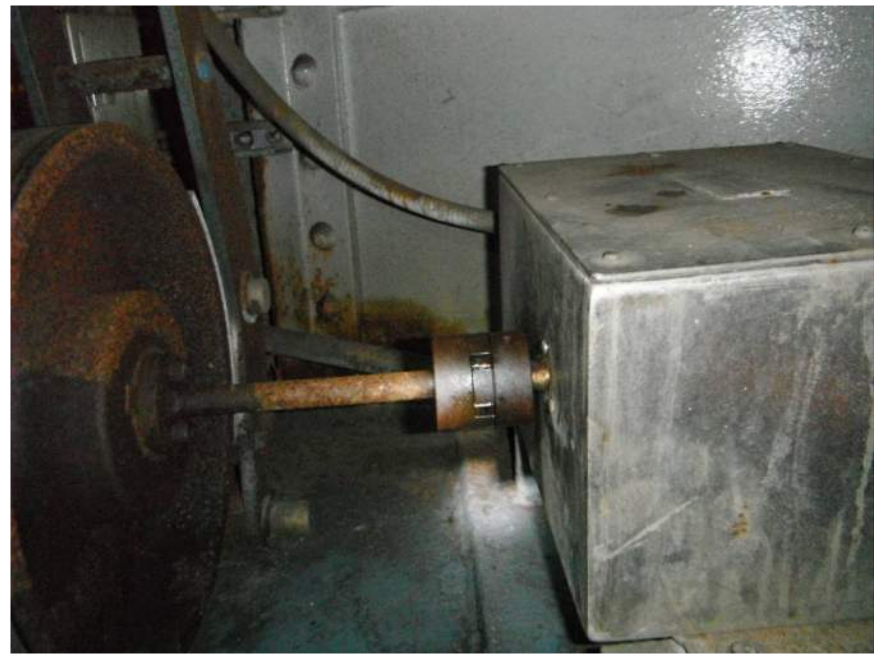


Photo M02: View of west motor rear extension shaft coupled to tachometer/overspeed switch assembly. Note that since the last inspection maintenance staff have installed a new “spider” insert that had been missing from between coupling jaws during the last inspection.

Bridge No.	01138	Inspected by:	D. Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M03: Tachometer / overspeed switch cover screws interfering with coupling

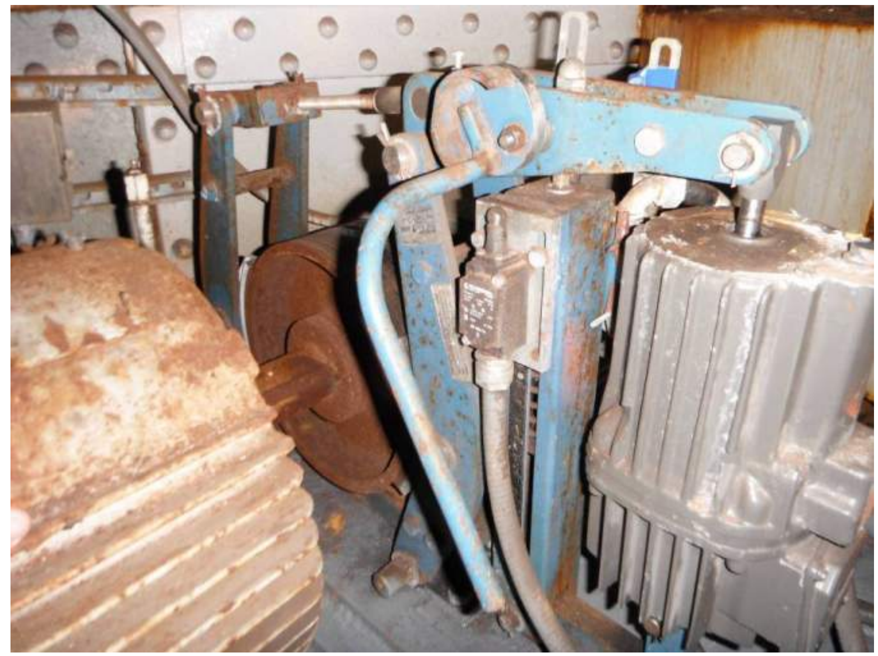


Photo M04: General view of east span drive motor brake.

Bridge No.	01138	Inspected by:	D. Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

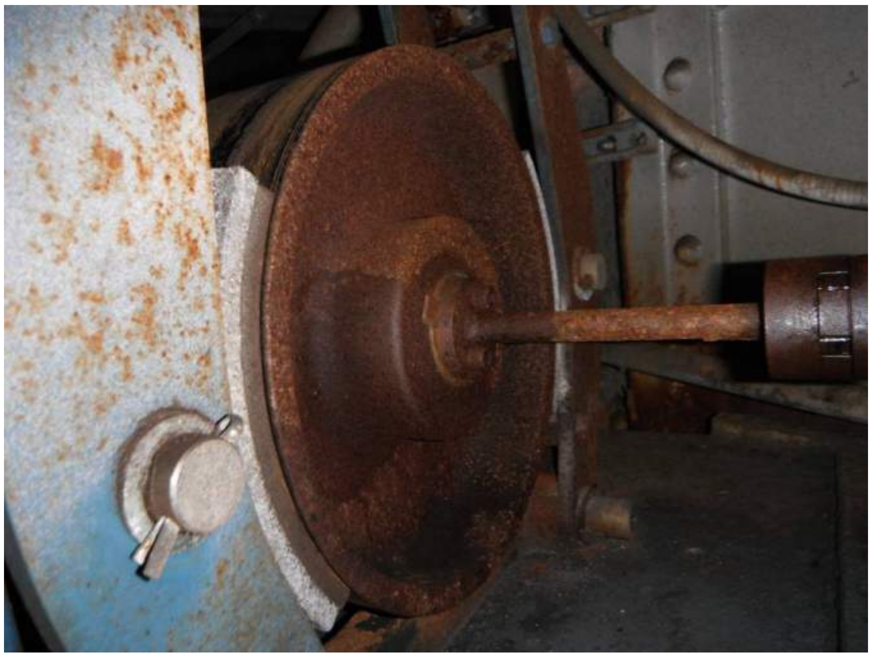


Photo M05: View of west motor rear extension shaft coupled to tachometer/overspeed switch assembly. Note lack of paint protection and light to moderate surface corrosion throughout.

Photo M06: General view of east machinery brake. Note that the manual release lever can no longer be locked in either the engaged or disengaged positions.

Bridge No.	01138	Inspected by:	D. Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

	
Photo M07: View of west machinery brake lining overhanging the brake wheel.	**Photo M08:** View looking up at lower half of west main pinion shaft coupling. Note grease actively purging from lower hub seal as noted during past inspections.

Bridge No.	01138	Inspected by:	D. Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M09: Close-up of purge plugs on west main pinion shaft coupling – plugs show signs of recent movement from maintenance activities.

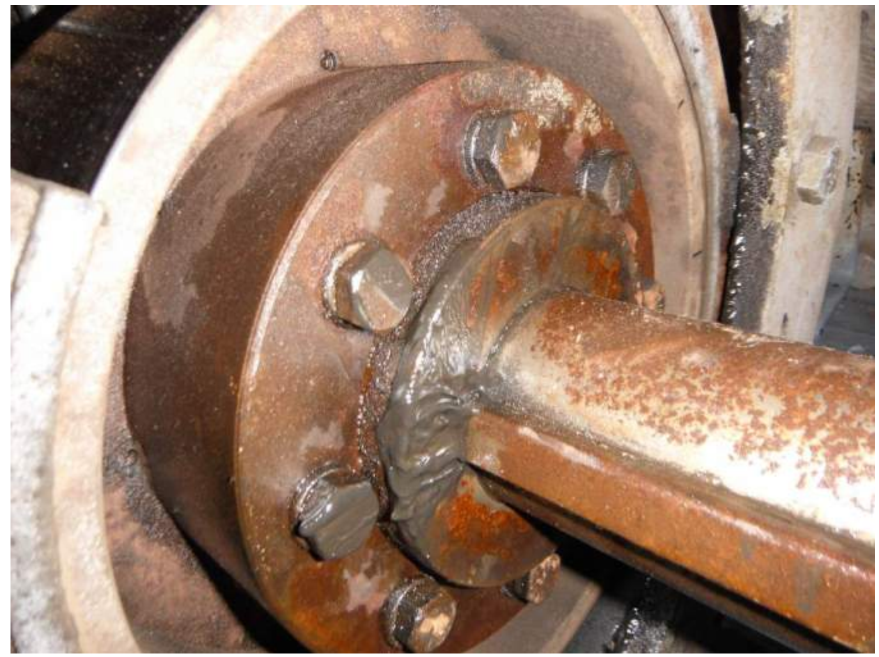


Photo M10: West brake wheel coupling with lubricant leak through keyway

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

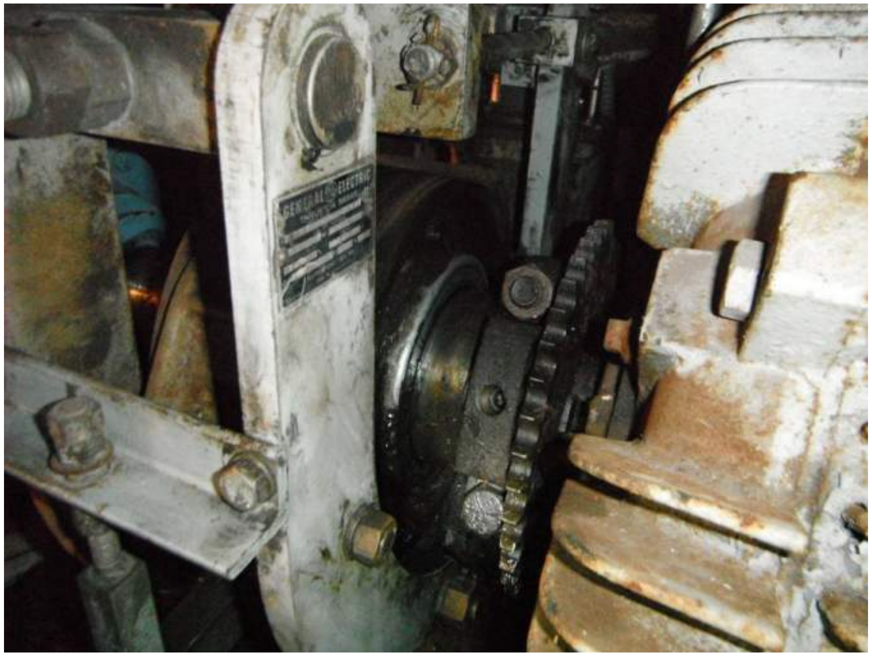


Photo M11: Close-up of west brakewheel coupling, adjacent to manual drive chain sprocket. Note heavy purging of grease through coupling seals. Seals have likely failed.

Photo M12: View of east main pinion shaft, with strain gauge instrumentation from unknown testing. Note good condition, but absence of paint system.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M13: View of west upper pinion shaft bearing.

Photo M14: View of east lower pinion shaft bearing. Note three open holes in face.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M15: Note additional mounting bolt, likely from prior repair or replacement work.

Photo M16: View of east span drive enclosed speed reducer. Note debris accumulation and surface corrosion on top of unit.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M17: View of east span drive reducer desiccant breather requiring replacement.

Photo M18: View of east span drive rotary cam limit switch drivetrain on top of the enclosed speed reducer. Note lack of corrosion protection on open gears.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M19: View of possible light oil seepage from east enclosed speed reducer output shaft bearing.

Photo M20: View looking at rear of east speed reducer lubricating oil circulation pump. Note failing paint protection and surface corrosion on both the housing and mounting bolts.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M21: East circulating pump oil gauge with coagulated oil

Photo M22: West circulating pump with broken oil pressure gauge

Bridge No.	01138		Inspected by
Town:	East Haddam		
Feature Carried:	Route 82		Date Inspect
Feature Crossed:	The Connecticut River		Project No.:

Photo M23: Closeup view of closing face of east main pinion gear showing past impact damage in addendum and topland of tooth.

Photo M24: Close up of opening face of west main pinion gear tooth. Note pitting and scoring

	
Photo M25: Close up of closing face of west main pinion gear tooth.	**Photo M26:** Close up of closing face of west rack gear tooth in segment #10, near where the west pinion engages the rack at fully open position.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

	
Photo M27: Close up of opening face of west rack gear tooth in segment #10, near where the west pinion engages the rack at the fully open position.	**Photo M28:** View looking south at center pivot bearing.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M29: Closeup view of rack/track segment #7, note debris buildup in casting pockets has been removed.

Photo M30: Looking at South East balance wheel

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M31: View looking east at SE center wedge assembly.

Photo M32: View looking west at NW center wedge lower crank/connecting rod assembly.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

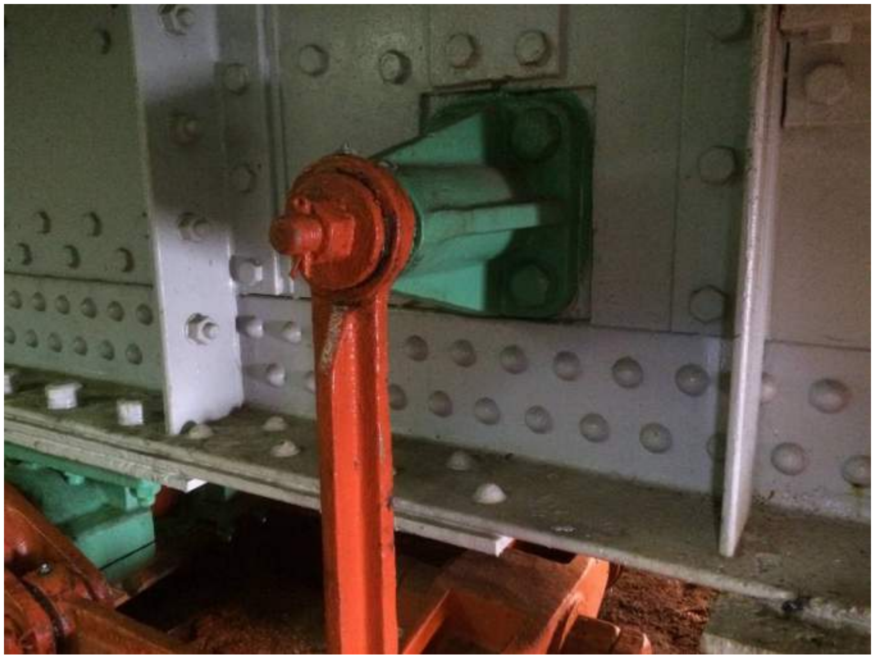


Photo M33: View looking west at NW center wedge inboard rocker arm bearing assembly.

Photo M34: Corrosion on mounting bolts at SE wedge.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M35: View looking up and south at underside of north center wedge gear reducer. Note presence of primer coat only as noted during prior inspection.

Photo M36: View north center wedge gear reducer desiccant breather. Note all of desiccant has turned pink, indicating the breather should be replaced.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M37: View of north center wedge brakemotor housing. Note lack of paint protection and developing surface corrosion.

Photo M38: View of north center wedge rotary cam switch jaw coupling. Note lack of paint protection and surface corrosion.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

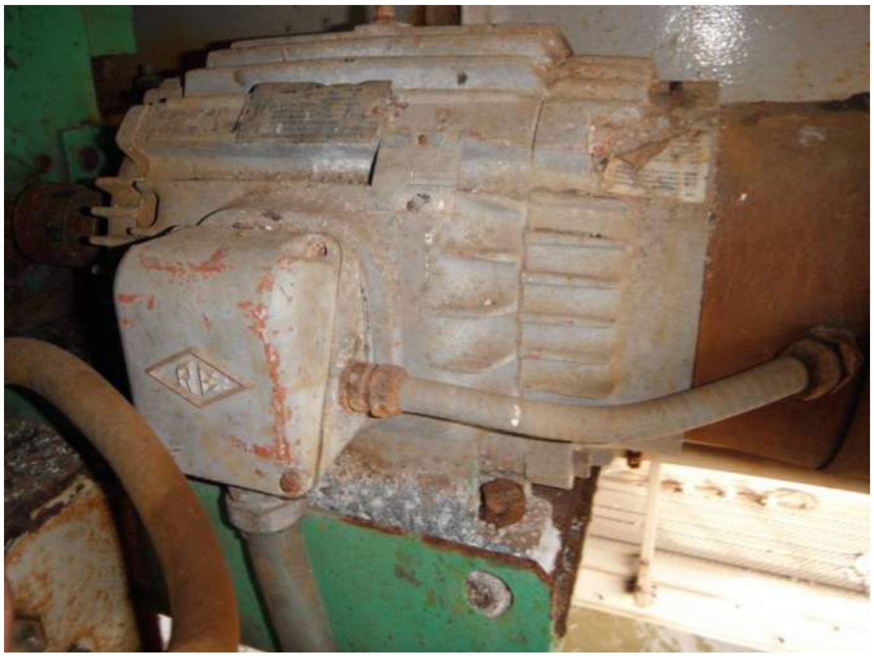


Photo M39: General view of west end wedge brakemotor. Note debris on motor housing and absence of paint protection and developing surface corrosion on disc brake housing and motor output/reducer input shaft and jaw coupling.

Photo M40: View west end wedge reducer oil level sight glass. Note oil level below that recommended by the manufacturer.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M41: View of west end wedge gear reducer desiccant breather. Note almost all desiccant has changed color to pink, indicating the breather requires replacement.

Photo M42: View of west end wedge C2 single engagement gear coupling. Note moderate paint failure and surface corrosion.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M43: View looking south at SE end wedge assembly. Note corrosion between top shim plate and top shoe.

Photo M44: View looking south at NW end wedge assembly.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M45: View of east end latch receiver. Note that spring loaded sliding socket blocks are displaced and latch does not fully seat.

Photo M46: View of east latch not fully seated. Roller on latch follows the steel plates to return back to receiver as the latch does not fully retract to clear the pier prior to the socket blocks.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M47: View of NE barrier gate piston with corrosion at base.

Photo M48: View looking at east barrier gate bottom live load shoe with gap.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M49: View of W barrier gate hydraulic tubing without heat tracing. Tubing at the west gate can be felt pumping under live load.

Photo M46: View of W barrier gate hydraulic equipment. Note broken temperature gauge.

Bridge No.	01138	Inspected by:	D.Biegel, M. Camoscio
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12/2016 & 1/13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo M51: View of west auxiliary drive air motor and sprocket attachment

Photo M52: View of west auxiliary drive chain and sprocket attachment. Note light to moderate surface corrosion throughout the components and less than optimal storage conditions for the chain.

Appendix B

Mechanical Field Data

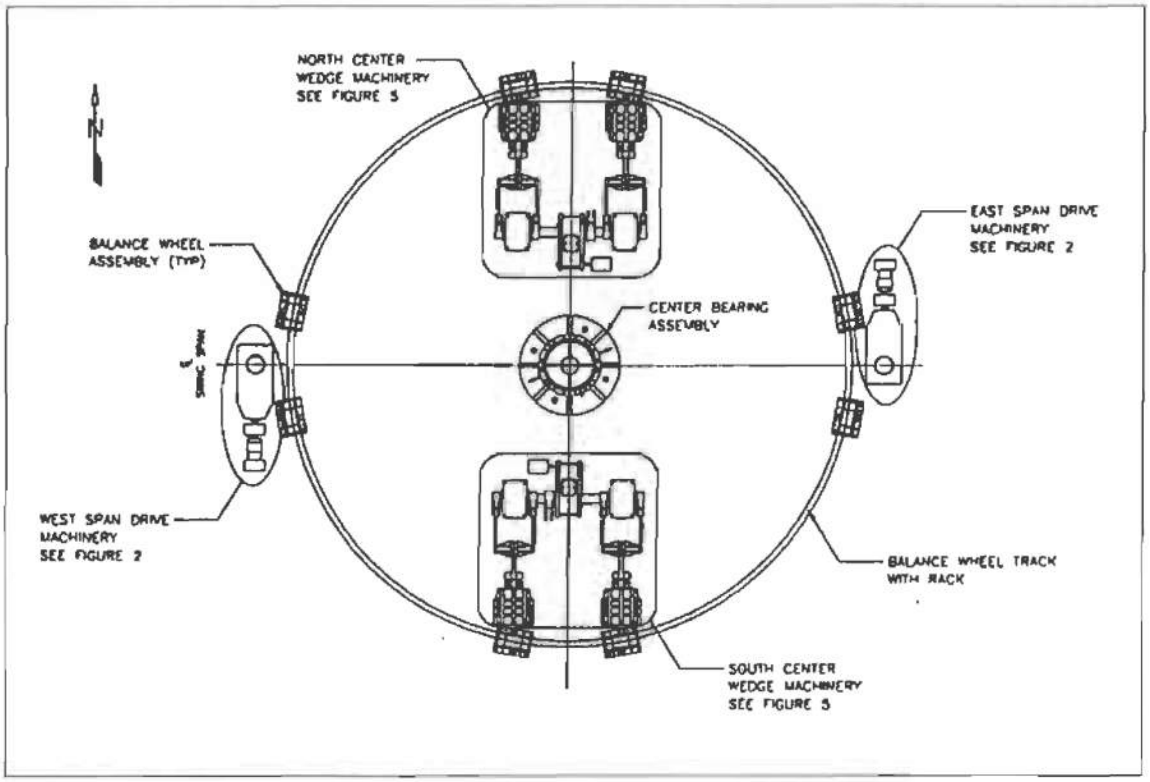


Figure 1: Plan View of Machinery at Center Pier

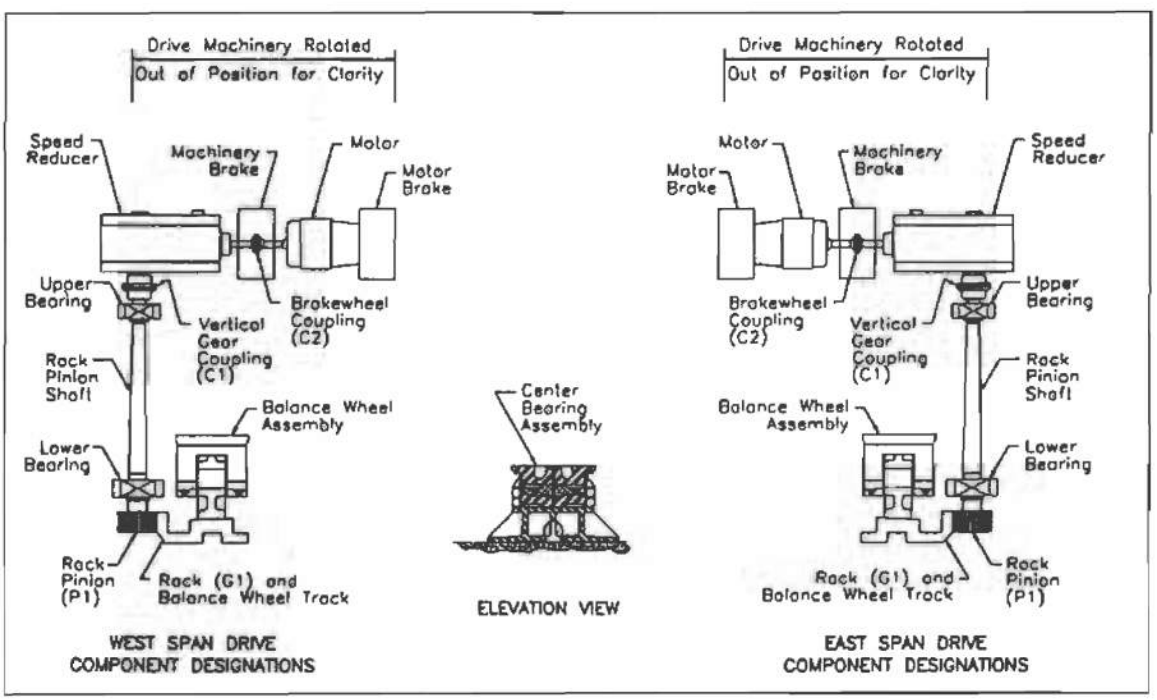


Figure 2: Span Drive Machinery Schematic

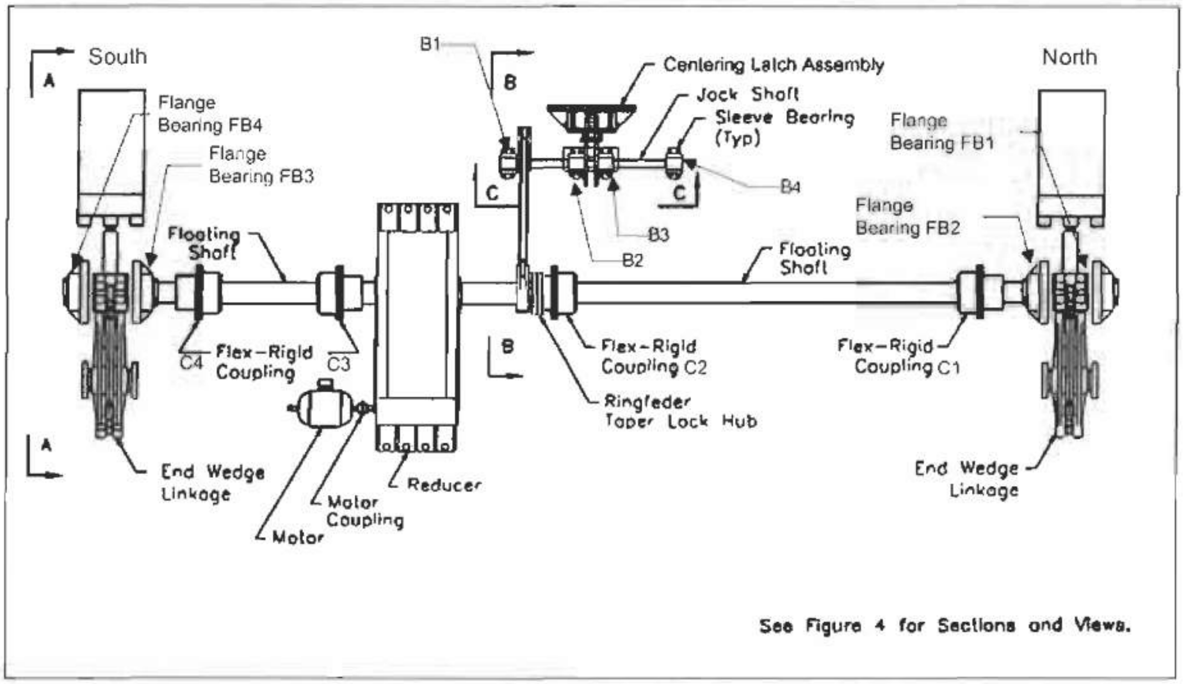


Figure 3: End Wedge Machinery, Plan View

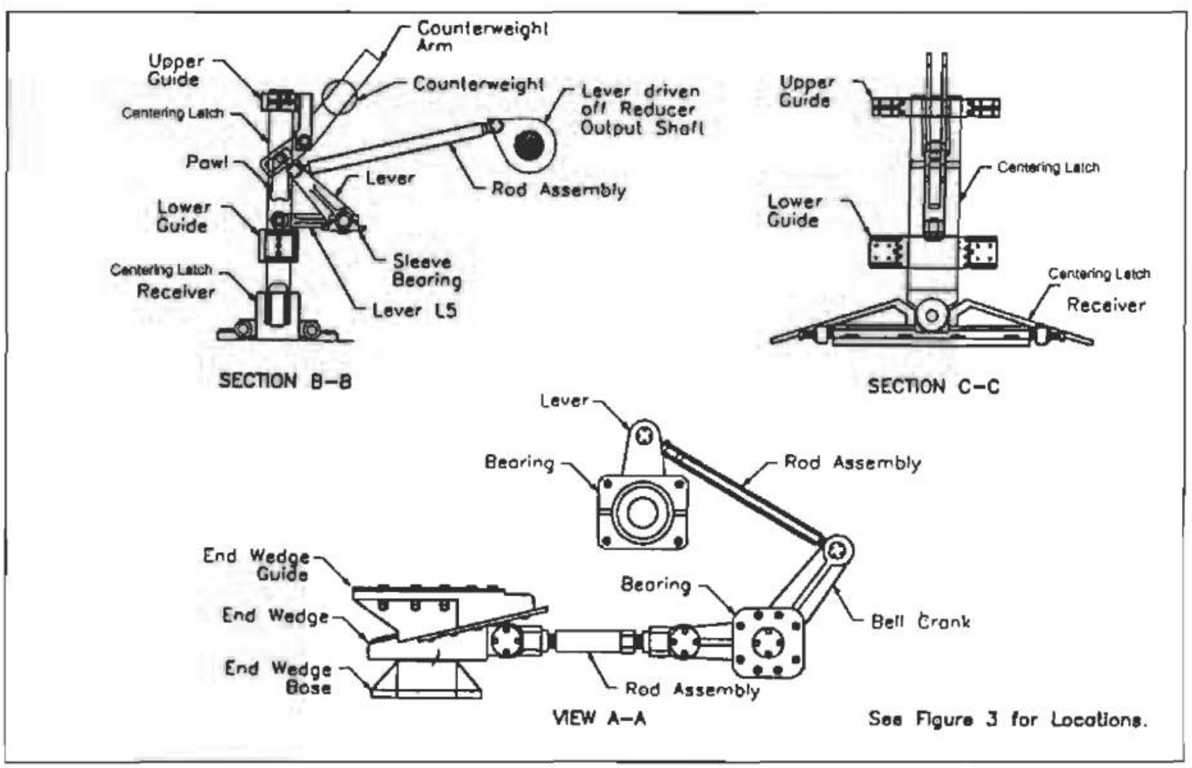


Figure 4: End Wedge and Centering Latch, Views and Sections

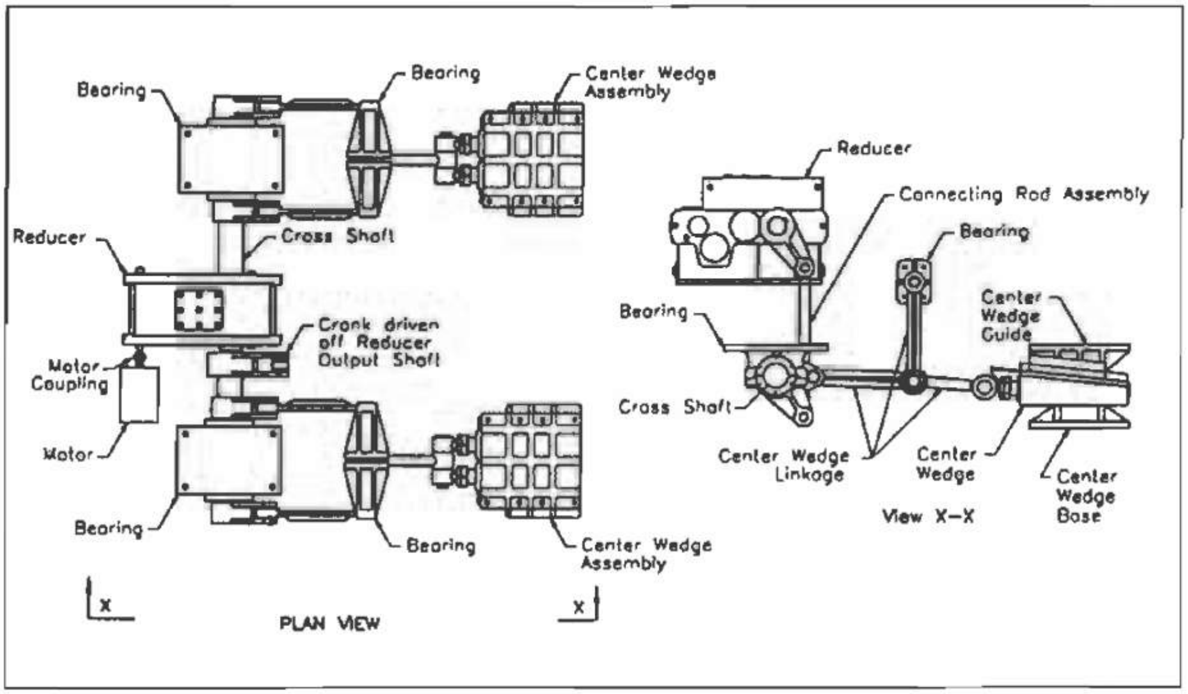


Figure 5: Center Wedge Machinery
Typical – North and South

EAST SPAN DRIVE MOTOR						
Item	**Condition/Nameplate Data**					
Type	Manufacturer:	Sterling Electric			Type:	AC Wound Rotor
	Serial No.:	U6860507			Date Code:	0386
	Product No.:	85-5458			Frame:	444 TX
	Phase:	3	Hz:	60	Ins. Class:	B
	HP:	60	Encl:	TENV	Eff. Code:	93.2
	RPM:	900	Full Load Amps:	81.4	Time Rating:	60 Minute
	Volts:	460			Serv. Factor:	1.15
Fasteners	No deficiencies noted.					
General	Bearing No.: DE 6318 DDE 6315					
	No deficiencies noted with supports. Lube ports do not appear to have been used.					
	Minor debris on motor and components leading to isolated paint loss and light to					
	moderate surface corrosion on motor frame and chock blocks.					
	Instrumentation coupling appears to have been lubricated – coupling does not					
	require any lubrication.					

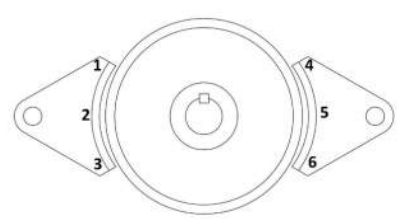
WEST SPAN DRIVE MOTOR						
Item	**Condition/Nameplate Data**					
Type	Manufacturer:	Sterling Electric			Type:	AC Wound Rotor
	Serial No.:	U6860506			Date Code:	0386
	Product No.:	85-5458			Frame:	444 TX
	Phase:	3	Hz:	60	Phase:	3
	HP:	60	Encl:	TENV	HP:	60
	RPM:	900	Full Load Amps:	81.4	RPM:	900
	Volts:	460			Volts:	460
Fasteners	Moderate surface corrosion on bolts and chock blocks has been painted over.					
	Buildup of debris around motor mounting feet seen in 2014 has been cleared.					
General	Bearing No.: DE 6318 DDE 6315					
	No deficiencies noted with supports. Lube ports do not appear to have been used.					
	Minor debris on motor and components leading to isolated paint loss and light to					
	moderate surface corrosion on motor frame and chock blocks.					
	Marginal alignment between motor extension shaft and tachometer/overspeed					
	switch – requires re-alignment. Screws from tach/over-speed switch cover interfere					
	with adjacent coupling hub – may be cause of loud operation.					

Brake ID:	**EAST MOTOR BRAKE**	Brake Type:	Shoe Type Drum Brake, Spring Set, Thrustor Released

	Thrustor	Brake Assembly
Name Plate Data		
	Eldro	Siegerland-Bremsen
	Ed 30/5 2LL5 021-9	D-35708 Halger; Type SB315/30
	No. 06/472654; 300N @ 50mm;	MRB 50-590; Kom-Nr 115545
	3 Ph delta Y 230/460 V ± 10%; 60 Hz	LFD NR 02777; Reibwert u 0.4
	200W; 0.69/0.40 A; I. CL. IP 65; 14 kg	400 N-m Spring Setting
	FL4 Heteung; 220W, 115V Heater	

Thrustor Oil Level	Fill cap jammed – unable to remove		
Spring Setting	400 N-m		
Thrustor Stroke	11/16” on hand release, 3.5 second drop time		
Linings	No deficiencies noted. Pads 6/16” thick.		
Hand Release	Functional, but not smooth		
Limit Switches	Set: OK	Released: OK	Hand Released: OK
Brake Wheel	Minor surface corrosion and moderate surface scoring. Moderate to heavy surface corrosion on unpainted sides of brakewheel.		
Assembly Condition	No cover present. Minor debris buildup on brake and components contributing to various levels of corrosion.		
Mounting Bolts	No deficiencies noted.		
Cover	None		

Lining Contact		1	2	3
Tight when set	S. Face	**Y**	**Y**	**Y**
	N. Face	**Y**	**Y**	**Y**
Free when released	S. Face	**N**	**N**	**N**
	N. Face	**Y**	**Y**	**Y**
		4	5	6
Tight when set	S. Face	**Y**	**Y**	**Y**
	N. Face	**Y**	**Y**	**Y**
Free when released	S. Face	**Y**	**Y**	**Y**
	N. Face	**N**	**N**	**N**



Notes	West shoe does not release when the brake is manually released.
	Brake linkage is tight when manually released.

Brake ID:	**WEST MOTOR BRAKE**	Brake Type:	Shoe Type Drum Brake, Spring Set, Thrustor Released

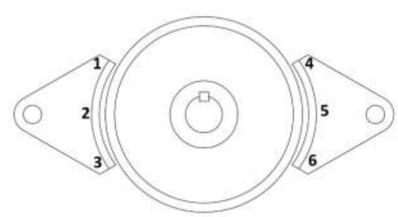
	Thrustor	Brake Assembly
Name Plate Data		
	Eldro	Siegerland-Bremsen
	Ed 30/5 2LL5 021-9	D-35708 Halger; Type SB315/30
	No. 99/461957; 300N @ 50mm;	MRB 50-590; Kom-Nr 115545
	3 Ph delta Y 265/460 V ± 10%; 60 Hz	LFD NR 02777; Reibwert u 0.4
	200W; 0.69/0.40 A; I. CL. IP 65; 14 kg	385 N-m Spring Setting
	FL4 Heteung; 220W, 115V Heater	

Thrustor Oil Level	OK
Spring Setting	375 N-m
Thrustor Stroke	1-1/2" on hand release, 7.5 second drop time
Linings	West pad is axially misaligned 1/8" towards motor – condition acceptable.
	Pads measured to be 21/64" thick.
Hand Release	No deficiencies noted.

Limit Switches	Set: OK	Released: OK	Hand Released: OK

Brake Wheel	Minor to moderate surface corrosion on non-contact surfaces (brakewheel hub, web, etc.). Minor scoring/grooving on drum tread surface.
Assembly Condition	No cover present. Minor debris buildup on brake and components contributing to various levels of corrosion.
Mounting Bolts	Good condition. Minor debris accumulation around bolts.
Cover	None

Lining Contact		1	2	3
Tight when set	N. Face	**Y**	**N**	**Y**
	S. Face	**Y**	**N**	**Y**
Free when released	N. Face	**N**	**Y**	**N**
	S. Face	**Y**	**Y**	**Y**
		4	5	6
Tight when set	N. Face	**Y**	**Y**	**Y**
	S. Face	**Y**	**Y**	**Y**
Free when released	N. Face	**Y**	**Y**	**Y**
	S. Face	**Y**	**Y**	**Y**



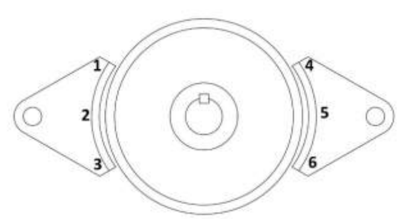
Notes	
	Thrustor was replaced between 2009 and 2011 inspections.
	Corrosion developing on east mounting bolts.

Brake ID:	**EAST MACHINERY BRAKE**	Brake Type:	Shoe Type Drum Brake, Spring Set, Thrustor Released

	Thrustor	Brake Assembly
Name Plate Data		
		General Electric
	GEH 935	GE 9616464T024CB148S
	Cat#9331779D788	5-15/16" spring length for 400 ft-lbs max
	Rest of nameplate illegible	1-1/8" strok; 0.60 ft-lbs min

Thrustor Oil Level	OK
Spring Setting	6"
Thrustor Stroke	Could not be measured (brake is hand released semi-permanently)
Linings	previous axial misalignment of east brake pad appears to be corrected.
	Pads measured to be 12/32" thick.
Hand Release	Hand release is wire tied in the released position.
Limit Switches	Set: OK; Released: OK; Hand Released: OK
Brake Wheel	Good condition. Grease is leaking from brakewheel coupling on to wheel and wheel tread. Minor isolated surface corrosion.
Assembly Condition	No cover present. Minor debris buildup on brake and components contributing to various levels of corrosion.
Mounting Bolts	Minor debris accumulation around bolts. Minor-moderate surface corrosion.
Cover	None

Lining Contact		1	2	3
Tight when set	S. Face	*	*	*
	N. Face	*	*	*
Free when released	S. Face	**Y**	**Y**	**N**
	N. Face	**Y**	**Y**	**N**
		4	5	6
Tight when set	S. Face	*	*	*
	N. Face	*	*	*
Free when released	S. Face	**Y**	**Y**	**Y**
	N. Face	**Y**	**Y**	**Y**



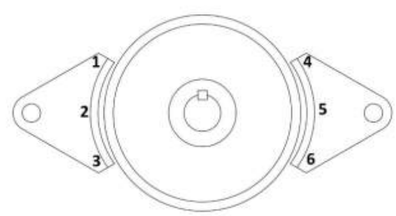
Notes	
	* Clearance when set could not be measured due to tie back of hand release lever
	Brake is out of service.
	Limit switch housings corroded.

Brake ID:	**WEST MACHINERY BRAKE**	Brake Type:	Shoe Type Drum Brake, Spring Set, Thrustor Released

	Thrustor	Brake Assembly
Name Plate Data		
		General Electric
	GEH 935	GE 9616464T021CB148S
	Cat#9331779D788	5-15/16” spring length for 400 ft-lbs max
	Rest of nameplate illegible	1-1/8” stroke; 0.60 ft-lbs min

Thrustor Oil Level	OK
Spring Setting	6-8/32”
Thrustor Stroke	1-10/32” on hand release. Less than 1 second drop time.
Linings	Minor wear depression on the reducer side of the east and west linings.
	Pads measured to be 12/32” thick on south side.
Hand Release	Functioning properly. No detent pin for released position.
Limit Switches	Set: OK; Released: OK; Hand Released: OK
Brake Wheel	Minor surface pitting – heavier on the north end of the tread surface. Minor grooving/scoring.
Assembly Condition	No cover present. Minor debris buildup on brake and components contributing to various levels of corrosion.
Mounting Bolts	Good condition.
Cover	None

Lining Contact		1	2	3
Tight when set	N. Face	**Y**	**Y**	**N**
	S. Face	**Y**	**Y**	**Y**
Free when released	N. Face	**N**	**N**	**Y**
	S. Face	**Y**	**Y**	**Y**
		4	5	6
Tight when set	N. Face	**Y**	**Y**	**Y**
	S. Face	**Y**	**Y**	**N**
Free when released	N. Face	**Y**	**Y**	**Y**
	S. Face	**N**	**Y**	**N**



Notes	
	The east shoe does not fully release when the brake is manually released.

EAST PINION SHAFT COUPLING	
Coupling Identification per Figure 2:	**EAST-VERTICAL GEAR COUPLING (C1)**
NAMEPLATE DATA:	
Coupling Type:	Double engagement gear
Grid/Gear Condition:	NA – coupling was not disassembled
Seal/Gasket Condition:	Minor leaks at split gaskets and lower hub seal. Gasket appears to be working out of split.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Not painted. Minor surface corrosion developing.
Hubs & Keys/Keyways:	Bottom OK. Top inaccessible.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. Two fittings are in the top half; remaining two ports have plugs.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plugs on lower coupling half ports.

WEST PINION SHAFT COUPLING	
Coupling Identification per Figure 2:	**WEST-VERTICAL GEAR COUPLING (C1)**
NAMEPLATE DATA:	
Coupling Type:	Double engagement gear
Grid/Gear Condition:	NA – coupling was not disassembled
Seal/Gasket Condition:	Top hub seal is dislodged around the circumference of the hub. Bottom seal has moderate to significant leakage, with the heaviest on the south face when span closed.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Not painted. Minor surface corrosion developing.
Hubs & Keys/Keyways:	Bottom exhibit minor surface corrosion. Top inaccessible.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One fitting in top half; remaining two ports have plugs.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plugs on lower coupling half ports.

EAST BRAKEWHEEL COUPLING	
Coupling Identification per Figure 2:	**EAST-BRAKEWHEEL COUPLING (C2)**
NAMEPLATE DATA:	
Coupling Type:	Grid/Brakewheel
Grid/Gear Condition:	NA – coupling was not disassembled
Seal/Gasket Condition:	Grease is purging on to brakewheel tread surface
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Not painted.
Hubs & Keys/Keyways:	Motor side keyway inaccessible. Reducer side can be shifted axially.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted.
Comments	Apply paint.
	Monitor reducer-side key as part of future inspections.

WEST BRAKEWHEEL COUPLING	
Coupling Identification per Figure 2:	**WEST-BRAKEWHEEL COUPLING (C2)**
NAMEPLATE DATA:	
Coupling Type:	Grid/Brakewheel
Grid/Gear Condition:	NA – coupling was not disassembled
Seal/Gasket Condition:	Grease is purging through the keyway on reducer side. Motor side hub seal is completely displaced.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Not painted.
Hubs & Keys/Keyways:	Motor side keyway inaccessible. Reducer side can be shifted axially.
Alignment:	No deficiencies noted.
Lubrication:	Grease purging through reducer-side keyway and motor side seal.
Comments	Apply paint.
	Monitor reducer-side key as part of future inspections.

EAST PINION SHAFT	
Identification per Figure 2:	**EAST-RACK PINION SHAFT**
Surface Condition:	Not painted, but no surface corrosion due to grease exiting from Upper Pinion Bearing.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Comments:	Strain gauge and wiring mounted to shaft between bearings.

WEST PINION SHAFT	
Identification per Figure 2:	**WEST-RACK PINION SHAFT**
Surface Condition:	Not painted, but no surface corrosion due to grease exiting from Upper Pinion Bearing.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Comments:	Strain gauge and wiring mounted to shaft between bearings.

Span Drive Bearing Inspection		
Bearing ID:	**EAST – UPPER BEARING**	*(Refer to Figure 2 for location)*
Bearing Type:	Rolling element	
Journal Diameter:	Not measured/Inaccessible	
Clearance	Gap:	Not measured/Inaccessible
	Location:	--
Lubrication:	OK. The top port of the bearing base is open to the environment – a plug cap should be installed.	
Bolts:	Good condition. Mounting bolts have single nuts with no lock washers. Mounting bolts not painted with minor surface corrosion. Double cap bolts in good condition.	
Comments:		
Meither SAFS 55048; Paint protection OK, with isolated areas of paint loss and resulting minor to moderate surface corrosion. Additional pair of mounting bolts with single nuts were added during a past (1990's) repair. Bolts and nuts appear to be unpainted stainless steel and are in good condition.		

Span Drive Bearing Inspection		
Bearing ID:	**EAST – LOWER BEARING**	*(Refer to Figure 2 for location)*
Bearing Type:	Rolling element	
Journal Diameter:	Not measured/Inaccessible	
Clearance	Gap:	Not measured/Inaccessible
	Location:	--
Lubrication:	OK. Minor grease leakage at lower shaft seals. Purge plugs present on bearing housing. Excessive grease buildup on top of pinion from bearing lower seal.	
Bolts:	Good condition. Mounting bolts have single nuts with no lock washers. Mounting bolts not painted with minor surface corrosion. Double cap bolts in good condition.	
Comments:		
Meither SAFS 55544-14; Paint protection OK, with isolated areas of paint loss and resulting minor to moderate surface corrosion. Note: Appears to be non-standard bearing cap provided by original manufacturer (Meither). Additional pair of mounting bolts with single nuts were added during a past (1990's) repair. Bolts and nuts appear to be unpainted stainless steel and are in good condition.		

Span Drive Bearing Inspection		
Bearing ID:	**WEST – UPPER BEARING**	*(Refer to Figure 2 for location)*
Bearing Type:	Rolling element	
Journal Diameter:	Not measured/Inaccessible	
Clearance	Gap:	Not measured/Inaccessible
	Location:	--
Lubrication:	OK. Minor grease leakage at shaft seals. Purge plug present in bearing housing.	
Bolts:	Good condition. Mounting bolts have single nuts with no lock washers. Mounting bolts not painted with minor surface corrosion. Cap bolts in good condition.	
Comments:		
Meither SAFS 55048; Paint protection failing, with resulting minor to moderate surface corrosion.		

Span Drive Bearing Inspection		
Bearing ID:	**WEST – LOWER BEARING**	*(Refer to Figure 2 for location)*
Bearing Type:	Rolling element	
Journal Diameter:	Not measured/Inaccessible	
Clearance	Gap:	Not measured/Inaccessible
	Location:	--
Lubrication:	OK. Minor grease leakage at lower shaft seals. Purge plugs present on bearing housing. Excessive grease buildup on top of pinion from bearing lower seal.	
Bolts:	Good condition. Mounting bolts have single nuts with no lock washers. Mounting bolts not painted with minor surface corrosion. Cap bolts in good condition.	
Comments:		
Meither SAFS 55544-14; Paint protection failing, with resulting minor to moderate surface corrosion. Note: Appears to be non-standard bearing cap provided by original manufacturer (Meither).		

Span Drive Enclosed Gearing				
Coupling Identification per Figure 2:				**EAST-SPEED REDUCER**
Nameplate Data:	Manufacturer:	Philadelphia Gear	Rated HP:	60
	Size/Type:	14VB-3	Ratio:	112.37:1
	Repair Order No.:	D552370 (April 2006)	Input RPM:	900
	Serial No.:	137660-61	Service Factor:	1.75
Lubrication:	Oil level good. Cap was added to drain valve since 2014 inspection.			
Seals:	No deficiencies noted.			
Housing:	No deficiencies noted.			
Bearings:	Minor oil seepage at output shaft bearing cover plate.			
Fasteners:	Moderate corrosion under heads of bolts and washers. Bolt heads unpainted.			
General:	Minor debris buildup on housing, contributing to isolated areas of paint loss and surface corrosion on top of unit. Desiccant breather requires replacement. No inspection hatch from which to examine housing interior. Rotary can switch gears are dry - require either regular lubrication or paint. Half of the rotary cam coupling is not painted. Cover added over switch assembly since 2014 inspection			

Span Drive Enclosed Gearing Lubrication System	
Item:	**EAST-SPEED REDUCER OIL SYSTEM**
Gearmotor:	Paint failure on housing leading to minor surface corrosion. Minor oil seepage at gearmotor output shaft. Moderate surface corrosion on mounting bolts.
Pump:	Heavy corrosion on mounting bolts.
Assembly Support:	Moderate corrosion on mounting bolts.
General:	Heat trace appears to be functioning. Moderate corrosion of jaw coupling between gearmotor and pump. Light buildup of debris on pump and other components contributing to varying levels of surface corrosion. Grease seepage through circulating pump input shaft. Heat trace functioning. Oil in pressure gage has coagulated – leaving the dial illegible. Unclear if temperature is the cause or if gage oil became contaminated.

Span Drive Enclosed Gearing				
Coupling Identification per Figure 2:				**WEST-SPEED REDUCER**
Nameplate Data:	Manufacturer:	Philadelphia Gear	Rated HP:	60
	Size/Type:	14VB-3	Ratio:	112.37:1
	Repair Order No.:	D552370 (April 2006)	Input RPM:	900
	Serial No.:	137660-61	Service Factor:	1.75
Lubrication:	Oil level good. Signs of oil spill during servicing.			
Seals:	No deficiencies noted.			
Housing:	Good condition, but with debris buildup, isolated paint failure and surface corrosion on top and at mounting feet.			
Bearings:	No deficiencies noted.			
Fasteners:	Moderate corrosion under heads of bolts and washers.			
General:	Minor to moderate debris buildup on housing, contributing to isolated areas of paint loss and surface corrosion. Desiccant breather requires replacement. No inspection hatch from which to examine housing interior. Rotary can switch gears are dry - require either regular lubrication or paint. Half of the rotary cam coupling is not painted.			

Span Drive Enclosed Gearing Lubrication System	
Item:	**WEST-SPEED REDUCER OIL SYSTEM**
Gearmotor:	Paint failure on housing leading to minor surface corrosion. Moderate to heavy surface corrosion on housing and mounting bolts.
Pump:	Heavy corrosion on mounting bolts.
Assembly Support:	Moderate corrosion on mounting bolts.
General:	Heat trace appears to be functioning (trace only on suction line). Moderate corrosion of jaw coupling between gearmotor and pump. Heavy buildup of debris on pump and other components contributing to varying levels of surface corrosion. Pressure gage needle broken.

Gear ID		Chordal Tooth Thickness Measurements [All dimensions in inches]						
	Addendum[1]	Original[2]	Meas. 2003	Meas. 2007	Meas. 2009	Meas. 2011	Meas. 2014	**Measured 2016**
P1 East Pinion	1.000	2.062	1.970	1.973 top	1.978 top	1.975 top	1.978 top	**1.980 top**
				1.975 bot	1.975 bot	1.975 bot	1.975 bot	**1.978 bot**
Rack E	1.000		Note that severe tooth tip flow, followed by material removal by grinding wheel as reported by maintenance personnel, prevented obtaining consistent and accurate tooth measurements. The average chordal rack tooth thickness at 1.000"* addendum was 1.907" at the top and 1.950" at the bottom. The original tooth thickness at this addendum depth that is referenced in past inspection reports is 2.088"** While a tooth wear in terms of a percentage has been given in past inspection reports, STV feels this is not informative given that an arbitrary reference addendum was used as the basis for the thickness measurements. The information from the inspection reports made available to STV indicate that little if any tooth wear appears to be occurring.					

1) Chordal thickness measurements were taken at a reference addendum of 1.000" to serve as a basis for comparison with measurements from past inspection reports.

2) No original gear tooth details are available to verify the accuracy of this value – past inspection reports have been used as bases for historical comparison.

Observations:	**P1 EAST PINION**
Opening Face:	Minor pitting and tearing in addendum. Moderate to significant plastic flow with fins in root at dedendum. Plastic flow at pitch line.
Closing Face:	Minor pitting and tearing and abrasive scoring. Foreign matter impact damage in addendum and topland. Moderate to significant plastic flow with fins in root at dedendum.
General:	Pinion axially misaligned 5/8" downward relative to the rack teeth, but still with full face contact. Condition is therefore acceptable to be left as-is.

Observations:		**P1 EAST RACK**
5TH Tooth from Fully Closed	Opening Face:	Moderate plastic flow across whole face. Moderate full face tip flow from past removed. Full contact across face of tooth. Top half of tooth beginning to exhibit minor corrosion. Minor isolated rippling/plastic flow.
	Closing Face:	Moderate to heavy plastic flow across whole face, with the formation of metal ridges/fins. Minor abrasive wear at the tip and over the bottom end of the tooth.
3rd Tooth from Fully Open	Opening Face:	Minor abrasive wear bottom end. Severe tip flow full face removed by grinding in past. Isolated gouges. Moderate to significant plastic flow whole tooth. Tip flow from past removed. Minor corrosion in middle 1/3rd of tooth when lubricant removed
	Closing Face:	Heavy full-face tip flow from past removed. Moderate plastic flow whole face. Minor end flow to bottom. Isolated depression at bottom possibly from foreign object. Minor corrosion in middle 1/3rd of tooth when lubricant removed

Gear ID		Chordal Tooth Thickness Measurements [All dimensions in inches]						
	Addendum[1]	Original[2]	Meas. 2003	Meas. 2007	Meas. 2009	Meas. 2011	Meas. 2014	**Measured 2016**
P1 West Pinion	1.000	2.062	1.975	1.980 top	1.975 top	1.988 top	1.984 top	**1.985 top**
				1.989 bot	1.985 bot	1.991 bot	1.990 bot	**1.990 bot**
Rack W	1.000		Note that severe tooth tip flow, followed by material removal by grinding wheel as reported by maintenance personnel, prevented obtaining consistent and accurate tooth measurements. The average chordal rack tooth thickness at 1.000"* addendum was 1.897" at the top and 1.988" at the bottom. The original tooth thickness at this addendum depth that is referenced in past inspection reports is 2.088"** While a tooth wear in terms of a percentage has been given in past inspection reports, STV feels this is not informative given that an arbitrary reference addendum was used as the basis for the thickness measurements. The information from the inspection reports made available to STV indicate that little if any tooth wear appears to be occurring.					

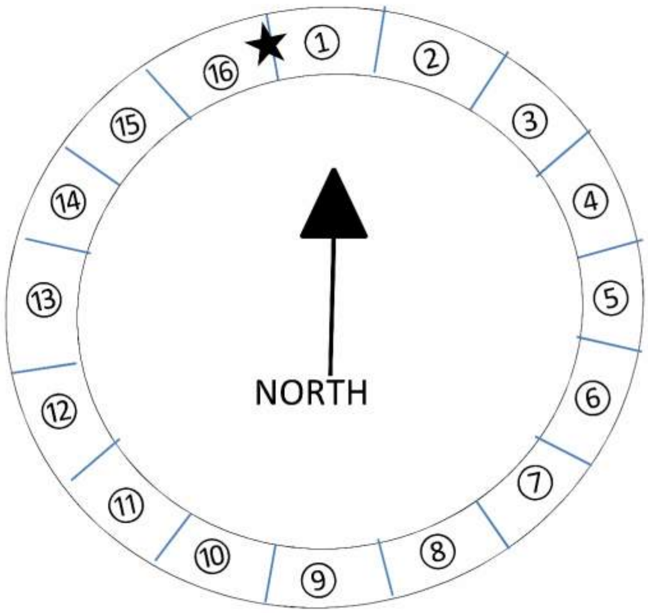
** Chordal thickness measurements were taken at a reference addendum of 1.000" to serve as a basis for comparison with measurements from past inspection reports.*

***No original gear tooth details are available to verify the accuracy of this value – past inspection reports have been used as bases for historical comparison.*

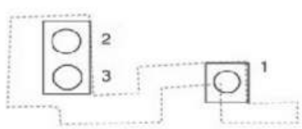
Observations:	**P1 WEST PINION**
Opening Face:	Moderate scoring in the addendum. Minor pitting and tearing is present. Moderate plastic flow was observed at the pitch line into the dedendum. Original machining marks still visible at tips and areas of no contact.
Closing Face:	Moderate to significant scoring in the addendum. Minor pitting and tearing is present. Original machining marks still visible at tips and areas of no contact. Moderate plastic flow was observed at the pitch line and into the dedendum.
General:	Pinion axially misaligned 1/4" downward relative to the rack teeth, but still with full face contact. Condition is therefore acceptable to be left as-is.

Observations:		**P1 WEST RACK**
6[TH] Tooth from Fully Closed	Opening Face:	Full-face contact below 5/16". Minor full-face tip flow. Significant plastic flow in addendum and dedendum and over lip. Pinion shifted 5/16" downards. Minor end-flow to bottom. Minor scoring. Minor pitting and tearing in dedendum.
	Closing Face:	Minor full-face tip flow heavier to bottom. Minor abrasive wear in addendum. Minor/moderate plastic flow whole face. Minor depression in pitch line full-face.
3[rd] Tooth from Fully Open	Opening Face:	Minor abrasive wear in addendum. Severe tip flow-heavier in the top half. Slight pitch line depression. Full-face contact below 5/16". Minor to moderate plastic flow whole face. Minor pitting and tearing in dedendum.
	Closing Face:	Severe full-face tip flow-heavier in the top half. Minor abrasive wear in tip. Noticeable wear depression. Moderate end flow at bottom end. Moderate pitting and tearing in dedendum. Moderate plastic flow full face.

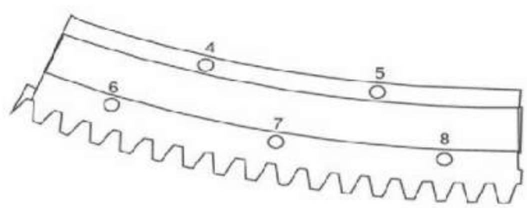
OPEN GEARING -RACK



Rack Segment Identification



Elevation View



Plan View

Figure 6: Rack Mounting Bolt Identification

RACK & TRACK CONDITION:

1. The circular rack and track is comprised of 16 equal cast steel segments. The rack and track are integral.
2. See Figure 6 on the previous page for identification illustrations and bolt/anchor locations.
3. Each segment has 6 drain holes. All drain holes were clear, except a single hole in Segment 7.
4. Typically there was heavy debris buildup and limited access for Segment Bolts #1.

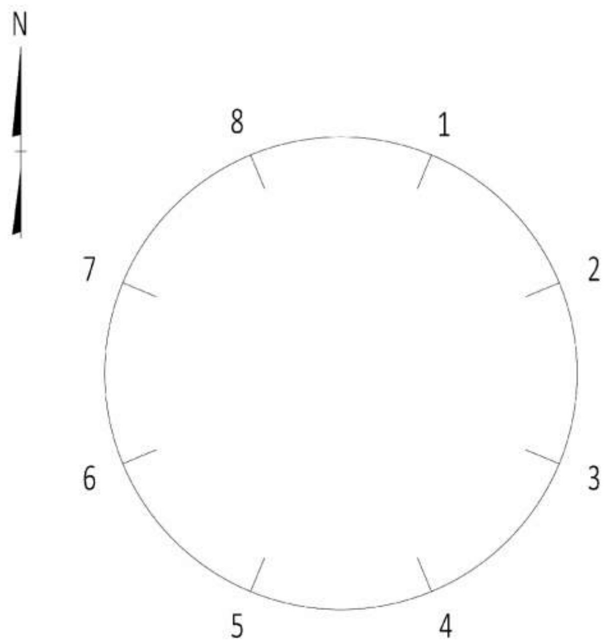
Segment	% Section of Loss by Location of Anchor/Bolt Nuts							
	1	2	3	4	5	6	7	8
1	<10	<10	10	100	70	30	90	40
2	<10	<10	10	100	80	80	90	100
3	60	<10	80	100	100	90	100	100
4	<10	<10	10	20	30	10	20	20
5	<10	<10	30	50	70	40	30	40
6	<10	<10	30	20	20	20	50	10
7	<10	<10	60	30	20	90	80	40
8	<10	<10	30	20	20	80	100	10
9	<10	<10	30	70	20	40	70	10
10	<10	<10	100 h	60	60	50	80	90
11	<10	<10	20	40	80	10	80	80
12	<10	<10	10	10	10	10	10	10
13	<10	<10	<10	50	20	70	10	20
14	<10	<10	20	40	40	10	10	10
15	<10	<10	<10	90	80	100	100	50
16	80/80 h	<10	80/50 h	40	80	70	90	100

Note 1: Segment numbering begins at "★" shown in Figure 6 on the previous page
Note 2: h = head of bolt

BALANCE WHEELS:

Balance wheel clearance measurements were performed with the span closed and all wedges driven.

Weather: Sunny, about 30°F on 1/12/2016
Sunny, about 25°F on 1/13/2016



Balance Wheel Numbering

Wheel No.	Shim Thickness	Approximate Clearance between Bottom of Wheel & Top of Track	Wheel Rotates Freely?
1	0.906” w/ 1/2" spacer plate	0.006”	Yes
2	0.351” w/o spacer plate	0.059”	Yes
3	0.278” w/o spacer plate	0.015”	Yes
4	0.390” w/ 1/2" spacer plate	0.079”	Yes
5	0.416” w/ 1/2" spacer plate	0.116” Outboard/ 0.101” Inboard	Yes
6	0.402” w/o spacer plate	< 0.005”	No
7	0.530” w/o spacer plate	< 0.005”	No
8	1.085” w/ 1/2" spacer plate	0.014”	Yes

BALANCE WHEELS (continued):

Balance Wheel Axle Bearing Clearances				
Wheel No.	Outboard Side		Inboard Side	
	Maximum Clearance	Location	Maximum Clearance	Location
1	0.010”	12:00	0.014”	12:00
2	0.010”	12:00	0.024”	12:00
3	0.010”	12:00	0.012”	12:00
4	0.010”	12:00	0.012”	12:00
5	0.008”	8:00	0.004”	3:00
6	0.010”	6:00	0.003”	11:00
7	0.005”	6:00	0.005”	6:00
8	0.012”	12:00	0.012”	12:00

Notes:

1. See sketch on previous page for balance wheel numbers and locations.
2. All bearings appear to be bronze bushed on the top half only.
3.
4. Bearing at Wheel #7 appears to lack lubrication at the outboard bearing; lubrication at the inboard bearing appears adequate, similar as noted during 2014 inspection

CENTER PIVOT BEARING:

Notes:

1. No oil level sight glass is present.
2. There is minor oil seepage from the fill pipe elbow on the north side.
3. The previously reported bend in the dust skirt/cover on the east side is still present.

Center Wedge Machinery				
Identification per Figure 5:			**NORTH CENTER WEDGE BRAKEMOTOR**	
Nameplate Data:	Manufacturer:	Reuland	Enclosure:	TENV
	Serial No.:	97-3850A-2	RPM:	1800
	Model No.:	85-5458	Insulation:	B
	Horsepower:	2.5 HP		60 Hz
	Volts:	460	NEMA Frame:	184
		3 Phase	Brake Torque:	15 ft-lbs
Lubrication:	No deficiencies noted.			
Supports:	Top of support has no paint protection and minor surface corrosion.			
Fasteners:	No paint present. Moderate surface corrosion.			
General:	Light debris on brakemotor housing and components, contributing to varying degrees of surface corrosion. Manual release operates with no deficiencies.			

Center Wedge Machinery				
Identification per Figure 5:			**SOUTH CENTER WEDGE BRAKEMOTOR**	
Nameplate Data:	Manufacturer:	Reuland	Enclosure:	TENV
	Serial No.:	97-3850A-1	RPM:	1800
	Model No.:	85-5458	Insulation:	B
	Horsepower:	2.5 HP		60 Hz
	Volts:	460	NEMA Frame:	184
		3 Phase	Brake Torque:	15 ft-lbs
Lubrication:	No deficiencies noted.			
Supports:	No deficiencies noted.			
Fasteners:	No paint present. Moderate surface corrosion.			
General:	Light debris on brakemotor housing and components, contributing to varying degrees of surface corrosion. Manual release operates with no deficiencies.			

Center Wedge Machinery				
Identification per Figure 5:		**NORTH CENTER WEDGE SPEED REDUCER**		
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	2.5
	Size/Type:	HLX-4-1204	Ratio:	983.543:1
			Input RPM:	1750
	Serial No.:	305610 6C72598V 8/97	Service Factor:	1.5
	Output Torque:	132,830 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	Oil level 1/2" low in sight glass			
Seals:	Minor oil seepage at input shaft packing seal.			
Housing:	Good condition. Paint appears recent, except for top and bottom of housing.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	Recent paint application did not adequately coat bolts.			
General:	No deficiencies with regard to operation.			
	Motor coupling inaccessible due to guard. No lubrication fitting – only 2 plugs.			
	Light coating of oil/grease over coupling housing.			
	All bearing lubrication fittings OK.			
	Desiccant breather requires replacement.			
	Minor surface corrosion on auxiliary input shaft cover fasteners.			
	No paint and moderate surface corrosion on rotary cam jaw coupling and shaft.			
	North manual operation shaft interlock limit switch is interlocked with the			
	south center wedge drive motor.			

Center Wedge Machinery				
Identification per Figure 5:				**SOUTH CENTER WEDGE SPEED REDUCER**
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	2.5
	Size/Type:	HLX-4-1204	Ratio:	983.543:1
			Input RPM:	1750
	Serial No.:	305610 6C72598V 8/97	Service Factor:	1.5
	Output Torque:	132,830 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	OK.			
Seals:	No deficiencies noted.			
Housing:	Good condition. Paint appears recent, except for top, inboard and mounting feet.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	No deficiencies noted			
General:	The packing type seals for the output shafts are nearing the end of their adjustment.			
	Motor coupling inaccessible due to guard. No lubrication fitting – only 2 plugs.			
	Light coating of oil/grease over coupling housing. Visible portion appears OK.			
	All bearing lubrication fittings OK.			
	Desiccant breather requires replacement.			
	No paint and moderate surface corrosion on rotary cam jaw coupling and shaft.			
	South manual operation shaft interlock limit switch is interlocked with the north center wedge drive motor.			

Center Wedge Machinery				
NORTH CROSS SHAFT BEARINGS				
Bearing Location		Clearance	Location	Shaft Ø
East	Inboard	Inaccessible	--	5”
	Outboard	0.005”	Upper Half	
West	Inboard	Inaccessible	--	
	Outboard	0.007”	Upper Half	

Center Wedge Machinery				
SOUTH CROSS SHAFT BEARINGS				
Bearing Location		Clearance	Location	Shaft Ø
East	Inboard	Inaccessible	--	5”
	Outboard	0.005”	Upper Half	
West	Inboard	Inaccessible	--	
	Outboard	0.007”	Upper Half	

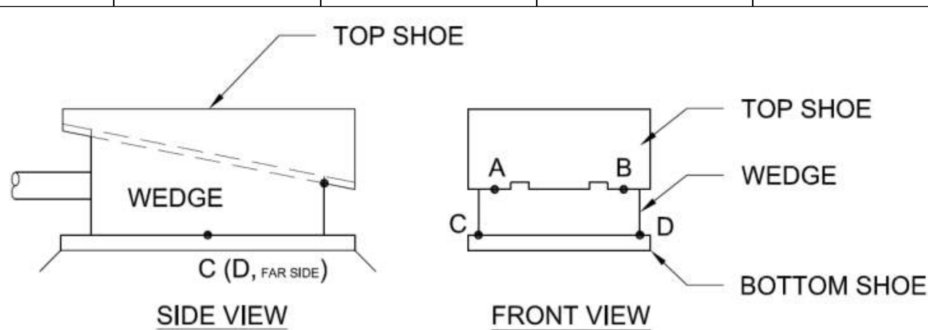
Upper Bearings:

1. Clearance measurements could not be taken due to the linkage orientation.
2. Upper southeast inboard bearing is only primed, not fully painted.

General Comments:

1. Minor debris on components contributing to varying levels of surface corrosion.
2. Paint failing on north base casting mounting bolts.

Center Wedge Machinery				
WEDGE AND SHOE CLEARANCES				
Location	West Wedge		East Wedge	
North Wedges	A - < 0.003”	B - < 0.003”	A - < 0.003”	B - < 0.003”
	C - < 0.003”	D - < 0.003”	C - < 0.003”	D - < 0.003”
South Wedges	A - < 0.003”	B - < 0.003”	A - < 0.003”	B - < 0.003”
	C - < 0.003”	D - < 0.003”	C - < 0.003”	D - < 0.003”



EAST END WEDGE MOTOR						
Item	**Condition/Nameplate Data**					
Type	Manufacturer:	Reuland			Type:	AC Wound Rotor
	Serial No.:				Date Code:	
	Product No.:	85-5458			Frame:	256U
	Phase:	3	Hz:	60	Ins. Class:	
	HP:	7.5	Encl:	TENV	Eff. Code:	
	RPM:	900	Full Load Amps:		Time Rating:	
	Volts:	460			Serv. Factor:	
Fasteners	Top of mounting bolt nuts are moderately corroded with failed or absent paint protection. SW mounting bolt has been replaced. Debris buildup around all bolts/nuts.					
Bearings	Front and rear lubrication fittings appear to not be in use.					
Lubrication	Front and rear lubrication fittings appear to not be in use.					
General	Minor debris on housing and components contributing to varying levels of surface corrosion. Motor coupling (gear type) is not painted and exhibits moderate corrosion.					

Identification per Figure 3:			**EAST END WEDGE SPEED REDUCER**	
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	7.5
	Size/Type:	HLX-4-2004	Ratio:	983.933:1
			Input RPM:	870
	Serial No.:	3056026C72597V 4-97	Service Factor:	1.5
	Output Torque:	802,000 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	OK.			
Seals:	No deficiencies noted.			
Housing:	Very minor, isolated paint failure.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	Channel side mounting bolts exhibit significant paint failure and corrosion.			
General:	Rotary cam coupling not painted and exhibits moderate corrosion. Desiccant breather requires replacement. Light debris on reducer and components contributing to varying levels of surface corrosion. Oil level OK. Smooth operation.			

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**EEW-C1**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	No deficiencies noted.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**EEW-C2**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	Moderate corrosion
Cover Condition:	Indications of cracked paint at split line. Isolated areas of moderate paint failure and surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Moderate paint failure and surface corrosion.

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**EEW-C3**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Indications of cracked paint at split line.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**EEW-C4**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Indications of cracked paint at split line.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

EAST END WEDGE MACHINERY (continued):

Observations:

1. Cross shaft bearings and shafts are in good overall condition.
2. Bearing lubrication appears adequate.
3. Bearings inaccessible for clearance measurements.
4. Contact between wear strips, maximum gaps for both top and bottom of east and west sides of NE wedge <0.005”
5. Contact between wear strips, maximum gaps for both top and bottom of east and west sides of SE wedge <0.005”
6. Limit switch rotary cam coupling has no paint protection and moderate surface corrosion.
7. Threads of connecting rod turnbuckle are greased to prevent corrosion.
8. The south upper wedge guide has minor scoring on the runners.

EAST END WEDGE MACHINERY: CENTERING LATCHES

Pivot Shaft Bearing Clearances		
Bearing No.	Maximum Clearance	Location
East - 1	0.005”	12:00 from N
East - 2	<0.003”	12:00 from S
East - 3	<0.003”	12:00 from N
East - 4	<0.003”	12:00 from N

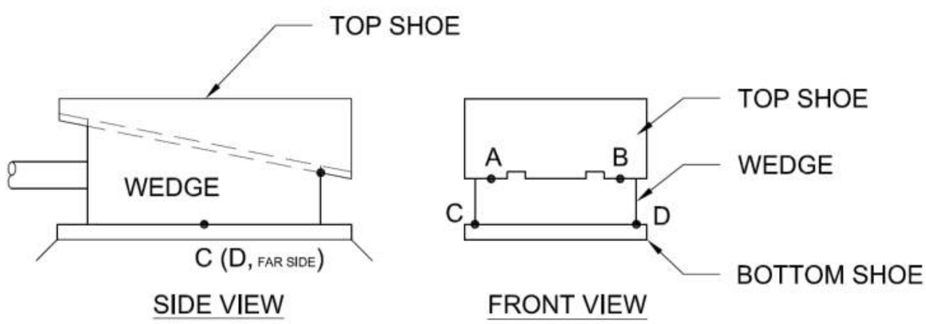
Note: Only accessible from 10:00 to 2:00 (12:00 = vertical)

Observations:

1. Lubrication appears adequate.
2. Bolts in good condition.
3. Light debris buildup on components and housings contributing to varying levels of surface corrosion.
4. Minor surface corrosion on Bearing 1 & 4, moderate surface corrosion on Bearing 3 & 4.
5. The internal springs on the north side of the latch receiver assembly appear non-functional – the north half of the receiver is out of position to the north by approximately 3 inches. Note that the swing span rotates such that the east end of the span should impact the receiver in this direction.

Latch Bar Components	
Latch Bar:	Lubrication appears adequate. Cannot be moved by hand.
Upper Guide:	Mounting bolts exhibit moderate surface corrosion. >0.032” clearance N; 0.006” clearance S
Lower Guide:	Isolated, minor paint failure on mounting bolts. 0.008” clearance N; ,>0.032” clearance S
Retainer Plate:	Allen head cap screws exhibit minor to moderate surface corrosion. Plate exhibits moderate surface corrosion.
Turnbuckle:	No deficiencies noted.
Linkages:	No deficiencies noted.

East End Wedge Machinery				
WEDGE AND SHOE CLEARANCES				
Location	South Wedge		North Wedge	
East Wedges	A - < 0.003”	B - < 0.003”	A - < 0.003”	B - < 0.003”
	C - < 0.003”	D - < 0.003”	C - < 0.003”	D - < 0.003”



WEST END WEDGE MOTOR						
Item	**Condition/Nameplate Data**					
Type	Manufacturer:	Reuland			Type:	AC Wound Rotor
	Serial No.:				Date Code:	
	Product No.:	85-5458			Frame:	256U
	Phase:	3	Hz:	60	Ins. Class:	
	HP:	7.5	Encl:	TENV	Eff. Code:	
	RPM:	900	Full Load Amps:		Time Rating:	
	Volts:	460	Stearns Brake:	50 ft-lbs	Serv. Factor:	
Fasteners	Top of the NE mounting bolt exhibits 100% section loss due to corrosion, along with the attachment point for the motor casting itself.					
Bearings	Front and rear lubrication fittings appear to not be in use.					
Lubrication	Front and rear lubrication fittings appear to not be in use.					
General	Minor debris on housing and components contributing to varying levels of surface corrosion. Brake release does not lock in released position. Rear manual drive shaft cover limit switch is sticking.					

Identification per Figure 3:			**WEST END WEDGE SPEED REDUCER**	
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	7.5
	Size/Type:	HLX-4-2004	Ratio:	983.933:1
			Input RPM:	870
	Serial No.:	3056026C72597V 4-97	Service Factor:	1.5
	Output Torque:	802,000 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	OK.			
Seals:	No deficiencies noted.			
Housing:	Very minor, isolated paint failure.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	Debris buildup at channel side mounting bolts, but bolts in good condition.			
General:	Rotary cam coupling and support have been recently painted. Desiccant breather requires replacement. Light to moderate debris on reducer and components contributing to varying levels of surface corrosion. Smooth operation. Oil level slightly low.			

WEST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**WEW-C1**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**WEW-C2**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	Minor corrosion.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**WEW-C3**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**WEW-C4**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST END WEDGE MACHINERY (continued):

Observations:

1. All components in generally good condition (except as noted).
2. Cross shaft bearings and shafts are in good overall condition.
3. Very isolated, minor paint failure with the beginnings of corrosion on the south lower final flange bearing bolts – inboard and outboard.
4. Bearing lubrication appears adequate.
5. Bearings inaccessible for clearance measurements.
6. Threads of connecting rod turnbuckle are greased to prevent corrosion.
7. Minor debris buildup on components contributing to varying levels of surface corrosion.

WEST END WEDGE MACHINERY: CENTERING LATCHES

Pivot Shaft Bearing Clearances		
Bearing No.	Maximum Clearance	Location
East - 1	< 0.003”	12:00 from S (poor access)
East - 2	0.003”	12:00 from N
East - 3	0.003”	12:00 from S
East - 4	Inaccessible	--

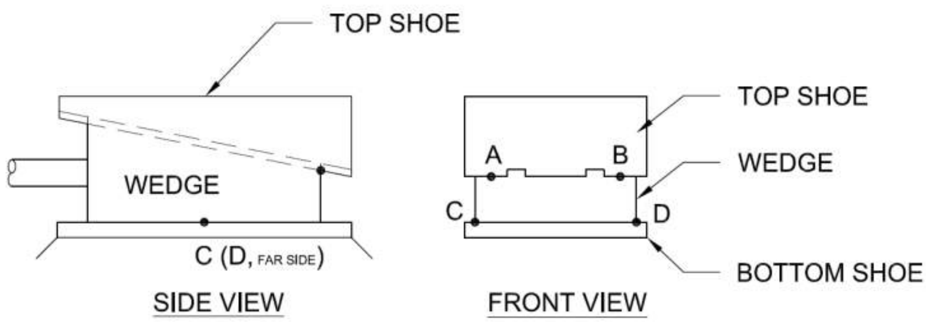
Observations:

1. Lubrication appears adequate.
2. Bolts in good condition.
3. Light debris buildup on components and housings contributing to varying levels of surface corrosion.

Latch Bar Components	
Latch Bar:	Lubrication appears adequate. Cannot be moved by hand.
Upper Guide:	Mounting bolts exhibit moderate surface corrosion. 0.020” clearance N; 0.010” clearance S
Lower Guide:	Isolated, minor paint failure on mounting bolts, exfoliating bolt heads. >0.062” clearance N; ,<0.003” clearance S
Retainer Plate:	Allen head cap screws exhibit minor to moderate surface corrosion. Plate exhibits minor surface corrosion.
Turnbuckle:	Upper jam nut is not painted and is developing minor surface corrosion.
Linkages:	Minor surface corrosion and paint loss.

All components functioned smoothly during test operations.

West End Wedge Machinery				
WEDGE AND SHOE CLEARANCES				
Location	North Wedge		South Wedge	
West Wedges	A - < 0.003”	B - < 0.003”	A - < 0.003”	B - < 0.003”
	C - < 0.003”	D - < 0.003”	C - < 0.003”	D - < 0.003”



NORTHEAST TRAFFIC WARNING GATE	
Model Information:	B&B Roadway Manufacturing CT118-VW4-3-2
Housing:	No deficiencies noted
Anchors/Bolts:	Anchor bolts covered with debris
Lubrication:	Oil level full. Grease application adequate.
Arm:	No deficiencies noted
Motor:	Minor surface corrosion on manual input shaft
Linkage:	Minor corrosion on lower turnbuckle nuts
General:	Minor debris noted within the gate housing resulting in minor corrosion. Manual brake release and manual crank in good condition. Chain tension adequate. Rotary cam limit switch mount and housing are not of substantial construction – two mounting bolts missing.

SOUTHEAST TRAFFIC WARNING GATE	
Model Information:	B&B Electromatic Protect-O-Arm VT40
Housing:	No deficiencies noted
Anchors/Bolts:	4 of 4 anchor bolts not sealed
Lubrication:	Oil level full. Grease application adequate.
Arm:	No deficiencies noted
Motor:	NW reducer mounting channel bolt is loose
Linkage:	Hard contact between lower crank and lower rod end. Upper crank has slid axially to east, but bolts are tight
General:	Minor debris noted within the gate housing resulting in minor corrosion. Manual brake release and manual crank in good condition. Chain tension adequate. Rotary cam limit switch mount and housing are not of substantial construction – two mounting bolts missing.

NORTHWEST TRAFFIC WARNING GATE	
Model Information:	B&B Electromatic Protect-O-Arm VT40
Housing:	No deficiencies noted
Anchors/Bolts:	No deficiencies noted
Lubrication:	Oil level full. Grease application adequate.
Arm:	No deficiencies noted
Motor:	No deficiencies noted
Linkage:	Lower crank and lower rod end are misaligned (not self-locking)
General:	Minor debris noted within the gate housing resulting in minor corrosion. Manual brake release and manual crank in good condition. Chain tension adequate. Rotary cam limit switch mount and housing are not of substantial construction.

SOUTHWEST TRAFFIC WARNING GATE	
Model Information:	B&B Roadway Manufacturing CT118-VW4-3-2
Housing:	No deficiencies noted
Anchors/Bolts:	No deficiencies noted
Lubrication:	Oil level full. Grease application adequate.
Arm:	No deficiencies noted
Motor:	No deficiencies noted
Linkage:	Properly aligned (self-locking)
General:	Minor debris noted within the gate housing resulting in minor corrosion. Manual brake release and manual crank in good condition. Chain tension adequate. Rotary cam limit switch mount and housing are not of substantial construction.

EAST RESISTANCE BARRIER	
HPU:	Reservoir level was good but temperature could not be read. Reservoir was cold to touch. Pressure readings: 700 psi raising/ 750 psi lowering
Cylinders:	No covers on the north and south piston rods; piston rods polished and smooth. No visible oil leaks..
Piping:	Live load pumping could be felt through the hosing/piping. No heat tracing.
General:	Live load seats all need replacement. Hydraulic system needs further evaluation to verify control systems functions, the system does not appear to be fully releasing when the barrier seats.

WEST RESISTANCE BARRIER	
HPU:	Reservoir level was good but temperature could not be read. Reservoir was cold to touch. Pressure readings: 725 psi raising/ 750 psi lowering.
Cylinders:	Lower mounting clevis bolts are undersized; upper pin connections loose but 2 cotter pins are present. No noticeable sag in cylinders after raising the gate. No visible leaks.
Piping:	Hydraulic lines are long with no heat (3/4" diameter).
General:	Longitudinal movement of the barrier gate under live loading with some pumping. This may be due to misadjusted "live load seats". Guide rollers all should be replaced along with their respective attachment bolts. The guide roller system is presently non-functional.

SWING SPAN END DEFLECTIONS		
	North	South
East End	2” ↓	1-3/4” ↓
West End	1” ↓	1-1/4” ↓

Appendix C

Mechanical Field Notes

Couplings:

The pinion shaft couplings are in fair condition. Both east and west pinion shaft couplings exhibit minor to moderate grease leakage at the lower hub seal (see Photograph M07). The covers on both pinion shaft couplings are unpainted and exhibit light rust. The lubrication purge ports are oriented 180 degrees from the grease fittings and do not appear to be in use (see Photograph M08).

The brake wheel couplings are in fair condition. As previously noted, the reducer input shaft key can be moved axially in the keyway by hand. The west brake wheel coupling has a significant leak on the reducer side and motor side hub seal is out. Grease is purging onto the brake drum surface (see Photograph M09). This coupling requires seal replacement at a "Priority D" level (within the next 6 months), since this is the only one of the two machinery brakes currently in use. Paint should be field applied to the couplings. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning. Any solvent use should be investigated carefully for compatibility with the coupling seals. Hand tools should be used with care so as to prevent damage to the seals or contaminants from getting pasts the seals.

Pinion Shafts:

The pinion shafts are in good condition. The shafts appear to lack paint protection, but grease and oil leakage from the coupling, bearings and gear reducer has prevented surface corrosion from developing (see Photograph M10). Paint should be field applied to these shafts. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning. WEST PINION SHAFT WITH STRAIN GAUGE

Pinion Shaft Bearings:

WEST LOWER HAS NEW THREADED RODS

The pinion shaft bearings are in good condition. Both upper and lower bearings on both shafts exhibit minor to moderate surface corrosion (see Photographs M11 and M12). None of the bearing mounting bolts has lock washers or nuts and all are unpainted. Paint should be field applied to these bearings and there mounting and cap bolts. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

the

Enclosed Gear Reducers:

The reducers generally are in good condition (see Photograph M13). As previously noted, light debris on these units is causing various levels of corrosion to them and their ancillary components, particularly their mounting bolts. The desiccant breather on each reducer is brown in color and should be replaced (see Photograph M14). As noted by previous reports, the color of the desiccant is unusual. STV speculates this color could be caused by oil splashing up into the breather desiccant during operation. It could also be that the reducer was inadvertently overfilled sometime after these breathers were installed. STV recommends replacing the breathers, which are relatively inexpensive items (< $200 each retail), and continue to monitor the condition of the breathers as part

6

of regular maintenance until the next routine inspection in two years. If the condition re-occurs, then new piping with a 90-degree (or two 90-degree) bends should be added between the top reducer ports and the breather to eliminate oil splashing into the breathers. TWO 90 BENDS NEED

The open gearing of the rotary cam limits on both units require lubrication or paint protection (see Photograph M15).

There are signs of possible oil seepage at the vertical output shaft lower seal at the east speed reducer (see Photograph M16). This possible condition should be monitored by maintenance forces and as part of future inspections.

The reducer lubrication systems are in fair condition. The heat traces are working on both units. As previously noted, light debris on these units is causing various levels of corrosion to them and their ancillary components. The pump bases and their respective attachment bolts are severely corroded (see Photographs M17 and M18). Touch-up paint should be field applied to pumps, gearmotors and other lubrication system components as needed. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Open Gearing:

The main pinion gears are in adequate condition. As noted in previous reports, both main pinions exhibit minor to moderate wear based on visual observations. The east pinion gear (8.0 inches wide) is axially misaligned 5/8 inch downward relative to the top of the rack teeth. The west pinion gear (8.5 inches wide) is axially misaligned 1/4 inch downward relative to the top of the rack teeth. PHOTO

(scoring)

The east pinion exhibits minor pitting and tearing in the addendum and moderate plastic flow with light fins in the dedendum into the root on the opening face. The closing face exhibits minor pitting, tearing and abrasive scoring with isolated foreign matter impact defects in the addendum and moderate plastic flow with light fins in the dedendum into the root (see Photograph M19). The west pinion exhibits minor pitting and tearing with moderate scoring in the addendum and moderate plastic flow at the pitch line into the dedendum on the opening face. The closing face exhibits minor pitting, tearing and moderate abrasive scoring in the addendum and moderate plastic flow at the pitch line into the dedendum. (see Photographs M20 and M21). MINOR + FINING

Chordal tooth thickness measurements (at an addendum setting of 1 inch) were taken near the top and bottom of the main pinion tooth faces and compared to recent (2001, 2003, 2007 and 2009) measurements.

FIN IS A CAUSED BY LIP ON RACK TEETH

7

RACK #10

the whole closing face. At the near fully open position, west rack teeth exhibit heavy full face tip flow with minor to moderate plastic flow across their entire face (see Photographs M22 and M23). Minor to moderate pitting is present in the dedendum.

Lubrication for the rack and pinions appeared adequate and fresh.

Span Support and Alignment

Center Bearing: but some minor chipped paint

The center bearing assembly is in good condition overall (see Photograph M25). Paint system is in ~~very~~ good condition. The oil level was good. As previously noted, there is a very minor oil leak on the north side of the fill elbow. NOT OBSERVED

Balance Wheels and Track:

HOLES CLEANED EXCEPT 1 HOLE WITH RUSTED DEPOSITS

The track is generaly in adequate condition. There are six drainage holes within each segment; all were found to be open except Segment 7 (see Photograph M24); while all segments had at least minor debris buildup, this segment had the greatest deposition of debris within its casting pockets resulting in the holes being blocked. Of the 128 anchors that secure the circular rack and track, rough 1/4 exhibit 80% or higher levels of section loss and a little over 1/3 exhibit 50% or higher levels of section loss.

The balance wheel assemblies are in good condition. Bearing clearances were checked and minimal wear was detected. Wheel clearances with the track were checked with an average clearance of approximately 1/16 inch except for Wheels 6 and 7 (east pair), these wheels have no clearance.

The track surface itself has some very minor corrosion and has a thin layer of dirt on it. Paint should be field applied to rack/rack segments after all debris is cleared away. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Center Wedges:

The center wedges are in good condtion overall (see Photograph M23). In general, the paint protection on the majority of the center wedge components is in very good condition. In isolated areas, principally near the gearmotors, reducers, etc., light debris on components is causing various levels of surface corrosion.

The north and south wedges were observed to operate as intended with no deficiencies noted. Based on wedge base grease patterns, the bottoms of the wedges were in full contact. The connecting rods, cranks, turnbuckles, and other linkage components were all in good condition with no deficiencies noted (see Photographs M27, M28 and M29). Isolated paint failure is beginning on several linkage components (see Photograph M30). Bearing clearance measurements were taken for the outboard cross shafts at

WEDGE MOVING BARS W/ MINOR CORROSION + EXPANDING NUTS. WORSE ON NORTH

9

MAC 1/12/16

MAIN PINION CHORDAL TOOTH THICKNESS MEASUREMENTS				
YEAR	EAST PINION		WEST PINION	
	TOP	BOTTOM	TOP	BOTTOM
2001	1.973"	1.984"	1.984"	1.990"
2003	1.970"		1.975"	
2007	1.973"	1.975"	1.980"	1.989"
2009	1.978"	1.975"	1.975"	1.985"
2011	1.975"	1.975"	1.988"	1.991"
2014	**1.978"**	**1.975"**	**1.984"**	**1.990"**
2016	1.980"	1.978"	1.985"	1.990"

Based on these measurements little to no wear has occurred since the 2001 inspection.

Chordal tooth thickness measurements (at an addendum setting of 1 inch) were taken near the top and bottom of the rack both faces. Measurements were taken at the eighth tooth away from the respective pinion end of six rack segments total.

RACK CHORDAL TOOTH THICKNESS MEASUREMENTS						
YEAR	WEST PINION TRAVEL REGION					
	Rack Segment No.					
	#12		#11		#10	
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
2011	1.912"	1.993"	1.943"	2.018"	1.935"	2.005"
2014	**1.884"**	**1.975"**	**1.896"**	**2.010"**	**1.912"**	**1.980"**
2016	1.895"	1.985"	1.902"	2.018	1.916"	2.004"
YEAR	WEST PINION TRAVEL REGION					
	Rack Segment No.					
	#4		#3		#2	
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
2011	1.885"	1.964"	1.896"	1.975"	1.933"	1.931"
2014	**1.890"**	**1.964"**	**1.895"**	**1.964"**	**1.935"**	**1.921"**
2016	1.885"	1.962"	1.892"	1.963"	1.935"	1.930"

Differences in the above sets of measurements may be due to past maintenance practices of grinding away plastic flow at the topland of the rack gear teeth to alleviate possible binding with the pinion gearteeth. Since the topland of the gear tooth is a primary reference surface from which chordal tooth measurements are based, sets of measurements of rack gear teeth may not be readily comparable. However, given that the pinion teeth have exhibited little wear in recent years, it is probably not unreasonable to speculate that the rack teeth have similarly not experienced significant wear.

The gear teeth on the east and west sides of the rack assembly generally show signs of moderate wear. East rack teeth exhibit moderate plastic flow with the creation of metal ridges on the closing face near the fully closed position. West rack teeth near the fully closed position exhibit minor full face tip flow and minor to moderate plastic flow across

8

both locations and very minor wear was observed. All lubrication was fresh and adequate.

+ Shaft Bearing Gear Bolts Corrosion

The oil levels in both reducers appeared adequate. The reducer housings are in good condition. Paint protection is in good condition, except for the bottoms and tops of the units (see Photograph M31), which appear to be primed only. The desiccant in the breathers on each reducer (DES-CAS DC-3) were about half pink in color and the breathers should be replaced soon (see Photograph M32). Full

The brakemotors are in fair condition, with isolated paint failure on the motor housings, mounting bolts and fittings. Moderate surface corrosion is present on the rear mounted disc brakes – no paint protection appears to be present on these components (see Photograph M33).

The couplings between the brakemotors and reducers are inaccessible due to protective guards. The couplings at both the north and south reducers have a light coating of oil and no lubrication fittings. The rotary cam jaw couplings and adjacent shafts exhibit moderate surface corrosion and no paint protection (see Photograph M34).

End Wedges / Centering Latches:

The end wedge brakemotors are in fair condition, with the west motor being in a slighty more deteriorated condition (see Photograph M35). Typical on both motors (and most components within the bridge end machinery area) are various levels of minor debris (masonry type materials and road salts) that appears to have originated from the deteriorating overhead structure. This overhead structure is the underside of the filled deck panels that form the bridge end machinery area roof. It appears his roof is formed by four precast deck panels that are bolted to the roadway stringers. The west wedge motor has significant deterioration around its base; the north east connecting bolt upper end exhibits 100% section loss and a section on the motor mounting feet exhibits 100% section loss. This motor was unusualy noisy during subsequent test openings and STV recommends it be refurbished or replaced. All end wedge machinery was observed to operate smoothly.

The end wedge reducers are in good condition. The oil level at the east end is good and the west end is ¾ inches low (see Photograph M36). The desiccant in both east and west reducer breathers (DES-CAS DC-3) has turned almost entirely pink in color and should be replaced (see Photograph M37). As previously noted, the channel side fasteners at both locations are heavily corroded.

The main cross shaft gear couplings are in fair condition, except for noted surface corrosion (see Photograph M38). Typical on all couplings, the lubrication is fresh but the purge ports do not appear to be in use.

10

The wedge assemblies are in good condition (see Photographs M39 and M40), all linkages are tight and well-lubricated.

Both the centering latch assemblies are in good condition. Clearances were checked on the latches and pivot shaft bearings with minimal wear detected. The latch bar receivers have spring loaded north and south sliding socket blocks. The socket blocks on the east were displaced transversely by several inches with respect to the rest of the receiver assemblies (see Photographs M41). This may be due to a failure or jamming of the internal springs. The spring loaded action of the receiver socket blocks on the west side is still functional. The east receiver should be rehabilitated before the west receiver springs begin to fail. It is also suggested that the motor and machinery brake settings be evaluated and the main motor deceleration rates provided by the control system be evaluated with the intent being to slow the rate of deceleration of the swing span as it approaches its fully seated position. This would reduce the impact forces experienced by the centering latches. In the intermediate to long term, it could be considered whether to permanently accept that the bidge will only operate in one direction and eliminate the centering latches entirely by driving the swing span into fixed bumpers. This seating methodology can generally be made to be more reliable than the use of centering latches.

Lubrication is adequate and fresh. During test openings, the latches and wedges functioned smoothly. The wedge seat bearing plates showed minimal wear and are in good condition (see Photograph M42).

PHOTO

There are counterweight materials (concrete blocks) placed within the chord above the east wedges. Damp roadway debris is trapped around these blocks, resulting in deterioration to the chord member. This material should be removed and the respective paint systems and structural members should be evaluated. Steel counterweight plates should be placed in the adjacent storage point.

Paint should be field applied to this equipment after all debris is cleared away. Note that surface preparation should be limited to solvent cleaning or hand tool cleaning.

Traffic Warning Gates and Resistance Barrier Gates

The traffic warning gates are in good condition. All function correctly and minor surface corrosion was observed within the units.

The resistance barrier gates are in adequate condition. The west barrier gate lower guide rollers are non-functional due to frozen / broken rollers (see Photograph M43) and the deteriorated roller bracket connecting hardware.

The east barrier gate live load shoes are in poor condition and should be rehabilitated or replaced (see Photographs M44 and M45). Cylinder rod protective boots were in place and functioning (see Photograph M46). The hydraulic cylinders both have minor seal leaks and the system was observed to be pumping with live load traffic. It appears this

11

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

EAST PINION SHAFT COUPLING	
Coupling Identification per Figure 2:	EAST-VERTICAL GEAR COUPLING (C1)
NAMEPLATE DATA:	
Coupling Type:	Double engagement gear
Grid/Gear Condition:	NA – coupling was not disassembled
Seal/Gasket Condition:	Minor leaks at split gaskets and lower hub seal. Gasket appears to be working out of split.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Not painted. Minor surface corroson developing.
Hub & Keys/Keyways:	Bottom OK. Top inaccessible. ~~Minor grease seepage fom lower key/keyway.~~
Alignment:	No deficiencies noted. TWO ports @ 90°
Lubrication:	No deficiencies noted. ~~One~~ fitting in top half; remaining three ports have plugs.
Comments	Ensure maintenance procedure for applying grease indudes removal of plugs on lower coupling half ports.

WEST PINION SHAFT COUPLING	
Coupling Identification per Figure 2:	WEST-VERTICAL GEAR COUPLING (C1)
NAMEPLATE DATA:	
Coupling Type:	Double engagement gear
Grid/Gear Condition:	NA – coupling was not disassembled
Seal/Gasket Condition:	Top hub seal is dislodged around the circumference of the hub. Bottom seal has moderate to significant leakage. HEAVIER ON N SEAL (2) CLOSED POINTS
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Not painted. Minor surface corrosion developing.
Hub & Keys/Keyways:	Bottom exhibit minor surface corrosion. Top inaccessible.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One fitting in top half; remaining three ports have plugs.
Comments	Ensure maintenance procedure for applying grease indudes removal of plugs on lower coupling half ports.

gate is not fully seating either due to the damaged live load shoes or a faulty hydraulic control valve setting or timing resulting in the cylinder seals being loaded due to live load traffic. Further investigation is recommended.

Auxiliary Span Drive

The pneumatic drive back up system is in fair condition with progressive surface corosion on numerous components (see Photograph M47). It was reported to be is curently disabled. It is unknown when / if this system was ever used. STV notes that typcally pneumatic systems do not function reliably without regular and frequent use. The auxiliary drive chains are being stored in the open and surface corrosion is developing (see Photograph M48). It is recommended the chains be stored removed from their sprockets in a bucket of motor oil to prevent corrosion and to keep them lubricated.

12

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

Span Drive Bearing Inspection		
Bearing ID:	WEST – UPPER BEARING	(Refer to Figure 2 for location)
Bearing Type:	Rolling element	
Journal Diameter:	Not measured/Inaccessible	
Clearance	Gap:	Not measured/Inaccessible
	Location:	--
Lubrication:	OK. Minor grease leakage at shaft seals. Purge plug present in bearing housing.	
Bolt:	Good condition. Mounting bolts have single nuts with no lock washers. Mounting bolts not painted with minor surface corrosion. DOUBLE Cap bolts in good condition.	
Comments:		
Meither SAFS 55048; Paint protection failing, with resulting minor to moderate surface corrosion.		

Span Drive Bearing Inspection		
Bearing ID:	WEST – LOWER BEARING	(Refer to Figure 2 for location)
Bearing Type:	Rolling element	
Journal Diameter:	Not measured/Inaccessible	
Clearance	Gap:	Not measured/Inaccessible
	Location:	--
Lubrication:	OK. Minor grease leakage at lower shaft seals. Purge plugs present on bearing housing. Excessive grease buildup on top of pinion from bearing lower seal. PHOTO	
Bolt:	Good condition. Mounting bolts have single nuts with no lock washers. Mounting bolts not painted with minor surface corrosion. DOUBLE Cap bolts in good condition.	
Comments:		
Meither SAFS 55544-14; Paint protection failing, with resulting minor to moderate surface corrosion.		
Note: Appears to be non-standard bearing cap provided by original manufacturer (Meither).		
[illegible]		

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

EAST PINION SHAFT	
Identification per Figure 2:	EAST-RACK PINION SHAFT
Surface Condition:	Not painted, but no surface corrosion due to grease exiting from Upper Pinion Bearing
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Comments:	STRAIN GAUGE MOUNTED

WEST PINION SHAFT	
Identification per Figure 2:	WEST-RACK PINION SHAFT
Surface Condition:	Not painted, but no surface corrosion due to grease exiting from Upper Pinion Bearing
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Comments:	STRAIN GAUGE MOUNTED

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

Gear ID	Chordal Tooth Thickness Measurements [All dimensions in inches]						
	Addendum*	Original**	Measured 2003	Measured 2007	Measured 2009	Measured 2011	**Measured 2014**
P1 East Pinion	1.000	2.062	1.970	1.973 top 1.975 bot	1.978 top 1.975 bot	1.975 top 1.975 bot	**1.978 top** **1.975 bot**
Rack E	1.000	Note that severe tooth tip flow, followed by material removal by grinding wheel as reported by maintenance personnel, prevented obtaining consistent and accurate tooth measurements. The average chordal rack tooth thickness at 1.000"* addendum was 1.907" at the top and 1.950" at the bottom. The original tooth thickness at this addendum depth that is referenced in past inspection reports is 2.088"** While a tooth wear in terms of a percentage has been given in past inspection reports, STV feels this is not informative given that an arbitrary reference addendum was used as the basis for the thickness measurements. The information from the inspection reports made available to STV indicate that little if any tooth wear appears to be occurring.					

UPDATE

** Chordal thickness measurements were taken at a reference addendum of 1.000" to serve as a basis for comparison with measurements from past inspection reports.*

***No original gear tooth details are available to verify the accuracy of this value – past inspection reports have been used as bases for historical comparison.*

Observations:	**P1 EAST PINION**
Opening Face:	Minor pitting and tearing in addendum. Moderate to significant plastic flow with fins in root at dedendum. Plastic flow at pitch line.
Closing Face:	Minor pitting and tearing and abrasive scoring. Foreign mater impact damage in addendum and topland. Moderate to significant plastic flow with fins in root at dedendum.
General:	PHOTO Pinion axially misaligned 5/8" downward relative to the rack teeth, but still with full face contact. Condition is therefore acceptable to be left as-is.

Observations:		**P1 EAST RACK**
5[TH] Tooth from Fully Closed	Opening Face:	Moderate plastic flow across whole face. Moderate full face tip flow from past removed. Full contact across face of tooth. Top ¾ of tooth beginning to exhibit minor corrosion. Minor isolated rippling/plastic flow.
	Closing Face:	Moderate to heavy plastic flow across whole face, with the formation of metal ridges/fins. Minor abrasive wear at the tip and over the bottom end of the tooth.
3[rd] Tooth from Fully Open	Opening Face:	Minor abrasive wear bottom end. Severe tip flow full face removed by grinding in past. Isolated gouges. Moderate to significant plastic flow whole tooth. Tip flow from past removed. MINOR CORROSION
	Closing Face:	Heavy full-face tip flow from past removed. Moderate plastic flow whole face. Minor end flow to bottom. Isolated depression at bottom possibly from foreign object. MINOR CORROSION

OPEN GEARING -RACK

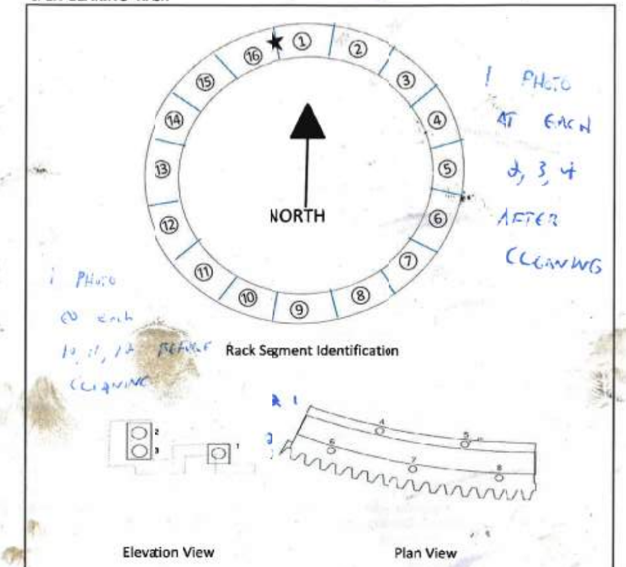


Figure 6: Rack Mounting Bolt Identification

UP

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

Gear ID	Chordal Tooth Thickness Measurements [All dimensions in inches]						
	Addendum*	Original**	Measured 2003	Measured 2007	Measured 2009	Measured 2011	**Measured 2014**
P1 West Pinion	1.000	2.062	1.575	1.980 top	1.975 top	1.988 top	**1.984 top**
				1.989 bot	1.985 bot	1.991 bot	**1.990 bot**
Rack W	1.000	Note that severe tooth tip flow, followed by material removal by grinding wheel as reported by maintenance personnel, prevented obtaining consistent and accurate tooth measurements. The average chordal rack tooth thickness at 1.000"* addendum was 1.897" at the top and 1.988" at the bottom. The original tooth thickness at this addendum depth that is referenced in past inspection reports is 2.088"** While a tooth wear in terms of a percentage has been given in past inspection reports, STV feels this is not informative given that an arbitrary reference addendum was used as the basis for the thickness measurements. The information from the inspection reports made available to STV indicate that little if any tooth wear appears to be occurring.					

** Chordal thickness measurements were taken at a reference addendum of 1.000" to serve as a basis for comparison with measurements from past inspection reports.*

***No original gear tooth details are available to verify the accuracy of this value – past inspection reports have been used as bases for historical comparison.*

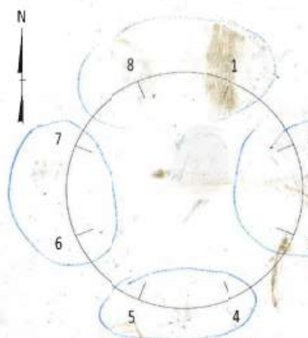
Observations:	P1 WEST PINION
Opening Face:	Moderate scoring in the addendum. Minor pitting and tearing is present. Moderate plastic flow was observed at the pitch line into the dedendum. Original machining marks still visible at tips and areas of no contact.
Closing Face:	Moderate to significant scoring in the addendum. Minor pitting and tearing is present. Original machining marks still visible at tips and areas of no contact. Moderate plastic flow was observed at the pitch line and into the dedendum.
General:	Pinion axially misaligned 1/4" downward relative to the rack teeth, but still with full face contact. Condition is therefore acceptable to be left as is.

Observations:		P1 WEST RACK
6TH Tooth from Fully Closed	Opening Face:	Full-face contact below 5/16". Minor full-face tip flow. Significant plastic flow in addendum and dedendum and over lip. Pinion shifted 5/16" downwards. Minor end-flow to bottom. Minor scoring. Minor pitting and tearing in dedendum.
	Closing Face:	Minor full-face tip flow heavier to bottom Minor abrasive wear in addendum. Minor/moderate plastic flow whole face ~~with metal pieces breaking off~~. Minor depression in pitch line full-face.
3rd Tooth from Fully Open	Opening Face:	Minor abrasive wear in addendum. Severe tip flow-heavier in the top half. Slight pitch line depression. Full-face contact below 5/16". Minor to moderate plastic flow whole face ~~with metal pieces breaking of~~. Minor pitting and tearing in dedendum.
	Closing Face:	Severe full-face tip flow-heavier in the top half. Minor abrasive wear in tip. Noticeable wear depression. Moderate end flow at bottom end. Moderate pitting and tearing in dedendum. Moderate plastic flow full face.

BALANCE WHEELS:

Balance wheel clearance measurements were performed with the span closed and all wedges driven.

Weather: Sunny, about 25°F



Balance Wheel Numbering

Wheel No.	Shim Thickness	Approximate Clearance between Bottom of Wheel & Top of Track	Wheel Rotates Freely?
1	0.506" w/ 1/2" spacerplate	0.006" ~~< 0.005"~~	~~No~~ YES
2	0.3?? w/o 1/2" spacer plate	0.059"	Yes
3	0.278" w/o 1/2" spacer plate	0.015"	Yes
4 0.392"	0.393" w/ 1/2" spacerplate	0.079"	Yes
5	0.416" w/ 1/2" spacerplate	0.134" Outboard/ 0.101" Inboard	Yes
6	0.412" w/o 1/2" spacer plate	< 0.005"	No
7	0.310" w/o 1/2" spacer plate	< 0.005"	No
8	1.085" w/ 1/2" spacerplate	< 0.005"	No YES

0.3 0.510" 0.016" 0.014 0.086" 1 OK

RACK & TRACK CONDITION:

1. The circular rack and track is comprised of 16 equal cast steel segments. The rack and track are integral.
2. See Figure 6 on the previous page for identification illustrations and bolt/anchor locations.
3. Each segment has 6 drain holes. All drain holes were clear, except ~~for those~~ in Segment 7.
4. Typically there was heavy debris buildup and limited access for Segment Bolts #1.

Segment	% Section of Loss by Location of Anchor/Bolt Nuts							
	1	2	3	4	5	6	7	8
1	<10	<10	10	100	70 ~~50~~	30	90	40
2	<10	<10	10	100	10	80	90	100
3	60	<10	80	100	100	90	100	~~90~~
4	<10	<10	10	20	10	10	20	20
5	<10	<10	30	50	10	40	30	40
6	<10	<10	20 ~~30~~	20	10	20	50	10
7	<10	<10	60	30	10	90	80	~~80~~ 40
8	<10	<10	30	70 ~~10~~	10	80	100	10
9	<10	<10	3 ~~20~~	70 ~~60~~	10	40	70	10
10	<10	<10	100h	60	10	50	80	90
11	<10	<10	80/40h	40	10	10	80	80
12	<10	<10	20h	10	10	10	10	10
13	<10	<10	<10	50	10	70	10	20
14	<10	<10	20	40 ~~20~~	10	~~20~~ 10	10	10
15	<10	<10	<10	90	10	100	100	50 ~~40~~
16	80/80h	<10	80/50h	40	10	70 ~~50~~	90	100

Note 1: Segment numbering begins at "★" shown in Figure 6 on the previous page
Note 2: h = head of bolt

20 10

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

BALANCE WHEELS (continued):

Balance Wheel Axle Bearing Clearances				
Wheel No.	Outboard Side		Inboard Side	
	Maximum Clearance	Location	Maximum Clearance	Location
1	~~0.008"~~ 0.010	12:00	0.014"	~~9:00~~ 12
2	0.010"	12:00	0.024"	12:00
3	~~0.007"~~ 0.010	12:00	0.012"	12:00
4	0.010"	12:00	0.013" 0.012	12:00
5	~~0.011"~~ 0.008	~~12:00~~ 5	0.004"	~~3:00~~ 11
6	0.011" 0.015	6:00	0.003"	11:00
7	~~0.003"~~ 0.005	6:00	0.005"	~~4:00~~ 1:00
8	0.012"	12:00	~~0.005"~~ 0.012	~~11:00"~~ 12

Notes:

1. See sketch on previous page for balance wheel numbers and locations.
2. All bearings appear to be bronze bushed on the top half only.
3. ~~Bearing at Wheel #3 pumps under traffic live load although wheel can be rotated freely by hand.~~
4. Bearing at Wheel #7 appears to lack lubrication at the outboard bearing; lubrication at the inboard bearing appears adequate.

STILL TRUE

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

Center Wedge Machinery				
Identification per Figure 5:			NORTH CENTER WEDGE BRAKEMOTOR	
Nameplate Data:	Manufacturer:	Reuland	Enclosure:	TENV
	Serial No.:	97-3850A-2	RPM:	1800
	Model No.:	85-5458	Insulation:	B
	Horsepower:	2.5 HP		60 Hz
	Volts:	460	NEMA Frame:	184
		3 Phase	Brake Torque:	15 ft-lbs
Lubrication:	No deficiencies noted.			
Supports:	Top of support has no paint protection and minor surface corrosion.			
Fasteners:	No paint present. Moderate surface corrosion.			
General:	Light debris on brakemotor housing and components, contributing to varying degrees of surface corrosion. Manual release operates with no deficiencies.			

Center Wedge Machinery				
Identification per Figure 5:			SOUTH CENTER WEDGE BRAKEMOTOR	
Nameplate Data:	Manufacturer:	Reuland	Enclosure:	TENV
	Serial No.:	97-3850A-1	RPM:	1800
	Model No.:	85-5458	Insulation:	B
	Horsepower:	2.5 HP		60 Hz
	Volts:	460	NEMA Frame:	184
		3 Phase	Brake Torque:	15 ft-lbs
Lubrication:	No deficiencies noted.			
Supports:	No deficiencies noted.			
Fasteners:	No paint present. Moderate surface corrosion.			
General:	Light debris on brakemotor housing and components, contributing to varying degrees of surface corrosion. Manual release operates with no deficiencies.			

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

Center Wedge Machinery				
Identification per Figure 5:	**NORTH CENTER WEDGE SPEED REDUCER**			
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	2.5
	Size/Type:	HLX-4-1204	Ratio:	983.543:1
			Input RPM:	1750
	Serial No.:	305610 6C72598V 8/97	Service Factor:	1.5
	Output Torque:	132,830 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	Oil level 1/2" low in sight glass			
Seals:	Minor oil seepage at input shaft packing seal.			
Housing:	Good condition. Paint appears recent, except for top and bottom of housing.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	Recent paint application did not adequately coat bolts.			
General:	No deficiencies with regard to operation.			
	Motor coupling inaccessible due to guard. No lubrication fitting – only 2 plugs.			
	Light coating of oil/grease over coupling housing.			
	All bearing lubrication fittings OK.			
	Desiccant breather requires replacement.			
	Minor surface corrosion on auxiliary input shaft cover fasteners. ~~1-SHAFT~~			
	No paint and moderate surface corrosion on rotary cam jaw coupling and shaft.			
?	North manual operation shaft interlock limit switch is interlocked with the south center wedge drive motor.			

LL

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

Center Wedge Machinery				
NORTH CROSS SHAFT BEARINGS (INNER)				
Bearing Location		Clearance	Location	Shaft Ø
East	Inboard	Inaccessible	--	5"
	Outboard	0.005"	Upper Half	
West	Inboard	Inaccessible	--	
	Outboard	0.007"	Upper Half ~~just above split~~	

Center Wedge Machinery				
SOUTH CROSS SHAFT BEARINGS (INNER)				
Bearing Location		Clearance	Location	Shaft Ø
East	Inboard	Inaccessible	--	5"
	Outboard	0.005"	Upper Half	
West	Inboard	Inaccessible	--	
	Outboard	0.007"	Upper Half	

Upper Bearings:

1. Clearance measurements could not be taken due to the linkage orientation.
2. Upper southeast inboard bearing is only primed, not fully painted.

General Comments:

1. Minor debris on components contributing to varying levels of surface corrosion.
2. Paint failing on north base casting mounting bolts.

	CWM	SHOES / CLEARANCE
SOUTH WEDGE	EAST A C < 0.003 B D	WEST A C < 0.003 B D
NORTH WEDGE	EAST A C < 0.003 B D	WEST A C < 0.003 B D

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

EAST END WEDGE MOTOR

Item	Condition/Nameplate Data					
Type	Manufacturer:	Reuland			Type:	AC Wound Rotor
	Serial No.:				Date Code:	
	Product No.:	85-5458			Frame:	256U
	Phase:	3	Hz:	60	Ins. Class:	
	HP:	7.5	Encl:	TENV	Eff. Code:	
	RPM:	900	Full Load Amps:		Time Rating:	
	Volts:	460			Serv. Factor:	
Fasteners	Top of mounting bolt nuts are moderately corroded with failed or absent paint protection. SW mounting bolt has been replaced. Debris buildup around all bolts/nuts.					
Bearings	Front and rear lubrication fittings appear to not be in use.					
Lubrication	Front and rear lubrication fittings appear to not be in use.					
General	Minor debris on housing and components contributing to varying levels of surface corrosion. Motor coupling (gear type) is not painted and exhibits moderate corrosion.					

EAST END WEDGE SPEED REDUCER

Identification per Figure 3:				
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	7.5
	Size/Type:	HLX-4-2004	Ratio:	983.933:1
			Input RPM:	870
	Serial No.:	3056026C72597V4-97	Service Factor:	1.5
	Output Torque:	802,000 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	OK.			
Seals:	No deficiencies noted.			
Housing:	Very minor, isolated paint failure.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	Channel side mounting bolts exhibit significant paint failure and corrosion.			
General:	Rotary cam coupling not painted and exhibits moderate corrosion. Desiccant breather requires replacement. Light debris on reducer and components contributing to varying levels of surface corrosion. Smooth operation			

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	EEW-C1
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grd/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	No deficiencies noted.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	EEW-C2
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grd/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	~~No deficiencies noted.~~ Mod corrosion
Cover Condition:	Indications of cracked paint at split line. Isolated areas of ~~minor~~ mod paint failure and surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	~~Minor~~ paint failure and surface corrosion.
	mod

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**EEW-C3**
NAMEPLATE DATA:	
Couping Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Indications of cracked paint at split line.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**EEW-C4**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	No deficiencies noted.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Indications of cracked paint at split line.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

EAST END WEDGE MACHINERY (continued):

Observations:

1. Cross shaft bearings and shafts are in good overall condition.
2. Bearing lubrication appears adequate.
3. Bearings inaccessible for clearance measurements.
4. Contact between wear strips, maximum gaps for both top and bottom of east and west sides of NE wedge <0.005"
5. Contact between wear strips, maximum gaps for both top and bottom of east and west sides of SE wedge <0.005"
6. Limit switch rotary cam coupling has no paint protection and moderate surface corrosion.
7. Threads of connecting rod turnbuckle are greased to prevent corrosion.
8. The south upper wedge guide has minor scoring on the runners.

EAST END WEDGE MACHINERY: CENTERING LATCHES

Pivot Shaft Bearing Clearances		
Bearing No.	Maximum Clearance	Location
East - 1	0.005"	12:00 from N
East - 2	<0.003"	12:00 from S
East - 3	<0.003"	12:00 from N
East - 4	<0.003"	12:00 from N

Observations:

1. Lubrication appears adequate.
2. Bolts in good condition.
3. Light debris buildup on components and housings contributing to varying levels of surface corrosion.
4. ~~Isolated~~ minor surface corrosion on Bearing East – 3. 1+4 mod 2+3
5. The internal springs on the north side of the latch receiver assembly appear non-functional – the north half of the receiver is out of position to the north by approximately 3 inches. Note that the swing spar rotates such that the east end of the span should impact the receiver in this direction.

Latch Bar Components	
Latch Bar:	Lubrication appears adequate. Cannot be moved by hand.
Upper Guide: >0.030	Mounting bolts exhibit moderate surface corrosion. 0.014" clearance N; 0.021" clearance S 0.006
Lower Guide:	Isolated, minor paint failure on mounting bolts. >0.025" clearance N; 0.003" clearance S >0.032
Retainer Plate:	Allen head cap screws exhibit minor to moderate surface corrosion. Plate exhibits moderate surface corrosion.
Turnbuckle:	No deficiencies noted.
Linkages:	No deficiencies noted.

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

WEST END WEDGE MOTOR						
Item	**Condition/Nameplate Data**					
Type	Manufacturer:	Reuland			Type:	AC Wound Rotor
	Serial No.:				Date Code:	
	Product No.:	85-5458			Frame:	256U
	Phase:	3	Hz:	60	Ins. Class:	
	HP:	7.5	Encl:	TENV	Eff. Code:	
	RPM:	900	Full Load Amps:		Time Rating:	
	Volts:	460	Stearns Brake:	50 ft-lbs	Serv. Factor:	
Fasteners	Top of the NE mounting bolt exhibits ~~100% section loss due to~~ corrosion, ~~along with the attachment point for the motor casting itself.~~ major DC-NMI					
Bearings	Front and rear lubrication fittings appear to not be in use.					
Lubrication	Front and rear lubrication fittings appear to not be in use.					
General	Minor debris on housing and components contributing to varying levels of surface corrosion. Brake release is good. Rear manual drive shaft cover limit switch is sticking.					

Identification per Figure 3:	WEST END WEDGE SPEED REDUCER			
Nameplate Data:	Manufacturer:	Foote Jones Illinois Gear	Rated HP:	7.5
	Size/Type:	HLX-4-2004	Ratio:	983.933:1
			Input RPM:	870
	Serial No.:	3056026C72597V 4-97	Service Factor:	1.5
	Output Torque:	802,000 in-lbs	Lubricant:	5EP AGMA (ISO = C220)
Lubrication:	OK.			
Seals:	No deficiencies noted.			
Housing:	Very minor, isolated paint failure.			
Bearings:	Inspection cover not removed.			
Gears:	Inspection cover not removed.			
Fasteners:	Debris buildup at channel side mounting bolts, but bolts in good condition.			
General:	Rotary cam coupling not painted and exhibits moderate corrosion. Desiccant breather requires replacement. Light debris on reducer and components contributing to varying levels of surface corrosion. Smooth operation.			

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

WEST

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	WEW-C1
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	WEW-C2
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No ~~deficiencies noted.~~ minor corrosion
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

WEST

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**WEW-C3**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST

EAST END WEDGE MACHINERY: CROSS SHAFT COUPLING	
Coupling Identification per Figure 3:	**WEW-C4**
NAMEPLATE DATA:	
Coupling Type:	Single engagement gear
Grid/Gear Condition:	Not inspected – coupling was not disassembled
Seal/Gasket Condition:	Minor grease seepage at flex half.
Cap & Housing Bolts:	No deficiencies noted.
Cover Condition:	Paint failure and heavy surface corrosion.
Hubs & Keys/Keyways:	No deficiencies noted.
Alignment:	No deficiencies noted.
Lubrication:	No deficiencies noted. One grease fitting and one plug fitting present.
Comments	Ensure maintenance procedure for applying grease includes removal of
	plug fittings.
	Minor paint failure and surface corrosion.

WEST END WEDGE MACHINERY (continued):

Observations:

1. All components in generally good condition (except as noted).
2. Cross shaft bearings and shafts are in good overall condition.
3. Very isolated, minor paint failure with the beginnings of corrosion on the south lower final flange bearing bolts – inboard and outboard.
4. Bearing lubrication appears adequate.
5. Bearings inaccessible for clearance measurements.
6. Threads of connecting rod turnbuckle are greased to prevent corrosion.
7. Minor debris buildup on components contributing to varying levels of surface corrosion.

minor

WEST END WEDGE MACHINERY: CENTERING LATCHES

Pivot Shaft Bearing Cearances		
Bearing No.	Maximum Clearance	Location
East - 1	< 0.003"	12:00 from S (poor access)
East - 2	0.003"	12:00 from ~~S~~ N
East - 3	~~0.011"~~ 0.003	12:00 from ~~N~~ S
East - 4	Inaccessible	--

NW – 1"
SW – 1¼"
DROP

Observations:

1. Lubrication appears adequate.
2. Bolts in good condition.
3. Light debris buildup on components and housings contributing to varying levels of surface corrosion.

Latch Bar Components	
Latch Bar:	Lubrication appears adequate. Cannot be moved by hand.
Upper Guide: 0.030"	Mounting bolts exhibit moderate surface corrosion. >~~0.025"~~ clearance N; ~~<0.003"~~ clearance S 0.010"
Lower Guide: >0.362"	~~Isolated,~~ minor paint failure on mounting bolts. + exfoliating bolt heads >~~0.025"~~ clearance N; <0.003" clearance S
Retainer Plate:	Allen head cap screws exhibit minor to moderate surface corrosion. Plate exhibits minor surface corrosion.
Turnbuckle:	Upper jam nut is not painted and is developing minor surface corrosion.
Linkages:	~~No deficiencies noted.~~ minor ~~...~~ surface corrosion

All components functioned smoothly during test operations.

CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

EAST RESISTANCE BARRIER	
HPL:	Reservoir leve was good but temperature could not be read. Reservoir was cold to touch. Pressure readings: 700 ~~psi raising/ 750psi lowering~~ no gauge
Cylinders:	No covers on the north and south piston rods; piston rods polished and smooth. Moderate oil leak from piston seal on the north and south pistons.
Piping:	Live load pumping could be felt through the hosing/piping. no heat
General:	Live load seats all need replacement. Hydraulic system needs further evaluation to verify control systems functions, the system does not appear to be fully releasing when the barrier seats.

WEST RESISTANCE BARRIER	
HPL:	Reservoir leve was good but temperature could not be read. Reservoir was cold to touch. Pressure readings: 725 ~~psi raising/ 750 psi lowering.~~ no gauge
Cylinders:	Lower mounting clevis bolts are undersized; upper pinconnections loose but 2 cotter pins are present. No noticeable sag in cylinders after raising the gate. no visible leaks
Piping:	Hydraulic linesare long with no heat (3/4" diameter).
General:	Longitudinal movement of the barrier gate under live loading with some pumping. Thismay be due to misadjusted "live load seats". Guide rollers all should be replaced along with their respective attachment bolts. The guide roller system is presently non-functional.

SWING SPAN END DEFLECTIONS	North	South
East End	2" ↓	1-3/4" ↓
West End	1" ↓	1-1/4" ↓

1/12 - 30°F clear
1/13 - 25°F clear

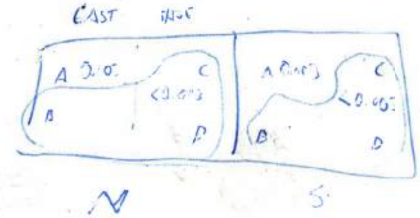
CTDOT Bridge No. 01138
Route 82 over the Connecticut River
Prepared by STV 100 Years

MECHANICAL FIELD NOTES
February 6, 2014
for AI Engineers, Inc.

NORTHEAST TRAFFIC WARNING GATE	
Model Information:	B&B Roadway Manufacturing CT118-VW4-3-2
Housing:	No deficiencies noted
Anchors/Bolts:	Anchor bolts covered with debris
Lubrication:	Oil level full. Grease application adequate.
Arm:	No deficiencies noted
Motor:	Minor surface corrosion on manual input shaft
Linkage:	Minor corrosion on lower turnbuckle nuts
General:	Minor debris noted within the gate housing resulting in minor corrosion. Manual brake release and manualcrank in good condition. Chain tension adequate. Rotary cam limit switch mount and housing are not of substantial construction – two mounting bolts missing.

SOUTHEAST TRAFFIC WARNING GATE	
Model Information:	B&B Electromatic Protect-O-Arm VT40
Housing:	No deficiencies noted
Anchors/Bolts:	4 of 4 anchor bolts not sealed
Lubrication:	Oil level full. Grease application adequate.
Arm	No deficiencies noted
Motor:	NW reducer mounting channel bolt is loose
Linkage:	Hard contact between lower crank and lower rod end. Upper crank has slid axially to east, but bolts are tight
General:	Minor debris noted within the gate housing resulting in minor corrosion. Manual brake release and manualcrank in good condition. Chain tension adequate. Rotary cam limit switch mount and housing are not of substantial construction – two mounting bolts missing.

EAST SHOE



APPENDIX D

MOVABLE SPANS

NUMERICAL CONDITION INSPECTION REPORT

MECHANICAL COMPONENTS

BRIDGE No.: **01138** INSPECTION DATES: **1/12, 1/13/2016**

COMMON COMPONENTS		**BASCULE SPANS**		**LIFT SPANS**	
COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*
OPEN GEARING	**6**				
REDUCERS	**7**				
SHAFTS	**7**				
BEARINGS	**6**				
COUPLINGS	**6**				
FASTENERS	**6**				
MACHINERY SUPPORTS	**6**	**SWING SPANS**			
CENTERING DEVICE ASSY	**4**	CENTER BEARING ASSY	**7**		
BUFFER CYLINDERS	**NA**	CIRCULAR RACK	**5**	**MISCELLANEOUS COMPONENTS**	
STRIKE PLATES	**7**	BALANCE WHEEL ASSY	**7**	HYDR. POWER UNITS (BARRIER GATE)	**6**
EMERGENCY DRIVES	**5**	CIRCULAR TRACK	**5**	PIPING AND HOSES	**7**
LIVE LOAD SHOES	**NA**	RIM BEARING ASSY	**NA**	HYDRAULIC CYLINDERS	**5**
BRAKES MOTOR	**6**	CENTER WEDGE ASSY	**7**	(BARRIER GATE)	
BRAKES MACHINERY	**5**	END WEDGE ASSY	**6**		
MECHANICAL CONDITION OVERALL RATING		**6**			

- NCR IS AN ACRONYM FOR NUMERICAL CONDITION RATING (SEE BELOW):

<u>NUMERICAL CONDITION RATING INFORMATION</u>

9 **NEW:** DISPLAY NO WEAR AND/OR DETERIORATION; EXCELLENT FUNCTIONAL PERFORMANCE.

8 **EXCELLENT:** DISPLAY INSIGNIFICANT WEAR AND/OR DETERIORATION; PERFORMS WITH A HIGH DEGREE OF RELIABILITY AND EFFECTIVENESS.

7 **GOOD:** VERY EARLY WEAR/DETERIORATION; PERFORMS WITH A HIGH DEGREE OF RELIABILITY AND/OR EFFECTIVENESS.

6 **FAIR:** EARLY MEASURABLE WEAR/DETERIORATION; PERFORMS WITH LITTLE REDUCTION IN RELIABILITY AND/OR EFFECTIVENESS.

5 **ADEQUATE:** MODERATE WEAR/DETERIORATION; PERFORMS WITH MODERATE REDUCTION IN RELIABILITY AND/OR EFFECTIVENESS.

4 **MARGINAL:** ADVANCED WEAR/DETERIORATION; PERFORMANCE MARGINAL: CORRECTIVE ACTION REQUIRED WITHIN ONE YEAR.

3 **POOR:** SEVERE WEAR/DETERIORATION; PERFORMANCE POOR AND/OR UNRELIABLE; CORRECTIVE ACTION REQUIRED WITHIN 6 MONTHS.

2 **URGENT:** MOVABLE SPAN OPERATION HIGHLY UNRELIABLE OR DANGEROUS AND SHOULD BE RESTRICTED; CORRECTIVE ACTION REQUIRED AS SOON AS POSSIBLE.

1 **CRITICAL:** MOVABLE SPAN OPERATION PROHIBITED PENDING REPLACEMENT OR REPAIR.

0 **FAILURE:** MOVABLE SPAN WILL NOT OPERATE WITHOUT REPLACEMENT OR REPAIR.

NA NOT APPLICABLE.

Routine Electrical Inspection

For

CONNDOT Bridge No. 01138

Route 82 over the Connecticut River

East Haddam, Connecticut

Completed for Connecticut Department of Transportation and AI Engineers, Inc.

By

STV Incorporated

January 2016

Table of Contents

EXECUTIVE SUMMARY

An electrical inspection of the East Haddam Bridge (Route 82) over the Connecticut River was conducted by STV personnel on February 12th and the 13th, 2016 to evaluate existing bridge electrical systems and components.

The intent of the inspection was to ascertain the integral functionality of the safety and electrical systems, including visual inspection of all traffic safety equipment, accessible electrical equipment, and associated components, such as bridge electrical power and distribution system, lighting, grounding & bonding, control systems, uniformity and smooth operation of the bridge. In addition, evaluation of their physical condition was performed and resistance (megger) readings of electrical components were taken and the interlocking system was inspected. No current or voltage reading were taken for span drive equipment during the inspection due to existing problems with the span drive control system.

The following codes and standards were considered for this inspection and report:

- American Association of State Highway and Transportation Officials (AASHTO), Bridge Inspection, Evaluation and Maintenance Manual - 1998 edition
- ConnDOT Bridge Inspection Manual
- NFPA 70, National Electric Code (NEC)
- NFPA 101, Life Safety Code (LSC)
- National Electrical Manufacturers Association (NEMA)
- Manual on Uniform Traffic Control Devices (MUTCD)
- Code of Federal Regulation, Title 33 (CFR)

Overall, the condition and operation of the bridge's electrical control systems is considered to be poor and it is recommended that they be upgraded or rehabilitated to minimize bridge malfunctions due to their unreliable existing condition. On the other hand, the bridge power distribution appears to be working properly and is considered to be in fair condition. There are a few significant work items that will be cited in more detail at later in this report under their corresponding element descriptions, such as:

- Re-establish the dual operation drive so both pinions are driving the bridge simultaneously. Ensure that the motor tachometers' feedback is used to drive both motors at the identical speed. Eliminate single pinion operation at the operator's discretion (by disabling the selector switch on the control console) and make single pinion operation a special case requiring hard wired changes to the bridge controls.
- Properly implement motors/drives load sharing application as intended by design. The 2 motors shall run at identical speeds
- Consider replacing existing relay based control system with an adequate well designed relay based control system. Assess any other safety modifications to the relay logic and implement them as soon as possible. Have the existing wiring traced and properly documented, generating new, accurate "as-built" wiring diagrams to assist in subsequent troubleshooting and control system modifications as part of any changes.
- Adjusting over-travel limit switches. **- 2014**
- Replacing motor brake # 2 starter within the MCC. **- 2014**

- Fixing or replacing the control console touch screen. **- 2014**
- Removing wire jumpers on the bridge control system. **- 2014**
- Replace malfunction north end wedges limit switches and end left proximity switches.
- Provide keyed bypass switches on the control console to aid maintenance personnel during emergency or test operation.

REPAIR RECOMMENDATIONS

Recommendations for repair of existing deficiencies are prioritized to immediate, 1 month, 3 months, 6 months, and 2 years. Recommendations that were listed in the 2014 inspection report are labeled in parenthesis with the previous priority.

IMMEDIATE (Priority A) –

1. Repair all the bypassed items in order to return the bridge to proper operation. **(previous recommendation)**

1 MONTH (Priority B) – None

2 MONTHS (Priority C)

1. Repair or replace the console touch screen so it displays the correct information. **(previous recommendation)**
2. Properly land and terminate wiring within the relay control panel. **(previous recommendation)**
3. Provide missing brake starter within the MCC. **(previous recommendation)**
4. Adjust over-travel limit switches so that they make proper contact with their target plates especially in the bridge wedge assemblies. **(previous recommendation)**
5. Repair and/or replace damage conduit and missing conduit supports throughout the bridge structure. **(previous recommendation)**
6. Replace broken incandescent light fixture protective cages within the center pier machinery enclosure. **(previous recommendation)**
7. Adjust the flexible cables near the south center wedge in the cable grips so that the bend radius of the cable is no less than 16 inches in diameter. **(previous recommendation)**
8. Replace malfunctioning north end wedges limit switches and end lift proximity switches.
9. Re-establish the dual operation drive so both pinions are driving the bridge simultaneously. Ensure that the motor tachometers' feedback is used to drive both motors at the identical speed. Eliminate single pinion operation at the operator's discretion (by disabling the selector switch on the control console) and make single pinion operation a special case requiring hard wired changes to the bridge controls.
10. Assess any other safety modifications to the relay logic and implement them as soon as possible.
11. Replace or provide cover plates for maintenance and convenience receptacles on bridge and correct maintenance lighting switch installation at base of stairs leading to the operator's house. Repair or replace receptacles along west wall of operator's house.
12. Service generator to repair leaks to fluid lines and exhaust. Clean area around generator.
13. Determine why telephone service is lost during inclement weather.
14. Repair disconnect switch enclosure for east barrier gate pump motor.
15. Investigate and troubleshoot/repair periodic west side roadway lighting circuit breaker trips.
16. Replace wire nut splice within the control console with a permanent crimp splice.
17. Provide and install wireway covers within the control console.
18. Repair or replace heater within the PLC cabinet.

19. Have the existing wiring traced and properly documented, generating new, accurate "as-built" wiring diagrams to assist in subsequent troubleshooting and control system modifications.
20. After the previous recommendation is implemented, assess any safety modifications to the relay logic and implement them as soon as possible.

<u>6 MONTHS (Priority D)</u>

1. Clean span motors' collector rings and grease motors' bearings. **(previous recommendation)**
2. Clean and paint span motors' frames**. (previous recommendation)**
3. Clean and paint cam limit switch enclosures throughout the bridge. **(previous recommendation)**
4. Put in place a procedure and train bridge tenders to operate the bridge using the different drive control alternatives. Alter current practice to use load sharing mode as the "normal" mode of operation. **(previous recommendation)**
5. Clean and paint local motor service disconnects throughout the bridge. **(previous recommendation)**
6. Clean and paint minor corrosion present on the barrier gates HPU reservoir and remove foreign objects from within the enclosure. **(previous recommendation)**
7. Clean and paint minor corrosion that is building up on the pier navigational lights' supports. **(previous recommendation)**
8. Reverse the orientation of the light switch serving the service west spot light. **(previous recommendation)**
9. Provide keyed bypass switches on the control console to aid maintenance personnel during emergency or test operation. **(previous recommendation)**
10. Investigate reason why all traffic gates are reflecting voltage back to their motor starter at the MCC. **(previous recommendation)**
11. Clean and paint submarine cable enclosures. **(previous recommendation)**
12. Clean within the MCC buckets and correct loose wiring.
13. Replace ceiling and properly support conduit on ceiling of generator room.
14. Provide switch for exhaust fan in the electrical room.
15. Properly terminate wires within the auxiliary relay cabinet.

<u>2 YEARS (Priority E)</u>

1 Clean and organize wiring within the two drive controllers (SCR's cabinets). **(previous recommendation)**
2 Consider providing some type of recording equipment (DVR) for the bridge CCTV system and provide additional cameras for the waterway. **(previous recommendation)**
3 Remove unused CP located within the CCTV enclosure. **(previous recommendation)**
4 Properly lace and organize wiring, properly land, and properly terminate wiring within the control console. **(previous recommendation)**
5 Clean and paint ATS enclosure. **(previous recommendation)**
6 Consider replacing existing relay based control system with an updated, properly designed relay control system.
7 Consider providing two or four CCTV cameras on the navigational channel (waterway) under the swing span to aid the bridge tender during bridge operation.
8 Provide new submarine cables and provide protection at rest piers, center pier and within the machinery room.

GENERAL DESCRIPTION

The East Haddam Bridge swing span carries Route 82 over the Connecticut River in East Haddam, Connecticut. The bridge is oriented west to east and carries a single lane in each direction. The bridge was electrically and mechanically rehabilitated in the 90's, and as part of the rehabilitation, the swing span was designed to open in both directions, clockwise (CW) and counterclockwise (CCW). Presently the feature allowing the span to be opened in a CW direction has been disabled.

The East Haddam Bridge features a swing span that is controlled from the operator's house located on the moving swing span superstructure, above the roadway and slightly off-center from the center of span to the west. Vehicular traffic control is controlled from the operator's house. The electrical room is located at roadway level on the south side of the swing span. The generator/service entrance equipment room is located on the northeast approach adjacent to the northeast oncoming traffic signal. All bridge operations including warning, barrier gates, traffic lights control and bridge control are performed from consoles in the operator's house with the help of a CCTV system to assure a better view and/or line of sight of oncoming and off going vehicular traffic.

Two methods of span operation are provided; main drives and auxiliary drives. The main drives are supplied with wound-rotor motors and the auxiliary drives consist of an air motor and an air compressor that appears not to be working at the present time. The main drives operation could be operated in two different modes FIXED mode and VAR mode and at the time of inspection the bridge tender indicated that the VAR mode was the only way they operated the bridge. Additionally, a drive/motor selector switch is provided to operate the bridge on Drive/Motor "A", Drive/Motor "B" and Drive/Motor "A&B". It should be noted that this capability is not advisable on a dual pinion drive swing span and should be eliminated. Furthermore, there is also a bridge manual control and auto control switch to select between drive/motor combinations. Presently the bridge could only be operated on the manual setting which is the incorrect setting. Span movement is initiated through push-bottom control from a fairly new control console, SCR drives, and primary and secondary resistor banks to control span motor speed and torque characteristics.

The span drive motors, center wedge motors and brakes are located in the machinery enclosure under the roadway at the center (pivot) pier. The enclosure is considered to be in fair condition with the exception of the existing lighting arrangement that does not meet current AASHTO Standards and the underside of the bridge deck that serves as the roof of the enclosure is deteriorating, causing debris to collect on the equipment. Access to electrical equipment in this room is extremely limited and does not meet the clearance requirements listed in the 2015 NEC.

The swing span is controlled via relay logic, which is managed by a programmable logic controller (PLC). The PLC receives inputs from the control console and various sensors around the bridge which work in conjuncture with the relay logic to control the bridge. Several types of limit and proximity switches are used throughout the structure to provide positive feedback to the controller to ensure safe operation of the bridge. Without verification from these sensors the inputs from the control console to the PLC will not provide an output for a function to be completed. The PLC processor and I/O racks are located within the control console in the operator's house and the motor control center that is located within the electrical room. The system was designed to provide bridge control, monitoring and troubleshooting. Currently, the monitoring HMI unit mounted on the bridge control console is out of service; therefore, no data is being displayed on the bridge control console HMI unit.

Span driving power for the swing span is provided by two 60 horsepower, 900 RPM wound rotor AC induction motors and speed controlled by two old, SCR Hubbell Drives that are still in good condition. The existing drive/motor arrangement could be run independently (motor/drive "A" or motor/drive "B") configuration or in a load sharing configuration ("A" & "B") in which case both motors are engaged in the operation (normal bridge operating mode). The load sharing mode is currently not functioning.

An air motor arrangement is present as a backup in the event the primary system fails. There is an existing air compressor outside of the control house which was not verified to be in working condition. Bridge maintenance staff stated that they do not test or maintain the backup air motor system.

The swing span is equipped with two sets of center wedges, north and south. Each center wedge assembly is powered by a 2-½ horsepower, 1800 RPM squirrel cage induction motor with integral electro-magnetic brakes mounted on the rear end of the motor.

The swing span is also equipped with end wedges on the east and west ends of the movable span. Each end wedge assembly includes two wedges powered by a single 7-½ horsepower, 900 RPM, squirrel cage AC induction motor with integral electro-magnetic brakes. Centering latch counterweighted devices were also present at both ends of the movable span for aligning purpose.

Traffic control devices located on the approaches include; two three-aspect type traffic signals on each approach, a single flashing red light prior to the traffic signals, two traffic warning gates on each approach, a single hydraulically operated barrier gate on each approach and one single "draw bridge ahead" sign at each approach.

The bridge was also equipped with a standard swing span navigational light aids arrangement as required by the latest AASHTO LRFD Movable Bridge Design guidelines and standards.

The bridge's electrical service is provided by a set of three (bank) utility-company owned pole-mounted transformers located on the northeast approach. The service is rated at 480/277-Volts, three-phase 60Hz. Utility metering equipment, main entrance service disconnect, generator set and automatic transfer switch are located inside the generator shed on the east approach.

Emergency power to the bridge is provided via a diesel backup generator rated at 288KVA and an automatic transfer switch (ATS) rated at 400A. The existing generator set assembly is rated and capable of providing electrical power for all bridge operations within ten seconds upon a loss of utility power.

A CCTV system consisting of two bridge-mounted, pan-tilt-zoom, color cameras and two color monitors provide the operator with views of the swing span roadway. The cameras are structure-mounted under the operator's house, above the roadway, providing views of eastbound and westbound vehicle traffic. The two monitors are located on the east side of the operator's house adjacent to the bridge control console. The CCTV system only offers live viewing; no recording equipment is present.

OBSERVATIONS

Bridge Electric Service

The Bridge's incoming electrical service is rated at 480V, three phase, 60Hz. Electrical service to the bridge is protected by a 400A main circuit breaker located in the generator room. The main breaker appears to be in good working condition. A main entrance transient voltage surge suppression system (TVSS) is located adjacent to the bridge's main disconnect switch to protect the downstream electrical equipment such as panelboards and control equipment. Power to the generator room is routed underground from the nearby overhead utility owned pole mounted transformers. The bridge's electrical service is in good condition with no visible signs of deterioration.

Span Drive Motors

The bridge is equipped with two 60Hp span drive motors located on the east and west sides of the machinery room. Both motors appear to be in fair working condition with some signs of deterioration due to the motor's exposed environmental condition and motor's aging process. Collector rings and brushes on motors appear to be in fair condition with some levels of carbon dust present inside the motors and minor normal discoloration on the collector's rings. Both motors are showing signs of frame and motor shaft surface corrosion and paint failure due to environmental exposure and poor maintenance. (Refer to photo E1). Refer to Appendix B for motor's electrical measurements. The span drive motors were meggered during the inspection and were found to be in good condition with readings greater than 200 MΩ.

Span Control, Limit Switches and Tachometers

The bridge is equipped with peripheral electrical equipment and components for positioning and feedback purposes. The overall condition of the feedback components is considered to be fair with some signs of deterioration and deficiencies.

The wedge rotary cam limit switches appear to be in good condition with some signs of moderate corrosion on the switches' enclosures. (Refer to photo E2). Individual switches within the rotary cam limit switches enclosure are fully operational and wiring is properly laced and connected to its corresponding terminals. In some cases, such as the north center wedge rotary cam limit switch and the west machinery rotary cam limit switch, the cover for the enclosure could not be opened due to the buildup of corrosion on the threaded pieces of the latch.

Proximity switches mounted on the center latches are working intermittently, therefore; condition state for this devices is unknown. We recommend all limit and proximity switches within the bridge be replaced with new reliable devices. The same condition exists for the fully raised limit switch for the east side barrier gate.

The north center wedge’s limit switch arm assembly is bent so that it cannot make contact with its corresponding strike plate. Therefore, the switch assembly should be modified or redesigned to assure proper functionality of the switch. Functionality of these switches is questionable since they are also working intermittently leading to control system malfunctions. (Refer to photo E3). Some of the over-travel limit switches on the bridge do not come in contact with their respective striking surfaces. The “fully driven” and “fully driven” switches located at the east and west ends of the bridge are not making contact or not making enough contact to trigger the switch and should be corrected. (Refer to photo E4).

The bridge relay control system is intermittently malfunctioning making it very hard for maintenance personnel to troubleshoot the system. As-built drawings are very difficult to follow due to the fact that they don’t document all existing control devices/relays functions and/or depicted devices that are no longer an integral part of the system. Furthermore, the original control system design configuration was altered. The current control system was intended to allow the swing span to open either CCW or CW. This option was disabled and the bridge can only swing open CCW. Mechanically, due to asymmetric gear wear, this should not be altered except in an emergency. The system was also primarily designed as a load sharing configuration to allow for both span motors to share electrical loads and pinions to share equal mechanical load. This condition is no longer functional. An “A” / “B” motor/drive configuration was also designed as a secondary source of span operation in the event of the load sharing configuration was not working properly to allow for temporary means of swing span operation. This last configuration is the only configuration that is currently working even though at the time of inspection the bridge failed to operate from the control desk employing either “A” or “B” configuration. After some troubleshooting, ConnDOT maintenance personnel were able to restore the bridge into a condition that it was able to be opened from the control console but required maintenance personnel in the electrical room to physically depressing the open and closed relays to close the bridge. This poses a major problem as there is a high risk of damaging the centering pin and the structure without closing the bridge at a reduced speed. STV personnel on site interviewed some of the maintenance personnel at the time of bridge malfunctioning to see if that condition was a random incident and found out that it is very common for maintenance personnel to need to perform such operations at least once every other month depending on bridge usage and season. It is strongly recommended that the bridge control system be updated/rehabilitated and existing or new as-built drawings be properly documented to minimize or eliminate potential electrical malfunctions. The upgrades should return the bridge to a condition that both motors are used to operate the bridge as the structure and mechanical systems were designed to share the loads between two forces instead of a single concentrated force. Motor tachometers with the drives should be utilized so that the speed of the motors is equalized so that the mechanical load are as balanced as possible.

Each span drive thyristor controller is provided with a feedback tachometer which provides the drive speed control feedback. The tachometers appear to be in good condition.

Span Drive Brakes

The bridge is equipped with two machinery and two motor brake thrustor units. The overall condition of both the machinery and motor brakes are considered to be good with no visual deficiencies. The east machinery brake is wire tied in the manually released position. This condition existed during the 2014 inspection and needs to be corrected, but does not constitute an immediate hazard as there is ample remaining brake capacity to stop and hold the swing span.

Each of the brakes utilizes three lever arm limit switches for control, interlocking and feedback to the bridge control system. All limit switches are in good condition with the exception that the brake set limit switch on the west side is not making contact with its strike plate. (Refer to photo E5). This corresponds with the “brake not set” indication at the control desk. It was also noted that the starter for motor brake #2 was removed from the MCC. (Refer to photo E6).

End and Center Wedges

The overall condition of the end and center wedges from the electrical point of view is considered to be fair with some signs of surface corrosion on the motor’s frame and motor’s shaft. Refer to Appendix B for motors electrical readings and measurements.

Span Drive Thyristor Controllers

The bridge is provided with two SCR thyristor drive controllers dating from the 1990’s. Independent span drive thyristor controllers control each drive motor. The Hubbell drives control system is configured so that the bridge can be operated in three different modes. A load sharing mode (Slave “A&B”) which allows both drives to evenly share electrical loads and a Slave Drive “A” / Master Regulator “A” mode or a Slave Drive “B” / Master Regulator “B” mode. By selecting either of these two modes, the control system will only allow one drive/motor to operate the bridge. If the arrangements are selected incorrectly (e.g. Drive “A” / Master Regulator “B”) then the system will not respond; therefore, no bridge movement will occur, and also no alarm will be displayed in the PLC control system. The intent of the original design was to operate the bridge in a load sharing configuration to reduce any potential mechanical degradation of the gear train system, but the bridge is not currently able to operate using this setting. At the time of inspection, the bridge was being operated on Mode “B”, which indicated that drive/motor “A” configuration was not getting exercised. Drive/Motor “A” configuration is currently under-performing (lower motor efficiency) due to lack of motor exercise. It is recommended that the bridge be operated in a configuration where both motors are used with their speeds synchronized at all times and that the necessary repairs be made on the system to allow this. In addition, the ability of the operator to select single motor operation should be disabled. The original “load sharing” methodology is not advisable for a swing bridge as it can cause the two machinery drivetrains to operate at different speeds in response to differing loads.

Each drive is paired with primary and secondary resistor banks in order to shape the motors speed/torque while the bridge is in operation. The primary resistors appear to be in good condition. The secondary resistors located on the operator's house platform are in fair condition but their enclosures are beginning show signs of corrode and no all enclosure hardware are present.

It was also noted during the electrical inspection that the drive controller's module (controller # 2) located on the MCC was out of service. This condition existed during the 2014 inspection.

The controllers appear to be in fair operating condition but do not provide proper control and/or speed regulation to the span motors. There are some minor visual deficiencies within the drive enclosures such as corrosion, foreign materials present within enclosure, disorganized wiring and improper wiring splicing. This condition existed during the 2014 inspection. (Refer to photo E7).

Disconnect Switches

Local disconnect switches are provided for the main drive motors, end wedge motors, brake motors and center wedge motors. All are in fair condition but are missing labels. Corrosion is forming on the exterior of enclosures and conduit. Conduit bodies and terminations are also starting to show signs of corrosion. Ground lugs within the enclosures are also showing signs of corrosion. The local disconnect switches for the span drive equipment on the west side of the machinery room are in poor physical condition. These switches exhibit the highest levels of corrosion and the motor disconnect switch has to many wires within the enclosure. (Refer to photo E8). Similar conditions exist for the east side drive equipment disconnect switches.

The disconnect switch for the east barrier gate has an open penetration on the bottom but appears to be operating correctly without any major signs of corrosion with the enclosure. The oil sump motor local disconnect switches are in excellent condition.

Traffic Signals and Warning Signs

The LED type traffic signals are in good condition. The east signals are supported over the roadway on wire and the west signals are supported over the roadway via a single pole with a cantilevered arm. Each signal was observed during bridge operations with satisfactory results.

An alternating flashing dual signal is located near the southeast warning gate with a warning gong mounted on the top of the pole.

Traffic Warning Gates

The overall condition of the traffic warning gates is considered to be good with some minor deficiencies as depicted bellow:

The flexible conduit powering the gate arm lights on the east side oncoming gate is split in two and electrical tape was used to join both pieces of conduit; therefore, the conduit is not properly supported. (Refer to photo E9). There are improper terminations and some corrosion starting to develop within the enclosure of the off going gate on the east side.

A cable support is missing on the northeast gate arm between the second and third warning lights, which should be repaired.

Traffic Barrier Gates

Both traffic barrier gates appear to be in good working with no visible damage from the electrical point of view. The barrier gate limit switches appears to be in good working condition.

There was some minor corrosion present on the HPU reservoirs, but no oil leaks or corrosion were present on the pump motors or actuator valves. It was also noted that the conduit feeding the hydraulic motor is not supported for its full run. (Refer to photo E10). Refer to mechanical section of the report for more details about the barrier gates' HPU systems.

Navigation Lights and Aids

The overall condition on the bridge navigation lights system is considered to be fair with no visual signs of deterioration or light malfunctioning. It was noted that minor corrosion is starting to build up on the navigational light supports, conduit supports and fixture enclosures. The navigation lighting arrangement consists of B&B pier red fixtures on the approach and center piers, and three combination red/green fixtures on the swing span.

Marine Radios, CCTV, Weather Station and Warning Signage

The overall condition of the marine radio within the operator's house is considered to be fair with no visual signs of deterioration. The radio system is equipped with a battery backup to assure proper functionality in the event of a power outage.

The Closed Circuit Television (CCTV) monitors and cameras appear to be in good working condition. Two pan-tilt-zoom (PTZ) type cameras were installed over the westbound lane under the operator's house platform to determine the presence of vehicles or pedestrians on the swing span. There were no cameras serving the waterway; therefore, the operator has to physically inspect the waterway before any opening or closing operation of the movable span. It was also noted that no recording equipment was provided for the CCTV system; instead a PC was provided but is never been used. It was noticed during the inspection that the CCTV equipment enclosure within the operator's house was without knockouts for cables. Currently the door of the enclosure cannot be closed since the wiring servicing the equipment was run through the front access door. (Refer to Photo E11). Runs should be rerouted thought the rear so that the cabinet could be properly close.

The anemometer base unit readout is in the operator's house. The system components are in good condition and are working properly. The phone system was working properly during the time of the inspection but it was noted by bridge operators that the phone system will go out with inclement weather.

As previously reported, the SLOW matrix warning sign on the off going southeast corner of the movable span is only partially legible.

Spotlights located on the operator's platform were noted to be in fair condition with the following deficiencies. The spotlight on the west side of the house is wired incorrectly so that on is off and off is on. The bulb of the spotlight on the east side of the house is out.

Roadway Lighting

At the time of the inspection all roadway lights were functioning properly. Per conversation with the on-shift bridge tender, the west side roadway light lighting circuit breaker trips every so often and has to be reset. Some of the conduit runs powering the fixtures are missing conduit support and/or being supported with wire ties. Illumination level on the span during night time appeared to be uniform and adequate with no dark areas observed.

Roadway lighting consists of wall-pack type luminaires with high-pressure sodium lamps installed on alternating vertical bridge columns. Lighting control is via a console mounted selector switch with "Automatic" and "ON" settings.

Maintenance Lighting and Receptacles

Maintenance lighting on the end (rest) and center piers is generally adequate and in fair condition. The water tight light switch mounted at roadway level adjacent to the service stair serving the operator's house is installed backward. When the switch is turn to the "off" position the lights turn "on" and when in the "on" position the lights are "off".

Emergency lighting on the movable span consists of standard thermoplastic safety lighting series E3 dual lamp head with sealed lead calcium battery. All safety lights were operational and in satisfactory condition.

The overall condition of the receptacles throughout the bridge structure is considered to be fair with some minor corrosion on outdoor receptacle covers. It was noticed that a receptacle located within the electrical room opposite the wedge motor starters is missing a cover plate. (Refer to Photo E12).

Operator's House

The operator's house lighting and receptacles are in fair condition with the exception of two receptacles along the west wall that were showing signs of arcing. (Refer to Photo E13).

The house through-wall air conditioning and electric baseboard heating systems are functional and are in excellent condition.

Control Console

The overall condition of the control console is considered to be good with some deficiencies as depicted below.

- The touch screen is out of service and according to maintenance personnel some of the functions within the PLC system were bypassed some time ago to assure proper functionality of the bridge.
- Wiring within the control console is not properly laced or routed. (Refer to Photo E14).
- There is exposed and un-landed wiring within the console. (Refer to Photo E15).
- A wire nut splice was used within the control console which represents a violation of section 8.9.2 (Splicing and Tapping) of the latest AASHTO LRFD Movable Highway Bridge.
- A power supply is laying on the cables and should be properly stored.
- Wire-way covers are missing or not installed within the console.
- No keyed bypass switches such as traffic gates bypass, barrier gates bypass and wedges bypass, exist on the control console.

Bridge Control Logic

The PLC system, input-output modules, power supplies and cabinets were all found to be in fair condition and operating satisfactorily. The PLC processor is located in its own cabinet in the electrical equipment room. Remote PLC I/O racks are located within the console and additional relays are installed in a wall-mounted cabinet inside the electrical equipment room.

The heaters in the main PLC cabinet were not functional during the inspection. The thermostatically controlled heater in the wall-mounted relay cabinet was functioning during the inspection.

Some relays such as “MSC-CCW and MSC-CW within the relay control cabinet were bypassed to assure bridge functionality and integrity. (Refer to Photo E16). Also, some of the wiring within the cabinet is not properly terminated and/or hangs loosely within the enclosure. (Refer to Photo E17). The termination points are without covers and some spare parts and wire are present within the enclosure. The cable harness for the cabinet span position indicator is deteriorating. The cabinet is equipped with a ground bar on the lower portion of the enclosure and a ground lug is present on the bar with no wire connected to it. (Refer to Photo E18).

Refer to Appendix C for Safety Interlock Testing results.

Motor Control Center (MCC)

The Eaton/Cutler Hammer MCC is rated 480/277V, 3 Phase, 4 Wire, 600 Amp horizontal and vertical buses, 300 Amp neutral bus, and a 400 Amp main circuit breaker. The MCC appears to be in fair condition with no signs of deterioration, arcing, or overheating. Minor corrosion was noted on the lower portion of the MCC but no corrosion was noted within the buckets. (Refer to photo E19).

Each of the motor starter cubicles were opened and visually inspected. Generally they were all in good condition with moderate dust accumulation. While meggering all bridge motors from the MCC cubicles, it was noted that there is a small voltage (33V) reflecting back from the traffic gates to its corresponding motor starter. It was also noted that the starter for motor brake #2 was removed from its bucket and currently resides on the floor of the electrical room. (Refer to photo E20).

Panelboards and Transformers

The overall condition of the panelboards and transformers within the bridge is considered to be good with no visible signs of corrosion, overheating, abnormal noises or damaged wires within the devices. It was noticed during the inspection that the wiring for the lighting transformer within the MCC is loosely run and there is a large amount of dust accumulation within the enclosure. (Refer to photo E21).

Emergency Generator and Automatic Transfer Switch (ATS)

The bridge is equipped with an emergency standby diesel generator set rated at 230 KW, 288 KVA. Oil for the generator is provided via a sub-base fuel tank mounted on the generator frame.

The generator and the automatic transfer switch (ATS) are located in a detached building on the northeast corner of the bridge. The system is equipped with an audible/visual alarm signal to detect and announce low fuel level. The system was energized during the inspection to access its integrity. The generator operated properly with no sign of distress but two deficiencies were noted. The generator is leaking fluid during and after operation and the exhaust system is also leaking. (Refer to photo E22). There is also a large amount of items being stored around the generator restricting access to the generator. (Refer to photo E23). It was also noted that there is or was water penetrating the roof of the generator building. The ceiling has been partially taken down but a new section that supports a conduit has begun to fall. (Refer to photo E24).

It was noted that the ATS enclosure is showing signs of surface corrosion, but all the ATS's internal components are in good working condition.

Submarine Cables

All submarine cables and associated hardware appear to be in fair to poor condition. A console mounted selector switch allows the bridge to operate on either of the two submarine cables.

As previously reported, a section of submarine cable located in the center span has been crushed, although no apparent visual damage was noted. The cables run unprotected within the machinery room and at the center pier. The submarine cable assembly was subject to a visual inspection and it was noted that the cables are missing their outer protective arctic heavy duty neoprene polychloroprene rubber jacket. The cables' steel reinforcement (steel bars) is showing signs of corrosion and the cables are not properly supported on the rest piers. (Refer to Photo E25).

It was previously noted that the flexible cables located near the south center wedge machinery are installed with below-minimum bend radius requirements. This condition still exists. The cables should be pulled back through the cable grips far enough such that the bend radius is higher than seven times the radius of the cable.

It was also noted during the submarine cable inspection that the cables' enclosures are showing some signs of corrosion and distress due to environmental conditions.

Wiring, Cable and Raceway

The condition of the conduit system on the bridge ranges from good to fair. Raceways throughout the facility were visually inspected with particular attention given to supports, structural integrity and internal junction boxes conditioning.

Some of the conduits throughout the bridge are in need of repair and properly tagged, others are missing paint, supports and corrosion is evident in most of the conduits and junction boxes at both rest piers. Conduits leaving the MCC entering the machinery area below have been labeled with tape and paper and should receive proper conduit tags. There is a conduit at the east end, under the roadway, that is missing a conduit strap near where it passes behind the centering pin and instead a rope was used as conduit support.

Conduit clamps are needed to secure conduits that connect the controller to secondary resistors on the operator platform. (Refer to Photo E26). It was also noticed that a conduit feeding the equipment on the west side is unsupported and has begun to bend at the last conduit coupling. (Refer to photo E27).

Within the electrical room it was noticed that the exhaust fan was not provided with a switch although a box was installed for a switch. It was also noted that a number of wires within the Auxiliary Relay cabinet were not properly terminated. A wire for monitoring wind conditions has been taped around the safety horn to the east of the operators house and should be properly supported and protected. (Refer to photo E28).

AppendixA:Electrical Photographs

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 1 Typical Span Motor Condition

Note exterior corrosion and paint failure.
Note corrosion on motor nameplate.

Photo E 2 Typical Rotary Cam Limit Switch Enclosure

Note Corrosion on the exterior of frame.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 3 North Center Wedge Limit Switch

Note that the switch arm is bent.

Photo E4 East Side Wedge Limit Switch

Note that the switch arm is not making contact with the axel. .

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 5 East Motor Brake Limit Switch

Note that the limit switch is not making contact with the strike plate.

Photo E 6 Motor Brake #2 Starter

Started not installed within enclosure.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 7 Drive A Enclosure Interior

Note loose wires and paper within enclosure.

Photo E 8 Center Pier Motor disconnect Switches

Note that corrosion on the enclosure, conduit terminals, ground and supports.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 9 East Side Oncoming Traffic Gate

Note tape over conduit termination.

Photo E 10 East Traffic Barrier Gate Hydraulic Feeder Conduit

Note that the conduit is not supported.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 11 CCTV Equipment Enclosure

Note that cord closes on wires.

Photo E 12 Receptacle Within Electrical Room

Note missing cover plate.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 13 Receptacle Within Control House

Note signs of arcing and overheating.

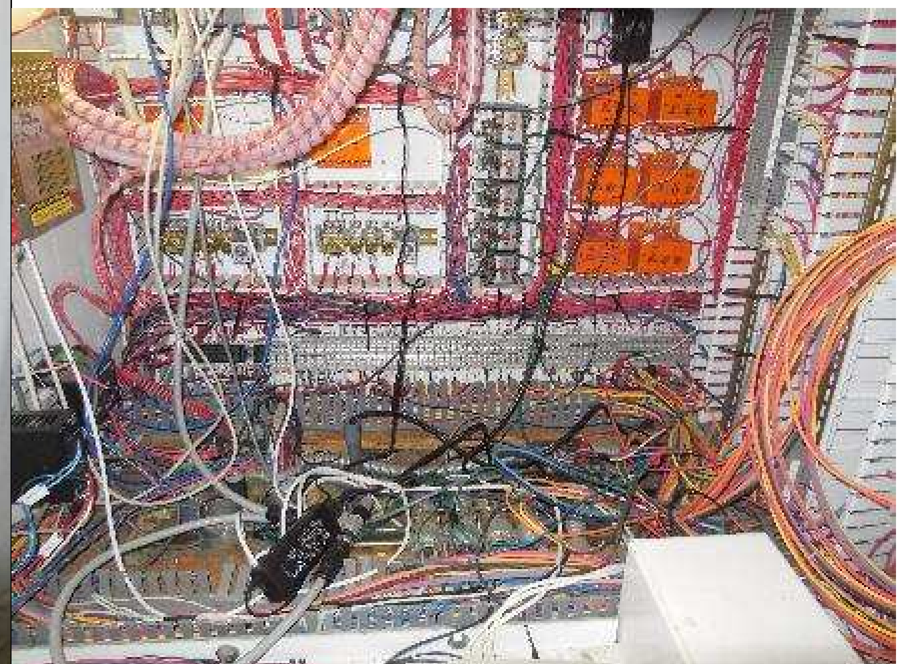


Photo E 14 Below Control Console

Note disorganized sires, missing termination covers and power supply on wire bundle..

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

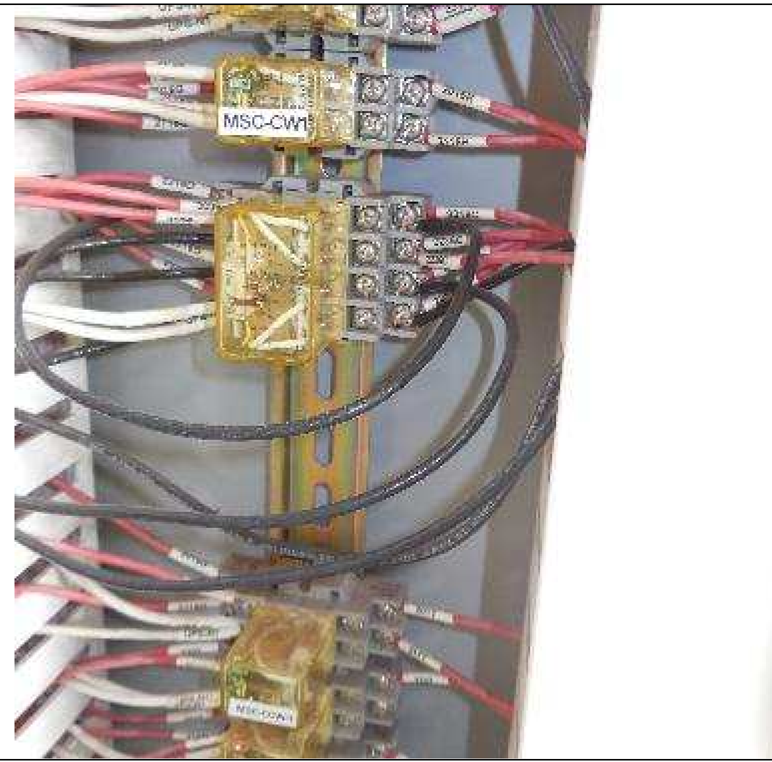


Photo E 15 Below Control Console Note improperly terminated wires	Photo E 16 Inside PLC Cabinet Note bypassed and unlabeled relay

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

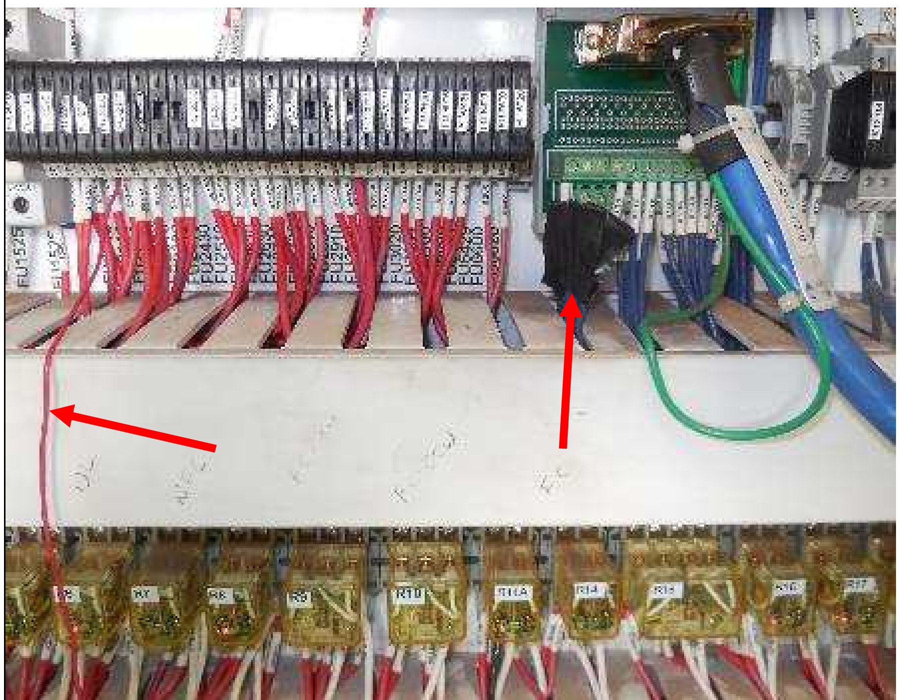


Photo E 17: Inside PLC Cabinet

Note improperly terminated wires, jumper wire hanging loosely and missing labels.

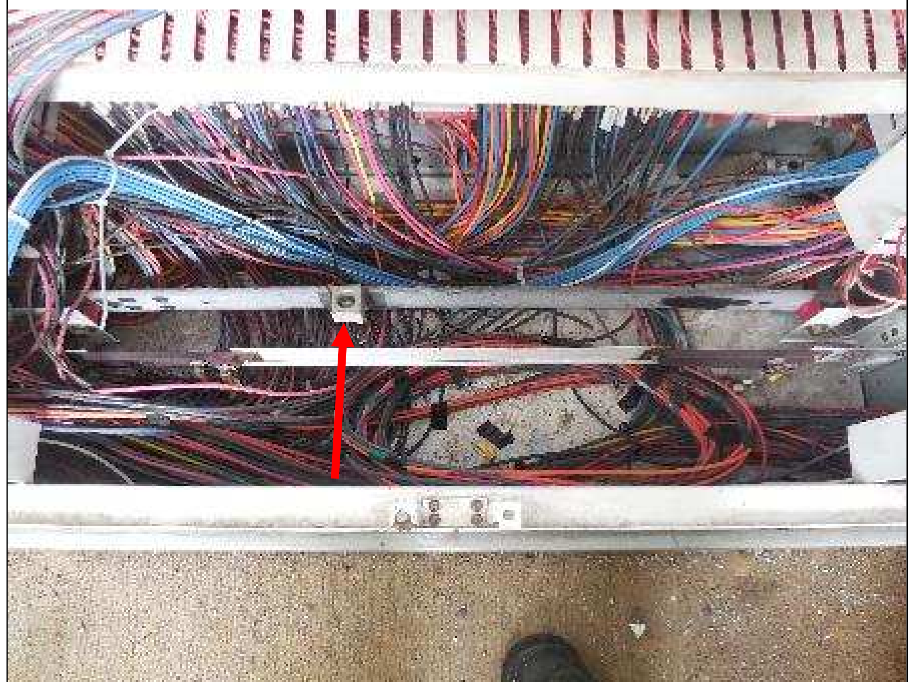


Photo E 18: Inside PLC Cabinet

Note missing ground, loose wires and foreign materials.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 19: Bottom of MCC

Note corrosion starting to form.

Photo E 20: MCC

Note that the motor brake #2 controller is missing.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 21: Lighting Transformer within MCC

Note dust accumulation and loose wires.

Photo E 22: Generator

Note fluid freshly leaked during generator exercising.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 23: Generator Room

Note items being stored around generator restrict access to the generator.

Photo E 24: Generator Room

Note conduit is supported by part of the ceiling that is falling down.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 25: Submarine Cables

Note that the outer rubber jacket has deteriorated and the steel armor is exposed. Also not the cable is unprotected.

Photo E 26: Control House Platform Conduit To Secondary Resistors

Note missing conduit clamps.

Bridge No.	01138	Inspected by:	J. Leon, R. Foley
Town:	East Haddam		
Feature Carried:	Route 82	Date Inspected:	1/12 &13/2016
Feature Crossed:	The Connecticut River	Project No.:	

Photo E 27: West Motor Equipment Conduit Feed

Note that conduit is unsupported and starting to bend at the previous coupling.

Photo E 28: Control House Weather Device

Note that the cable is missing taped to the horn and unprotected.

AppendixB:ElectricalMeasurements

Motor Currents

MOTORCURRENTS(AMPS)	PULLED	DRIVEN
North Center Wedge	3.1	3.3
South Center Wedge	3.2	3.5
East End Wedge	13.0	13.1
West End Wedge	13.1	13.6
	RAISE	LOWER
East Resistance Barrier		
West Resistance Barrier	2.5	2.9
Southwest Traffic Gate	1.5	1.5
Southeast Traffic Gate	0.8	0.8
Northwest Traffic Gate	0.7	0.7
Northeast Traffic Gate	1.5	1.5

System Voltage Readings

Reading location(Volts)	LinetoLine	LinetoNeutral
MCC – Phases A	480	278
MCC – Phases B	481	275
MCC – Phases C	479	276
Generator Room – Phase A	480	274
Generator Room – Phase B	481	271
Generator Room – Phase C	479	273

Voltage and current readings on this page were obtained using a Fluke Model 289 multifunction meter. MCC voltage readings were obtained using the MCC's built-in meter.

AppendixC:Numerical Bridge Rating

MOVABLE SPANS
NUMERICAL CONDITION INSPECTION REPORT
ELECTRICAL COMPONENTS

BRIDGE No.: **01138** INSPECTION DATES: **1/12-13/2016**

COMMON COMPONENTS		BASCULE SPANS		LIFT SPANS	
COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*	COMPONENT TITLE	NCR*
WIRING AND CABLE	**6**	SPAN SEATED LIMIT SWITCH	**NA**	FESTOON CABLE	**NA**
CONDUIT AND RACEWAY	**4**	TOE LOCK MOTORS	**NA**	SPAN SEATED LIMIT SWITCH	**NA**
UTILITY SERVICE	**7**	HEEL LOCK MOTORS	**NA**	SPAN LOCKS	**NA**
SPAN DRIVE MOTORS	**4**			WEDGE MOTORS	**NA**
SWITCHGEAR	**6**			DRIVE SYNC. SYSTEM	**NA**
MOTOR CONTROLS	**2**				
CONTROL DESK	**5**	**SWING SPANS**			
PLC CONTROLS	**2**	END OF TRAVEL LIMIT SWITCH	**1**		
ROTARY CAM LIMIT SWITCH	**3**			**MISCELLANEOUS COMPONENTS**	
SPAN POSITION INDICATOR	**6**	CENTERING DEVICE	**5**		
SUBMARINE CABLE	**3**	WEDGE MOTORS	**6**		
DISCONNECT SWITCHES	**6**	JACK MOTORS	**NA**		
GENERAL LIGHTING	**5**				
ROADWAY LIGHTING	**5/6**				
TRAFFIC SIGNS	**6**				
TRAFFIC GATES	**6**				
RESISTANCE BARRIERS	**6**				
NAVIGATION LIGHTS	**6**				
STANDBY GENERATOR	**7**				
ELECTRICAL CONDITION OVERALL RATING	**4**				

- NCR IS AN ACRONYM FOR NUMERICAL CONDITION RATING (SEE BELOW):

NUMERICAL CONDITION RATING INFORMATION

9 **NEW:** DISPLAY NO WEAR AND/OR DETERIORATION; EXCELLENT FUNCTIONAL PERFORMANCE.

8 **EXCELLENT:** DISPLAY INSIGNIFICANT WEAR AND/OR DETERIORATION; PERFORMS WITH A HIGH DEGREE OF RELIABILITY AND EFFECTIVENESS.

7 **GOOD:** VERY EARLY WEAR/DETERIORATION; PERFORMS WITH A HIGH DEGREE OF RELIABILITY AND/OR EFFECTIVENESS.

6 **FAIR:** EARLY MEASURABLE WEAR/DETERIORATION; PERFORMS WITH LITTLE REDUCTION IN RELIABILITY AND/OR EFFECTIVENESS.

5 **ADEQUATE:** MODERATE WEAR/DETERIORATION; PERFORMS WITH MODERATE REDUCTION IN RELIABILITY AND/OR EFFECTIVENESS.

4 **MARGINAL:** ADVANCED WEAR/DETERIORATION; PERFORMANCE MARGINAL: CORRECTIVE ACTION REQUIRED WITHIN ONE YEAR.

3 **POOR:** SEVERE WEAR/DETERIORATION; PERFORMANCE POOR AND/OR UNRELIABLE; CORRECTIVE ACTION REQUIRED WITHIN 6 MONTHS.

2 **URGENT:** MOVABLE SPAN OPERATION HIGHLY UNRELIABLE OR DANGEROUS AND SHOULD BE RESTRICTED; CORRECTIVE ACTION REQUIRED AS SOON AS POSSIBLE.

1 **CRITICAL:** MOVABLE SPAN OPERATION PROHIBITED PENDING REPLACEMENT OR REPAIR.

0 **FAILURE:** MOVABLE SPAN WILL NOT OPERATE WITHOUT REPLACEMENT OR REPAIR.

NA NOT APPLICABLE.

AppendixD:ElectricalFieldNotes

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138 Dates: 1/12&13/2016

Location: East Haddam, CT Sheet: _1_ of _7_

Inspect. Init.: JL, RF

Device/Location	Notes
Northeast warning gate	Cable support missing between 2nd and 3rd arm lights Flexible cable not intact- termination broken (4) double-sided lights Motor – Leeson ½ HP, 230/460V, 1 Phase, 60Hz
Southeast warning gong	Good condition
Southwest three signal lights	Good condition
Southeast warning gate	Good Condition Flexible cable no intact Motor – Leeson ½ HP, 230/460V, 1 Phase, 60Hz
East barrier gate	Type – hydraulically powered, rising vertically from ground Stainless steel disconnect switch with open hole in bottom No additional visual damage Motor – Baldor, 3 HP, 1750 RPM, Frame 182 TC, 208/230/460V, 8.3/8.2/4.1 Amps, Serial # F0504264023
East three signal lights	Good condition

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138 Dates: 1/12&13/2016

Location: East Haddam, CT Sheet: _2 _ of _7_

Inspect. Init.: JL, RF

Device/Location	Notes
East end wedge motor	Motor – Reuland, Ser. No. 96-5910A-1, Model No. 0075F-1AAB-0021, 460 V, 3 PH, 900 RPM, 7 ½ HP, 15.1 A Some corrosion on the mounting hardware and motor frame Overall good condition
East wedge motor disconnect switch	Minor corrosion on the mounting hardware Mounted under bridge over platform (north side)
East wedge motor rotary limit switches	Missing paint and corrosion on the enclosure Internal components in good condition See photos
East wedge limit switches and center proximity switch	Fully closed limit switch not making contact – gap of approximately 1/4" See photo Some minor corrosion on mounting hardware All other LS in fair condition
West end wedge motor	Motor – Reuland, Model No. 0075F-1AAB-0021, 460 V, 3 PH, 900 RPM, 7 ½ HP, 15.1 A Some corrosion on the mounting hardware and motor frame Overall good condition
West wedge motor disconnect switch	Good condition

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138 Dates: 1/12&13/2016

Location: East Haddam, CT Sheet: _3 _ of _7_

Inspect. Init.: JL, RF

Device/Location	Notes
West wedge limit switches and center proximity switch	One of the fully open limit switches has a bent arm not making contact with the target Fully closed limit switch not making enough contact to trigger switch.
West barrier gate power unit and disconnect switch	Good condition Motor - Baldor – 208-230/460 V, 3 PH, 1750 RPM, 3 HP, 8.3-8.2/4.1 A NEMA 4X SS disc switch – good
West submarine cable box	Some surface corrosion Cable not intact
East barrier gate power unit and disconnect switch	Good condition Motor - Baldor – 208-230/460 V, 3 PH, 1750 RPM, 3 HP, 8.3-8.2/4.1 A NEMA 4X SS disc switch – good
Grounding (west pier)	Good grounding connection Grounding not measured Some corrosion
Southwest warning gate	Good condition

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138 Dates: 1/12&13/2016

Location: East Haddam, CT Sheet: _4 _ of _7_

Inspect. Init.: JL, RF

Device/Location	Notes
Southwest warning gong and light	Good condition No visual deficiencies
Northwest warning gate	B&B Roadway Cam switch cover missing GFCI receptacle does not work
West main drive motor	Heavy corrosion on motor frame and supports Motor – Sterling Electric- Model No. 85-5458, 460 V, 3 PH, 883 RPM, 60 HP, 81.4 A, Date Code 03-86 Nameplate in poor condition Some grooving on brushes Carbon dust accumulation Slip rings OK Lube fittings on ends show signs of recent lubrication Bearing look good – need grease
West main motor disconnect switch	Some corrosion on the disconnect and hardware
West motor brake	Like new condition LS in good condition Eldro Model No. 30/5, 230/460 V, 0.76/0.38 A

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138 Dates: 1/12&13/2016

Location: East Haddam, CT Sheet: _5 _ of _7_

Inspect. Init.:JL, RF

Device/Location	Notes
West machinery brake	good condition LS operational GE Thrustor Brake 460 V, 3 Phase, 60 Hz
West machinery brake disconnect switch	NEMA 4X SS Disconnect switch minor exterior corrosion
West tachometer speed switch	Hubbell – Pilot Duty Speed Switch - Cat. No. 2210-262CC13 Good overall condition
East main motor disconnect switch	Fair condition with some paint peeling Steel enclosure-good Strut support majorly rusted, upper support major rusting
East motor brake disconnect switch	Fair condition with some exterior paint peeling NEMA 4X SS enclosure Major corrosion on unit strut supports
East machinery brake disconnect switch	Fair condition with some exterior paint peeling NEMA 4X SS enclosure Major corrosion on unit strut supports

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138 Dates: 1/12&13/2016

Location: East Haddam, CT Sheet: _6 _ of _7_

Inspect. Init.: JL, RF

Device/Location	Notes
East speed reducer disconnect switch	Good Condition
East speed reducer circulation pump motor	good condition Surface corrosion Motor: Invensys – 208-230/460 V, 3 PH, 1720 RPM, 1 1/2 HP, 4.50/2.25 A
East machinery brake	good condition LS good condition GE Thrustor Brake 460 V, 3 Phase, 60 Hz
West center pier – cable pit	East and west side submarine boxes in fair condition Some corrosion on cables support Cables missing outer jacket
North center wedge motor	Motor – Reuland, Model No. 97-3050A-2, 460 V, 3 PH, 1800 RPM, 2 ½ HP, 4.0 A – fair condition LS arm is bent Internal components good
Motor Control Center	Good condition Minor rust staring to build up lower portion Missing a knock out Some dust inside buckets Internal panelboard – excellent Controller #2 out of service- see photo

Movable Bridge Inspection Form - Electrical Field Notes

Bridge Name/Number: East Haddam Swing Bridge #01138   Dates: 1/12&13/2016

Location: East Haddam, CT   Sheet: _7 _ of _7_

Inspect. Init.: JL, RF

Device/Location	Notes
Incoming service	Underground to shed from OH wires Utility pole mounted transformers – looks ok 400A MCB – good Room – good condition
Generator/ATS	230kW, 288kVA, 480/277 V, 346 A, 1800RPM 764 run hours as of 12/14/2011 Fluid leaks during operational ATS enclosure some corrosion
East main drive motor	Heavy corrosion on motor frame and mounting hardware Motor – Sterling Electric? Model No. 85-5458, 460 V, 3 PH, 883 RPM, 60 HP, 81.4 A, Date Code 03-86 nameplate in poor condition- Some grooving on brushes Slip rings look good Carbon dust build-up inside – needs cleaning Lube fittings –good Bearing- no noise –grease
SCR Drives	Old Hubbell Thyristor Controller Fair Condition Disorganized wiring

Pavan Seemakurty

From: Prescott, Jr., Richard A <Richard.Prescott@ct.gov>
Sent: Thursday, December 17, 2015 7:33 AM
To: Muhammad Iqbal; Pavan Seemakurty
Cc: Aslam Siddiqui; Taddonio, Adam; Daigle, John L; Burgess, Seth A; Ference, Alan
Subject: FW: 01138 Navigation Lights

Good morning Asif/Pavan,

Ok, I confirmed that Maintenance Electrical will be out there tomorrow just after 9 AM to repair the stanchion and replace the bulbs. They will have a bucket truck but they may need use of the manlift.

Adam, a BMM will not be necessary.

Rick Prescott
Bridge Safety & Evaluation
Bureau of Engineering & Construction
860-594-2708

From: Prescott, Jr., Richard A
Sent: Wednesday, December 16, 2015 2:54 PM
To: Ference, Alan; Latouche, Phillip R
Cc: Taddonio, Adam
Subject: FW: 01138 Navigation Lights

Good afternoon Al/Phil,

AI Engineers is currently inspecting Bridge No. 01138, Swing Bridge in East Haddam. Please see the attached photo and video showing a missing nut and the stanchion is loose. We are going to issue a BMM "C" for the repairs but maybe you can have a crew out there Friday (AI cancelled tomorrow) and work within their sign pattern and use their manlift for access? You can e-mail me back or call me at Cell 860-818-5997, office 860-594-2708.

Rick Prescott
Bridge Safety & Evaluation
Bureau of Engineering & Construction
860-594-2708

From: Muhammad Iqbal [mailto:miqbal@aiengineers.com]
Sent: Monday, December 14, 2015 4:50 PM
To: Prescott, Jr., Richard A
Cc: Aslam Siddiqui; Pavan Seemakurty; Ethan Cote
Subject: FW: 01138 Navigation Lights

Rick,

Please see below e-mail and attached photos and video. Let me know if you need additional information.

Thanks,
Asif

From: Pavan Seemakurty
Sent: Monday, December 14, 2015 3:28 PM
To: Muhammad Iqbal
Cc: Ethan Cote
Subject: 01138 Navigation Lights

Asif,

The navigation light at pier 2 in span 3 (over the swing span truss) of the subject bridge has a loose anchor bolt with a missing nut (1 of 3). The light is slightly unstable.

Attached are a photo and video of that location.

Thanks,

Pavan Seemakurty, P.E.
Senior Structural Engineer

AI Engineers, Inc.

Celebrating Over 20 Years of Engineering Excellence
919 Middle Street
Middletown, CT 06457
Phone: 860-635-7740 ext. 121
Fax: 860-635-7312
www.aiengineers.com

ULTRASONIC TESTING REPORT

TEAM® Industrial Services, In
196 Woodlawn Rd
Berlin, CT 06037

(860) 828-6333
(860) 828-7488 FAX

REPORT OF NON-DESTRUCTIVE EXAMINATION

Ultrasonic Inspection - Report # 13756139

Client: AI Engineers
Address: 919 Middle St.
Middletown, CT

Jobsite: Bridge #01138
Address East Haddam, CT. (RTE. 82)

Contact Name: Akram
Site Contact(s): Pavan Seemakurty

Components Inspected: UT Inspection of Bridge Pins.
10 Pins Inspected on Bridge # 01138.
See attached list and drawings for specific locations

Results: No Reject able Indications Noted.
All pin surfaces painted

Inspector's Name (Print): Joshua Follansbee
Level: II
Inspector's Signature: [signature]
Date: 12-28-15

Specification: AWS D1.5
Purchase Order # TBD
Procedure: UT.AWS.3 Rev.1
Acceptance: AWS D1.5

Ultrasonic: [X] A-Scan [ ] B-Scan [ ] C-Scan [X] Contact [ ] Immersion

Equipment: Mfg: G.E. Model: USM-GO S/N: 09100111

Transducer: Mfg.: KBA Model: GAMMA S/N 00LRMX Angle: 0
Size: .750" Frequency: 2.25 MHz
Mfg.: KBA Model: GAMMA S/N 42746/87174 Angle: 15°/45°
Size: .500" Frequency: 2.25 MHz

Calibration Block: Type: Notches Material: C/STL S/N: LICH-2

Scanning: [X] Manual [ ] Automatic Couplant: Ultragel II Batch # 13C028
Pattern: Parallel Scanning Speed < 4 IPS % Overlap 50

Form #22.6-46

TEAM® Industrial Services, Inc.

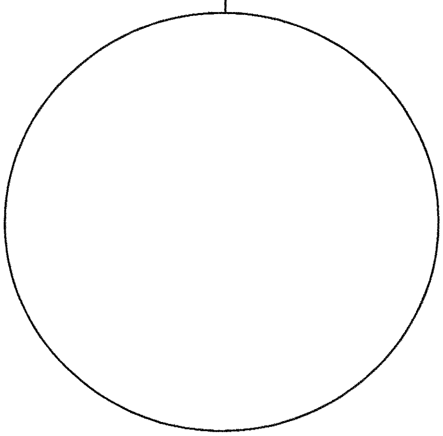
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. u6-west Truss North Span 3

Circumferential Location

0 Deg. (TDC)

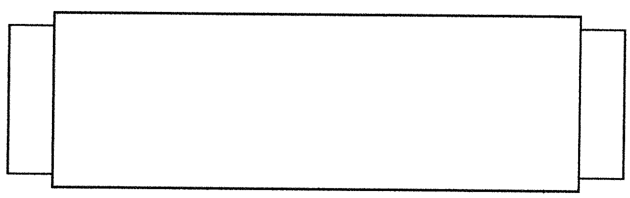


Pin Dia. 6"

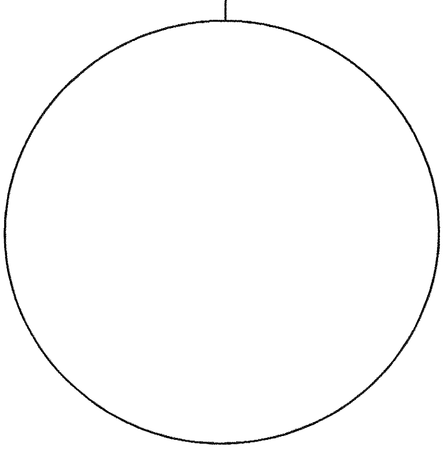
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

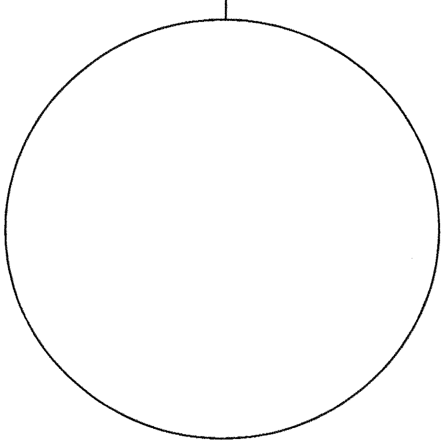
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. U7-West Truss North Span 3

Circumferential Location

0 Deg. (TDC)

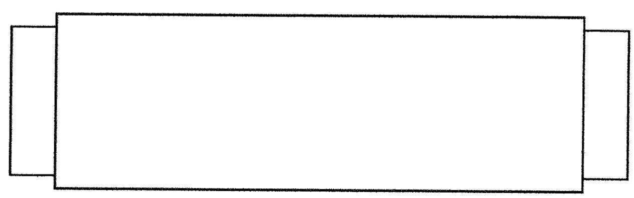


Pin Dia. 6"

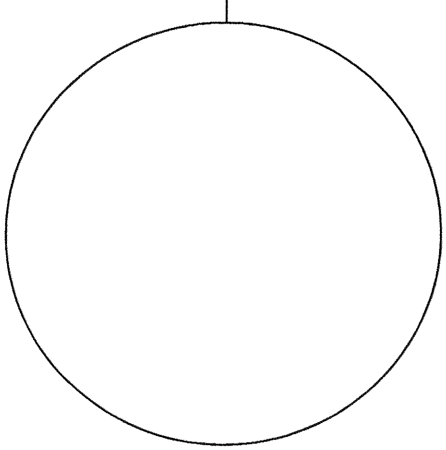
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

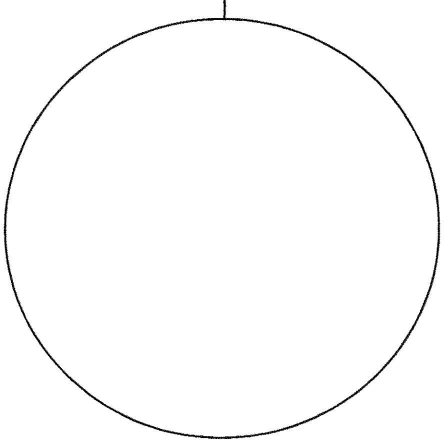
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. U9-west Truss North Span 3

Circumferential Location

0 Deg. (TDC)

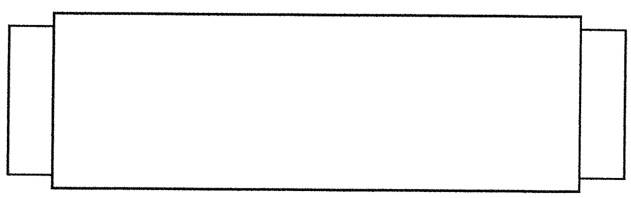


Pin Dia. 6"

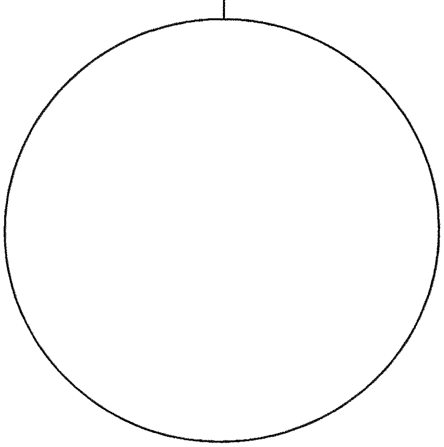
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

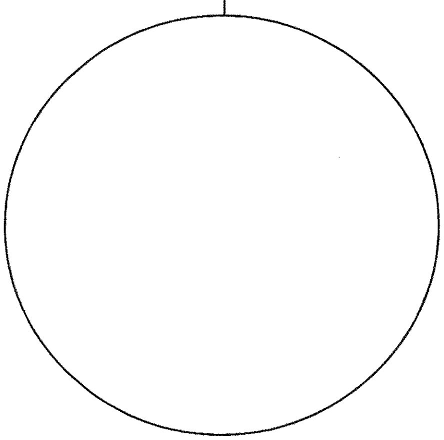
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. U10-West Truss North Span 3

Circumferential Location

0 Deg. (TDC)

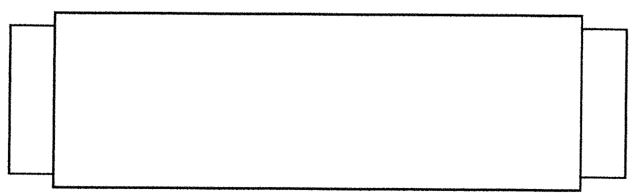


Pin Dia. 6"

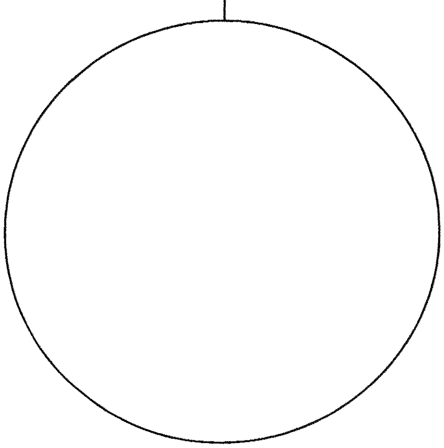
Pin Length 20"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

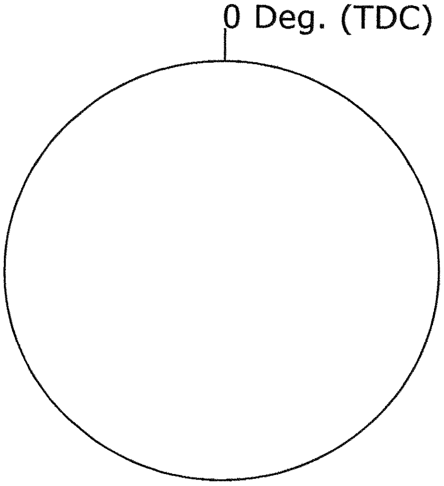
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. U7-West Truss South Span 3

Circumferential Location

0 Deg. (TDC)

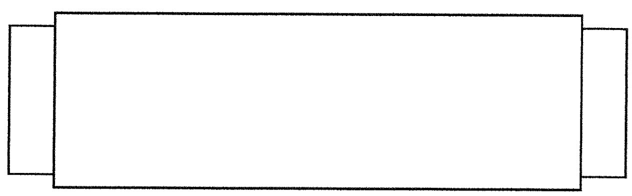


Pin Dia. 6"

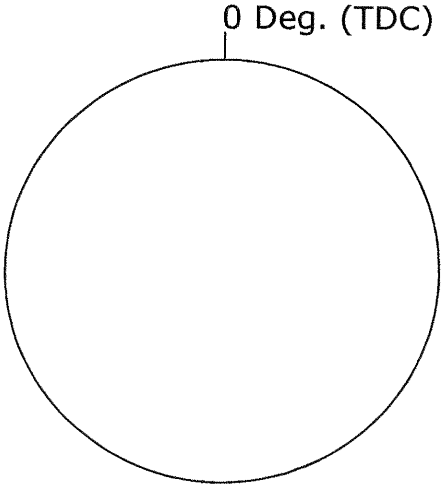
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

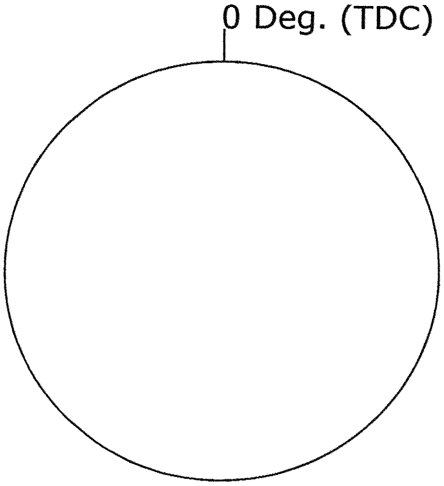
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. U9-West Truss South Span 3

Circumferential Location

0 Deg. (TDC)

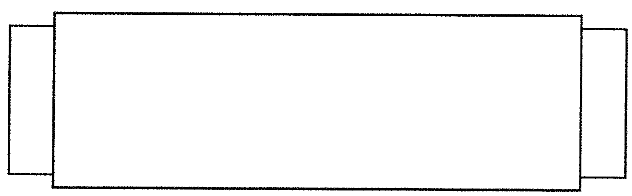


Pin Dia. 6"

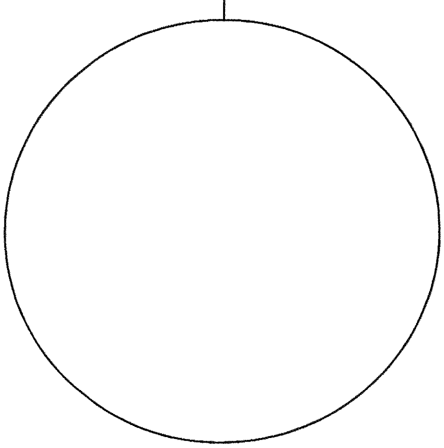
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

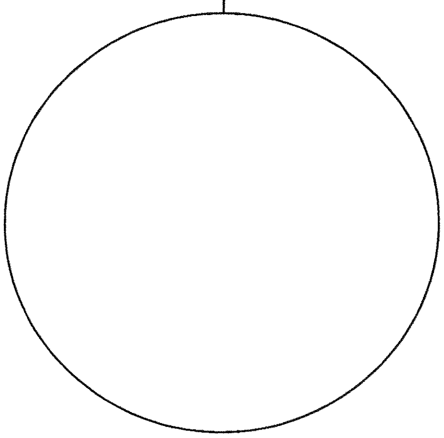
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. U10-West Truss South Span 3

Circumferential Location

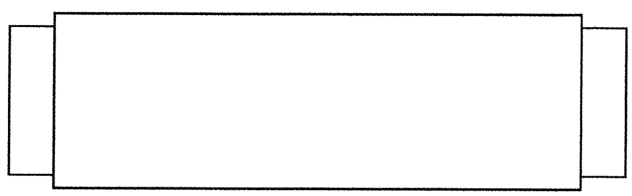
0 Deg. (TDC)



Pin Dia. 6"

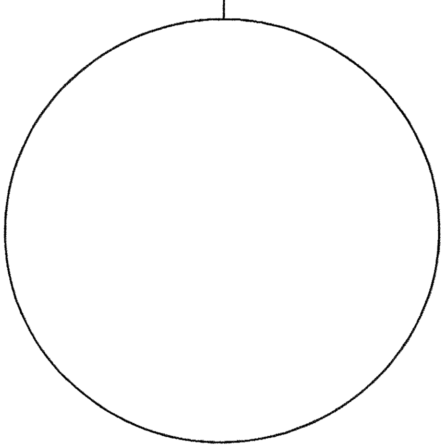
Pin Length 20"

Axial Location



N End

0 Deg. (TDC)



S End

Comments: Accept

TEAM® Industrial Services, Inc.

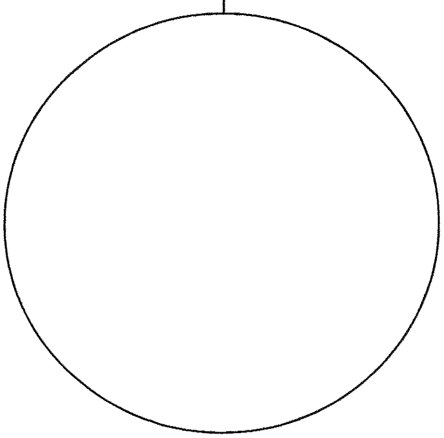
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. M7-West Truss South Span 3

Circumferential Location

0 Deg. (TDC)

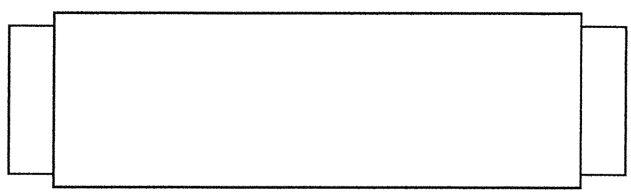


Pin Dia. 6"

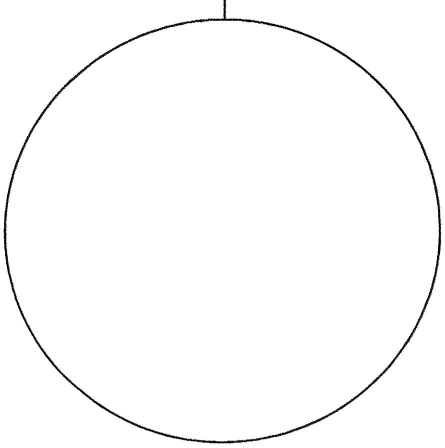
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

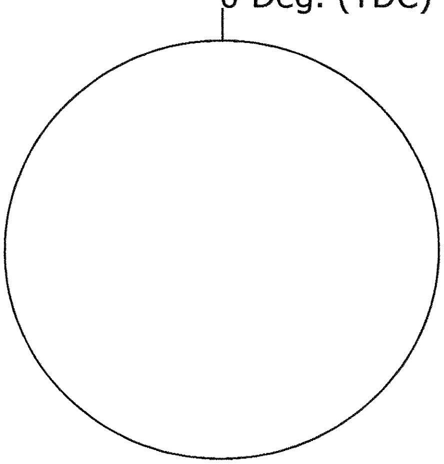
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. L6-West Truss South Span 3

Circumferential Location

0 Deg. (TDC)

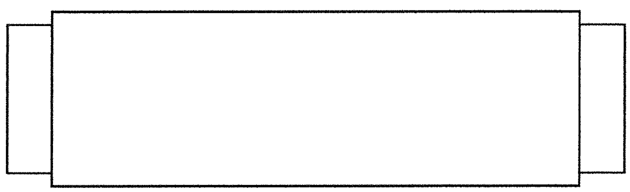


Pin Dia. 6"

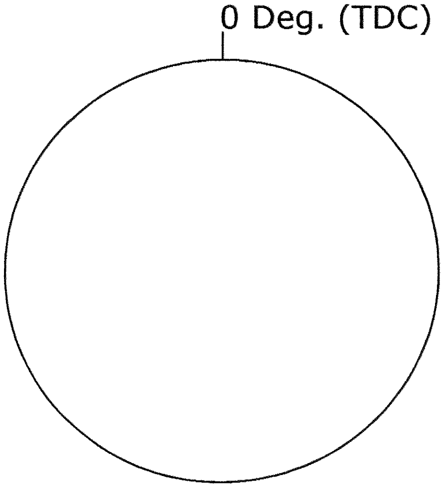
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

TEAM® Industrial Services, Inc.

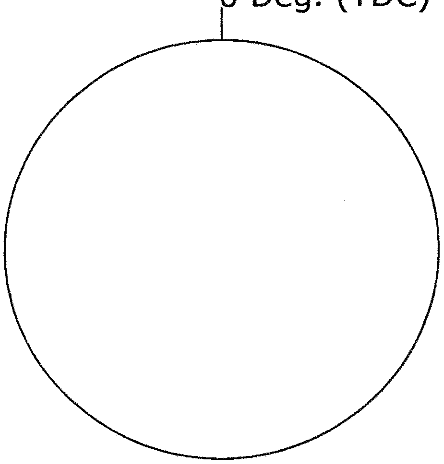
Bridge Pin Indication Diagram

Bridge # 01138 Location East Haddam

Pin I.D. L6-East Truss South Span 4

Circumferential Location

0 Deg. (TDC)

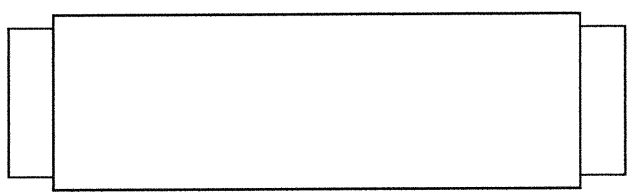


Pin Dia. 6"

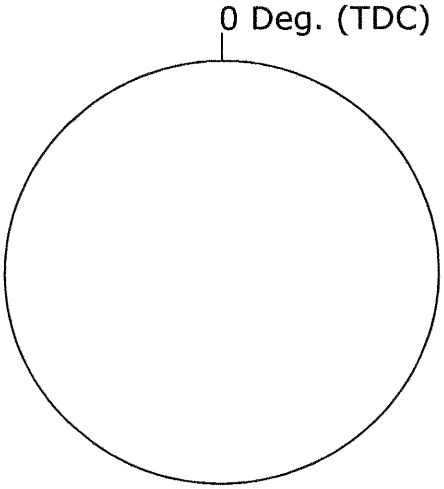
Pin Length 22"

Axial Location

N End



0 Deg. (TDC)



S End

Comments: Accept

Bridge # 01138
Route 82 over Connecticut River
East Haddam, CT

ULTRASONIC TESTING OF PINS

Pin location	South Truss	North Truss
U5-west		
U6-west		2015
U7-west	2015	2015
U8-west		
U9-west	2015	2015
U10-west	2015	2015
U10-east		
U9-east		
U8-east		
U7-east		
U6-east		
U5-east		

Pin location	South Truss	North Truss
M7-west	2015	
M7-east		

Pin location	South Truss	North Truss
L6-west	2015	
L6-east	2015	

www.cmeengineering.com

☐ Original ☐ Copy ☐ Record

CME Project No. 2016651