City of Aurora
2019 Bridge Condition Report
Rotary Plaza Pedestrian Walkway

PREPARED FOR:

City of Aurora - Department of Public Works / Engineering
Chris Lirot, PE
Road & Bridge Coordinator
44 E. Downer Place
Aurora, Illinois 60507

August 2019 – Draft
October 2019 - Final
Benesch Project No. 10483.03

benesch

BRIDGE CONDITION REPORT

REGION:	**1**
DISTRICT:	**1**
ROUTE:	**N/A**
COUNTY:	**KANE**
JOB NUMBER:	**N/A**
STRUCTURE NUMBER:	**N/A**

LOCATION: **Rotary Plaza Pedestrian Bridge over Land**

PREPARED BY:	**Alfred Benesch & Company**
DATE PREPARED:	**AUGUST 2019 (Draft)**
	OCTOBER 2019 (Final)
PROPOSED LETTING DATE:	**TBD**

Table of Contents

Attachments:

I. Geographical and Administrative Data

Structure Number:	N/A
County:	Kane
Feature Carried:	Rotary Plaza Pedestrian Walkway
Feature Crossed:	Land
Station:	N/A
Roadway Classification:	Pedestrian Walkway
Inventory Rating:	N/A
Operating Rating:	N/A
Sufficiency Rating:	N/A

Construction/Reconstruction/Repair History:

The Rotary Plaza Pedestrian Bridge in Kane County, Illinois was constructed in 2000. No known repairs have been performed on this structure.

II. Physical Description of Structure

General:
The Rotary Plaza Pedestrian Bridge consists of a single span weathering steel, symmetric pony-type truss with a timber deck carrying pedestrian traffic. The structure has a total length of 59'-7⅞" (back-to-back of end floor beams), an out-to-out width of 7'-10", clear width of 6'-10" and a total deck area of approximately 418 square feet. The safety rails extend beyond the ends of the bridge by 1'-2" at each end and is 3'-6" high. The structure does not have a skew, it has a straight horizontal alignment and the north bearing seat is 1'-8¼" higher than the south. The structure runs parallel to the Fox River and spans over the steep embankment of the east bank of the east channel. See Attachment B for photos.

Existing plans are only available for the truss superstructure and none are available for the concrete abutment substructure. This structure is owned and maintained by the City of Aurora.

Superstructure:
Deck: The existing deck is made-up of Iron Woods planks with steel plank hold downs and steel plank supports along the deck edge.

Stringers: The deck is supported by two longitudinal steel stringers (HSS 3"x3"x3/16") and a center nailer (HSS 2"x2"x3/16") which are stitch welded to the top of the floorbeams.

Floorbeams: The stringers are supported by transverse steel HSS floorbeams (typically HSS 5"x3"x¼"; end floorbeams (2) HSS 5"x5"x3/16" stacked) spaced 4'-11" on center. The floorbeams are welded to the bottom of the bottom chords. The floorbeams have diagonal braces (HSS 2"x2"x3/16") which are welded to the faces of the floorbeams.

Truss: The verticals (HSS 5"x5"x3/16") and diagonals (HSS 3"x2"x3/16") are welded to the top and bottom chords (HSS 5"x5"x3/16"). The railing pickets are welded to the exterior faces of the top and bottom chords with a cap along the top of the pickets, the Iron Wood rub rail is bolted to a plate that is welded to the vertical truss members, and the steel toe plate (¼"x6") is welded to the inside face of the vertical members.

Bearings: Steel bearing plates with slotted holes for longitudinal expansion are used at both abutments.

Substructure:
Abutments: The north and south abutments are reinforced concrete stub abutments with unknown foundations. There are retaining walls forming the river channel immediately adjacent to the back face of both abutments. There is a short retaining wall running the length of the structure just east of the bridge.

III. Field Inspection and Physical Evaluation

A field inspection was conducted on July 25, 2019 on this structure. The top and bottom of the deck, superstructure and substructure were inspected by visual observation and, when possible, sounding. The focus of the inspection was on the floorbeams, truss and abutments.

Superstructure:

Deck: Several of the planks throughout the deck area are loose and there are a few that are broken through. The welds along the plank hold downs are broken and there is moderate corrosion throughout the hold downs.

Stringers: The two stringers have moderate to heavy corrosion with moderate flaking, and the center nailer has failed through the majority of the bridge.

Floorbeams: The floorbeams typically have moderate to heavy corrosion with moderate to heavy flaking throughout the inside and outside faces. Ten of the thirteen floorbeams have corrosion holes on up to three faces of the member in a single cross section. The corrosion holes range from 1" to 24" along the length of the floor beam and up to the entire vertical face height.

Truss: The weathering steel protective coating show signs of degradation on the truss members above the deck. The diagonal and vertical members have minor section loss. The bottom chord has moderate section loss and moderate to heavy flaking on the bottom face and along the inside face between the plank hold down and the face of the chord. There is debris collecting between the railing pickets and the outside face of the bottom chord. The toe plate connection welds are intact. The rub rail bolted to the vertical members is heavily weathered and split in several areas.

Bearings: The southeast bearing is buried and the other three bearings have minor debris surrounding them. There is minor corrosion and flaking on the bearing plates.

Substructure:

Abutments: The abutments have corrosion staining and minor to moderate debris build-up on the bearing seat. There is minor scour along the west end of the South Abutment along the embankment.

Inspection History (NBIS Ratings):

Year	Deck	Super	Sub
N/A	N/A	N/A	N/A

Geometric, Horizontal & Vertical Clearance / Hydraulic Data:

N/A

IV. Potential Scope of Work Determination & Discussion

Due to the level of deterioration of the existing structure, there are four viable alternatives for rehabilitating the Rotary Plaza area and returning the riverwalk pedestrian walkway to a suitable state. Several of the alternatives have additional sub-options as described in the text below.

ALTERNATIVE	DESCRIPTION
1	Repair existing structure
2	Remove existing structure & pave the detour that the pedestrians already created
3	Remove existing structure, install retaining wall & construct sidewalk along existing alignment
4	Remove existing superstructure, install prefabricated truss superstructure on existing abutments
5	Remove existing structure (superstructure and potentially substructure), install “roadway style” structure along existing alignment & profile

Alternative 1 – Repair existing superstructure:
The first option to consider is to repair the existing structure. As noted in the previous section, the inspection of the existing structure found the deck and floor system to be beyond repair. It would be necessary to remove and replace the timber deck, plank holddowns, stringers, center nailer, diagonal bracing and floorbeams to return the existing structure to a functional condition. Additionally, the existing truss is designed to an outdated code and the bottom chord has moderate deterioration. In order to achieve a reasonable service life for the structure after the rehabilitation is complete, the bottom chord would require extensive repairs. Due to the significant member replacement and strengthening that would be required, liability issues repairing an existing bridge designed to an old code, and the environmental issues that you may have with the blasting and painting on site this option is not considered economical nor viable.

Cost estimate range for Alternative 1: Not applicable.

Alternative 2 – Eliminate the structure and utilize the adjacent at grade solution:
Since the closure of the existing pedestrian bridge, local foot traffic has created a detour just east of the structure, see Photo A. This option involves removing the existing superstructure and re-aligning the sidewalk to the existing detour, east of the current alignment. Moderate surface work in the adjacent area and additional pedestrian railing would be necessary. Additional work can be performed on the approaches to smooth out the alignment of the path and allow for a more natural route. The embankment below the existing structure would be left as-is since it is stabilized with riprap and well vegetated. The existing abutments can be left in place or removed.

This alternative improves the overall aesthetics of the riverwalk since the existing bridge railing is a mismatch. Removing the weathering steel truss and installing pedestrian railing to match

the style and finish of the existing railing allows the area to blend with the adjacent sections and create a more uniform aesthetic. The current path width can be maintained, however due to the path re-alignment that is required, this option does not allow for a smooth flow of foot and bicycle traffic. Additional work performed in the approach areas can mitigate the disruption. Long-term maintenance of the area is the same as the adjacent areas of the walkway.

Cost estimate range for Alternative 2: $65,000 to $80,000.

Photo A – Existing Detour East of Bridge

<u>Alternative 3 – Construct a retaining wall to maintain alignment:</u>
This alternative involves removing the existing superstructure, constructing a retaining wall between the two existing retaining walls (adjacent and to the west of the current structure) and constructing sidewalk on-grade following the current path alignment. Minimal surface work in the adjacent area and additional pedestrian railing is necessary. There are several retaining wall types that can be considered. The most appropriate option(s) will depend on a geotechnical investigation and any aesthetic requirements the City has.

This alternative will blend with the overall aesthetics of the riverwalk the best. The current lack of retaining wall and railing mismatch at the bridge location will be resolved and a uniform look to the riverwalk can be created. Additionally, the ability to maintain the current path width, alignment and profile is ideal for pedestrian and bicyclist familiarity. Due to the proximity of the retaining wall structure to the river, long-term erosion is a potential concern. The cost estimate makes assumptions about the nature of the soil in the area, additional geotechnical information is required to confirm the below cost estimate.

Cost estimate range for Alternative 3: $110,000 to $135,000.

Alternative 4 – Install a prefabricated truss superstructure:
This alternative involves removing the existing superstructure and installing a similar style prefabricated truss superstructure. The existing abutments will be re-used, thus maintaining the current path alignment and vertical profile. There are several combinations of options available for the deck and protective coating on the steel. The truss can be self-weathering, painted or galvanized steel and the deck can be timber planks or solid concrete. A solid concrete deck will increase the dead load on the structure. Without existing plans for the abutment, it is unknown if the current abutments can be re-used.

Since the walkway is heavily salted in the winter months, consideration needs to be given to the deck and protective coating type. The current structure is built using self-weathering steel with a timber plank deck; it had a service life of almost 20 years. In order to improve the service life of the replacement structure, consideration should be given to more suitable protective coatings and/or a solid deck to reduce the amount of salt contacting the steel. Due to the increased dead load for a concrete deck versus a timber deck, a subsurface investigation would be required if the solid deck option is chosen. The aesthetics of the riverwalk will remain relatively unchanged with this alternative.

Cost estimate range for Alternative 4: $110,000 to $140,000.

Alternative 5 – Construct a “roadway style” structure:
This alternative involves removing the existing superstructure and constructing a bridge type more typically seen on roadways rather than pedestrian bridges. There are several potential options to consider, including a slab bridge, PPC deck beams and double-T beams or steel beams.

For a slab bridge, the existing abutments can be re-used and still maintain the existing vertical profile of the path; however, a new pier will need to be constructed due to the span length limitations. Since existing plans do not exist for the abutments and the beam-type superstructures will increase the dead load on the substructure, these superstructure types will require a full bridge reconstruction. In addition to the unknown foundation type of the existing abutments, the new abutments will need to be lower than the existing to maintain the vertical profile of the current path since the current distance from bearing seat to top of deck is only approximately 12”. Any of the roadway style structures can have precast fascia panels added to mimic the filled arch aesthetic found on the surrounding roadway bridges.

This alternative maintains the familiarity of the alignment and profile for pedestrians and bicyclists, will provide the longest service life for the alternatives involving a structure and requires minimal long-term maintenance. The railing can be designed to improve the aesthetic continuity with the adjacent riverwalk sections. If the City is interested, arched precast panels can be added to the west fascia. Several roadway bridges in the area have been reconstructed as beam-type bridges with arched fascia panels to replicate the filled arch look of the older structures; a similar approach can be taken with this alternative. A geotechnical investigation would be required due to the substructure work involved.

Cost estimate range for Alternative 5: $200,000 to $300,000.

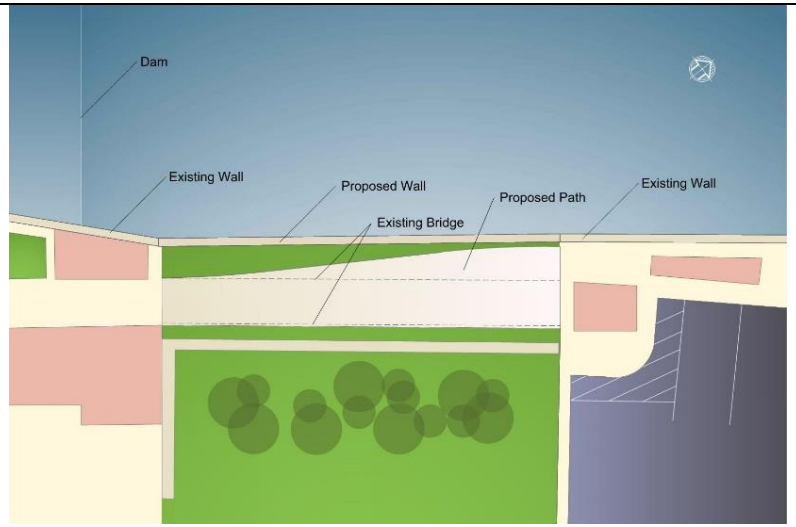
V. Recommended Scope of Work

Upon evaluating the project's needs, desires, constraints and per concurrence with the City, Alternative 3, constructing a retaining wall, is recommended. Below are two options to consider concerning the overall riverwalk aesthetics and path alignment preference. The final wall location will be dictated by the findings of the geotechnical, environmental and hydraulic investigations.

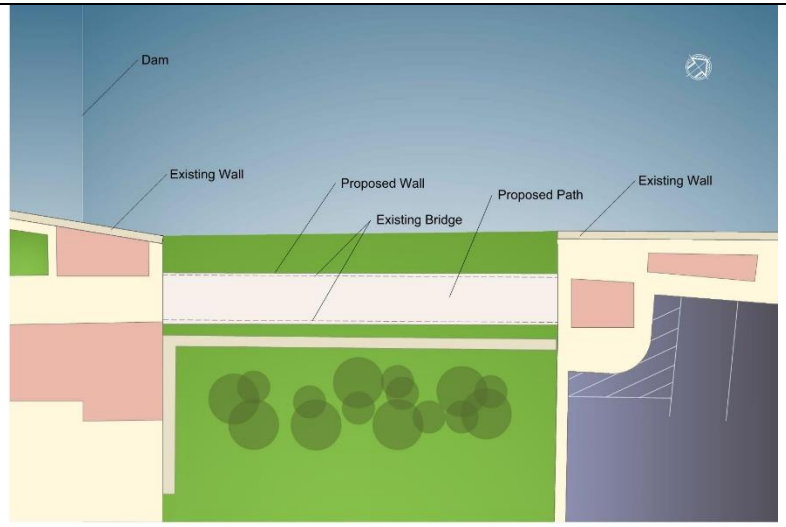
Aurora Riverwalk - Existing View Looking South at Pedestrian Walkway Bridge

Aurora Riverwalk - Proposed View Looking South at Replacement of the Existing Pedestrian Walkway Rotary Bridge – <u>Option 1</u>

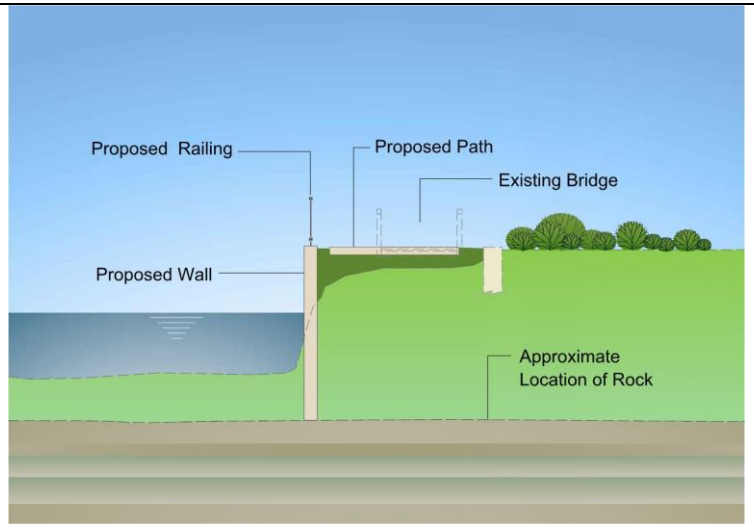
Aurora Riverwalk - Proposed View Looking South at Replacement of the Existing Pedestrian Walkway Rotary Bridge – <u>Option 2</u>



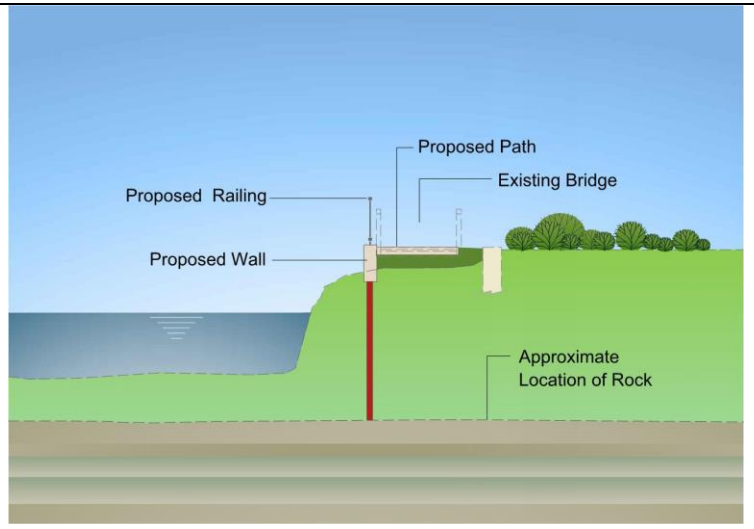
Aurora Riverwalk - Proposed Plan at Replacement of the Existing Pedestrian Walkway Rotary Bridge – <u>Option 1</u>



Aurora Riverwalk - Proposed Plan at Replacement of the Existing Pedestrian Walkway Rotary Bridge – <u>Option 2</u>

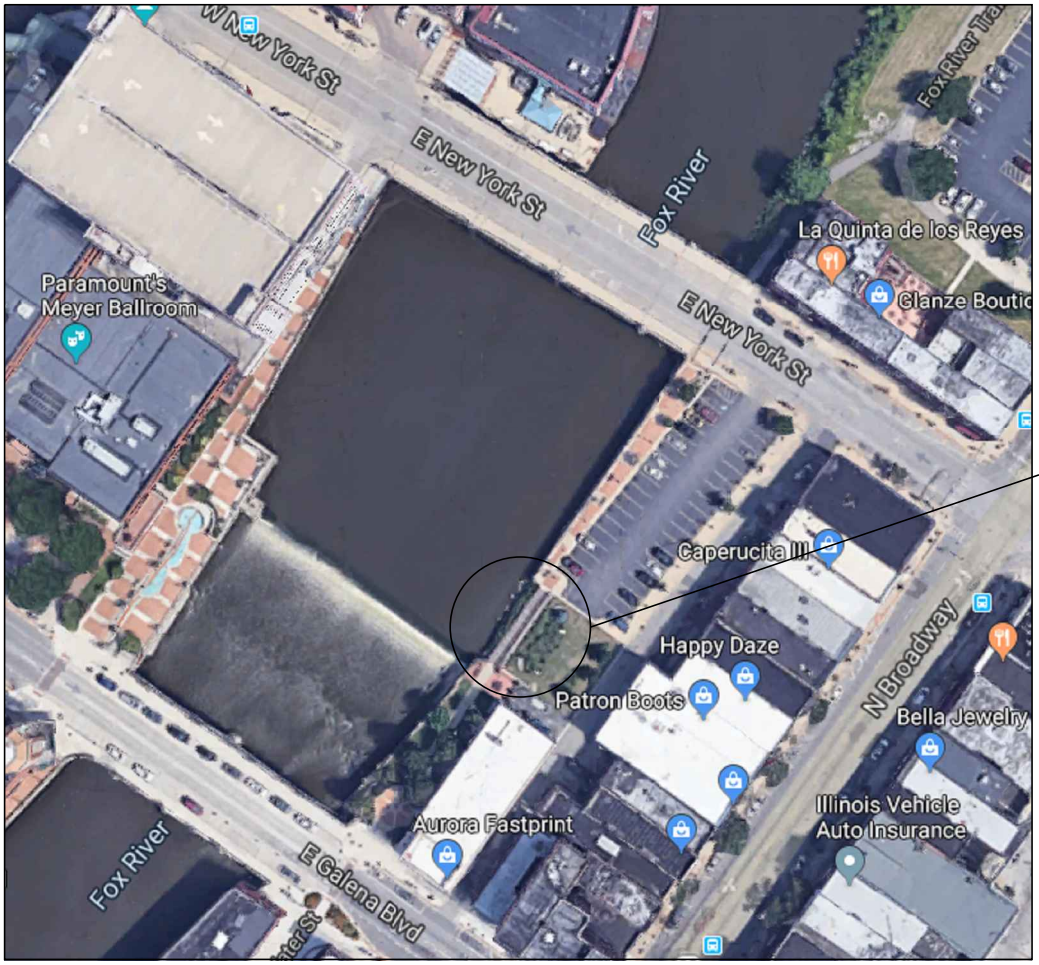


Aurora Riverwalk - Proposed Cross Section at Replacement of the Existing Pedestrian Walkway Rotary Bridge – <u>Option 1</u>



Aurora Riverwalk - Proposed Cross Section at Replacement of the Existing Pedestrian Walkway Rotary Bridge – <u>Option 2</u>

ATTACHMENT A
LOCATION MAP



LOCATION MAP

ATTACHMENT B
STRUCTURE PHOTOGRAPHS

Photo 1 – General Elevation, Looking Northwest

Photo 2 – Top of Deck, Looking South

Photo 3 – Typical Truss above Deck and Rub Rail, Looking Northwest

Photo 4 – Top and Outside Faces of Bottom Chord, Looking Down

Photo 5 – Floorbeam 5, Looking Southeast

Photo 6 – Bottom Chord Inside and Bottom Faces

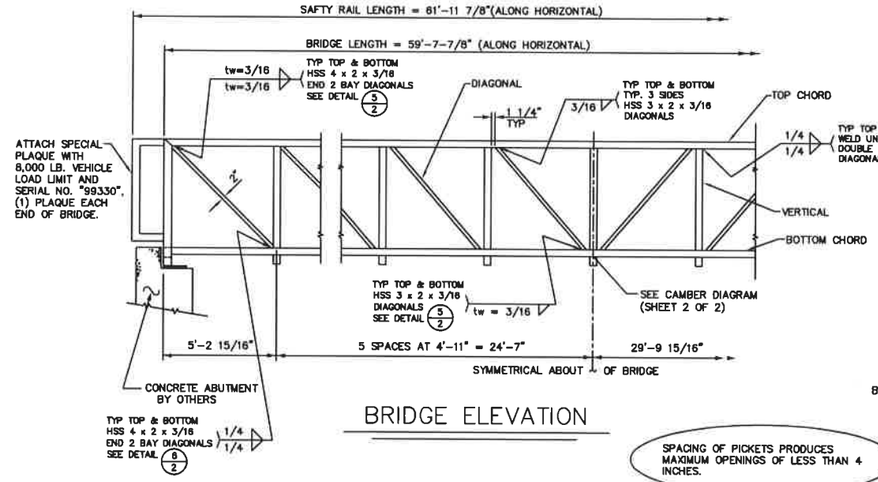
Photo 7 – Typical Inside of Floorbeam

Photo 8 – Typical Center Nailer, Looking South

Photo 9 – Southwest Bearing

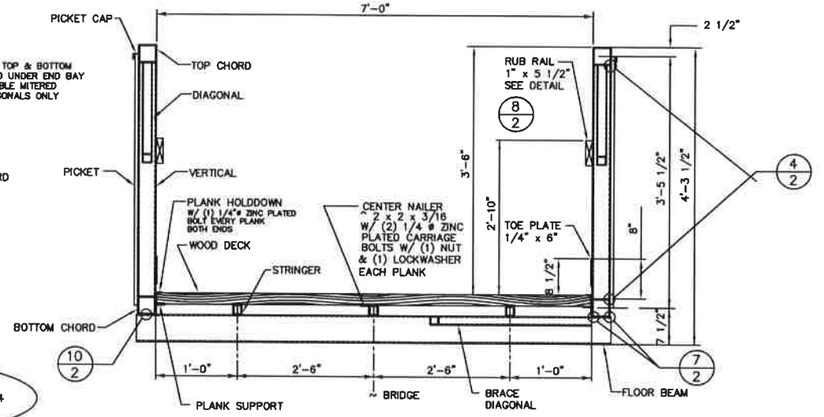
Photo 10 – North Abutment, Looking North

ATTACHMENT C
ABBREVIATED EXISTING PLANS



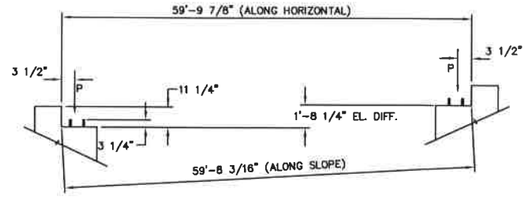
BRIDGE ELEVATION

SPACING OF PICKETS PRODUCES MAXIMUM OPENINGS OF LESS THAN 4 INCHES.



1/1 BRIDGE SECTION

PICKETS, RUB RAIL & TOE PLATE NOT SHOWN IN ELEVATION, SEE BRIDGE SECTION & PICKET LAYOUT FOR CORRECT NUMBER & LOCATION.



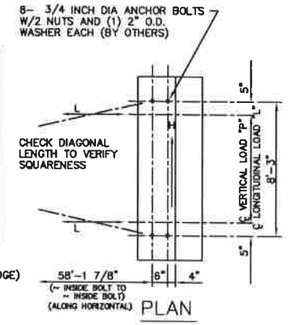
ANCHOR BOLT ELEVATION

COMBINE REACTIONS AS PER LOCAL OR GOVERNING BUILDING CODES AS REQUIRED

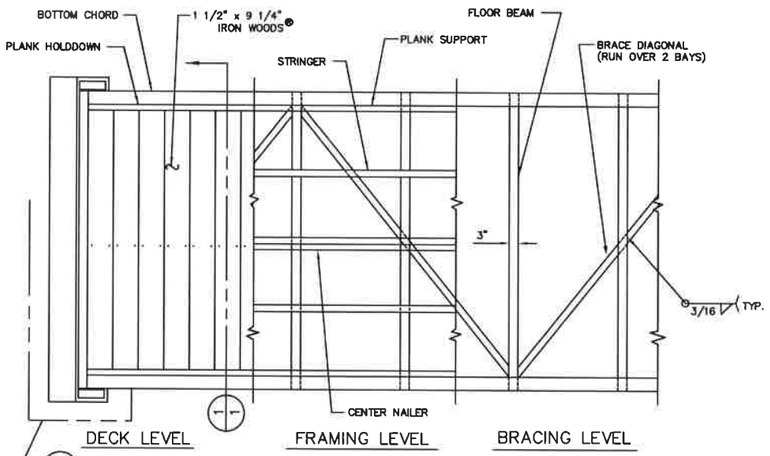
BRIDGE REACTIONS	+ DOWNWARD LOAD – UPWARD LOAD		
	P (LBS)	H (LBS)	L (LBS)
DEAD LOAD	3,550		
UNIFORM LIVE LOAD	9,050		
VEHICLE LOAD	4,000		
WIND UPLIFT 20 PSF	–3,575		
WIND	±955	3,330	
THERMAL			1,245

"P" – VERTICAL LOAD EACH BASE PLATE (4 PER BRIDGE)
"H" – HORIZONTAL LOAD EACH FOOTING (2 PER BRIDGE)
"L" – LONGITUDINAL LOAD EACH BASE PLATE (4 PER BRIDGE)

BRIDGE LIFTING WEIGHT: 14,200 LBS



PLAN

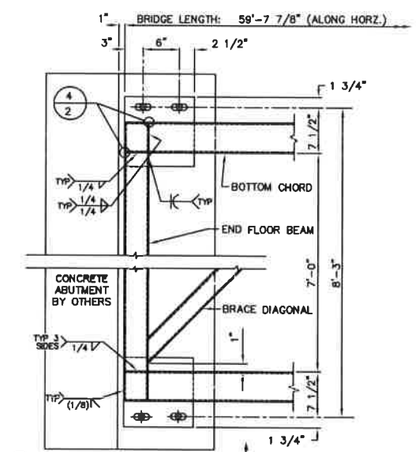


BRIDGE PLAN

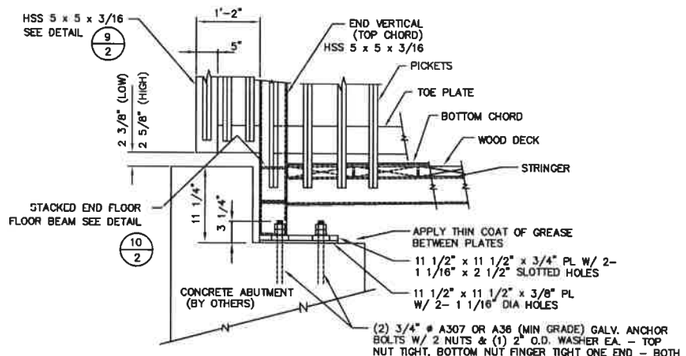
SCHEDULE OF MEMBER SIZES	
TOP CHORD	HSS 5 x 5 x 3/16
BOTTOM CHORD	HSS 5 x 5 x 3/16
VERTICAL	HSS 5 x 5 x 3/16
DIAGONAL	HSS 3 x 2 x 3/16 *
BRACE DIAGONAL	HSS 2 x 2 x 3/16
FLOOR BEAM	HSS 5 x 3 x 1/4
END FLOOR BEAM	(2) HSS 5 x 5 x 3/16 STACKED
PICKETS	^ 1 1/4 x 1 1/4 x 1/8
PLANK HOLDDOWN	^ 1 1/4 x 1 1/4 x 1/8
STRINGER	HSS 3 x 3 x 3/16
PLANK SUPPORT	^ 1 1/4 x 1 1/4 x 1/8
CENTER NAILER	^ 2 x 2 x 3/16
PICKET CAP	^ 1 1/4 x 1 1/4 x 1/8

* USE HSS 4 x 2 x 3/16 FOR END 2 BAYS, DOUBLE MITERED, TYP. EACH END.

SHOP NOTE: EXTEND END VERTICAL TO BASE PLATE



2/1 PLAN – BEARING ASSEMBLY



3/1 SIDE VIEW – BEARING ASSEMBLY

CAUTION:

WE ARE PROVIDING A WOOD DECK ON THIS STRUCTURE IN ACCORDANCE WITH THE SPECIFICATIONS AND/OR THE CONTRACT DOCUMENTS. BE AWARE THAT MOST PEDESTRIAN BRIDGE LIABILITY CLAIMS ARE STATISTICALLY SLIP AND FALL CLAIMS. IT IS THE OWNER'S RESPONSIBILITY TO KEEP THE DECK FREE FROM SLIP OR TRIP HAZARDS DUE TO CUPPING, SPLITS, GAPS AND SMOOTH SURFACES.

GENERAL NOTES

1. DESIGN STRESSES ARE IN ACCORDANCE WITH THE MANUAL OF STEEL CONSTRUCTION FOR ALLOWABLE STRESS DESIGN AS ADOPTED BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC), LATEST EDITION.
2. BRIDGE MEMBERS ARE FABRICATED FROM HIGH STRENGTH, LOW ALLOY, ENHANCED ATMOSPHERIC CORROSION RESISTANT ASTM A847 COLD-FORMED WELDED SQUARE AND RECTANGULAR TUBING, AND ASTM A588, ASTM A606, OR ASTM A242 PLATE AND STRUCTURAL SHAPES (Fy = 50,000 PSI).
3. BRIDGE DECKING 1 1/2" THICK NATURALLY DURABLE IRON WOODS ® FEQ (CLEAR ALL HEART) OR F1F (FIRST ONE FACE) GRADE.
4. THE GAS METAL ARC WELDING PROCESS WITH OXYGEN/ARGON SHIELDING GAS WILL BE USED.
5. ALL TOP AND BOTTOM CHORD SHOP SPLICES TO BE COMPLETE PENETRATION TYPE WELDS. WELD BETWEEN TOP CHORD AND END VERTICAL SHALL BE COMPLETE PENETRATION TYPE WELDS ON BOTH SIDES WITH A PARTIAL PENETRATION GROOVE WELD ON THE TOP SIDE AND A FILLET WELD ON BOTTOM SIDE.
6. UNLESS OTHERWISE NOTED, WELDED CONNECTIONS SHALL BE FILLET WELDS (OR HAVE THE EFFECTIVE THROAT OF A FILLET WELD) OF A SIZE EQUAL TO THE THICKNESS OF THE LIGHTEST GAGE MEMBER IN THE CONNECTION. WELDS SHALL BE APPLIED AS FOLLOWS:
   A) BOTH ENDS OF VERTICALS, DIAGONALS, BRACE DIAGONALS, AND FLOOR BEAMS SHALL BE WELDED ALL AROUND.
   B) BOTTOM OF STRINGERS WILL BE STITCH WELDED TO TOP OF FLOOR BEAMS.
   C) MISCELLANEOUS NON-STRUCTURAL MEMBERS WILL BE STITCH WELDED TO THEIR SUPPORTING MEMBERS.
7. BRIDGE DESIGN WAS ONLY BASED ON COMBINATIONS OF THE FOLLOWING LOADS WHICH WILL PRODUCE MAXIMUM CRITICAL MEMBER STRESSES.
   A) 85 PSF UNIFORM LIVE LOADING ON THE FULL DECK AREA OR ONE 8,000 POUND VEHICLE LOAD. THE LOAD SHALL BE DISTRIBUTED AS A FOUR-WHEEL VEHICLE WITH 60% OF LOAD ON THE REAR WHEELS. THE WHEEL TRACK WIDTH OF THE VEHICLE SHALL BE 5'-0" AND THE WHEEL BASE SHALL BE 8'-6". THE VEHICLE SHALL BE POSITIONED SO AS TO PRODUCE THE MAXIMUM STRESS IN EACH MEMBER, INCLUDING DECKING.
   B) 25 PSF WIND LOAD ON THE FULL HEIGHT OF THE BRIDGE, AS IF ENCLOSED.
   C) 20 PSF UPWARD FORCE APPLIED AT THE WINDWARD QUARTER POINT OF THE TRANSVERSE BRIDGE WIDTH (AASHTO 3.15.3).
8. CLEANING: ALL EXPOSED SURFACES OF STEEL SHALL BE CLEANED IN ACCORDANCE WITH STEEL STRUCTURES PAINTING COUNCIL SURFACES PREPARATION SPECIFICATIONS NO. 7 BRUSH OFF BLAST CLEANING. SSPC-SP7-LATEST EDITION.

CONTINENTAL BRIDGE
ALEXANDRIA MN 320–852–7500

REV. BY:	DATE:	LEVEL:	REVISION:
MDM	11/24/99	B	BRIDGE LENGTH WAS 60'-10"; ADDED ELEVATION DIFFERENCE
BLP	10/28/99	A	CHANGED SAFETY RAIL TO PICKETS

59'–7 7/8" x 7'–0"
ROTARY PLAZA BRIDGE
PEDESTRIAN BRIDGE
AURORA, IL

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF ILLINOIS

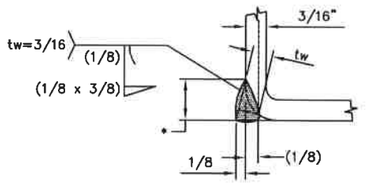
DATE:

REG. NO. 062-046018

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
SEC	BLP	SEC	DGR

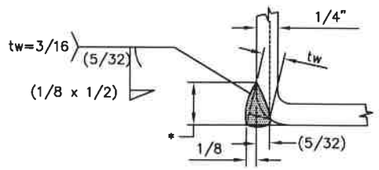
DATE:	SHEET NO.	JOB #
10/25/99	1 OF 2	99330

NOTE: IF THE OUTSIDE RADIUS OF THE TUBE IS LESS THAN 1.5 TIMES THE WALL THICKNESS, CONTACT THE ENGINEER FOR APPROPRIATE WELD MODIFICATIONS.



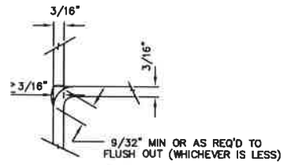
3/16" WALL THICKNESS
* 3/8" MINIMUM OR AS REQUIRED TO FLUSH OUT RADIUS, WHICHEVER IS GREATER

7/1 WELD DETAIL



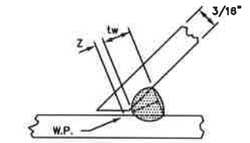
1/4" WALL THICKNESS, 3/16 WELD
* 1/2" MINIMUM OR AS REQUIRED TO FLUSH OUT RADIUS, WHICHEVER IS GREATER

10/1 WELD DETAIL



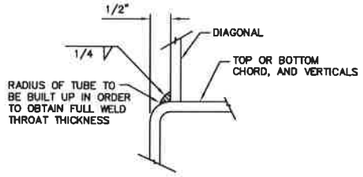
MATCHED EDGES OF VERTICALS TO BOTH CHORDS TO BE PARTIAL PENETRATION WELDS

4/1,2 WELD DETAIL



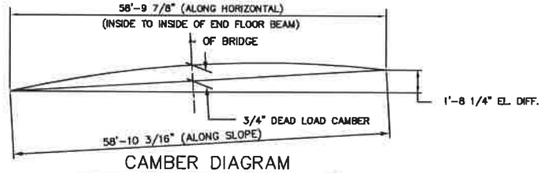
"Z" LOSS DIMENSION TO BE DETERMINED IN ACCORDANCE WITH AWS D1.1 - TABLE 2.8

5/1 WELD DETAIL

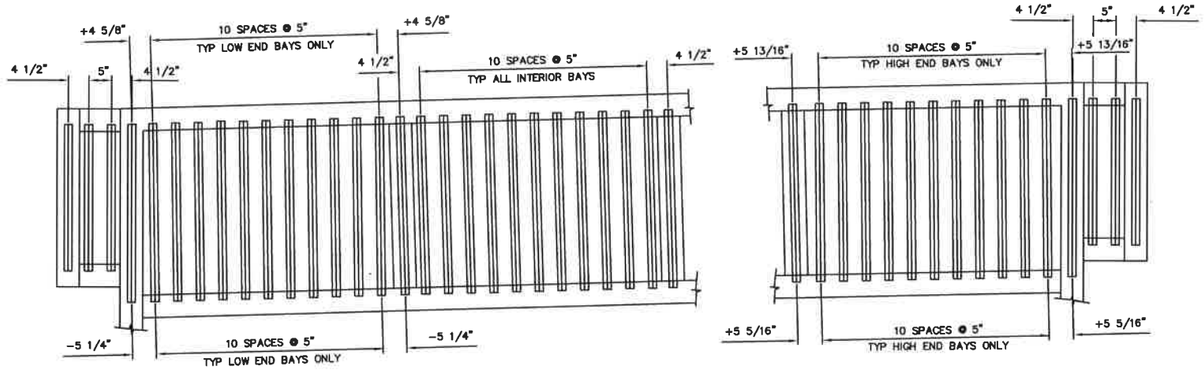


6/1 WELD DETAIL
TYP. END 2 BAY DIAGONALS

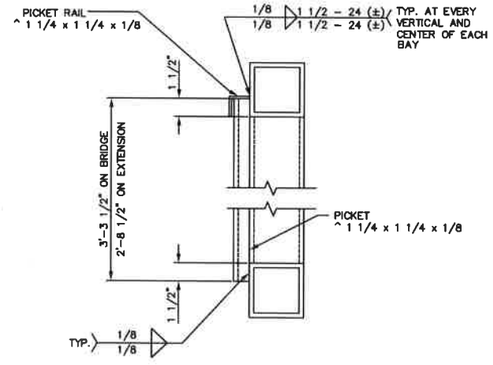
SHOP NOTE: MARK HIGH END OF BRIDGE



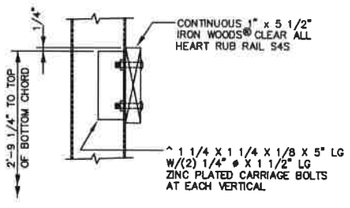
CAMBER DIAGRAM



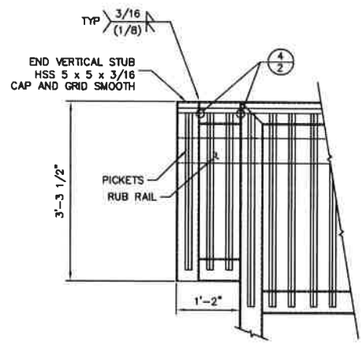
PICKET LAYOUT DETAIL



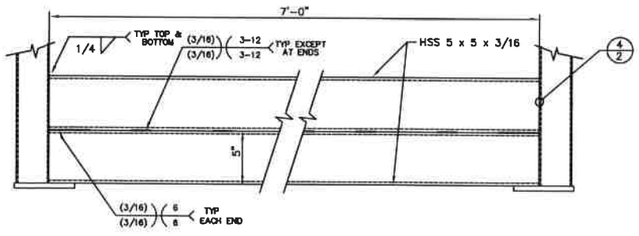
PICKET ATTACHMENT DETAIL



8/1 RUB RAIL DETAIL
EXTEND 1'-2" PASS END VERTICAL



9/1 PICKETS & RUB RAIL EXTENSION DETAIL
EXTEND 1'-2" PASS END VERTICAL



END FLOOR BEAM DETAIL
BUILD (2)

CONTINENTAL BRIDGE
ALEXANDRIA MN 320-852-7500

REV. BY:	DATE:	LEVEL:	REVISION:
MDM	11/24/99	B	BRIDGE LENGTH WAS 60'-10"; ADDED ELEVATION DIFFERENCE
BLP	11/24/99	A	CHANGED SAFETY TO PICKETS

59'-7 7/8" x 7'-0"
ROTARY PLAZA BRIDGE
PEDESTRIAN BRIDGE
AURORA, IL

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF ILLINOIS

DATE:

REG. NO. 062-046018

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
SEC	BLP	SEC	DGR

DATE:	SHEET NO.	JOB #
10/25/99	2 OF 2	99330