2016 QBS
Request for Statement of Interest (SOI)
Silver Glen Road over Otter Creek
Bridge Rehabilitation/Replacement
Section Number 16-00115-02-BR

The Kane County Division of Transportation is in need of professional services from a qualified engineering firm to provide engineering services as detailed in the attached preliminary scope of work.

Statements of Interest received will be used by the County to determine a preferred consultant for the work.

The attached ***Bridge Inspection Report*** provides a summary of the current bridge conditions and should be used in determining alternatives to be provided in the Phase I and Phase II services required.

At this time the County anticipates starting this work as soon as possible.

The Statement of Interest shall be limited to 2 pages, must be submitted electronically via **KDOT QBS** no later than 4:00 pm on May 20th, 2016, and should be addressed to Candi Thomas, P.E., Senior Project Manager. The SOI shall be submitted in a PDF format viewable with the latest version of Adobe Reader.

If you plan to enter into a joint venture with another firm for this project please note this on your Statement of Interest, including the name of the firm you are entering into a joint venture with for this project.

For more information regarding the 2-page SOI, such as content and format of these items, please reference the QBS document found at: KQBS - Professional Services Procurement Process.

Any questions on the project may be emailed to Candi Tomas.

A Statement of Interest (SOI) received after the above noted deadline will not be used as part of our consultant selection process.

Candi Thomas, P.E.
Senior Project Manager
Kane County Division of Transportation
41W011 Burlington Road
St. Charles, Illinois 60175
thomascandance@co.kane.il.us

Please refer to the following Preliminary Scope of work for more information on this project.

Silver Glen Road over Otter Creek
Preliminary Scope of Work

Project Description/Scope of Services:

This project consists of Phase I & Phase II design services to rehabilitate/replace the bridge/superstructure along Silver Glen Road over Otter Creek (045-3122).

Please see attached references:

- 2015 Bridge Report

This project is funded through STP-Bridge.

2015 Kane County Routine Bridge Inspection Report

STRUCTURE NO. 045-3122

Silver Glen Road / F.A.P. 0526

over

Otter Creek

February 19, 2016

Prepared for:

Kane County Division of Transportation

Prepared by:

COLLINS ENGINEERS INC.

123 North Wacker Drive, Suite 900
Chicago, Illinois 60606
312.704.9300 • www.collinsengr.com

STRUCTURE INVENTORY DATA

INSPECTION INFORMATION

Date:	February 19, 2016
Weather:	55° F, Sunny
Note:	

STRUCTURE INFORMATION

Structure Number:	045-3122
District:	1
County:	Kane
Township:	St. Charles
Feature Carried:	Silver Glen Road / F.A.P. 0526
Feature Crossed:	Otter Creek
Type:	Precast Prestressed Concrete Deck Beams
Span Arrangement:	Two simple spans (45'-5 ½", 45'-5 ½")
Length:	93'-5" back-to-back of abutments
Width:	40'-0" out-to-out of deck 40'-0" face-to-face of rail 8'-0" out-to-out of deck & face-to-face of rail for separate pedestrian bridge supported on widened abutments of the main roadway structure
Skew:	0°
Abutments:	Concrete Pile/Metal Shell Pile Supported Stub Abutment
Piers:	Individually Encased Pile Bent
Year Constructed:	1984
Year/s Reconstructed:	1999 – Widened abutments and added pedestrian bridge

ROADWAY INFORMATION

ADT (2014):	6550– IDOT Master Structure Report
ADTT (2014):	4% – IDOT Master Structure Report
Inventory Rating RF:	0.741 – Collins Engineers, Inc. 1.000 – IDOT Master Structure Report
Operating Rating RF:	1.236 – Collins Engineers, Inc. 1.365 – IDOT Master Structure Report
Existing Clear Width:	40'-0"
Width to Remain in Place:	28'-0"
Clear Roadway Bridge Width:	40'-0"

INSPECTION HISTORY (NBIS RATINGS)

Year	Deck:	Super:	Sub:
2002	8	8	7
2006	7	7	7
2010	5	5	7
2012	5	5	5
2014	5	5	5
2016	4	4	5

STRUCTURE CONDITION FINDINGS

APPROACH ROADWAY

The approach roadway consists of HMA surface and shoulders. The approach roadways have been resurfaced since the previous inspection and are in **good condition** *(see Photo No. 3 & 4).*

- Transverse cracks up to 1/4 in. wide are present in the roadway near the abutments *(see Photo No. 5).*

BRIDGE PARAPET / RAIL

The Type S-1 steel railing is in **good condition** *(see Photo No. 6).*

- No impact damage was noted at the time of the inspection.
- The bridge rail is not crash tested, and therefore does not meet current IDOT requirements for this structure.

SUPERSTRUCTURE

The superstructure is in **poor condition**.

Top of Deck *(see Photo No. 7)*

- The HMA wearing surface has been replaced since the previous inspection and it is in good condition.
- A transverse crack up to 1/4 in. wide is present at the pier *(see Photo No. 8).*

Beams *(see Photo No. 9)*

- The PPC deck beams are in poor condition.
- A 1 ft. by 1 ft. spall with 2 in. penetration is located at the south exterior beam in the east span along the top edge at the 2nd bridge rail post from the east abutment.
- Spalls and delaminations are present on four beams in the west span and nine beams in the east span. Many spalls have exposed, corroded stirrups *(see Photo No. 10).* Refer to sketch in Appendix C for more details.
- Water infiltration is occurring through several of the joints in both spans, most notably at beam joints 1-2 and 2-3 of the west span.

Pedestrian Bridge *(see Photo No. 11)*

- Two separate PPC deck beams, which support an adjacent bike path structure, are in good condition. These beams are supported by widened substructure units of the main bridge.
- The asphalt surface of the pedestrian bridge exhibits transverse cracking up to 1/2 in. wide at approximately 10 ft. spacing *(see Photo No. 12).*
- Settlement up to 1 in. of the approach pathways has created an uneven riding surface *(see Photo No. 13).*

SUBSTRUCTURE

The substructure is in **fair condition**.

Abutments *(see Photo No. 14 & 15)*

- Minor vertical hairline cracking and water staining is present throughout both abutment caps.
- The earth embankment along the east abutment is heavily eroded with up to a 4 ft. vertical face, and the top 6 in. of the south pile is exposed (*see Photo No. 16).*
- The rating was previously reduced to a "5" due to the erosion around the southeast abutment pile.
- The abutments were widened at the north ends in 1999 to accommodate a pedestrian structure adjacent to the bridge.
- The widened section at the north end of the west abutment is slightly undermined, but no pile is visible.

Wingwalls *(see Photo No. 17)*

- The wingwalls are typically smooth and sound with no notable defects.

Pier *(see Photo No. 18)*

- Several of the concrete piles exhibit minor hairline cracking at the top below the cap.
- All of the original bridge pier piles have extensive cracking, delaminations, and impending spalls *(see Photo No. 19).*
- There is a 6 in. by 8 in. spall with 1 in. penetration and exposed reinforcement and a 3 in. by 6 in. spall with 1/2 in. penetration near the north end on the east face of the pier cap. A 6 in. by 1 ft. spall is also present on the east face of the pier cap at the south end with up to 1.5 in. of penetration.
- A spall the width of the pier is present on the bottom of the pier cap in between the third and fourth pile from the south with exposed corroded reinforcement.
- Water staining is present on the cap due to leakage from the superstructure joint.
- Several of the pile encasements have significant spalling at the waterline with up to 4 in. of penetration (*see Photo No. 20).*
- The north end of the pier was widened in 1999 to accommodate a bike path structure adjacent to the bridge. The cap and the piles are in good condition.

SLOPE / CHANNEL *(see Photo No. 21 & 22)*

Slope/Channel Protection

- The upstream and downstream channel banks are moderately sloped and well vegetated.
- Bank erosion up to 3 ft. tall was observed, most notably at the southwest bank.
- No riprap scour protection is in place at the structure.
- The east abutment embankment is heavily eroded. A 6 in. diameter clay drain tile that runs under the abutment is exposed. The south end of the east abutment is eroded underneath the cap and one pile is exposed *(see Photo No. 23).*
- Runoff erosion due to water flowing over the deck is present in between the structure and the pedestrian bridge *(see Photo No. 24).*

Channel Adequacy

- Minor debris up to 6 in. in diameter has accumulated around some of the piles most notably around the 3rd pile from the north, which is partially restricting the flow (*see Photo No. 25).*
- A scour pocket, 2 to 3 ft. deep, is present at the north 4 columns of the pier.

TRAFFIC SAFETY

Pavement lane marking are present and visible. There is an intersection with Crane Rd. approximately 0.3 miles east of the structure and an intersection with Burr Rd. & Reserve Ct. approximately 0.2 miles west of the structure.

Guardrail *(see Photo No. 26)*

- Steel plate beam guardrail and Type 1 Special (Tangent) end sections are present at all four corners of the structure and are in good condition with no impact damage noted.
- The approach guardrail and end sections meet current IDOT standards.

Signage

- Hazard clearance markers are present on all of the guardrail ends.

GEOMETRY / UTILITIES

Geometry

- The structure is in a tangent horizontal alignment with no vertical grade change.

Utilities

- There are no utilities attached to the structure.
- An overhead, pole-mounted utility is located in the south right-of-way.

STRUCTURE RATING / POSTING

- The structure was load rated based on the original design plans and field inspection data. The results are as follows:
  - Inventory Rating = RF 0.741 (HS 14.8)
  - Operating Rating = RF 1.236 (HS 24.7)
- This structure has an Operating Rating of less than 1.0 for Kane County Special Permit Vehicles, and weight restrictions for these vehicles should be implemented. Refer to Structure Rating calculations (Appendix F) for recommended posting and permit vehicle weight restrictions.

  Posting not required.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- The new HMA wearing surface is in good condition.
- The superstructure is in poor condition with areas of spalling with exposed corroded reinforcement along the PPC deck beams.
- Water leakage between several of the beams indicates that the keyways are damaged. The spalls and delaminations on the bottom of the PPC deck beams indicate that they are beginning to decline in condition and capacity. Repairs to the beams would not restore capacity when considering the load rating and posting of the structure.
- The existing substructure is in fair condition due to the exposure of one of the piles at the south end of the east abutment. The east abutment is heavily eroded and there is a minor amount of debris buildup around the pier piles. Additionally, the concrete pile encasements are heavily spalled at the waterline.
- The bridge rail does not meet current IDOT crash tested requirements.
- Weight restrictions should be implemented for Kane County permit vehicles. Refer to Structure Rating calculations (Appendix F) for recommended posting and permit vehicle weight restrictions.

RECOMMENDATIONS

Short Term (1 – 3 Years)

- Fill eroded areas of the channel near the abutments and pier and install riprap to protect the channel from further erosion. This may require an Army Corps of Engineers permit.
- Consider replacing existing bridge rail with bridge rail that is crash tested in accordance with current IDOT requirements.

Long Term (4 – 12 Years)

- Initiate a Phase 1 study to investigate improvement by superstructure replacement or complete structure replacement.

APPENDICES

Appendix A Bridge Inspection Report
Appendix B IDOT Master Structure Report
Appendix C Structure Sketches
Appendix D Structure Photos
Appendix E Cost Estimates
Appendix F Structure Rating

APPENDIX A

BRIDGE INSPECTION REPORT

Illinois Department of Transportation

Routine Inspection Report

SN: 045-3122	**District:** 1	**Spans:** 2	**Appr. Spans:** 0	**Skew:** 0°0'0"	**ADT:** 6550	**Truck Pct:** 4	
ADT Un: N	**Maint. Co:** Kane	**Twsp:** St. Charles			**Status:** Open - No Restriction		
Facility Carried: Silver Glen Road			**Feature Crossed:** Otter Creek				
Location: 0.83 MI W. Randall Rd.	**Municipality:** South Elgin		**Team/Sub Section:** N/N		**Insp/Rte:** N		
Bridge Name: N			**Material & Type:** 5/05 - Prestressed Concrete Box Beam				
Insp. Intervals Routine: 24	**Fracture Critical:** 0	**Underwater:** 0	**Special:** N		**Element Level:** 0		
90- Inspection Date:	2/19/2016		90C - Temp. (°F):	55°	90B1- In Depth:	☐	
Is Delinquent: ☐	Reason:	N					
90A - Agency Program Manager:	Hamelka, J. M.		90A3- Consultant Program Manager:		N		
90A1- Team Leader:	Guerriero, J. P.		90A2- Inspector:	Schneider, J. M.			
90B- Inspection Remarks:							
Previous Inspections							

Resources

Time to Inspect (H:M):	2:30	2:30	Traffic Control:	N	N	Boat:	N	N	Waders:	Y	Y	Snooper:	N	N		
Ladder:	N	N	Manlift:	N	N	Bucket Truck:	N	N	Other:							

Inspector's Appraisals

	Prev	New	Comments
58 - Deck Condition:	5	4	New asphalt overlay has been installed since previous inspection and it is in good condition.
59 - Superstructure Cond:	5	4	Several spalls and delaminations with exposed corroded shear reinforcement. Leakage and efflorescence present along the majoirty of keyway joints.
60 - Substructure Cond:	5	5	Scour pocket around the 4 upstream columns of the pier up to 3' deep. Loss of section of the pier columns at the waterline. Multiple areas of erosion along abutments with exposed piles.
62 - Culvert Condition:	N	N	
61 - Channel Condition:	5	5	Southwest bank exhibiting erosion with up to 3' vertical face. Erosion 4' deep present along bank in front of the east abutment.
71 - Waterway Adequacy:	8	8	
72 - Approach Rdwy Align:	8	8	
111 - Pier Navig Protection:	N	N	

90B - Inspection Remarks

Additional Inspection Data

	Prev	New
36A - Bridge Railing Adequacy:	2	2

Rail Types: Type S-1 Steel Rail

	Prev	New		Prev	New		Prev	New
Approach Guardrail Adequacy: 36B - Transitions:	3	3	36C - Guardrail:	3	3	36D - Ends:	3	3

	Prev	New		Prev	New		Prev	New
108A - Wearing Surface Type:	G	G	108B - Type of Membrane:	A	A	108C - Deck Protection:	J	J
108D - Total Deck Thickness (In.):	25.0	25.0						

	Prev	New
59A - Paint Date (Mo/Yr):		
59B - Paint Type		

Color: Fascia - _____ ; Inter. - _____; Railing - _____

		Prev	New
59C - Utilities Attached:	N-N-N	N-N-N	

		Prev	New
Weight Limit Posting	70A2 - Single Unit Vehicles		Tons
	70B2 - Combination Type 3S-1 (3 or 4 axles):		Tons
	70C2 - Combination Type 3S-2 (5 or more axles):		Tons
	70D2 - One Truck at a Time		

Joint Openings (In.): N/A

90B - Inspection Remarks Continued:

	Signature	Date
Inspection Team Leader:		2/19/2016
Consultant Program Manager:		
Agency Program Manager:		2/19/2016

APPENDIX B

IDOT MASTER STRUCTURE REPORT

Illinois Department of Transportation
Structures Information Management System
Master Structure Report (S-107)

Structure Number: 045-3122 **District: 1**

Inventory Data

Facility Carried:	SILVER GLEN RD	**Bridge Name:**		**Sufficiency Rating:**	84.8	**Structure Length:**	93.4
Feature Crossed:	OTTER CREEK	**Location:**	0.83 MI W RANDALL RD	**HBP Eligible:**	No	**AASHTO Bridge Length:**	88.4
Bridge Remarks:				**Replaced By:**		**Length of Long Span:**	44.8
Bridge Status:	1 OPEN - NO RESTRICT	**StatusDate:**	04/1988	**Replaces:**		**Bridge Roadway Width:**	40.0
Status Remarks:				**Last Update Date:**	07/05/2012	**Appr Roadway Width:**	30.0
Maint County:	045 KANE	**Maint Township:**	14 ST CHARLES	**Parallel Structure:**	None	**Deck Width:**	40.0
Maint Responsibility:	03 COUNTY			**Multi-Level Structure Nbr:**		**Sidewalk Width Right:**	0.0
Service On/Under:	1 HIGHWAY	/	5 WATERWAY	**Skew Direction:**	None	**Sidewalk Width Left:**	0.0
Reporting Agency:	3 COUNTY			**Skew Angle:**	0 **D**	**Navigation Control:**	0 No
Main Span Matl/Type:	5 PRESTRESS CONCRETE	/	05 BOX BEAM OR GIRDER-MULTIPLE	**Structure Flared:**	No	**Navigation Horiz Clear:**	0
Nbr Of Main Spans:	2 **Nbr Of Approach Spans:** 0			**Historical Significance:**	No	**Navigation Vert Clear:**	0
*****Approaches*****				**Border Bridge State:**		**Culvert Fill Depth:**	0.0
Near #1 Matl/Type:	/			**Bdr State SN:**		**Number Culvert Cells:**	0
Near #2 Matl/Type:	/			**Bdr State % Responsibility:**	0	**Culvert Opening Area:**	0.0
Far #1 Matl/Type:	/			**Structural Steel Wt:**	0	**Culvert Cell Height:**	0.00
Far #2 Matl/Type:	/			**Substructure Material:**	55	**Culvert Cell Width:**	0.00
Median Width/Type:	0 Ft. / 0 None			**Rated By:**	N N/A	**Rate Method:**	D
Guardrail Type L/R:	0 None / 0 None			**Inventory Rating:**	1.000 (36)	**Load Rating Date:**	01/15/1986
Toll Facility Indicator:	0 No Toll			**Operating Rating:**	1.365 (49)		
Latitude:	41.97022000	**Longitude:**	88.35634000	**Design Load:**	02 HS20		
Deck Structure Type:	E PCAST PRES CN DK BM			**Deck Structure Thickness:**	21.0 **SD:** N **FO:** N		
Sidewalks Under Structure:	0 None						

*****Railroad Crossing Info*****

Crossing 1 Nbr:
Crossing 1 Nbr:
RR Lateral Underclear: 0.0
RR Vertical Underclear: 0 Ft 0 In

Key Route On Data

Key Route Nbr:	FEDERAL-AID PRIMARY 0526	**Station:**	6.5400		
Appurtenances	Main Route 00000	**Segment:**			
Inventory County:	045 KANE	**Linked:**	Y		
Township/Road Dist	14 ST CHARLES	**Natl. Hwy System:**	Not on NHS		
Municipality	5410 SOUTH ELGIN	**Inventory Direction:**			
Urban Area:	1051	**Curr AADT Yr/Count:**	2014 / 6550		
Functional Class:	5	**Est Truck Percentage:**	4		
**** CLEARANCES ****	**South/East**	**North/West**	**Number Of Lanes:**	2	
Max Rdwy Width:	24.0		**One Or Two Way:**	2 Two-Way	
Horizontal:	26.0	0.0	**Bypass Length:**	3	
Min Vertical:	99 Ft 11 In	99 Ft 11 In	**Future AADT Yr/Cnt:**	2032 / 2300	
10 Ft Vertical:	99 Ft 11 In	99 Ft 11 In	**Designated Truck Rte:**	NONE	
Lateral:			**Special Systems:**	No	

Key Route Under Data

		Station:	
		Segment:	
		Linked:	
		Natl. Hwy System:	
		Inventory Direction:	
		Curr AADT Yr/Count:	/
		Est Truck Percentage:	
South/East	**North/West**	**Number Of Lanes:**	
		One Or Two Way:	
		Bypass Length:	
Ft In	Ft In	**Future AADT Yr/Cnt:**	/
Ft In	Ft In	**Designated Truck Rte:**	
Ft	Ft	**Special Systems:**	

*** Marked Route On Data ***

	Designation	Kind	Number
Route #1:	1 Mainline	8 Other	
Route #2:	1 Mainline		
Route #3:	1 Mainline		

*** Marked Route Under Data ***

	Designation	Kind	Number
Route #1:			
Route #2:			
Route #3:			

Structure Number: 045-3122 **District: 1**

Data Related to Inspection Information

***Inspection Intervals ***				*** Maximum Allowable Posting Limits ***				Bridge Posting Level:	
Routine NBIS:	24 MOS	Underwater:	0 MOS	One Truck At A Time:	0	Combination Type 3S-1:	Tons	5	No Posting Required
Fracture Critical:	0 MOS	Special:	N	Single Unit Vehicles:	Tons	Combination Type 3S-2:	Tons		

Inspection/Appraisal Information

Inspection Date:	02/25/2014	Inspection Temperature:	16 Deg. F	Insp by (Name):	HaasM	** Actual Posted Limits **			
Deck:	5	FAIR CONDITION - MINOR SECTION LOSS, CRACKS		Insp by (Name):	KoisC	Single Unit Vehicles:		Tons	
Superstructure:	5	FAIR CONDITION - MINOR SECTION LOSS, CRACKS		Utilities Attached:	N N/A	Combination Type 3S-1:		Tons	
Substructure:	5	FAIR CONDITION - MINOR SECTION LOSS, CRACKS			N N/A	Combination Type 3S-2:		Tons	
Culvert:	N	NOT APPLICABLE			N N/A	One Truck At A Time:	0		
Channel and Protection:	5	FAIR CONDITION - MINOR SECTION LOSS, CRACKS		Deck Wearing Surf:	G BITUMINOUS OVERLAY	Last Paint Type:			
Structural Evaluation:	5	BETTER THAN ADEQUATE TO BE LEFT IN PLACE		Deck Membrane:	A WATERPROOF MEM SYST				
Deck Geometry:	5	BETTER THAN ADEQUATE TO BE LEFT IN PLACE		Deck Protection:	J NONE				
Underclearance-Vert/Lat.:	N	NOT APPLICABLE		Total Deck Thick:	25.0				
Waterway Adequacy:	8	EQUAL TO PRESENT DESIRABLE CRITERIA		Last Paint Date:					
Approach Roadway Align:	8	EQUAL TO PRESENT DESIRABLE CRITERIA		Inspection Remarks:					
Bridge Railing Appraisal:	2	Doesn't Meet Standards							
Approach Guardrail:	333	Acceptable	Acceptable	Acceptable					
Pier Navig Protection:	N	N/A							

Underwater Inspection/Appraisal Information

Inspection Date:					
Temperature:		Inspection Method:			
Inspected By:		Inspected By:		Appraisal Rating:	
Inspection Remarks:					

Scour Critical Information

Rating:	5 CALCULATED SCOUR ACCEPTABLE	Evaluation Method:	B Rational Analysis
Analysis Date:	09/29/1996	Analysis By:	FOUAD ALSABBAGH

Miscellaneous

Fracture Critical Members:	No
Microfilm Data Recorded:	No

Construction Information

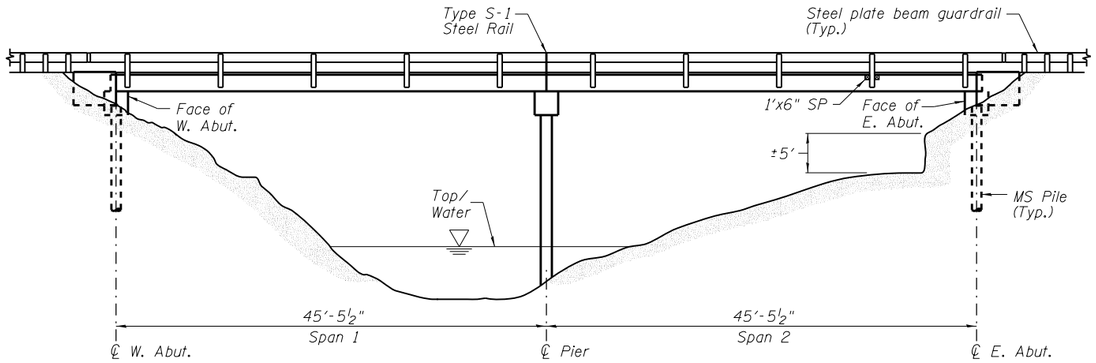
Year:	1984 Original			Reconstructed	
Route:	FAP0526	Sta:	10+08	Sta:	
Section Nbr:	82-00115-01-BR				
Contract Nbr:					
Fed Aid Pr #:	00000000000000				
Built By:	3 COUNTY AGENCY				

Proposed Improvement

Cost Estimate Year:		Length:		*** Costs in Dollars ***	
Type of Work:				Bridge Cost:	
Done By:				Roadway Cost:	
Remarks:				Total Project Cost:	

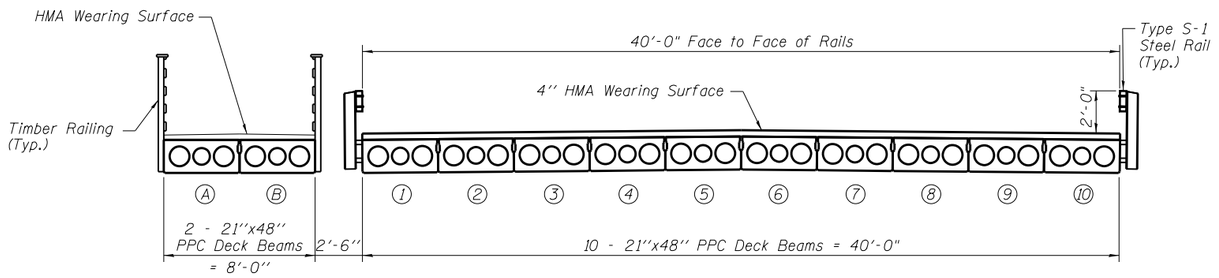
APPENDIX C

STRUCTURE SKETCHES



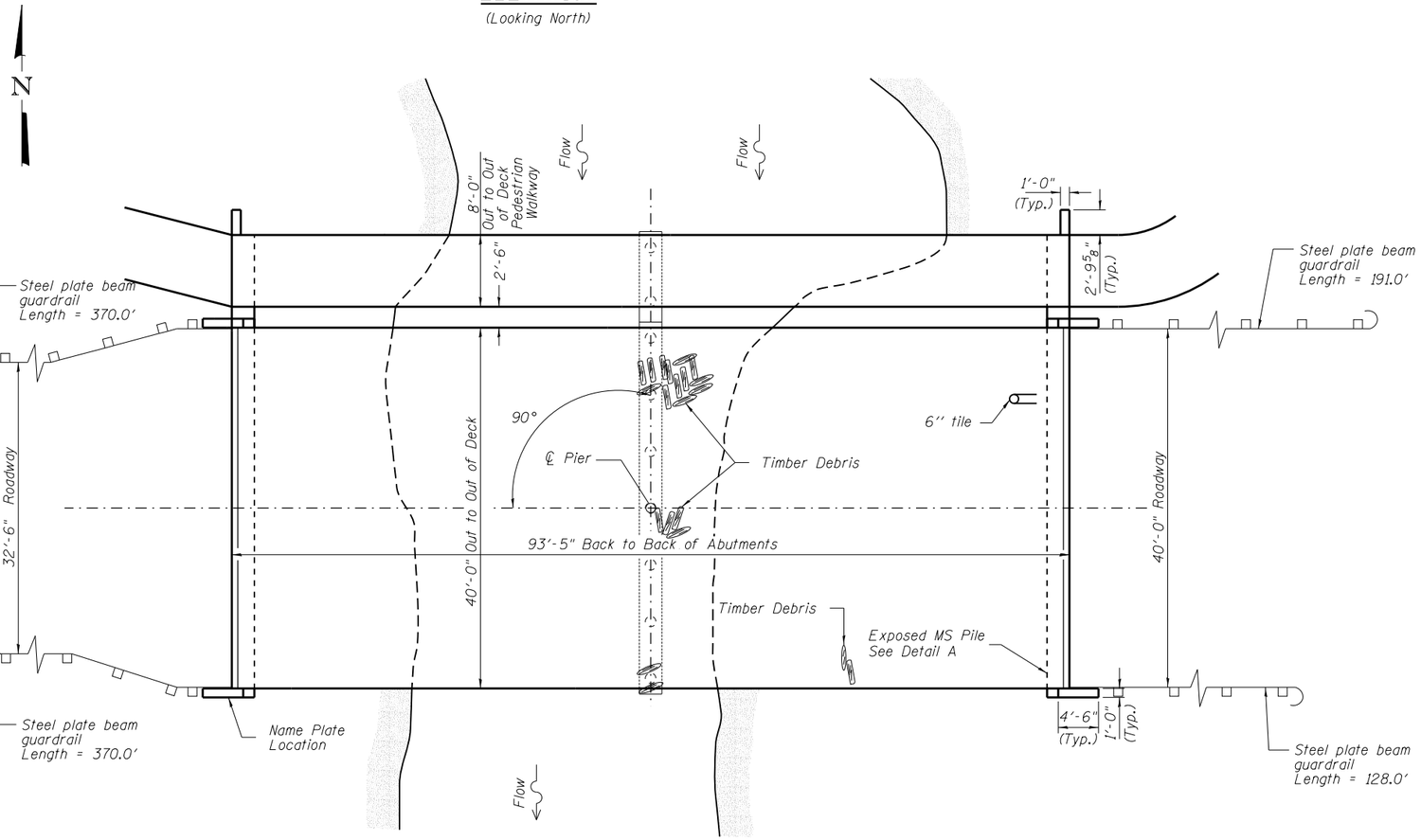
ELEVATION

(Looking North)

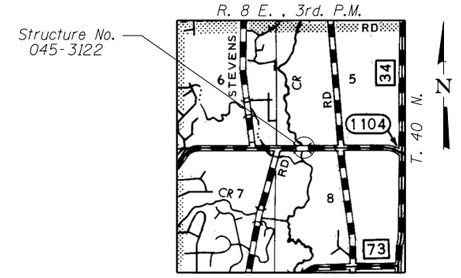


TYPICAL DECK CROSS SECTION

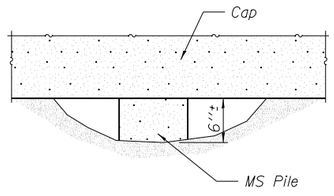
(Looking East)



PLAN



LOCATION SKETCH



DETAIL A

LEGEND

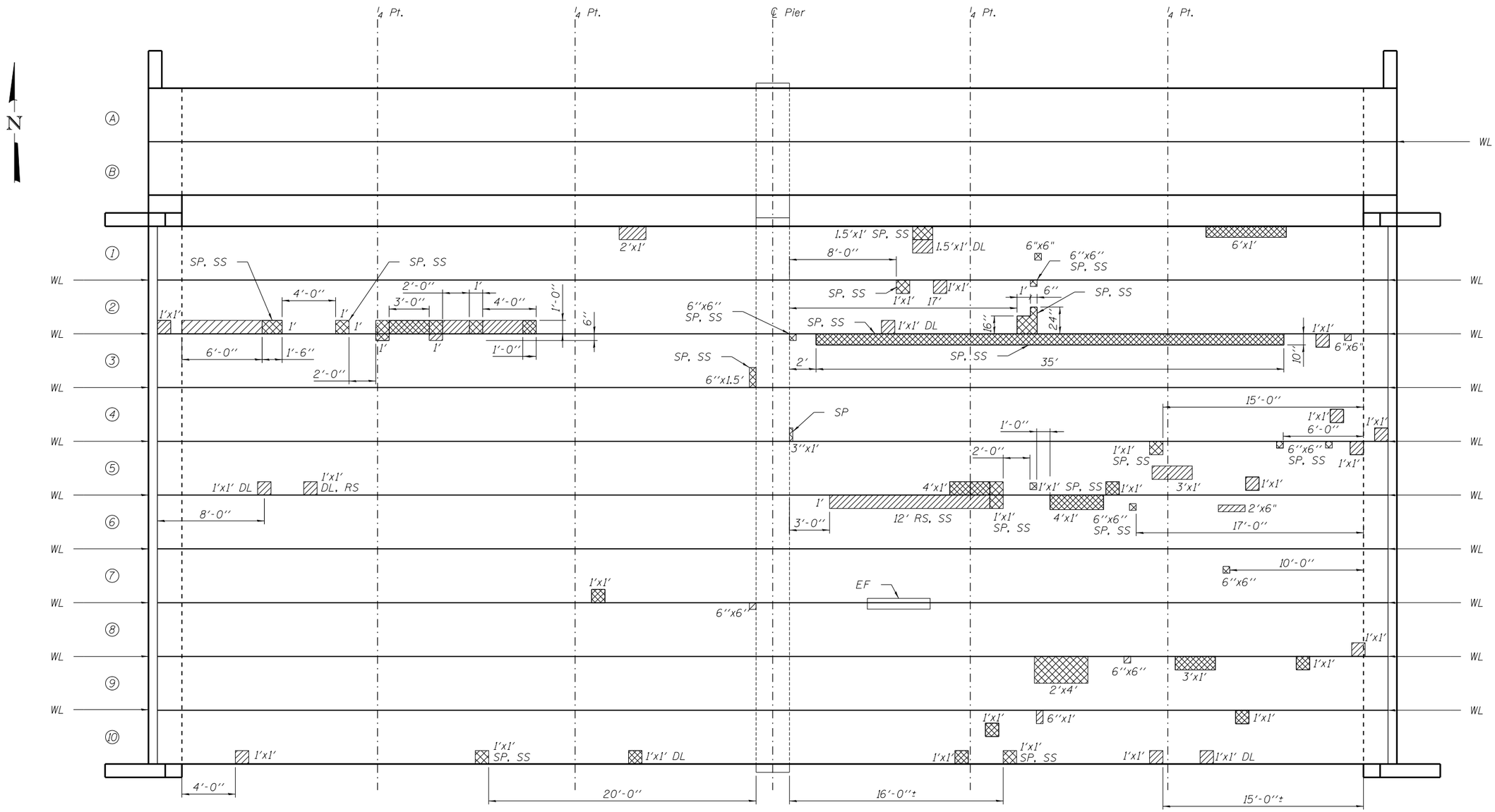
CO = Crack - Open	SS = Shear Stirrup
CC = Crack - Closed	EF = Efflorescence
DL = Delamination	WL = Water Leakage
LE = Leaching	
PD = Plugged Drain Hole	Delamination
PS = Prestressed Strand	Spalls
RF = Reinforcement	Crack
RP = Repair	
RS = Rust Staining	
SP = Spall	

KANE COUNTY DIVISION OF TRANSPORTATION

SILVER GLEN ROAD OVER
OTTER CREEK
KANE COUNTY
STRUCTURE NUMBER: 045-3122

GENERAL PLAN AND ELEVATION

DRAWN BY: ELN	COLLINS ENGINEERS 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9500 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184008993	DATE: FEBRUARY 19, 2016
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 1 OF 4



LEGEND

CO = Crack - Open	SS = Shear Stirrup
CC = Crack - Closed	EF = Efflorescence
DL = Delamination	WL = Water Leakage
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PD = Plugged Drain Hole	Delamination
PS = Prestressed Strand	Spalls
RF = Reinforcement	Crack
RP = Repair	
RS = Rust Staining	
SP = Spall	

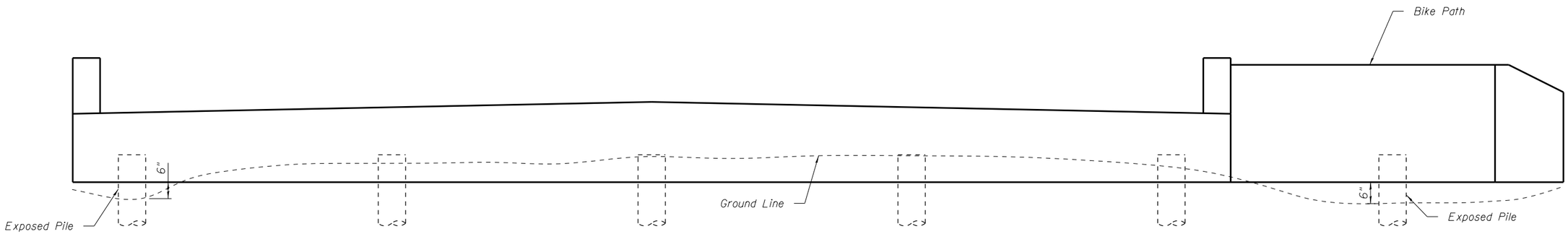
UNDERSIDE OF DECK PLAN

KANE COUNTY DIVISION OF TRANSPORTATION

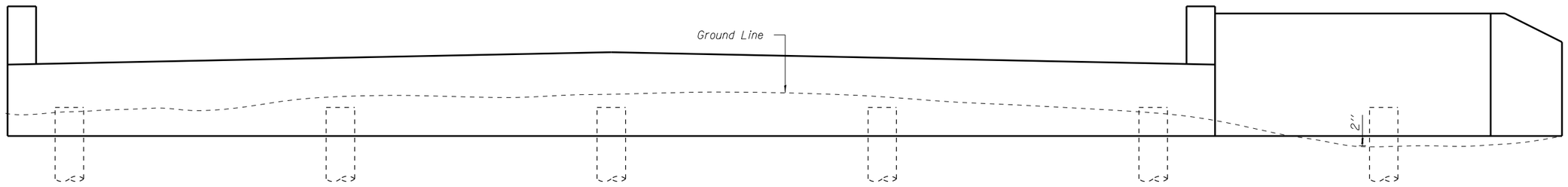
SILVER GLEN ROAD OVER
OTTER CREEK
KANE COUNTY
STRUCTURE NUMBER: 045-3122

UNDERSIDE OF DECK

DRAWN BY: ELN	COLLINS ENGINEERS 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184-001993	DATE: FEBRUARY 19, 2016
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 2 OF 4



EAST ABUTMENT



WEST ABUTMENT

LEGEND

CO = Crack - Open
CC = Crack - Closed
DL = Delamination
LE = Leaching
PD = Plugged Drain Hole
PS = Prestressed Strand
RF = Reinforcement
RP = Repair
RS = Rust Staining
SP = Spall
SS = Shear Stirrup
EF = Efflorescence
WL = Water Leakage
Delamination
Spalls
Crack

KANE COUNTY DIVISION OF TRANSPORTATION

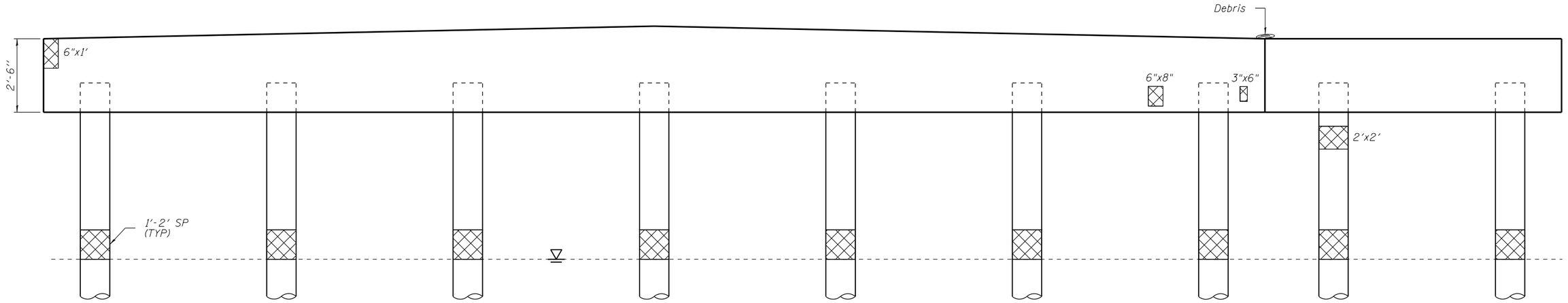
SILVER GLEN ROAD OVER
OTTER CREEK
KANE COUNTY
STRUCTURE NUMBER: 045-3122

ABUTMENTS

DRAWN BY: ELN
CHECKED BY: MAH
PROJECT NO. 8847

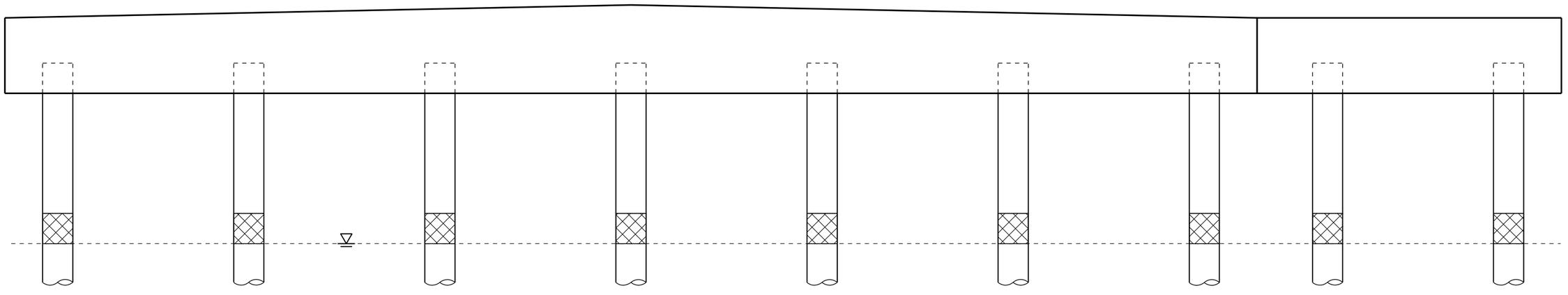
COLLINS ENGINEERS
123 North Wacker Drive
Suite 900
Chicago, IL 60606
(312) 704-9300
www.collinsengr.com
ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184008993

DATE: FEBRUARY 19, 2016



PIER
(East Face)

Note: Cracking, delaminations, and impending spalls present on all columns.



PIER
(West Face)

LEGEND

CO = Crack - Open	SS = Shear Stirrup
CC = Crack - Closed	EF = Efflorescence
DL = Delamination	WL = Water Leakage
LE = Leaching	
PD = Plugged Drain Hole	Delamination
PS = Prestressed Strand	Spalls
RF = Reinforcement	
RP = Repair	Crack
RS = Rust Staining	
SP = Spall	

KANE COUNTY DIVISION OF TRANSPORTATION

SILVER GLEN ROAD OVER
OTTER CREEK
KANE COUNTY
STRUCTURE NUMBER: 045-3122

PIER

DRAWN BY: ELN	COLLINS ENGINEERS, INC. 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184008993	DATE: FEBRUARY 19, 2016
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 4 OF 4

APPENDIX D

STRUCTURE PHOTOS

Photo No. 1
North Elevation, looking Southeast

Photo No. 2
South Elevation, looking Northeast

Photo No. 3
Topside of Structure, looking West

Photo No. 4
Topside of Structure, looking East

Photo No. 5
Approach Roadway Transverse Cracking (West Shown), looking North

Photo No. 6
Typical Bridge Rail Condition (South Shown), looking Southwest

Photo No. 7
Typical Top of Deck Condition, looking Northwest

Photo No. 8
Transverse Crack at Pier, looking North

Photo No. 9
Typical Bottom of Beam Condition (East Span Shown), looking West

Photo No. 10
Typical Spalls and Delaminations (Beam 5 & 6 Shown), looking West

Photo No. 11
Topside of Pedestrian Bridge, looking East

Photo No. 12
Typical Transverse Cracking in Pedestrian Bridge Surface, looking South

Photo No. 13
Typical Settlement at Pedestrian Bridge Joint, looking South

Photo No. 14
East Abutment, looking Southeast

Photo No. 15
West Abutment, looking Northwest

Photo No. 16
Exposed Metal Shell Pile at South End of East Abutment, looking Southeast

Photo No. 17
Typical Wingwall Condition (Southwest Shown), looking North

Photo No. 18
Pier (East Face Shown), looking Southwest

Photo No. 19
Third Pile from South Condition, looking West

Photo No. 20
Typical Pile Condition at the Waterline (3rd from the South Shown), looking West

Photo No. 21
Upstream Channel View, looking North

Photo No. 22
Downstream Channel View, looking South

Photo No. 23
Erosion in Front of the East Abutment, looking Southeast

Photo No. 24
Runoff Erosion in Between the Structure and Pedestrian Bridge, looking East

Photo No. 25
Timber Debris at the 3rd & 4th Columns from the North, looking Northwest

Photo No. 26
Typical Guardrail/Guardrail End (Southeast Shown), looking Southwest

APPENDIX E

COST ESTIMATE

Cost Estimate

Short Term Recommended Repairs

Item	Unit	Quantity	Unit Price	Total
Bridge Rail Replacement	Foot	180	$175	$31,500
Channel Fill and Grading	Cu. Yd.	75	$105	$7,875
Stone Riprap	Ton	80	$200	$16,000
Traffic Control and Protection	L Sum	1	$1,800	$1,800
Subtotal				$57,175
10% Contingency				$5,718
10% Mobilization				$5,718
The total cost of the short term recommended repairs				$68,610

Overall Replacement of Structure

Replacement of the PPC deck beam bridge with a 2 span bridge with a length of 93'-5'' back to back of abutments and a width of 54'-6'' out to out of deck would cost approximately $1,529,000.

APPENDIX F

STRUCTURE RATING

Structure Rating Summary

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Simple Span PPC Deck Beam Rating

LFR METHOD

	RF	HS	Gross Weight (Tons)
HS-20 Inventory	0.741	14.8	26.6
HS-20 Operating	1.236	24.7	44.4

Illinois Posting Vehicle (Operating Level)

	RF	Gross Weight (Tons)
Single Unit	1.707	37.5
3 or 4 axles	1.512	44.2
5 or more axles	1.139	46.4

Kane County Special Permit Vehicle (Operating Level)

	RF	Gross Weight (Kips)
KC-1	0.830	141.1
KC-2	0.832	137.2
KC-3	0.897	125.5
KC-4	1.112	127.8

AASHTO Notional Truck (Operating Level)

	RF	Gross Weight (Tons)
AASHTO Notional	1.047	41.8

Recommended Bridge Postings

	Gross Vehicle Weight
Single Unit	--
3 or 4 axles	--
5 or more axles	--

Bridge posting not required.

Recommended Kane County Special Permit Vehicle Limitations

	Gross Vehicle Weight
KC-1	141.1 Kips
KC-2	137.2 Kips
KC-3	125.5 Kips
KC-4	115.0 Kips

Weight restrictions should be implemented for special permit vehicles. Gross Vehicle Weight indicated is the maximum recommended weight for that vehicle type.

Current IDOT S-107 Bridge Posting Level:	5	No Posting Required
Recommended Bridge Posting Level:	3	10.0-19.9% Below Legal Loads

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Simple Span PPC Deck Beam Rating - Span 1

LFR METHOD

BRIDGE INFORMATION

Span	44.83	ft	
Year constructed	1983		
Skew	0.00	deg	
Out to Out	40.00	ft	
Clear width	40	ft	
Design Lanes	3		AASHTO 3.6/MBE 6B.6.2.2
Actual Lanes Loaded	2		

BEAM TYPE **6** **21x48**

diaphragms	1	
diaphragm weight	0.295	k
WS Thickness	4.00	in
f 's (prestressing strands)	270000	psi
f 'c	5000	psi
f 'ci	4000	psi
fy (shear reinforcement)	60	ksi
Rail / Parapet	0.068	k/ft
Strand Type	stress relieved	

Deck Beams:

Beam	21x48	
Number of Beams	10	
% Strand Area Reduction	0.00	%
% Shear Key Reduction	0.00	%
Beam Depth	21	in
Beam Width, b	4.00	ft
Beam Weight	0.7200	k/ft
Beam Area	667.72	in^2
Centroid from Bottom, Cb	10.42	in

Strands:

Strand Diameter		1/2		in
Strand Area		0.153		in
Number of Strands @				
Original		Current		
	12	8	1.75	in
	2	2	3.25	in
			4.50	in
			6.00	in
			7.50	in
			9.00	in
			10.50	in
			12.00	in
			15.00	in
Total	14.00	10.00		strands
C.G.	1.96	2.05		in
d	19.04	18.95		in

Dead Load:

Beam	0.720	k/ft
Wearing Surface	0.200	k/ft
Rail / Parapet (3 Bms Max)	0.023	k/ft
Fill	0.000	k/ft
	0.943	k/ft

Other / Diaphram	0.295	k
Distance to Diaphgram	--	ft

Moment Capacity (current section properties)

As*	1.53	in^2	
Aeff = bd	909.60	in^2	
ρ*	0.0017		(3) (Eq. 10)
b' (web, total)	32.189	in	
γ*	0.40		(3) 1.1.7
β_1	0.80		(1) 8.16.2.7
f*su	257,738	psi	(3) (Eq. 11)
a	1.93	in	(3) (Eq. 12)
t_{flange}	4.25	in	(3) (Eq. 13)
Check:	rectangular section		
Reinf. Index	0.087		(3) 1.1.7
Reinf. Index M	0.288		(3) 1.1.7
ϕ	1		(1) 9.14
ϕMn	590.3	k-ft	(3)(Eq. 13&14)
ϕMn max	590.3	k-ft	(3)(Eq. 15&16)

Prestress Losses

Humidity RH	70.00	%	(3) 1.1.5
Es	28,000	ksi	(3) 1.1.5
Eci	3,605	ksi	(3) 1.1.5
Ec	4031	ksi	
n	7		
e (initial)	8.456	in	
e (current)	8.370	in	(3) 1.1.6
I	33,673.00	in^4	
Mdl beam	184.21	k-ft	
f*cir (initial)	0.764	ksi	(3) 1.1.5
Msdl	55.96	k-ft	
fcds (initial)	0.169	ksi	(3) 1.1.5
SH	6.500	ksi	(3) (Eq. 1a)
ES	5.936	ksi	(3) (Eq. 1b)
CRc	7.990	ksi	(3) (Eq. 1c)
CRs	14.728	ksi	(3) (Eq. 1d&e)
Fsi	189000	psi	(3) 1.1.4
% loss	18.60	%	(3) (Eq. 2)
Fi (for current s	289.17	k	(3) 1.1.6
F (now)	235.39	k	(3) 1.1.6
Sb	3232.5	in^3	
fpe (now)	0.962	ksi	(3) 1.1.7
Fr	530.33	psi	(3) 1.1.7
M*cr (now)	402.00	k-ft	(3) (Eq. 17)

Mcap=ϕMn	590.3	k-ft
1.2 * Mcr	482.4	k-ft
k	1.22	
Use kϕMn?	no	
ϕMn = C	590.3	k-ft
%Cap.Reductior	0.0	%
C	590.3	k-ft

M (HS 20)	535.7	k-ft
V (HS 20)	57	k

Live load shears and moments taken from AASHTO

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

HS-20 Moments and Stresses (AASHTO)

D	MDL	240.17	k-ft
L	MLL (per beam with impact)	173.07	k-ft
S	Prestress secondary M or V	0.000	k-ft
	St	3183	in^3
	Sb	3233	in^3

Concrete stresses

Fd (top)	0.906	ksi
Fd (bottom)	-0.892	ksi
Fs (top)	0.000	ksi
Fs (bottom)	0.000	ksi
Fp (top)	-0.267	ksi
Fp (bottom)	0.962	ksi
Fd+Fs+Fp (top)	0.639	ksi
Fd+Fs+Fp (bottom)	0.070	ksi
FL (top)	0.653	ksi
FL (bottom)	-0.642	ksi

Negative = Conc.Tension
Positive = Conc.Compression

Steel stresses for live loads beyond cracking moment

ybottom	1.75	in
c	2.684	in
Check:	OK: c is in top flange	
I_{cr}	3121.6	in4
Fp	153.85	ksi
Fd	106.25	ksi
FL	76.57	ksi

Factors:

Design Lanes	2
	IDOT PCM
K	0.800
C	0.714
S	3.300
D	6.611
DF	0.499

Number of striped lanes instead of number of design lanes used for load rating analysis per IDOT comments.

Impact	0.294		
Design DF	0.499	wheel/beam	IDOT PCM
	0.499	wheel/beam	

HS 20 Ratings

Inventory	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Concrete Tension	-0.4242641	0.07041047	-0.64246966	0.77	15.4	27.7
Concrete Compression	3.000	0.639	0.65	3.618	72.3	130.2
Concrete Compression	2.00	0.320	0.65	2.575	51.5	92.7
Prestressing Steel Tension	216.00	106.255	76.57	1.433	28.6	51.6
Flexural Strength	590.33	240.17	173.07	0.74	14.8	26.6
Shear Strength	See next page			2.335	46.7	84

Operating	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Prestressing Steel Tension	243	106.3	76.57	1.786	35.7	64.2
Flexural Strength	590.3	240.17	173.07	1.236	24.7	44.4
Shear Strength	See next page			3.897	77.9	140.2

Inventory Rating

$$RF = \frac{6\sqrt{f'_c} - (F_d + F_p + F_s)}{F_1}$$ Concrete Tension

$$RF = \frac{0.6 f'_c - (F_d + F_p + F_s)}{F_1}$$ Concrete Compression

$$RF = \frac{0.4 f'_c - \frac{1}{2}(F_d + F_p + F_s)}{F_1}$$ Concrete Compression

$$RF = \frac{0.8 f^*_y - (F_d + F_p + F_s)}{F_1}$$ Prestressing Steel Tension

$$RF = \frac{\varphi R_n - (1.3D + S)}{2.17L(1+I)}$$ Flexural and Shear Strength

Inventory Rating: Structure may be utilized for an indefinite period of time at inventory rating levels
Operating Rating: Absolute maximum permissible load level

	RF	HS
Inventory	0.741	14.8
Operating	1.236	24.7

	Controlling Rating
Inventory:	Concrete Compression
Operating:	Flexural Strength

Operating Rating

$$RF = \varphi R_n - \frac{(1.3D + S)}{1.3L(1+I)}$$ Flexural and Shear Strength

$$RF = \frac{0.9 f^*_y - (F_d + F_p + F_s)}{F_1}$$ Prestressing Steel Tension

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

fraction DL externally applied	0.235
fraction DL from beam	0.765

HS-20 Shear Rating	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
Vd (total dead load shear)	19.79	17.05	12.83	8.60	4.23	0.00	k
VLL max. (STAAD - axle load)	54.04	49.70	42.38	35.06	27.98	21.47	k
VLL (max per beam with impa	17.46	16.06	13.69	11.33	9.04	6.94	k
Vs (total unfactored)	37.24	33.11	26.52	19.93	13.27	6.94	k
Vult (total factored)	63.62	57.03	46.40	35.77	25.12	15.06	k
V @ Mmax (axle)	51.75	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	34.08	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9

Conservative approximation of zero shear at point of maximum moment (AASHTO 9.20.2.2/IDOT PCM Eq. 23) is used unless shear controls rating under this assumption and requires additional analysis.

MDL	32.81	86.60	154.24	202.94	232.69	243.49	k-ft
MLL max (STAAD - axle load)	81.2	222.82	379.97	474.58	528.13	525.68	k-ft
MLL (per beam with impact)	26.23	71.99	122.75	153.32	170.62	169.83	k-ft
Ms	59.04	158.58	277.00	356.26	403.31	413.31	k-ft
Mult	99.60	268.85	467.01	596.68	672.91	685.23	k-ft
Mmax (factored from externall	66.96	182.69	313.54	394.75	441.39	442.96	k-ft

e	8.37	8.37	8.37	8.37	8.37	8.37	in
d or 0.8xh	18.95	18.95	18.95	18.95	18.95	18.95	in
b'	32.19	32.19	32.19	32.19	32.19	32.19	in
vu	0.104	0.093	0.076	0.059	0.041	0.025	Vult/b'd ksi

F/A	0.353	0.353	0.353	0.353	0.353	0.353	ksi
Fe/Sb	0.609	0.609	0.609	0.609	0.609	0.609	ksi
fpe	0.962	0.962	0.962	0.962	0.962	0.962	ksi
fd	0.122	0.322	0.573	0.754	0.864	0.904	ksi
y	10.42	10.42	10.42	10.42	10.42	10.42	
Mcr	340.5	286.7	219.1	170.4	140.6	129.8	AASHTO (9-28)
vci	0.359	0.084	0.068	0.058	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.359	0.120	0.120	0.120	0.120	0.120	

Fe(y'-Cb)/I	0.00	0.00	0.00	0.00	0.00	0.00	ksi
M DL(Y'-Cb)/I	0.00	0.00	0.00	0.00	0.00	0.00	ksi
fpc	0.353	0.353	0.353	0.353	0.353	0.353	ksi
Vp	0.00	0.00	0.00	0.00	0.00	0.00	k
vcw	0.353	0.353	0.353	0.353	0.353	0.353	ksi

Welded wire fabric

Spacing	W size	Area (sq.in./wi	Area (sq.in./ft)
3	W5.5	0.055	0.22
8	W2.5	0.025	0.0375

Shear reinforcement bar size	W5.5	W5.5	W5.5	W5.5	W5.5	W5.5	
Av	0.11	0.11	0.11	0.11	0.11	0.11	in
s	3.0	3.0	3.0	3.0	3.0	3.0	in
vs	0.068	0.068	0.068	0.068	0.068	0.068	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	17.46	16.06	13.69	11.33	9.04	6.94	
Inventory RF	5.430	2.335	2.923	3.757	4.997	6.877	
Operating RF	9.064	3.897	4.879	6.271	8.341	11.480	

Shear Rating Factor:	RF	HS
Inventory	2.335	46.7
Operating	3.897	77.9

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Simple Span PPC Deck Beam Rating 0.499 wheel per beam

Illinois Posting Vehicles:

	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
STAAD LL moment	276.34	387.96	437.83	581.53	414.14	k-ft

	Moments and Stresses (AASHTO)	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
D	Total deal load moment	240.17	240.17	240.17	240.17	240.17	k-ft
L	Live load moment w/ imp. per	89.28	125.34	141.45	187.87	133.79	k-ft
S	Prestress secondary M or V	0.000	0.000	0.000	0.000	0.000	k-ft
	St	3183	3183	3183	3183	3183	in^3
	Sb	3233	3233	3233	3233	3233	in^3
	Concrete stresses						
	Fd (top)	0.906	0.906	0.906	0.906	0.906	ksi
	Fd (bottom)	-0.892	-0.892	-0.892	-0.892	-0.892	ksi
	Fs (top)	0.000	0.000	0.000	0.000	0.000	ksi
	Fs (bottom)	0.000	0.000	0.000	0.000	0.000	ksi
	Fp (top)	-0.267	-0.267	-0.267	-0.267	-0.267	ksi
	Fp (bottom)	0.962	0.962	0.962	0.962	0.962	ksi
	Fd+Fs+Fp (top)	0.639	0.639	0.639	0.639	0.639	ksi
	Fd+Fs+Fp (bottom)	0.070	0.070	0.070	0.070	0.070	ksi
	FL (top)	0.337	0.473	0.533	0.708	0.504	ksi
	FL (bottom)	-0.331	-0.465	-0.525	-0.697	-0.497	ksi
	Steel stresses						
	Fp	153.85	153.85	153.85	153.85	153.85	ksi
	Fd	NA	NA	NA	106.25	NA	ksi
	FL	NA	NA	NA	83.12	NA	ksi

Inventory RF	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2
Concrete Tension	1.493	1.063	0.942	0.709	0.996
Concrete Compression	7.014	4.996	4.427	3.333	4.680
Concrete Compression	4.992	3.556	3.151	2.372	3.331
Prestressing Steel Tension	NA	NA	NA	1.320	NA
Flexural Strength	1.436	1.023	0.906	0.682	0.958
Shear Strength	4.744	3.431	3.224	2.275	3.245

Operating RF					
Prestressing Steel Tension	NA	NA	NA	1.645	NA
Flexural Strength	2.396	1.707	1.512	1.139	1.599
Shear Strength	7.918	5.727	5.382	3.797	5.416

Refer to following pages for shear rating calculations

Postings: (Operating Level)		RF OPERATING	Tons
Single Unit	Type 2	**2.396**	**37.7**
	Type 3	**1.707**	**37.5**
Semi-Trailers	Type 3-S1	**1.512**	**44.2**
	Type 3-S2	**1.139**	**46.4**
	Type 3-S2	**1.599**	**63.9**

Recommended Posting	
Single Unit	--
3 or 4 axles	--
5 or more axles	--

** Structures less then a rating of 3 Tons should be closed to traffic.
Operating = Absolute maximum permissible load level

Conservative approximation of zero shear at point of maximum moment at the various sections checked for shear capacity (AASHTO 9.20.2.2/IDOT PCM Eq. 23) indicates that shear does not control for legal vehicles or or permit vehicles included in this rating.

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Simple Span PPC Deck Beam Rating 0.499 wheel per beam

Kane County Special Permit Vehicles:

	KC-1	KC-2	KC-3	KC-4	AASHTO	
STAAD LL moment	797.33	795.97	738.25	595.55	632.56	k-ft

	Moments and Stresses (AASHTO)	KC-1	KC-2	KC-3	KC-4	AASHTO	
D	Total deal load moment	240.17	240.17	240.17	240.17	240.17	k-ft
L	Live load moment w/ imp. per	257.59	257.15	238.50	192.40	204.36	k-ft
S	Prestress secondary M or V	0.0	0.0	0.0	0.0	0.0	k-ft
	St	3183	3183	3183	3183	3183	in^3
	Sb	3233	3233	3233	3233	3233	in^3
	Concrete stresses						
	Fd (top)	0.906	0.906	0.906	0.906	0.906	ksi
	Fd (bottom)	-0.892	-0.892	-0.892	-0.892	-0.892	ksi
	Fs (top)	0.000	0.000	0.000	0.000	0.000	ksi
	Fs (bottom)	0.000	0.000	0.000	0.000	0.000	ksi
	Fp (top)	-0.267	-0.267	-0.267	-0.267	-0.267	ksi
	Fp (bottom)	0.962	0.962	0.962	0.962	0.962	ksi
	Fd+Fs+Fp (top)	0.639	0.639	0.639	0.639	0.639	ksi
	Fd+Fs+Fp (bottom)	0.070	0.070	0.070	0.070	0.070	ksi
	FL (top)	0.971	0.970	0.899	0.725	0.771	ksi
	FL (bottom)	-0.956	-0.955	-0.885	-0.714	-0.759	ksi
	Steel stresses						
	Fp	153.85	153.85	153.85	153.85	153.85	ksi
	Fd	106.25	106.25	106.25	106.25	106.25	ksi
	FL	113.96	113.76	105.51	85.12	90.41	ksi

Inventory RF	KC-1	KC-2	KC-3	KC-4	AASHTO
Concrete Tension	0.517	0.518	0.559	0.693	0.652
Concrete Compression	2.431	2.435	2.625	3.255	3.064
Concrete Compression	1.401	1.404	1.513	1.876	1.766
Prestressing Steel Tension	0.963	0.965	1.040	1.289	1.214
Flexural Strength	0.498	0.498	0.537	0.666	0.627
Shear Strength	1.738	1.728	1.659	2.058	2.439

Operating RF					
Prestressing Steel Tension	1.200	1.202	1.296	1.607	1.513
Flexural Strength	0.830	0.832	0.897	1.112	1.047
Shear Strength	2.902	2.884	2.770	3.435	4.072

Permit Vehicles

	RF OPERATING	Gross Weight	
Type KC 1 - 170,000 lb	**0.830**	**141.1**	Kips
Type KC 2 - 165,000 lb	**0.832**	**137.2**	Kips
Type KC 3 - 140,000 lb	**0.897**	**125.5**	Kips
Type KC 4 - 115,000 lb	**1.112**	**127.8**	Kips
Type AASHTO Notional Truck- 80K	**1.047**	**41.8**	Tons

Refer to following pages for shear rating calculations

Conservative approximation of zero shear at point of maximum moment at the various sections checked for shear capacity (AASHTO 9.20.2.2/IDOT PCM Eq. 23) indicates that shear does not control for legal vehicles or or permit vehicles included in this rating.

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Shear Ratings	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
e	8.37	8.37	8.37	8.37	8.37	8.37	in
d or 0.8xh	18.95	18.95	18.95	18.95	18.95	18.95	in
b'	32.19	32.19	32.19	32.19	32.19	32.19	in
fpe	0.962	0.962	0.962	0.962	0.962	0.962	ksi
fd	0.122	0.322	0.573	0.754	0.864	0.904	ksi
y	10.42	10.42	10.42	10.42	10.42	10.42	
Mcr	340.5	286.7	219.1	170.4	140.6	129.8	k-ft
vcw	0.353	0.353	0.353	0.353	0.353	0.353	ksi
vs	0.068	0.068	0.068	0.068	0.068	0.068	
Vd VDL (total dead load shear)	19.79	17.05	12.83	8.60	4.23	0.00	k
MDL	32.81	86.60	154.24	202.94	232.69	243.49	k-ft

Conservative approximation of zero shear at point of maximum moment for vci (AASHTO 9.20.2.2/IDOT PCM Eq. 23) is used unless shear controls rating under this assumption and requires additional analysis.

IDOT Posting Vehicles

IDOT Type 2 - 15.75 Tons	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	26.35	24.46	21.25	18.05	14.84	11.64	k
VLL (per beam with impact)	8.51	7.90	6.87	5.83	4.79	3.76	k
Vs (total unfactored)	28.30	24.96	19.69	14.43	9.02	3.76	k
Vult (total factored)	44.20	39.33	31.58	23.84	15.90	8.16	k
V @ Mmax (axle)	23.60	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	18.82	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	37.03	109.63	190.54	243.12	269.31	266.77	k-ft
MLL (per beam with impact)	11.96	35.42	61.56	78.54	87.00	86.18	k-ft
Ms	44.77	122.01	215.80	281.48	319.69	329.67	k-ft
Mult	68.62	189.47	334.15	434.34	491.38	503.64	k-ft
Mmax (factored from externall	35.98	103.30	180.68	232.41	259.86	261.37	k-ft
vu	0.072	0.064	0.052	0.039	0.026	0.013	Vult/b'd ksi
vci	0.367	0.094	0.071	0.060	0.050	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.367	0.120	0.120	0.120	0.120	0.120	ksi
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	8.51	7.90	6.87	5.83	4.79	3.76	
Inventory RF	11.135	4.744	5.829	7.297	9.422	12.685	
Operating RF	18.588	7.918	9.730	12.180	15.727	21.174	

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

IDOT Type 3 - 22 Tons

	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	36.48	33.82	29.35	24.87	20.40	15.92	k
VLL (per beam with impact)	11.78	10.93	9.48	8.03	6.59	5.14	k
Vs (total unfactored)	31.57	27.98	22.31	16.64	10.82	5.14	k
Vult (total factored)	51.30	45.89	37.26	28.62	19.80	11.17	k
V @ Mmax (axle)	32.18	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	23.47	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	50.49	151.63	263.14	336.98	377.22	387.96	k-ft
MLL (per beam with impact)	16.31	48.99	85.01	108.87	121.87	125.34	k-ft
Ms	49.12	135.58	239.25	311.80	354.55	368.82	k-ft
Mult	78.06	218.92	385.07	500.17	567.06	588.63	k-ft
Mmax (factored from externall	45.42	132.76	231.60	298.25	335.54	346.37	k-ft
vu	0.084	0.075	0.061	0.047	0.032	0.018	Vult/b'd ksi
vci	0.363	0.089	0.070	0.059	0.050	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.363	0.120	0.120	0.120	0.120	0.120	
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	11.78	10.93	9.48	8.03	6.59	5.14	
Inventory RF	8.045	3.431	4.220	5.296	6.854	9.275	
Operating RF	13.429	5.727	7.045	8.840	11.441	15.482	

IDOT Type 3-S1 - 29.25 Tons

	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	39.41	35.99	31.33	25.57	19.62	13.67	k
VLL (per beam with impact)	12.73	11.63	10.12	8.26	6.34	4.42	k
Vs (total unfactored)	32.52	28.68	22.95	16.86	10.57	4.42	k
Vult (total factored)	53.36	47.41	38.65	29.12	19.26	9.59	k
V @ Mmax (axle)	39.38	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	27.37	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	61.79	162.24	280.90	374.01	422.98	437.83	k-ft
MLL (per beam with impact)	19.96	52.41	90.75	120.83	136.65	141.45	k-ft
Ms	52.77	139.01	244.99	323.77	369.34	384.93	k-ft
Mult	85.99	226.36	397.53	526.14	599.16	623.61	k-ft
Mmax (factored from externall	53.34	140.20	244.06	324.22	367.64	381.35	k-ft
vu	0.087	0.078	0.063	0.048	0.032	0.016	Vult/b'd ksi
vci	0.361	0.088	0.069	0.059	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.361	0.120	0.120	0.120	0.120	0.120	
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	12.73	11.63	10.12	8.26	6.34	4.42	
Inventory RF	7.445	3.224	3.954	5.151	7.126	10.801	
Operating RF	12.428	5.382	6.600	8.598	11.895	18.030	

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

IDOT Type 3-S2 - 40.75 Tons

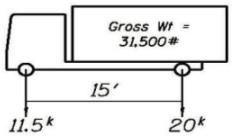
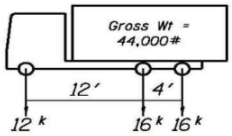
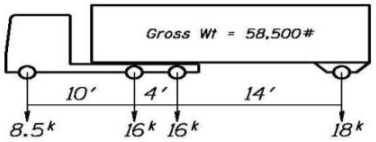
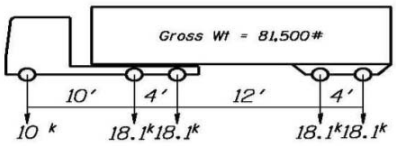
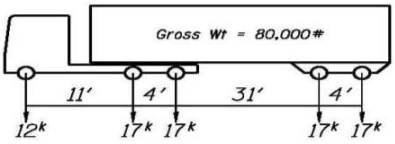
	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	56.42	51.01	42.63	34.25	27.26	19.90	k
VLL (per beam with impact)	18.23	16.48	13.77	11.06	8.81	6.43	k
Vs (total unfactored)	38.01	33.53	26.60	19.67	13.03	6.43	k
Vult (total factored)	65.30	57.95	46.58	35.20	24.61	13.96	k
V @ Mmax (axle)	35.63	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	25.34	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	84.14	228.68	386.02	494.08	555.58	563.22	k-ft
MLL (per beam with impact)	27.18	73.88	124.71	159.62	179.49	181.96	k-ft
Ms	59.99	160.47	278.95	362.56	412.17	425.44	k-ft
Mult	101.66	272.96	471.26	610.35	692.16	711.56	k-ft
Mmax (factored from externall	69.02	186.80	317.79	408.43	460.64	469.29	k-ft
vu	0.107	0.095	0.076	0.058	0.040	0.023	Vult/b'd ksi
vci	0.280	0.083	0.068	0.058	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.280	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.313	0.170	0.170	0.170	0.170	0.170	ksi
C	191.1	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	18.23	16.48	13.77	11.06	8.81	6.43	
Inventory RF	4.182	2.275	2.906	3.845	5.129	7.420	
Operating RF	6.980	3.797	4.850	6.419	8.562	12.385	

IDOT Type 3-S2 - 40 Tons

	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	38.78	35.76	31.08	26.40	21.72	17.43	k
VLL (per beam with impact)	12.53	11.55	10.04	8.53	7.02	5.63	k
Vs (total unfactored)	32.31	28.61	22.87	17.13	11.24	5.63	k
Vult (total factored)	52.92	47.25	38.47	29.70	20.73	12.22	k
V @ Mmax (axle)	35.90	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	25.49	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	56.33	160.30	278.82	358.28	401.10	414.14	k-ft
MLL (per beam with impact)	18.20	51.79	90.08	115.75	129.58	133.79	k-ft
Ms	51.00	138.38	244.32	318.69	362.27	377.28	k-ft
Mult	82.16	225.00	396.07	515.11	583.81	607.00	k-ft
Mmax (factored from externall	49.51	138.84	242.60	313.18	352.29	364.73	k-ft
vu	0.087	0.077	0.063	0.049	0.034	0.020	Vult/b'd ksi
vci	0.362	0.088	0.069	0.059	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.362	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	12.53	11.55	10.04	8.53	7.02	5.63	
Inventory RF	7.566	3.245	3.985	4.989	6.437	8.471	
Operating RF	12.630	5.416	6.653	8.328	10.745	14.141	

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

		Empty Weight	GVW
	Single Unit		
	Type 2	4 Tons	15.75 Tons
	Type 3	8 Tons	22 Tons
		Empty Weight	***GVW***
	***3 or 4 axles*** Type 3-S1	12 Tons	29.75 Tons
	***5 or more axles*** Type 3-S2	13 Tons	40.75 Tons
	***5 or more axles*** Type 3-S2	13 Tons	40 Tons

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Kane County Special Permit Vehicles Shear Rating

Type KC-1 - 170,000 lb	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	72.66	66.75	57.59	49.20	40.04	30.89	k
VLL (per beam with impact)	23.47	21.56	18.61	15.89	12.94	9.98	k
Vs (total unfactored)	43.26	38.62	31.43	24.50	17.16	9.98	k
Vult (total factored)	76.68	68.99	57.07	45.69	33.58	21.67	k
V @ Mmax (axle)	68.31	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	43.05	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	107.18	299.82	522.30	670.31	765.46	780.88	k-ft
MLL (per beam with impact)	34.63	96.86	168.74	216.55	247.29	252.27	k-ft
Ms	67.43	183.46	322.98	419.49	479.98	495.76	k-ft
Mult	117.82	322.86	566.84	733.96	839.36	864.22	k-ft
Mmax (factored from externall	85.18	236.70	413.37	532.03	607.84	621.95	k-ft
vu	0.126	0.113	0.094	0.075	0.055	0.036	Vult/b'd ksi
vci	0.357	0.081	0.067	0.058	0.050	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.357	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	23.47	21.56	18.61	15.89	12.94	9.98	
Inventory RF	4.039	1.738	2.151	2.677	3.492	4.780	
Operating RF	6.741	2.902	3.590	4.468	5.829	7.979	

Type KC-2 - 165,000 lb	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	72.57	67.15	57.99	48.84	39.68	30.53	k
VLL (per beam with impact)	23.45	21.69	18.73	15.78	12.82	9.86	k
Vs (total unfactored)	43.23	38.75	31.56	24.38	17.05	9.86	k
Vult (total factored)	76.62	69.27	57.35	45.44	33.32	21.41	k
V @ Mmax (axle)	68.45	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally ap	43.12	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	107.41	301.02	520.90	670.71	765.03	780.25	k-ft
MLL (per beam with impact)	34.70	97.25	168.28	216.68	247.15	252.07	k-ft
Ms	67.51	183.84	322.53	419.62	479.84	495.56	k-ft
Mult	117.98	323.70	565.86	734.24	839.06	863.78	k-ft
Mmax (factored from externall	85.34	237.54	412.39	532.31	607.54	621.51	k-ft
vu	0.126	0.114	0.094	0.074	0.055	0.035	Vult/b'd ksi
vci	0.357	0.081	0.067	0.058	0.050	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.357	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	23.45	21.69	18.73	15.78	12.82	9.86	
Inventory RF	4.044	1.728	2.136	2.697	3.524	4.836	
Operating RF	6.750	2.884	3.566	4.501	5.882	8.073	

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Type KC-3 - 140,000 lb

	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	77.46	69.93	57.22	46.09	37.83	30.18	k
VLL (per beam with impact)	25.03	22.59	18.49	14.89	12.22	9.75	k
Vs (total unfactored)	44.81	39.65	31.31	23.49	16.45	9.75	k
Vult (total factored)	80.05	71.22	56.81	43.51	32.03	21.17	k
V @ Mmax (axle)	67.78	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	42.76	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	106.36	313.50	516.60	656.27	714.15	738.25	k-ft
MLL (per beam with impact)	34.36	101.28	166.89	212.02	230.72	238.50	k-ft
Ms	67.17	187.88	321.14	414.96	463.40	481.99	k-ft
Mult	117.25	332.45	562.84	724.11	803.38	834.32	k-ft
Mmax (factored from externall	84.60	246.29	409.37	522.19	571.86	592.05	k-ft
vu	0.131	0.117	0.093	0.071	0.053	0.035	Vult/b'd ksi
vci	0.357	0.080	0.067	0.058	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.357	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.379	0.170	0.170	0.170	0.170	0.170	ksi
C	231.4	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	25.03	22.59	18.49	14.89	12.22	9.75	
Inventory RF	3.788	1.659	2.165	2.858	3.696	4.892	
Operating RF	6.323	2.770	3.614	4.770	6.169	8.167	

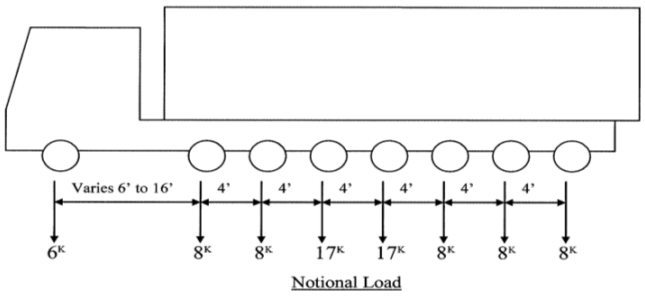
Type KC-4 - 115,000 lb

	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	63.16	56.39	46.22	38.25	31.64	24.71	k
VLL (per beam with impact)	20.41	18.22	14.93	12.36	10.22	7.98	k
Vs (total unfactored)	40.19	35.27	27.76	20.96	14.45	7.98	k
Vult (total factored)	70.02	61.72	49.09	38.01	27.69	17.33	k
V @ Mmax (axle)	38.11	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	26.68	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	98.29	252.80	416.25	516.44	573.07	595.55	k-ft
MLL (per beam with impact)	31.75	81.67	134.48	166.84	185.14	192.40	k-ft
Ms	64.56	168.27	288.72	369.78	417.82	435.89	k-ft
Mult	111.59	289.88	492.46	626.04	704.43	734.23	k-ft
Mmax (factored from externall	78.94	203.72	338.99	424.11	472.91	491.97	k-ft
vu	0.115	0.101	0.080	0.062	0.045	0.028	Vult/b'd ksi
vci	0.264	0.082	0.068	0.058	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.264	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.299	0.170	0.170	0.170	0.170	0.170	ksi
C	182.2	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	20.41	18.22	14.93	12.36	10.22	7.98	
Inventory RF	3.534	2.058	2.680	3.443	4.419	5.976	
Operating RF	5.899	3.435	4.473	5.748	7.376	9.975	

Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

Type AASHTO Notional - 80k	0.035	0.1	0.2	0.3	0.4	0.5	along span
	1.59	4.48	8.97	13.45	17.93	22.42	ft
VLL max. (STAAD - axle load)	52.49	47.57	40.04	32.68	24.69	16.90	k
VLL (per beam with impact)	16.96	15.37	12.94	10.56	7.98	5.46	k
Vs (total unfactored)	36.74	32.42	25.76	19.16	12.20	5.46	k
Vult (total factored)	62.53	55.53	44.76	34.10	22.81	11.85	k
V @ Mmax (axle)	44.45	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally ap	30.12	5.20	3.91	2.62	1.29	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	82.07	213.37	387.58	522.56	610.04	632.56	k-ft
MLL (per beam with impact)	26.51	68.93	125.21	168.82	197.08	204.36	k-ft
Ms	59.32	155.53	279.45	371.76	429.77	447.84	k-ft
Mult	100.21	262.23	472.35	630.33	730.36	760.19	k-ft
Mmax (factored from externall	67.57	176.06	318.88	428.41	498.84	517.92	k-ft
vu	0.103	0.091	0.073	0.056	0.037	0.019	Vult/b'd ksi
vci	0.324	0.084	0.068	0.058	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.324	0.120	0.120	0.120	0.120	0.120	
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.353	0.170	0.170	0.170	0.170	0.170	ksi
C	215.2	103.5	103.5	103.5	103.5	103.5	k
D	19.79	17.05	12.83	8.60	4.23	0.00	
L	16.96	15.37	12.94	10.56	7.98	5.46	
Inventory RF	5.150	2.439	3.094	4.030	5.663	8.737	
Operating RF	8.597	4.072	5.164	6.727	9.453	14.584	

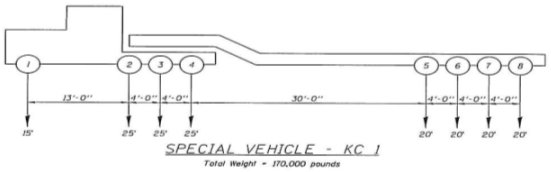


Notional Load

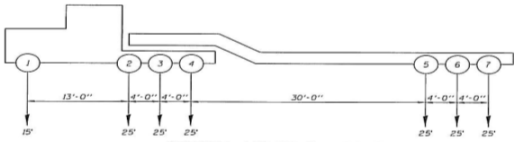
Structure Rating Calculations

Load Rating Performed	ELN	3/29/2016
Load Rating Checked	AMS	4/20/2016

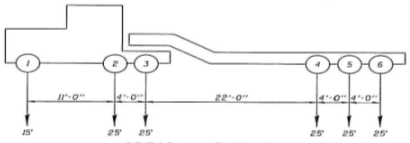
SPECIAL PERMIT VEHICLES



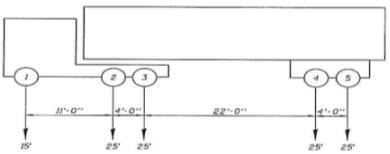
SPECIAL VEHICLE - KC 1
Total Weight = 170,000 pounds



SPECIAL VEHICLE - KC 2
Total Weight = 165,000 pounds



SPECIAL VEHICLE - KC 3
Total Weight = 140,000 pounds



SPECIAL VEHICLE - KC 4
Total Weight = 115,000 pounds

Codes Used:

1: Standard Specifications for Highway Bridges, 17th Ed. - AASHTO
2: Manual for Bridge Evaluation, 2nd Ed. With 2013 Interim Revisions - AASHTO
3: Prestressed Concrete Manual, 1994 - IDOT
4: Structural Services Manual, Section 4, Feb. 2013 - IDOT