2017 QBS
Request for Statement of Interest (SOI)
Muirhead Road over the CN Railroad
Bridge Replacement
Section Number 17-12082-01-BR

The Plato Township Road District is in need of professional services from a qualified engineering firm to provide engineering services as detailed in the attached preliminary scope of work. The Kane County Division of Transportation is assisting the Road District with the consultant selection process. Ultimately, the Road District will administer the project.

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

The attached ***Preliminary Scope of Services and Bridge Inspection Report*** provide a summary of items that will be encountered during the course of the Phase I/II design engineering services required.

The Statement of Interest shall be limited to two pages and must be submitted electronically via **KDOT QBS** **no later than 4:30 pm on April 7, 2017**, and should be addressed to Michael Zakosek, P.E., Chief of Design. The SOI shall be submitted in a PDF format viewable with the latest version of Adobe Reader.

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.

The Road District will contact the preferred consultant.

Any questions on the project may be emailed to the below contact.

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

Michael Zakosek, P.E.
Chief of Design
Kane County Division of Transportation
41W011 Burlington Road
St. Charles, Illinois 60175
zakosekmike@co.kane.il.us

Muirhead Road over the CN Railroad
Scope of Work

Project Description/Preliminary Scope of Services

This project consists of Phase I (and at the discretion of the Road District, Phase II) engineering design services to rehabilitation the Muirhead Road over the CN Railroad structure (045-3132). The project also includes any needed approach reconstruction or reprofiling.

The work includes all design, permitting, plat and plan preparation activities necessary to construction the project.

This project will be funded through the STP-Bridge Program.

2015 Kane County Routine Bridge Inspection Report

STRUCTURE NO. 045-3132

Muirhead Road / T.R. 2110

over

Canadian National Railroad

September 10, 2015

Prepared for:

Kane County Division of Transportation

Plato Township

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:	September 10, 2015
Weather:	63° F, Cloudy

STRUCTURE INFORMATION

Structure Number:	045-3132
District:	1
County:	Kane
Township:	Plato
Feature Carried:	Muirhead Road / T.R. 2110
Feature Crossed:	Canadian National Railroad
Type:	Precast Prestressed Concrete Deck Beams
Span Arrangement:	Five Simple Spans (Span 1: 41'- 3 1/4", Span 2: 42'- 1 3/8", Span 3: 44'- 1 3/8", Span 4: 36'- 1 3/8", Span 5: 35'- 3 1/4")
Length:	202'- 2 5/8" back-to-back of abutments
Width:	42'-0" out-to-out of deck 38'-10" face-to-face of parapets
Skew:	41° 24' left forward
Abutments:	Concrete stub abutments on concrete piles
Piers 1 & 4:	Metal shell pile bent with eight 12-inch diameter concrete filled metal shell piles per pier
Piers 2 & 3:	Multi-column reinforced concrete piers with crashwalls supported on spread footings
Year Constructed:	1989
Year/s Reconstructed:	N/A

ROADWAY INFORMATION

ADT (2014):	2400 – IDOT Master Structure Report
ADTT (2014):	9% – IDOT Master Structure Report
Inventory Rating HS:	0.710 – Collins Engineers, Inc. 0.860 – IDOT Master Structure Report
Operating Rating HS:	1.186 – Collins Engineers, Inc. 1.435 – IDOT Master Structure Report
Existing Clear Width:	38'-10"
Width to Remain in Place:	24'-0"
Clear Roadway Bridge Width:	30'-0"

INSPECTION HISTORY (NBIS RATINGS)

Year	Deck:	Super:	Sub:
2003	5	6	6
2005	5	6	6
2007	6	6	6
2009	6	5	6
2011	5	5	6
2012	4	4	6
2014	4	4	6
2015	4	4	6

STRUCTURE CONDITION FINDINGS

APPROACH ROADWAY *(see Photo No. 5 & 6)*
The approach roadway consists of a bituminous roadway surface with aggregate shoulders and it is in **fair condition**.

- No approach slabs are present at the structure.
- Transverse and longitudinal cracking up to 1/4 in. wide is present in the approach roadway, most of which have been sealed.
- Minor settlement up to 2 in. is present behind both of the abutments.
- Minor debris and vegetation growth is present in the approach drain at the southwest shoulder.

BRIDGE PARAPET / RAIL *(see Photo No. 7)*
The New Jersey type concrete bridge parapets are in **good condition** overall.

- Minor vertical hairline cracks and concrete popouts are present on the bridge parapets.
- Minor hairline cracking is present at the guardrail connections.
- Heavy cracking up to 1/4 in. wide and a delamination is present at the north end of the west parapet *(see Photo No. 8)*.
- A 2 ft. by 1 ft. spall with exposed rebar is present on the north end of the west parapet.

SUPERSTRUCTURE
Top of Deck *(see Photo No. 9 – 11)*
A 2 in. thick bituminous wearing surface is present on the PPC deck beams. The wearing surface is in **fair condition** *(see Photo No. 12).*

- Longitudinal and transverse cracks, up to 1/4 in. wide are present in the wearing surface and are typically located in the wheel lines. Most of the larger cracks have been previously sealed and they are in good condition.
- Minor areas of water staining are present along the base of the parapets at the outside faces of the beam fascias.
- Minor to moderate debris has accumulated along the curb lines with random areas of vegetation growth.
- Transverse cracks up to 1/2 in. wide are present along the abutment and pier joints, most of which have been sealed; however, water leakage is present on the abutments and pier caps *(see Photo No. 13).*

Beams *(see Photo No. 14)*
The precast prestressed concrete deck beams are in **poor condition**.

- Water leakage is present along many of the shear keyway joints, extending approximately 50 percent of the keyway length *(see Photo No. 15).*
- The joints along the fascia beams and centerline have more significant water leakage.
- The west edge beam in Span 1 has a 10 ft. longitudinal crack up to 1/16 in. wide along the center of the beam approximately 15 ft. from the south abutment *(see Photo No. 16).*
- A 4 ft. longitudinal hairline crack is present in the middle of the 5th beam from the west near the south end in Span 5.
- Beam 5 in Span 1 exhibits a 4 ft. longitudinal hairline crack near the north quarter point.
- A 5 ft. longitudinal hairline crack is present at the midspan of Beam 2 in Span 2.

- Several minor spalls with exposed corroded reinforcement are located on the underside of the deck beams. These spalls are up to 2 square ft. with up to 1 in. of penetration *(see Photo No. 17-18).*
- Several delaminated areas, typically 1 square ft. or less, are present on the underside of the beams *(see Photo No. 19)*.
- The bearing pad under the north end of the east edge beam at the north pier is located slightly closer to the edge of the pier than the typical bearing pad location.

SUBSTRUCTURE

The abutments, piers, and wingwalls are in **satisfactory condition**.

Abutments *(see Photo No. 20 & 21)*

- Water staining is present sporadically on both of the abutment caps.
- Hairline map cracks and horizontal cracks with isolated locations of rust staining and efflorescence are present on both of the caps *(see Photo No. 22).*

Piers *(see Photo No. 23 – 26)*

- Moderate water staining is present on all of the pier caps.
- Vertical hairline cracking is present on the pier caps and crashwalls of Piers 2 and 3.
- A 1 ft. by 1 ft. concrete delamination is present on the underside of the Pier 1 cap at Pile 3 *(see Photo No. 27).*
- A 2 ft. by 1 ft. spall with up to 2 in. of penetration and exposed corroded reinforcement is present on the bottom of the cap on the east side of Pile 5 of Pier 1 *(see Photo No. 28).*
- There is a hairline to 1/16 in. wide crack on the south face of the Pier 2 crashwall just east of the 2nd column from the west.
- There is a 4 ft. by 4 ft. concrete delamination on the south face of the Pier 2 crashwall between the 1st and 2nd columns from the east end.
- Concrete delaminations are present on the south face of the Pier 3 cap on both sides of the 2nd column from the west end.
- Concrete spalls with exposed reinforcement are present on the underside of the Pier 4 cap at Pile 6 from the east, measuring 3 ft. by 2 ft. with up to 2 in. penetration and at Pile 3 from the east, measuring 2 ft. by 2 ft. with up to 2 in. penetration *(see Photo No. 29 – 30).*
- Moderate surface corrosion is present on all of the metal shell piles, with minor to moderate section loss just beneath the pier caps on the majority of them.

Wingwalls *(see Photo No. 31)*

- The top of the northwest wingwall has a 1 ft. by 1 ft. by 3 in. corner spall with no exposed reinforcement *(see Photo No. 32)*.

Slopewalls *(see Photo No. 33)*

- Minor hairline cracking is present in the concrete slope walls.
- Gaps up to 1 in. wide are present between the slope walls and the abutment caps.
- Minor runoff erosion is present below the south slopewall *(see Photo No. 34).*

TRAFFIC SAFETY

Pavement lane marking are worn but mostly visible.

Guardrail *(see Photo No. 34)*

- Steel plate beam guardrails are present at all four corners of the structure.
- The guardrail end sections do not meet current IDOT standards.
- Minor impact damage is present on the northeast and southeast guardrail ends *(see Photo No. 35)*.
- A small erosion hole is present at the base of one guardrail post at the southeast corner, which has been partially fixed with an asphalt patch.

Signage

- Hazard clearance markers are present on all of the guardrail ends.
- Stop signs are present at the intersection of Muirhead Road and Plato Road.

Railroad Line *(see Photo No. 36 & 37)*

- The structure crosses a single line of the Canadian National Railroad.
- The railroad is aligned to the structure skew.
- The minimum vertical clearance for the railroad is 21.5 ft. according to existing plans.

UTILITIES

Geometry

- The structure is in a tangent horizontal alignment in a crest vertical curve.

Utilities

- There are no utilities attached to the structure.
- An overhead, pole-mounted utility is present in the east right-of-way.
- Railroad signal lights are present beneath the structure on the south side of the tracks.

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 0.710 (HS 14.2)
  - Operating Rating = RF 1.186 (HS 23.7)
- This structure has an Operating Rating of less than 1.0 for Kane County Special Permit Vehicles, and weight restrictions for permit vehicles should be implemented. Refer to Structure Rating calculations (Appendix F) for recommended permit vehicle weight restrictions.

  Posting not required.

SPECIAL FEATURE INSPECTION

IDOT started a 12 month special feature inspection on August 16, 2013 to monitor the condition of the deteriorating PPC deck beams. See Appendix A for the IDOT special inspection form.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- The superstructure is in poor condition with water leakage through approximately 50 percent of the length of most of the keyway joints and several longitudinal cracks, spalls and delaminations. It would not be cost effective to perform concrete repairs on the deck beams because IDOT does not consider concrete repairs to prestressed deck beams to restore load carrying capacity.
- The cracks in the wearing surface are allowing water to infiltrate to the deck beams and substructure units.
- The substructure is in satisfactory condition. Several spalls and delaminations are present on the pier caps. The metal shell piles exhibit surface corrosion and minor to moderate section loss. Water staining and hairline cracking is present on the abutment caps and all of the pier caps.
- The minor runoff erosion at the south slopewall is not a structural concern at this time and has not worsened since the previous inspection; however, it should be monitored in future inspections.
- The guardrail ends do not meet current IDOT requirements. Additionally, impact damage is present at the northeast and southeast guardrail ends.
- Posting is not required to restrict the weight of legal vehicles; however weight restrictions should be implemented for Kane County permit vehicles. Refer to Structure Rating calculations (Appendix F) for recommended permit vehicle weight restrictions.

RECOMMENDATIONS

Short Term (1 – 3 Years)

- Seal the cracks in the wearing surface to inhibit water infiltration to the deck beams.
- Clean and paint steel columns to prohibit further corrosion and section loss.
- Consideration should be given to replacing the guardrail ends, two of which have impact damage, with guardrail ends that meet current IDOT requirements.

Long Term (4 – 12 Years)

- Based on the age and condition of the deck beams, a Phase I study should be initiated to determine if the substructure is suitable for a superstructure replacement. If not, consideration should be given to a complete structure replacement.

APPENDICES

Appendix A Bridge Inspection Reports
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 REPORTS

Illinois Department of Transportation

Routine Inspection Report

SN: 045-3132	**District:** 1	**Spans:** 5	**Appr. Spans:** 0	**Skew:** 41°24' 0"	**ADT:** 2400	**Truck Pct:** 9	
ADT Un:	**Maint. Co:** Kane	**Twsp:** Plato			**Status:** Open - No Restrictions		
Facility Carried: Muirhead Road			**Feature Crossed:** Canadian National Railroad				
Location: 0.5 MI N. of Bowes Rd.	**Municipality:**		**Team/Sub Section:**		**Insp/Rte:**		
Bridge Name:			**Material & Type:** 5/05 - Prestress Concrete Box Beam or Girder Multiple				
Insp. Intervals Routine: 24	**Fracture Critical:** 0	**Underwater:** 0	**Special:** Y	**Element Level:** 0			
90- Inspection Date: 9/10/2015		90C - Temp. (°F): 63°		90B1- In Depth: ☐			
Is Delinquent: ☐	Reason:						
90A - Agency Program Manager: James Hamelka		90A3- Consultant Program Manager:					
90A1- Team Leader: Michael Haas		90A2- Inspector: Joe Guerriero					
90B- Inspection Remarks:							
Previous Inspections							

Resources

Time to Inspect (H:M):	2:00	6:00	Traffic Control:	N	Y	Boat:	N	N	Waders:	N	N	Snooper:	N	Y		
Ladder:	N	N	Manlift:	N	N	Bucket Truck:	N	N	Other:							

Inspector's Appraisals

	Prev	New	Comments
58 - Deck Condition:	4	4	Transverse and longitudinal cracks up to 1/4" in bituminous overlay and transverse cracks up to 1/2" over the abutments and piers.
59 - Superstructure Cond:	4	4	Several longitudinal HL cracks and small spalls and delaminations on bottoms of beams. Water leakage along approximately 50% of the length of most keyway joints.
60 - Substructure Cond:	6	6	Several spalls and delaminations on pier caps. Surface corrosion and moderate section loss on metal shell piles. Water leakage & HL cracking on abutment & pier caps.
62 - Culvert Condition:	N	N	
61 - Channel Condition:	N	N	
71 - Waterway Adequacy:	N	N	
72 - Approach Rdwy Align:	N	N	
111 - Pier Navig Protection:	N	N	

90B - Inspection Remarks

Additional Inspection Data

	Prev	New									
36A - Bridge Railing Adequacy:	3	3	Rail Types: New Jersey Parapet								
Approach Guardrail Adequacy: 36B - Transitions:	Prev 3	New 3	36C - Guardrail:	Prev 3	New 3	36D - Ends:	Prev 2	New 2			
108A - Wearing Surface Type:	Prev G	New G	108B - Type of Membrane:	Prev A	New A	108C - Deck Protection:	Prev J	New J			
108D - Total Deck Thickness (In.):	19.0	19.0									

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

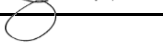
Color: Fascia - _____ ; Inter. - _____; Railing - _____

		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:		9/10/2015
Consultant Program Manager:		
Agency Program Manager:		9/10/2015

Illinois Department of Transportation

Special Inspection Report

SN: 045-3132	District: 1	Spans: 5	Appr. Spans: 0	Skew: 41	ADT: 2400	Truck Pct: 9
ADT Un:	Maint. Co: Kane		Twsp: Plato		Status: Open - No Restrict	
Facility Carried: Muirhead Road			Feature Crossed: Canadian National RR			
Location: 0.5 MI N of Bowes Rd.	Municipality:			Team/Sub Section: /	Insp/Rte:	
Bridge Name:			Material & Type: 5/05 Presetressed Conc Box Bea			
Insp. Intervals Routine: 24	Fracture Critical: **0**		Underwater: 0	Special: 12	Element Level: 0	
93C– Inspection Date: 9 / 10 / 2015			93C3– Temp. (ºF): 63°			
Is Delinquent: ☐	Reason:					
90E-Agency Program Manager: James Hamelka			90E3-Consultant Program Manager:			
93C2A– Team Leader: Michael Haas			93C2B- Inspector: Joe Guerriero			

93C4 –Special Inspection Remarks:

Previous Inspection: 2014 - Water leakage along approximately 50% of the length of most keyway joints. Several longitudinal cracks and spalls. Minor progression of deteriorated areas on PPC deck beams does not require load restrictions at this time.

Resources

Time to Inspect (H:M):	2 : 00	6 : 00	Traffic Control:	Y	Y	Boat:	N	N	Waders:	N	N	Snooper:	Y	Y				
Ladder:	N	N	Manlift:	N	N	Bucket Truck:	N	N	Other:	_____								

Special Inspection Inventory

92C– Inspection Interval: 12 92C4– Initiated By: 1 If "4-Other Agency" Describe: _____

92C2– Start Date: 8 / 16 / 2013 92C6– Determination Date: __ / __ / ____ 92C7 – Inspect By Date: __ / __ / ____

92C1– Type Code:

- ☐ A – Structural Damage/Steel Superstructure
- ☒ B – Structural Damage/Concrete Superstructure
- ☐ C – Structural Damage/Timber Superstructure
- ☐ D – Structural Damage/Steel Substructure
- ☐ E – Structural Damage/Concrete Substructure
- ☐ F – Structural Damage/Timber Substructure
- ☐ G – Underwater/Debris and/or Erodible Soil
- ☐ H – Underwater/Flow Restrictions or Velocity
- ☐ I – Underwater/Spread footings not adequately keyed into rock or protected from the effects of streambed scour
- ☐ J – Reserved
- ☐ K – Underwater/Scour Critical Evaluation Monitoring
- ☐ L – Existing Streambed Scour/Spread Footing
- ☐ M – Existing Streambed Scour/Pile Supported Footing
- ☐ N – Existing Streambed Scour/Pile Bent Substructure Unit
- ☐ P – Embankment Movement or Settlement
- ☐ Q – Substructure Movement or Settlement
- ☐ R– Pin & Link in Multi-Girder (Redundant) Bridge (If checked must add BBS Form(s) 2760 and 2780 if needed)
- ☐ S – Specifically Identified Problematic Structural Details
- ☐ T – Deck
- ☐ X – Critical Finding
- ☐ Z – Other (Describe):

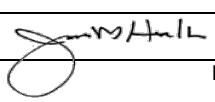
92C5 – Special Inspection Type Remarks:

SPECIAL INSPECTION

93C1 – Special Inspection Condition Status:

Prev	New	
☐ 0	☐ 0	- Worsening Condition Indicating Imminent Structural Failure - Immediate closure required, then contact BBS
☐ 1	☐ 1	- Progression of Deterioration or Worsening Condition - Contact BBS, Program Manager, and SI Initiator
☒ 2	☒ 2	- No Change in Condition Noted
☐ 3	☐ 3	- Corrected Condition Noted - Special inspections no longer required after verification by BBS personnel
☐ 4	☐ 4	- Feature Determined to be in Adequate Condition - Primarily for monitoring problematic structural details

93C4 – Special Inspection Remarks: Condition of bridge has not worsened since the previous inspection.

	Signature	Date
Inspection Team Leader:		9 / 10 / 2015
Consultant Program Manager:		/ /
Agency Program Manager:		9 / 10 / 2015

93C4 – Special Inspection Remarks:

APPENDIX B

IDOT MASTER STRUCTURE REPORT

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

Structure Number: 045-3132 **District: 1**

Inventory Data

Facility Carried:	MUIRHEAD RD.	**Bridge Name:**		**Sufficiency Rating:**	63.7	**Structure Length:**	202.2
Feature Crossed:	CANADIAN NATIONAL RR	**Location:**	0.5 M N. of Bowes Rd	**HBP Eligible:**	Yes	**AASHTO Bridge Length:**	99.9
Bridge Remarks:				**Replaced By:**		**Length of Long Span:**	42.4
Bridge Status:	1 OPEN - NO RESTRICT	**StatusDate:**	01/1990	**Replaces:**	045-3003	**Bridge Roadway Width:**	38.8
Status Remarks:				**Last Update Date:**	12/03/2012	**Appr Roadway Width:**	24.0
Maint County:	045 KANE	**Maint Township:**	12 PLATO	**Parallel Structure:**	None	**Deck Width:**	42.0
Maint Responsibility:	09 TOWNSHIP OR ROAD DISTRICT			**Multi-Level Structure Nbr:**		**Sidewalk Width Right:**	0.0
Service On/Under:	1 HIGHWAY / 2 RAILROAD			**Skew Direction:**	Left	**Sidewalk Width Left:**	0.0
Reporting Agency:	3 COUNTY			**Skew Angle:**	41 D	**Navigation Control:**	N N/A
Main Span Matl/Type:	5 PRESTRESS CONCRETE / 05 BOX BEAM OR GIRDER-MULTIPLE			**Structure Flared:**	No	**Navigation Horiz Clear:**	0
Nbr Of Main Spans:	5	**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:**	2 IDOT	**Rate Method:**	6
Guardrail Type L/R:	0 None / 0 None	**Inventory Rating:**	0.860 (30)	**Load Rating Date:**	08/27/2013	*****Railroad Crossing Info*****	
Toll Facility Indicator:	0 No Toll	**Operating Rating:**	1.435 (51)			**Crossing 1 Nbr:**	
Latitude:	42.02066326	**Longitude:**	88.42037018	**Design Load:**	02 HS20	**Crossing 1 Nbr:**	
Deck Structure Type:	E PCAST PRES CN DK BM	**Deck Structure Thickness:**	17.0	**SD:** Y	**FO:** N	**RR Lateral Underclear:**	15.3
Sidewalks Under Structure:	0 None					**RR Vertical Underclear:**	21 Ft 06 In

Key Route On Data

Key Route Nbr:	TOWNSHIP OR ROAD DISTRICT 2110	**Station:**	1.8400		
Appurtenances	Main Route 00000	**Segment:**			
Inventory County:	045 KANE	**Linked:**	Y		
Township/Road Dist	12 PLATO	**Natl. Hwy System:**	Not on NHS		
Municipality	0000	**Inventory Direction:**			
Urban Area:	1051	**Curr AADT Yr/Count:**	2014 / 2400		
Functional Class:	7	**Est Truck Percentage:**	9		
**** CLEARANCES ****	**South/East** **North/West**	**Number Of Lanes:**	2		
Max Rdwy Width:	38.8	**One Or Two Way:**	2 Two-Way		
Horizontal:	38.8 0.0	**Bypass Length:**	4		
Min Vertical:	99 Ft 11 In 00 Ft 00 In	**Future AADT Yr/Cnt:**	2032 / 2743		
10 Ft Vertical:	99 Ft 11 In 00 Ft 00 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	4 FAS, CH, or TR's Unmarked	
Route #2:	1 Mainline		
Route #3:	1 Mainline		

*** Marked Route Under Data ***

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

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

Structure Number: 045-3132 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:	Y	Single Unit Vehicles:	Tons	Combination Type 3S-2:	Tons		

Inspection/Appraisal Information

Inspection Date:	09/20/2014	Inspection Temperature:	68 Deg. F	Insp by (Name):	HaasM	** Actual Posted Limits **			
Deck:	4	POOR CONDITION - ADVANCED DETERIORATION		Insp by (Name):	GuerrieroJ	Single Unit Vehicles:		Tons	
Superstructure:	4	POOR CONDITION - ADVANCED DETERIORATION		Utilities Attached:	N N/A	Combination Type 3S-1:		Tons	
Substructure:	6	SATISFACTORY CONDITION - MINOR DETERIORATION			N N/A	Combination Type 3S-2:		Tons	
Culvert:	N	NOT APPLICABLE			N N/A	One Truck At A Time:	0		
Channel and Protection:	N	NOT APPLICABLE		Deck Wearing Surf:	G BITUMINOUS OVERLAY	Last Paint Type:			
Structural Evaluation:	4	MINIMUM ADEQUACY 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.:	5	BETTER THAN ADEQUATE TO BE LEFT IN PLACE		Total Deck Thick:	19.0				
Waterway Adequacy:	N	NOT APPLICABLE		Last Paint Date:					
Approach Roadway Align:	8	EQUAL TO PRESENT DESIRABLE CRITERIA		Inspection Remarks:					
Bridge Railing Appraisal:	3	Meets Standards							
Approach Guardrail:	332	Acceptable	Acceptable	Not 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:		Evaluation Method:	
Analysis Date:		Analysis By:	

Miscellaneous

Fracture Critical Members:	No
Microfilm Data Recorded:	No

Construction Information

Year:	1989 Original			Reconstructed	
Route:		Sta:	9+94		Sta:
Section Nbr:	87-00082-00-BR				
Contract Nbr:					
Fed Aid Pr #:					
Built By:	3 COUNTY AGENCY				

Proposed Improvement

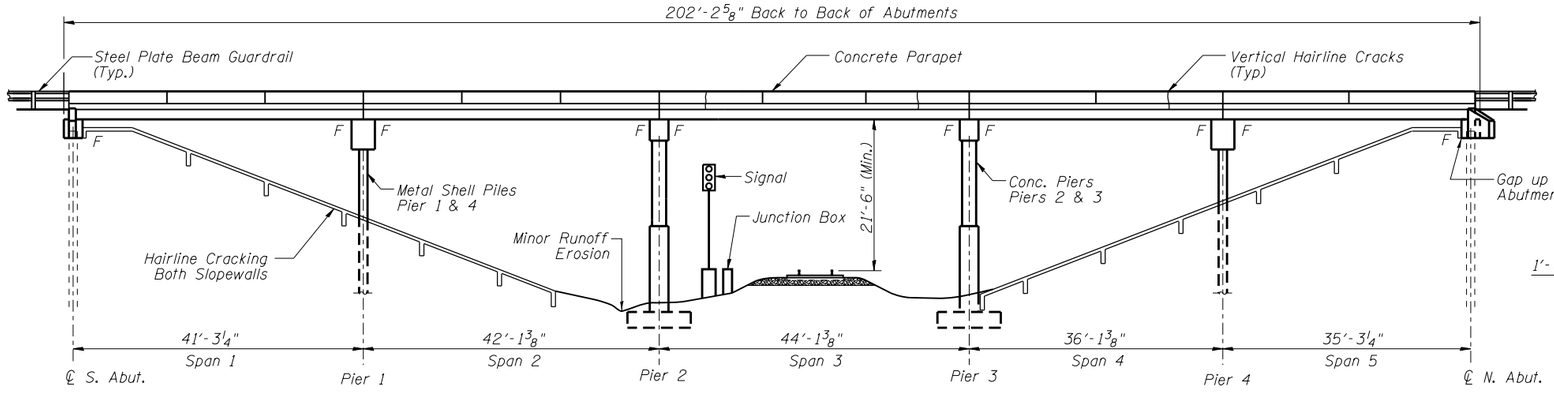
Cost Estimate Year:		Length:	
Type of Work:			
Done By:			
Remarks:			

*** Costs in Dollars ***

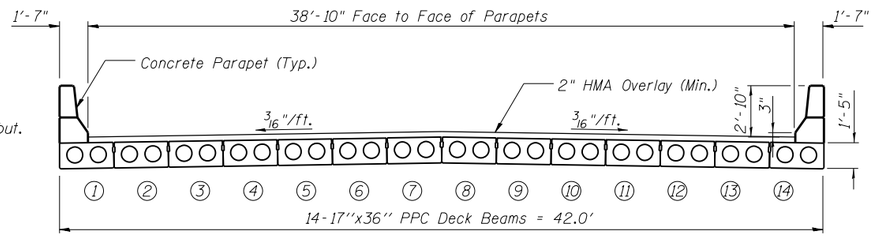
Bridge Cost:	
Roadway Cost:	
Total Project Cost:	

APPENDIX C

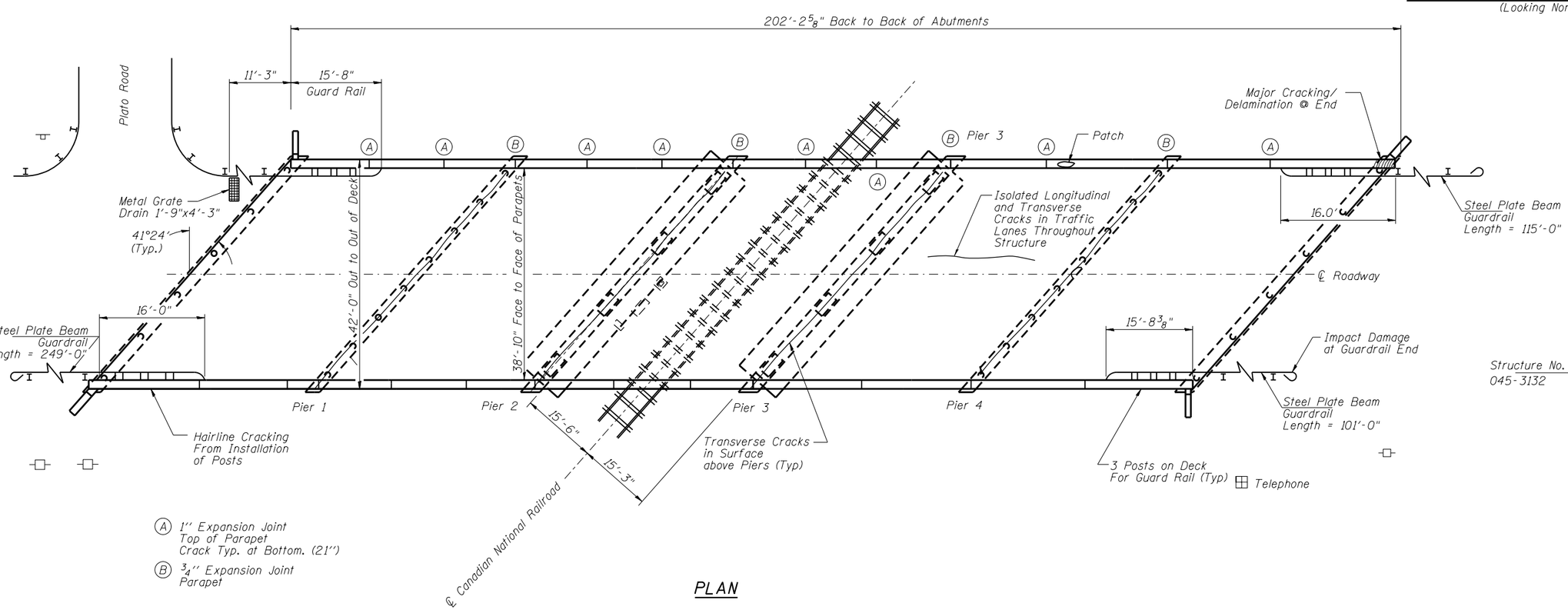
STRUCTURE SKETCHES



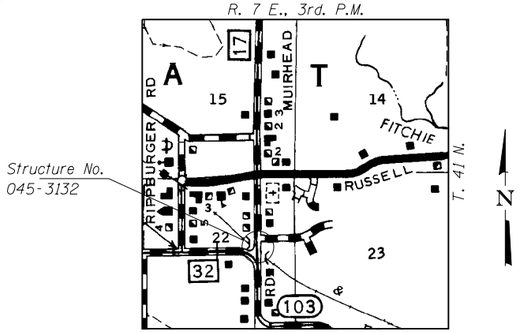
ELEVATION
(Looking West)



TYPICAL DECK CROSS SECTION
(Looking North)



PLAN



LOCATION SKETCH

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	
RF = Reinforcement	Spalls
RP = Repair	
RS = Rust Staining	Crack
SP = Spall	

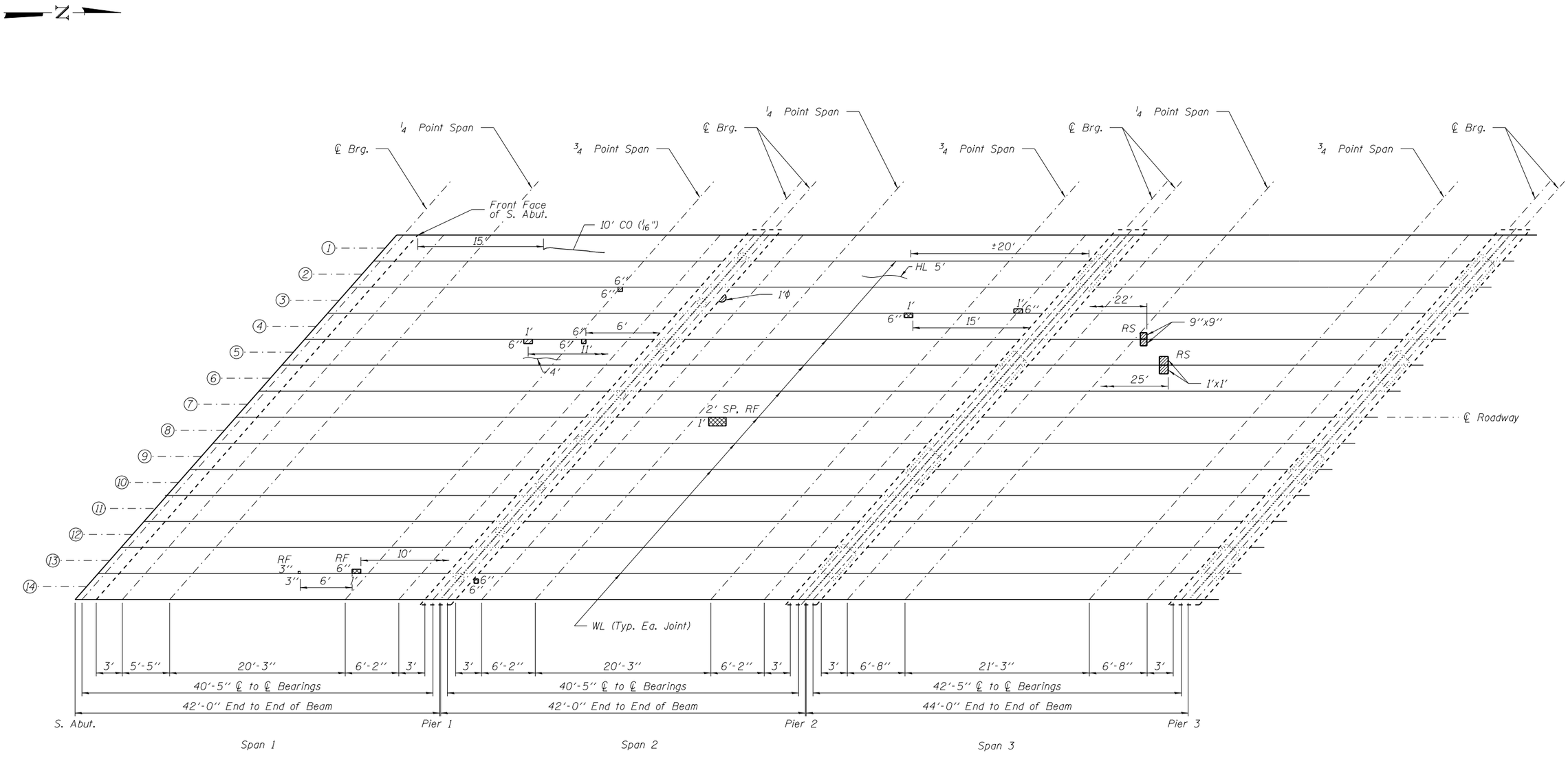
Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

GENERAL PLAN AND ELEVATION

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: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 1 OF 8



UNDERSIDE OF DECK PLAN

(Reflected View)

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	

Note:
Damage area dimensions are shown as length along beam x width across beam.

GENERAL BEAM CONDITION:

Moderate water leakage through most keyway joints.
Water leakage is present on all pier caps.

Plato Township

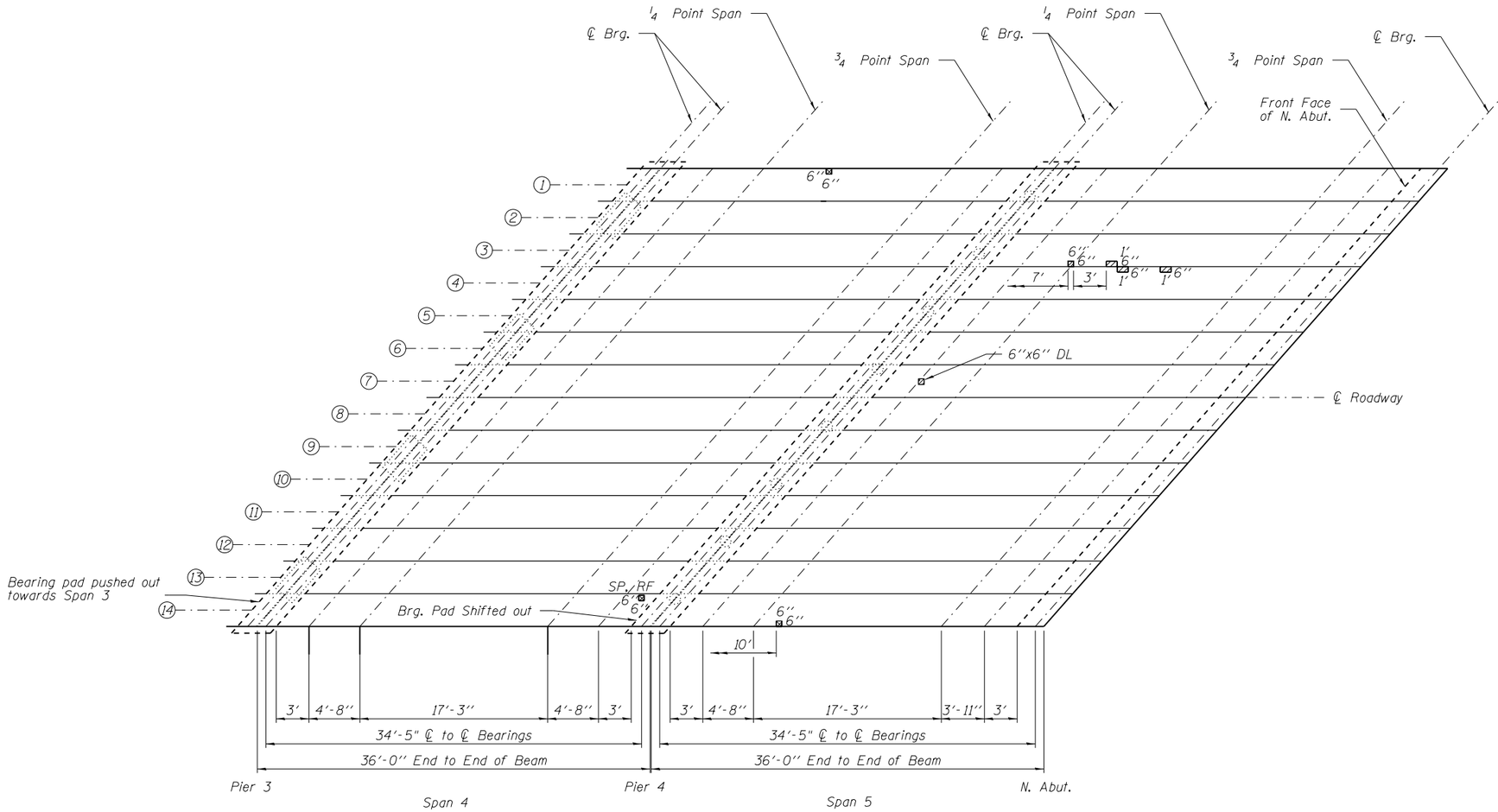
KANE COUNTY DIVISION OF TRANSPORTATION

MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

UNDERSIDE OF DECK SPANS 1-3

DRAWN BY: ELN	COLLINS ENGINEERS 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-6500 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184008993	DATE: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 2 OF 8

N



UNDERSIDE OF DECK PLAN

(Reflected View)

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

Note:
Damage area dimensions are shown as length along beam x width across beam.

GENERAL BEAM CONDITION:

Moderate water leakage through most keyway joints. Water leakage is present on all pier caps.

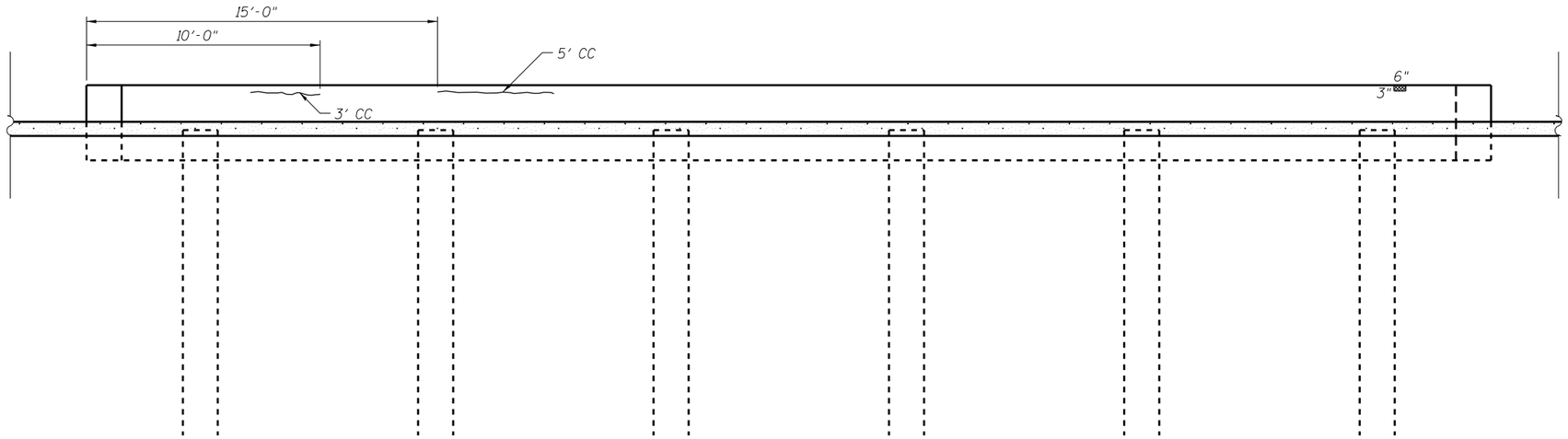
Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

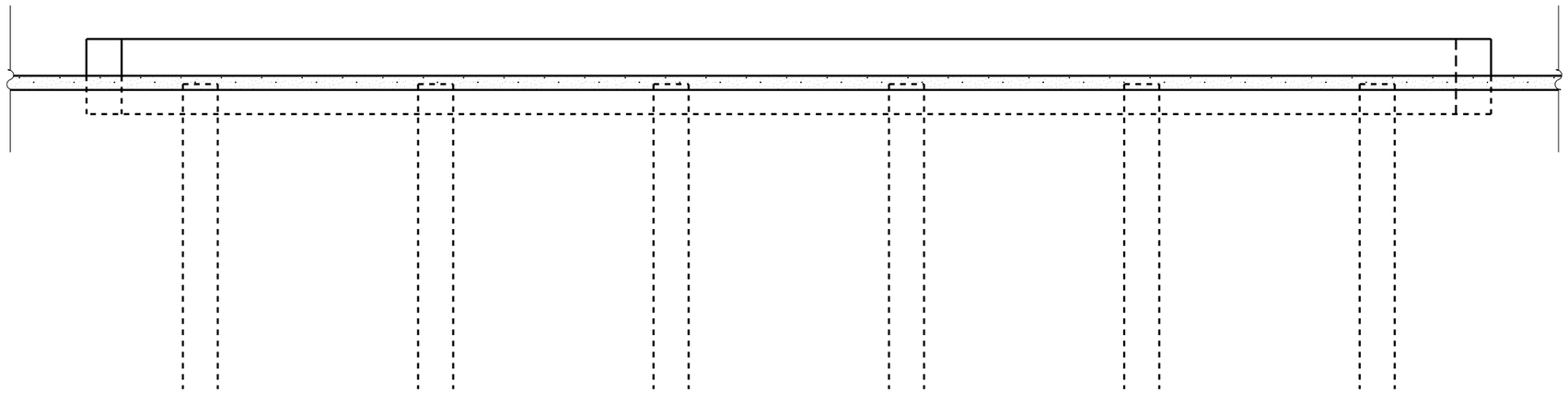
UNDERSIDE OF DECK SPANS 4-5

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. 184008993	DATE: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 3 OF 8



SOUTH ABUTMENT ELEVATION

Note: Areas of rust staining and efflorescence present sporadically throughout both abutment caps.



NORTH ABUTMENT ELEVATION

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

NOTE:

Water leakage, staining and HL vertical cracking is present along both abutment caps.

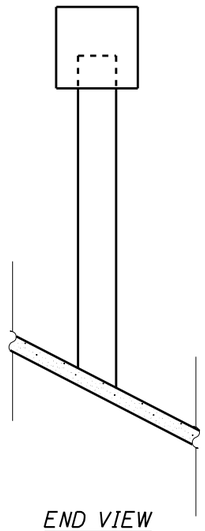
Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

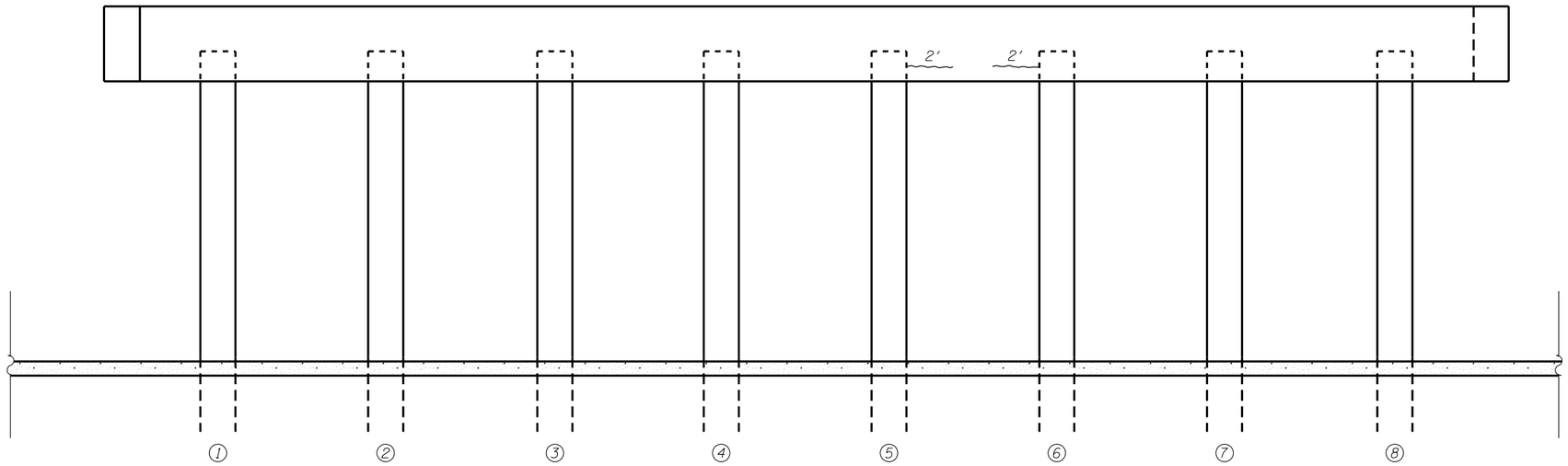
MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

ABUTMENTS

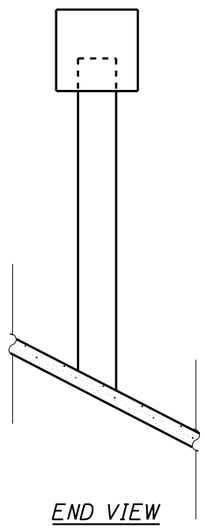
DRAWN BY: ELN	COLLINS ENGINEERS, INC. 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184008993	DATE: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 4 OF 8



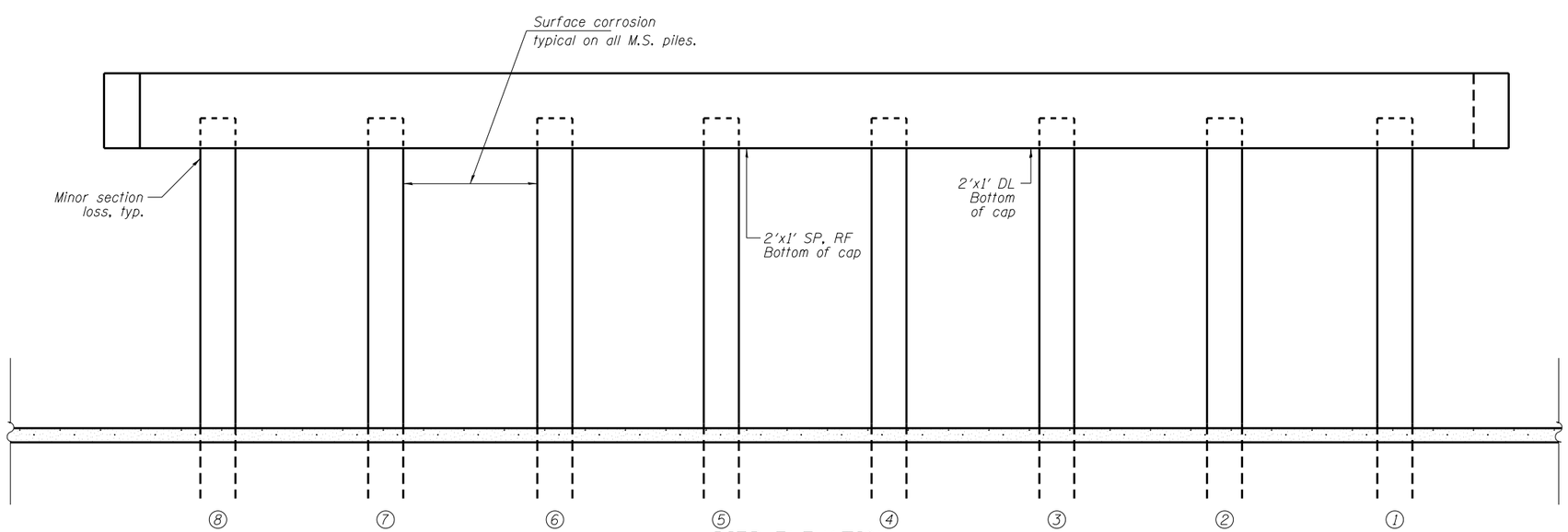
END VIEW
(East Nose)



PIER ELEVATION
(North Face)



END VIEW
(West Nose)



PIER ELEVATION
(South Face)

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

NOTE:

1. Water leakage, staining and HL vertical cracking is present along pier cap.
2. Areas of paint remain sporadically on all piles.

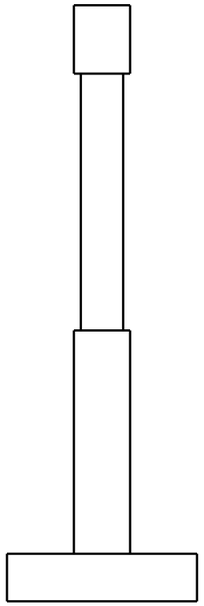
Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

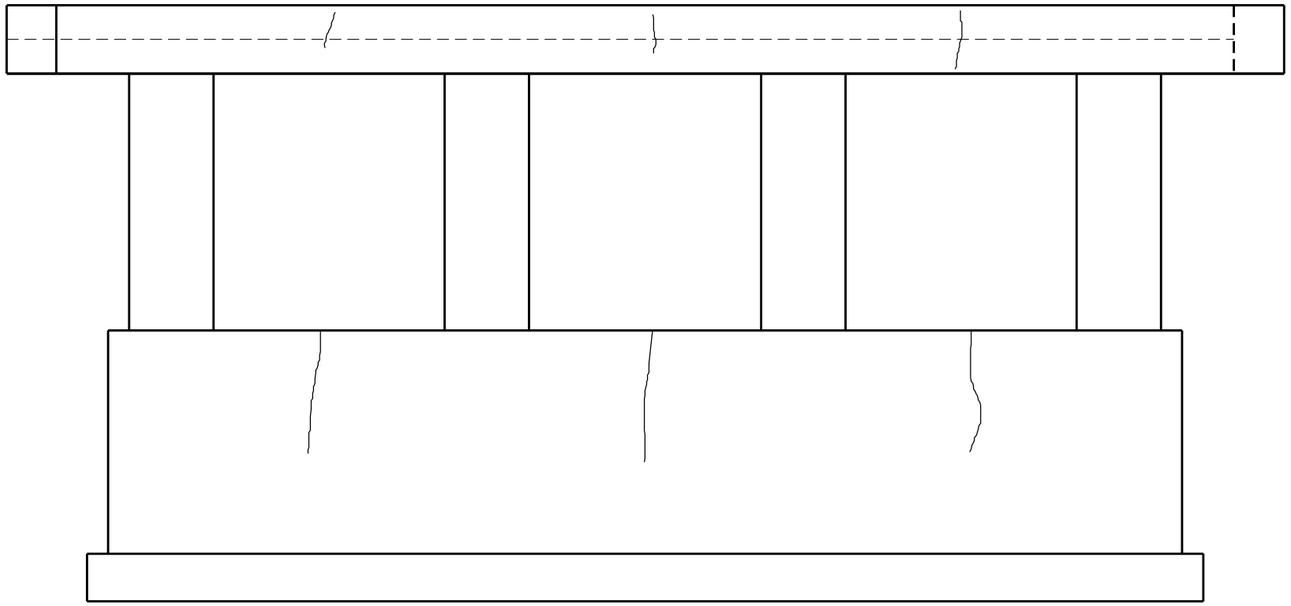
MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

PIER 1

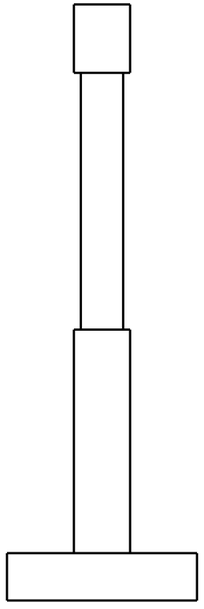
DRAWN BY: ELN	COLLINS ENGINEERS, INC. 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184-000993	DATE: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 5 OF 8



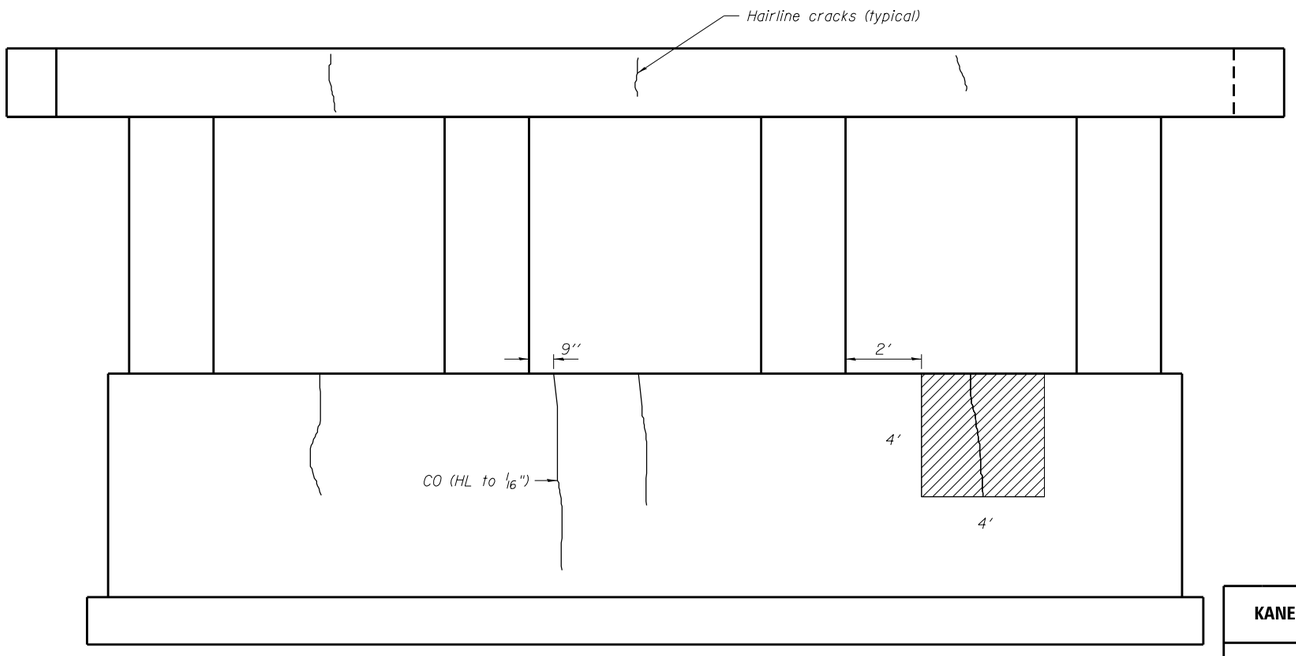
END VIEW
(East Nose)



PIER ELEVATION
(North Side)



END VIEW
(West Nose)



PIER ELEVATION
(South Side)

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

NOTE:
Water leakage, staining and HL vertical cracking is present along pier cap.

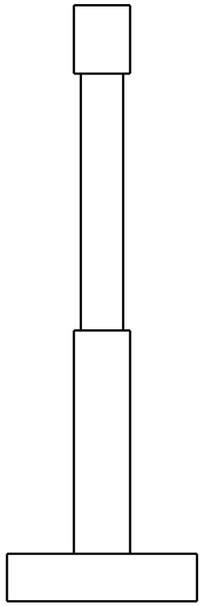
Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

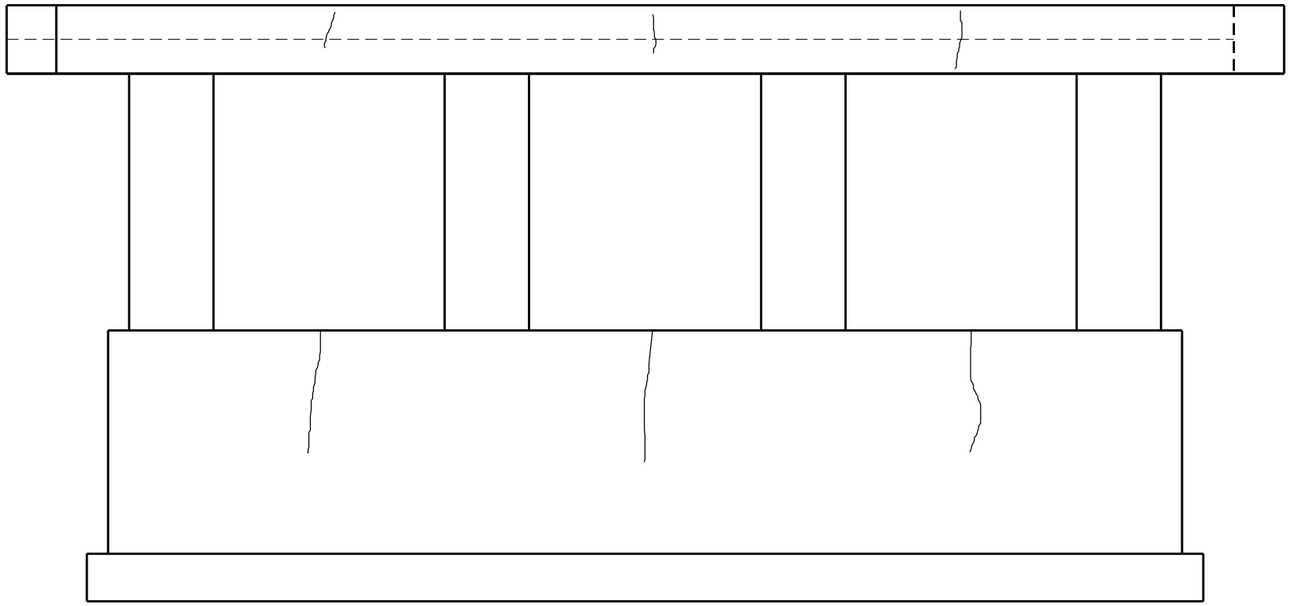
MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

PIER 2

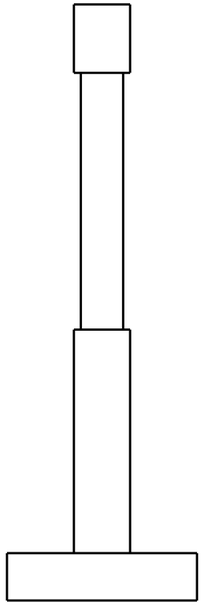
DRAWN BY: ELN	COLLINS ENGINEERS, INC. 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com ILLINOIS PROFESSIONAL DESIGN FIRM LICENSE NO. 184008993	DATE: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 6 OF 8



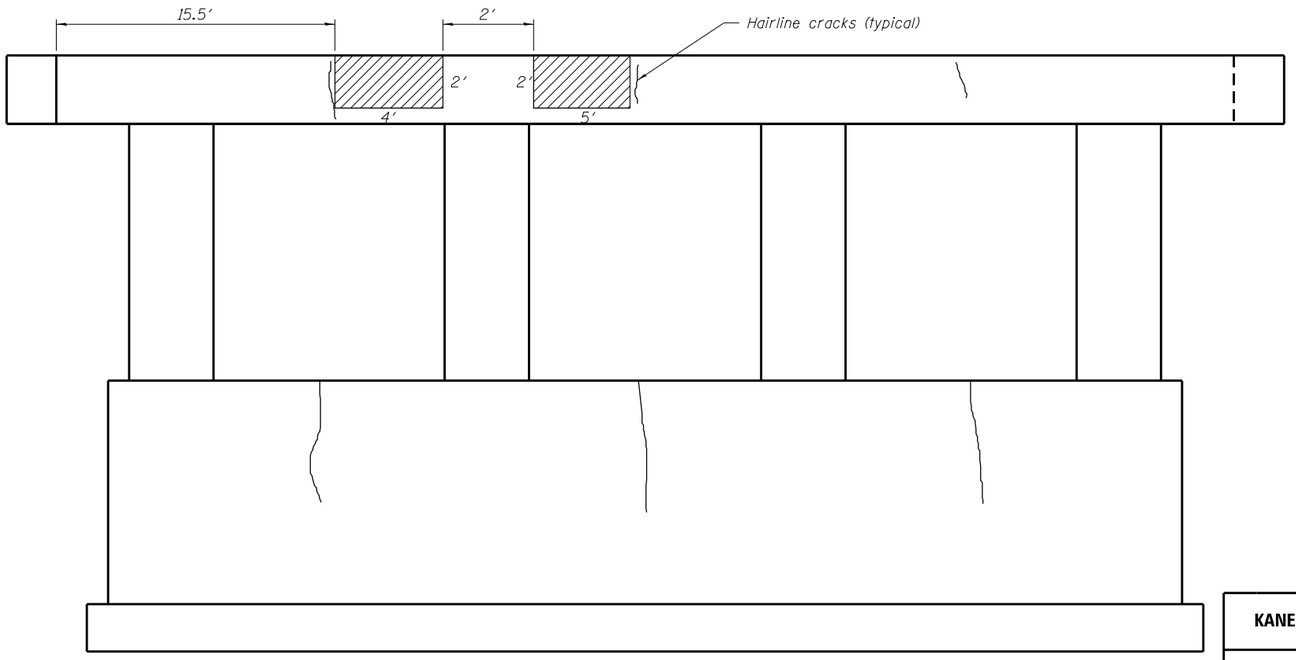
END VIEW
(East Nose)



PIER ELEVATION
(North Side)



END VIEW
(West Nose)



PIER ELEVATION
(South Side)

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

NOTE:

Water leakage, staining and HL vertical cracking is present along pier cap.

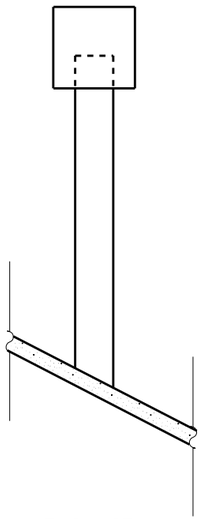
Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

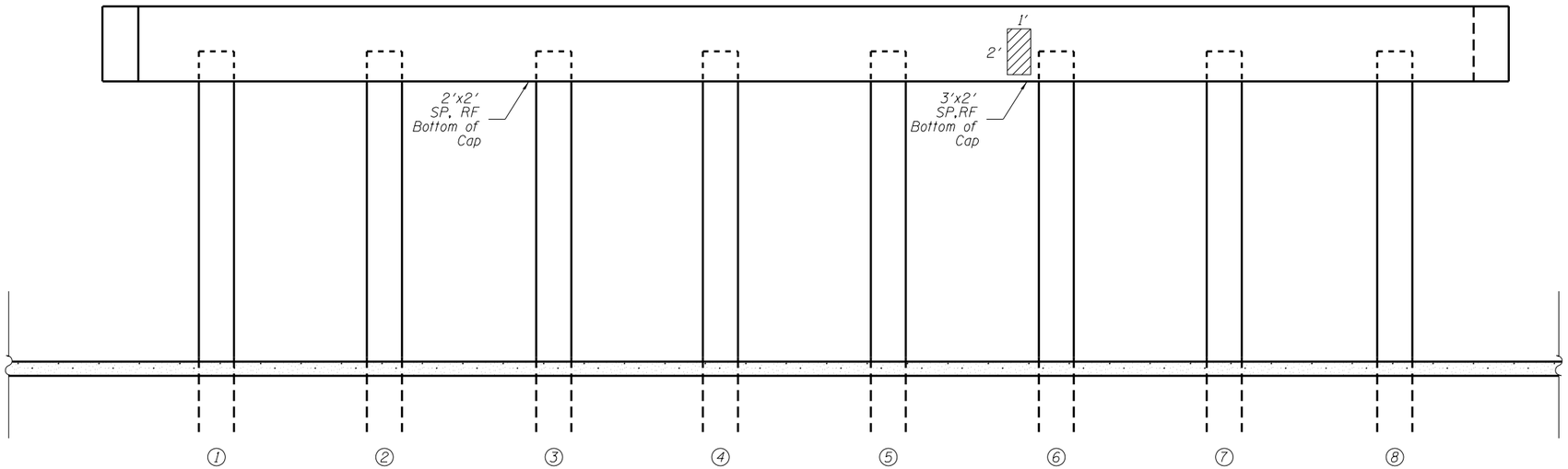
MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

PIER 3

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: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 7 OF 8

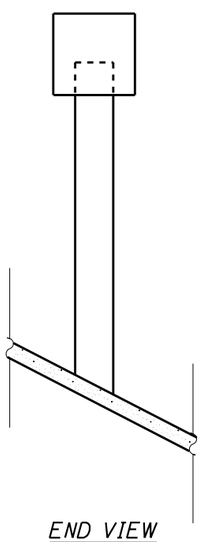


END VIEW
(East Nose)

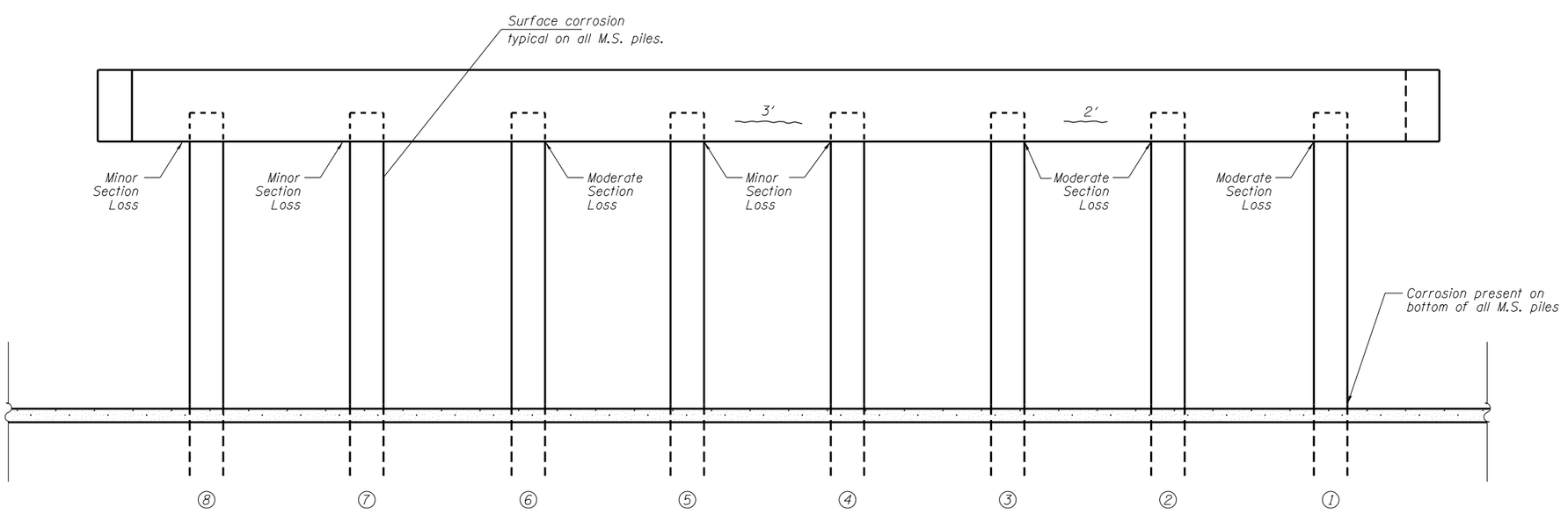


PIER ELEVATION
(North Face)

Note: Areas of paint remain sporadically on all piles.



END VIEW
(West Nose)



PIER ELEVATION
(South Face)

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

NOTE:

1. Water leakage, staining and HL vertical cracking is present along pier cap.
2. Areas of paint remain sporadically on all piles.

Plato Township

KANE COUNTY DIVISION OF TRANSPORTATION

MUIRHEAD ROAD OVER
CANADIAN NATIONAL RAILROAD
KANE COUNTY
STRUCTURE NUMBER: 045-3132

PIER 4

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. 184-000993	DATE: SEPTEMBER 10, 2015
CHECKED BY: MAH		
PROJECT NO. 8847		SHEET 8 OF 8

APPENDIX D

STRUCTURE PHOTOS

Photo No. 1
East Elevation, looking West

Photo No. 2
West Elevation, looking East

Photo No. 3
Topside of Structure, looking North

Photo No. 4
Topside of Structure, looking South

Photo No. 5
North Approach Roadway, looking Northwest

Photo No. 6
South Approach Roadway, looking Southwest

Photo No. 7
Typical Bridge Parapet (West shown), looking Northwest

Photo No. 8
North End of West Parapet Condition, looking South

Photo No. 9
Top of Deck (South Span), looking West

Photo No. 10
Typical Top of Deck Center Span Condition (Span 2 Shown), looking West

Photo No. 11
Top of Deck (North Span), looking West

Photo No. 12
Typical Condition of Deck Overlay, looking North

Photo No. 13
Typical Roadway over Abutment (North shown), looking West

Photo No. 14
Typical Condition of Beams (Span 3 Shown), looking Southeast

Photo No. 15
Typical Keyway Joint Condition (Span 3 Shown), looking North

Photo No. 16
Crack in West Edge Beam of South Span, looking North

Photo No. 17
Typical Spall (Beam 8 of Span 2 Shown), looking West

Photo No. 18
Typical Spall (Beams 4-5 of Span 1 Shown), looking South

Photo No. 19
Typical Delamination (Beam 3 in Span 2 near Pier 1 shown), looking Southwest

Photo No. 20
South Abutment, looking Southwest

Photo No. 21
North Abutment, looking Northwest

Photo No. 22
Rust Staining and Efflorescence on South Abutment, looking South

Photo No. 23
Pier 1, looking Northwest

Photo No. 24
Pier 2, looking North

Photo No. 25
Pier 3, looking South

Photo No. 26
Pier 4, looking Southeast

Photo No. 27
Impending Spall on Pier 1, 3rd Pile from East, looking North

Photo No. 28
Spall on Pier 1, 5th Pile from East, looking North

Photo No. 29
Spall at Pier 4, 6th Pile from East, looking South

Photo No. 30
Spall at Pier 4, 3rd Pile form East, looking South

Photo No. 31
Typical Wingwall (Southwest shown), looking South

Photo No. 32
Spall at Northwest Wing Wall, looking North

Photo No. 33
Typical Slopewall Condition (South Shown), looking Southeast

Photo No. 34
Water Flow and Erosion at South Slope Wall, looking West

Photo No. 35
Typical Guardrail/Guardrail End (Northwest Shown), looking South

Photo No. 36
Typical Guardrail End Impact Damage (Northeast Shown), looking South

Photo No. 37
View of Track West of Structure, looking West

Photo No. 38
View of Track East of Structure, looking East

APPENDIX E

COST ESTIMATES

Cost Estimates

Short Term Recommended Repairs

Item	Unit	Quantity	Unit Price	Total
Bituminous Crack Sealer	Ft.	1350	$12	$16,200
Guardrail End Sections	Each	4	$2,500	$10,000
Clean & Paint Steel Columns	Sq. Ft.	1032	$15	$15,480
Traffic Control and Protection	L Sum	1	$1,800	$1,800
Subtotal				$43,480
10% Contingency				$4,348
10% Mobilization				$4,348
The total cost of the short term recommended repairs				$52,176

Superstructure Replacement

Replacing the existing PPC deck beams with new PPC deck beams on the existing substructure would cost approximately $1,700,000.

Overall Replacement of Structure

Replacing the existing structure with a PPC deck beam bridge with a length of 202 ft. back to back of abutments and a width of 42 ft. would cost approximately $2,545,000.

APPENDIX F

STRUCTURE RATING

Structure Rating Summary

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating

LFR METHOD

	RF	HS	Gross Weight (Tons)
HS-20 Inventory	0.710	14.2	25.5
HS-20 Operating	1.186	23.7	42.6

Illinois Posting Vehicle (Operating Level)

	RF	Gross Weight (Tons)
Single Unit	1.518	33.3
3 or 4 axles	1.459	42.6
5 or more axles	1.158	47.1

Kane County Special Permit Vehicle (Operating Level)

	RF	Gross Weight (Kips)
KC-1	0.755	128.3
KC-2	0.757	124.9
KC-3	0.764	106.9
KC-4	0.977	112.3

AASHTO Notional Truck (Operating Level)

	RF	Gross Weight (Tons)
AASHTO Notional	0.975	39.0

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	128.3 Kips
KC-2	124.9 Kips
KC-3	106.9 Kips
KC-4	112.3 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:		No Change Recommended

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating - Spans 1 & 2
LFR METHOD

BRIDGE INFORMATION

Span	40.44	ft
Year constructed	1988	
Skew	41.4	deg
Out to Out	42	ft
Clear width	38.83	ft
Design Lanes	3	AASHTO 3.6/MBE 6B.6.2.2
Actual Lanes Loaded	2	

BEAM TYPE **3** **17x36**

diaphragms	1		
diaphragm weight	0.658	k	each
WS Thickness	2.00	in	
f 's (prestressing strands)	270000	psi	
f 'c	5000	psi	
f 'ci	4000	psi	
fy (shear reinforcement)	60	ksi	
Rail / Parapet	0.570	k/ft	
Strand Type	stress relieved		

Deck Beams:

Beam	17x36	
Number of Beams	14.00	
% Strand Area Reduction	0.00	%
% Shear Key Reduction	0.00	%
Beam Depth	17	in
Beam Width, b	3.00	ft
Beam Weight	0.4700	k/ft
Beam Area	430.57	in^2
Centroid from Bottom, Cb	8.21	in

Strands:

Strand Diameter	1/2	in
Strand Area	0.153	in^2

Number of Strands @		
Original	Current	
10	8	1.75 in
2	2	3.25 in
		4.50 in
		6.00 in
		7.50 in
		9.00 in
		10.50 in
2	2	12.00 in
		15.00 in

Total	14.00	12.00	strands
C.G.	3.43	3.71	in
d	13.57	13.29	in

Dead Load:

Beam	0.470	k/ft
Wearing Surface	0.075	k/ft
Rail / Parapet (3 Bms Max)	0.190	k/ft
Fill	0.000	k/ft
	0.735	k/ft

Other / Diaphram	0.658	k

Moment Capacity (current section properties)

As*	1.84	in^2	
Aeff = bd	478.50	in^2	
ρ*	0.0038		(3) (Eq. 10)
b' (web, total)	25.81	in	
χ*	0.40		(3) 1.1.7
β_1	0.80		(1) 8.16.2.7
f*su	242,028	psi	(3) (Eq. 11)

a	2.90	in	(3) (Eq. 12)
t_{flange}	2.75	in	(3) (Eq. 13)
Check:	a recalculated for voided section		
Reinf. Index	0.014		(3) 1.1.7
Reinf. Index M	0.288		(3) 1.1.7
ϕ	1		(1) 9.14
ϕMn	436.2	k-ft	(3)(Eq. 13&14)
ϕMn max	436.2	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)	4.785	in	
e (current)	4.506	in	(3) 1.1.6
I	13274	in^4	
Mdl beam	102.75	k-ft	
f*cir (initial)	1.030	ksi	(3) 1.1.5
Msdl	54.18	k-ft	
fcds (initial)	0.234	ksi	(3) 1.1.5
SH	6.500	ksi	(3) (Eq. 1a)
ES	8.002	ksi	(3) (Eq. 1b)
CRc	10.723	ksi	(3) (Eq. 1c)
CRs	13.355	ksi	(3) (Eq. 1d&e)
Fsi	189000	psi	(3) 1.1.4
% loss	20.41	%	(3) (Eq. 2)

Fi (for current s	347.00	k	(3) 1.1.6
F (now)	276.17	k	(3) 1.1.6
Sb	1616	in^3	
fpe (now)	1.411	ksi	(3) 1.1.7
Fr	530.33	psi	(3) 1.1.7
M*cr (now)	261.49	k-ft	(3) (Eq. 17)
Asf	1.74	in^2	(3) 1.1.7
Asr	0.10	in^2	(3) 1.1.7

Mcap=ϕMn	436.2	k-ft	
1.2 * Mcr	313.8	k-ft	
k	1.39		
Use kϕMn?	no		
ϕMn = C	436.2	k-ft	
%Cap.Reductior	0.0	%	
C	436.2	k-ft	

M (HS 20)	457.6	k-ft
V (HS 20)	55.4	k

Live load shears and moments taken from AASHTO

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

HS-20 Moments and Stresses (AASHTO)

D	MDL	156.93	k-ft
L	MLL (per beam with impact)	147.40	k-ft
S	Prestress secondary M or V	0.000	k-ft
	St	1511	in^3
	Sb	1616	in^3

Factors:

Design Lanes	3
	IDOT PCM
K	0.800
C	0.768
S	3.214
D	6.486
DF	0.496

Concrete stresses

Fd (top)	1.246	ksi
Fd (bottom)	-1.165	ksi
Fs (top)	0.000	ksi
Fs (bottom)	0.000	ksi
Fp (top)	-0.182	ksi
Fp (bottom)	1.411	ksi
Fd+Fs+Fp (top)	1.064	ksi
Fd+Fs+Fp (bottom)	0.246	ksi
FL (top)	1.171	ksi
FL (bottom)	-1.095	ksi

Negative = Conc.Tension
Positive = Conc.Compression

Steel stresses for live loads beyond cracking moment

ybottom	1.75	in
c	2.735	in
Check:	OK: c is in top flange	
I_{cr}	1666.9	in4
Fp	150.42	ksi
Fd	98.22	ksi
FL	92.25	ksi

Impact	0.300		
Design DF	0.496	wheel/beam	IDOT PCM
	0.496	wheel/beam	

HS 20 Ratings

Inventory	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Concrete Tension	-0.424	0.246	-1.09	0.612	12.2	22
Concrete Compression	3.00	1.064	1.17	1.653	33	59.5
Concrete Compression	2.00	0.532	1.17	1.254	25	45.1
Prestressing Steel Tension	216	98.2	92.252	1.569	31.3	56.4
Flexural Strength	436.2	156.93	147.40	0.726	14.5	26.1
Shear Strength	See next page			1.442	28.8	51.9

Operating	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Prestressing Steel Tension	243	98.2	92.25	1.971	39.4	70.9
Flexural Strength	436.2	156.93	147.40	1.212	24.2	43.6
Shear Strength	See next page			2.407	48.1	86.6

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*	0.726	14.5
Operating	1.212	24.2

	Controlling Rating
Inventory:	Flexural Strength
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

*Concrete tension inventory rating is neglected because prestressing steel tension rating is used.

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

fraction DL externally applied	0.353
fraction DL from beam	0.647

HS-20 Shear Rating	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
Vd (total dead load shear)	14.36	12.22	9.25	6.27	2.97	0.00	k
VLL max. (STAAD - axle load)	53.29	48.63	40.89	33.58	26.81	20.80	k
VLL (max per beam with impac	17.17	15.66	13.17	10.82	8.64	6.70	k
Vs (total unfactored)	31.53	27.88	22.42	17.09	11.61	6.70	k
Vult (total factored)	55.93	49.89	40.61	31.64	22.61	14.55	k
V @ Mmax (axle)	51.02	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	34.03	5.60	4.24	2.88	1.36	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	17.08	56.76	101.50	134.21	154.91	163.58	k-ft
MLL max (STAAD - axle load)	57.77	192.77	330.72	407.86	450.66	447.84	k-ft
MLL (per beam with impact)	18.61	62.09	106.53	131.37	145.16	144.25	k-ft
Ms	35.69	118.85	208.02	265.59	300.07	307.83	k-ft
Mult	62.61	208.59	363.22	459.69	516.52	525.82	k-ft
Mmax (factored from externally	48.23	160.83	277.81	346.75	386.17	388.17	k-ft

e	4.51	4.51	4.51	4.51	4.51	4.51	in
d	13.60	13.60	13.60	13.60	13.60	13.60	in
b'	25.81	25.81	25.81	25.81	25.81	25.81	in
vu	0.159	0.142	0.116	0.090	0.064	0.041	Vult/b'd ksi

F/A	0.641	0.641	0.641	0.641	0.641	0.641	ksi
Fe/Sb	0.770	0.770	0.770	0.770	0.770	0.770	ksi
fpe	1.411	1.411	1.411	1.411	1.411	1.411	ksi
fd	0.127	0.421	0.754	0.997	1.150	1.215	ksi
y	8.21	8.21	8.21	8.21	8.21	8.21	
Mcr	230.1	190.4	145.7	113.0	92.3	83.6	AASHTO (9-28)
vci	0.546	0.096	0.075	0.063	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.546	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	0.641	0.641	0.641	0.641	0.641	0.641	ksi
Vp	0.00	0.00	0.00	0.00	0.00	0.00	k
vcw	0.440	0.440	0.440	0.440	0.440	0.440	ksi

Shear reinforcement bar size	W5.5	W5.5	W5.5	W5.5	W5.5	W5.5	
Av	0.44	0.44	0.44	0.44	0.44	0.44	in
s	12	12	12	12	12	21	in
vs	0.085	0.085	0.085	0.085	0.085	0.049	

$\phi = 0.90$

$\phi vn = \phi(vs+vc)$	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	17.17	15.66	13.17	10.82	8.64	6.70	
Inventory RF	3.953	1.442	1.850	2.418	3.258	3.671	
Operating RF	6.599	2.407	3.089	4.036	5.438	6.127	

Shear Rating Factor:	RF	HS
Inventory	1.442	28.8
Operating	2.407	48.1

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating 0.496 wheel per beam

Illinois Posting Vehicles:

	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
STAAD LL moment	236.62	340.13	373.71	478.96	364.40	k-ft

	Moments and Stresses (AASHTO)	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
D	Total deal load moment	156.93	156.93	156.93	156.93	156.93	k-ft
L	Live load moment w/ imp. per l	76.22	109.56	120.37	154.28	117.37	k-ft
S	Prestress secondary M or V	0.000	0.000	0.000	0.000	0.000	k-ft
	St	1511	1511	1511	1511	1511	in^3
	Sb	1616	1616	1616	1616	1616	in^3
	Concrete stresses						
	Fd (top)	1.246	1.246	1.246	1.246	1.246	ksi
	Fd (bottom)	-1.165	-1.165	-1.165	-1.165	-1.165	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)	-0.182	-0.182	-0.182	-0.182	-0.182	ksi
	Fp (bottom)	1.411	1.411	1.411	1.411	1.411	ksi
	Fd+Fs+Fp (top)	1.064	1.064	1.064	1.064	1.064	ksi
	Fd+Fs+Fp (bottom)	0.246	0.246	0.246	0.246	0.246	ksi
	FL (top)	0.605	0.870	0.956	1.225	0.932	ksi
	FL (bottom)	-0.566	-0.814	-0.894	-1.146	-0.872	ksi
	Steel stresses						
	Fp	150.42	150.42	150.42	150.42	150.42	ksi
	Fd+Fs+Fp	NA	98.22	98.22	98.22	98.22	ksi
	FL	NA	68.57	75.34	96.56	73.46	ksi

Inventory RF	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2
Concrete Tension	1.184	0.824	0.750	0.585	0.769
Concrete Compression	3.198	2.225	2.025	1.580	2.076
Concrete Compression	2.425	1.687	1.535	1.198	1.574
Prestressing Steel Tension	NA	1.718	1.563	1.220	1.603
Flexural Strength	1.404	0.977	0.889	0.694	0.912
Shear Strength	2.941	2.129	2.007	1.437	2.010

Operating RF					
Prestressing Steel Tension	NA	2.111	1.922	1.499	1.971
Flexural Strength	2.344	1.631	1.484	1.158	1.522
Shear Strength	4.909	3.553	3.351	2.399	3.356

NA rating for Prestressing Steel Tension: Stress in steel does not exceed effective prestress and does not control rating

Refer to following pages for shear rating calculations

Postings: (Operating Level)	RF OPERATING	Tons
Single Unit	Type 2	**2.344**	**36.9**
	Type 3	**1.631**	**35.8**
Semi-Trailers	Type 3-S1	**1.484**	**43.4**
	Type 3-S2	**1.158**	**47.1**
	Type 3-S2	**1.522**	**60.8**

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

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

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating 0.496 wheel per beam

Kane County Special Permit Vehicles:

	KC-1	KC-2	KC-3	KC-4	AASHTO	
STAAD LL moment	684.55	685.71	657.00	524.20	544.46	k-ft

	Moments and Stresses (AASHTO)	KC-1	KC-2	KC-3	KC-4	AASHTO	
D	Total deal load moment	156.93	156.93	156.93	156.93	156.93	k-ft
L	Live load moment w/ imp. per l	220.50	220.87	211.62	168.85	175.37	k-ft
S	Prestress secondary M or V	0.0	0.0	0.0	0.0	0.0	k-ft
	St	1511	1511	1511	1511	1511	in^3
	Sb	1616	1616	1616	1616	1616	in^3
	Concrete stresses						
	Fd (top)	1.246	1.246	1.246	1.246	1.246	ksi
	Fd (bottom)	-1.165	-1.165	-1.165	-1.165	-1.165	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)	-0.182	-0.182	-0.182	-0.182	-0.182	ksi
	Fp (bottom)	1.411	1.411	1.411	1.411	1.411	ksi
	Fd+Fs+Fp (top)	1.064	1.064	1.064	1.064	1.064	ksi
	Fd+Fs+Fp (bottom)	0.246	0.246	0.246	0.246	0.246	ksi
	FL (top)	1.751	1.754	1.681	1.341	1.393	ksi
	FL (bottom)	-1.637	-1.640	-1.571	-1.254	-1.302	ksi
	Steel stresses						
	Fp	150.42	150.42	150.42	150.42	150.42	ksi
	Fd+Fs+Fp	98.22	98.22	98.22	98.22	98.22	ksi
	FL	138.00	138.24	132.45	105.68	109.76	ksi

Inventory RF	KC-1	KC-2	KC-3	KC-4	AASHTO
Concrete Tension	0.409	0.409	0.427	0.535	0.515
Concrete Compression	1.105	1.103	1.152	1.443	1.390
Concrete Compression	0.534	0.533	0.557	0.698	0.672
Prestressing Steel Tension	0.853	0.852	0.889	1.115	1.073
Flexural Strength	0.485	0.485	0.506	0.634	0.610
Shear Strength	1.070	1.077	1.086	1.335	1.544

Operating RF					
Prestressing Steel Tension	1.049	1.047	1.093	1.370	1.319
Flexural Strength	0.810	0.809	0.844	1.058	1.019
Shear Strength	1.787	1.798	1.812	2.229	2.577

Permit Vehicles

	RF OPERATING	Gross Weight	
Type KC 1 - 170,000 lb	**0.810**	**137.7**	Kips
Type KC 2 - 165,000 lb	**0.809**	**133.4**	Kips
Type KC 3 - 140,000 lb	**0.844**	**118.1**	Kips
Type KC 4 - 115,000 lb	**1.058**	**121.6**	Kips
Type AASHTO Notional Truck- 80K	**1.019**	**40.7**	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	1/6/2016
Load Rating Checked	CEK	2/8/2016

Shear Ratings	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
e	4.51	4.51	4.51	4.51	4.51	4.51	in
d	13.60	13.60	13.60	13.60	13.60	13.60	in
b'	25.81	25.81	25.81	25.81	25.81	25.81	in
fpe	1.411	1.411	1.411	1.411	1.411	1.411	ksi
fd	0.127	0.421	0.754	0.997	1.150	1.215	ksi
y	8.21	8.21	8.21	8.21	8.21	8.21	
Mcr	230.1	190.4	145.7	113.0	92.3	83.6	k-ft
vcw	0.440	0.440	0.440	0.440	0.440	0.440	ksi
vs	0.085	0.085	0.085	0.085	0.085	0.049	
Vd VDL (total dead load shear)	14.36	12.22	9.25	6.27	2.97	0.00	k
MDL	17.08	56.76	101.50	134.21	154.91	163.58	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	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	26.20	23.85	20.89	17.64	14.38	11.42	k
VLL (per beam with impact)	8.44	7.68	6.73	5.68	4.63	3.68	k
Vs (total unfactored)	22.80	19.90	15.98	11.96	7.60	3.68	k
Vult (total factored)	36.99	32.56	26.63	20.49	13.92	7.99	k
V @ Mmax (axle)	23.04	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	18.98	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	26.09	96.46	168.99	213.98	236.31	230.96	k-ft
MLL (per beam with impact)	8.40	31.07	54.43	68.92	76.12	74.39	k-ft
Ms	25.49	87.83	155.93	203.14	231.02	237.97	k-ft
Mult	40.45	141.24	250.12	324.11	366.63	374.16	k-ft
Mmax (factored from externally	26.08	93.48	164.71	211.17	236.28	236.51	k-ft
vu	0.105	0.093	0.076	0.058	0.040	0.023	Vult/b'd ksi
vci	0.560	0.110	0.079	0.065	0.052	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.560	0.120	0.120	0.120	0.120	0.120	ksi
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	8.44	7.68	6.73	5.68	4.63	3.68	
Inventory RF	8.041	2.941	3.622	4.603	6.073	6.686	
Operating RF	13.423	4.909	6.046	7.683	10.138	11.160	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

IDOT Type 3 - 22 Tons

	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	36.23	32.95	28.81	24.27	19.72	15.58	k
VLL (per beam with impact)	11.67	10.61	9.28	7.82	6.35	5.02	k
Vs (total unfactored)	26.03	22.83	18.53	14.09	9.32	5.02	k
Vult (total factored)	44.00	38.93	32.17	25.13	17.65	10.89	k
V @ Mmax (axle)	31.31	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	23.43	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	35.45	133.57	233.04	296.33	330.82	339.84	k-ft
MLL (per beam with impact)	11.42	43.02	75.06	95.45	106.56	109.46	k-ft
Ms	28.50	99.78	176.56	229.66	261.47	273.04	k-ft
Mult	47.00	167.19	294.91	381.70	432.72	450.30	k-ft
Mmax (factored from externally	32.62	119.43	209.50	268.76	302.37	312.65	k-ft
vu	0.125	0.111	0.092	0.072	0.050	0.031	Vult/b'd ksi
vci	0.554	0.103	0.077	0.064	0.052	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.554	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	11.67	10.61	9.28	7.82	6.35	5.02	
Inventory RF	5.815	2.129	2.626	3.345	4.429	4.901	
Operating RF	9.707	3.553	4.384	5.584	7.393	8.180	

IDOT Type 3-S1 - 29.25 Tons

	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	38.38	34.94	30.24	24.57	19.07	13.03	k
VLL (per beam with impact)	12.36	11.25	9.74	7.91	6.14	4.20	k
Vs (total unfactored)	26.72	23.47	18.99	14.19	9.12	4.20	k
Vult (total factored)	45.51	40.32	33.17	25.34	17.20	9.11	k
V @ Mmax (axle)	38.70	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	27.40	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	43.82	143.14	244.60	320.13	361.22	373.71	k-ft
MLL (per beam with impact)	14.11	46.11	78.79	103.12	116.35	120.37	k-ft
Ms	31.20	102.87	180.28	237.33	271.26	283.95	k-ft
Mult	52.85	173.88	302.99	398.34	453.98	473.98	k-ft
Mmax (factored from externally	38.48	126.12	217.59	285.40	323.63	336.34	k-ft
vu	0.130	0.115	0.094	0.072	0.049	0.026	Vult/b'd ksi
vci	0.550	0.101	0.077	0.064	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.550	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	12.36	11.25	9.74	7.91	6.14	4.20	
Inventory RF	5.488	2.007	2.502	3.305	4.580	5.860	
Operating RF	9.162	3.351	4.177	5.516	7.644	9.781	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

IDOT Type 3-S2 - 40.75 Tons

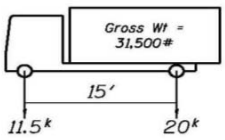
	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	54.39	48.81	40.29	32.26	25.46	17.97	k
VLL (per beam with impact)	17.52	15.72	12.98	10.39	8.20	5.79	k
Vs (total unfactored)	31.88	27.94	22.22	16.66	11.17	5.79	k
Vult (total factored)	56.70	50.02	40.19	30.72	21.67	12.57	k
V @ Mmax (axle)	52.38	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	34.76	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	59.32	197.37	327.99	418.34	469.46	472.36	k-ft
MLL (per beam with impact)	19.11	63.57	105.65	134.75	151.22	152.15	k-ft
Ms	36.19	120.33	207.15	268.96	306.12	315.73	k-ft
Mult	63.69	211.81	361.31	467.02	529.67	542.97	k-ft
Mmax (factored from externally	49.31	164.05	275.90	354.08	399.32	405.32	k-ft
vu	0.162	0.142	0.114	0.087	0.062	0.036	Vult/b'd ksi
vci	0.545	0.096	0.075	0.063	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.545	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	17.52	15.72	12.98	10.39	8.20	5.79	
Inventory RF	3.874	1.437	1.878	2.517	3.430	4.249	
Operating RF	6.466	2.399	3.135	4.201	5.726	7.092	

IDOT Type 3-S2 - 40 Tons

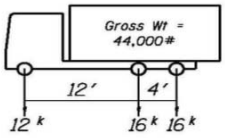
	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	38.31	34.89	30.56	25.81	21.05	16.73	k
VLL (per beam with impact)	12.34	11.24	9.84	8.31	6.78	5.39	k
Vs (total unfactored)	26.70	23.46	19.09	14.59	9.75	5.39	k
Vult (total factored)	45.46	40.28	33.39	26.20	18.58	11.70	k
V @ Mmax (axle)	33.59	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	24.65	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	38.04	142.08	247.19	315.76	352.60	364.40	k-ft
MLL (per beam with impact)	12.25	45.76	79.62	101.71	113.57	117.37	k-ft
Ms	29.34	102.52	181.12	235.92	268.48	280.95	k-ft
Mult	48.81	173.14	304.80	395.29	447.95	467.47	k-ft
Mmax (factored from externally	34.43	125.38	219.40	282.35	317.60	329.83	k-ft
vu	0.129	0.115	0.095	0.075	0.053	0.033	Vult/b'd ksi
vci	0.553	0.101	0.077	0.064	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.553	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	12.34	11.24	9.84	8.31	6.78	5.39	
Inventory RF	5.499	2.010	2.476	3.146	4.149	4.564	
Operating RF	9.179	3.356	4.133	5.251	6.925	7.618	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

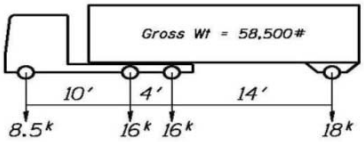


	Empty Weight	GVW
Single Unit		
Type 2	4 Tons	15.75 Tons

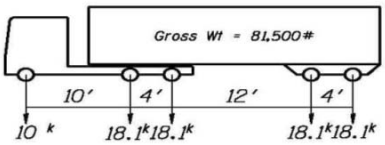


Type 3	8 Tons	22 Tons

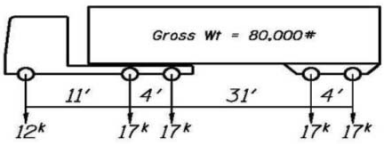
	Empty Weight	GVW
3 or 4 axles		
Type 3-S1	12 Tons	29.75 Tons



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	1/6/2016
Load Rating Checked	CEK	2/8/2016

Kane County Special Permit Vehicles Shear Rating

Type KC-1 - 170,000 lb	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	71.62	65.53	56.23	47.77	38.47	29.56	k
VLL (per beam with impact)	23.07	21.11	18.11	15.39	12.39	9.52	k
Vs (total unfactored)	37.43	33.33	27.36	21.66	15.36	9.52	k
Vult (total factored)	68.75	61.71	51.34	41.56	30.77	20.67	k
V @ Mmax (axle)	65.73	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	41.94	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	74.43	265.02	458.44	587.40	671.00	681.00	k-ft
MLL (per beam with impact)	23.97	85.36	147.67	189.20	216.13	219.35	k-ft
Ms	41.06	142.12	249.16	323.42	371.04	382.93	k-ft
Mult	74.26	259.11	452.53	585.24	670.60	688.87	k-ft
Mmax (factored from externally	59.88	211.35	367.12	472.30	540.25	551.22	k-ft
vu	0.196	0.176	0.146	0.118	0.088	0.059	Vult/b'd ksi
vci	0.542	0.092	0.074	0.062	0.052	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.542	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	23.07	21.11	18.11	15.39	12.39	9.52	
Inventory RF	2.941	1.070	1.346	1.700	2.270	2.583	
Operating RF	4.910	1.787	2.246	2.837	3.789	4.312	

Type KC-2 - 165,000 lb	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	71.84	65.13	56.68	47.37	38.07	29.93	k
VLL (per beam with impact)	23.14	20.98	18.26	15.26	12.26	9.64	k
Vs (total unfactored)	37.50	33.20	27.50	21.53	15.24	9.64	k
Vult (total factored)	68.90	61.43	51.66	41.28	30.49	20.93	k
V @ Mmax (axle)	41.32	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally app	28.81	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	74.79	264.72	458.40	587.80	669.92	681.90	k-ft
MLL (per beam with impact)	24.09	85.27	147.65	189.33	215.78	219.64	k-ft
Ms	41.17	142.03	249.15	323.55	370.69	383.22	k-ft
Mult	74.51	258.90	452.50	585.52	669.85	689.50	k-ft
Mmax (factored from externally	60.13	211.14	367.09	472.58	539.50	551.85	k-ft
vu	0.196	0.175	0.147	0.118	0.087	0.060	Vult/b'd ksi
vci	0.397	0.092	0.074	0.062	0.052	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.397	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.434	0.185	0.185	0.185	0.185	0.152	ksi
C	152.5	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	23.14	20.98	18.26	15.26	12.26	9.64	
Inventory RF	2.665	1.077	1.335	1.714	2.294	2.551	
Operating RF	4.449	1.798	2.228	2.861	3.829	4.258	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Type KC-3 - 140,000 lb

	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	73.91	64.60	53.91	45.07	37.31	29.93	k
VLL (per beam with impact)	23.81	20.81	17.36	14.52	12.02	9.64	k
Vs (total unfactored)	38.17	33.03	26.61	20.79	14.99	9.64	k
Vult (total factored)	70.35	61.06	49.72	39.67	29.95	20.93	k
V @ Mmax (axle)	40.50	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	28.37	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	73.86	263.90	436.00	554.20	627.20	657.00	k-ft
MLL (per beam with impact)	23.79	85.00	140.44	178.51	202.02	211.62	k-ft
Ms	40.87	141.76	241.94	312.72	356.93	375.20	k-ft
Mult	73.86	258.33	436.84	562.02	639.97	672.08	k-ft
Mmax (factored from externally	59.48	210.57	351.43	449.09	509.62	534.44	k-ft
vu	0.200	0.174	0.142	0.113	0.085	0.060	Vult/b'd ksi
vci	0.396	0.092	0.074	0.062	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.396	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.433	0.185	0.185	0.185	0.185	0.152	ksi
C	152.0	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	23.81	20.81	17.36	14.52	12.02	9.64	
Inventory RF	2.582	1.086	1.404	1.802	2.341	2.551	
Operating RF	4.310	1.812	2.343	3.007	3.907	4.258	

Type KC-4 - 115,000 lb

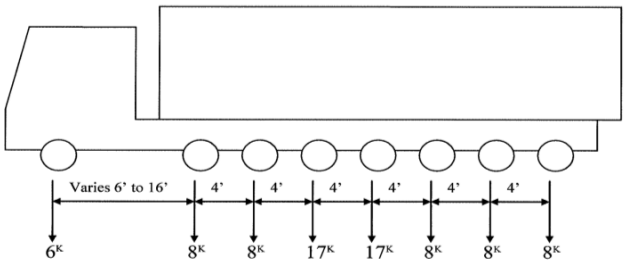
	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	59.72	52.52	43.62	36.90	30.80	24.08	k
VLL (per beam with impact)	19.23	16.92	14.05	11.89	9.92	7.76	k
Vs (total unfactored)	33.60	29.14	23.30	18.16	12.89	7.76	k
Vult (total factored)	60.43	52.61	42.52	33.96	25.40	16.84	k
V @ Mmax (axle)	60.04	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally app	38.88	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	67.98	212.70	353.56	454.33	504.56	524.20	k-ft
MLL (per beam with impact)	21.90	68.51	113.88	146.34	162.52	168.85	k-ft
Ms	38.98	125.27	215.38	280.56	317.43	332.42	k-ft
Mult	69.75	222.53	379.19	492.19	554.21	579.22	k-ft
Mmax (factored from externally	55.37	174.77	293.78	379.25	423.86	441.57	k-ft
vu	0.172	0.150	0.121	0.097	0.072	0.048	Vult/b'd ksi
vci	0.544	0.095	0.075	0.063	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.544	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	19.23	16.92	14.05	11.89	9.92	7.76	
Inventory RF	3.528	1.335	1.735	2.200	2.836	3.171	
Operating RF	5.889	2.229	2.896	3.673	4.733	5.293	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Type AASHTO Notional - 80k

	0.028	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.04	8.09	12.13	16.18	20.22	ft
VLL max. (STAAD - axle load)	50.27	45.43	38.11	30.42	23.10	15.63	k
VLL (per beam with impact)	16.19	14.63	12.28	9.80	7.44	5.03	k
Vs (total unfactored)	30.55	26.85	21.52	16.07	10.41	5.03	k
Vult (total factored)	53.82	47.65	38.67	29.43	20.02	10.93	k
V @ Mmax (axle)	50.81	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally app	33.92	5.60	4.24	2.88	1.36	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	57.53	184.12	335.53	454.31	526.01	544.46	k-ft
MLL (per beam with impact)	18.53	59.31	108.08	146.34	169.43	175.37	k-ft
Ms	35.61	116.07	209.57	280.55	324.34	338.95	k-ft
Mult	62.44	202.54	366.58	492.17	569.21	593.39	k-ft
Mmax (factored from externally	48.06	154.78	281.17	379.24	438.86	455.74	k-ft
vu	0.153	0.136	0.110	0.084	0.057	0.031	Vult/b'd ksi
vci	0.546	0.097	0.075	0.063	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.546	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.473	0.185	0.185	0.185	0.185	0.152	ksi
C	165.9	64.9	64.9	64.9	64.9	53.4	k
D	14.36	12.22	9.25	6.27	2.97	0.00	
L	16.19	14.63	12.28	9.80	7.44	5.03	
Inventory RF	4.191	1.544	1.985	2.669	3.781	4.885	
Operating RF	6.995	2.577	3.314	4.455	6.311	8.154	

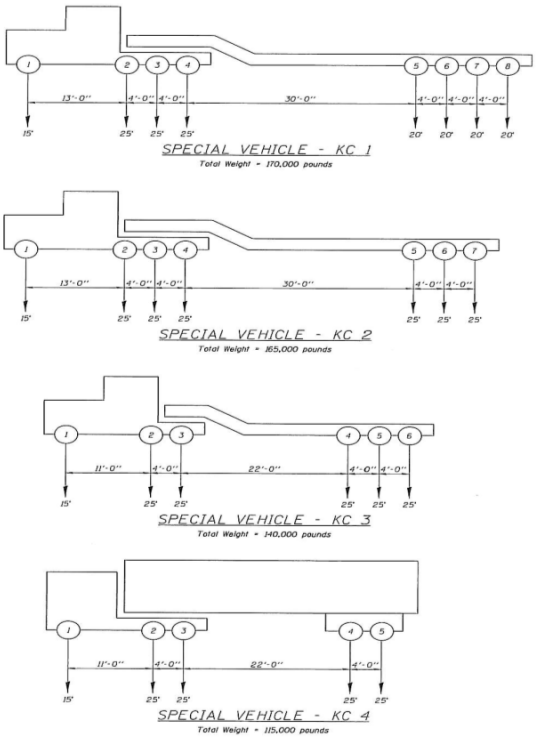


Notional Load

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

SPECIAL PERMIT VEHICLES



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

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating - Span 3
LFR METHOD

BRIDGE INFORMATION

Span	42.44	ft	
Year constructed	1988		
Skew	41.40	deg	
Out to Out	42.00	ft	
Clear width	38.83	ft	
Design Lanes	3		AASHTO 3.6/MBE 6B.6.2.2
Actual Lanes Loaded	2		

BEAM TYPE **3** **17x36**

diaphragms	1		
diaphragm weight	0.658	k	each
WS Thickness	2.00	in	
f 's (prestressing strands)	270000	psi	
f 'c	5000	psi	
f 'ci	4900	psi	
fy (shear reinforcement)	60	ksi	
Rail / Parapet	0.570	k/ft	
Strand Type	stress relieved		

Deck Beams:

Beam	17x36	
Number of Beams	14	
% Strand Area Reduction	0.00	%
% Shear Key Reduction	0.00	%
Beam Depth	17	in
Beam Width, b	3.00	ft
Beam Weight	0.4700	k/ft
Beam Area	430.57	in^2
Centroid from Bottom, Cb	8.21	in

Strands:

Strand Diameter		1/2	in	
Strand Area		0.153	in	
Number of Strands @				
	Original	Current		
	10	7	1.75	in
	7	7	3.25	in
			4.50	in
			6.00	in
			7.50	in
			9.00	in
			10.50	in
	2	2	12.00	in
			15.00	in
Total	19.00	16.00	strands	
C.G.	3.38	3.69	in	
d	13.62	13.31	in	

Dead Load:

Beam	0.470	k/ft
Wearing Surface	0.075	k/ft
Rail / Parapet (3 Bms Max)	0.190	k/ft
Fill	0.000	k/ft
	0.735	k/ft

Other / Diaphram	0.658	k

Moment Capacity (current section properties)

As*	2.45	in^2	
Aeff = bd	479.25	in^2	
ρ*	0.0051		(3) (Eq. 10)
b' (web, total)	25.81	in	
γ*	0.40		(3) 1.1.7
β_1	0.80		(1) 8.16.2.7
f*su	232,763	psi	(3) (Eq. 11)
a	3.72	in	(3) (Eq. 12)
t_{flange}	2.75	in	(3) (Eq. 13)
Check:	a recalculated for voided section		
Reinf. Index	0.087		(3) 1.1.7
Reinf. Index M	0.288		(3) 1.1.7
ϕ	1		(1) 9.14
ϕMn	511.0	k-ft	(3)(Eq. 13&14)
ϕMn max	511.0	k-ft	(3)(Eq. 15)

Prestress Losses

Humidity RH	70.00	%	(3) 1.1.5
Es	28,000	ksi	(3) 1.1.5
Eci	3,990	ksi	(3) 1.1.5
Ec	4031	ksi	
n	7		
e (initial)	4.832	in	
e (current)	4.527	in	(3) 1.1.6
I	13,274	in^4	
Mdl beam	112.82	k-ft	
f*cir (initial)	1.525	ksi	(3) 1.1.5
Msdl	59.67	k-ft	
fcds (initial)	0.261	ksi	(3) 1.1.5
SH	6.500	ksi	(3) (Eq. 1a)
ES	10.705	ksi	(3) (Eq. 1b)
CRc	16.481	ksi	(3) (Eq. 1c)
CRs	11.122	ksi	(3) (Eq. 1d&e)
Fsi	189000	psi	(3) 1.1.4
% loss	23.71	%	(3) (Eq. 2)
Fi (for current s	462.67	k	(3) 1.1.6
F (now)	352.98	k	(3) 1.1.6
Sb	1616	in^3	
fpe (now)	1.809	ksi	(3) 1.1.7
Fr	530.33	psi	(3) 1.1.7
M*cr (now)	314.97	k-ft	(3) (Eq. 17)
Asf	1.81	in^2	(3) 1.1.7
Asr	0.64	in^2	(3) 1.1.7

Mcap=ϕMn	511.0	k-ft
1.2 * Mcr	378.0	k-ft
k	1.35	
Use kϕMn?	no	
ϕMn = C	511.0	k-ft
%Cap.Reduction	0.0	%
C	511.0	k-ft

M (HS 20)	493.1	k-ft
V (HS 20)	56.2	k

Live load shears and moments taken from AASHTO

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

HS-20 Moments and Stresses (AASHTO)

D	MDL	172.49	k-ft
L	MLL (per beam with impact)	157.72	k-ft
S	Prestress secondary M or V	0.000	k-ft
	St	1511	in^3
	Sb	1616	in^3

Factors:

Design Lanes	3
	IDOT PCM
K	0.800
C	0.732
S	3.214
D	6.525
DF	0.493

Concrete stresses

Fd (top)	1.370	ksi
Fd (bottom)	-1.281	ksi
Fs (top)	0.000	ksi
Fs (bottom)	0.000	ksi
Fp (top)	-0.238	ksi
Fp (bottom)	1.809	ksi
Fd+Fs+Fp (top)	1.132	ksi
Fd+Fs+Fp (bottom)	0.528	ksi
FL (top)	1.253	ksi
FL (bottom)	-1.171	ksi

Negative = Conc.Tension
Positive = Conc.Compression

Steel stresses for live loads beyond cracking moment

ybottom	1.75	in
c	3.105	in
Check:	c is in voided section - recalculate c	
I_{cr}	2131.2	in4
Fp	144.19	ksi
Fd	81.94	ksi
FL	74.92	ksi

Impact	0.299		
Design DF	0.493	wheel/beam	IDOT PCM
	0.493	wheel/beam	

HS 20 Ratings

Inventory	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Concrete Tension	-0.424	0.528	-1.17	0.813	16.2	29.2
Concrete Compression	3.00	1.132	1.25	1.491	29.8	53.6
Concrete Compression	2.00	0.566	1.25	1.145	22.9	41.2
Prestressing Steel Tension	216	81.9	74.925	1.789	35.7	64.4
Flexural Strength	511.0	172.49	157.72	0.838	16.7	30.1
Shear Strength	See next page			1.430	28.6	51.4

Operating	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Prestressing Steel Tension	243	81.9	74.92	2.150	42.9	77.3
Flexural Strength	511.0	172.49	157.72	1.398	27.9	50.3
Shear Strength	See next page			2.387	47.7	85.9

Inventory Rating

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

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

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

$$RF = \frac{0.8 f^*_y - (F_d + F_p + F_s)}{F_l}$$ 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		Controlling Rating
Inventory	0.838	16.7	Inventory:	Flexural Strength
Operating	1.398	27.9	Operating:	Flexural Strength

Operating Rating

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

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

*Concrete tension inventory rating is neglected because prestressing steel tension rating is used.

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

fraction DL externally applied	0.353
fraction DL from beam	0.647

HS-20 Shear Rating	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
Vd (total dead load shear)	15.09	12.81	9.69	6.57	3.12	0.00	k
VLL max. (STAAD - axle load)	53.82	48.63	41.54	34.45	27.84	20.96	k
VLL (max per beam with impa	17.22	15.55	13.29	11.02	8.90	6.70	k
Vs (total unfactored)	32.31	28.36	22.97	17.59	12.02	6.70	k
Vult (total factored)	57.00	50.42	41.44	32.46	23.39	14.55	k
V @ Mmax (axle)	51.63	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	34.54	5.88	4.45	3.01	1.43	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	17.97	62.37	111.51	147.40	170.05	179.46	k-ft
MLL max (STAAD - axle load)	59.17	206.40	352.61	438.62	484.77	482.88	k-ft
MLL (per beam with impact)	18.93	66.02	112.78	140.29	155.05	154.45	k-ft
Ms	36.90	128.39	224.29	287.69	325.11	333.91	k-ft
Mult	64.45	224.41	389.81	496.20	557.69	568.61	k-ft
Mmax (factored from externall	49.34	171.95	296.03	372.23	414.68	417.68	k-ft

e	4.53	4.53	4.53	4.53	4.53	4.53	in
d	13.60	13.60	13.60	13.60	13.60	13.60	in
b'	25.81	25.81	25.81	25.81	25.81	25.81	in
vu	0.162	0.144	0.118	0.092	0.067	0.041	Vult/b'd ksi

F/A	0.820	0.820	0.820	0.820	0.820	0.820	ksi
Fe/Sb	0.989	0.989	0.989	0.989	0.989	0.989	ksi
fpe	1.809	1.809	1.809	1.809	1.809	1.809	ksi
fd	0.133	0.463	0.828	1.095	1.263	1.333	ksi
y	8.21	8.21	8.21	8.21	8.21	8.21	
Mcr	282.7	238.3	189.2	153.3	130.6	121.2	AASHTO (9-28)
vci	0.649	0.102	0.078	0.065	0.053	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.649	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	0.820	0.820	0.820	0.820	0.820	0.820	ksi
Vp	0.00	0.00	0.00	0.00	0.00	0.00	k
vcw	0.493	0.493	0.493	0.493	0.493	0.493	ksi

Shear reinforcement bar size	W5.5	W5.5	W5.5	W5.5	W5.5	W5.5	
Av	0.44	0.44	0.44	0.44	0.44	0.44	in
s	12.0	12.0	12.0	12.0	12.0	21.0	in
vs	0.085	0.085	0.085	0.085	0.085	0.049	

$\phi = 0.90$

$\phi vn = \phi(vs+vc)$	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	17.22	15.55	13.29	11.02	8.90	6.70	
Inventory RF	4.369	1.430	1.814	2.357	3.149	3.668	
Operating RF	7.292	2.387	3.029	3.935	5.257	6.123	

Shear Rating Factor:	RF	HS
Inventory	1.430	28.6
Operating	2.387	47.7

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating 0.493 wheel per beam

Illinois Posting Vehicles:

	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
STAAD LL moment	251.98	362.00	402.61	519.37	386.98	k-ft

	Moments and Stresses (AASHTO)	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
D	Total deal load moment	172.49	172.49	172.49	172.49	172.49	k-ft
L	Live load moment w/ imp. per	80.60	115.79	128.77	166.12	123.78	k-ft
S	Prestress secondary M or V	0.000	0.000	0.000	0.000	0.000	k-ft
	St	1511	1511	1511	1511	1511	in^3
	Sb	1616	1616	1616	1616	1616	in^3
	Concrete stresses						
	Fd (top)	1.370	1.370	1.370	1.370	1.370	ksi
	Fd (bottom)	-1.281	-1.281	-1.281	-1.281	-1.281	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)	-0.238	-0.238	-0.238	-0.238	-0.238	ksi
	Fp (bottom)	1.809	1.809	1.809	1.809	1.809	ksi
	Fd+Fs+Fp (top)	1.132	1.132	1.132	1.132	1.132	ksi
	Fd+Fs+Fp (bottom)	0.528	0.528	0.528	0.528	0.528	ksi
	FL (top)	0.640	0.920	1.023	1.319	0.983	ksi
	FL (bottom)	-0.598	-0.860	-0.956	-1.234	-0.919	ksi
	Steel stresses						
	Fp	144.19	144.19	144.19	144.19	144.19	ksi
	Fd+Fs+Fp	NA	NA	NA	81.94	NA	ksi
	FL	NA	NA	NA	78.92	NA	ksi

Inventory RF	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2
Concrete Tension	1.591	1.107	0.995	0.772	1.036
Concrete Compression	2.918	2.031	1.826	1.416	1.900
Concrete Compression	2.240	1.559	1.402	1.087	1.458
Prestressing Steel Tension	NA	NA	NA	1.699	NA
Flexural Strength	1.639	1.141	1.026	0.795	1.068
Shear Strength	2.880	2.084	1.950	1.406	1.970

Operating RF					
Prestressing Steel Tension	NA	NA	NA	2.041	NA
Flexural Strength	2.737	1.905	1.713	1.328	1.782
Shear Strength	4.808	3.479	1.950	2.347	3.288

NA rating for Prestressing Steel Tension: Stress in steel does not exceed effective prestress and does not control rating

Refer to following pages for shear rating calculations

Postings: (Operating Level)		RF OPERATING	Tons
Single Unit	Type 2	**2.737**	**43.1**
	Type 3	**1.905**	**41.9**
Semi-Trailers	Type 3-S1	**1.713**	**50.1**
	Type 3-S2	**1.328**	**54.1**
	Type 3-S2	**1.782**	**71.2**

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

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

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating 0.493 wheel per beam

Kane County Special Permit Vehicles:

	KC-1	KC-2	KC-3	KC-4	AASHTO	
STAAD LL moment	728.72	730.43	694.00	555.75	584.70	k-ft

	Moments and Stresses (AASHTO)	KC-1	KC-2	KC-3	KC-4	AASHTO	
D	Total deal load moment	172.49	172.49	172.49	172.49	172.49	k-ft
L	Live load moment w/ imp. per	233.08	233.63	221.98	177.76	187.02	k-ft
S	Prestress secondary M or V	0.0	0.0	0.0	0.0	0.0	k-ft
	St	1511	1511	1511	1511	1511	in^3
	Sb	1616	1616	1616	1616	1616	in^3
	Concrete stresses						
	Fd (top)	1.370	1.370	1.370	1.370	1.370	ksi
	Fd (bottom)	-1.281	-1.281	-1.281	-1.281	-1.281	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)	-0.238	-0.238	-0.238	-0.238	-0.238	ksi
	Fp (bottom)	1.809	1.809	1.809	1.809	1.809	ksi
	Fd+Fs+Fp (top)	1.132	1.132	1.132	1.132	1.132	ksi
	Fd+Fs+Fp (bottom)	0.528	0.528	0.528	0.528	0.528	ksi
	FL (top)	1.851	1.856	1.763	1.412	1.485	ksi
	FL (bottom)	-1.731	-1.735	-1.648	-1.320	-1.389	ksi
	Steel stresses						
	Fp	144.19	144.19	144.19	144.19	144.19	ksi
	Fd+Fs+Fp	81.94	81.94	81.94	81.94	81.94	ksi
	FL	110.73	110.99	105.45	84.44	88.84	ksi

Inventory RF	KC-1	KC-2	KC-3	KC-4	AASHTO
Concrete Tension	0.550	0.549	0.578	0.721	0.685
Concrete Compression	1.009	1.007	1.059	1.323	1.257
Concrete Compression	0.469	0.468	0.492	0.615	0.584
Prestressing Steel Tension	1.211	1.208	1.271	1.588	1.509
Flexural Strength	0.567	0.566	0.595	0.743	0.707
Shear Strength	1.046	1.052	1.035	1.283	1.498

Operating RF					
Prestressing Steel Tension	1.455	1.451	1.527	1.907	1.813
Flexural Strength	0.946	0.944	0.994	1.241	1.179
Shear Strength	1.746	1.756	1.728	2.142	2.500

Permit Vehicles

	RF OPERATING	Gross Weight	
Type KC 1 - 170,000 lb	**0.946**	**160.8**	Kips
Type KC 2 - 165,000 lb	**0.944**	**155.7**	Kips
Type KC 3 - 140,000 lb	**0.994**	**139.1**	Kips
Type KC 4 - 115,000 lb	**1.241**	**142.7**	Kips
Type AASHTO Notional Truck- 80K	**1.179**	**47.1**	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	1/6/2016
Load Rating Checked	CEK	2/8/2016

Shear Ratings		0.027	0.1	0.2	0.3	0.4	0.5	along span
		1.13	4.24	8.49	12.73	16.98	21.22	ft
	e	4.53	4.53	4.53	4.53	4.53	4.53	in
	d	13.60	13.60	13.60	13.60	13.60	13.60	in
	b'	25.81	25.81	25.81	25.81	25.81	25.81	in
	fpe	1.809	1.809	1.809	1.809	1.809	1.809	ksi
	fd	0.133	0.463	0.828	1.095	1.263	1.333	ksi
	y	8.21	8.21	8.21	8.21	8.21	8.21	
	Mcr	282.7	238.3	189.2	153.3	130.6	121.2	k-ft
	vcw	0.493	0.493	0.493	0.493	0.493	0.493	ksi
	vs	0.085	0.085	0.085	0.085	0.085	0.049	
Vd	VDL (total dead load shear)	15.09	12.81	9.69	6.57	3.12	0.00	k
	MDL	17.97	62.37	111.51	147.40	170.05	179.46	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	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	26.41	24.14	21.04	17.93	14.83	11.45	k
VLL (per beam with impact)	8.45	7.72	6.73	5.73	4.74	3.66	k
Vs (total unfactored)	23.54	20.53	16.42	12.30	7.86	3.66	k
Vult (total factored)	37.96	33.41	27.20	20.99	14.35	7.95	k
V @ Mmax (axle)	23.44	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	19.46	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	26.86	102.45	178.57	228.35	251.80	247.71	k-ft
MLL (per beam with impact)	8.59	32.77	57.12	73.04	80.54	79.23	k-ft
Ms	26.57	95.14	168.62	220.44	250.59	258.69	k-ft
Mult	42.02	152.23	268.96	350.19	395.92	405.31	k-ft
Mmax (factored from externall	26.90	99.77	175.18	226.22	252.90	254.38	k-ft
vu	0.108	0.095	0.077	0.060	0.041	0.023	Vult/b'd ksi
vci	0.668	0.119	0.084	0.067	0.053	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.668	0.120	0.120	0.120	0.120	0.120	ksi
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	8.45	7.72	6.73	5.73	4.74	3.66	
Inventory RF	8.903	2.880	3.582	4.530	5.912	6.715	
Operating RF	14.861	4.808	5.980	7.561	9.868	11.209	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

IDOT Type 3 - 22 Tons

	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	36.54	33.36	29.03	24.70	20.36	15.64	k
VLL (per beam with impact)	11.69	10.67	9.29	7.90	6.51	5.00	k
Vs (total unfactored)	26.78	23.48	18.97	14.47	9.63	5.00	k
Vult (total factored)	44.99	39.81	32.75	25.69	18.19	10.86	k
V @ Mmax (axle)	31.91	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	23.99	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	36.56	141.60	246.42	314.47	351.84	362.00	k-ft
MLL (per beam with impact)	11.69	45.29	78.82	100.58	112.54	115.79	k-ft
Ms	29.67	107.67	190.33	247.98	282.59	295.25	k-ft
Mult	48.75	179.41	316.07	409.99	465.38	484.67	k-ft
Mmax (factored from externall	33.64	126.96	222.29	286.02	322.37	333.74	k-ft
vu	0.128	0.113	0.093	0.073	0.052	0.031	Vult/b'd ksi
vci	0.660	0.110	0.081	0.066	0.053	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.660	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	11.69	10.67	9.29	7.90	6.51	5.00	
Inventory RF	6.435	2.084	2.596	3.288	4.306	4.916	
Operating RF	10.742	3.479	4.334	5.489	7.188	8.206	

IDOT Type 3-S1 - 29.25 Tons

	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	39.18	35.65	30.73	25.24	18.96	13.20	k
VLL (per beam with impact)	12.53	11.40	9.83	8.07	6.06	4.22	k
Vs (total unfactored)	27.62	24.21	19.52	14.64	9.18	4.22	k
Vult (total factored)	46.83	41.40	33.93	26.06	17.22	9.17	k
V @ Mmax (axle)	39.23	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	27.90	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	44.95	151.30	260.80	345.04	389.64	402.61	k-ft
MLL (per beam with impact)	14.38	48.39	83.42	110.36	124.63	128.77	k-ft
Ms	32.35	110.77	194.93	257.76	294.68	308.24	k-ft
Mult	54.58	186.15	326.06	431.22	491.63	512.87	k-ft
Mmax (factored from externall	39.46	133.69	232.28	307.25	348.62	361.94	k-ft
vu	0.133	0.118	0.097	0.074	0.049	0.026	Vult/b'd ksi
vci	0.655	0.109	0.080	0.065	0.053	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.655	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	12.53	11.40	9.83	8.07	6.06	4.22	
Inventory RF	6.001	1.950	2.453	3.218	4.624	5.825	
Operating RF	10.018	3.256	4.094	5.371	7.719	9.723	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

IDOT Type 3-S2 - 40.75 Tons

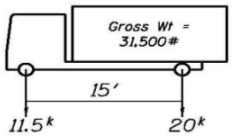
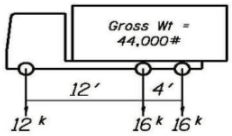
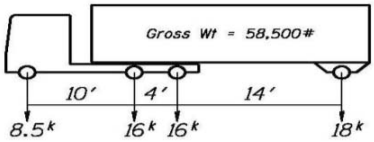
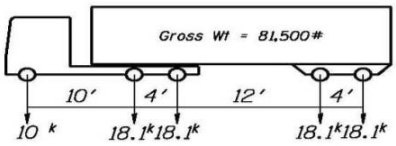
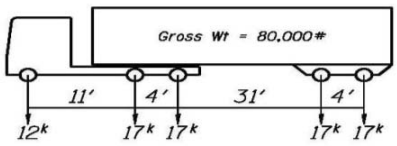
	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	55.40	49.46	41.34	33.33	26.20	19.07	k
VLL (per beam with impact)	17.72	15.82	13.22	10.66	8.38	6.10	k
Vs (total unfactored)	32.81	28.63	22.91	17.23	11.50	6.10	k
Vult (total factored)	58.09	50.99	41.30	31.68	22.25	13.24	k
V @ Mmax (axle)	53.33	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	35.44	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	61.11	211.51	354.49	453.52	508.92	514.26	k-ft
MLL (per beam with impact)	19.55	67.65	113.38	145.06	162.78	164.49	k-ft
Ms	37.52	130.03	224.89	292.46	332.83	343.95	k-ft
Mult	65.80	227.96	391.12	506.54	574.46	590.40	k-ft
Mmax (factored from externall	50.68	175.50	297.34	382.58	431.44	439.47	k-ft
vu	0.165	0.145	0.118	0.090	0.063	0.038	Vult/b'd ksi
vci	0.649	0.102	0.078	0.065	0.053	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.649	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	17.72	15.82	13.22	10.66	8.38	6.10	
Inventory RF	4.244	1.406	1.823	2.437	3.346	4.032	
Operating RF	7.085	2.347	3.043	4.067	5.586	6.730	

IDOT Type 3-S2 - 40 Tons

	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	38.62	35.30	30.77	26.24	21.71	16.77	k
VLL (per beam with impact)	12.35	11.29	9.84	8.39	6.94	5.36	k
Vs (total unfactored)	27.44	24.10	19.53	14.96	10.06	5.36	k
Vult (total factored)	46.44	41.16	33.96	26.76	19.13	11.64	k
V @ Mmax (axle)	34.70	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	25.48	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	39.77	149.82	261.18	334.70	374.60	386.98	k-ft
MLL (per beam with impact)	12.72	47.92	83.54	107.05	119.82	123.78	k-ft
Ms	30.69	110.29	195.05	254.45	289.87	303.24	k-ft
Mult	50.98	185.12	326.32	424.04	481.19	502.02	k-ft
Mmax (factored from externall	35.87	132.66	232.54	300.07	338.17	351.09	k-ft
vu	0.132	0.117	0.097	0.076	0.054	0.033	Vult/b'd ksi
vci	0.658	0.109	0.080	0.066	0.053	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.658	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	12.35	11.29	9.84	8.39	6.94	5.36	
Inventory RF	6.089	1.970	2.450	3.095	4.038	4.585	
Operating RF	10.164	3.288	4.089	5.166	6.741	7.653	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

		Empty Weight	GVW
Single Unit			
	Type 2	4 Tons	15.75 Tons
	Type 3	8 Tons	22 Tons
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	1/6/2016
Load Rating Checked	CEK	2/8/2016

Kane County Special Permit Vehicles Shear Rating

Type KC-1 - 170,000 lb	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	72.97	66.48	56.80	47.94	39.08	30.21	k
VLL (per beam with impact)	23.34	21.26	18.17	15.33	12.50	9.66	k
Vs (total unfactored)	38.43	34.07	27.85	21.90	15.62	9.66	k
Vult (total factored)	70.29	62.81	52.04	41.83	31.19	20.98	k
V @ Mmax (axle)	67.11	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	42.81	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	76.9	282.12	487.80	625.44	714.44	727.20	k-ft
MLL (per beam with impact)	24.60	90.24	156.02	200.05	228.51	232.59	k-ft
Ms	42.57	152.61	267.53	347.45	398.57	412.06	k-ft
Mult	76.77	276.99	483.69	625.92	717.17	738.27	k-ft
Mmax (factored from externall	61.65	224.53	389.91	501.96	574.16	587.34	k-ft
vu	0.200	0.179	0.148	0.119	0.089	0.060	Vult/b'd ksi
vci	0.645	0.097	0.076	0.064	0.052	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.645	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	23.34	21.26	18.17	15.33	12.50	9.66	
Inventory RF	3.222	1.046	1.327	1.694	2.243	2.545	
Operating RF	5.379	1.746	2.215	2.828	3.745	4.248	

Type KC-2 - 165,000 lb	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	72.59	66.09	57.23	48.36	39.50	30.36	k
VLL (per beam with impact)	23.22	21.14	18.30	15.47	12.63	9.71	k
Vs (total unfactored)	38.31	33.95	27.99	22.04	15.75	9.71	k
Vult (total factored)	70.03	62.54	52.33	42.12	31.48	21.08	k
V @ Mmax (axle)	42.91	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally ap	29.87	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	77.17	280.50	486.40	625.08	712.46	726.20	k-ft
MLL (per beam with impact)	24.68	89.72	155.57	199.93	227.88	232.27	k-ft
Ms	42.66	152.09	267.08	347.33	397.93	411.74	k-ft
Mult	76.95	275.86	482.71	625.67	715.80	737.57	k-ft
Mmax (factored from externall	61.84	223.41	388.93	501.71	572.78	586.64	k-ft
vu	0.199	0.178	0.149	0.120	0.090	0.060	Vult/b'd ksi
vci	0.474	0.097	0.076	0.064	0.052	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.474	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.504	0.185	0.185	0.185	0.185	0.152	ksi
C	176.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	23.22	21.14	18.30	15.47	12.63	9.71	
Inventory RF	3.120	1.052	1.317	1.679	2.220	2.533	
Operating RF	5.209	1.756	2.198	2.803	3.705	4.228	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Type KC-3 - 140,000 lb

	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	76.18	67.15	54.95	45.31	37.92	30.36	k
VLL (per beam with impact)	24.36	21.48	17.58	14.49	12.13	9.71	k
Vs (total unfactored)	39.46	34.28	27.26	21.06	15.25	9.71	k
Vult (total factored)	72.52	63.28	50.75	40.00	30.39	21.08	k
V @ Mmax (axle)	65.68	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	42.05	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	75.26	285.15	468.80	594.90	662.90	694.00	k-ft
MLL (per beam with impact)	24.07	91.20	149.95	190.28	212.03	221.98	k-ft
Ms	42.05	153.58	261.45	337.68	382.08	401.44	k-ft
Mult	75.63	279.09	470.49	604.72	681.38	715.21	k-ft
Mmax (factored from externall	60.51	226.64	376.71	480.75	538.37	564.28	k-ft
vu	0.207	0.180	0.145	0.114	0.087	0.060	Vult/b'd ksi
vci	0.645	0.097	0.076	0.064	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.645	0.120	0.120	0.120	0.120	0.120	
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	24.36	21.48	17.58	14.49	12.13	9.71	
Inventory RF	3.087	1.035	1.372	1.792	2.312	2.533	
Operating RF	5.153	1.728	2.290	2.992	3.859	4.228	

Type KC-4 - 115,000 lb

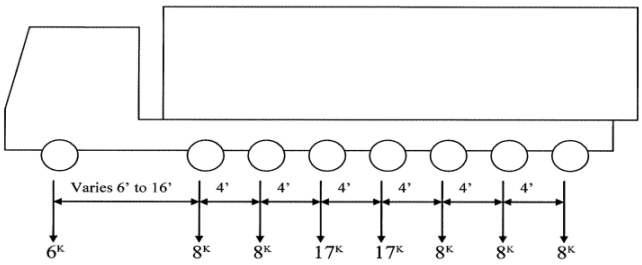
	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	61.71	54.19	44.34	37.49	31.09	24.69	k
VLL (per beam with impact)	19.74	17.33	14.18	11.99	9.94	7.90	k
Vs (total unfactored)	34.83	30.14	23.87	18.56	13.06	7.90	k
Vult (total factored)	62.47	54.28	43.38	34.57	25.64	17.14	k
V @ Mmax (axle)	61.92	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	40.04	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	70.96	231.30	378.50	480.97	535.70	555.75	k-ft
MLL (per beam with impact)	22.70	73.98	121.06	153.84	171.34	177.76	k-ft
Ms	40.67	136.36	232.57	301.24	341.40	357.22	k-ft
Mult	72.64	241.70	407.79	525.60	593.06	619.21	k-ft
Mmax (factored from externall	57.52	189.24	314.01	401.64	450.04	468.28	k-ft
vu	0.178	0.155	0.124	0.098	0.073	0.049	Vult/b'd ksi
vci	0.646	0.100	0.078	0.064	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.646	0.120	0.120	0.120	0.120	0.120	
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	19.74	17.33	14.18	11.99	9.94	7.90	
Inventory RF	3.810	1.283	1.700	2.166	2.820	3.114	
Operating RF	6.360	2.142	2.837	3.616	4.707	5.198	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Type AASHTO Notional - 80k

	0.027	0.1	0.2	0.3	0.4	0.5	along span
	1.13	4.24	8.49	12.73	16.98	21.22	ft
VLL max. (STAAD - axle load)	51.97	46.43	38.96	31.68	24.07	16.71	k
VLL (per beam with impact)	16.62	14.85	12.46	10.13	7.70	5.34	k
Vs (total unfactored)	31.71	27.66	22.15	16.70	10.82	5.34	k
Vult (total factored)	55.71	48.89	39.65	30.54	20.77	11.60	k
V @ Mmax (axle)	51.90	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally ap	34.68	5.88	4.45	3.01	1.43	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	59.47	197.42	359.28	485.34	564.92	584.70	k-ft
MLL (per beam with impact)	19.02	63.14	114.92	155.24	180.69	187.02	k-ft
Ms	37.00	125.52	226.42	302.64	350.74	366.48	k-ft
Mult	64.66	218.17	394.44	528.64	613.35	639.32	k-ft
Mmax (factored from externall	49.55	165.72	300.66	404.67	470.33	488.39	k-ft
vu	0.159	0.139	0.113	0.087	0.059	0.033	Vult/b'd ksi
vci	0.649	0.103	0.078	0.064	0.052	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.649	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.521	0.185	0.185	0.185	0.185	0.152	ksi
C	182.8	64.9	64.9	64.9	64.9	53.4	k
D	15.09	12.81	9.69	6.57	3.12	0.00	
L	16.62	14.85	12.46	10.13	7.70	5.34	
Inventory RF	4.525	1.498	1.935	2.564	3.642	4.601	
Operating RF	7.553	2.500	3.229	4.279	6.080	7.681	

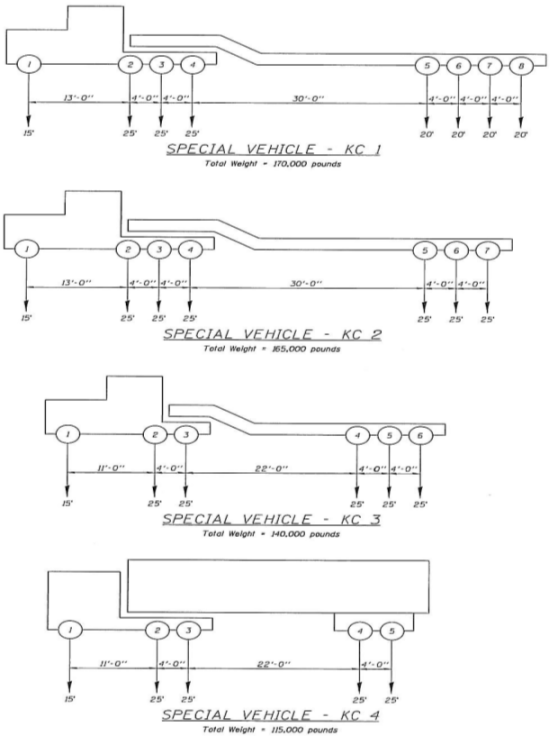


Notional Load

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

SPECIAL PERMIT VEHICLES



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

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating - Spans 4 & 5
LFR METHOD

BRIDGE INFORMATION

Span	34.44	ft	
Year constructed	1988		
Skew	41.4	deg	
Out to Out	42	ft	
Clear width	38.83	ft	
Design Lanes	3	AASHTO 3.6/MBE 6B.6.2.2	
Actual Lanes Loaded	2		

BEAM TYPE **3** **17x36**

diaphragms	1		
diaphragm weight	0.658	k	each
WS Thickness	2.00	in	
f 's (prestressing strands)	270000	psi	
f 'c	5000	psi	
f 'ci	4000	psi	
fy (shear reinforcement)	60	ksi	
Rail / Parapet	0.570	ksi	
Strand Type	stress relieved		

Deck Beams:

Beam	17x36	
Number of Beams	14.00	
% Strand Area Reduction	0.00	%
% Shear Key Reduction	0.00	%
Beam Depth	17	in
Beam Width, b	3.00	ft
Beam Weight	0.4700	k/ft
Beam Area	430.57	in^2
Centroid from Bottom, Cb	8.21	in

Strands:

Strand Diameter		1/2	in	
Strand Area		0.153	in	
Number of Strands @				
Original		Current		
	8	7	1.75	in
			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	8.00	7.00	strands	
C.G.	1.75	1.75	in	
d	15.25	15.25	in	

Dead Load:

Beam	0.470	k/ft
Wearing Surface	0.075	k/ft
Rail / Parapet (3 Bms Max)	0.190	k/ft
Fill	0.000	k/ft
	0.735	k/ft

Other / Diaphram	0.658	k

Moment Capacity (current section properties)

As*	1.07	in^2	
Aeff = bd	549.00	in^2	
ρ*	0.0020		(3) (Eq. 10)
b' (web, total)	25.81	in	
γ*	0.40		(3) 1.1.7
β_1	0.80		(1) 8.16.2.7
f*su	255,779	psi	(3) (Eq. 11)
a	1.79	in	(3) (Eq. 12)
t_{flange}	2.75	in	(3) (Eq. 13)
Check:	rectangular section		
Reinf. Index	0.100		(3) 1.1.7
Reinf. Index M	0.288		(3) 1.1.7
ϕ	1		(1) 9.14
ϕMn	327.3	k-ft	(3)(Eq. 13&14)
ϕMn max	327.3	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)	6.464	in	
e (current)	6.464	in	(3) 1.1.6
I	13,274.00	in^4	
Mdl beam	75.37	k-ft	
f*cir (initial)	0.699	ksi	(3) 1.1.5
Msdl	39.30	k-ft	
fcds (initial)	0.230	ksi	(3) 1.1.5
SH	6.500	ksi	(3) (Eq. 1a)
ES	5.425	ksi	(3) (Eq. 1b)
CRc	6.775	ksi	(3) (Eq. 1c)
CRs	15.175	ksi	(3) (Eq. 1d&e)
Fsi	189000	psi	(3) 1.1.4
% loss	17.92	%	(3) (Eq. 2)
Fi (for current s	202.42	k	(3) 1.1.6
F (now)	166.14	k	(3) 1.1.6
Sb	1616	in^3	
fpe (now)	1.050	ksi	(3) 1.1.7
Fr	530.33	psi	(3) 1.1.7
M*cr (now)	212.87	k-ft	(3) (Eq. 17)
Asf	0.47	in^2	(3) 1.1.7
Asr	0.61	in^2	(3) 1.1.7

Mcap=ϕMn	327.3	k-ft
1.2 * Mcr	255.4	k-ft
k	1.28	
Use kϕMn?	no	
ϕMn = C	327.3	k-ft
%Cap.Reductior	0.0	%
C	327.3	k-ft

M (HS 20)	351.3	k-ft
V (HS 20)	52.5	k

Live load shears and moments taken from AASHTO

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

HS-20 Moments and Stresses (AASHTO)

D	MDL	114.66	k-ft
L	MLL (per beam with impact)	115.61	k-ft
S	Prestress secondary M or V	0.000	k-ft
	St	1511	in^3
	Sb	1616	in^3

Factors:

Design Lanes	3
	IDOT PCM
K	0.800
C	0.902
S	3.214
D	6.349
DF	0.506

Concrete stresses

Fd (top)	0.911	ksi
Fd (bottom)	-0.851	ksi
Fs (top)	0.000	ksi
Fs (bottom)	0.000	ksi
Fp (top)	-0.325	ksi
Fp (bottom)	1.050	ksi
Fd+Fs+Fp (top)	0.586	ksi
Fd+Fs+Fp (bottom)	0.199	ksi
FL (top)	0.918	ksi
FL (bottom)	-0.859	ksi

Negative = Conc.Tension
Positive = Conc.Compression

Steel stresses for live loads beyond cracking moment

ybottom	1.75	in
c	2.313	in
Check:	OK: c is in top flange	
I_{cr}	1393.7	in4
Fp	155.12	ksi
Fd	88.73	ksi
FL	89.46	ksi

Impact	0.300		
Design DF	0.506	wheel/beam	IDOT PCM
	0.506	wheel/beam	

HS 20 Ratings

Inventory	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Concrete Tension	-0.424	0.199	-0.86	0.726	14.5	26.1
Concrete Compression	3.00	0.586	0.92	2.629	52.5	94.6
Concrete Compression	2.00	0.293	0.92	1.859	37.1	66.9
Prestressing Steel Tension	216	88.7	89.464	1.724	34.4	62
Flexural Strength	327.3	114.66	115.61	0.71	14.2	25.5
Shear Strength	See next page			1.704	34.0	61.3

Operating	Capacity	Dead Load	Live Load	RF	HS	Gross Tons
Prestressing Steel Tension	243	88.7	89.46	NA	NA	NA
Flexural Strength	327.3	114.66	115.61	1.186	23.7	42.6
Shear Strength	See next page			2.845	56.9	102.4

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	0.710	14.2
Operating	1.186	23.7

	Controlling Rating
Inventory:	Flexural Strength
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	1/6/2016
Load Rating Checked	CEK	2/8/2016

fraction DL externally applied	0.351
fraction DL from beam	0.649

HS-20 Shear Rating	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
Vd (total dead load shear)	12.05	10.46	7.92	5.39	2.53	0.00	k
VLL max. (STAAD - axle load)	50.75	48.63	38.17	31.48	25.12	18.77	k
VLL (max per beam with impa	16.70	16.00	12.56	10.36	8.27	6.18	k
Vs (total unfactored)	28.75	26.46	20.49	15.75	10.80	6.18	k
Vult (total factored)	51.93	48.34	37.57	29.50	21.24	13.41	k
V @ Mmax (axle)	48.06	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	31.92	4.78	3.62	2.46	1.16	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	16.33	41.50	74.29	98.35	113.70	120.32	k-ft
MLL max (STAAD - axle load)	61.24	154.42	262.91	328.32	349.57	339.68	k-ft
MLL (per beam with impact)	20.15	50.82	86.52	108.05	115.04	111.79	k-ft
Ms	36.48	92.32	160.81	206.40	228.74	232.11	k-ft
Mult	64.98	164.28	284.42	362.43	397.56	399.11	k-ft
Mmax (factored from externall	51.21	129.29	221.78	279.50	301.70	297.66	k-ft

e	6.46	6.46	6.46	6.46	6.46	6.46	in
d	15.25	15.25	15.25	15.25	15.25	15.25	in
b'	25.81	25.81	25.81	25.81	25.81	25.81	in
vu	0.132	0.123	0.095	0.075	0.054	0.034	Vult/b'd ksi

F/A	0.386	0.386	0.386	0.386	0.386	0.386	ksi
Fe/Sb	0.665	0.665	0.665	0.665	0.665	0.665	ksi
fpe	1.050	1.050	1.050	1.050	1.050	1.050	ksi
fd	0.121	0.308	0.552	0.730	0.844	0.893	ksi
y	8.21	8.21	8.21	8.21	8.21	8.21	
Mcr	182.3	157.1	124.3	100.2	84.9	78.3	AASHTO (9-28)
vci	0.362	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	0.362	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	0.386	0.386	0.386	0.386	0.386	0.386	ksi
Vp	0.00	0.00	0.00	0.00	0.00	0.00	k
vcw	0.363	0.363	0.363	0.363	0.363	0.363	ksi

Shear reinforcement bar size	W5.5	W5.5	W5.5	W5.5	W5.5	W5.5	
Av	0.44	0.44	0.44	0.44	0.44	0.44	in
s	12	12	12	12	12	21	in
vs	0.085	0.085	0.085	0.085	0.085	0.049	

$\phi = 0.90$

$\phi vn = \phi(vs+vc)$	0.402	0.185	0.185	0.185	0.185	0.152	ksi
C	158.3	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	16.70	16.00	12.56	10.36	8.27	6.18	
Inventory RF	3.936	1.704	2.292	2.926	3.874	4.464	
Operating RF	6.570	2.845	3.826	4.884	6.466	7.452	

Shear Rating Factor:	RF	HS
Inventory	1.704	34
Operating	2.845	56.9

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Simple Span PPC Deck Beam Rating 0.506 wheel per beam

Illinois Posting Vehicles:

	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
STAAD LL moment	190.54	274.51	285.51	356.96	295.84	k-ft

	Moments and Stresses (AASHTO)	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2	
D	Total deal load moment	114.66	114.66	114.66	114.66	114.66	k-ft
L	Live load moment w/ imp. per	62.71	90.34	93.96	117.47	97.36	k-ft
S	Prestress secondary M or V	0.000	0.000	0.000	0.000	0.000	k-ft
	St	1511	1511	1511	1511	1511	in^3
	Sb	1616	1616	1616	1616	1616	in^3
	Concrete stresses						
	Fd (top)	0.911	0.911	0.911	0.911	0.911	ksi
	Fd (bottom)	-0.851	-0.851	-0.851	-0.851	-0.851	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)	-0.325	-0.325	-0.325	-0.325	-0.325	ksi
	Fp (bottom)	1.050	1.050	1.050	1.050	1.050	ksi
	Fd+Fs+Fp (top)	0.586	0.586	0.586	0.586	0.586	ksi
	Fd+Fs+Fp (bottom)	0.199	0.199	0.199	0.199	0.199	ksi
	FL (top)	0.498	0.718	0.746	0.933	0.773	ksi
	FL (bottom)	-0.466	-0.671	-0.698	-0.872	-0.723	ksi
	Steel stresses						
	Fp	155.12	155.12	155.12	155.12	155.12	ksi
	Fd+Fs+Fp	NA	NA	NA	88.73	NA	ksi
	FL	NA	NA	NA	90.91	NA	ksi

Inventory RF	Type 2	Type 3	Type 3-S1	Type 3-S2	Type 3-S2
Concrete Tension	1.338	0.929	0.893	0.714	0.862
Concrete Compression	4.847	3.365	3.235	2.587	3.122
Concrete Compression	3.428	2.379	2.287	1.830	2.208
Prestressing Steel Tension	NA	NA	NA	1.400	NA
Flexural Strength	1.310	0.909	0.874	0.699	0.844
Shear Strength	3.582	2.599	2.480	1.879	2.448

Operating RF					
Prestressing Steel Tension	NA	NA	NA	1.697	NA
Flexural Strength	2.186	1.518	1.459	1.167	1.408
Shear Strength	5.979	4.338	4.140	3.137	4.086

NA rating for Prestressing Steel Tension: Stress in steel does not exceed effective prestress and does not control rating

Refer to following pages for shear rating calculations

Postings: (Operating Level)	RF OPERATING	Tons
Single Unit	Type 2 **2.186**	**34.4**
	Type 3 **1.518**	**33.3**
Semi-Trailers	Type 3-S1 **1.459**	**42.6**
	Type 3-S2 **1.167**	**47.5**
	Type 3-S2 **1.408**	**56.3**

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

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

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

0.506 wheel per beam

Simple Span PPC Deck Beam Rating

Kane County Special Permit Vehicles:

	KC-1	KC-2	KC-3	KC-4	AASHTO	
STAAD LL moment	552.04	550.20	545.00	426.40	427.06	k-ft

	Moments and Stresses (AASHTO)	KC-1	KC-2	KC-3	KC-4	AASHTO	
D	Total deal load moment	114.66	114.66	114.66	114.66	114.66	k-ft
L	Live load moment w/ imp. per	181.67	181.07	179.36	140.33	140.54	k-ft
S	Prestress secondary M or V	0.0	0.0	0.0	0.0	0.0	k-ft
	St	1511	1511	1511	1511	1511	in^3
	Sb	1616	1616	1616	1616	1616	in^3
	Concrete stresses						
	Fd (top)	0.911	0.911	0.911	0.911	0.911	ksi
	Fd (bottom)	-0.851	-0.851	-0.851	-0.851	-0.851	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)	-0.325	-0.325	-0.325	-0.325	-0.325	ksi
	Fp (bottom)	1.050	1.050	1.050	1.050	1.050	ksi
	Fd+Fs+Fp (top)	0.586	0.586	0.586	0.586	0.586	ksi
	Fd+Fs+Fp (bottom)	0.199	0.199	0.199	0.199	0.199	ksi
	FL (top)	1.443	1.438	1.425	1.115	1.116	ksi
	FL (bottom)	-1.349	-1.345	-1.332	-1.042	-1.044	ksi
	Steel stresses						
	Fp	155.12	155.12	155.12	155.12	155.12	ksi
	Fd+Fs+Fp	88.73	88.73	88.73	88.73	88.73	ksi
	FL	140.59	140.12	138.79	108.59	108.76	ksi

Inventory RF	KC-1	KC-2	KC-3	KC-4	AASHTO
Concrete Tension	0.462	0.464	0.468	0.598	0.597
Concrete Compression	1.673	1.679	1.695	2.166	2.163
Concrete Compression	0.980	0.983	0.993	1.269	1.267
Prestressing Steel Tension	0.905	0.908	0.917	1.172	1.170
Flexural Strength	0.452	0.454	0.458	0.585	0.584
Shear Strength	1.315	1.324	1.407	1.714	1.959

Operating RF					
Prestressing Steel Tension	1.097	1.101	1.112	1.421	1.418
Flexural Strength	0.755	0.757	0.764	0.977	0.975
Shear Strength	2.194	2.211	2.349	2.861	3.271

Permit Vehicles

	RF OPERATING	Gross Weight	
Type KC 1 - 170,000 lb	**0.755**	**128.3**	Kips
Type KC 2 - 165,000 lb	**0.757**	**124.9**	Kips
Type KC 3 - 140,000 lb	**0.764**	**106.9**	Kips
Type KC 4 - 115,000 lb	**0.977**	**112.3**	Kips
Type AASHTO Notional Truck- 80K	**0.975**	**39.0**	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	1/6/2016
Load Rating Checked	CEK	2/8/2016

Shear Ratings		0.037	0.1	0.2	0.3	0.4	0.5	along span
		1.27	3.44	6.89	10.33	13.78	17.22	ft
	e	6.46	6.46	6.46	6.46	6.46	6.46	in
	d	15.25	15.25	15.25	15.25	15.25	15.25	in
	b'	25.81	25.81	25.81	25.81	25.81	25.81	in
	fpe	1.050	1.050	1.050	1.050	1.050	1.050	ksi
	fd	0.121	0.308	0.552	0.730	0.844	0.893	ksi
	y	8.21	8.21	8.21	8.21	8.21	8.21	
	Mcr	182.3	157.1	124.3	100.2	84.9	78.3	k-ft
	vcw	0.363	0.363	0.363	0.363	0.363	0.363	ksi
	vs	0.085	0.085	0.085	0.085	0.085	0.049	
Vd	VDL (total dead load shear)	12.05	10.46	7.92	5.39	2.53	0.00	k
	MDL	16.33	41.50	74.29	98.35	113.70	120.32	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	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	25.12	23.14	20.02	16.89	13.76	10.63	k
VLL (per beam with impact)	8.27	7.62	6.59	5.56	4.53	3.50	k
Vs (total unfactored)	20.32	18.07	14.51	10.95	7.06	3.50	k
Vult (total factored)	33.61	30.12	24.60	19.08	13.12	7.59	k
V @ Mmax (axle)	21.56	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	17.35	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	27.48	79.71	137.87	174.48	189.62	183.86	k-ft
MLL (per beam with impact)	9.04	26.23	45.37	57.42	62.40	60.51	k-ft
Ms	25.37	67.74	119.66	155.77	176.10	180.83	k-ft
Mult	40.86	110.91	195.08	252.52	283.29	287.78	k-ft
Mmax (factored from externall	27.09	75.91	132.44	169.59	187.42	186.33	k-ft
vu	0.085	0.077	0.063	0.048	0.033	0.019	Vult/b'd ksi
vci	0.370	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	0.370	0.120	0.120	0.120	0.120	0.120	ksi
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.404	0.185	0.185	0.185	0.185	0.152	ksi
C	158.9	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	8.27	7.62	6.59	5.56	4.53	3.50	
Inventory RF	7.985	3.582	4.370	5.453	7.072	7.883	
Operating RF	13.329	5.979	7.295	9.102	11.804	13.158	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

IDOT Type 3 - 22 Tons

	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	34.65	31.89	27.52	23.15	18.78	14.41	k
VLL (per beam with impact)	11.40	10.49	9.06	7.62	6.18	4.74	k
Vs (total unfactored)	23.46	20.95	16.98	13.01	8.71	4.74	k
Vult (total factored)	40.42	36.38	29.96	23.55	16.71	10.30	k
V @ Mmax (axle)	29.10	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	21.50	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	37.08	109.83	189.90	240.83	267.17	274.24	k-ft
MLL (per beam with impact)	12.20	36.14	62.50	79.26	87.92	90.25	k-ft
Ms	28.53	77.65	136.78	177.61	201.62	210.57	k-ft
Mult	47.72	132.43	232.25	299.93	338.69	352.36	k-ft
Mmax (factored from externall	33.95	97.43	169.61	216.99	242.82	250.90	k-ft
vu	0.103	0.092	0.076	0.060	0.042	0.026	Vult/b'd ksi
vci	0.366	0.089	0.069	0.059	0.050	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.366	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.404	0.185	0.185	0.185	0.185	0.152	ksi
C	158.9	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	11.40	10.49	9.06	7.62	6.18	4.74	
Inventory RF	5.788	2.599	3.179	3.978	5.181	5.815	
Operating RF	9.662	4.338	5.307	6.641	8.649	9.707	

IDOT Type 3-S1 - 29.25 Tons

	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	35.25	33.42	28.46	23.37	18.89	13.15	k
VLL (per beam with impact)	11.60	11.00	9.37	7.69	6.22	4.33	k
Vs (total unfactored)	23.65	21.45	17.29	13.08	8.75	4.33	k
Vult (total factored)	40.85	37.47	30.63	23.71	16.79	9.40	k
V @ Mmax (axle)	36.73	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	25.69	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	46.81	115.10	196.79	245.72	277.08	285.51	k-ft
MLL (per beam with impact)	15.41	37.88	64.76	80.87	91.19	93.96	k-ft
Ms	31.73	79.38	139.05	179.22	204.88	214.28	k-ft
Mult	54.67	136.19	237.18	303.42	345.77	360.41	k-ft
Mmax (factored from externall	40.90	101.19	174.54	220.49	249.90	258.95	k-ft
vu	0.104	0.095	0.078	0.060	0.043	0.024	Vult/b'd ksi
vci	0.364	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	0.364	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.404	0.185	0.185	0.185	0.185	0.152	ksi
C	158.9	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	11.60	11.00	9.37	7.69	6.22	4.33	
Inventory RF	5.689	2.480	3.074	3.941	5.151	6.372	
Operating RF	9.497	4.140	5.132	6.578	8.599	10.637	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

IDOT Type 3-S2 - 40.75 Tons

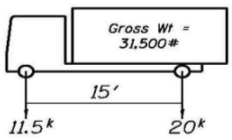
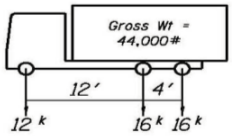
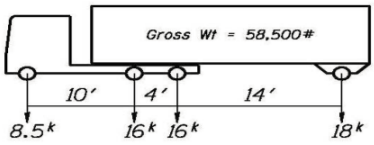
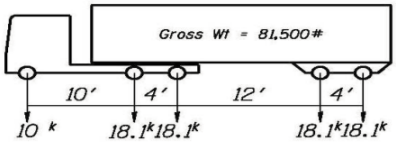
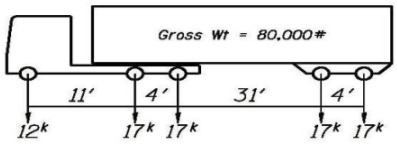
	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	48.99	44.10	36.28	29.09	21.90	16.29	k
VLL (per beam with impact)	16.12	14.51	11.94	9.57	7.21	5.36	k
Vs (total unfactored)	28.18	24.97	19.86	14.97	9.74	5.36	k
Vult (total factored)	50.67	45.10	36.22	27.79	18.94	11.64	k
V @ Mmax (axle)	48.10	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	31.94	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	61.29	152.38	254.12	320.59	351.57	348.56	k-ft
MLL (per beam with impact)	20.17	50.15	83.63	105.51	115.70	114.71	k-ft
Ms	36.50	91.65	157.92	203.86	229.40	235.03	k-ft
Mult	65.02	162.83	278.14	356.91	398.99	405.46	k-ft
Mmax (factored from externall	51.25	127.83	215.50	273.98	303.12	304.00	k-ft
vu	0.129	0.115	0.092	0.071	0.048	0.030	Vult/b'd ksi
vci	0.362	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	0.362	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.402	0.185	0.185	0.185	0.185	0.152	ksi
C	158.3	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	16.12	14.51	11.94	9.57	7.21	5.36	
Inventory RF	4.077	1.879	2.412	3.166	4.443	5.144	
Operating RF	6.806	3.137	4.026	5.285	7.417	8.587	

IDOT Type 3-S2 - 40 Tons

	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	36.74	33.86	29.29	24.72	20.15	15.59	k
VLL (per beam with impact)	12.09	11.14	9.64	8.14	6.63	5.13	k
Vs (total unfactored)	24.14	21.60	17.56	13.53	9.16	5.13	k
Vult (total factored)	41.92	37.78	31.23	24.67	17.69	11.14	k
V @ Mmax (axle)	31.43	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	22.78	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	40.05	116.60	202.72	257.74	286.61	295.84	k-ft
MLL (per beam with impact)	13.18	38.37	66.71	84.82	94.32	97.36	k-ft
Ms	29.51	79.88	141.00	183.18	208.02	217.68	k-ft
Mult	49.84	137.26	241.41	312.01	352.58	367.79	k-ft
Mmax (factored from externall	36.07	102.27	178.77	229.08	256.71	266.33	k-ft
vu	0.106	0.096	0.079	0.063	0.045	0.028	Vult/b'd ksi
vci	0.365	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	0.365	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.404	0.185	0.185	0.185	0.185	0.152	ksi
C	158.9	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	12.09	11.14	9.64	8.14	6.63	5.13	
Inventory RF	5.458	2.448	2.987	3.726	4.829	5.375	
Operating RF	9.111	4.086	4.986	6.219	8.061	8.972	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

		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	1/6/2016
Load Rating Checked	CEK	2/8/2016

Kane County Special Permit Vehicles Shear Rating

Type KC-1 - 170,000 lb

	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	68.69	63.05	54.11	44.18	35.78	28.09	k
VLL (per beam with impact)	22.61	20.75	17.81	14.54	11.78	9.24	k
Vs (total unfactored)	34.66	31.20	25.73	19.93	14.31	9.24	k
Vult (total factored)	64.75	58.64	48.96	38.57	28.85	20.07	k
V @ Mmax (axle)	63.46	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	40.38	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	80.86	217.14	372.72	474.04	540.10	546.20	k-ft
MLL (per beam with impact)	26.61	71.46	122.66	156.00	177.74	179.75	k-ft
Ms	42.94	112.96	196.95	254.36	291.44	300.08	k-ft
Mult	79.00	209.10	362.87	466.55	533.69	546.66	k-ft
Mmax (factored from externall	65.23	174.10	300.23	383.62	437.82	445.21	k-ft
vu	0.164	0.149	0.124	0.098	0.073	0.051	Vult/b'd ksi
vci	0.360	0.080	0.066	0.058	0.049	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.360	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.400	0.185	0.185	0.185	0.185	0.152	ksi
C	157.6	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	22.61	20.75	17.81	14.54	11.78	9.24	
Inventory RF	2.894	1.315	1.617	2.085	2.720	2.983	
Operating RF	4.830	2.194	2.699	3.480	4.540	4.980	

Type KC-2 - 165,000 lb

	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	68.22	62.58	53.64	44.70	35.98	28.53	k
VLL (per beam with impact)	22.45	20.59	17.65	14.71	11.84	9.39	k
Vs (total unfactored)	34.50	31.05	25.58	20.10	14.37	9.39	k
Vult (total factored)	64.41	58.30	48.62	38.95	29.00	20.38	k
V @ Mmax (axle)	63.02	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally ap	40.14	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	80.31	215.52	371.62	474.14	541.40	547.10	k-ft
MLL (per beam with impact)	26.43	70.93	122.30	156.04	178.17	180.05	k-ft
Ms	42.76	112.43	196.59	254.39	291.87	300.37	k-ft
Mult	78.61	207.94	362.09	466.62	534.62	547.31	k-ft
Mmax (factored from externall	64.84	172.94	299.45	383.69	438.75	445.85	k-ft
vu	0.164	0.148	0.124	0.099	0.074	0.052	Vult/b'd ksi
vci	0.360	0.080	0.066	0.058	0.049	0.042	ksi
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.360	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.400	0.185	0.185	0.185	0.185	0.152	ksi
C	157.6	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	22.45	20.59	17.65	14.71	11.84	9.39	
Inventory RF	2.914	1.324	1.631	2.060	2.705	2.937	
Operating RF	4.864	2.211	2.723	3.439	4.514	4.903	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Type KC-3 - 140,000 lb

	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	65.24	58.89	50.87	43.42	35.98	28.53	k
VLL (per beam with impact)	21.47	19.38	16.74	14.29	11.84	9.39	k
Vs (total unfactored)	33.52	29.84	24.66	19.68	14.37	9.39	k
Vult (total factored)	62.28	55.67	46.65	38.03	29.00	20.38	k
V @ Mmax (axle)	63.02	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	40.14	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	80.31	202.80	352.60	452.20	519.50	545.00	k-ft
MLL (per beam with impact)	26.43	66.74	116.04	148.82	170.97	179.36	k-ft
Ms	42.76	108.25	190.33	247.17	284.66	299.68	k-ft
Mult	78.61	198.85	348.50	450.94	518.97	545.81	k-ft
Mmax (factored from externall	64.84	163.85	285.86	368.01	423.10	444.35	k-ft
vu	0.158	0.141	0.118	0.097	0.074	0.052	Vult/b'd ksi
vci	0.360	0.081	0.067	0.058	0.049	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.360	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.400	0.185	0.185	0.185	0.185	0.152	ksi
C	157.6	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	21.47	19.38	16.74	14.29	11.84	9.39	
Inventory RF	3.047	1.407	1.720	2.121	2.705	2.937	
Operating RF	5.086	2.349	2.871	3.541	4.514	4.903	

Type KC-4 - 115,000 lb

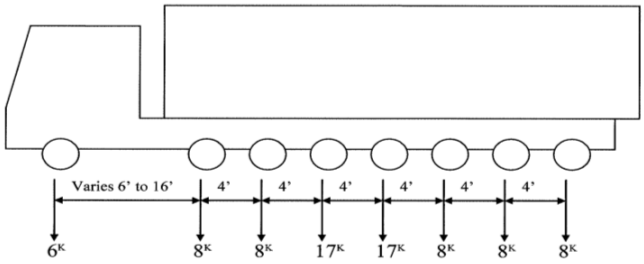
	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	53.02	48.35	41.90	35.44	28.99	22.53	k
VLL (per beam with impact)	17.45	15.91	13.79	11.66	9.54	7.41	k
Vs (total unfactored)	29.50	26.37	21.71	17.06	12.07	7.41	k
Vult (total factored)	53.55	48.14	40.24	32.33	24.00	16.10	k
V @ Mmax (axle)	51.97	0.00	0.00	0.00	0.00	0.00	
Vi (factored from externally ap	34.07	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	66.23	168.90	292.84	372.32	411.14	426.40	k-ft
MLL (per beam with impact)	21.80	55.58	96.37	122.53	135.30	140.33	k-ft
Ms	38.12	97.09	170.66	220.88	249.00	260.65	k-ft
Mult	68.55	174.63	305.80	393.87	441.55	461.07	k-ft
Mmax (factored from externall	54.78	139.63	243.16	310.94	345.68	359.61	k-ft
vu	0.136	0.122	0.102	0.082	0.061	0.041	Vult/b'd ksi
vci	0.361	0.083	0.067	0.058	0.050	0.042	
vci minimum	0.120	0.120	0.120	0.120	0.120	0.120	
vci used	0.361	0.120	0.120	0.120	0.120	0.120	
ϕ = 0.90							
ϕvn = ϕ(vs+vc)	0.402	0.185	0.185	0.185	0.185	0.152	ksi
C	158.1	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	17.45	15.91	13.79	11.66	9.54	7.41	
Inventory RF	3.762	1.714	2.088	2.599	3.357	3.719	
Operating RF	6.279	2.861	3.486	4.338	5.603	6.208	

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016

Type AASHTO Notional - 80k

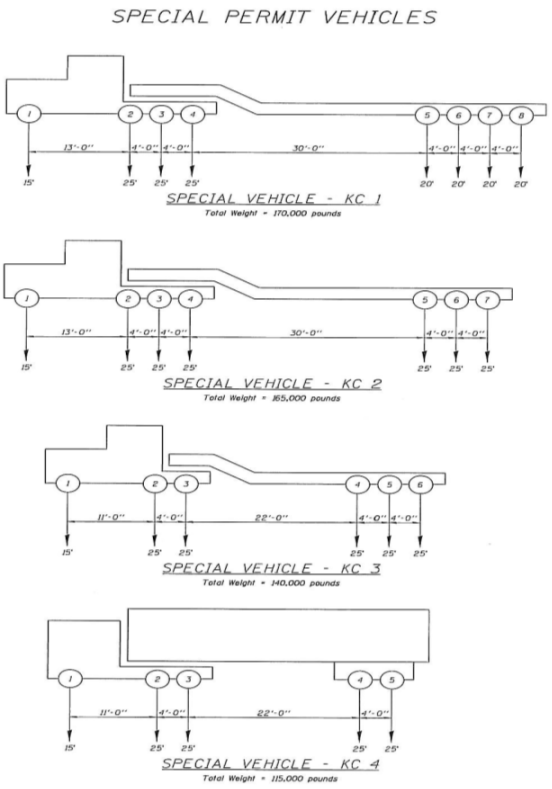
	0.037	0.1	0.2	0.3	0.4	0.5	along span
	1.27	3.44	6.89	10.33	13.78	17.22	ft
VLL max. (STAAD - axle load)	45.85	42.30	35.22	28.10	20.76	13.90	k
VLL (per beam with impact)	15.09	13.92	11.59	9.25	6.83	4.57	k
Vs (total unfactored)	27.14	24.38	19.51	14.64	9.36	4.57	k
Vult (total factored)	48.43	43.81	35.46	27.09	18.12	9.93	k
V @ Mmax (axle)	46.47	0.00	0.00	0.00	0.00	0.00	k
Vi (factored from externally ap	31.05	4.78	3.62	2.46	1.16	0.00	PCM 1.1.9
MLL max (STAAD - axle load)	59.22	145.77	266.79	360.85	411.46	427.06	k-ft
MLL (per beam with impact)	19.49	47.97	87.80	118.75	135.41	140.54	k-ft
Ms	35.82	89.48	162.09	217.11	249.11	260.87	k-ft
Mult	63.54	158.10	287.19	385.68	441.78	461.54	k-ft
Mmax (factored from externall	49.77	123.11	224.55	302.74	345.91	360.09	k-ft
vu	0.123	0.111	0.090	0.069	0.046	0.025	Vult/b'd ksi
vci	0.362	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	0.362	0.120	0.120	0.120	0.120	0.120	
$\phi = 0.90$							
$\phi vn = \phi(vs+vc)$	0.402	0.185	0.185	0.185	0.185	0.152	ksi
C	158.4	72.8	72.8	72.8	72.8	59.8	k
D	12.05	10.46	7.92	5.39	2.53	0.00	
L	15.09	13.92	11.59	9.25	6.83	4.57	
Inventory RF	4.359	1.959	2.484	3.278	4.687	6.028	
Operating RF	7.276	3.271	4.147	5.471	7.824	10.063	



Notional Load

Structure Rating Calculations

Load Rating Performed	ELN	1/6/2016
Load Rating Checked	CEK	2/8/2016



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