

Behind the Scenes: Load Ratings

Jennifer Hart, PE

INDOT Bridge Evaluation

Indiana Department of Transportation

DESIGN

how many years of
bridge design
experience do you
have?

LOAD RATING

how many years of
bridge load rating
experience do you
have?



same basic equation

DESIGN

$$Capacity > Demand$$

$$Capacity > DeadLoad + LiveLoad$$

$$Capacity > AppliedLoadCombination$$

$$Capacity > \gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW) + \gamma_{LL} \cdot (LL + IM)$$

$$C > \gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW) + \gamma_{LL} \cdot (LL + IM)$$

LOAD RATING

$$RatingFactor := \frac{ExcessCapacity}{LiveLoad}$$

$$RatingFactor := \frac{Capacity - DeadLoad}{LiveLoad}$$

$$RatingFactor := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

DESIGN

$$C > \gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW) + \gamma_{LL} \cdot (LL + IM)$$

AASHTO LRFD Bridge Design Specification Load Combination, Table 3.4.1-1

LOAD RATING

$$RatingFactor := \frac{ExcessCapacity}{LiveLoad}$$

$$RatingFactor := \frac{Capacity - DeadLoad}{LiveLoad}$$

$$RatingFactor := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

General Load Rating Equation, Manual for Bridge Evaluation 6A.4.2

DESIGN

$$C > \gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW) + \gamma_{LL} \cdot (LL + IM)$$

$$-\gamma_{DC} \cdot (DC) - \gamma_{DW} \cdot (DW)$$

LOAD RATING

$$\text{RatingFactor} := \frac{\text{ExcessCapacity}}{\text{LiveLoad}}$$

$$\text{RatingFactor} := \frac{\text{Capacity} - \text{DeadLoad}}{\text{LiveLoad}}$$

$$\text{RatingFactor} := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

DESIGN

$$C > \gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW) + \gamma_{LL} \cdot (LL + IM)$$

$$- \gamma_{DC} \cdot (DC) - \gamma_{DW} \cdot (DW)$$

$$C - \gamma_{DC} \cdot (DC) - (\gamma_{DW} \cdot (DW)) > \gamma_{LL} \cdot (LL + IM)$$

LOAD RATING

$$\text{RatingFactor} := \frac{\text{ExcessCapacity}}{\text{LiveLoad}}$$

$$\text{RatingFactor} := \frac{\text{Capacity} - \text{DeadLoad}}{\text{LiveLoad}}$$

$$\text{RatingFactor} := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

DESIGN

$$\frac{C - \gamma_{DC} \cdot (DC) - (\gamma_{DW} \cdot (DW))}{\gamma_{LL} \cdot (LL + IM)} > \gamma_{LL} \cdot (LL + IM)$$

LOAD RATING

$$RatingFactor := \frac{ExcessCapacity}{LiveLoad}$$

$$RatingFactor := \frac{Capacity - DeadLoad}{LiveLoad}$$

$$RatingFactor := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

DESIGN

$$\frac{C - \gamma_{DC} \cdot (DC) - (\gamma_{DW} \cdot (DW)) > \gamma_{LL} \cdot (LL + IM)}{\gamma_{LL} \cdot (LL + IM)}$$

$$\frac{C - (\gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW))}{\gamma_{LL} \cdot (LL + IM)}$$

LOAD RATING

$$RatingFactor := \frac{ExcessCapacity}{LiveLoad}$$

$$RatingFactor := \frac{Capacity - DeadLoad}{LiveLoad}$$

$$RatingFactor := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

DESIGN

$$\frac{C - (\gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW))}{\gamma_{LL} \cdot (LL + IM)}$$

LOAD RATING

$$RatingFactor := \frac{ExcessCapacity}{LiveLoad}$$

$$RatingFactor := \frac{Capacity - DeadLoad}{LiveLoad}$$

$$RatingFactor := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

$$RF := \frac{C - (\gamma_{DC}) \cdot (DC) - (\gamma_{DW}) \cdot (DW)}{\gamma_{LL} \cdot (LL + IM)}$$

DESIGN

$$\frac{C - (\gamma_{DC} \cdot (DC) + \gamma_{DW} \cdot (DW))}{\gamma_{LL} \cdot (LL + IM)}$$

AASHTO LRFD Bridge Design Specification Load Combination, Table 3.4.1-1

LOAD RATING

$$RF := \frac{C - (\gamma_{DC} \cdot (DC) - (\gamma_{DW} \cdot (DW))}{\gamma_{LL} \cdot (LL + IM)}$$

General Load Rating Equation, Manual for Bridge Evaluation 6A.4.2

LOAD RATING

LFR

6B.4—RATING EQUATION

6B.4.1—General

The following general expression should be used in determining the load rating of the structure:

$$RF = \frac{C - A_1 D}{A_2 L (1 + I)} \quad (6B.4.1-1)$$

6B.4.3—Load Factor

For the load factor method, $A_1 = 1.3$ and A_2 varies depending on the rating level desired. For inventory level, $A_2 = 2.17$ and for operating level, $A_2 = 1.3$.

The nominal capacity, C , is the same regardless of the rating level desired (see Article 6B.5.3).

LRFR

6A.4.2—General Load-Rating Equation

6A.4.2.1—General

The following general expression shall be used in determining the load rating of each component and connection subjected to a single force effect (i.e., axial force, flexure, or shear):

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)} \quad (6A.4.2.1-1)$$

Permanent Load Factors

Manual for Bridge Evaluation

AASHTO LRFD Bridge Design Specification

$$DeadLoad := \gamma_{DC} \cdot DC + \gamma_{DW} \cdot DW$$

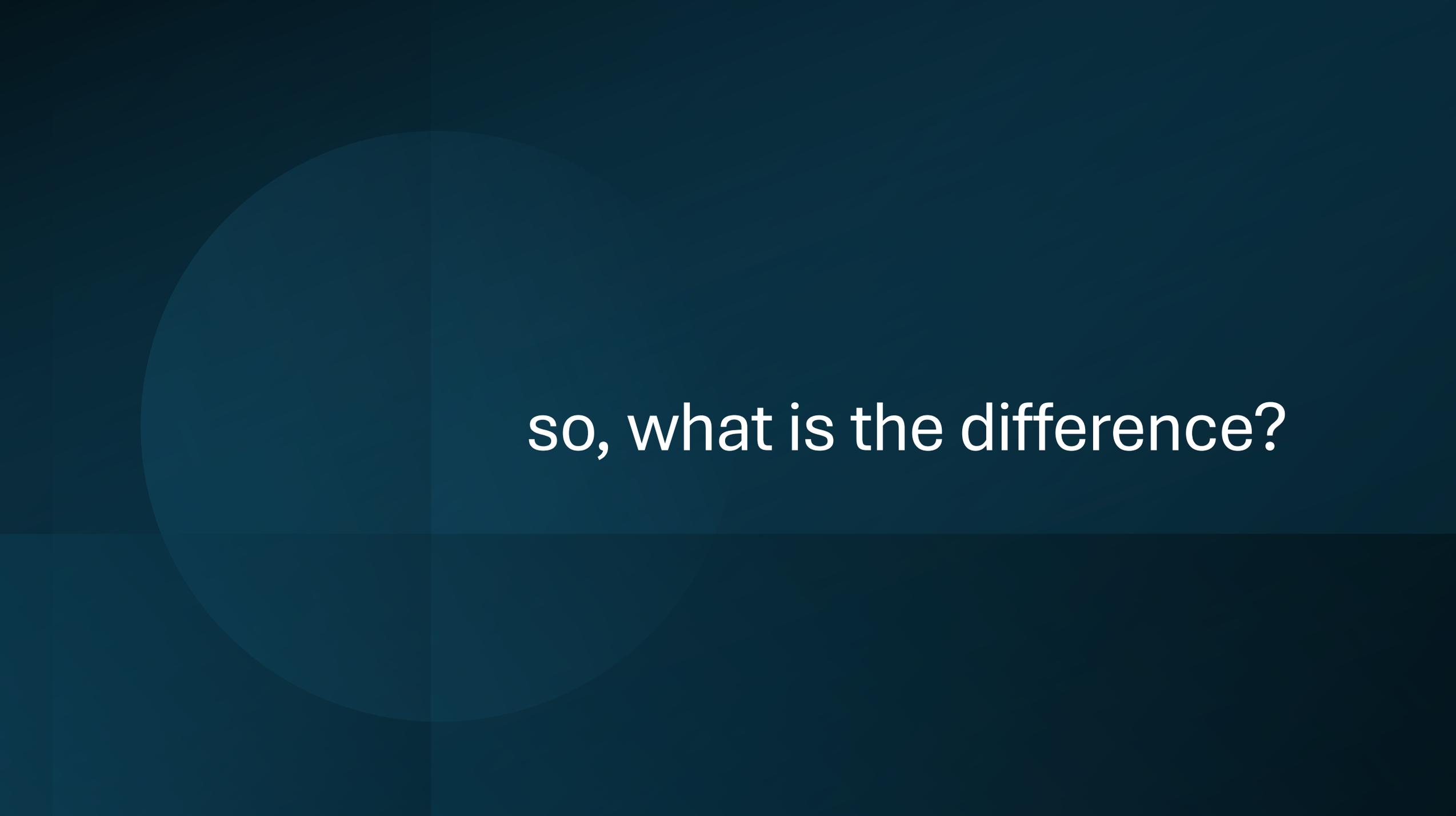
Table 6A.4.2.2-1—Limit States and Load Factors for I

Table 3.4.1-2—Load Factors for Permanent Loads, γ_p

Bridge Type	Limit State*	Dead Load γ_{DC}	Dead Load γ_{DW}
Steel	Strength I	1.25	1.50
	Strength II	1.25	1.50
	Service II	1.00	1.00
	Fatigue	0.00	0.00
Reinforced Concrete	Strength I	1.25	1.50
	Strength II	1.25	1.50
	Service I	1.00	1.00
Prestressed Concrete	Strength I	1.25	1.50
	Strength II	1.25	1.50
	Service III	1.00	1.00
	Service I	1.00	1.00
Wood	Strength I	1.25	1.50
	Strength II	1.25	1.50

Type of Load, Foundation Type	Load Factor	
	Maximum	Minimum
<i>DC</i> : Component and Attachments	1.25	0.90
<i>DC</i> : Strength IV only	1.50	0.90
<i>DW</i> : Wearing Surfaces and Utilities	1.50	0.65
<i>EH</i> : Horizontal Earth Pressure		
• Active	1.50	0.90
• At-Rest	1.35	0.90
• Apparent earth pressure (<i>AEP</i>) for anchored walls	1.35	N/A
<i>EL</i> : Locked-in Construction Stresses	1.00	1.00
<i>EV</i> : Vertical Earth Pressure		
• Overall and Compound Stability	1.00	N/A
• Retaining Walls and Abutments	1.35	1.00
• MSE wall internal stability soil reinforcement loads		
○ Stiffness Method		
▪ Reinforcement and connection rupture	1.35	N/A
▪ Soil failure – geosynthetics (Service I)	1.20	N/A
○ Coherent Gravity Method	1.35	N/A
• Rigid Buried Structure	1.30	0.90
• Rigid Frames	1.35	0.90
• Flexible Buried Structures		
○ Metal Box Culverts, Structural Plate Culverts with Deep Corrugations, and Fiberglass Culverts	1.50	0.90
○ Thermoplastic Culverts	1.30	0.90
○ All others	1.95	0.90
• Internal and Compound Stability for Soil Failure in Soil Nail Walls	1.00	N/A
<i>ES</i> : Earth Surcharge	1.50	0.75

* Defined in the AASHTO LRFD Bridge Design Specification



so, what is the difference?

vehicle certainty and frequency...

LRFR Live Load Factor

Manual for Bridge Evaluation $LiveLoad := \gamma_{LL} \cdot (LL + I)$

Table 6A.4.2.2-1—Limit States and Load Factors for Load Rating

Bridge Type	Limit State*	Dead Load γ_{DC}	Dead Load γ_{DW}	Design
				Inventory γ_{LL}
Steel	Strength I	1.25	1.50	1.75
	Strength II	1.25	1.50	—
	Service II	1.00	1.00	1.30
	Fatigue	0.00	0.00	0.75
Reinforced Concrete	Strength I	1.25	1.50	1.75
	Strength II	1.25	1.50	—
	Service I	1.00	1.00	—
Prestressed Concrete	Strength I	1.25	1.50	1.75
	Strength II	1.25	1.50	—
	Service III	1.00	1.00	0.80
	Service I	1.00	1.00	—
Wood	Strength I	1.25	1.50	1.75
	Strength II	1.25	1.50	—

* Defined in the AASHTO LRFD Bridge Design Specifications

Table 3.4.1-1—Load Combinations

Load Combination Limit State	DC	LL
	DW	IM
	EH	CE
	EV	BR
	ES	PL
	EL	LS
	PS	
	CR	
	SH	
Strength I (unless noted)	γ_p	1.75
Strength II	γ_p	1.35
Strength III	γ_p	—
Strength IV	γ_p	—
Strength V	γ_p	1.35
Extreme Event I	1.00	γ_{EQ}
Extreme Event II	1.00	0.5/ 1.00
Service I	1.00	1.00
Service II	1.00	1.30
Service III	1.00	γ_{LL}
Service IV	1.00	—
Fatigue I—LL, IM & CE only	—	1.75
Fatigue II—LL, IM & CE only	—	0.80

6B.4.3—Load Factor

For the load factor method, $A_1 = 1.3$ and A_2 varies depending on the rating level desired. For inventory level, $A_2 = 2.17$ and for operating level, $A_2 = 1.3$.

The nominal capacity, C , is the same regardless of the rating level desired (see Article 6B.5.3).

Permit Load γ_{LL}
—
Table 6A.4.5.4.2a-1
1.00
—
—
Table 6A.4.5.4.2a-1
1.00
—
Table 6A.4.5.4.2a-1
—
1.00
—
Table 6A.4.5.4.2a-1

LRFR Live Load Factors

Manual for Bridge Evaluation $LiveLoad := \gamma_{LL} \cdot (LL + IM)$

Table 6A.4.2.2-1—Limit States and Load Factors for Load Rating

Bridge Type	Limit State*	Dead Load γ_{DC}	Dead Load γ_{DW}	Design Load	
				Inventory	Operating
				γ_{LL}	γ_{LL}
Steel	Strength I	1.25	1.50	1.75	1.35
	Strength II	1.25	1.50	—	—
	Service II	1.00	1.00	1.30	1.00
	Fatigue	0.00	0.00	0.75	—
Reinforced Concrete	Strength I	1.25	1.50	1.75	1.35
	Strength II	1.25	1.50	—	—
	Service I	1.00	1.00	—	—
Prestressed Concrete	Strength I	1.25	1.50	1.75	1.35
	Strength II	1.25	1.50	—	—
	Service III	1.00	1.00	0.80	—
	Service I	1.00	1.00	—	—
Wood	Strength I	1.25	1.50	1.75	1.35
	Strength II	1.25	1.50	—	—

* Defined in the AASHTO LRFD Bridge Design Specifications

Table 3.4.1-1—Load Combinations :

Load Combination Limit State	<i>DC</i>	
	<i>DW</i>	
	<i>EH</i>	
	<i>EV</i>	<i>LL</i>
	<i>ES</i>	<i>IM</i>
	<i>EL</i>	<i>CE</i>
	<i>PS</i>	<i>BR</i>
	<i>CR</i>	<i>PL</i>
	<i>SH</i>	<i>LS</i>
Strength I (unless noted)	γ_p	1.75
Strength II	γ_p	1.35
Strength III	γ_p	—
Strength IV	γ_p	—
Strength V	γ_p	1.35
Extreme Event I	1.00	γ_{EQ}
Extreme Event II	1.00	0.5/ 1.00
Service I	1.00	1.00
Service II	1.00	1.30
Service III	1.00	γ_{LL}
Service IV	1.00	—
Fatigue I— <i>LL</i> , <i>IM</i> & <i>CE</i> only	—	1.75
Fatigue II— <i>LL</i> , <i>IM</i> & <i>CE</i> only	—	0.80

LRF Live Load Factors

Manual for Bridge Evaluation $LiveLoad := \gamma_{LL} \cdot (LL + IM)$

Table 6A.4.2.2-1—Limit States and Load Factors

Bridge Type	Limit State*	Dead Load Factor γ_{DC}
Steel	Strength I	1.25
	Strength II	1.25
	Service II	1.00
	Fatigue	0.00
Reinforced Concrete	Strength I	1.25
	Strength II	1.25
	Service I	1.00
Prestressed Concrete	Strength I	1.25
	Strength II	1.25
	Service III	1.00
	Service I	1.00
Wood	Strength I	1.25
	Strength II	1.25

Table 6A.4.4.2.3a-1—Generalized Live Load Factors, γ_L for Routine Commercial Traffic

Traffic Volume (One direction)	Load Factor
Unknown	1.45
$ADTT \geq 5,000$	1.45
$ADTT \leq 1,000$	1.30

Linear interpolation is permitted for $ADTT$ values between 5,000 and 1,000.

Table 6A.4.4.2.3b-1—Generalized Live Load Factors, γ_L for Specialized Hauling Vehicles

Traffic Volume (One Direction)	Load Factor
Unknown	1.45
$ADTT \geq 5,000$	1.45
$ADTT = 1,000$	1.30

Linear interpolation is permitted for $ADTT$ values between 1,000 and 5,000.

Table 3.4.1-1—Load Combinations

Load Combination Limit State	DC DW EH EV ES EL PS CR SH	LL IM CE BR PL LS
Strength I (unless noted)	γ_p	1.75
Strength II	γ_p	1.35
Strength III	γ_p	—
Strength IV	γ_p	—
Strength V	γ_p	1.35
Extreme Event I	1.00	γ_{EQ}
Extreme Event II	1.00	0.5/ 1.00
Service I	1.00	1.00
Service II	1.00	1.30
Service III	1.00	γ_{LL}
Service IV	1.00	—
Fatigue I— LL , IM & CE only	—	1.75
Fatigue II— LL , IM & CE only	—	0.80

* Defined in the AASHTO LRFD Bridge Design Specifications

LRF Live Load Factors

Manual for Bridge Evaluation $LiveLoad := \gamma_{LL} \cdot (LL + IM)$

Permit Type	Frequency	Loading Condition	DF ^a	ADTT (one direction)	Load Factor by Permit Weight Ratio ^b		
					GVW / AL < 2.0 (kip/ft)	2.0 < GVW / AL < 3.0 (kip/ft)	GVW / AL > 3.0 (kip/ft)
Routine or Annual	Unlimited Crossings	Mix with traffic (other vehicles may be on the bridge)	Two or more lanes	>5,000	1.4	1.35	1.30
				=1,000	1.35	1.25	1.20
				<100	1.30	1.20	1.15
	Unlimited Crossings (Reinforced Concrete Box Culverts) ^c	Mix with traffic (other vehicles may be on the bridge)	One lane	All ADTTs	1.40		
					All Weights		
Special or Limited Crossing	Single-Trip	Escorted with no other vehicles on the bridge	One lane	N/A	1.10		
	Single-Trip	Mix with traffic (other vehicles may be on the bridge)	One lane	All ADTTs	1.20		
	Multiple Trips (less than 100 crossings)	Mix with traffic (other vehicles may be on the bridge)	One lane	All ADTTs	1.40		

Table 3.4.1-1—Load Combinations

Load Combination Limit State	DC DW EH EV ES EL PS CR SH	LL IM CE BR PL LS
Strength I (unless noted)	γ_p	1.75
Strength II	γ_p	1.35
Strength III	γ_p	—
Strength IV	γ_p	—
Strength V	γ_p	1.35
Extreme Event I	1.00	γ_{EQ}
Extreme Event II	1.00	0.5/ 1.00
Service I	1.00	1.00
Service II	1.00	1.30
Service III	1.00	γ_{LL}
Service IV	1.00	—
Fatigue I—LL, IM & CE only	—	1.75
Fatigue II—LL, IM & CE only	—	0.80

* Values in this table are for bridge design specifications

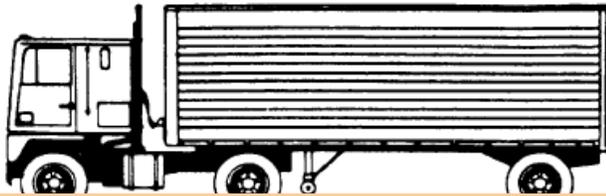
DESIGN

3.6.1.2—Design Vehicular Live Load

3.6.1.2.1—General

Vehicular live loading on the roadways of bridges or incidental structures, designated HL-93, shall consist of a combination of the:

- Design truck or design tandem, and
- Design lane load.



72,000 lbs + Lane Load
or
50,000 lbs+ Lane Load

LOAD RATING

Design Loads

TRAFFIC DATA - SR 462	
LOAD:	SR 462
DESIGN DATA:	SR 462
DESIGN DATA:	SR 462

TRAFFIC DATA - SR 62	
LOAD:	SR 62
DESIGN DATA:	SR 62
DESIGN DATA:	SR 62

STRUCTURE INFORMATION	
STRUCTURE:	SR 462
DESIGN DATA:	SR 462
DESIGN DATA:	SR 462

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS
FOR SPANS OVER 20 FEET
ROUTE: SR 462 AT: 0+02
PROJECT NO. 1900102 P.E.
R/W
1900102 CONST

Deck Reconstruction and Overlay on SR 462 over Blue River Located in Section 25, T-3S, R-2-E, Harrison Township, Harrison County

INDIANA DEPARTMENT OF TRANSPORTATION

100 North Senate Avenue
Room 1875
Indianapolis, Indiana 46204

Eric Holcomb, Governor
Michael Smith, Commissioner

Date: Friday, August 11, 2023

To: Maricor Colglazier
Project Manager

Ref: Request Type: New Design
Contract #: B-42292
DES #: 1900102
NBI #: 032810
Structure #: 462-31-04571 B
Work Type: Bridge Deck Overlay
Documentation: LOADRTG LoadRtgRwPlans 1900102 For Bridge Services.pdf
Certified By: Andrew Bishop, P.E., Wiss, Janney, Elstner Associates, Inc.

The referenced structure has been reviewed and the load rating completed. Based on documentation provided (Bridge plans or current reported condition) the structure rates >= 1.0 for design vehicles and >= 1.0 for state legal vehicles per the INDOT Bridge Inspection Manual. Re-evaluation is required if modifications are made to the documentation referenced above.

Jennifer Hart, P.E.
Load Rating Engineer

www.in.gov/indot
An Equal Opportunity Employer

uniformly distributed over a 10.0-ft width. The force

LOAD RATING

Legal Loads

State & Federal agencies have identified vehicles that are legal to travel unrestricted.

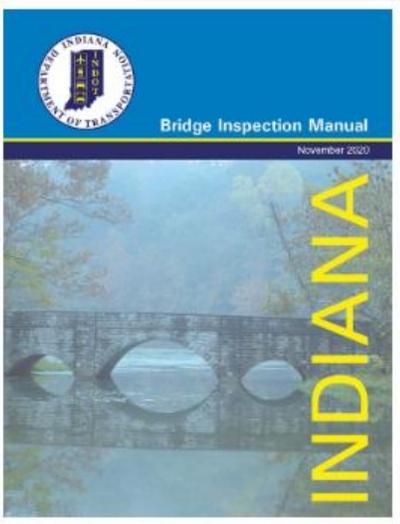
If Legal Load rating factors are < 1.0 , then posting or restricting consideration is required.

Did you know Indiana Code allows for various commodities to exceed Federal Formula B by 10%?

Truck Configuration	LRFR Code Reference
H-20	MBE 6A.4.4.2.1a
HS-20	MBE 6A.4.4.2.1a
Alternate military	MBE 6A.4.4.2.1a
AASHTO Type 3	MBE 6A.4.4.2.1a
AASHTO Type 3S2	MBE 6A.4.4.2.1a
AASHTO Type 3-3	MBE 6A.4.4.2.1a
Lane-Type*	MBE 6A.4.4.2.1a
EV2	MBE 6A.4.4.2.1a
EV3	MBE 6A.4.4.2.1a
NRL**	MBE 6A.4.4.2.1b
SU4	MBE 6A.4.4.2.1b
SU5	MBE 6A.4.4.2.1b
SU6	MBE 6A.4.4.2.1b
SU7	MBE 6A.4.4.2.1b

* Load and Resistance Factor Rating (LRFR) methodology only

** Not to be used for load posting. Not required for Engineering Judgment (EJ) methodology.



Fig

IC 9-20-4-2

Transportation of farm commodities and logs, wood chips, bark and sawdust

- (1) farm commodities from the place of production to the first point of delivery where the commodities are weighed and title to the commodities is transferred if the weight of the vehicle with load or combination of vehicles with load does not exceed the gross weight limit by more than ten percent (10%); or
- (2) logs, wood chips, bark, and sawdust if the weight of the vehicle with load does not exceed either:
 - (A) the gross weight limit; or
 - (B) the axle weight limit;

by more than ten percent (10%).

(b) The exemptions in subsection (a) do not apply to the following:

- (1) Weight limits imposed for bridges or sections of highways under IC 9-20-1-3.

Legal Loads

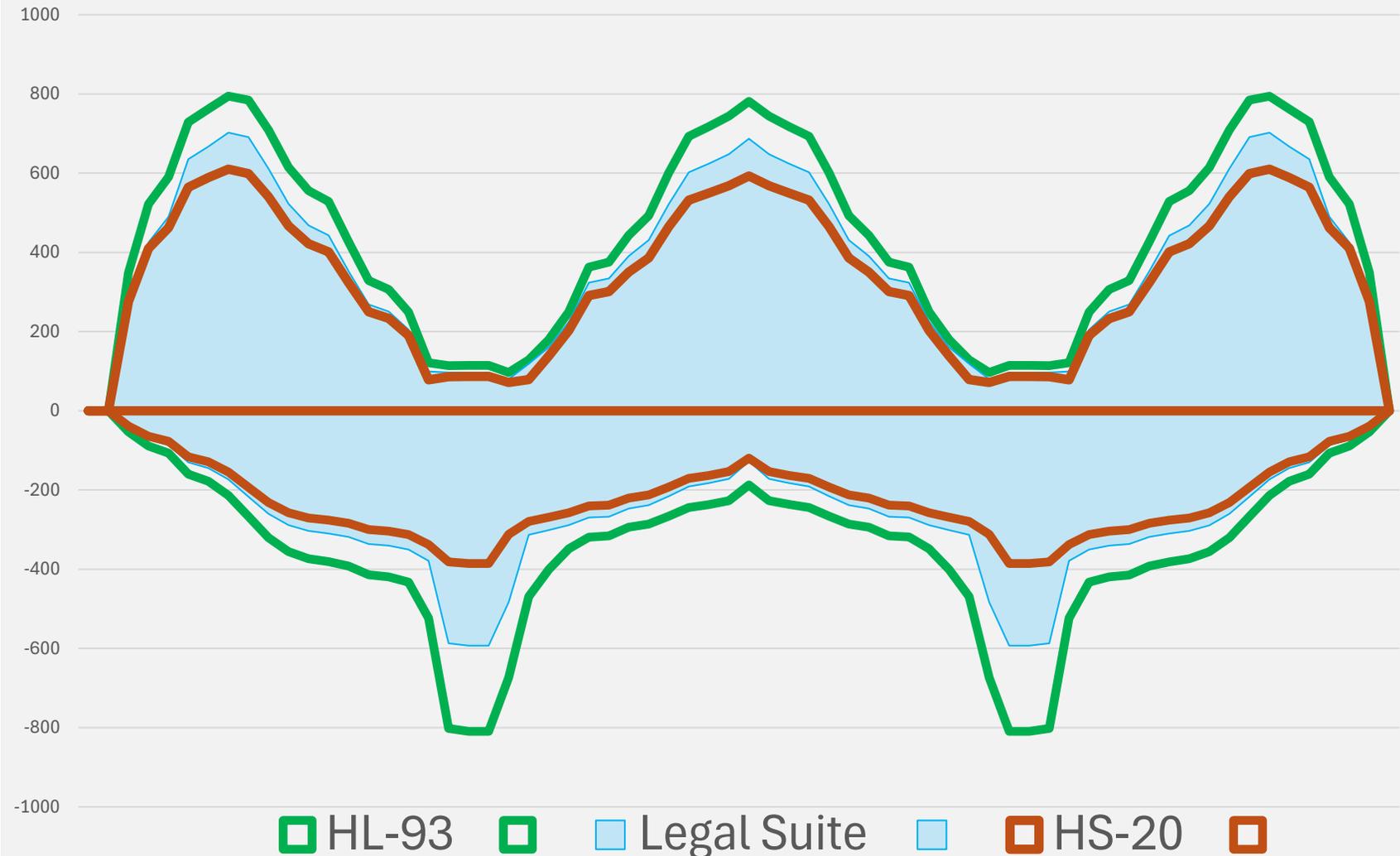
Sample Bridge
016-91-06044 B
NBI 004280

- Steel
- Three Span Continuous (70'–87'–70')
- Interior Beam
- LRFR LLD & Impact
- Unfactored Loads
- Original Design Criteria
 - Year Built = 1974
 - HS20-44
 - 1969 AASHO Spec
 - Allowable Stress

LRFR Rating Factors

- HL93 Des Inv = 1.696
- SU7 = 1.975 (Controlling Legal)
- EV3 = 2.235

Unfactored Moment Envelope



Legal Loads

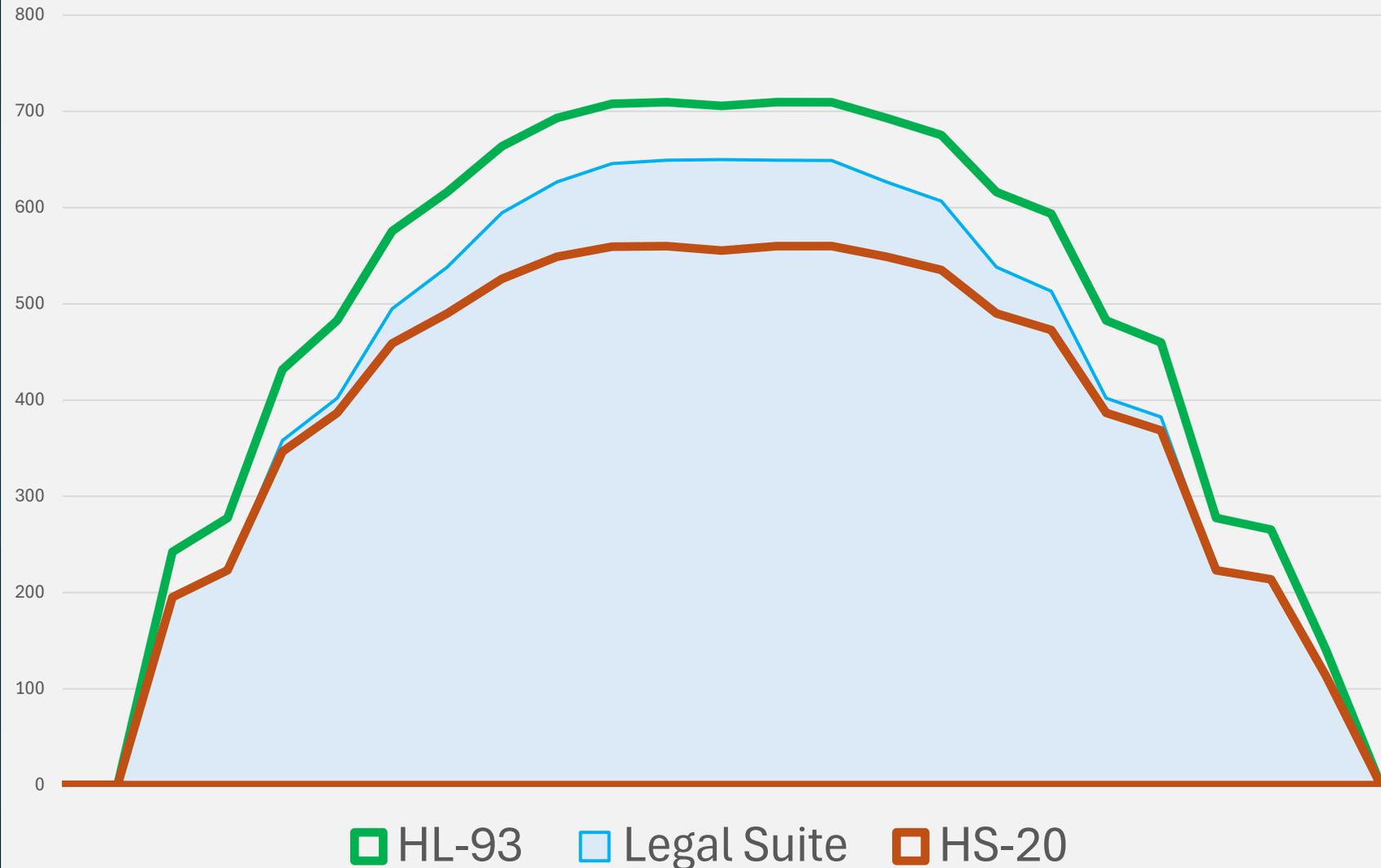
Sample Bridge
020-76-03680 C
NBI 005590

- Steel
- Single Span (60')
- Interior Beam
- LRFR LLD & Impact
- Unfactored Loads
- Original Design Criteria
 - Year Built = 1952
 - H20-S16
 - 1949 AASHO Spec
 - Allowable Stress

LRFR Rating Factors

- HL93 Des Inv = 1.556
- SU7 = 1.775 (Controlling Legal)
- EV3 = 1.996

Unfactored Moment Envelope



LOAD RATING

Permit Loads

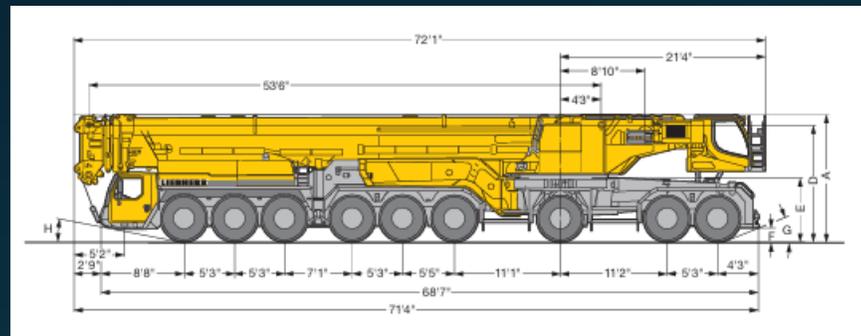
Indiana law states that drivers must obtain an oversize and/or overweight (OSOW) vehicle permit before traveling on Indiana roads if their vehicle exceeds:

- Height = 13'-6"
- Width = 8'-6"
- Length = 53' (semi-tractor-semi-trailer combination)
- Gross Vehicle Weight = 80,000 lbs (subject to axle weights)



Permit Loads

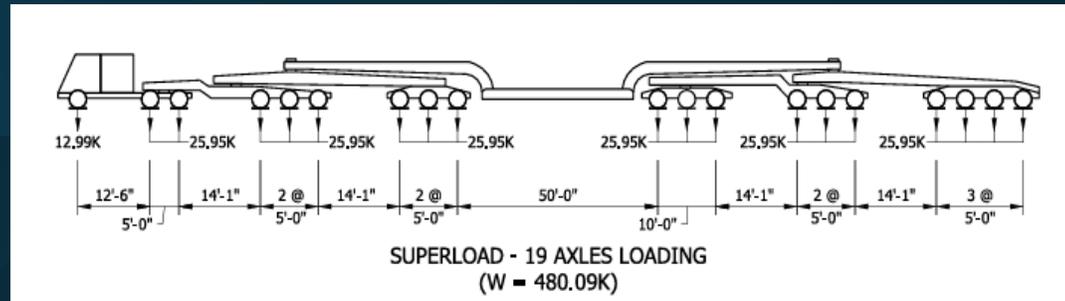
Crane, GVW = 218,250 lbs



Prestressed Beam, GVW = 294,000 lbs



Superload, GVW = 480,090 lbs

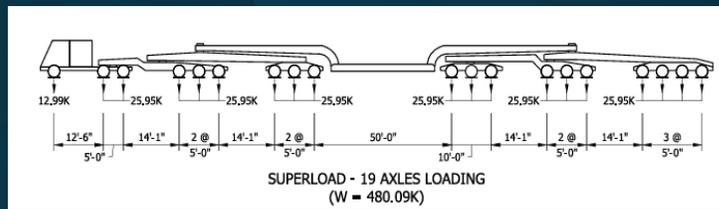
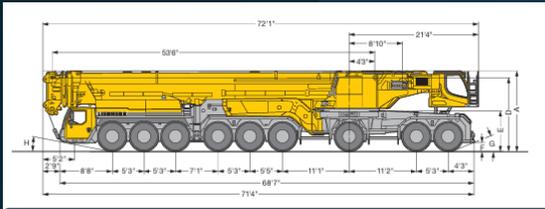


Common Permit, GVW = 118,000 lbs

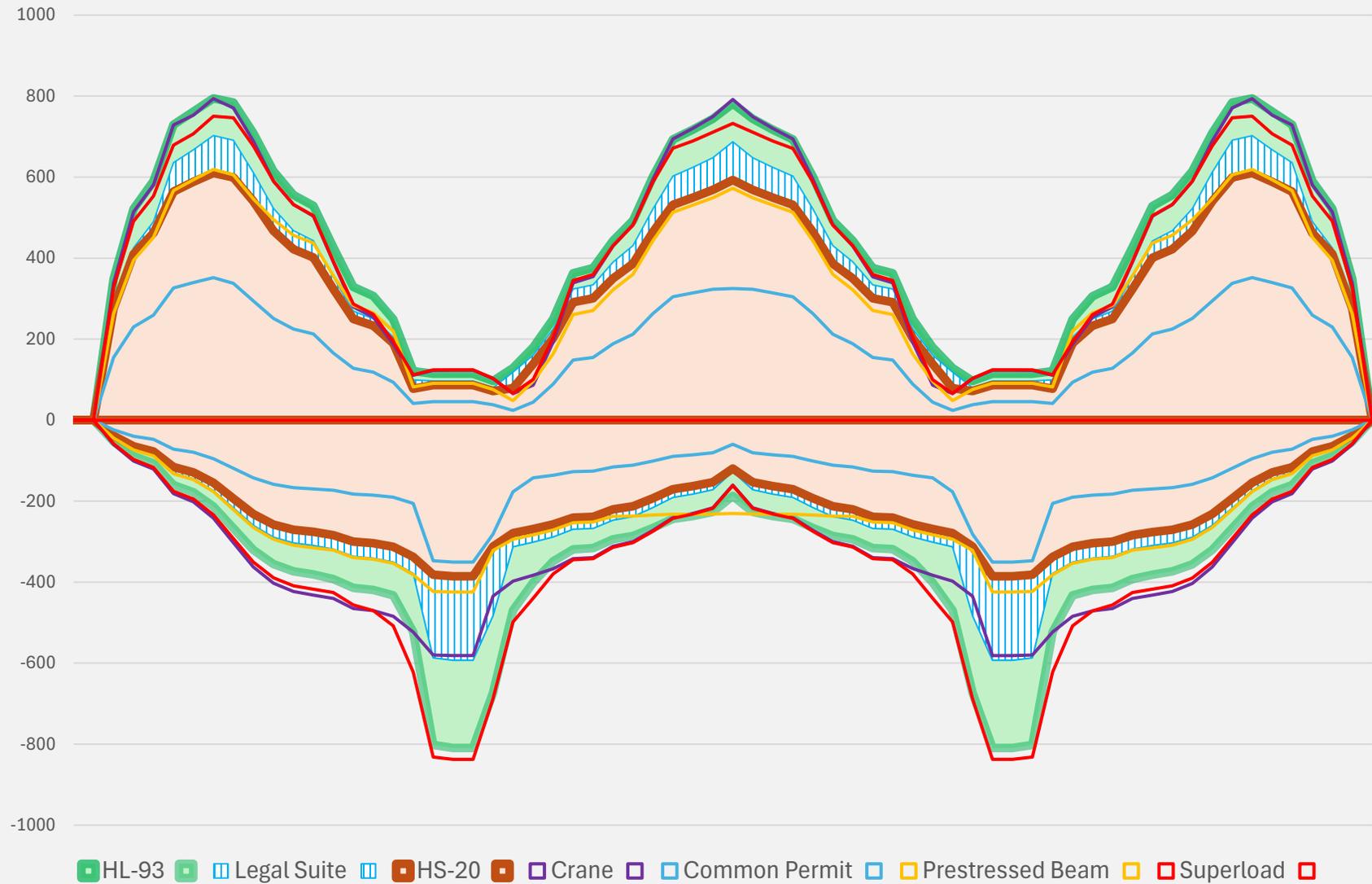


Permit Loads

Sample Bridge
016-91-06044 B
NBI 004280

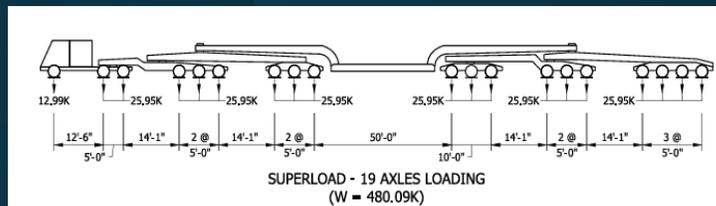
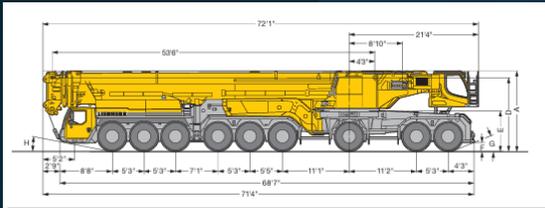


Unfactored Moment Envelope

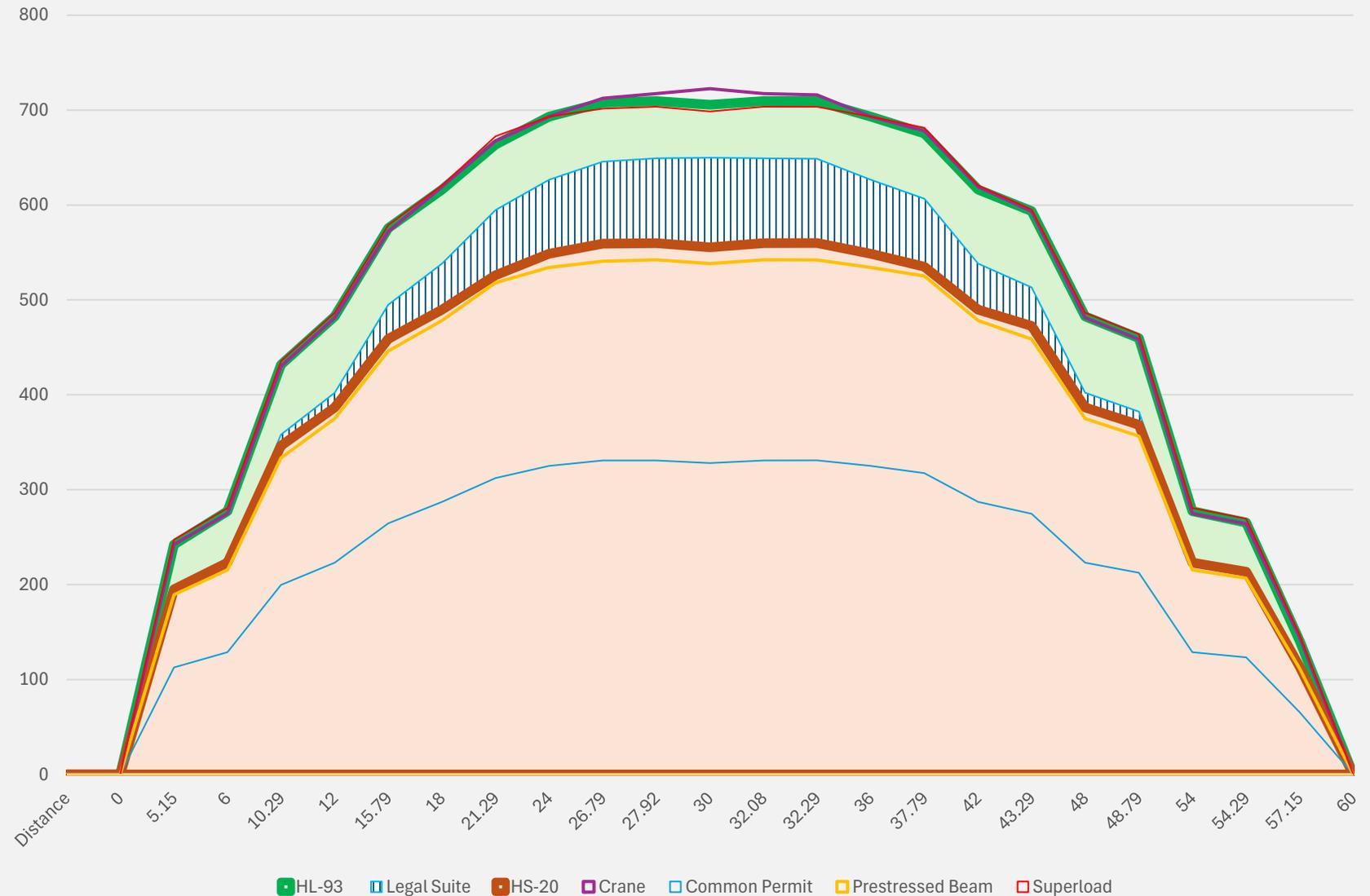


Permit Loads

Sample Bridge
020-76-03680 C
NBI 005590

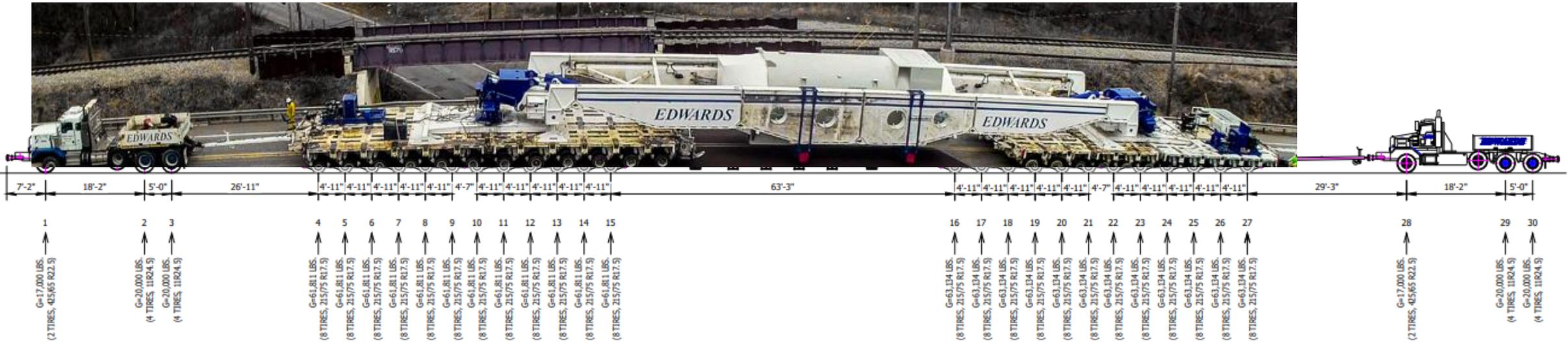
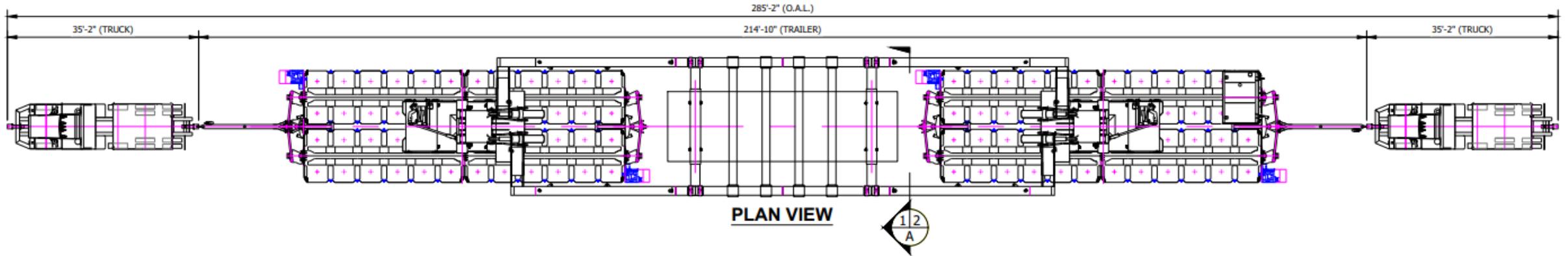


Unfactored Moment Envelope



what is the heaviest load
that has been permitted to
travel in the State of
Indiana?

1,577,500 lbs

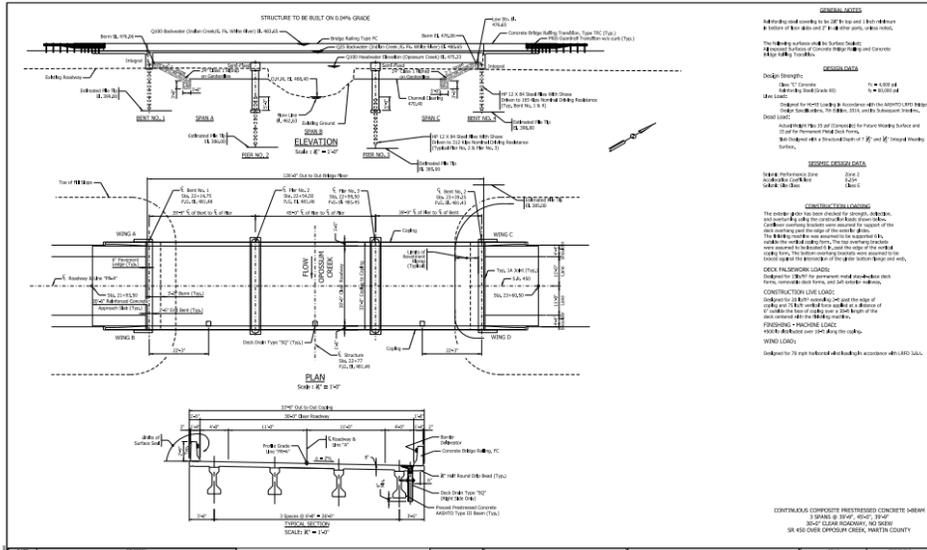


SIDE ELEVATION

once in place, a bridge will
continue to be analyzed for
the next 75 years.

the condition will change...

DESIGN



LOAD RATING



load rating is required by law



Code of Federal Regulations

A point in time eCFR system



 Title 23

(k) *Load rating.*

- (1) Rate each bridge as to its **safe load capacity** in accordance with Sections 6 and 8, excluding the 3rd paragraph in Article 6B.7.1, AASHTO Manual (incorporated by reference, see [§ 650.317](#)).
- (2) Develop and document procedures for completion of new and updated bridge load ratings. Load ratings must be completed as soon as practical, **but no later than 3 months after the initial inspection and when a change is identified that warrants a re-rating such as, but not limited to, changes in condition, reconstruction, new construction, or changes in dead or live loads.**
- (3) **Analyze routine and special permit loads for each bridge that these loads cross to verify the bridge can safely carry the load.**

rate each bridge



1

Rate Each Bridge



Code of Federal Regulations

A point in time eCFR system



 Title 23

(k) *Load rating.*

- (1) Rate each bridge as to its **safe load capacity** in accordance with Sections 6 and 8, excluding the 3rd paragraph in Article 6B.7.1, AASHTO Manual (incorporated by reference, see [§ 650.317](#)).



Rate Each Bridge



EV2 Load Factor	EV3 Load Factor	Structure Type	Deterioration	Length (ft)	Year Built	Bridge Name	Route	Mile/Km Post (mi)
FALSE	FALSE	KCSB	FALSE	199.500	1985		6	23.47
FALSE	FALSE	KCSG	FALSE	234.000	1985		6	27.38
FALSE	FALSE	KCSG	FALSE	234.000	1985		6	27.38
FALSE	FALSE	CPCBB	FALSE	179.770	1929		6	29.30
FALSE	FALSE	CRCS	FALSE	83.750	1985		6	29.48
FALSE	FALSE	PCIB	FALSE	45.932	1997		6	41.88
FALSE	FALSE	CPCTB	FALSE	179.000	2014		6	48.77
FALSE	FALSE	PCIB	FALSE	78.000	1996		6	50.68
FALSE	FALSE	CPCIB	FALSE	130.750	1984		6	53.59
FALSE	FALSE	CRCS	FALSE	87.000	1980		6	74.59
FALSE	FALSE	CPCIB	FALSE	136.500	1980		6	75.11
FALSE	FALSE	CPCIB	FALSE	170.250	1980		6	75.37
FALSE	FALSE	CPCIB	FALSE	136.500	1980		6	76.74
FALSE	FALSE	KCSG	FALSE	161.000	1980		6	77.87

001700	006-46-06647 A	LRFR	FALSE	FALSE	FALSE	CPCIB	FALSE	130.750	1984	6	53.59
001720	006-50-06577 B	LRFR	FALSE	FALSE	FALSE	CRCS	FALSE	87.000	1980	6	74.59
001724	006-50-06578 B	LRFR	FALSE	FALSE	FALSE	CPCIB	FALSE	136.500	1980	6	75.11
001726	006-50-02544 A	LRFR	FALSE	FALSE	FALSE	CPCIB	FALSE	170.250	1980	6	75.37
001730	006-50-05187 C	LRFR	FALSE	FALSE	FALSE	CPCIB	FALSE	136.500	1980	6	76.74
001735	006-50-06624 B	LRFR	FALSE	FALSE	FALSE	KCSG	FALSE	161.000	1980	6	77.87

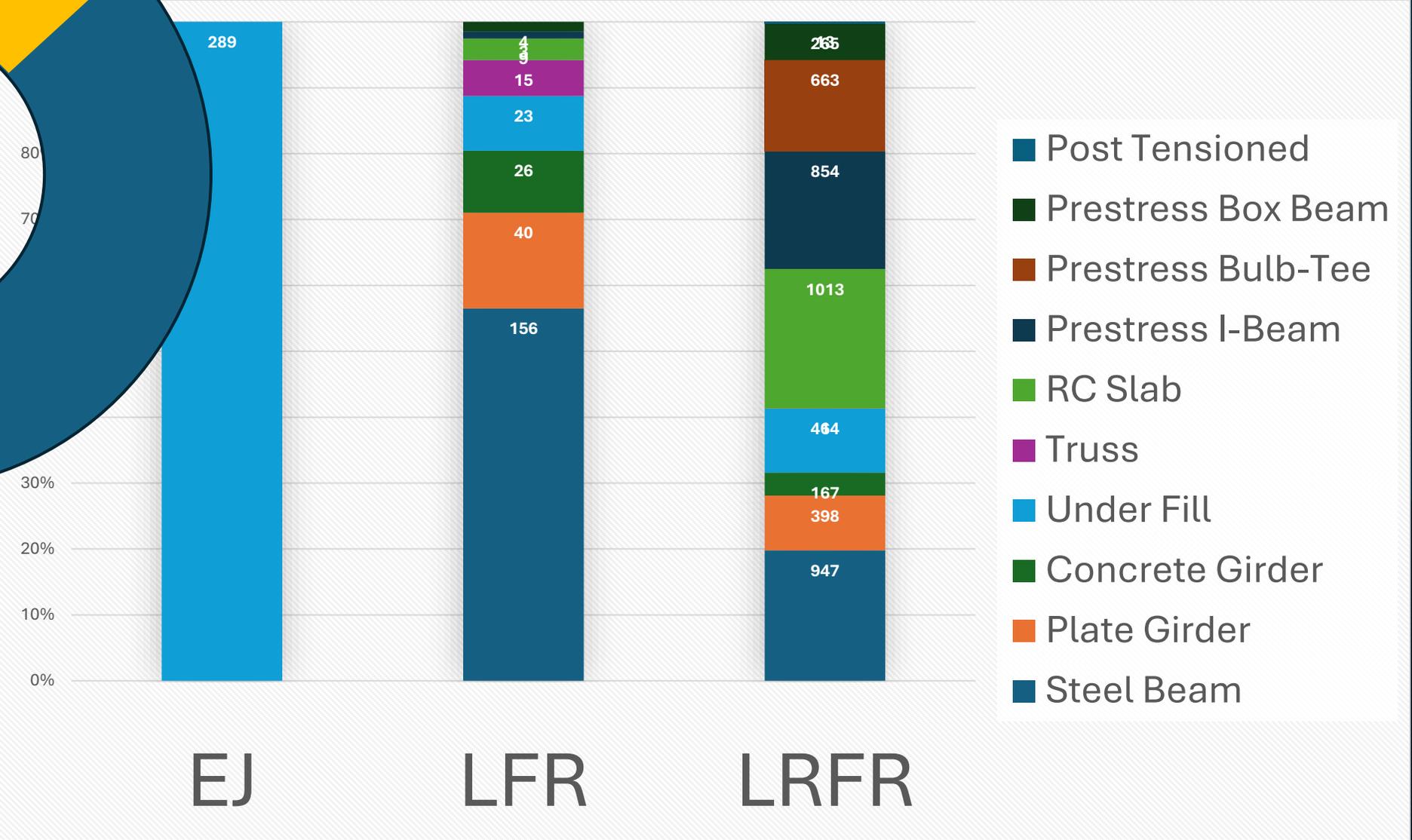
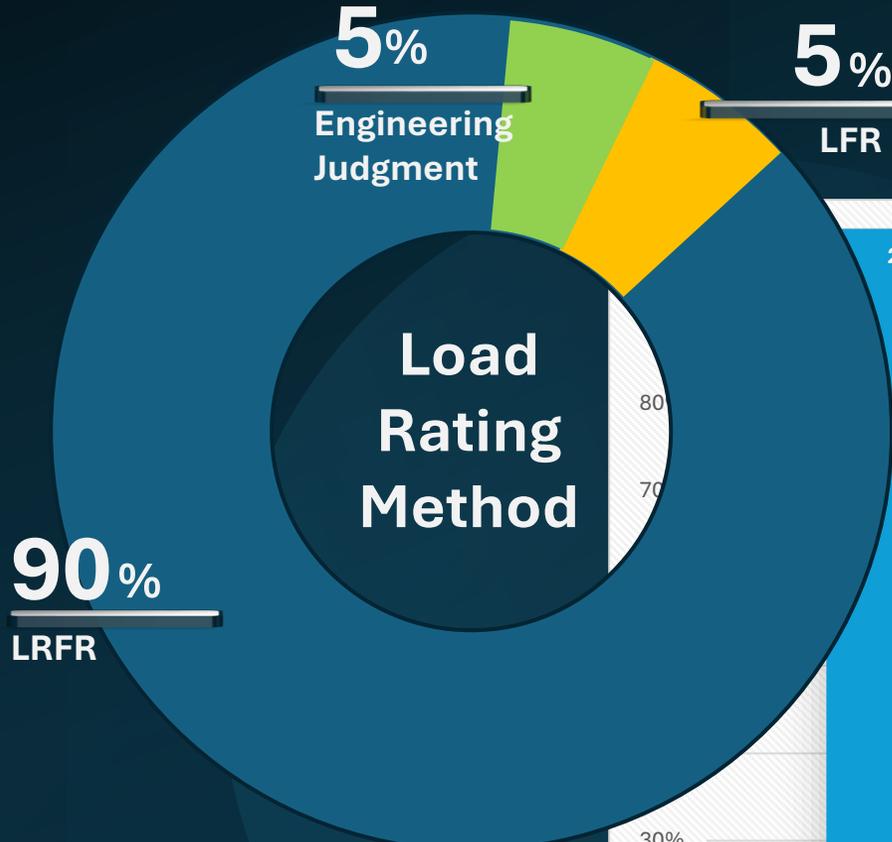
Submitted Date	NBI	Bridge #	Parent Asset	Rehab Designa	Rating Program	Program Version	B.LR.01 - Design Loa	B.LR.02 - Design Methd	B.LR.03 - Load R	B.LR.04 - Load	B.LR.05 - Inv. Lo	B.LR.06 - Oper.	B.LR.07 - Controlling Le
2/15/22 1:43 PM	001755	006-50-10034	La Porte	Original	Spreadsheet	N/A	HS20	LFD	7/10/2019	LRFR	0.67	0.87	5.76
2/26/22 12:21 PM	001761	006-20-09832	Fort Wayne	Original	AASHTOWARE BrR	6.8.4.3002	HL93	LRFD	7/19/2016	LRFR	0.87	1.54	1.58
8/31/22 3:20 PM	001771	006-20-09772 A	Fort Wayne	A	AASHTOWARE BrR	6.8.4.3002	HL93	LRFD	12/11/2013	LRFR	1.06	1.69	1.82
2/26/22 12:24 PM	001780	006-20-05056 B	Fort Wayne	B	AASHTOWARE BrR	6.8.4.3002	HS20	LFD	9/2/2021	LRFR	1.08	1.4	1.71
2/26/22 12:11 PM	001790	006-20-07269	Fort Wayne	Original	AASHTOWARE BrR	6.8.4.3002	HS20	LFD	3/31/2008	LRFR	0.95	1.23	1.5
2/26/22 12:11 PM	001800	006-57-07270	Fort Wayne	Original	AASHTOWARE BrR	6.8.4.3002	HS20	LFD	4/4/2008	LRFR	0.92	1.2	1.5
2/26/22 12:21 PM	001811	006-57-02686	Fort Wayne	Original	AASHTOWARE BrR	6.8.4.3002	HL93	LRFD	9/16/2016	LRFR	1.34	1.73	2.01
2/26/22 12:11 PM	001850	006-17-04695 B	Fort Wayne	B	AASHTOWARE BrR	6.8.4.3002	HS20	LFD	3/28/2008	LRFR	1.53	1.98	2.24
12/5/24 11:47 AM	001861	006-17-10421	Fort Wayne	Original	AASHTOWARE BrR	7.2.0.3001	HL93Plus	LRFD	12/4/2024	LRFR	1.57	2.26	3.28
1/26/24 2:33 PM	001870	006-17-03843 C	Fort Wayne	C	AASHTOWARE BrR	7.2.0.3001	HL93	LRFD	1/19/2024	LRFR	1.55	2.02	2.48
12/18/23 10:03 PM	001875	(6)206-17-07959	Fort Wayne	Original	AASHTOWARE BrR	7.2.0.3001	HS20	LFD	12/18/2023	LRFR	1.33	1.81	2.4
2/26/22 12:21 PM	001880	006-17-03844 C	Fort Wayne	C	AASHTOWARE BrR	6.8.4.3002	HS20	LFD	5/4/2016	LRFR	1.15	1.49	1.63
5/11							U	U	7/23/2020	LRFR	0.92	1.95	2.12
2/26/22 12:21 PM							HS20	LFD	9/29/2020	EJ	2.7	4.51	3.71
2/26/22 12:21 PM							HS20	LFD	8/20/2019	LRFR	0.93	1.21	1.29
2/26/22 12:21 PM							HS20	LFD	5/27/2008	LRFR	1.24	1.68	1.91
2/26/22 12:21 PM							HS20	LFD	3/24/2008	LRFR	1.13	1.47	1.87
2/26/22 12:21 PM							HS20	LFD	3/20/2008	LRFR	0.58	0.76	1.2
2/19/24 9:31 AM	001950	007-39-04918 A	Seymour	A	AASHTOWARE BrR	7.2.0.3001	HS20	LFD	2/15/2024	LRFR	1.24	1.67	2.27
2/26/22 12:11 PM	001960	007-39-00043 C	Seymour	C	AASHTOWARE BrR	6.8.4.3002	HL93	LRFD	9/3/2013	LRFR	1.12	1.59	1.72
2/2/24 11:14 PM	001970	007-40-06527 B	Seymour	B	AASHTOWARE BrR	7.2.0.3001	HS20	LFD	2/2/2024	LRFR	1.2	1.55	2.19
2/26/22 12:21 PM	001990	(3)7-40-02154 B	Sevmour	B	AASHTOWARE BrR	6.8.4.3002	HS20	LFD	1/28/2014	LRFR	0.94	1.23	1.4



IN.gov

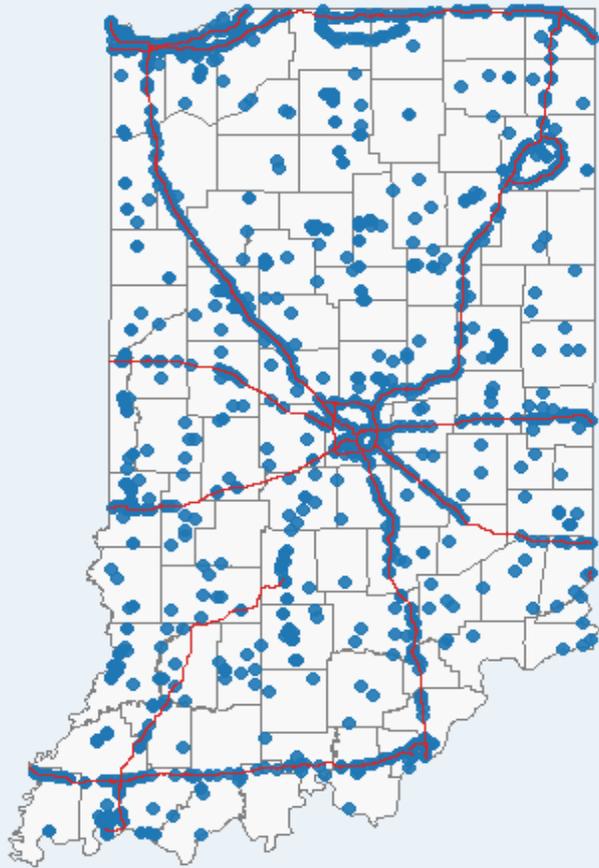
INDOT Bridge Rating Application Database of Indiana

Rate Each Bridge

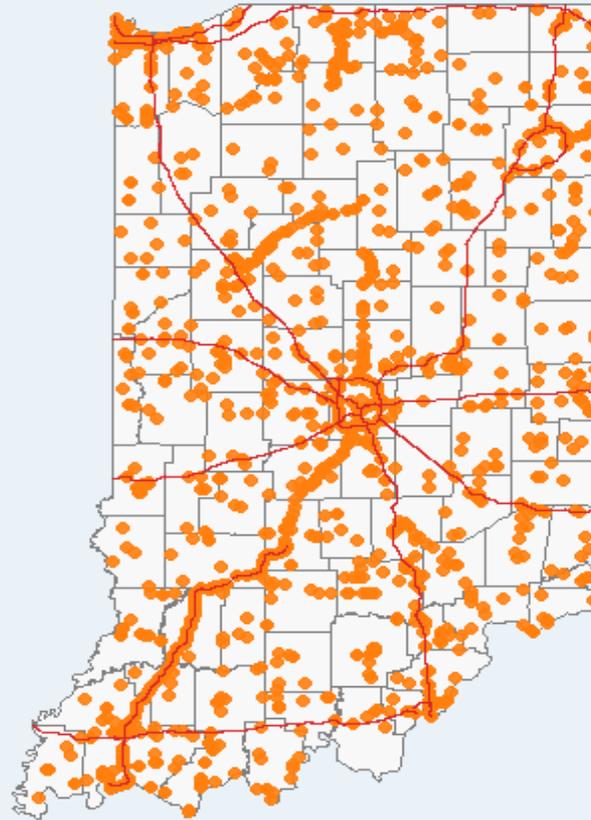


- Post Tensioned
- Prestress Box Beam
- Prestress Bulb-Tee
- Prestress I-Beam
- RC Slab
- Truss
- Under Fill
- Concrete Girder
- Plate Girder
- Steel Beam

Rate Each Bridge



Steel Bridges
1675 Bridges
Avg. Age - 53 years

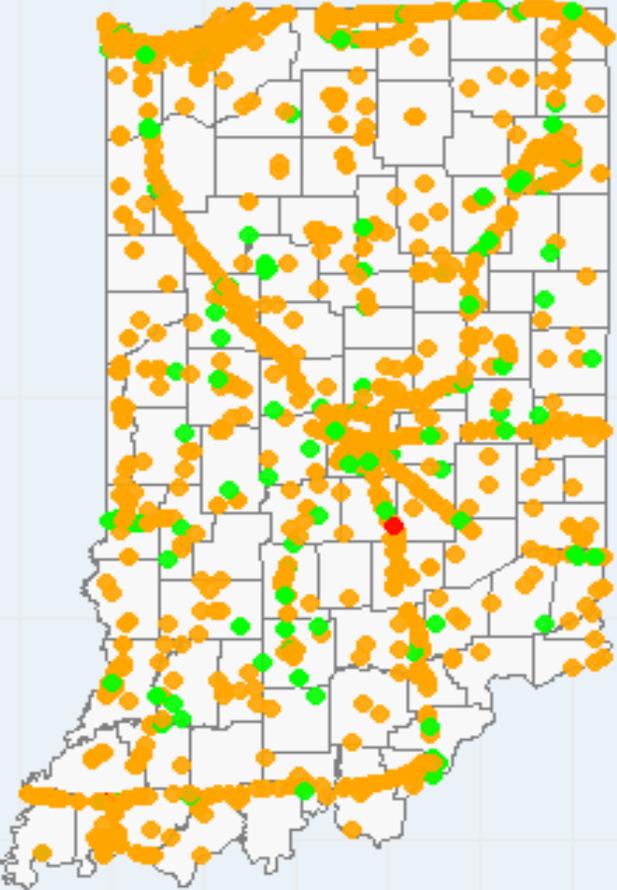


**Prestressed Concrete
Bridges**
1677 Bridges
Avg. Age - 27 years



**Reinforced Concrete
Bridges**
1294 Bridges
Avg. Age 44 years

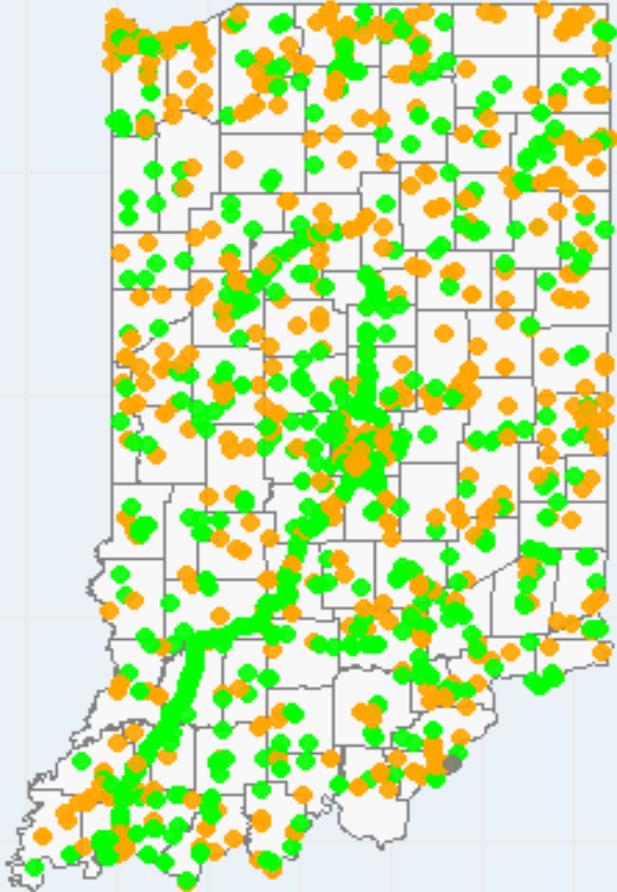
Rate Each Bridge



Steel Bridges

1675 Bridges

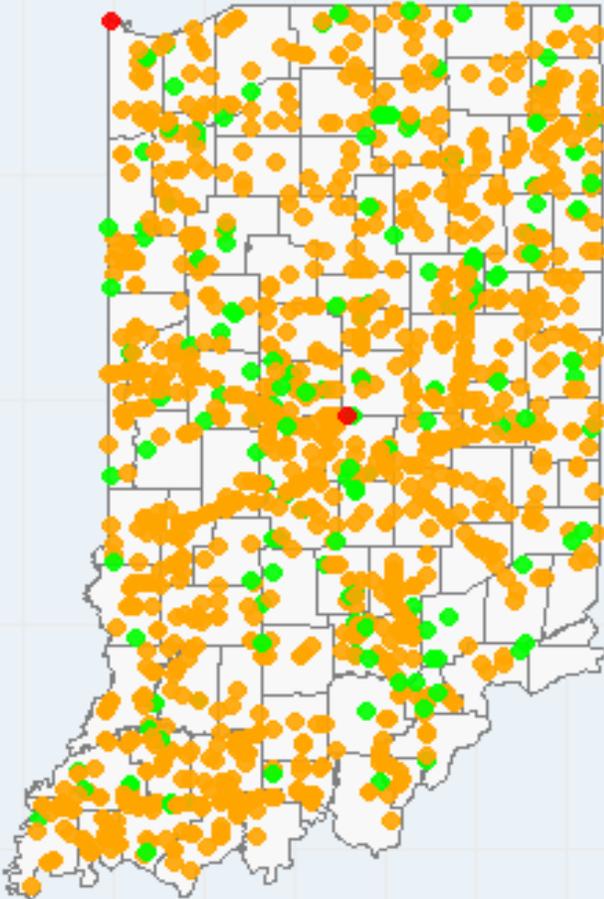
Avg Min CV Rating – 1.59



Prestressed Concrete Bridges

1677 Bridges

Avg Min CV Rating – 2.07



Plain Reinforced Concrete Bridges

1294 Bridges

Avg Min CV Rating – 1.61

update load
ratings when
things change



2

Update Load Ratings When Things Change

- (2) Develop and document procedures for completion of new and updated bridge load ratings. Load ratings must be completed as soon as practical, but **no later than 3 months after the initial inspection** and when a change is identified that warrants a re-rating such as, but not limited to, changes in condition, **reconstruction, new construction, or changes in dead or live loads.**



prepare to update the things we know will change



Update Load Ratings When Things Change



plan for coordination during construction - temporary bridges

Update Load Ratings When Things Change

INDOT

**LOAD RATING SUMMARY REPORT
for
NEW DESIGN**

BRIDGE NUMBER

064-13-03008 B

NBI NUMBER

023120

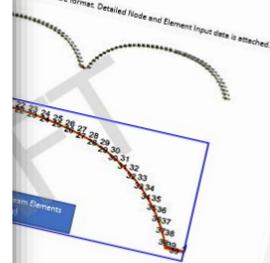


emcs

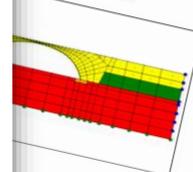
Nevill F. Gomes
Date: 5/29/2024



COMPUTATIONS BY: NIG on 04/16/2024
CHECKED BY: NPG on 05/21/2024
BACKCHECKED BY: NIG on 05/23/2024



1= Displacement Input (Rotation Fix)
0= Force Input (Rotation Free)



Fabricator

700-B-801d BRIDGE LOAD RATING CALCULATIONS AND SUMMARY

(Revised 02-10-16)

When the structure span, measured along the roadway centerline is greater than 20 feet, complete this form and include it with the load rating calculations as part of a box or 3-sided structure working drawings submittal.

Des. No.: _____ County: _____
Contract No.: _____ District: _____
Structure #: _____ Reference Post: _____

At least one of the following must be a registered professional engineer.

Load Rated By & Date: _____
Checked By & Date: _____

Bridge Information

Structure Type: _____
material, single or multi cell, box culvert or 3-sided structure (arch or flat top)

Year Built: _____
Skew (degrees, L/R): _____
Span (ft, measured along roadway centerline): _____
Paved Roadway Width (ft, including shoulders): _____
Reinforcement: _____
rebar size or WWR grid dimensions

Load Rating Information

Load Rating Method: **LRFR**
Load Rating Program: _____
AASHTOWARE, CANDE, SmartCulvert, ET Culvert

Design Loading*

*For Toll Road Live Load, a single truck with design lane load shall be used in each design lane. This loading shall be investigated under the Strength II Limit State. For Michigan Train Live Load, a single truck with design lane load shall be limited to one design lane located so as to cause extreme force effects, while the other design lanes are occupied by regular design loads. This loading shall be investigated under the Strength II Limit State.

Design Loading	Inventory Rating	Operating Rating
HL-93	■	■
Toll Road (90 kip) - required within 15 miles of an Indiana Toll Road gate.	■	■
Toll Road (90 kip) - required within 15 miles of an Indiana Toll Road gate.	■	■
Toll Road (126 kip) - required within 15 miles of an Indiana Toll Road gate.	■	■

700-B-801d
1 of 2

700-B-801d
2 of 2

prepare for the change that we know will happen quickly

Update Load Ratings When Things Change

Construction Change and CRI Plans uploaded into ERMS, as required per IDM 14-1.02(07), will be available for Load Rating once construction is complete.

The screenshot displays the ERMS system interface for the Indiana Department of Transportation. The main heading is "Posted Documents for View and Download". On the left, there are search criteria and document types available. The search criteria include Document Type (All), Contract Number (40589), District (Not Selected), Letting Date Month (Not Selected), and Letting Date Year (Not Selected). The document types available are categorized into Pre-Letting Documents (Contract Information Books, Revisions, Plan/Drawing Sets, Existing Plans, Permits, Asbestos Reports, Q And A Forms, Geotech Reports, Utilities Information, Additional Information, Project Commitments) and Post-Letting Documents (Construction Changes). The main content area shows a list of results found, with a "Begin a New Search" link. The list includes categories like Contract Information Books, Plan/Drawing Sets, Existing Plans, Revisions, Q And A Forms, Permits, Reports, Utilities Information & Right of Way, Project Commitments, and Construction Changes. The "Construction Changes" category is highlighted with a red circle. A text box at the bottom right of the screenshot contains the text "prepare for the change we know will happen."

Contract Letting Information · INDOT

Posted Documents for View and Download

Indiana Department of Transportation

Search Criteria

- Document Type: All
- Contract Number: 40589
- District: Not Selected
- Letting Date Month: Not Selected
- Letting Date Year: Not Selected

Document Types Available:

- Pre-Letting Documents:
 - Contract Information Books
 - Revisions
 - Plan/Drawing Sets
 - Existing Plans
 - Permits
 - Asbestos Reports
 - Q And A Forms
 - Geotech Reports
 - Utilities Information
 - Additional Information
 - Project Commitments
- Post-Letting Documents:
 - Construction Changes

Results Found:

[Begin a New Search](#)

Expand All Collapse All

Contract Information Books	Number of Records: 1
Plan/Drawing Sets	Number of Records: 1
Existing Plans	Number of Records: 1
Revisions	Number of Records: 3
Q And A Forms	Number of Records: 1
Permits	Number of Records: 2
Reports	Number of Records: 2
Utilities Information & Right of Way	Number of Records: 0
Project Commitments	Number of Records: 1
Construction Changes	

prepare for the change we know will happen.

Indiana Department of Transportation

Update Load Ratings When Things Change

RSP 105-C-247

(posted January 30, 2025)
Effective for
June, July, and August 2025 lettings.

Contract _____
District _____

NOTE: This Menu is divided into two sections:
SECTION I - Standard Recurring Special Provisions and Recurring Plan Details
and
SECTION II - Contract Specific Recurring Special Provisions.
Please review both sections to locate and ensure the correct items are placed in the contract.

Place In Contract (X)	Attach. Req'd. (X)	RSP Number	Title	A or R	Adopted or Revised Date	Letting Effective Date	Basis for Use
SECTION I: Standard Recurring Special Provisions and Recurring Plan Details							
SECTION II: Contract Specific Recurring Special Provisions							
X		105-C-247	Bridge Inspection Coordination	R	04-20-23	09-01-23	Required for any "B" or "R" contracts.

09-01-23

105-C-247 BRIDGE INSPECTION COORDINATION

(Revised 04-20-23)

The following bridge inspections are due to be performed by the Department's Bridge Inspection Office, or its authorized representative, on each bridge within the construction limits of the contract.

Structure Number	NBI Number	Location	Inspection Type	Last Inspection Date (MM/DD/YY)	Frequency (Mos.)	First Scheduled Inspection (MM/YY)	Second Scheduled Inspection (MM/YY)

Each bridge inspection shall be included in the schedule of work in accordance with 108.04. Portions of each bridge replaced, reconstructed, or repaired will receive an initial inspection within 60 days of being opened to traffic.

The Department's onsite Engineer will notify the Department's Bridge Inspection Office by email when construction is complete for each phase for each bridge included in the contract. This notification will assist the Department's Bridge Inspection office schedule an initial bridge inspection. The notification will be directed to inbridgeshelp@indot.in.gov. The email notification will include the Contract Number, Des Number, NBI Number and Structure Number in the subject line.

Notice will be given no less than seven days prior to each bridge inspection. Access, coordination, and cooperation for the bridge inspections shall be in accordance with 105.05.

6 per week

finalize the change when construction is complete

Update Load Ratings When Things Change

- (2) Develop and document procedures for completion of new and updated bridge load ratings. Load ratings must be completed as soon as practical, but **no later than 3 months after the initial inspection** and when a change is identified, limited to, **changes in condition**, reconstruction, new loads.



Critical Findings require immediate corrective action

be prepared for the changes outside of our control



1 per week

Friday, January 24th, 2025

I69 over SR 13

bridge strike

I69 over SR13 - Bridge Strike

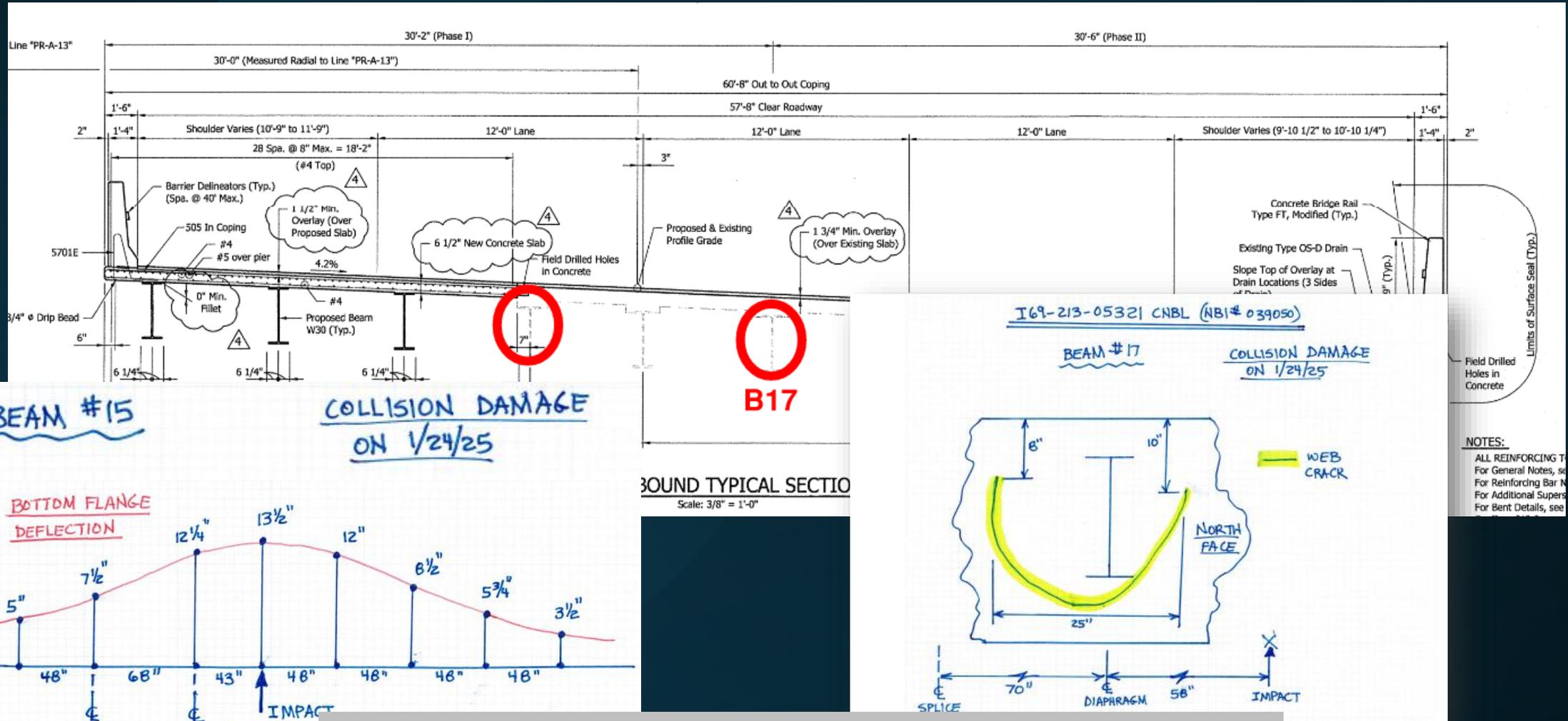
Friday, January 24th, 2025: TMC notified INDOT Inspection at 8:39 am, that an oversize load struck the I69 bridge over SB lanes of SR 13. Impact caused large web tears and horizontal deflections to Beams #15 & 17.



Asset 039050: I69-213-05321 CNBL

I69 over SR13 - Bridge Strike

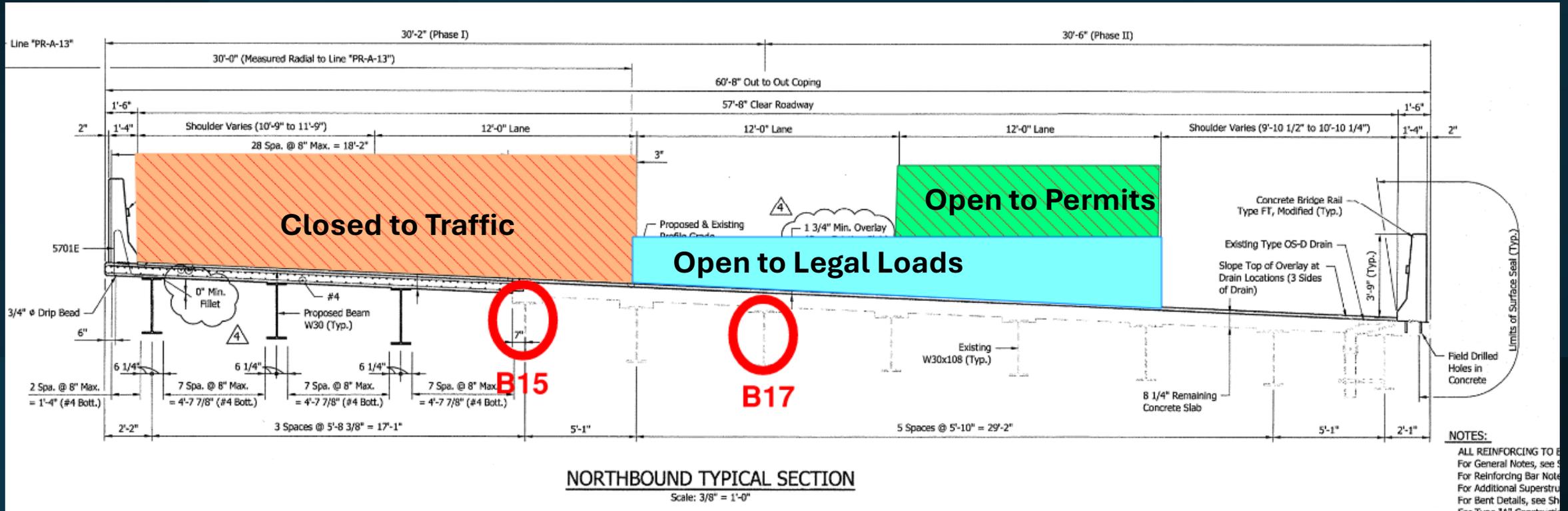
Friday, January 24th, 2025



Immediate Damage Assessment

I69 over SR13 - Bridge Strike

Friday, January 24th, 2025



Risk Assessment

I69 over SR13 - Bridge Strike

Saturday, January 25th, 2025



Immediate Action

I69 over SR13 - Bridge Strike

Tuesday, January 28th, 2025

PROJECT		DESIGNATION	
250035		250036	
CONTRACT		BRIDGE FILE	
S-46596		MIP-213-0521 DMB/CMB	

STRUCTURE INFORMATION			
STRUCTURE	TYPE	SPAN AND ROW	OVER
189-213-0521 DMB/DBL	CONTINUOUS COMPOSITE STEEL BEAM	SPAN: 2 @ 77' 0" SKIN: 7'0" TO 1' L1	SR 13
			STATION
			E STRUCTURE STA.768+68.30 TO

INDIANA DEPARTMENT OF TRANSPORTATION



BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET
ROUTE: I-69 AT: RP 214+45

DESIGNATION NO. 2500035 & 2500036 P.E.

NO ADDITIONAL RIGHT-OF-WAY
REQUIRED FOR THIS PROJECT

R/W

2500035 & 2500036 CONST.

Beam Repair on I-69 over SR 13
Located 1.9 Miles S of SR 38 in
Sections 21 & 22, T-18-N, R-6-E, Green Township, Madison County, Indiana



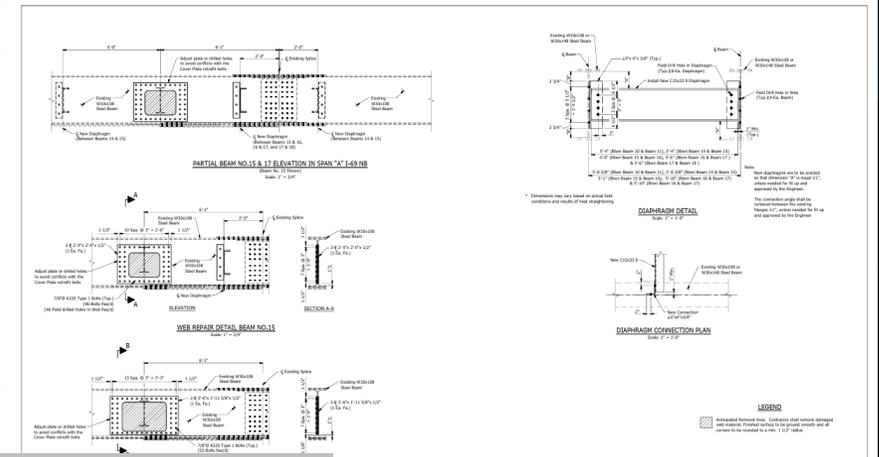
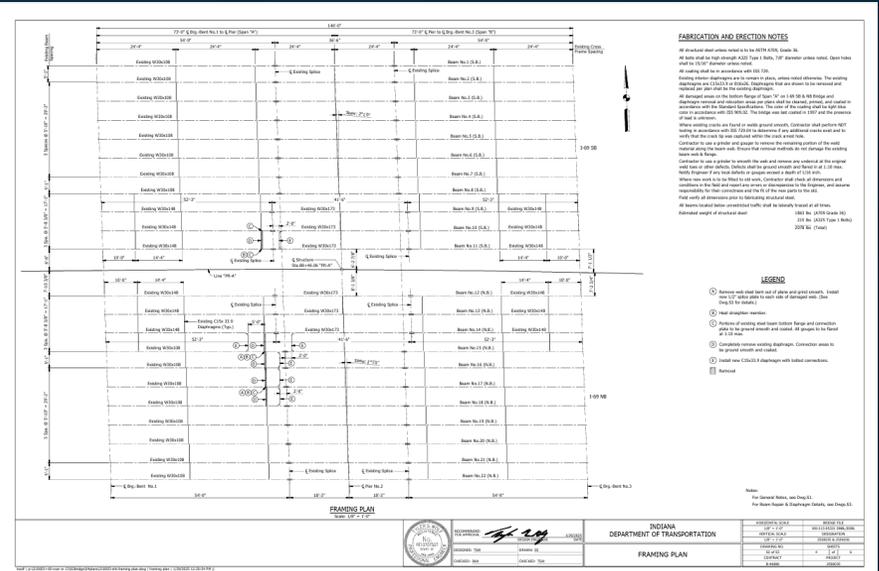
LOCATION MAP
SCALE: 1" = 2000'

TRAFFIC DATA	
A.A.D.T.	
A.A.D.T.	
PERCENT DISTRIBUTION	
TRUCKS	

DESIGN DATA	
DESIGN SPEED	
PROJECT DESIGN CATEGORY	
FUNCTIONAL CLASSIFICATION	
TERRAIN	
ACCESS CONTROL	



PROJECT LOCATION
MAD
LATITUDE: 39°59'42" N
BRIDGE LENGTH:
ROADWAY LENGTH:
TOTAL LENGTH:
MAX. GRADE:



INDIANA DEPARTMENT OF TRANSPORTATION		DESIGNATION	
250035		250036	
CONTRACT		BRIDGE FILE	
S-46596		MIP-213-0521 DMB/CMB	

BEAM REPAIR DETAILS			
SECTION	SCALE	DATE	BY
SECTION A-A	1/4" = 1'-0"	1/21/2025	...
SECTION B-B	1/4" = 1'-0"	1/21/2025	...



PLANS PREPARED BY: Egis USA, Inc. 8320 Craig Street Indianapolis, IN 46250 (317) 849-5832 www.egis.com

Onsite Pre-Bid Meeting

\\p1\010081140 over w 1522848p\4\m\210303-04\000.dwg | 1/21/2025 12:30:35 PM |

I69 over SR13 - Bridge Strike

Wednesday, January 29th, 2025

Home / NBI - 039050 / Rating - 83774

NBI: 039050 Bridge: I69-213-05321 CNBL

Rehab Designation	C
Deterioration Included	TRUE
DES	
SPMS Contract #	
Plans Available	TRUE
Shop Drawings Available	No
5.1 - LOADS AND LOAD RATING	
B.LR.01 - Design Load	HS20
B.LR.02 - Design Method	LFD
B.LR.03 - Load Rating Date	01/29/2025
B.LR.04 - Load Rating Method	LFR

NBI Number:	039050	Rating Method:	LFD
Bridge Number:	I69-213-05321 CNBL	Rating Program:	AASHTOWare BrR v.7.2.0.3001
DES Number:		Load Rater:	D. Bishop
Rating Type:	Deterioration	Reviewer(s):	D. Crampton, A. Werntz, J. Ko
Rating Date:	1/29/2025	Consultant:	Wiss, Janney, Elstner Associates, Inc.

Legal & Routine Permit Loads			
Number of Axles	Vehicle	Rating Factor	
2	EV2	1.494	
3	EV3	1.010	
varies	NRL	1.018	
2	H20-44	1.566	
2	Alternate Military	1.283	
3	HS20-44	1.008	
3	AASHTO Type 3	1.387	
4	SU4	1.255	
4	Toll Road Loading NO. 2		
5	AASHTO Type 3S2	1.317	
5	SUS	1.131	35.061
5	Toll Road Loading NO. 1		
6	AASHTO Type 3-3	1.394	55.760
6	Lane-Type		0.000
6	SU6	1.073	37.287
7	Special Toll Road Truck		
7 / 8	SU7	1.027	39.796
8	Michigan Train Truck NO. 5		
11	Michigan Train Truck NO. 8		

Additional Notes
This load rating is in response to impact damage on Beams 15 and 17 on January 24, 2025. See attached load rating comments for details. LFD methodology was used due to issues with BrR's calculation of lateral torsional buckling stresses. Legal ratings below represent traffic on either of the two right lanes. Permit ratings below represent permit traffic in the right lane only.

Special Permit Loads			
Number of Axles	Vehicle	Rating Factor	Load Capacity (tons)
11	Superload	0.890	114.810
13	Superload	0.926	123.621
14	Superload	0.758	132.650
19	Superload (305K)	0.918	139.995
19	Superload (480.09K)	0.778	186.755

5.2 - LOAD POSTING STATUS	
B.PS.01 - Load Posting Status	PR
B.PS.02 - Posting Status Change Date	01/24/2025

Load Rating for Restricted Travel



I69 over SR13 - Bridge Strike

Thursday, January 30th, 2025: Bid Documents available

Friday, January 31st, 2025: Emergency Letting

Wednesday, February 5th: Latest date for Notice to Proceed. Lane restrictions remain in place.

Friday, February 21st: Intermediate completion date for heat straightening on Beam 15 and other repairs to Beam 15 and Beam 17. Upon completion of these repairs the Contractor will notify the Engineer, who will review the repairs and authorize the removal of the left shoulder and left lane restriction on I69 NB. The permitted load restrictions will remain in place at this time.

Emergency Contract Timeline

I69 over SR13 - Bridge Strike

Friday, February 21st, 2025

 **Indiana Department of Transportation...**
Feb 13 · 🌐

2/21 UPDATE: All bridge beam repairs have been completed at I-69 over S.R. 13 in Madison County. All closures have been removed at this time. Beam painting will take place at a later date. ✅

2/13 UPDATE: Starting today, southbound lanes of S.R. 13 will close daily from 9 a.m. to 9 p.m., Monday through Saturday, at the I-69 overpass in Madison County. The closures will allow crews to safely complete bridge beam repairs following a crash last month. Repairs are expected to be complete by early March, weather permitting.

More information is here: <https://bit.ly/4hAmBpm>



DAILY CLOSURES ON SOUTHBOUND S.R. 13 AT I-69 OVERPASS

- STARTING THURS. 2/13, SOUTHBOUND LANES OF S.R. 13 CLOSED AT I-69 FROM 9 A.M. TO 9 P.M., MON. THROUGH SAT.
- CURRENT LANE & SHOULDER CLOSURES ON I-69 NB/SB REMAIN IN PLACE.

Remove Restriction

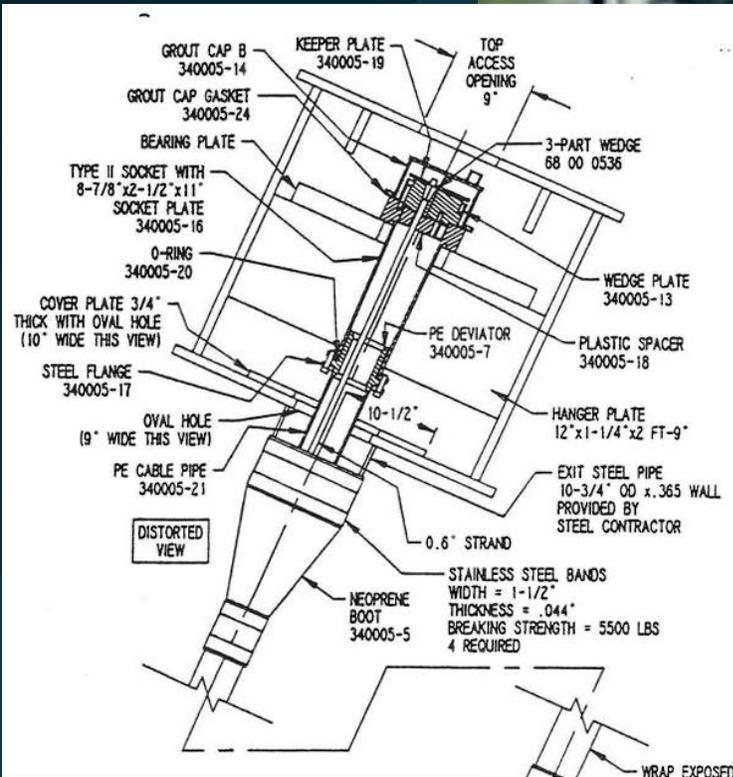
Friday, October 7th, 2022
165 Columbus Gateway Arch
deterioration

165 Columbus Gateway Arch - Deterioration



Asset 035520: 165-068-07910

165 Columbus Gateway Arch - Deterioration



“An estimate of somewhere between 5% to 15% section loss within the non-grouted portions of hanger cables 6E, 6W, 7E & 7W”

I65 Columbus Gateway Arch - Deterioration

Review existing load rating

Load rating date: 7/8/2020

Controlling Legal Load rating

SU7 = 1.00

Controlling member

Post Tensioned Deck

Not Hanger Cable

Check Hanger Cable Rating Factor

Controlling Legal Load Rating

SU7 = 1.12

Project: *INDOT Complex Load Rating Task 2004 I65-068-07910* **Michael Baker**
Task: *Hangers* Project No: *168460* INTERNATIONAL
Subject: *Results Summary*
Calculated By: *XW* Date: *7/8/2020* Checked By: *EWT* Date: *7/8/2020*
Results Summary

Vehicle	Rating Factor	Element	Member
H20-44	0.87	25	Southbound- TB6
HS20-44	0.87	25	Southbound- TB6
ALT. MILITARY LOADING	1.44	25	Southbound- TB6
H20 (TRUCK ONLY)	2.11	25	Southbound- TB6
H20 (LANE-TYPE)	1.81	25	Southbound- TB6
HS20 (TRUCK ONLY)	1.21	25	Southbound- TB6
HS20 (LANE-TYPE)	1.22	25	Southbound- TB6
ALT. MILITARY (TRUCK ONLY)	1.74	25	Southbound- TB6
ALT. MILITARY (LANE-TYPE)	1.59	25	Southbound- TB6
AASHTO Type 3 (25 tons)	1.78	25	Southbound- TB6
AASHTO Type 3-3 (40 tons)	1.22	25	Southbound- TB6
AASHTO Type 3S2 (36 tons)	1.29	25	Southbound- TB6
Lane-Type	1.23	25	Southbound- TB6
EV2 (TRUCK ONLY)	1.31	25	Southbound- TB6
EV2 (LANE-TYPE)	1.31	25	Southbound- TB6
EV3 (TRUCK ONLY)	1.17	25	Southbound- TB6
EV3 (LANE-TYPE)	1.18	25	Southbound- TB6
NRL	1.08	25	Southbound- TB6
SHV - SU4 (27 tons)	1.58	25	Southbound- TB6
SHV - SU5 (31 tons)	1.39	25	Southbound- TB6
SHV - SU6 (34.75 tons)	1.24	25	Southbound- TB6
SHV - SU7 (38.75 tons)	1.12	25	Southbound- TB6
SUPERLOAD - 11 AXLES	1.00	25	Southbound- TB6
SUPERLOAD - 13 AXLES	1.06	25	Southbound- TB6
SUPERLOAD - 14 AXLES	0.88	25	Southbound- TB6
SUPERLOAD - 19 AXLES(305K)	1.01	25	Southbound- TB6
SUPERLOAD - 19 AXLES(480K)	0.80	25	Southbound- TB6
HS20 OPR	1.13	25	Southbound- TB6

I65 Columbus Gateway Arch - Deterioration

- Immediate Action

- Create CARS Restriction limiting overweight permits to <200,000 lbs.

- Risk Assessment

- Restricting and or slowing travel to one lane on I65 is dangerous.

- Address commerce

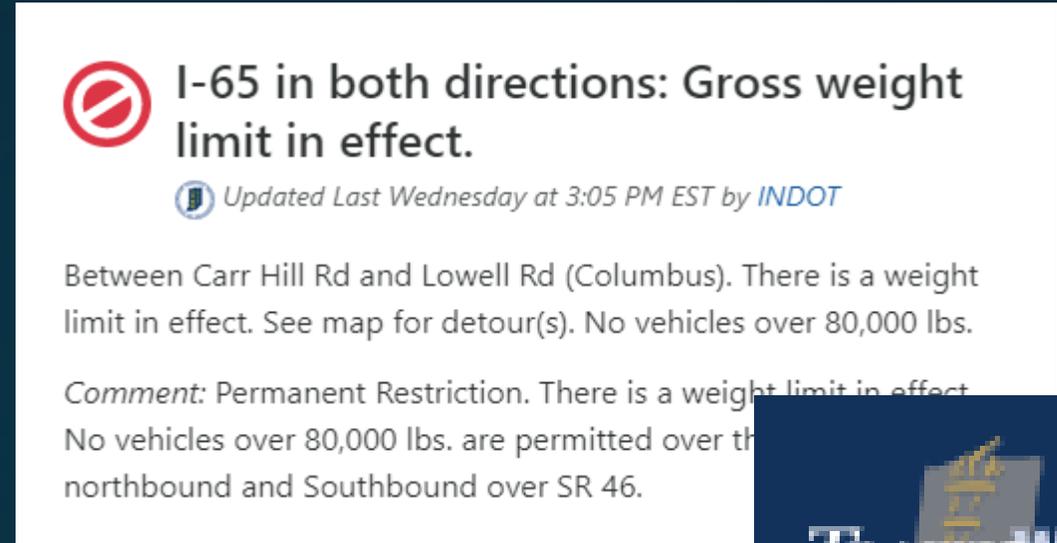
- Identify viable detour for overweight vehicles.
- Creating a CARS restriction, will cancel permits.

- Refine load rating model & evaluate options

- Determine if it is

measure/estimate section loss?

Immediate Action & Risk Assessment

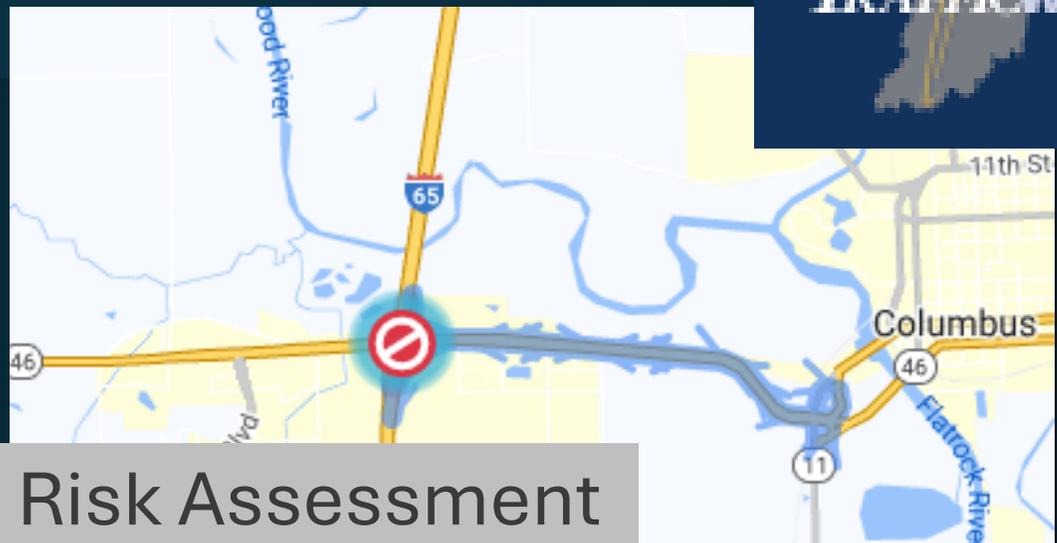


I-65 in both directions: Gross weight limit in effect.

Updated Last Wednesday at 3:05 PM EST by **INDOT**

Between Carr Hill Rd and Lowell Rd (Columbus). There is a weight limit in effect. See map for detour(s). No vehicles over 80,000 lbs.

Comment: Permanent Restriction. There is a weight limit in effect. No vehicles over 80,000 lbs. are permitted over the northbound and Southbound over SR 46.



how many overweight
permits (>80,000 lbs)
were cancelled on I65
when the CARS restriction
was created?

165 Columbus Gateway Arch - Deterioration

Hanger Summary (with TU_SH_CR)

	Vehicle	Member	2020 Original Pristine Rating Factor*	2022 Pristine Rating Factor	2022 with 2.5% SL Rating Factor	2022 with 5% SL Rating Factor	2022 with 7.5% SL Rating Factor	2022 with 10% SL Rating Factor	2022 with 12.5% SL Rating Factor	2022 with 15% SL Rating Factor
Design Trucks (3 loaded lanes)	H20-44	Southbound- TB6	0.87	0.78	0.72	0.65	0.59	0.52	0.46	0.39
	HS20-44	Southbound- TB6	0.87	0.78	0.72	0.65	0.59	0.52	0.46	0.39
	ALT. MILITARY LOADING	Southbound- TB6	1.44	1.28	1.18	1.07	0.97	0.86	0.75	0.65
Legal / Permit Trucks 2 Lanes, Striped, 6' Inside Shoulder	H20 (TRUCK ONLY)	Southbound- TB6	2.11	2.42	2.22	2.02	1.82	1.62	1.42	1.22
	H20 (LANE-TYPE)	Southbound- TB6	1.81	2.10	1.92	1.75	1.58	1.40	1.23	1.06
	HS20 (TRUCK ONLY)	Southbound- TB6	1.21	1.39	1.28	1.16	1.05	0.93	0.82	0.70
	HS20 (LANE-TYPE)	Southbound- TB6	1.22	1.42	1.30	1.18	1.07	0.95	0.83	0.72
	ALT. MILITARY (TRUCK ONLY)	Southbound- TB6	1.74	1.99	1.83	1.67	1.50	1.34	1.17	1.01
	ALT. MILITARY (LANE-TYPE)	Southbound- TB6	1.59	1.84	1.69	1.54	1.39	1.23	1.08	0.93
	AASHTO Type 3 (25 tons)	Southbound- TB6	1.78	2.05	1.88	1.71	1.54	1.38	1.21	1.04
	AASHTO Type 3-3 (40 tons)	Southbound- TB6	1.22	1.42	1.30	1.18	1.06	0.95	0.83	0.71
	AASHTO Type 3S2 (36 tons)	Southbound- TB6	1.29	1.50	1.38	1.25	1.13	1.01	0.88	0.76
	Lane-Type	Southbound- TB6	1.23	1.43	1.32	1.20	1.08	0.96	0.84	0.72
	EV2 (TRUCK ONLY)	Southbound- TB6	1.31	1.60	1.47	1.33	1.20	1.07	0.94	0.81
	EV2 (LANE-TYPE)	Southbound- TB6	1.31	1.58	1.45	1.32	1.19	1.06	0.93	0.80
	EV3 (TRUCK ONLY)	Southbound- TB6	1.17	1.33	1.22	1.11	1.00	0.89	0.78	0.67
	EV3 (LANE-TYPE)	Southbound- TB6	1.18	1.37	1.25	1.14	1.03	0.92	0.80	0.69
	NRL	Southbound- TB6	1.08	1.24	1.14	1.04	0.93	0.83	0.73	0.63
	SHV - SU4 (27 tons)	Southbound- TB6	1.58	1.82	1.67	1.52	1.37	1.22	1.07	0.92
	SHV - SU5 (31 tons)	Southbound- TB6	1.39	1.60	1.47	1.34	1.20	1.07	0.94	0.81
	SHV - SU6 (34.75 tons)	Southbound- TB6	1.24	1.43	1.31	1.19	1.08	0.96	0.84	0.72
	SHV - SU7 (38.75 tons)	Southbound- TB6	1.12	1.29	1.18	1.08	0.97	0.86	0.76	0.65
	SUPERLOAD - 11 AXLES	Southbound- TB6	1.06	1.03	0.95	0.86	0.78	0.69	0.61	0.52
	SUPERLOAD - 13 AXLES	Southbound- TB6	1.06	1.03	0.94	0.86	0.77	0.69	0.60	0.52
SUPERLOAD - 14 AXLES	Southbound- TB6	0.88	0.86	0.79	0.72	0.65	0.58	0.50	0.43	
SUPERLOAD - 19 AXLES(305K)	Southbound- TB6	1.01	0.98	0.90	0.82	0.74	0.66	0.57	0.49	
SUPERLOAD - 19 AXLES(480K)	Southbound- TB6	0.80	0.78	0.71	0.65	0.59	0.52	0.46	0.39	

LRFR legal ratings would require posting starting at 7.5% hanger section loss.

165 Columbus Gateway Arch - Deterioration

Allowable Stress

$$RF = \frac{C - A_1 D}{A_2 L(1 + I)} \quad (6B.4.1-1)$$

6B.4.2—Allowable Stress

For the allowable stress method, $A_1 = 1.0$ and $A_2 = 1.0$ in the general rating equation.

The capacity, C , depends on the rating level desired, with the higher value for C used for the Operating level. The determination of the nominal capacity of a member is discussed in Article 6B.5.2.

$$\text{Hanger Capacity} = A_{\text{strand}} N_{\text{strand}} \quad (45\% \text{ GUTS})$$

(GUTS = Guaranteed Ultimate Tensile Strength)

Load and Resistance Factor Rating

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)} \quad (6A.4.2.1-1)$$

Table 6A.4.2.4-1—System Factor: ϕ_s for Flexural and Axial Effects

Floorbeams with Spacing >12 ft and Noncontinuous Stringers	0.85
--	------

Table 6A.4.2.3-1—Condition Factor: ϕ_c

Structural Condition of Member	ϕ_c
Good or Satisfactory	1.00
Fair	0.95
Poor	0.85

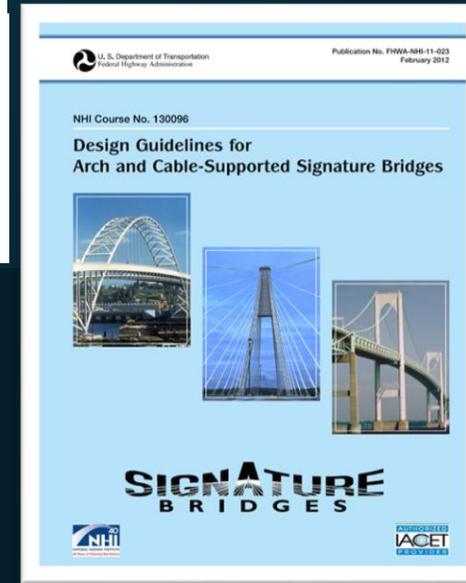
NHI Course No 130096

24.3 Resistance Factor

Resistance factors shall be as follows:

Strength A – Axial only

$$\phi = 0.65$$



$$\text{Hanger Capacity} = \phi_R \phi_C \phi_S A_{\text{strand}} N_{\text{strand}}$$

165 Columbus Gateway Arch - Deterioration

Allowable Stress

15.00% Section Loss					
			γ_{DW}	$\phi_{Pr} =$	330.18
			1.25	$P_a =$	268.93
MBI LRFR	Safe Posting Load (Tons)	Service LL+HM	LRFR RF (Measured Overlay)	Allowable Stress RF	C/D
1.26	--	40	1.33	1.67	2.47
1.11	--	46	1.17	1.47	2.41
0.73	22	69	0.77	0.96	2.20
0.75	23	68	0.79	0.99	2.22
1.04	--	49	1.10	1.37	2.38
0.97	22	52	1.03	1.28	2.35
1.07	--	47	1.13	1.41	2.40
0.75	25	68	0.79	0.99	2.22
0.80	25	63	0.85	1.06	2.25
0.77	26	66	0.81	1.02	2.23
0.84	23	60	0.89	1.11	2.28
0.83	23	61	0.88	1.10	2.27
0.70	23	72	0.74	0.93	2.18
0.72	23	70	0.76	0.95	2.19
0.95	25	53	1.00	1.26	2.34
0.84	23	60	0.89	1.11	2.28
0.75	22	68	0.79	0.99	2.22
0.67	20	76	0.71	0.89	2.15
0.55	92,143				
0.55	95,357				
0.46	80,000				
0.52	95,857				
0.42	82,301				

ASR legal ratings would require posting starting at 15% hanger section loss.

Load and Resistance Factor Rating

10.00% Section Loss					
			γ_{DW}	$\phi_{Pr} =$	349.61
			1.25	$P_a =$	284.75
MBI LRFR	Safe Posting Load (Tons)	Service LL+HM	LRFR RF (Measured Overlay)	Allowable Stress RF	C/D
1.67	--	38	1.75	2.16	2.63
1.47	--	44	1.54	1.90	2.58
0.97	34	66	1.01	1.25	2.36
1.00	--	64	1.05	1.29	2.38
1.38	--	46	1.44	1.78	2.55
1.29	--	50	1.35	1.67	2.51
1.43	--	45	1.50	1.85	2.56
1.00	--	64	1.05	1.29	2.38
1.06	--	60	1.11	1.37	2.41
1.02	--	63	1.07	1.32	2.39
1.11	39	58	1.16	1.43	2.44
1.10	39	58	1.15	1.42	2.43
0.92	39	70	0.96	1.19	2.33
0.95	39	67	0.99	1.23	2.35
1.26	--	51	1.32	1.63	2.50
1.11	--	58	1.16	1.43	2.44
0.99	34	65	1.04	1.28	2.37
0.90	33	71	0.94	1.16	2.32
0.73	158,486				
0.73	164,014				
0.61	155,000				
0.69	169,929				
0.55	171,461				

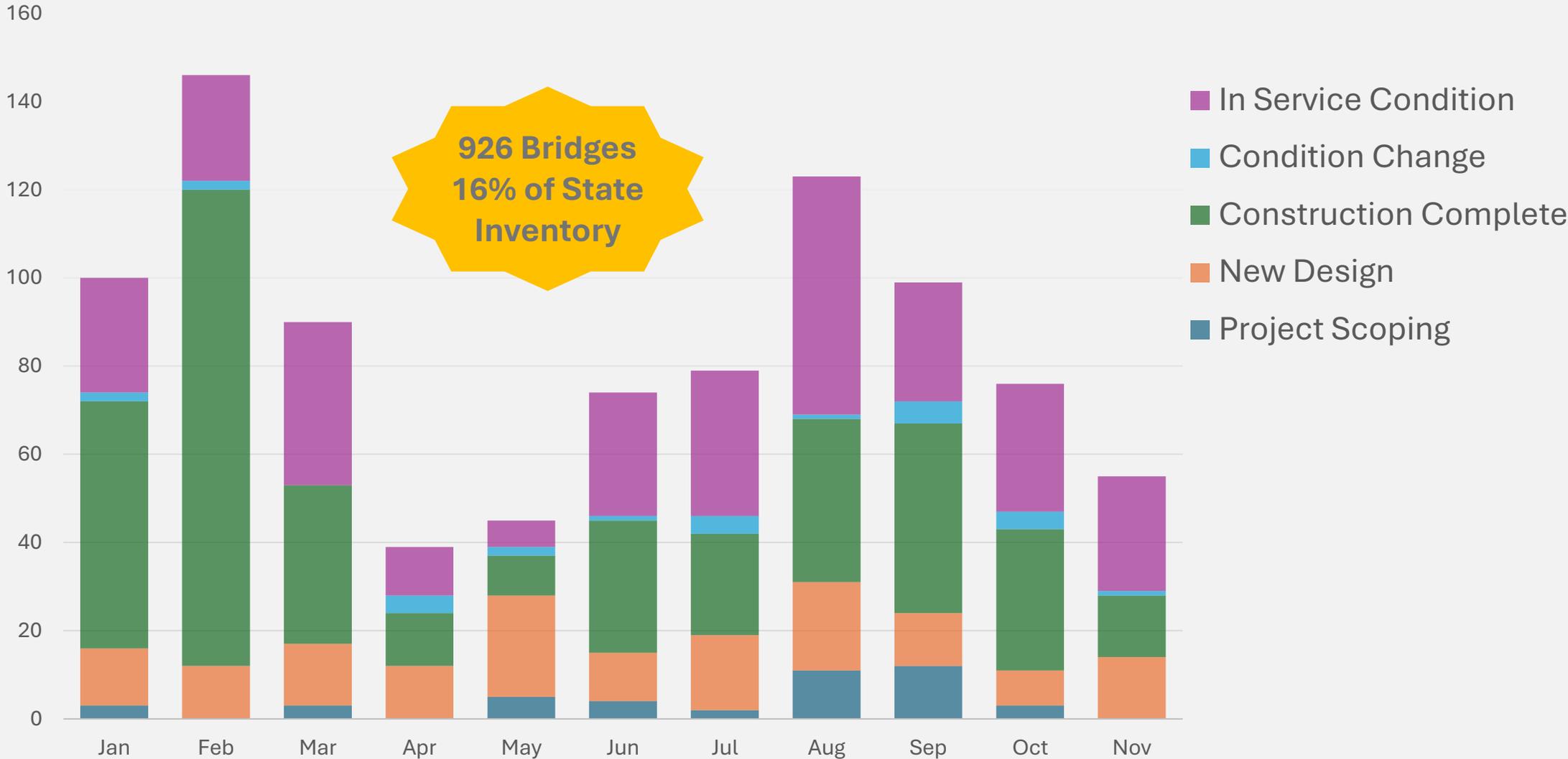
LRFR legal ratings would require posting starting at 10% hanger section loss.

I65 Columbus Gateway Arch - Deterioration

- Finalize LRFR Load Ratings
 - Assumptions
 - Hanger Section Loss = 10%
 - Cable Resistance Factor, $\phi_R = 0.65$
 - Dynamic Load Allowance, $IM = 20\%$,
INDOT Bridge Inspection confirmation of smoothness, minor surface deviations or depressions, MBE Table C6A.4.43-1
 - Wearing surface, $\gamma_{DW} = 1.25$,
Thickness is field measured, MBE 6A.2.2.3
 - Consider striping with traffic shifted to median
 - 2 - 12 ft lanes
 - 2 ft inside shoulder
- Design & construct temporary shoring tower under the structure along SR46.
- Design & construct temporary hanger support system adjacent to the existing cables.
- Remove CARS Restrictions following temporary hanger support construction



2024 LOAD RATING WORKLOAD



analyze routine
and special permit
loads for each
bridge



3

Analyze Routine and Special Permit Loads



Code of Federal Regulations

A point in time eCFR system



 Title 23

- (3) Analyze routine and special permit loads for each bridge that these loads cross to verify the bridge can safely carry the load.

how many oversize
overweight vehicles are
permitted to travel on the
state system each day?

Analyze Routine and Special Permit Loads

**~1,600
permits
per day**

Projects with GVW > 80,000 lbs are evaluated.

GVW < 200,000 lbs (~400,000 annually)

- Automated routing & approval
- Considers width, height and bridge load rating limitations

GVW ≥ 200,000 lbs (~1,200 annually)

- Automated routing considers width and height
- Permit Engineer performs manual review of Bridge Study
 - List of all crossed bridges
 - Permit rating factors & corresponding travel restrictions



**INDIANA
STATE
POLICE**

APPLICATIONS USED BY INDOT



ORACLE

Database Services



Load Rating



iTAMS

powered by BeyondAsset

Asset Inventory
Inspection



deighton

Optimization



esri™

Geospatial
Information System

castle
rock.

Road Conditions

PROMILES™

Oversize Overweight
Permitting

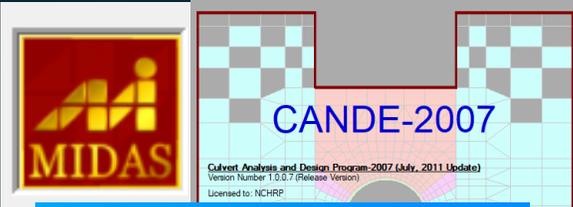
APPLICATIONS INFORM PERMITTING

INDOT Bridge Rating Application Database of Indiana



iTAMS

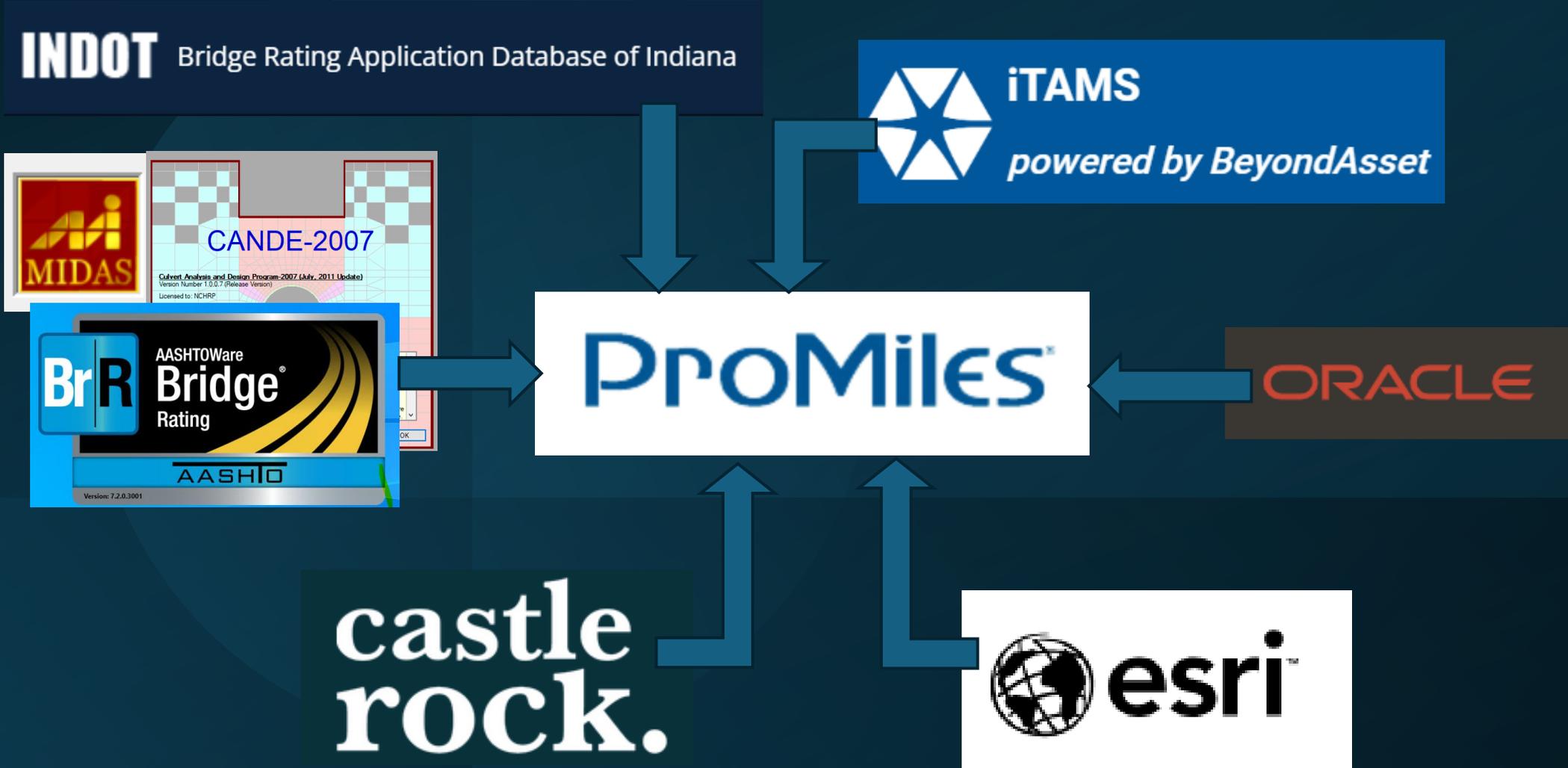
powered by BeyondAsset

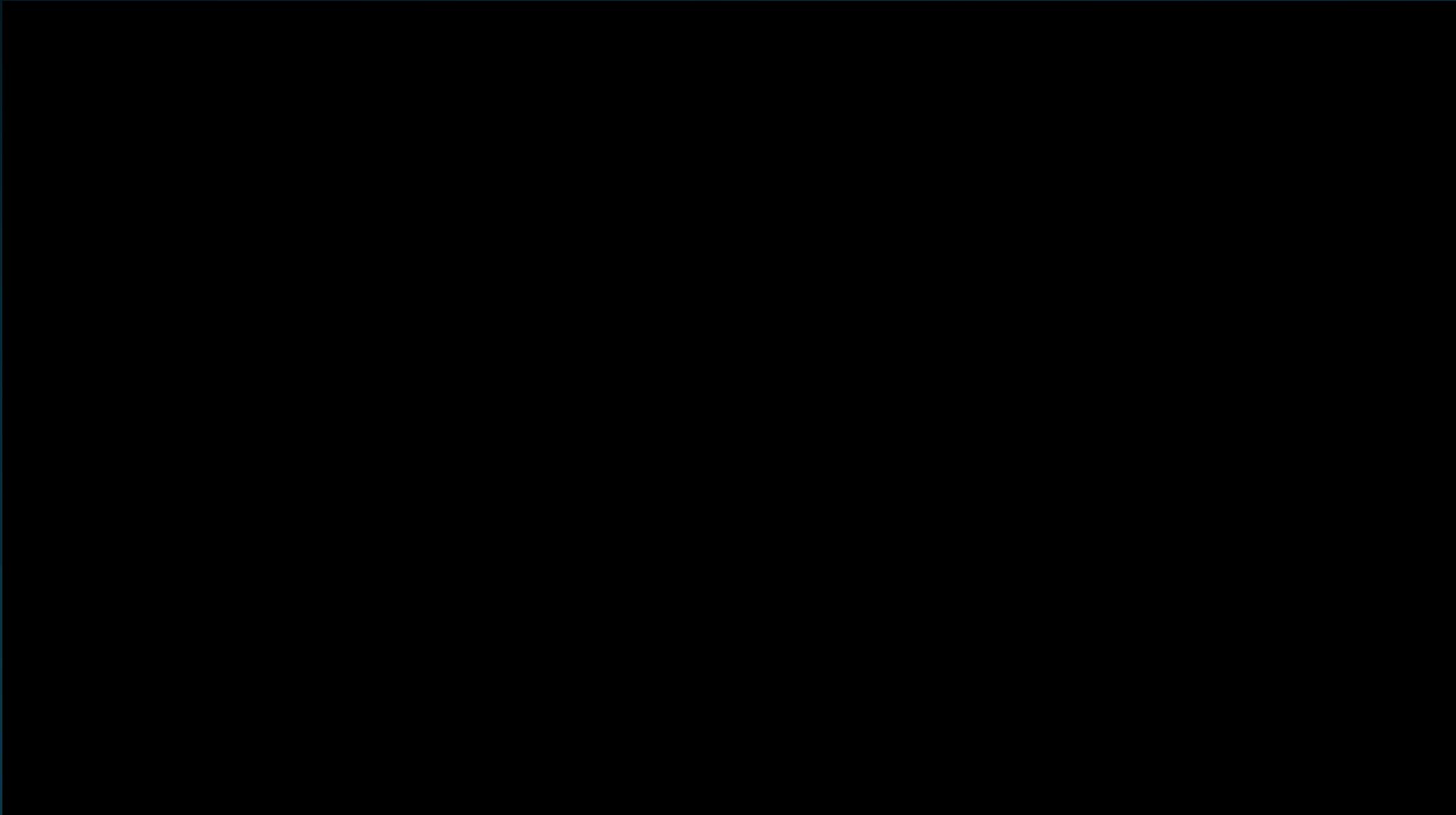


PROMILES™

ORACLE

**castle
rock.**



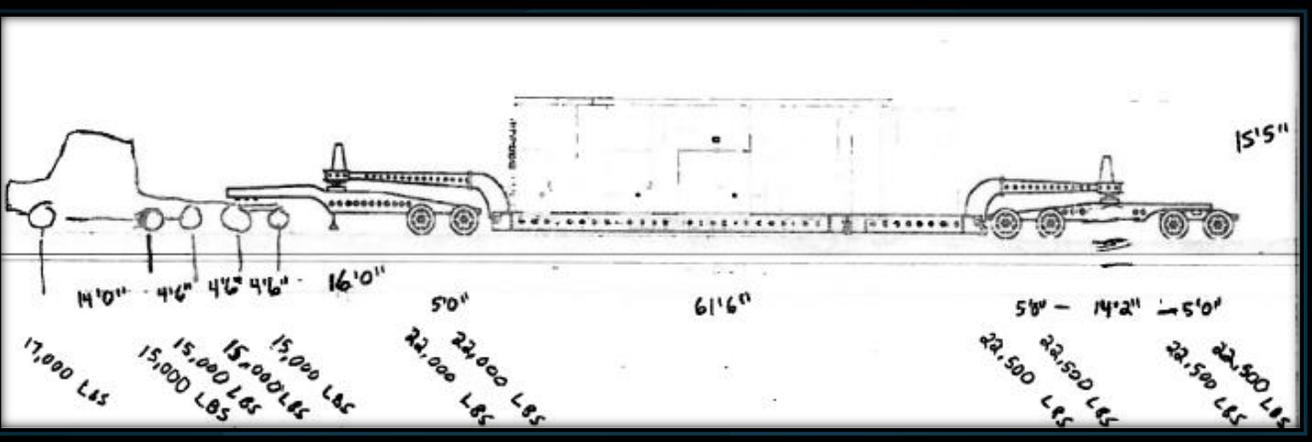
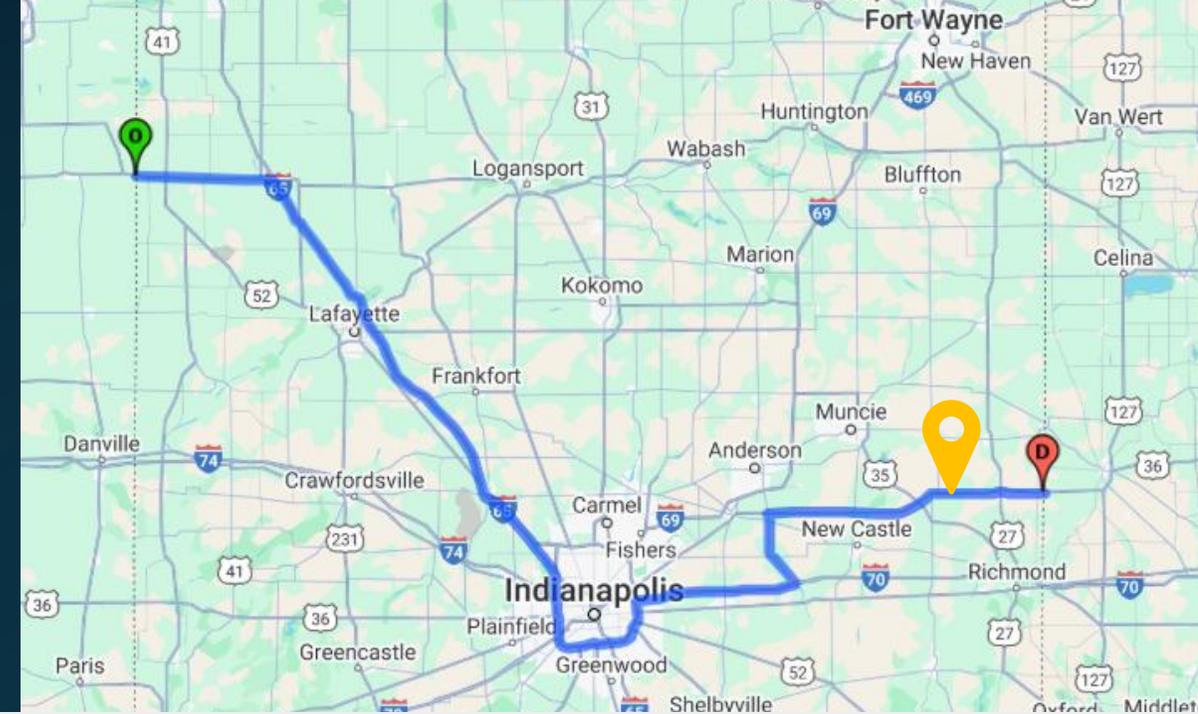


2024 Overweight Permit Manual Review GVW > 200,000 lbs.



Friday, October 11th, 2025
oversize overweight permit review
out of date bridge model

Overweight Manual Bridge Study Review (GVW = 211,000 lbs)



Bridge ID	(66C)Tons	Yr	Yr Recon	Span Len	Strc Len	Deck	Wear	Super	Sub	Culv	List	Status
036-68-03477 B		1941	1982	28	71.2	4	4	4	5	N		Pass with Restriction
NBI: 11800												

	Bridge Ratings					Printed Bridge Comments
Rating	1.815411	1.935468	1.935468	2.07253	2.414497	
Impact	1	0.75	0.75	0.5	0	
Single Lane	false	false	true	true	true	

Traffic Restriction / 5 mph

Due to poor Conditions; Traffic restriction 5 mph recommended.

Overweight Manual Bridge Study Review (GVW = 211,000 lbs)



# Inventory				
Assets	Contact(s)	Asset Name	Asset Number	Asset Category
Elements	Greenfield	036-68-03477 B	011800	Bridge



Inspection, April 19, 2024



(59) Superstructure:
● 4. Poor Condition (advanced deterioration)

(59A) Superstructure Comments:

Continuous Reinforced Concrete Slab: longitudinal cracks & efflorescence - fairly heavy in SW corner; map cracking & spalling with fairly heavy efflorescence at end bents; area of map cracking with efflorescence in Span B under WBL; large delaminations near construction joint at centerline of all spans - spalling with rebar exposed in Span B (2' x span length) & 2'x 8' in Span C; very heavy, deep scaling with rebar exposed - NW & NE corners; span A - 4'x 6' spalled area with rebar exposed & minor section loss at abandoned drain in NE corner; spalls with rebar exposed typical below drain holes in barrier; poor quality reconstructed areas in scattered locations.

Traffic Restriction / 5 mph



(58) Deck:
9. Excellent Condition

(59) Superstructure:
9. Excellent Condition

(58.01) Wearing Surface:
9. Excellent Condition

(58.04) Bridge Joints:
N. ONLY to remove other value that is no longer present.



how many vehicles were
permitted to cross this
bridge between May 23rd
and October 28th, 2024?

questions?

thank you

Jennifer Hart

INDOT Bridge Evaluation

loadrating@indot.in.gov