Load Rating Requirements and Forms

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TxDOT Bridge Division

January 17, 2023

Table of contents

What is a Load Rating?

- It is a measure of the bridge live load capacity
  - Two common Categories defined by AASHTO Manual for Bridge Evaluation
    - Inventory Rating
    - Operating Rating

Ting, E. (2019, May 25). *32 years ago, 300,000 people flattened the Golden Gate Bridge. SFGate.* https://www.sfgate.com/local-donotuse/article/Golden-Gate-bridge-walk-1987-anniversary-disaster-13896571.php#photo-17549621/

What is a Load Rating?

- Inventory Rating
  - A live load that can safely utilize the bridge
  - May be placed in multiple lanes
  - Can safely use the bridge for an indefinite period without impacting the life of the structure

The_Other_Guy. (2021, October 24. *Tractor Trailer carrying a toy truck* [Online Forum Post]. Reddit. https://www.reddit.com/r/funny/comments/qesmfm/tractor_trailer_carrying_a_toy_truck/

What is a Load Rating?

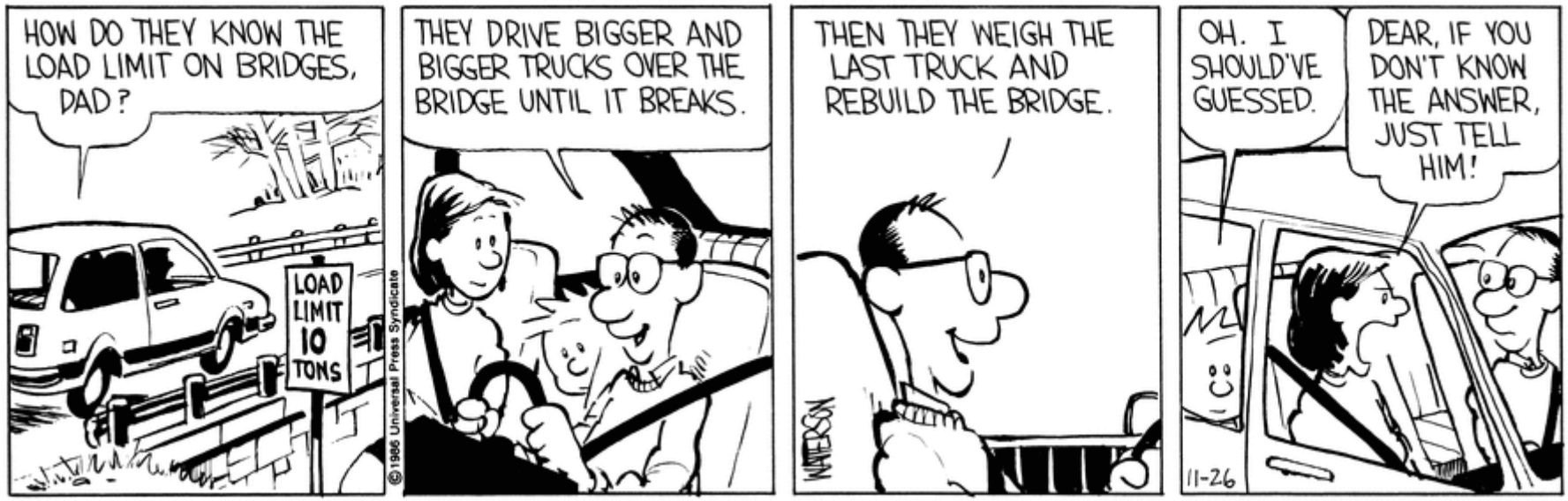
- Operating Rating

eSPeeScotty. (2011, August 18). *285 Ton Oversize Load Causes The Roosevelt Lake Bridge To Flex Under The Load 8-16-11* [Video]. YouTube. https://www.youtube.com/watch?v=K4VSfzBqbXM

- A maximum live load that can be placed on the bridge safely
- May also include the same load in multiple lanes
- Indefinite use would reduce the life of the bridge

Klco, A. (2020, September 15). *Pros and Cons of Driving a Wide Load Truck*. Drive My Way. https://www.drivemyway.com/blog/pros-and-cons-of-driving-a-wide-load-truck/

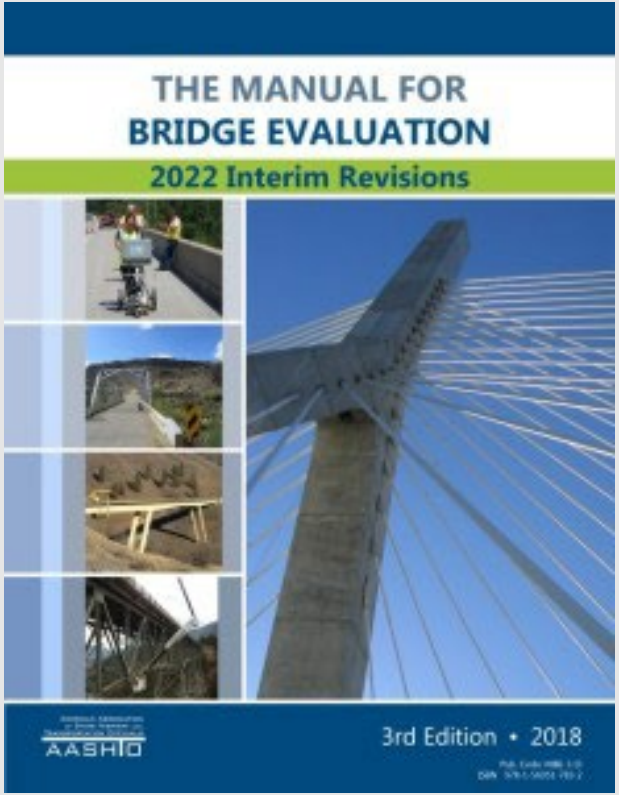
How do we Load Rate a bridge?



Watterson, B. (Artist) (1986, November 26). *Bridge Capacity*. Calvin and Hobbes Collection. Retrieved from https://www.gocomics.com/calvinandhobbes/1986/11/26

How do we Load Rate a bridge?

- TxDOT Load Rating requirements for NEW bridges:
  - Bridge Design Manual – LRFD (BDM – LRFD), issued January 2023
    - Available on TxDOT Bridge Publications Soon
  - Chapter 5, Section 7 outlines requirements
    - Load Rate in Accordance with AASHTO Manual for Bridge Evaluation (MBE) with current interims
      - Use the Load and Resistance Factor Rating (LRFR) method as outlined in in Chapter 6 Part A



How do we Load Rate a bridge?

- Live Load is per AASHTO LRFD Bridge Design Specifications, 9th Edition (2020)
  - Use HL-93 per Section 3.6.1.2 unless a special vehicle is specified or warranted
  - Use Fatigue Loading per Section 3.6.1.4

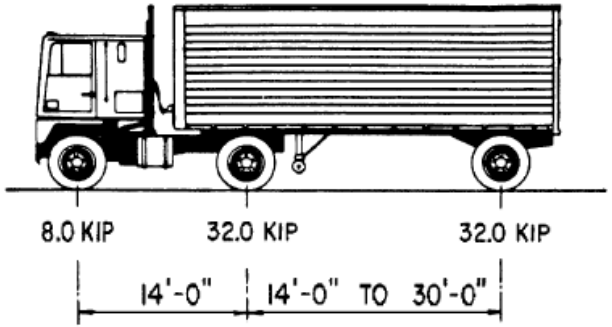


Figure 3.6.1.2.2-1—Characteristics of the Design Truck

How do we Load Rate a bridge?

- Use the BDM – LRFD Table 5-1 in lieu of MBE Table 6A.4.2.2-1

Table 5-1: TxDOT Limit States and Load Factors for Load Rating New Designs (Replaces MBE Table 6A.4.2.2-1)

Bridge Type	Limit State	Dead Load (1)		Design Live Load	
				Inventory	Operating
		γDC	γDW	γLL	γLL
Prestressed Concrete	Strength I	1.25	1.50	1.75	1.35
	Service III	1.00	1.00	0.80	N/A
Structural Steel	Strength I	1.25	1.50	1.75	1.35
	Service II	1.00	1.00	1.30	1.00
	Fatigue (2)	0.00	0.00	0.80	N/A
Reinforced Concrete (3)	Strength I	1.25	1.50	1.75	1.35
Post Tensioned Concrete (4)	Strength I	1.25 max, 0.9 min	1.50 max, 0.65 min	1.75	1.35
	Service I (5)	1.00	1.00	1.00	N/A
	Service III	1.00	1.00	0.80	N/A

(1) For most new structures, no dead load for wearing surface is employed in design and accounting for added future wearing surface is not required. Also, note that the entire concrete deck thickness is to be included in the DC load effects and the resisting capacity (include panels, no sacrificial thickness assumed).
(2) Only evaluate the fatigue limit state for fracture critical structures.
(3) Superstructure (eg. non-standard reinforced concrete slab or slab and girder (pan form spans)) and substructure (interior bent caps). Do not load rate bridge decks supported by girders, except where noted.
(4) Include the effects of creep, shrinkage, secondary effects (due to prestress/post-tensioning), uniform temperature change, and temperature gradient as indicated in Table 2.
(5) Applies to post-tensioned straddle bents and transverse analysis of post-tensioned concrete bridge decks.

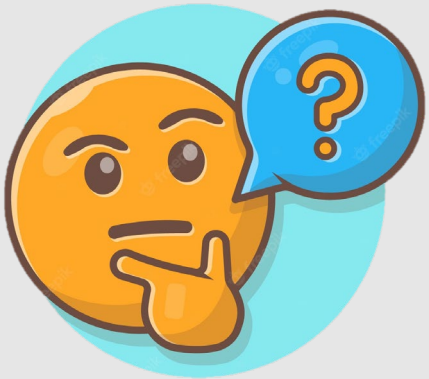
How do we Load Rate a bridge?

- What elements are required to be load rated?

Structure Type	Service Flexure	Ultimate Flexure	Ultimate Shear	Fatigue
Prestressed Beams & Girders	✓	✓	✓	
Steel Girders	✓	✓	✓	
Fracture Critical Steel Girders	✓	✓	✓	✓
Post-Tensioned Concrete Superstructure	✓	✓	✓	
Reinforced Concrete Superstructure		✓	✓	

How do we Load Rate a Bridge?

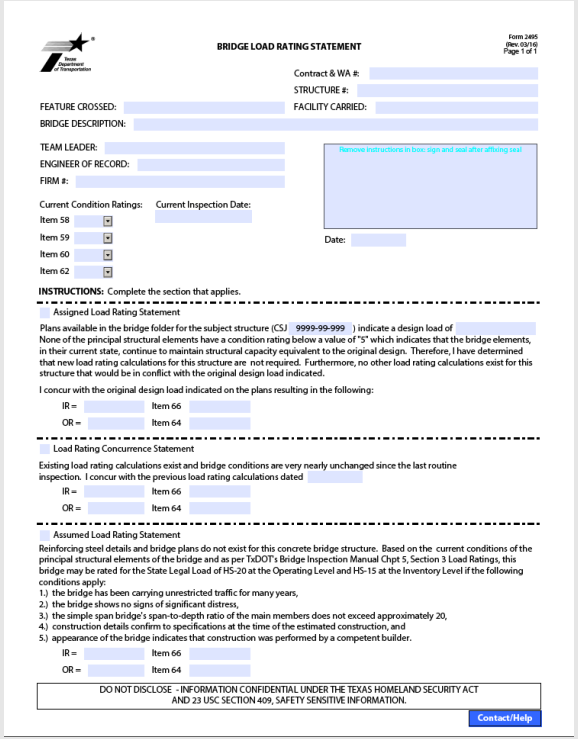
- Additional elements that may need load ratings but aren't required unless directed by TxDOT or where it may control:
  - Reinforced Concrete Bent Caps
  - Reinforced Concrete Inverted Tee Bent Caps
  - Post-Tensioned Bent Caps
  - Steel Bent Caps



Contact Bridge Division for guidance on unique structures or elements not addressed in the BDM - LRFD

Documentation of Load Rating – Form 2731 for New Bridges

Existing Bridges – Form 2495



BRIDGE LOAD RATING STATEMENT

Form 2495 (Rev. 03/16) Page 1 of 1

Contract & WA #:
STRUCTURE #:
FEATURE CROSSED:
FACILITY CARRIED:
BRIDGE DESCRIPTION:

TEAM LEADER:
ENGINEER OF RECORD:
FIRM #:

Remove instructions in box: sign and seal after affixing seal

Current Condition Ratings: Current Inspection Date:
Item 58
Item 59
Item 60
Item 62

Date:

INSTRUCTIONS: Complete the section that applies.

Assigned Load Rating Statement

Plans available in the bridge folder for the subject structure (CSJ 9999-99-999) indicate a design load of
None of the principal structural elements have a condition rating below a value of "5" which indicates that the bridge elements, in their current state, continue to maintain structural capacity equivalent to the original design. Therefore, I have determined that new load rating calculations for this structure are not required. Furthermore, no other load rating calculations exist for this structure that would be in conflict with the original design load indicated.

I concur with the original design load indicated on the plans resulting in the following:

IR = Item 66
OR = Item 64

Load Rating Concurrence Statement

Existing load rating calculations exist and bridge conditions are very nearly unchanged since the last routine inspection. I concur with the previous load rating calculations dated

IR = Item 66
OR = Item 64

Assumed Load Rating Statement

Reinforcing steel details and bridge plans do not exist for this concrete bridge structure. Based on the current conditions of the principal structural elements of the bridge and as per TxDOT's Bridge Inspection Manual Chpt 5, Section 3 Load Ratings, this bridge may be rated for the State Legal Load of HS-20 at the Operating Level and HS-15 at the Inventory Level if the following conditions apply:

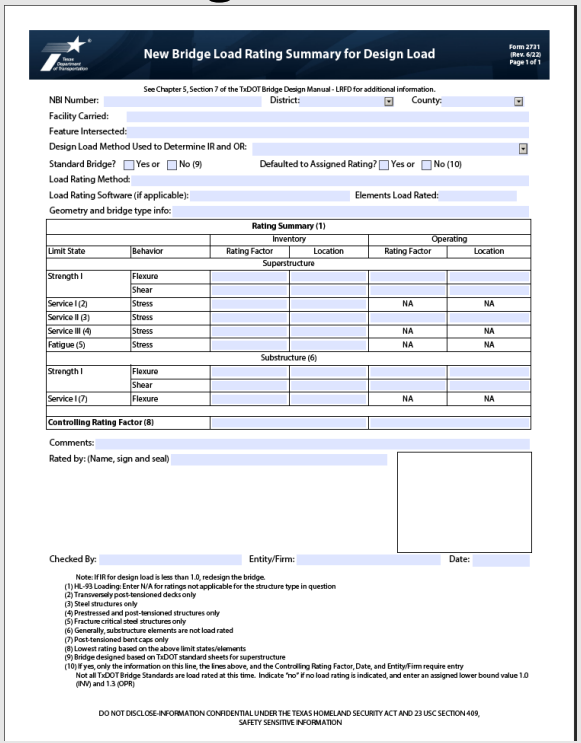
1.) the bridge has been carrying unrestricted traffic for many years,
2.) the bridge shows no signs of significant distress,
3.) the simple span bridge's span-to-depth ratio of the main members does not exceed approximately 20,
4.) construction details confirm to specifications at the time of the estimated construction, and
5.) appearance of the bridge indicates that construction was performed by a competent builder.

IR = Item 66
OR = Item 64

DO NOT DISCLOSE - INFORMATION CONFIDENTIAL UNDER THE TEXAS HOMELAND SECURITY ACT AND 23 USC SECTION 409, SAFETY SENSITIVE INFORMATION.

Contact/Help

New Bridges – Form 2731



New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: District: County:
Facility Carried:
Feature Intersected:
Design Load Method Used to Determine IR and OR:
Standard Bridge? Yes or No (9) Defaulted to Assigned Rating? Yes or No (10)
Load Rating Method:
Load Rating Software (if applicable): Elements Load Rated:
Geometry and bridge type info:

Rating Summary (1)

		Inventory		Operating	
Limit State	Behavior	Rating Factor	Location	Rating Factor	Location
Superstructure					
Strength I	Flexure				
	Shear				
Service I (2)	Stress			NA	NA
Service II (3)	Stress				
Service III (4)	Stress			NA	NA
Fatigue (5)	Stress			NA	NA
Substructure (6)					
Strength I	Flexure				
	Shear				
Service I (7)	Flexure			NA	NA
Controlling Rating Factor (8)					

Comments:
Rated by: (Name, sign and seal)

Checked By: Entity/Firm: Date:

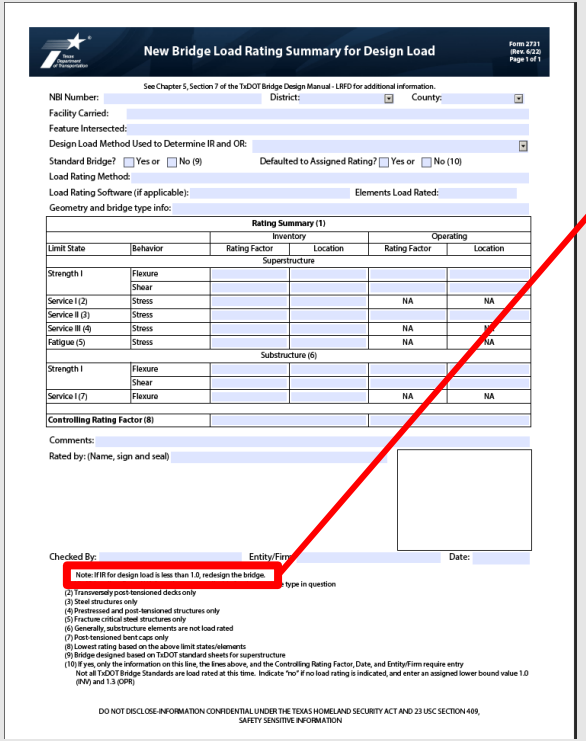
Note: If IR for design load is less than 1.0, redesign the bridge.
(1) HL-93 Loading: Enter N/A for ratings not applicable for the structure type in question
(2) Transversely post-tensioned decks only
(3) Steel structures only
(4) Prestressed and post-tensioned structures only
(5) Fracture critical steel structures only
(6) Generally, substructure elements are not load rated
(7) Post-tensioned bent caps only
(8) Lowest rating based on the above limit states/elements
(9) Bridge designed based on TxDOT standard sheets for superstructure
(10) If yes, only the information on this line, the lines above, and the Controlling Rating Factor, Date, and Entity/Firm require entry
Not all TxDOT Bridge Standards are load rated at this time. Indicate "no" if no load rating is indicated, and enter an assigned lower bound value 1.0 (INV) and 1.3 (OPR)

DO NOT DISCLOSE-INFORMATION CONFIDENTIAL UNDER THE TEXAS HOMELAND SECURITY ACT AND 23 USC SECTION 409, SAFETY SENSITIVE INFORMATION

Form 2731 is available on TxDOT Bridge Publications here

Documentation of Load Rating – Form 2731 for New Bridges

Important note regarding load ratings for new bridges:



New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: District: County:

Facility Carried:

Feature Intersected:

Design Load Method Used to Determine IR and OR:

Standard Bridge? Yes or No (9) Defaulted to Assigned Rating? Yes or No (10)

Load Rating Method:

Load Rating Software (if applicable): Elements Load Rated:

Geometry and bridge type info:

Rating Summary (1)

		Inventory		Operating	
Limit State	Behavior	Rating Factor	Location	Rating Factor	Location
Superstructure					
Strength I	Flexure				
	Shear				
Service I (2)	Stress			NA	NA
Service II (3)	Stress				
Service III (4)	Stress			NA	NA
Fatigue (5)	Stress			NA	NA
Substructure (6)					
Strength I	Flexure				
	Shear				
Service I (7)	Flexure			NA	NA
Controlling Rating Factor (8)					

Comments:

Rated by: (Name, sign and seal)

Checked By: Entity/Firm: Date:

Note: If IR for design load is less than 1.0, redesign the bridge.

type in question

(2) Transversely post-tensioned decks only
(3) Steel structures only
(4) Prestressed and post-tensioned structures only
(5) Fracture critical steel structures only
(6) Generally, substructure elements are not load rated
(7) Post-tensioned bent caps only
(8) Lowest rating based on the above limit states/elements
(9) Bridge designed based on TxDOT standard sheets for superstructure
(10) If yes, only the information on this line, the lines above, and the Controlling Rating Factor, Date, and Entity/Firm require entry
Not all TxDOT Bridge Standards are load rated at this time. Indicate "no" if no load rating is indicated, and enter an assigned lower bound value 1.0 (INV) and 1.3 (OPR)

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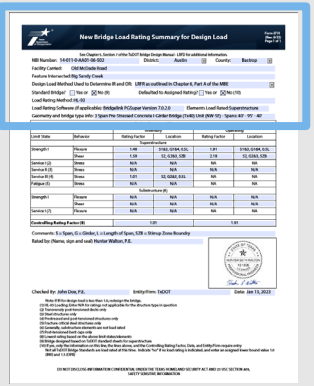
Note: If IR for design load is less than 1.0, redesign the bridge.

Documentation of Load Rating – Form 2731 for New Bridges



Form 2731

Texas Department of Transportation

New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☐ Yes or ☒ No (9) Defaulted to Assigned Rating? ☐ Yes or ☒ No (10)

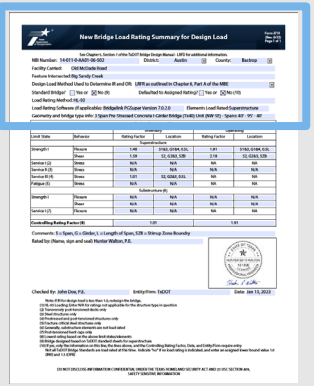
Load Rating Method: HL-93

Load Rating Software (if applicable): Bridgelink PGSuper Version 7.0.2.0 Elements Load Rated: Superstructure

Geometry and bridge type info: 3 Span Pre-Stressed Concrete I-Girder Bridge (Tx40) Unit (NW-SE) - Spans: 40' - 95' - 40'

Top of form is the identifying information for the bridge

Documentation of Load Rating – Form 2731 for New Bridges



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New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☐ Yes or ☒ No (9) Defaulted to Assigned Rating? ☐ Yes or ☒ No (10)

Load Rating Method: HL-93

Load Rating Software (if applicable): Bridgelink PGSuper Version 7.0.2.0 Elements Load Rated: Superstructure

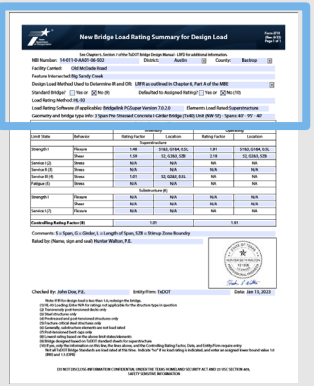
Geometry and bridge type info: 3 Span Pre-Stressed Concrete I-Girder Bridge (Tx40) Unit (NW-SE) - Spans: 40' - 95' - 40'

Only one option for new bridges – Load and Resistance Factor Rating

~~Load Factor~~

~~Allowable Stress~~

Documentation of Load Rating – Form 2731 for New Bridges



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New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☒ Yes or ☐ No (9) Defaulted to Assigned Rating? ☒ Yes or ☐ No (10)

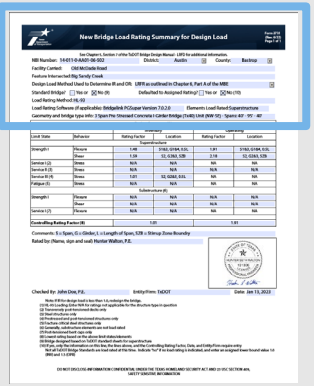
Load Rating Method:

Load Rating Software (if applicable): Elements Load Rated:

Geometry and bridge type info:

If a Standard Bridge AND the Standard has been Load Rated, check Yes on both and leave the next three lines blank

Documentation of Load Rating – Form 2731 for New Bridges



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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☒ Yes or ☐ No (9) Defaulted to Assigned Rating? ☐ Yes or ☒ No (10)

Load Rating Method:

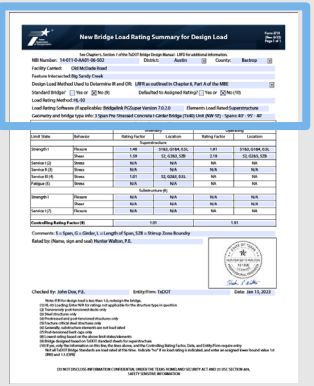
Load Rating Software (if applicable): Elements Load Rated:

Geometry and bridge type info:

If a Standard Bridge BUT the standard has not been Load Rated, check Yes on Standard Bridge and No on Defaulted to Assigned Rating and leave the next three lines blank

Note: All Standard Superstructures have been Load Rated except for Culverts

Documentation of Load Rating – Form 2731 for New Bridges



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New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☐ Yes or ☒ No (9) Defaulted to Assigned Rating? ☐ Yes or ☒ No (10)

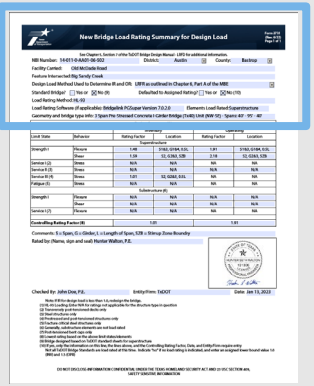
Load Rating Method: HL-93

Load Rating Software (if applicable): Bridgelink PGSuper Version 7.0.2.0 Elements Load Rated: Superstructure

Geometry and bridge type info: 3 Span Pre-Stressed Concrete I-Girder Bridge (Tx40) Unit (NW-SE) - Spans: 40' - 95' - 40'

If not a Standard Bridge, check No on both

Documentation of Load Rating – Form 2731 for New Bridges



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New Bridge Load Rating Summary for Design Load

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☐ Yes or ☒ No (9) Defaulted to Assigned Rating? ☐ Yes or ☒ No (10)

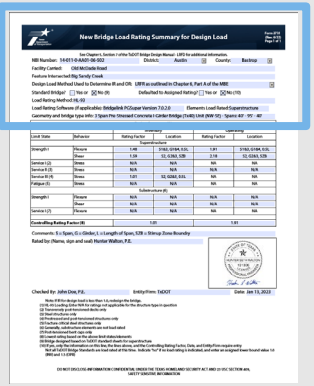
Load Rating Method: HL-93

Load Rating Software (if applicable): Bridgelink PGSuper Version 7.0.2.0 Elements Load Rated: Superstructure

Geometry and bridge type info: 3 Span Pre-Stressed Concrete I-Girder Bridge (Tx40) Unit (NW-SE) - Spans: 40' - 95' - 40'

- Typically, the only required load is the HL-93
- If Legal Loads (EV/SHV) or Permit Vehicle is required, include which vehicles here

Documentation of Load Rating – Form 2731 for New Bridges



Form 2731

New Bridge Load Rating Summary for Design Load

Texas Department of Transportation

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See Chapter 5, Section 7 of the TxDOT Bridge Design Manual - LRFD for additional information.

NBI Number: 14-011-0-AA01-06-502 District: Austin County: Bastrop

Facility Carried: Old McDade Road

Feature Intersected: Big Sandy Creek

Design Load Method Used to Determine IR and OR: LRFR as outlined in Chapter 6, Part A of the MBE

Standard Bridge? ☐ Yes or ☒ No (9) Defaulted to Assigned Rating? ☐ Yes or ☒ No (10)

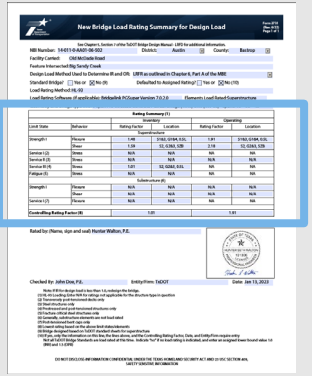
Load Rating Method: HL-93

Load Rating Software (if applicable): Bridgelink PGSuper Version 7.0.2.0 Elements Load Rated: Superstructure

Geometry and bridge type info: 3 Span Pre-Stressed Concrete I-Girder Bridge (Tx40) Unit (NW-SE) - Spans: 40' - 95' - 40'

- List the software used to load rate and the version number
- List all elements load rated (Superstructure and/or Substructure)
- Describe the bridge geometry and type

Documentation of Load Rating – Form 2731 for New Bridges


New Bridge Load Rating Summary for Design Load

Form 2731

Controlling Factor for Limit State and Behavior, as applicable

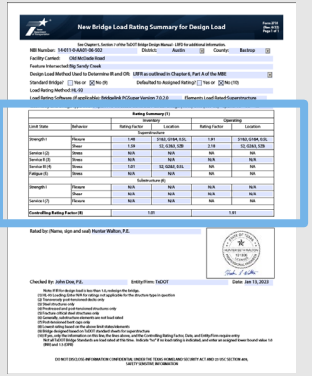
Describe Corresponding Location on bridge for Each Factor

Required for all structures

Rating Summary (1)

Limit State	Behavior	Inventory Rating Factor	Inventory Location	Operating Rating Factor	Operating Location
Superstructure					
Strength I	Flexure	1.48	S1&3, G1&4, 0.5L	1.91	S1&3, G1&4, 0.5L
	Shear	1.59	S2, G2&3, SZB	2.18	S2, G2&3, SZB
Service I (2)	Stress	N/A	N/A	NA	NA
Service II (3)	Stress	N/A	N/A	N/A	N/A
Service III (4)	Stress	1.01	S2, G2&3, 0.5L	NA	NA
Fatigue (5)	Stress	N/A	N/A	NA	NA
Substructure (6)					
Strength I	Flexure	N/A	N/A	N/A	N/A
	Shear	N/A	N/A	N/A	N/A
Service I (7)	Flexure	N/A	N/A	NA	NA
Controlling Rating Factor (8)		1.01		1.91	

Documentation of Load Rating – Form 2731 for New Bridges


New Bridge Load Rating Summary for Design Load

Form 2731

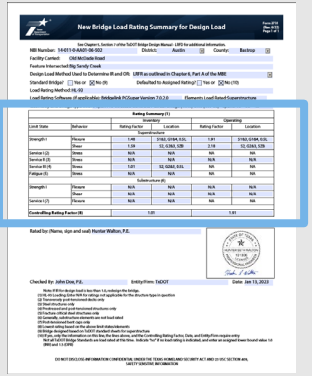
Service I Only applies to decks that are transversely post-tensioned

Rating Summary (1)

Limit State	Behavior	Inventory Rating Factor	Inventory Location	Operating Rating Factor	Operating Location
Superstructure					
Strength I	Flexure	1.48	S1&3, G1&4, 0.5L	1.91	S1&3, G1&4, 0.5L
	Shear	1.59	S2, G2&3, SZB	2.18	S2, G2&3, SZB
Service I (2)	Stress	N/A	N/A	NA	NA
Service II (3)	Stress	N/A	N/A	N/A	N/A
Service III (4)	Stress	1.01	S2, G2&3, 0.5L	NA	NA
Fatigue (5)	Stress	N/A	N/A	NA	NA
Substructure (6)					
Strength I	Flexure	N/A	N/A	N/A	N/A
	Shear	N/A	N/A	N/A	N/A
Service I (7)	Flexure	N/A	N/A	NA	NA
Controlling Rating Factor (8)		1.01		1.91	

Service II applies to steel structures only

Documentation of Load Rating – Form 2731 for New Bridges


New Bridge Load Rating Summary for Design Load

Form 2731

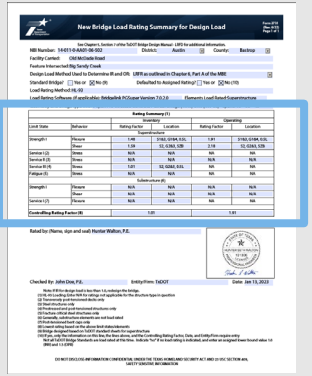
Service III applies to any prestressed or post-tensioned structure types

Rating Summary (1)

Limit State	Behavior	Inventory Rating Factor	Inventory Location	Operating Rating Factor	Operating Location
Superstructure					
Strength I	Flexure	1.48	S1&3, G1&4, 0.5L	1.91	S1&3, G1&4, 0.5L
	Shear	1.59	S2, G2&3, SZB	2.18	S2, G2&3, SZB
Service I (2)	Stress	N/A	N/A	NA	NA
Service II (3)	Stress	N/A	N/A	N/A	N/A
Service III (4)	Stress	1.01	S2, G2&3, 0.5L	NA	NA
Fatigue (5)	Stress	N/A	N/A	NA	NA
Substructure (6)					
Strength I	Flexure	N/A	N/A	N/A	N/A
	Shear	N/A	N/A	N/A	N/A
Service I (7)	Flexure	N/A	N/A	NA	NA
Controlling Rating Factor (8)		1.01		1.91	

Fatigue is only for Fracture Critical Steel Structures

Documentation of Load Rating – Form 2731 for New Bridges


New Bridge Load Rating Summary for Design Load

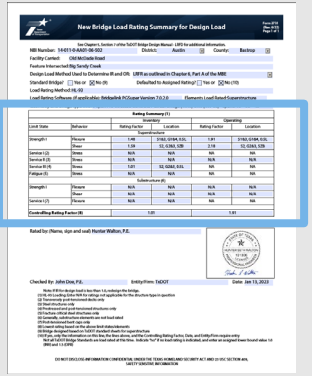
Form 2731

Generally, substructure is not required to be load rated but should be input here as required

Rating Summary (1)					
		Inventory		Operating	
Limit State	Behavior	Rating Factor	Location	Rating Factor	Location
Superstructure					
Strength I	Flexure	1.48	S1&3, G1&4, 0.5L	1.91	S1&3, G1&4, 0.5L
	Shear	1.59	S2, G2&3, SZB	2.18	S2, G2&3, SZB
Service I (2)	Stress	N/A	N/A	NA	NA
Service II (3)	Stress	N/A	N/A	N/A	N/A
Service III (4)	Stress	1.01	S2, G2&3, 0.5L	NA	NA
Fatigue (5)	Stress	N/A	N/A	NA	NA
Substructure (6)					
Strength I	Flexure	N/A	N/A	N/A	N/A
	Shear	N/A	N/A	N/A	N/A
Service I (7)	Flexure	N/A	N/A	NA	NA
Controlling Rating Factor (8)		1.01		1.91	

Service I only applies to post-tensioned bent caps

Documentation of Load Rating – Form 2731 for New Bridges


New Bridge Load Rating Summary for Design Load

Form 2731

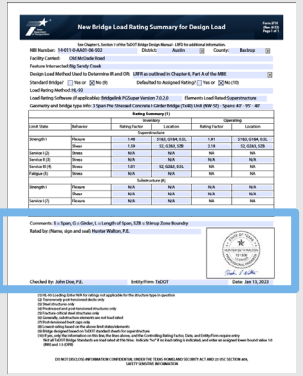
Lowest Operating Rating Listed in Above Columns

Rating Summary (1)

Limit State	Behavior	Inventory Rating Factor	Inventory Location	Operating Rating Factor	Operating Location
Superstructure					
Strength I	Flexure	1.48	S1&3, G1&4, 0.5L	1.91	S1&3, G1&4, 0.5L
	Shear	1.59	S2, G2&3, SZB	2.18	S2, G2&3, SZB
Service I (2)	Stress	N/A	N/A	NA	NA
Service II (3)	Stress	N/A	N/A	N/A	N/A
Service III (4)	Stress	1.01	S2, G2&3, 0.5L	N/A	NA
Fatigue (5)	Stress	N/A	N/A	NA	NA
Substructure (6)					
Strength I	Flexure	N/A	N/A	N/A	N/A
	Shear	N/A	N/A	N/A	N/A
Service I (7)	Flexure	N/A	N/A	NA	NA
Controlling Rating Factor (8)		1.01		1.91	

Lowest Inventory Rating Listed in Above Columns

Documentation of Load Rating – Form 2731 for New Bridges



Form 2731

Comments: S = Span, G = Girder, L = Length of Span, SZB = Stirrup Zone Boundry

Rated by: (Name, sign and seal) Hunter Walton, P.E.

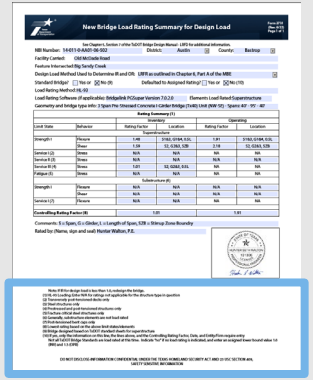
Checked By: John Doe, P.E. Entity/Firm: TxDOT Date: Jan 13, 2023

- Useful comments for previous inputs or rating
- Name of Rating Engineer with Signature, Seal & Date
- Name of Engineer who checked the Rating and the Entity/Firm

Location
S1&3, G1&4, 0.5L
S2, G2&3, SZB

If Location Given in Rating Summary requires additional info, comments can be used to elaborate

Documentation of Load Rating – Form 2731 for New Bridges

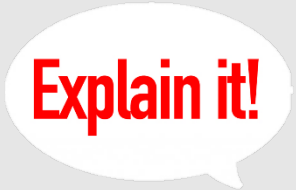

New Bridge Load Rating Summary for Design Load

Form 2731

Note: If IR for design load is less than 1.0, redesign the bridge.

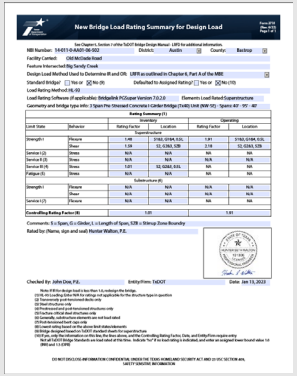
(1) HL-93 Loading: Enter N/A for ratings not applicable for the structure type in question
(2) Transversely post-tensioned decks only
(3) Steel structures only
(4) Prestressed and post-tensioned structures only
(5) Fracture critical steel structures only
(6) Generally, substructure elements are not load rated
(7) Post-tensioned bent caps only
(8) Lowest rating based on the above limit states/elements
(9) Bridge designed based on TxDOT standard sheets for superstructure
(10) If yes, only the information on this line, the lines above, and the Controlling Rating Factor, Date, and Entity/Firm require entry
Not all TxDOT Bridge Standards are load rated at this time. Indicate "no" if no load rating is indicated, and enter an assigned lower bound value 1.0 (INV) and 1.3 (OPR)

DO NOT DISCLOSE-INFORMATION CONFIDENTIAL UNDER THE TEXAS HOMELAND SECURITY ACT AND 23 USC SECTION 409,
SAFETY SENSITIVE INFORMATION



Bottom of Form includes notes corresponding to previous inputs on the sheet to convey intended use

Documentation of Load Rating – Form 2731 for New Bridges


New Bridge Load Rating Summary for Design Load

Form 2731

- Include form and supporting calculations in Bridge Design Notes

Documentation of Load Rating on Plans

- Include the final controlling inventory and operating load ratings on the bridge layout

  HL-93 Loading: Superstructure Inv/Opr Ratings= X.XX/Y.YY

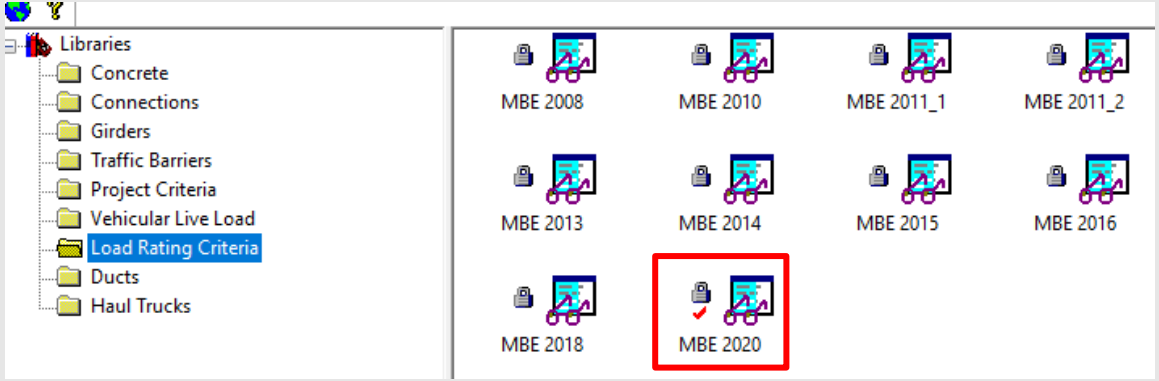
  Substructure Inv/Opr Ratings= X.XX/Y.YY OR “Substructure Not Rated”

- Include controlling load ratings for all girder designs for inventory and operating on relevant plan sheets

STRUCTURE	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN		CONCRETE		OPTIONAL DESIGN					LOAD RATING FACTORS		
	SPAN NO.	GIRDER NO.	GIRDER TYPE	PRESTRESSING STRANDS						NO.	TO END (in)	RELEASE STRGTH (1) f'ci (ksi)	MINIMUM 28 DAY COMP STRGTH f'c (ksi)	DESIGN LOAD COMP STRESS (TOP ℄) (SERVICE I) fct(ksi)	DESIGN LOAD TENSILE STRESS (BOTT ℄) (SERVICE III) fcb(ksi)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I) (kip-ft)	LIVE LOAD DISTRIBUTION FACTOR (2)		STRENGTH I		SERVICE III
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH fpu (ksi)	"e" ℄ (in)	"e" END (in)								Moment	Shear	Inv	Opr	Inv
Type Tx28 Girders 24' Roadway 8.5" Slab	40	ALL	Tx28		10	0.6	270	10.48	10.48			4.000	5.000	1.055	-1.423	1382	0.670	0.850	1.56	2.02	1.98
	45	ALL	Tx28		12	0.6	270	10.48	10.48			4.500	5.000	1.332	-1.744	1525	0.650	0.850	1.58	2.05	1.79
	50	ALL	Tx28		12	0.6	270	10.48	10.48			4.200	5.000	1.645	-2.113	1657	0.630	0.860	1.25	1.62	1.25
	55	ALL	Tx28		14	0.6	270	10.48	9.62	2	8.5	4.000	5.000	1.969	-2.490	1919	0.610	0.860	1.27	1.64	1.11
	60	ALL	Tx28		18	0.6	270	10.04	7.81	4	14.5	4.000	5.600	2.320	-2.901	2206	0.600	0.870	1.43	1.86	1.14
	65	ALL	Tx28		22	0.6	270	9.75	6.12	4	24.5	4.300	5.900	2.716	-3.337	2486	0.580	0.870	1.55	2.00	1.14
	70	ALL	Tx28		26	0.6	270	9.56	6.48	4	24.5	5.200	6.300	3.131	-3.802	2793	0.570	0.870	1.26	1.89	1.01
	75	ALL	Tx28		28	0.6	270	9.48	6.62	4	24.5	5.600	7.800	3.572	-4.291	3110	0.560	0.880	1.38	1.81	1.08

Performing Load Ratings on concrete superstructures using PGSuper

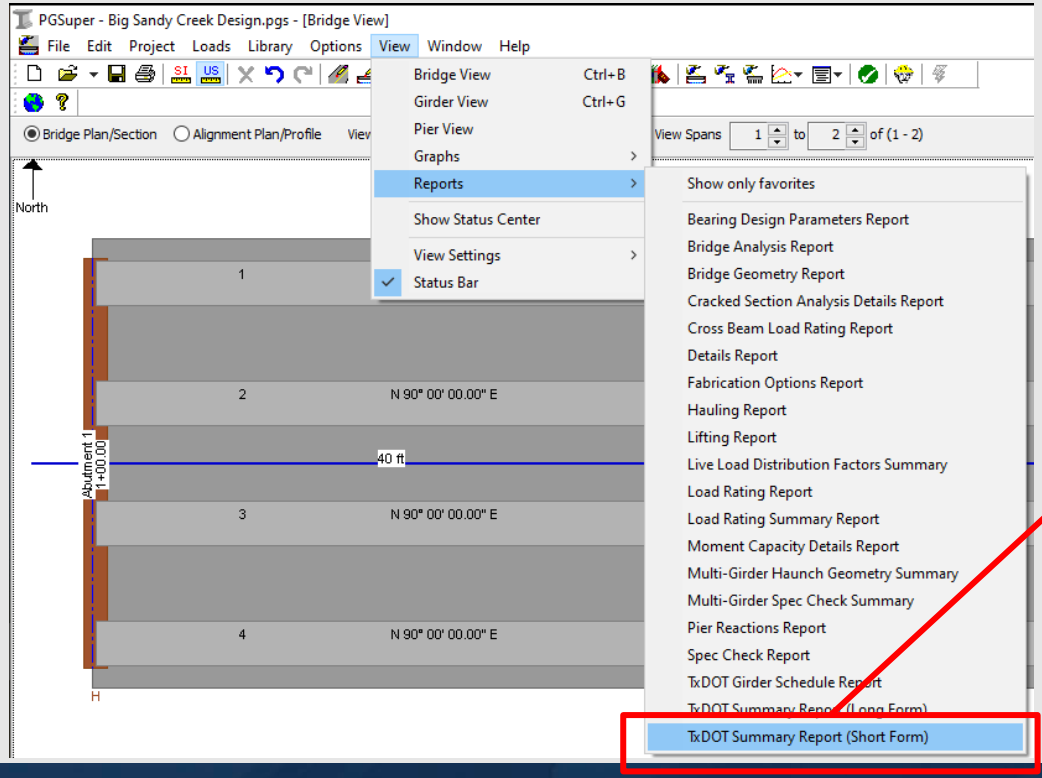
- Bridgelink's PG Super (Version 7.0.2) can provide load ratings for all standard TxDOT girder sections
  - TxDOT has coordinated load rating inputs and requirements for this purpose

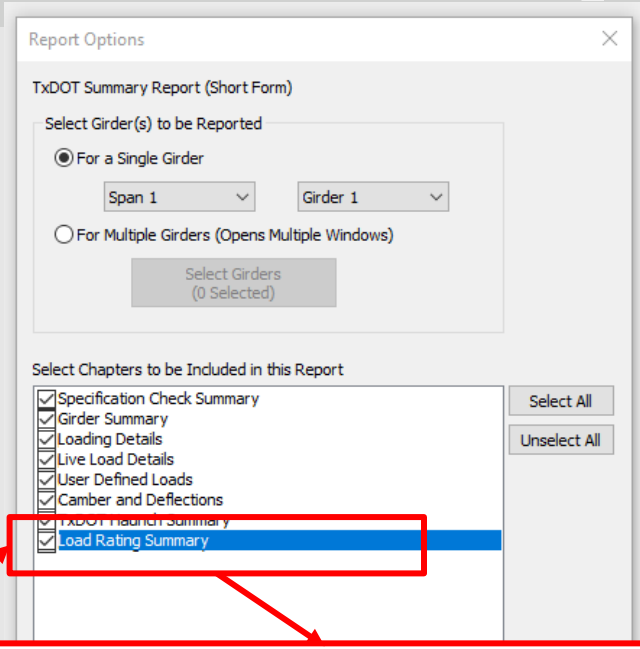


  - The load ratings be reviewed in a multitude of ways after girders have been designed and grouped

Performing Load Ratings on concrete superstructures using PGSuper

View ->Reports -> TxDOT Summary Report (Short Form)





Load Rating Summary

Design Load Rating

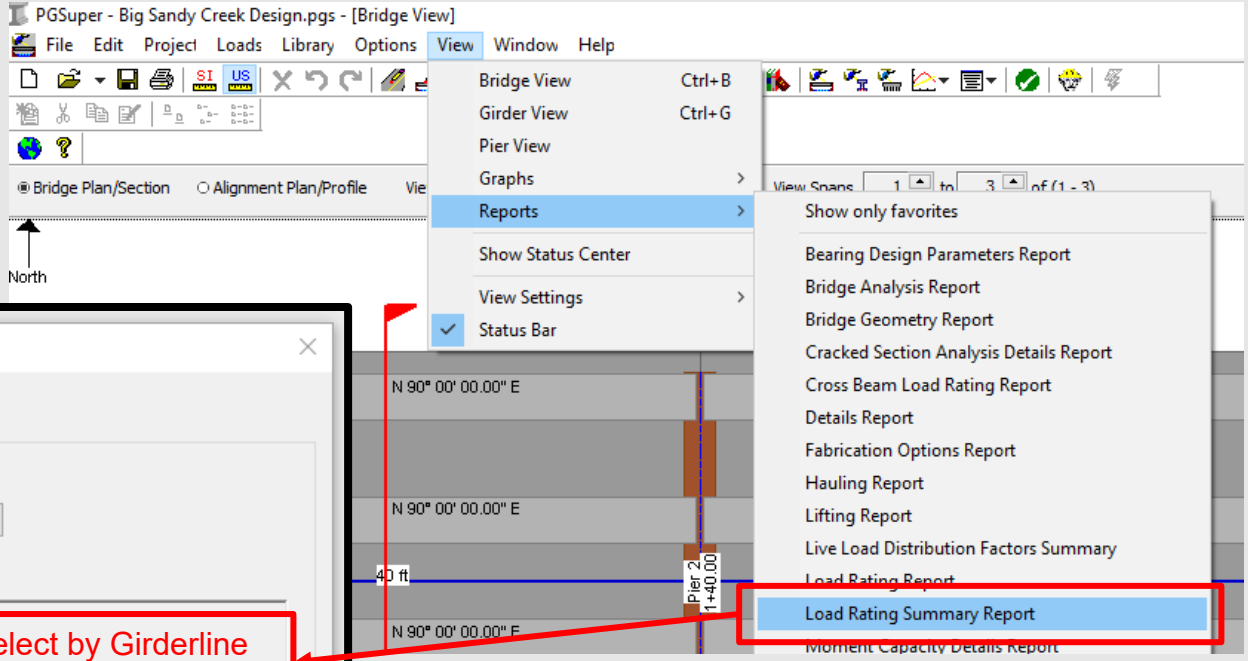
Controlling Factors per Girder

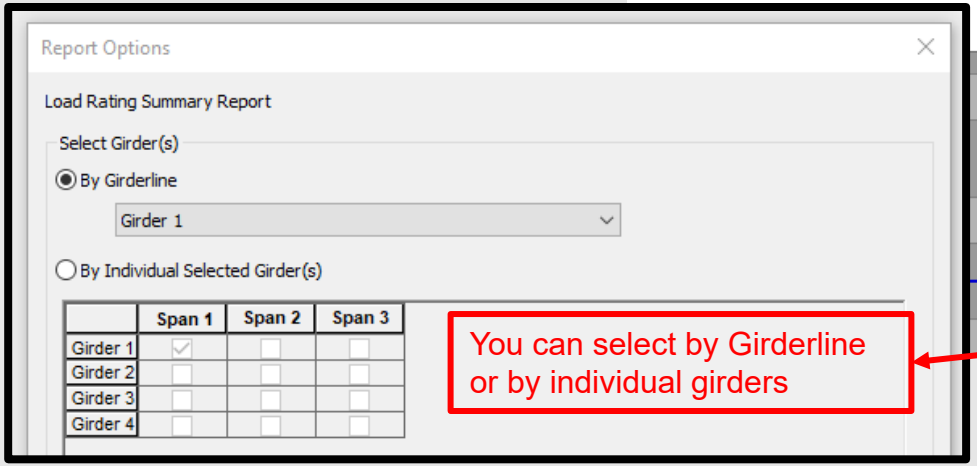
Limit State	Type	Inventory			Operating		
		RF	γ_{LL}	Location from Left Support	RF	γ_{LL}	Location from Left Support
Strength I	Flexure	1.48	1.750	Span 1 Girder 1, (0.5L_s) 19.000 ft	1.91	1.350	Span 1 Girder 1, (0.5L_s) 19.000 ft
	Shear	3.20	1.750	Span 1 Girder 1, (CS) 4.123 ft	4.15	1.350	Span 1 Girder 1, (CS) 4.123 ft
Service III	Stress	2.38	0.800	Span 1 Girder 1, (0.5L_s) 19.000 ft			

Performing Load Ratings on concrete superstructures using PGSuper

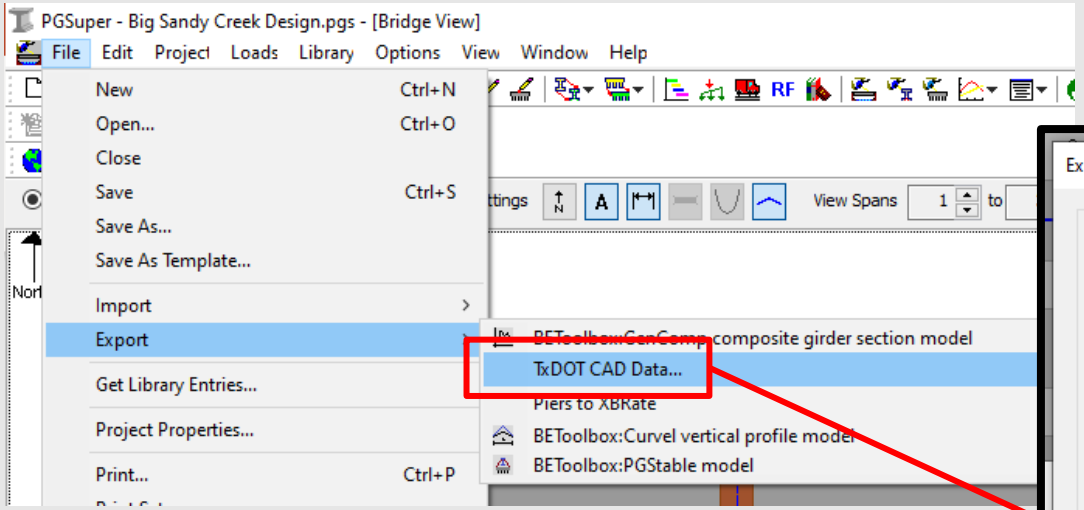
View ->Reports -> Load Rating Summary Report

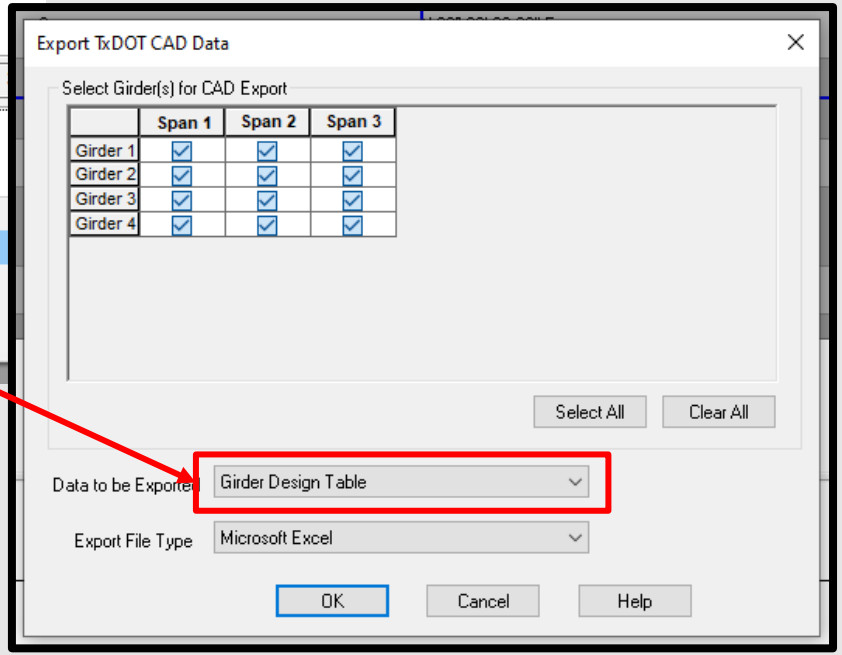
This will provide the controlling rating by selection and at tenth points





Generating CADD Tables for Plans





PGSuper makes it simple to export your girder designs and load rating for use in generating girder design tables

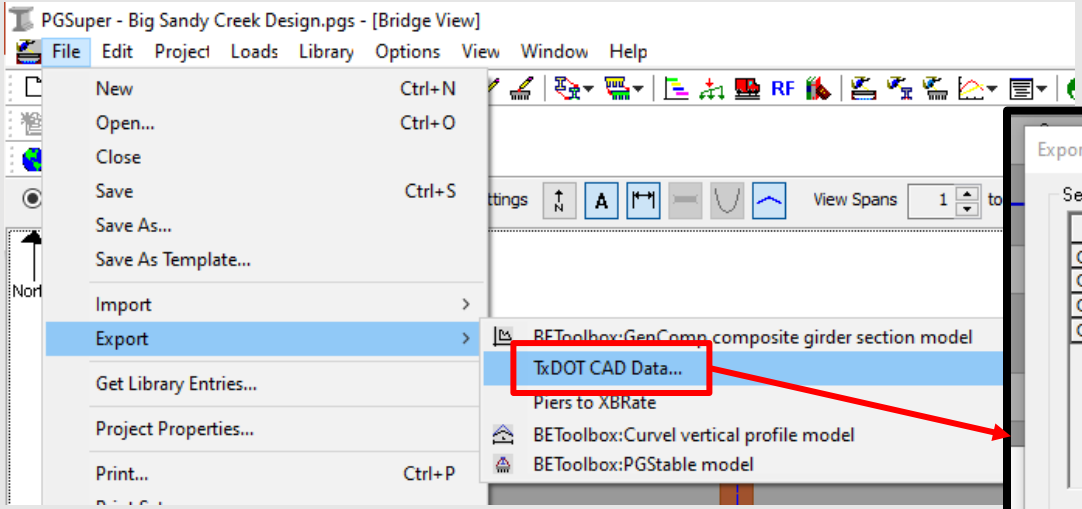
- Save as an excel file ready to import into your DGN

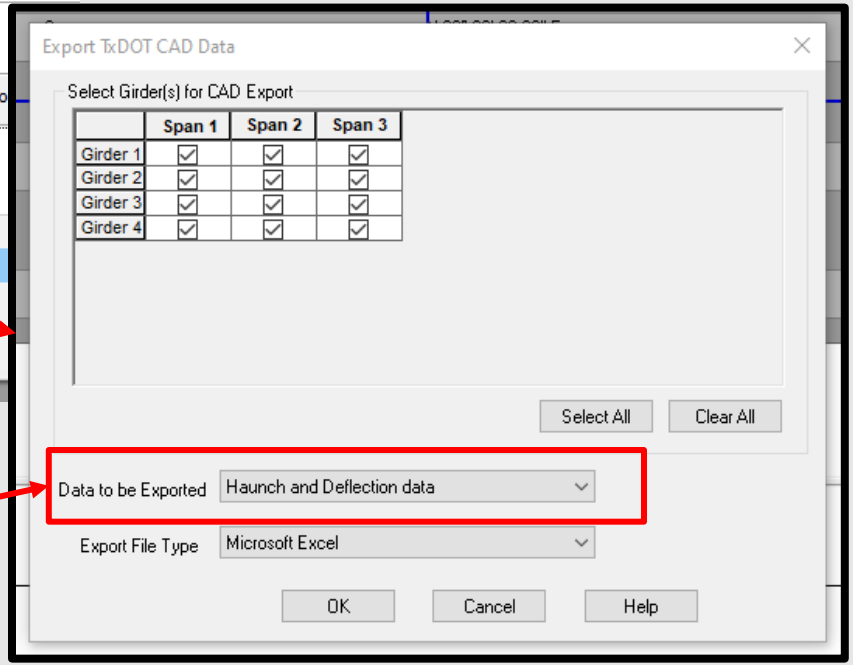
Generating CADD Tables for Plans

StructureName	DESIGNED GIRDERS									DEPRESSED STRAND PATTERN		CONCRETE		OPTIONAL DESIGN					LOAD RATING		
				PRESTRESSING STRANDS													LL Distribution Factor		Strength I		Service III
	Span #	Girder #	Girder Ty	Non-Std	Total #	Size	Strength	"e" CL	"e" END	#	To End	f'ci	f'c	Comp Stress	Tensile Stress	Ult Moment	Moment	Shear	Inv	Opr	Inv
						in	ksi	in	in												
	1	1	Tx40		8	0.6	270	15.60	15.60			4.000	5.000	0.688	-0.908	1758	0.787	0.814	1.48	1.91	2.38
	1	2	Tx40		10	0.6	270	15.60	15.60			4.000	5.000	0.704	-0.932	1790	0.787	0.814	1.92	2.49	2.89
	1	3	Tx40		10	0.6	270	15.60	15.60			4.000	5.000	0.704	-0.932	1790	0.787	0.814	1.92	2.49	2.89
	1	4	Tx40		8	0.6	270	15.60	15.60			4.000	5.000	0.688	-0.908	1758	0.787	0.814	1.48	1.91	2.38
	2	1	Tx40		34	0.6	270	14.07	8.78	6	36.5	5.400	6.100	3.682	-4.120	5060	0.619	0.814	1.58	2.06	1.06
	2	2	Tx40		34	0.6	270	14.07	10.19	6	28.5	5.800	6.700	3.839	-4.284	5203	0.619	0.814	1.58	2.05	1.01
	2	3	Tx40		34	0.6	270	14.07	10.19	6	28.5	5.800	6.700	3.839	-4.284	5203	0.619	0.814	1.58	2.05	1.01
	2	4	Tx40		34	0.6	270	14.07	8.78	6	36.5	5.400	6.100	3.682	-4.120	5060	0.619	0.814	1.58	2.06	1.06
	3	1	Tx40		8	0.6	270	15.60	15.60			4.000	5.000	0.688	-0.908	1758	0.787	0.814	1.48	1.91	2.38
	3	2	Tx40		10	0.6	270	15.60	15.60			4.000	5.000	0.704	-0.932	1790	0.787	0.814	1.92	2.49	2.89
	3	3	Tx40		10	0.6	270	15.60	15.60			4.000	5.000	0.704	-0.932	1790	0.787	0.814	1.92	2.49	2.89
	3	4	Tx40		8	0.6	270	15.60	15.60			4.000	5.000	0.688	-0.908	1758	0.787	0.814	1.48	1.91	2.38

Excel Report now includes controlling load factors for each girder

Generating CADD Tables for Plans – Additional New Feature





Change Data to 'Haunch and Deflection Data'

Generating CADD Tables for Plans – Additional New Feature

TABLE OF SECTION DEPTHS				
Span No.	Beam No.	"X" at ℄ of Brg	"Y" at ℄ of Brg	"Z" at ℄ of Span
1	1	10 ½"	4'-2 ½"	10 ¼"
1	2	10 ½"	4'-2 ½"	10 ⅛"
1	3	10 ½"	4'-2 ½"	10 ⅛"
1	4	10 ½"	4'-2 ½"	10 ¼"
2	1	10 ½"	4'-2 ½"	8 ¼"
2	2	10 ½"	4'-2 ½"	8 ⅜"
2	3	10 ½"	4'-2 ½"	8 ⅜"
2	4	10 ½"	4'-2 ½"	8 ¼"
3	1	10 ½"	4'-2 ½"	10 ¼"
3	2	10 ½"	4'-2 ½"	10 ⅛"
3	3	10 ½"	4'-2 ½"	10 ⅛"
3	4	10 ½"	4'-2 ½"	10 ¼"

Span No.	Beam No.	"A" Ft	"B" Ft
1	1	-0.003	-0.004
1	2	-0.003	-0.005
1	3	-0.003	-0.005
1	4	-0.003	-0.004
2	1	-0.109	-0.155
2	2	-0.124	-0.177
2	3	-0.124	-0.177
2	4	-0.109	-0.155
3	1	-0.003	-0.004
3	2	-0.003	-0.005
3	3	-0.003	-0.005
3	4	-0.003	-0.004

Generates an Excel Report with Table of Section Depths and Dead Load Deflection

Performing Load Ratings for other Structure Types

- Other Programs can generate Load Ratings for various structure types
  - Example: MDX can be used for steel girders
- Use of these programs is at the discretion of the Engineer performing the Rating

ViralHog. (2018, October 16). *Bus Ignores Weight Limit on Bridge* [Video]. YouTube. https://www.youtube.com/watch?v=eHxvj7C0OT8

Questions?

Hunter Walton, P.E.
TxDOT Bridge Division
hunter.walton@txdot.gov