Texas Load Rating Program – LFR

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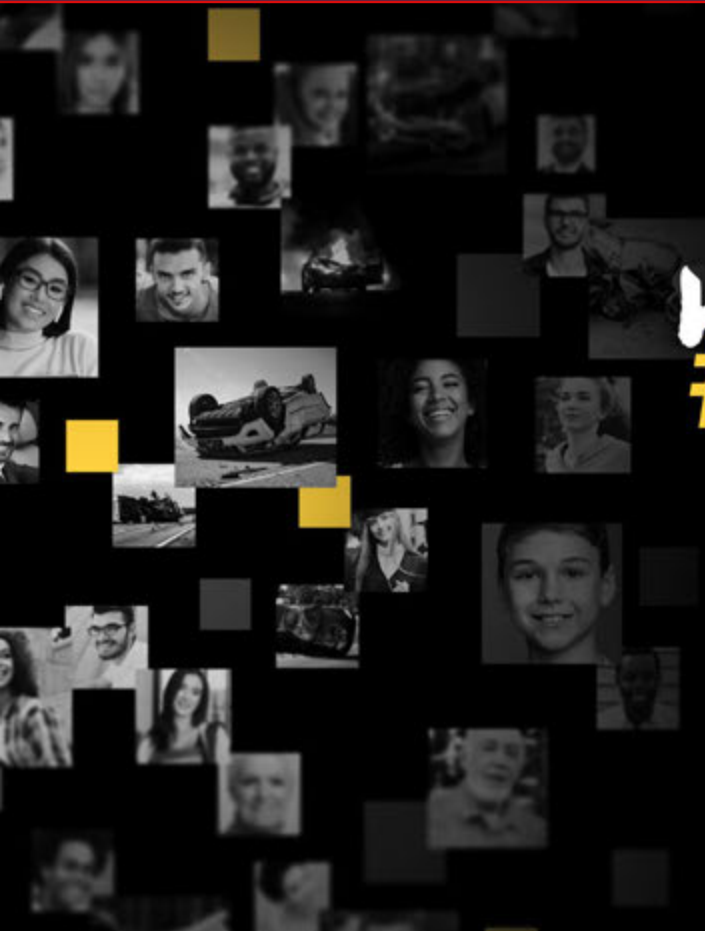
Texas Department of Transportation

February 13, 2025

Table of Contents



HELP
#EndTheStreakTX

End the streak of daily deaths on Texas roadways.

TxDOT.gov
#EndTheStreakTX Toolkit

What is Load Rating?

Per AASHTO MBE:

- Bridge load rating provides a basis for determining the safe load capacity of a bridge
- Load rating requires engineering judgement in determining a rating value that is applicable to maintain the safe use of the bridge and arriving at posting and permit decisions
- The specific load ratings are used in identifying the need for load posting or bridge strengthening and in making overweight-vehicle permit decisions
- Load ratings are routinely reported

Per Title 23 CFR 650, Subpart C – National Bridge Inspection Standards

- Every bridge must have a load rating evaluation
- FHWA Metric 13 – Load rating

What is Load Rating?

Load ratings must reflect the existing conditions and be updated for:

- Changes in the condition of the structural members
- Changes to the structural configuration
- Changes to the lane configuration
- Changes to the strength of the members
- Change in dead load
- Changes to the legal live loads

What is Load Rating?

Load Rating Methods:

- Calculated
- Assigned LR Based on Design Load
- Assumed LR Based on Engineering Judgement

Bridge Inspection Manual

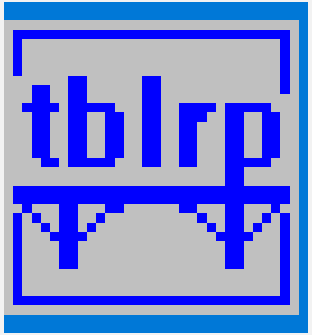
- Ch. 6 Load Ratings and Load Postings

https://onlinemanuals.txdot.gov/TxDOTOnlineManuals/txdotmanuals/ins/ins.pdf

What is Load Rating?

TxDOT Load Rating Tools:

- TBLRP*
- RATE Spreadsheet
- CULVLR
- BAR7
- AASHTOWare BrR
- MDX
- Other – Hand Calcs



What is Load Rating?

TxDOT Load Rating Tools:

- TBLRP-LFR
- RATE Spreadsheet
- CULVLR
- BAR7
- AASHTOWare BrR
- MDX
- Other – Hand Calcs

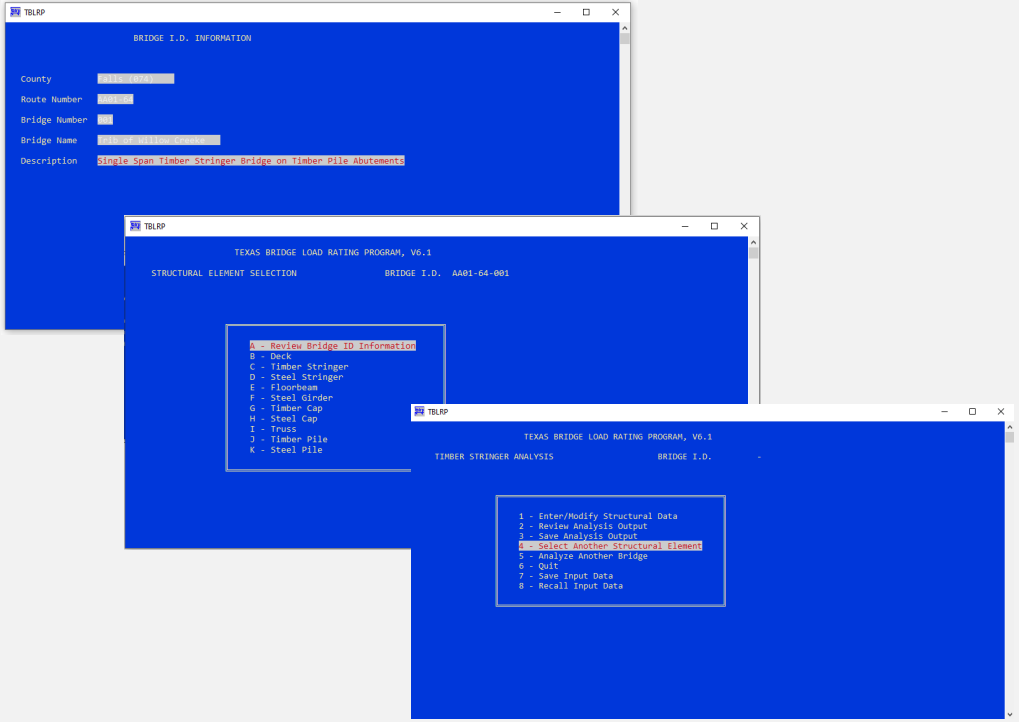
TBLRP-LFR

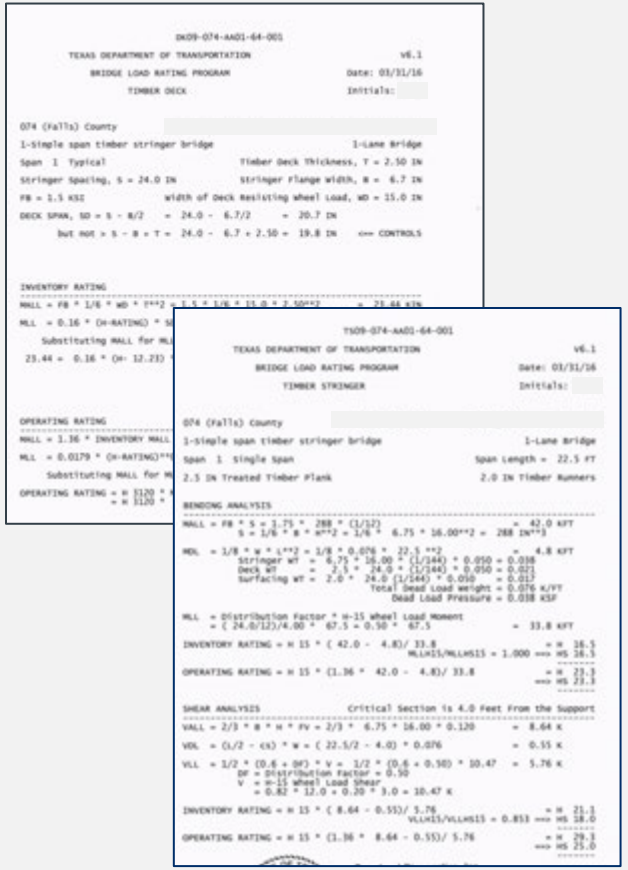
TBLRP (Original)

- Based on Working Stress (WS) or Allowable Stress (AS)
- Timber and Steel Deck, Superstructure, and Substructure
- Multiple components can be rated
- Allowed carryover of dead loads from stringer analysis to substructure components

TBLRP-LFR

TBLRP (Original)



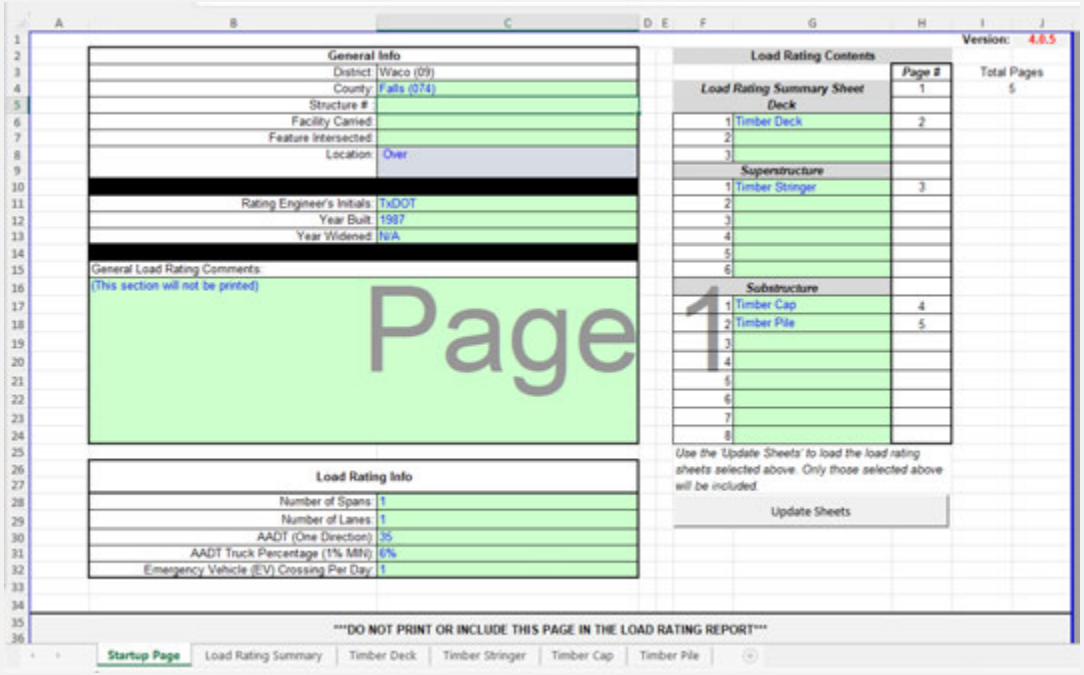


TBLRP-LFR

TBLRP-LFR (New)

- Steel member load rating based on Load Factor (LF)
- Timber member LR based on Working Stress (WS) or Allowable Stress (AS)
- Added Concrete Deck module – punching shear analysis
- Added Railroad Flatcar module
- Added drop-downs for AISC shapes (HP, S, and W)
- Retained ability for rating multiple components
- Retained carryover of dead loads from deck analysis to super and substructure

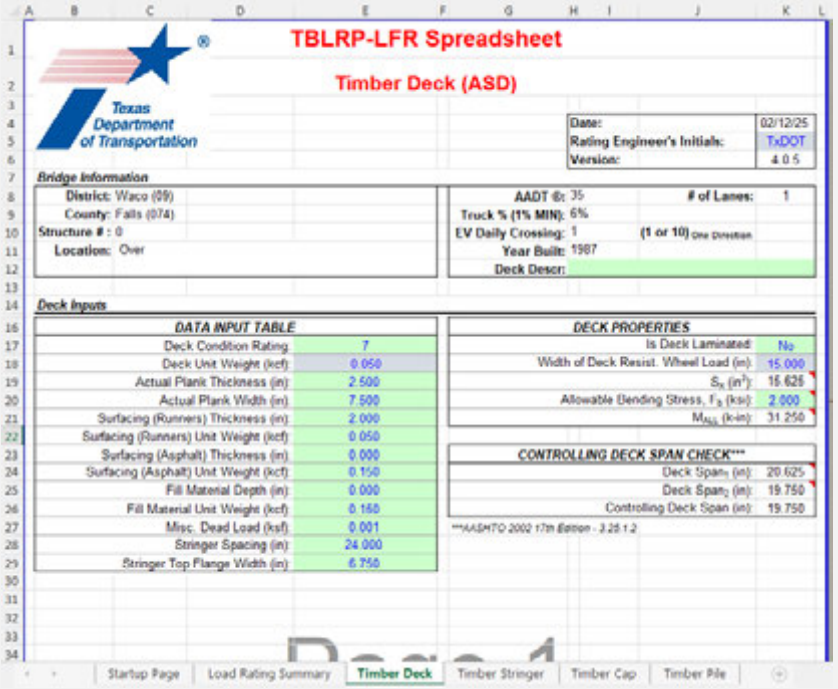
TBLRP-LFR


Version: 4.0.5
General Info
District: Waco (09)
County: Falls (074)
Structure #:
Facility Carried:
Feature Intersected:
Location: Over
Rating Engineer's Initials: TxDOT
Year Built: 1987
Year Widened: N/A
General Load Rating Comments:
(This section will not be printed)
Page 1
Load Rating Info
Number of Spans: 1
Number of Lanes: 1
AADT (One Direction): 35
AADT Truck Percentage (1% MIN): 6%
Emergency Vehicle (EV) Crossing Per Day: 1
Load Rating Contents
Load Rating Summary Sheet
Page #
Total Pages
1
5
Deck
1 Timber Deck 2
Superstructure
1 Timber Stringer 3
Substructure
1 Timber Cap 4
2 Timber Pile 5
Use the 'Update Sheets' to load the load rating sheets selected above. Only those selected above will be included.
Update Sheets
DO NOT PRINT OR INCLUDE THIS PAGE IN THE LOAD RATING REPORT
Startup Page
Load Rating Summary
Timber Deck
Timber Stringer
Timber Cap
Timber Pile

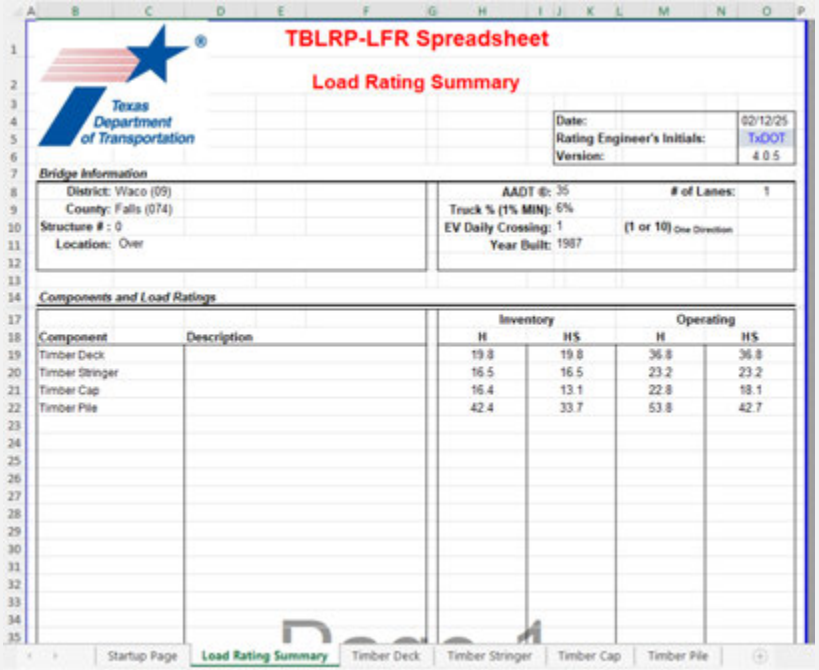
TBLRP-LFR

Color Scheme

- Green cells – input
- Gray cells – calculated cells
  - can be overwritten with an input
- White cells – locked cell that performs a calculation or imports a value from another module.



TBLRP-LFR



TBLRP-LFR Spreadsheet

Load Rating Summary

Texas Department of Transportation

Date:	02/12/25
Rating Engineer's Initials:	TxDOT
Version:	4.0.5

Bridge Information

District: Waco (09)	AADT @: 35	# of Lanes:	1
County: Falls (074)	Truck % (1% MIN): 6%		
Structure # : 0	EV Daily Crossing: 1	(1 or 10) One Direction	
Location: Over	Year Built: 1987		

Components and Load Ratings

		Inventory		Operating	
Component	Description	H	HS	H	HS
Timber Deck		19.8	19.8	36.8	36.8
Timber Stringer		16.5	16.5	23.2	23.2
Timber Cap		16.4	13.1	22.8	18.1
Timber Pile		42.4	33.7	53.8	42.7

Startup Page | Load Rating Summary | Timber Deck | Timber Stringer | Timber Cap | Timber Pile

TBLRP-LFR

Load Factor Rating (LFR)

- Steel Deck
- Steel Stringer (Simple and Continuous)
- Steel Girder-Floorbeam-Stringer (Simple)
- Steel Floorbeam
- Steel Cap
- Steel Pile
- Railroad Flatcar Bridges
- Concrete Deck Punching Shear Analysis

TBLRP-LFR

Working Stress (WSR) or Allowable Stress (ASR) Ratings

- Timber Deck
- Timber Stringer
- Timber Cap
- Timber Pile

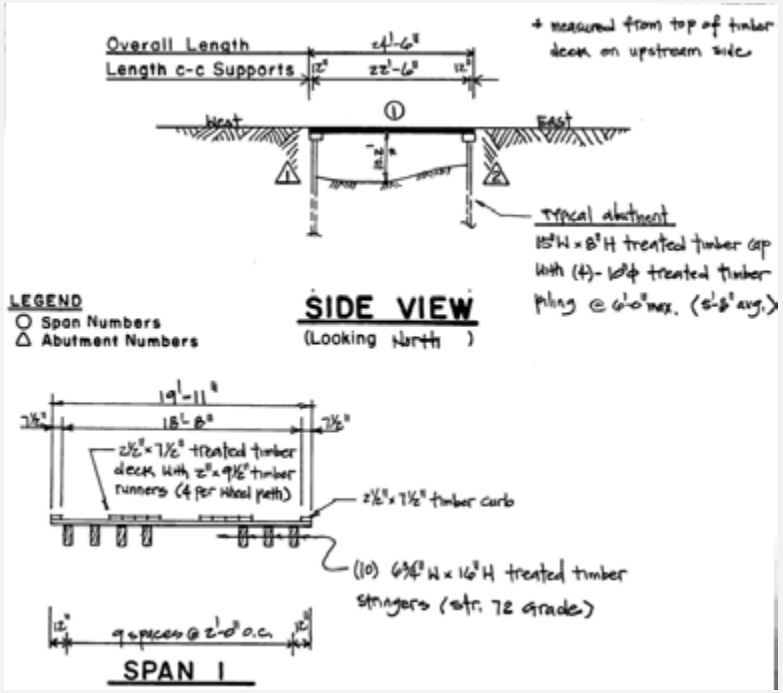
TBLRP-LFR Example 1

Single Span Timber Stringer Bridge On Timber Pile Abutments

TBLRP-LFR Example 1

Single Span Timber Stringer Bridge On Timber Pile Abutments

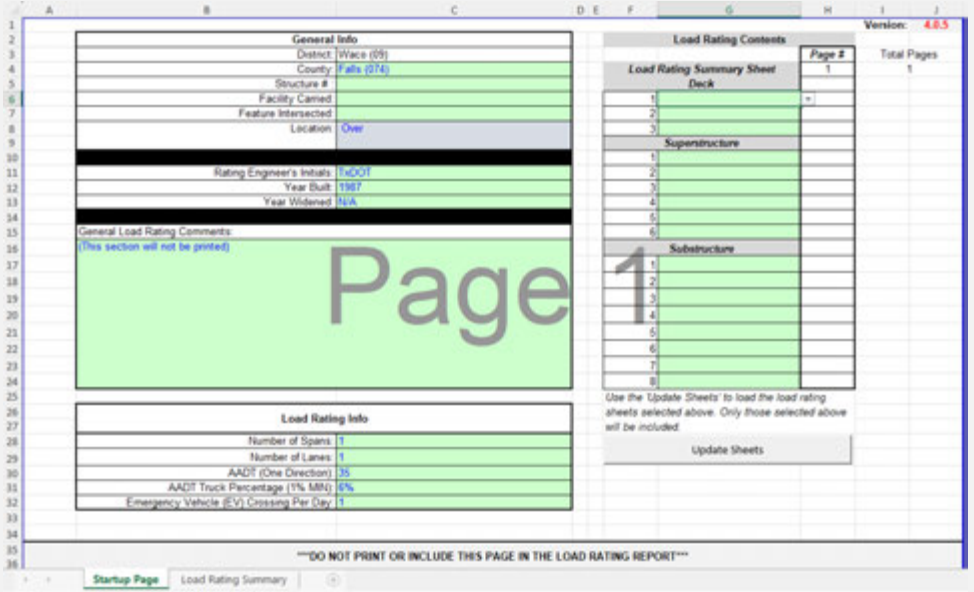
- Timber Deck
- Timber Stringers
- Timber Cap
- Timber Piles



TBLRP-LFR Example 1

Start up Page

- Enter General Information
- Select Applicable Modules
  - Timber Deck
  - Timber Stringer
  - Timber Cap
  - Timber Pile
- Click “Update Sheets”



TBLRP-LFR Example 1

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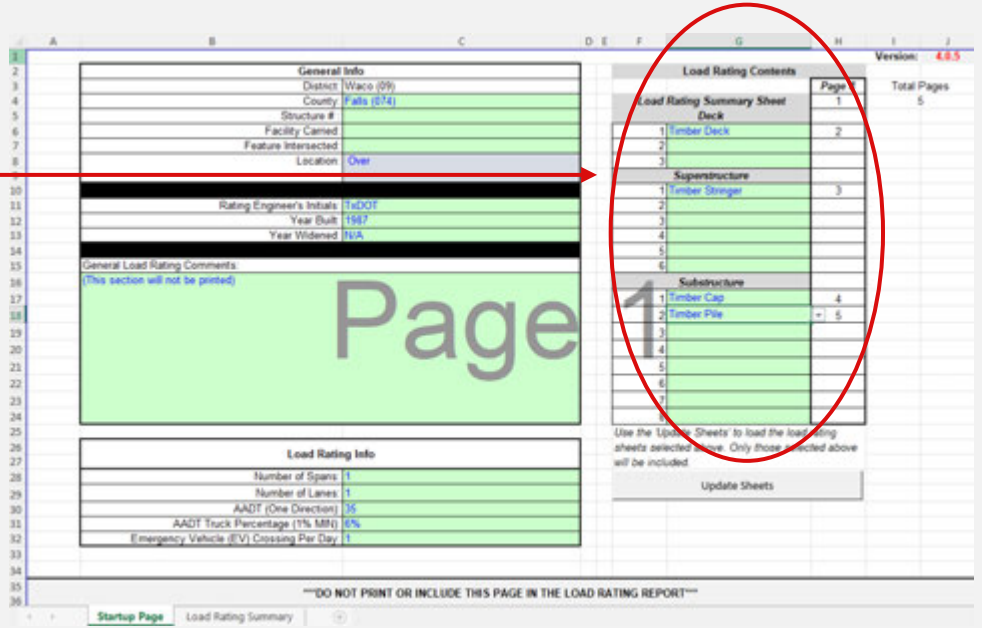

TBLRP-LFR Example 1

Start up Page

- Enter General Information
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  - Timber Deck
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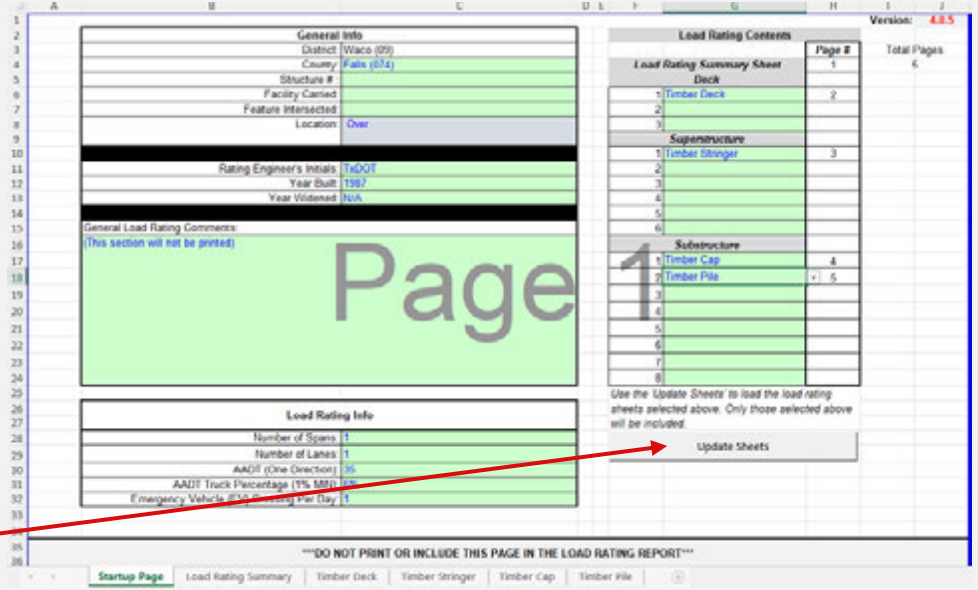
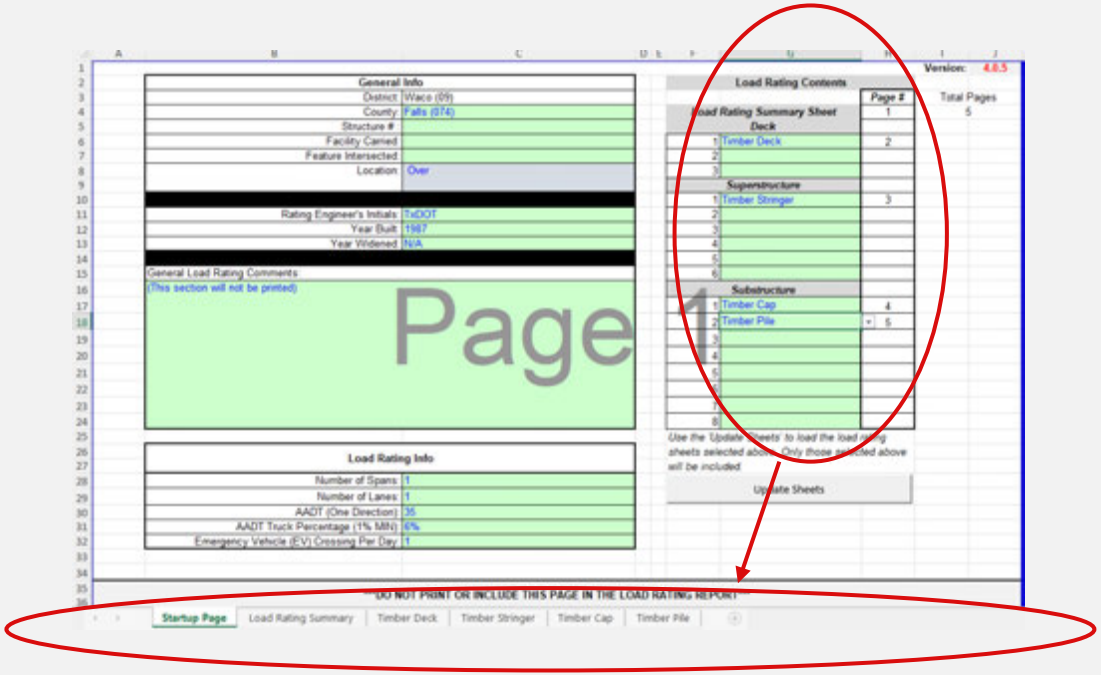
- Click “Update Sheets”



TBLRP-LFR Example 1

Start up Page

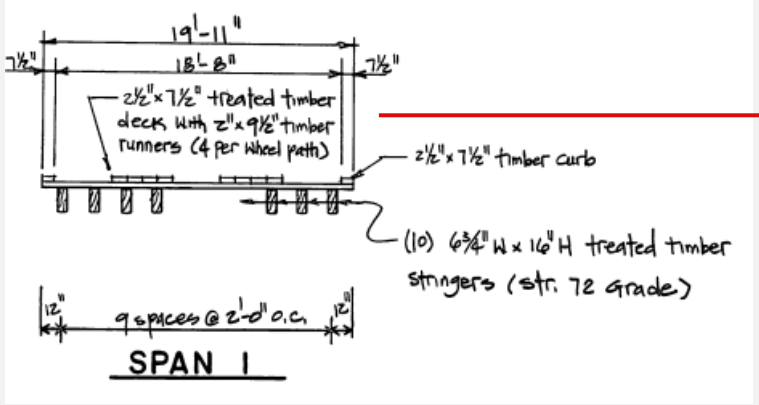
- Enter General Information
- Select Applicable Modules
  - Timber Deck
  - Timber Stringer
  - Timber Cap
  - Timber Pile
- Click “Update Sheets”



TBLRP-LFR Example 1

Timber Deck

- Enter details as shown in plans/sketch



TBLRP-LFR Spreadsheet

Timber Deck (ASD)

Texas Department of Transportation

Date:	02/12/25
Rating Engineer's Initials:	TxDOT
Version:	4.0.5

Bridge Information

District: Waco (09)	AADT ⇕: 35	# of Lanes:	1
County: Falls (074)	Truck % (1% MIN): 6%		
Structure # : 0	EV Daily Crossing: 1	(1 or 10) One Direction	
Location: Over	Year Built: 1987		
	Deck Descr:		

Deck Inputs

DATA INPUT TABLE	
Deck Condition Rating	7
Deck Unit Weight (kcf)	0.050
Actual Plank Thickness (in)	2.500
Actual Plank Width (in)	7.500
Surfacing (Runners) Thickness (in)	2.000
Surfacing (Runners) Unit Weight (kcf)	0.050
Surfacing (Asphalt) Thickness (in)	0.000
Surfacing (Asphalt) Unit Weight (kcf)	0.150
Fill Material Depth (in)	0.000
Fill Material Unit Weight (kcf)	0.150
Misc. Dead Load (ksf)	0.001
Stringer Spacing (in)	24.000
Stringer Top Flange Width (in)	6.750

DECK PROPERTIES	
Is Deck Laminated	No
Width of Deck Resist. Wheel Load (in)	15.000
S_x (in^3)	15.625
Allowable Bending Stress, F_b (ksi)	2.000
M_{ALL} (k-in)	31.250

CONTROLLING DECK SPAN CHECK***	
Deck Span$_1$ (in)	20.625
Deck Span$_2$ (in)	19.750
Controlling Deck Span (in)	19.750

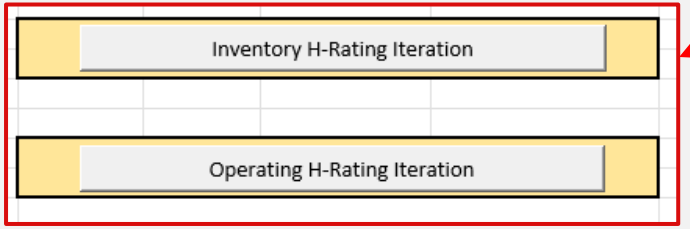
***AASHTO 2002 17th Edition - 3.25.1.2

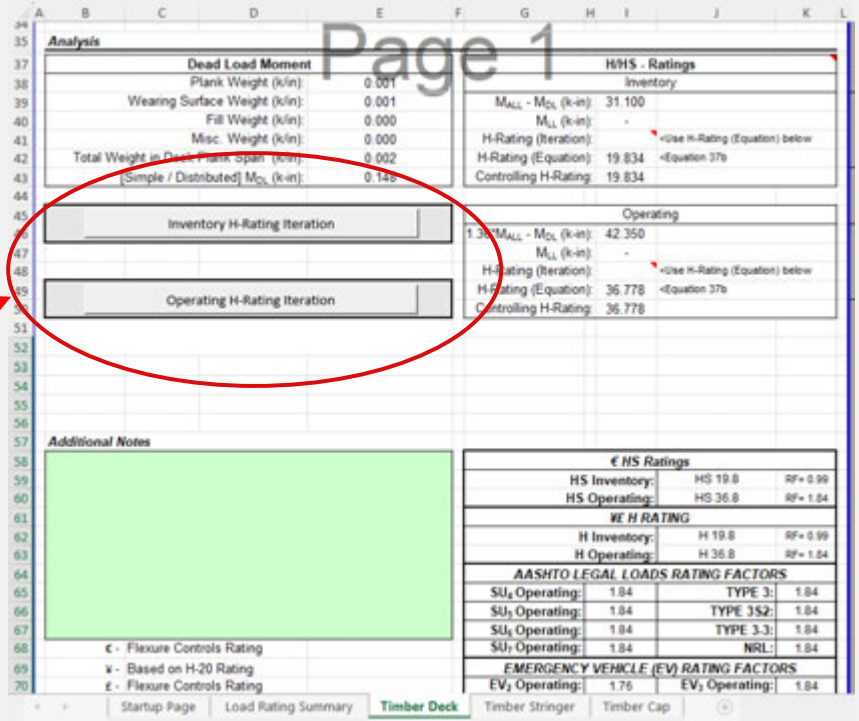
Startup Page | Load Rating Summary | Timber Deck | Timber Stringer | Timber Cap | Timber Pile

TBLRP-LFR Example 1

Timber Deck

- Click "H-Rating Iteration" buttons if highlighted

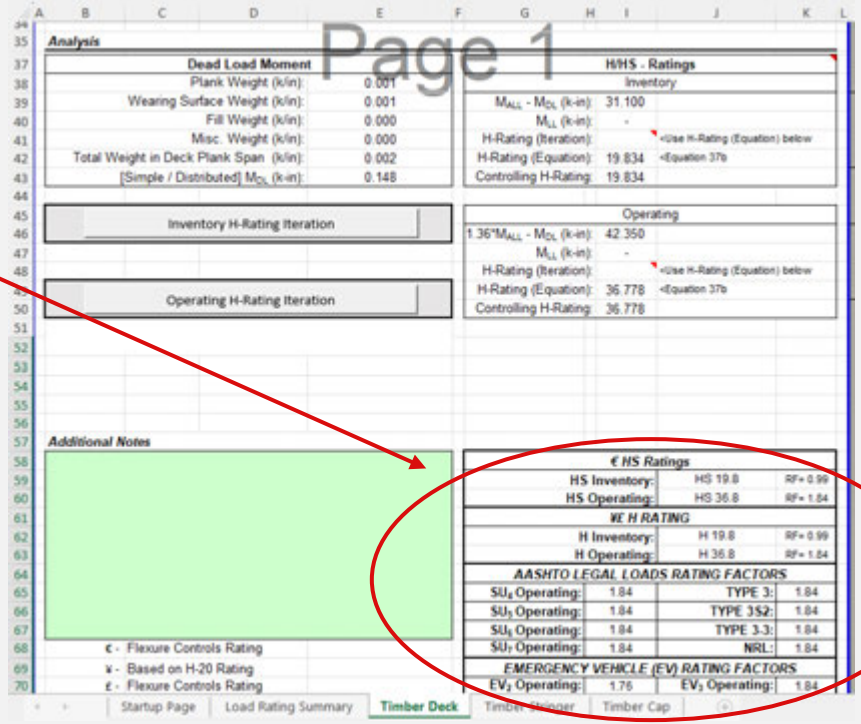




TBLRP-LFR Example 1

Timber Deck

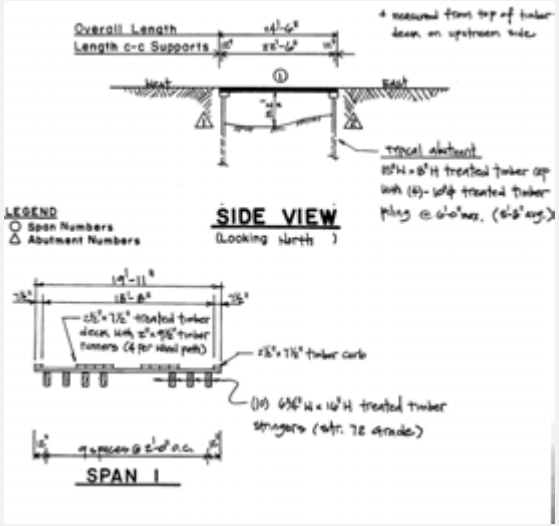
- Load Rating Results

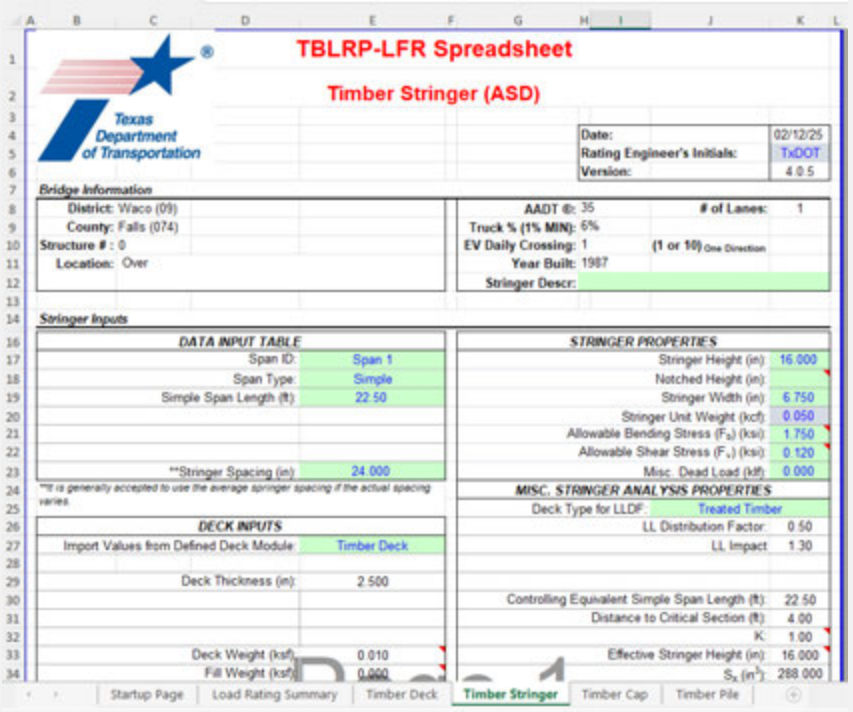


TBLRP-LFR Example 1

Timber Stringer

- Enter details as shown in plans/sketch

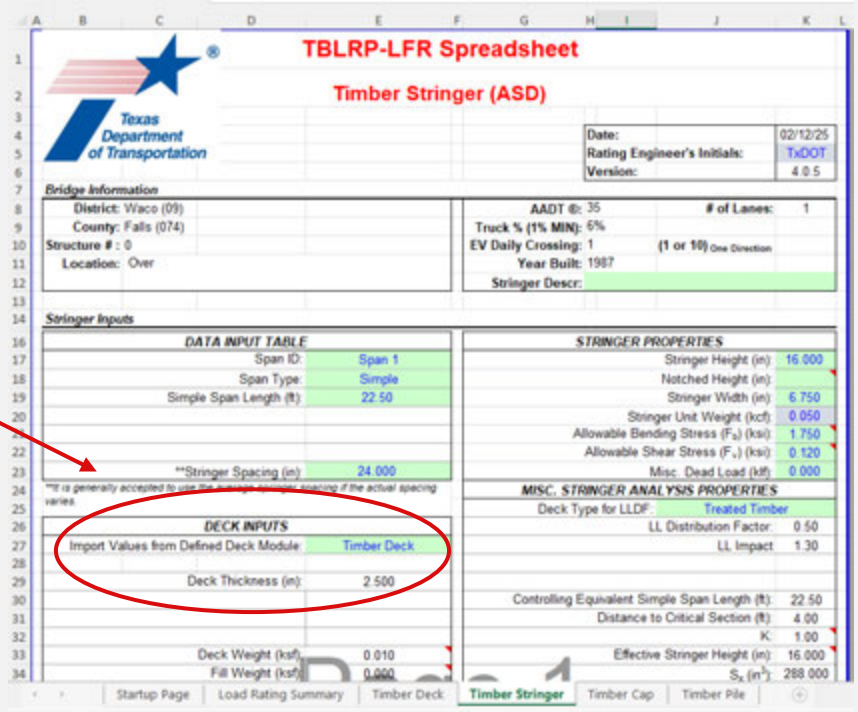




TBLRP-LFR Example 1

Timber Stringer

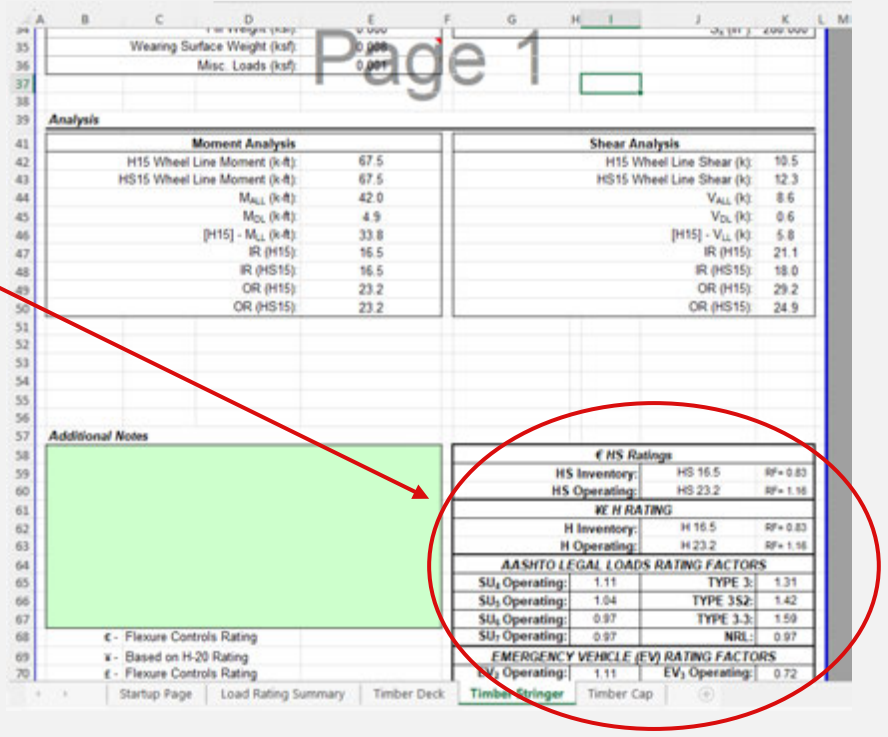
- Import data previously entered in deck module



TBLRP-LFR Example 1

Timber Stringer

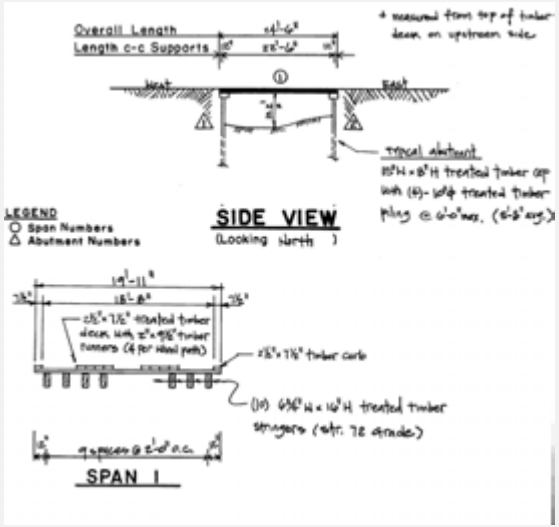
- Load Rating Results



TBLRP-LFR Example 1

Timber Cap

- Enter details as shown in plans/sketch



TBLRP-LFR Spreadsheet

Timber Cap (ASD)

Texas Department of Transportation

Date:	02/12/25
Rating Engineer's Initials:	TxDOT
Version:	4.0.5

Bridge Information

District:	Waco (09)	AADT ©:	35
County:	Falls (074)	# of Lanes:	1
Structure # :	0	Truck % (1% MIN):	6%
Location:	Over	EV Daily Crossing:	1 (1 or 10) One Direction
		Year Built:	1987
		Cap Descr:	

Cap Inputs

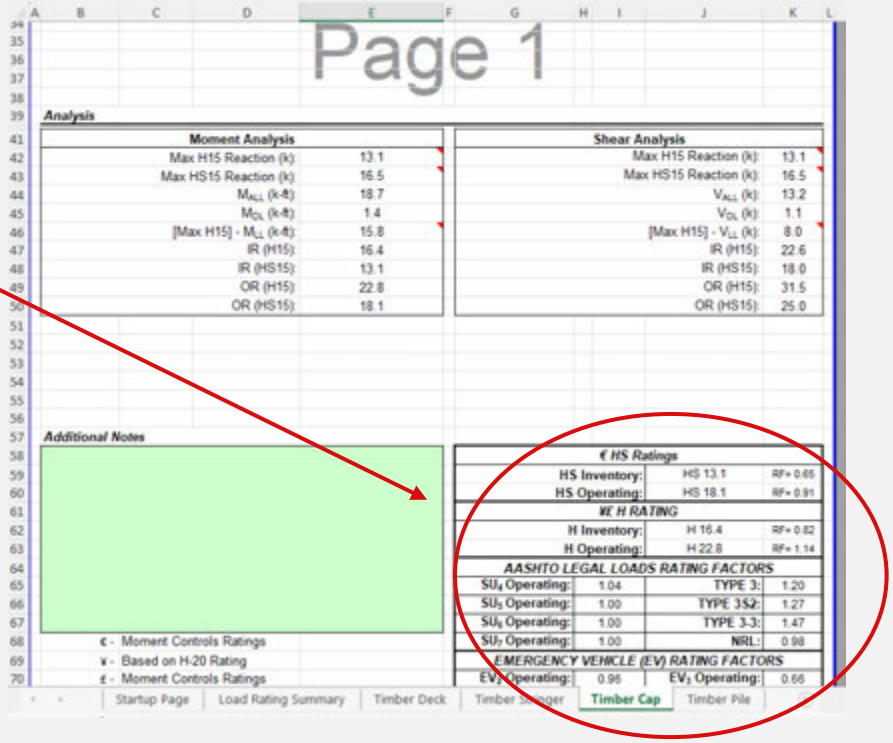
DATA INPUT TABLE		DEAD LOAD CALCS	
Bent ID Number:	Abutment	Effective Deck Length for Dead Loads (ft):	11.25
Pile Spacing (ft):	6.00	Deck Type:	Timber Deck
Equivalent Length Factor:	0.80	Deck+Fill+Wear. Surface (ksf):	0.020
Cap Unit Weight (kcf):	0.050	Superstructure Type:	Timber Stringer
Cap Width (in):	15.000	Superstructure Member Spacing (in):	24.000
Cap Height (in):	8.000	Superstructure Member Weight (klf):	0.038
Notched Height (in):		Cap Weight (klf):	0.042
Cap Condition:	Good	Total Dead Load (klf):	0.480
Abutment or Int. Bent:	Abutment	MISC. CAP ANALYSIS PROPERTIES	
Adjacent Span Length 1 (ft):	22.50	Equiv. Simple Span Length (ft):	4.80
Adjacent Span Length 2 (ft):	0.00	K:	1.00
Superstructure Material Type:	Timber	Effective Cap Height (in):	8.000
Is Superstructure Continuous Over Cap:	No	Allowable Bending Stress, F_b (ksi):	1.400
		Allowable Shear Stress, F_v (ksi):	0.165
		S_x (in^3):	160.000
		Distance to Critical Section (ft):	1.75
		Effective Horizontal Shear Factor, K_f:	0.861

Startup Page | Load Rating Summary | Timber Deck | Timber Stringer | Timber Cap | Timber Pile

TBLRP-LFR Example 1

Timber Cap

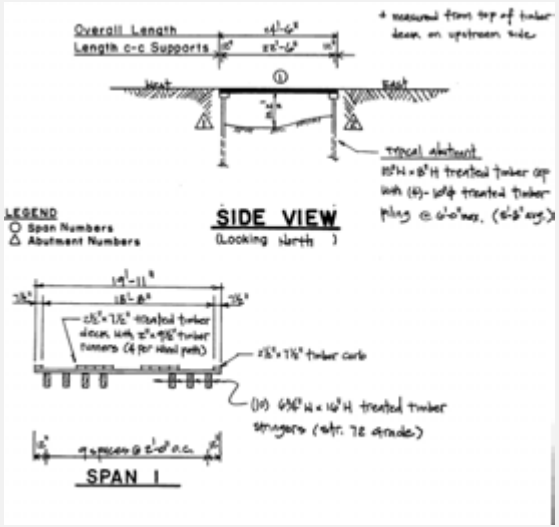
- Load Rating Results

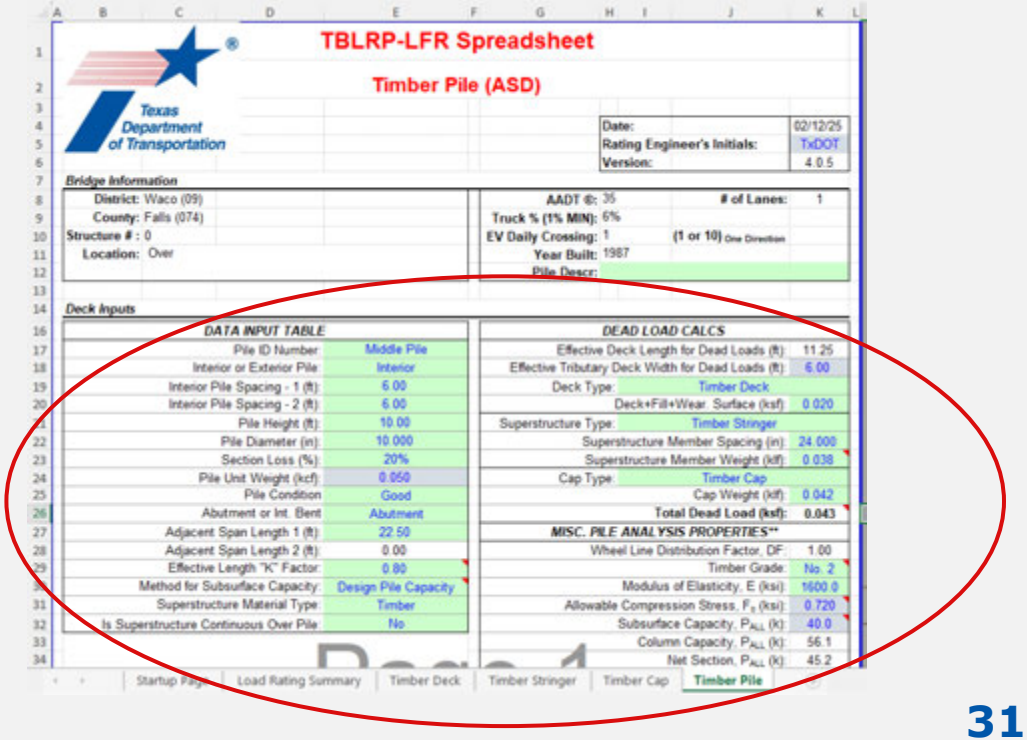


TBLRP-LFR Example 1

Timber Pile

- Enter details as shown in plans/sketch

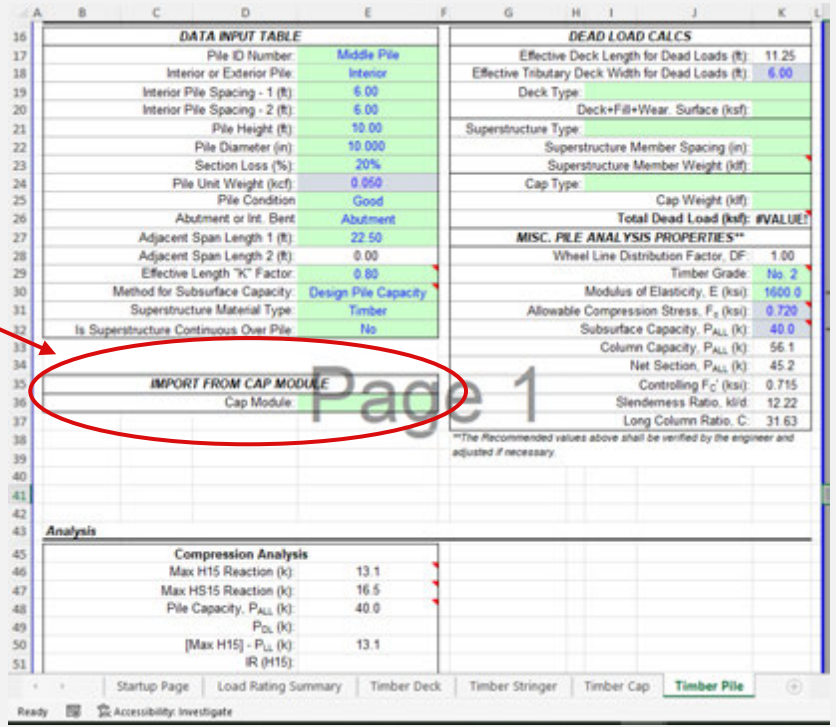




TBLRP-LFR Example 1

Timber Pile

- Select to import data from previous cap module



TBLRP-LFR Example 1

Timber Pile

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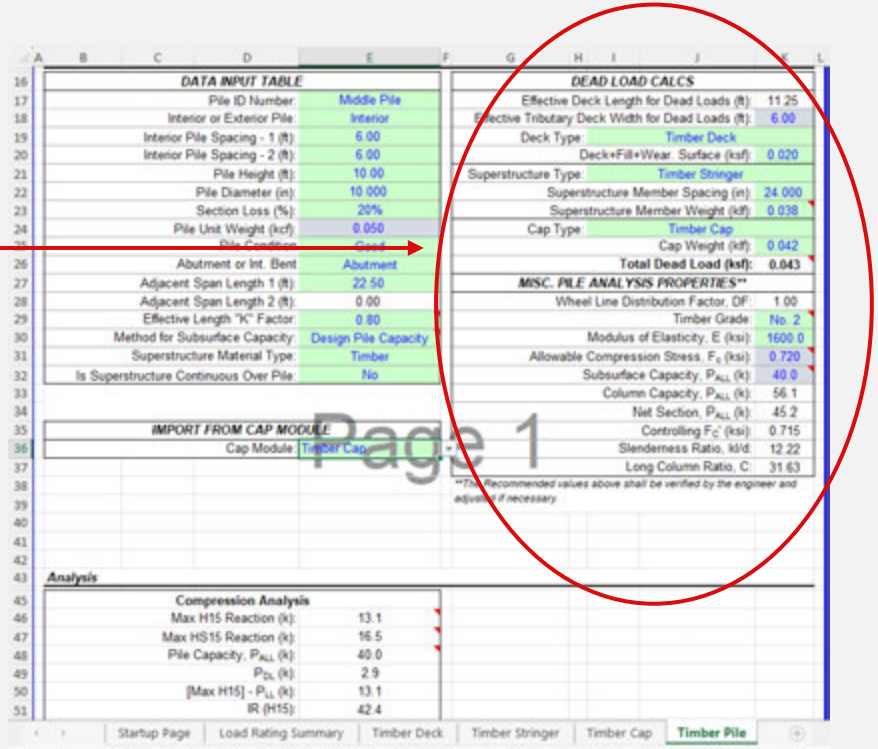
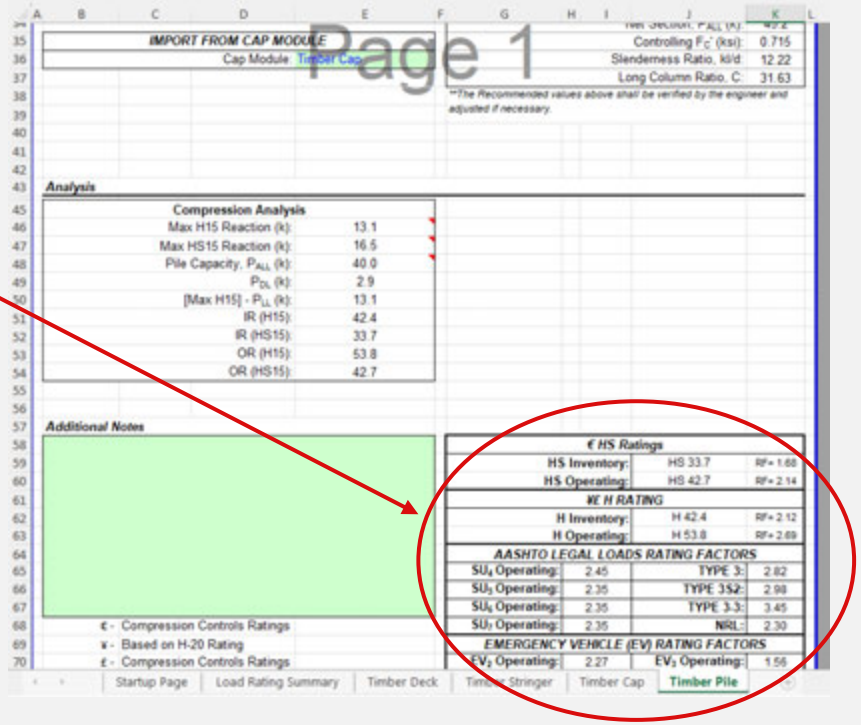


TBLRP-LFR Example 1

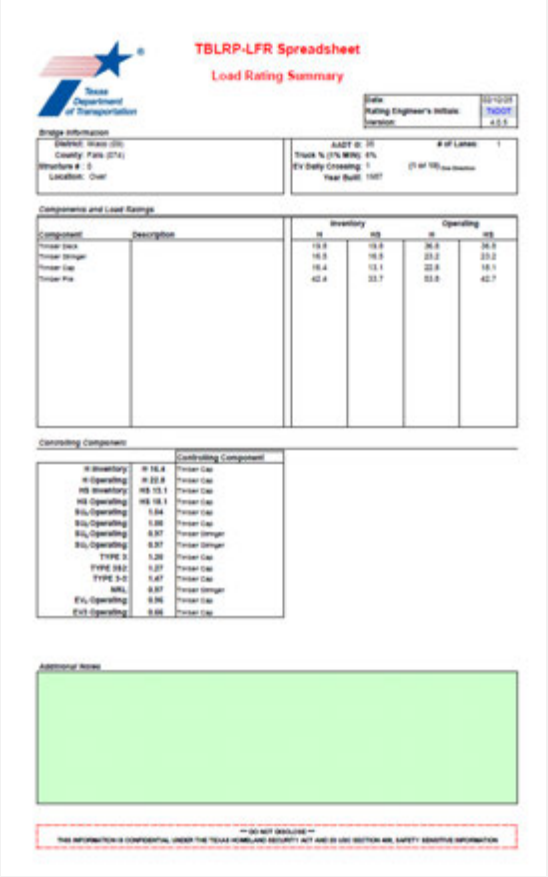
Timber Pile

- Load Rating Results



TBLRP-LFR Example 1

Load Rating Summary


TBLRP-LFR Spreadsheet

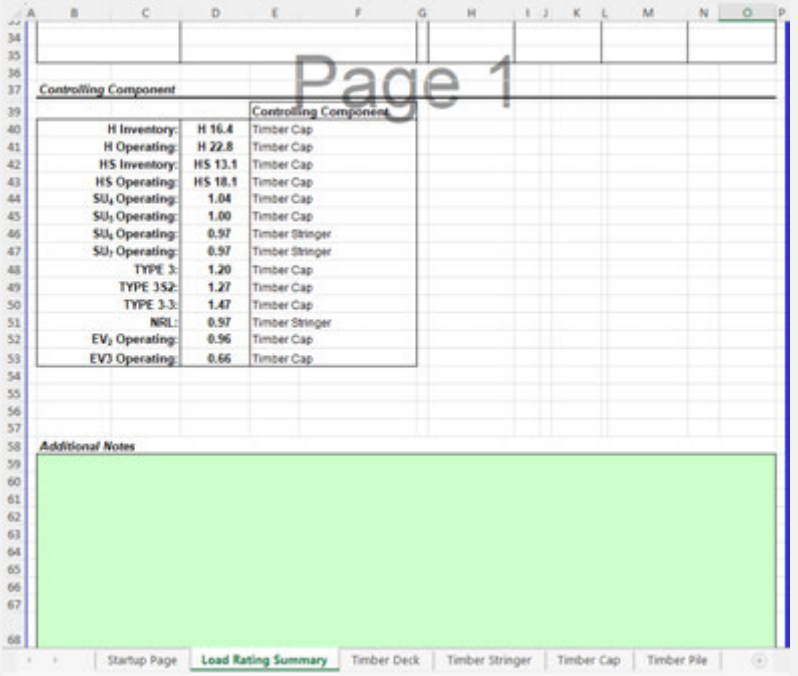
Load Rating Summary

TBLRP-LFR Example 1

Load Rating Summary

Components and Load Ratings

Component	Description	Inventory H	Inventory HS	Operating H	Operating HS
Timber Deck		19.8	19.8	36.8	36.8
Timber Stringer		16.5	16.5	23.2	23.2
Timber Cap		16.4	13.1	22.8	18.1
Timber Pile		42.4	33.7	53.8	42.7



TBLRP-LFR Example 2

4 Simple Span Precast Concrete Slab Panel Bridge on Steel & Timber Bents

TBLRP-LFR Example 2

4 Simple Span Precast Concrete Slab Panel Bridge

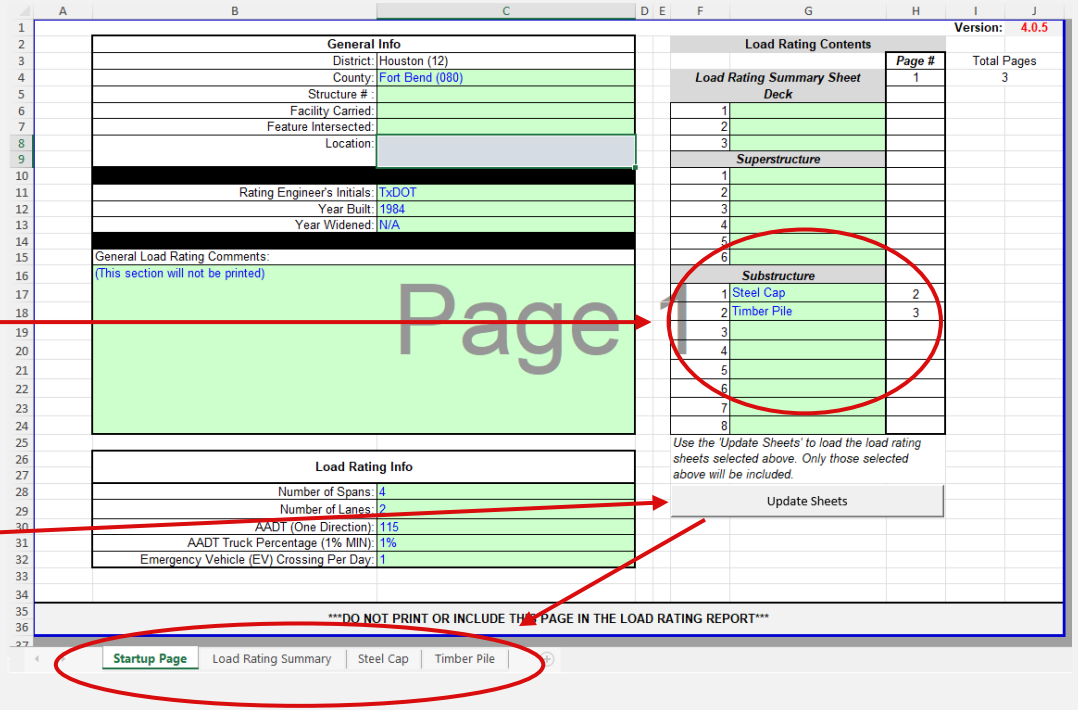
on Steel & Timber Bents

- Concrete Slab panels (Assumed rating)
- Steel Cap
- Timber Pile

TBLRP-LFR Example 2

Start up Page

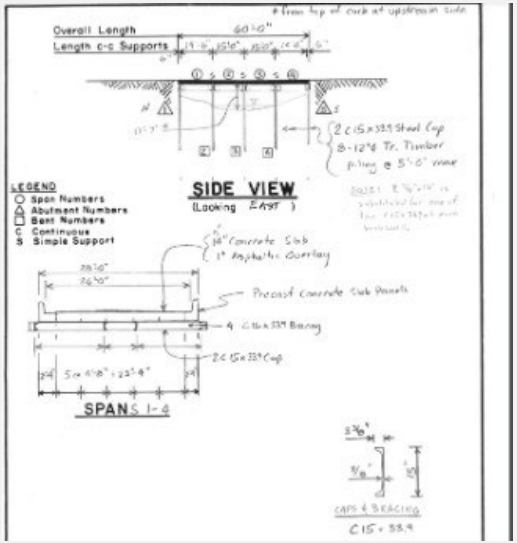
- Enter General Information
- Select Applicable Modules
  - Steel Cap
  - Timber Pile
- Click "Update Sheets"



TBLRP-LFR Example 2

Steel Cap

- Enter details as shown in plans/sketch



TBLRP-LFR Spreadsheet

Steel Cap

Texas Department of Transportation

Date:	02/07/25
Rating Engineer's Initials:	TxDOT
Version:	4.0.5

Bridge Information

District:	Houston (12)	AADT ©:	115
County:	Fort Bend (080)	# of Lanes:	2
Structure # :	0	Truck % (1% MIN):	1%
Location:	0	EV Daily Crossing:	1 (1 or 10) One Direction
		Year Built:	1984
		Cap Descr:	2 - C15 x 33.9 channels

Cap Inputs

DATA INPUT TABLE		DECK INPUTS	
Bent ID Number:	Bent 2	Deck Type:	Concrete Slab
Standard Beam Designation:		Deck Thickness (in):	14.000
Rolled Section Depth (in):	15.000	Deck Elastic Modulus, E (ksi):	3184.0
Web Thickness (in):	0.800	Deck+Fill+Wear. Surface (ksf):	0.300
Flange Width (in):	6.800	Deck Width (ft):	29.00
Top Flange Thickness (in):	0.650	**SUPERSTRUCTURE INPUTS**	
Bottom Flange Thickness (in):	0.650	Superstructure Type:	Concrete Slab
Fillet Radius (in):	0.500		
Moment of Inertia (in4):	636.567		
Z (in3): 102.411	S (in3): 84.876		
	Fy (ksi): 36.0		
Cap Length (ft):	29.00	**PILE INPUTS**	
Cap Weight (klf):	0.067	Number of Piles:	4
Cap Elastic Modulus (ksi):	29000.0	Distance to First Pile from Edge of Cap (ft):	0.00
Web Stiffeners Present (Y/N):	N	Pile Spacing (ft):	9.6 - 9.6 - 9.6
Abutment or Int. Bent:	Int. Bent		
Adjacent Span Length 1 (ft):	15.00		
Adjacent Span Length 2 (ft):	15.00		

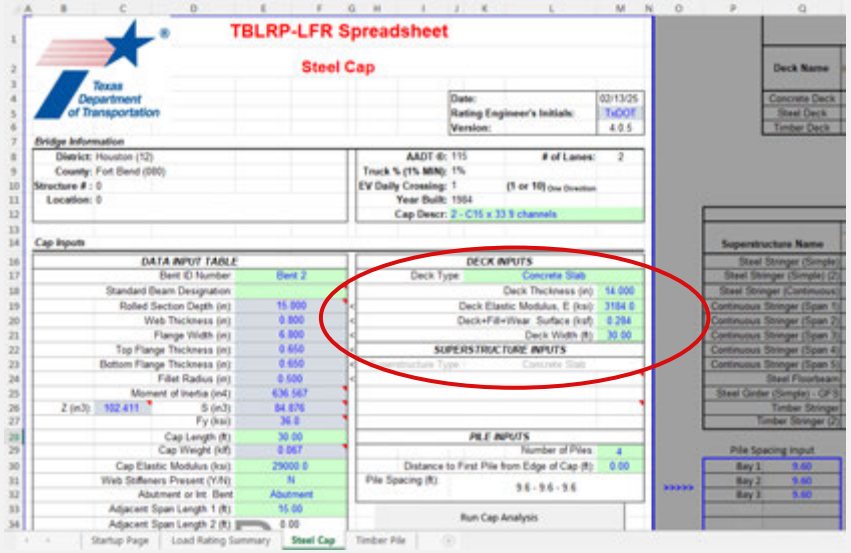
Run Cap Analysis

Startup Page | Load Rating Summary | Steel Cap | Timber Pile

TBLRP-LFR Example 2

Steel Cap

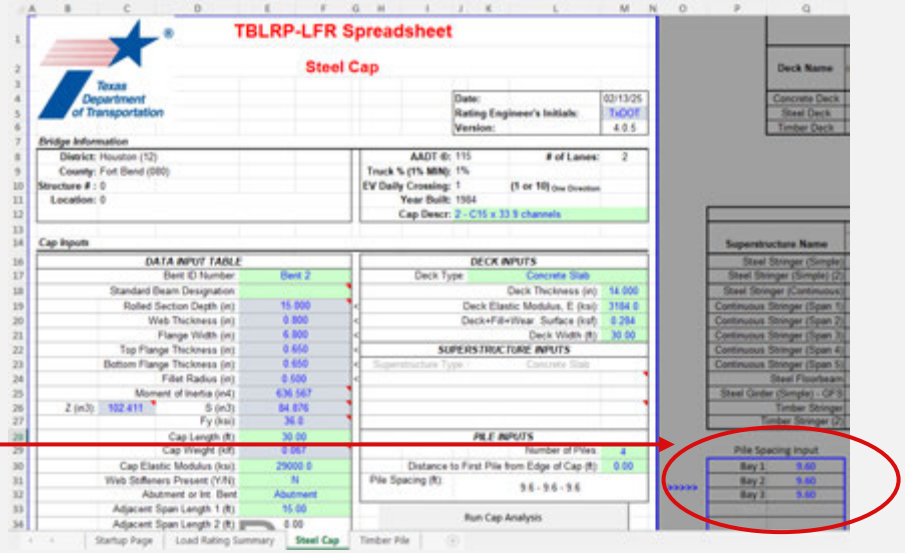
- Concrete Slab selected
- Deck Dead Load Hand Calc
  - Slab beam self weight
  - Steel stringer self weight
- Pile spacing
- Click “Run Cap Analysis”



TBLRP-LFR Example 2

Steel Cap

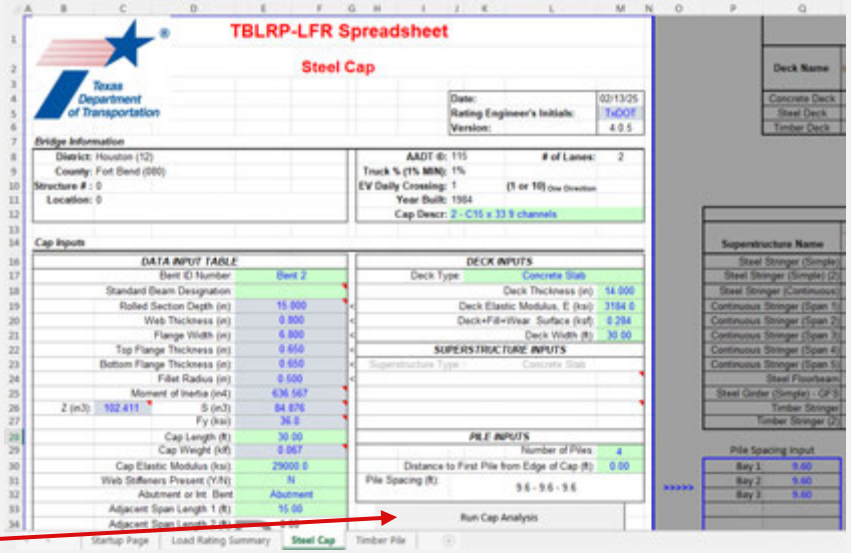
- Concrete Slab selected
- Deck Dead Load Hand Calc
  - Slab beam self weight
  - Steel stringer self weight
- Pile spacing
- Click “Run Cap Analysis”



TBLRP-LFR Example 2

Steel Cap

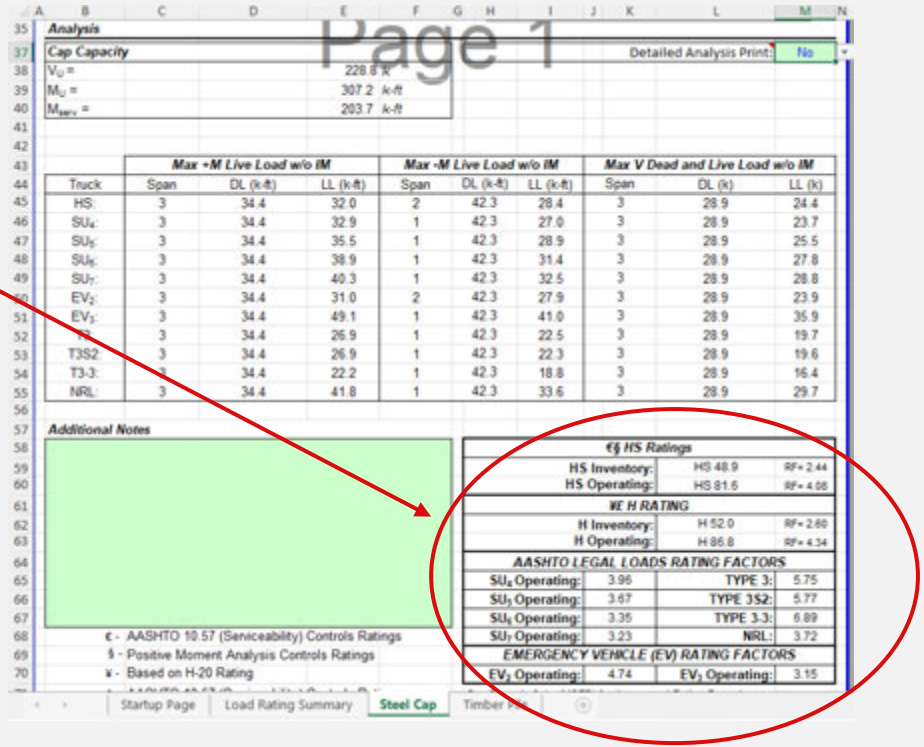
- Concrete Slab selected
- Deck Dead Load Hand Calc
  - Slab beam self weight
  - Steel stringer self weight
- Pile spacing
- Click “Run Cap Analysis”



TBLRP-LFR Example 2

Steel Cap

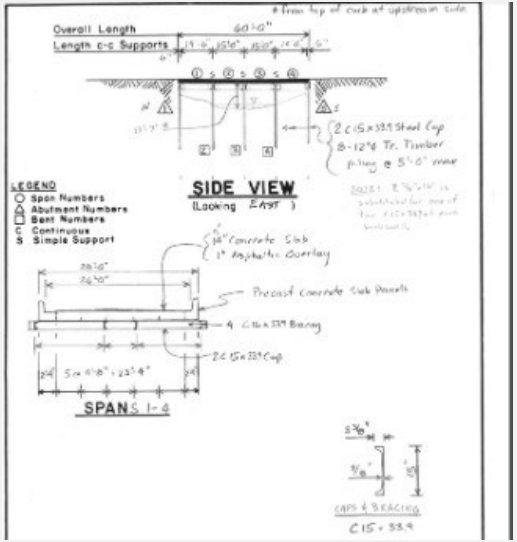
- Load Rating Results



TBLRP-LFR Example 2

Timber Pile

- Enter details as shown in plans/sketch



TBLRP-LFR Spreadsheet

Timber Pile (ASD)

Texas Department of Transportation

Date:	02/07/25
Rating Engineer's Initials:	TxDOT
Version:	4.0.5

Bridge Information

District: Houston (12)		AADT ©: 115	# of Lanes: 2
County: Fort Bend (080)		Truck % (1% MIN): 1%	
Structure # : 0		EV Daily Crossing: 1	(1 or 10) One Direction
Location: 0		Year Built: 1984	
		Pile Descr: 12" Timber Piles	

Deck Inputs

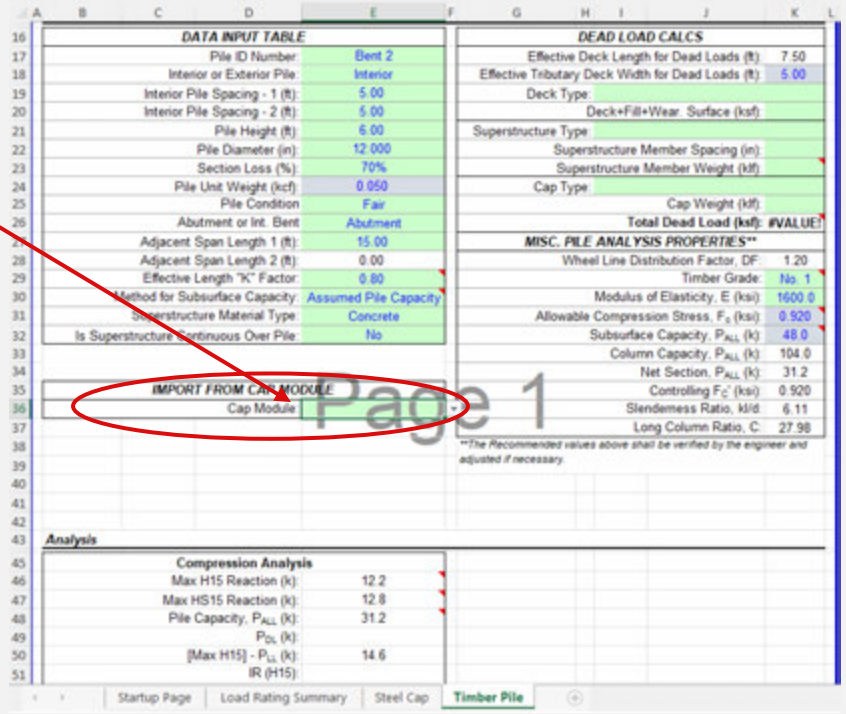
DATA INPUT TABLE		DEAD LOAD CALCS	
Pile ID Number	Bent 2	Effective Deck Length for Dead Loads (ft):	7.50
Interior or Exterior Pile	Interior	Effective Tributary Deck Width for Dead Loads (ft):	5.00
Interior Pile Spacing - 1 (ft):	5.00	Deck Type:	
Interior Pile Spacing - 2 (ft):	5.00	Deck+Fill+Wear. Surface (ksf):	
Pile Height (ft):	6.00	Superstructure Type:	
Pile Diameter (in):	12.000	Superstructure Member Spacing (in):	
Section Loss (%):	70%	Superstructure Member Weight (klf):	
Pile Unit Weight (kcf):	0.050	Cap Type:	
Pile Condition:	Fair	Cap Weight (klf):	
Abutment or Int. Bent:	Abutment	Total Dead Load (ksf):	#VALUE!
Adjacent Span Length 1 (ft):	15.00	MISC. PILE ANALYSIS PROPERTIES**	
Adjacent Span Length 2 (ft):	0.00	Wheel Line Distribution Factor, DF:	1.20
Effective Length "K" Factor:	0.80	Timber Grade:	No. 1
Method for Subsurface Capacity:	Assumed Pile Capacity	Modulus of Elasticity, E (ksi):	1600.0
Superstructure Material Type:	Concrete	Allowable Compression Stress, F_c (ksi):	0.920
Is Superstructure Continuous Over Pile:	No	Subsurface Capacity, P_{ALL} (k):	48.0
		Column Capacity, P_{ALL} (k):	104.0
		Net Section, P_{ALL} (k):	31.2

Startup Page | Load Rating Summary | Steel Cap | Timber Pile

TBLRP-LFR Example 2

Timber Pile

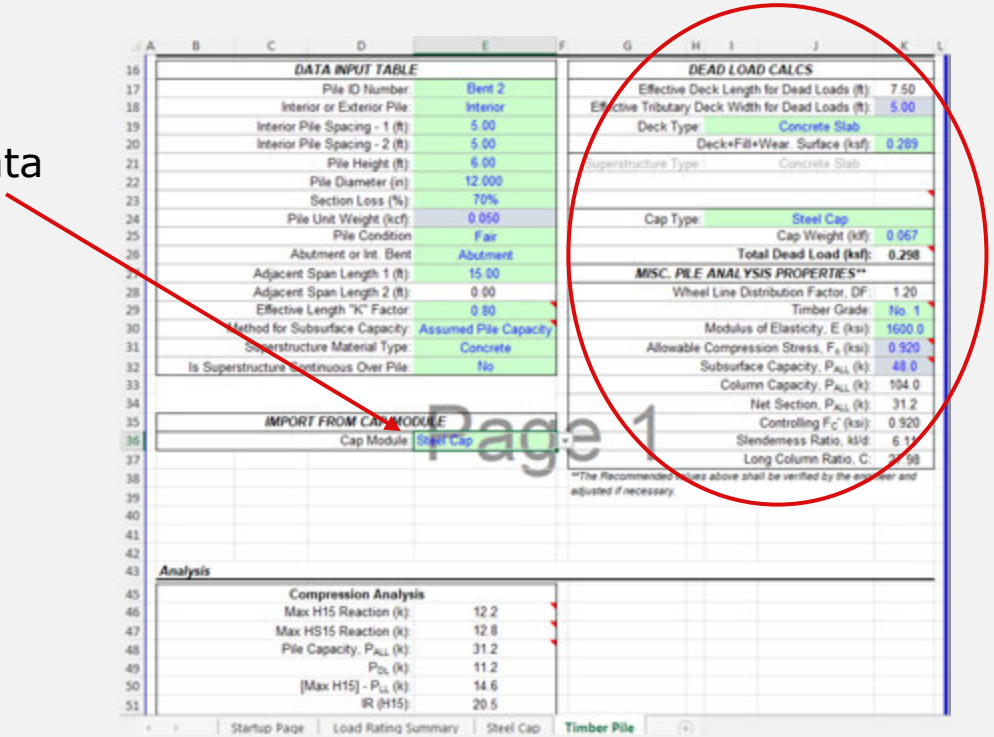
- Select to import Steel Cap data



TBLRP-LFR Example 2

Timber Pile

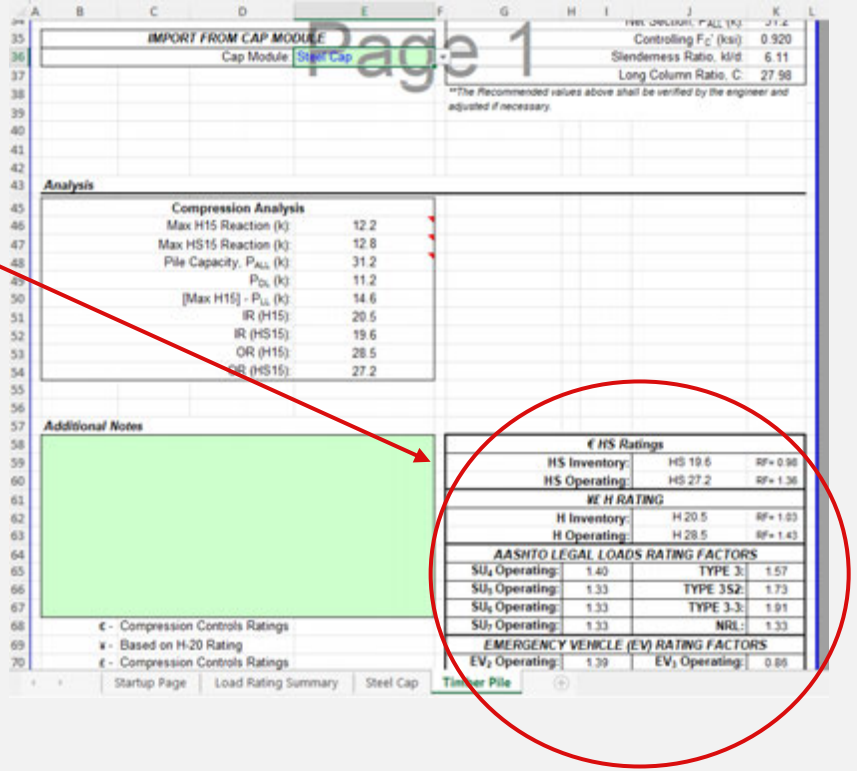
- Select to import Steel Cap data



TBLRP-LFR Example 2

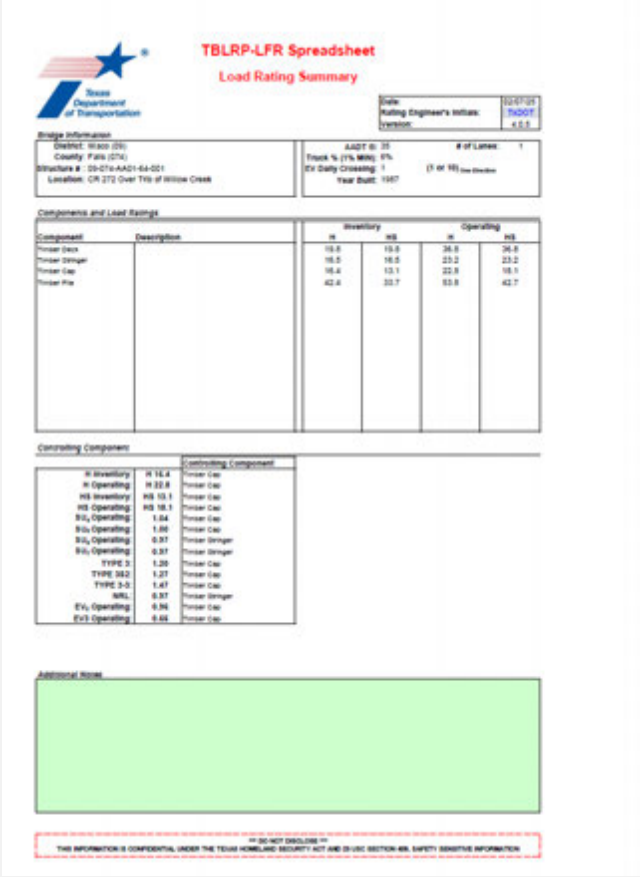
Timber Pile

- Load Rating Results



TBLRP-LFR Example 2

Load Rating Summary

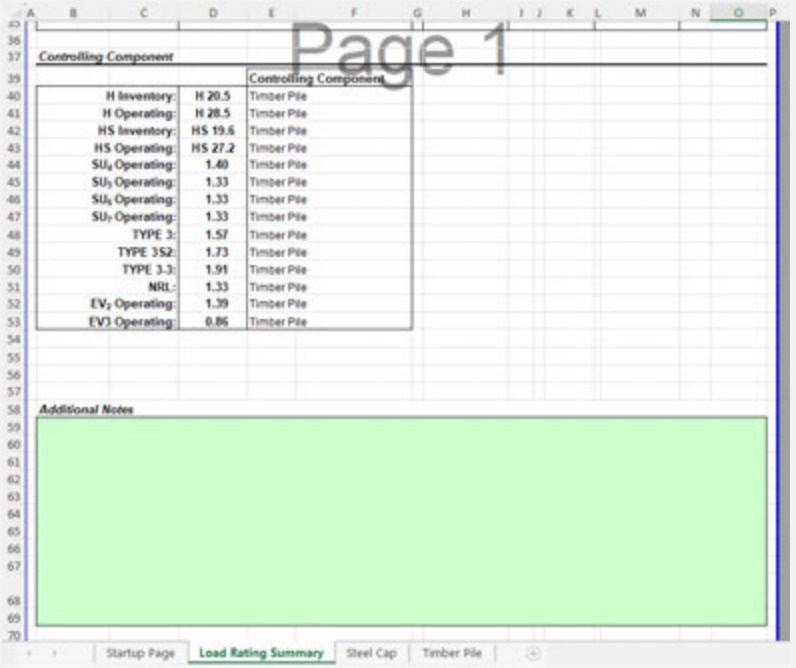


TBLRP-LFR Example 2

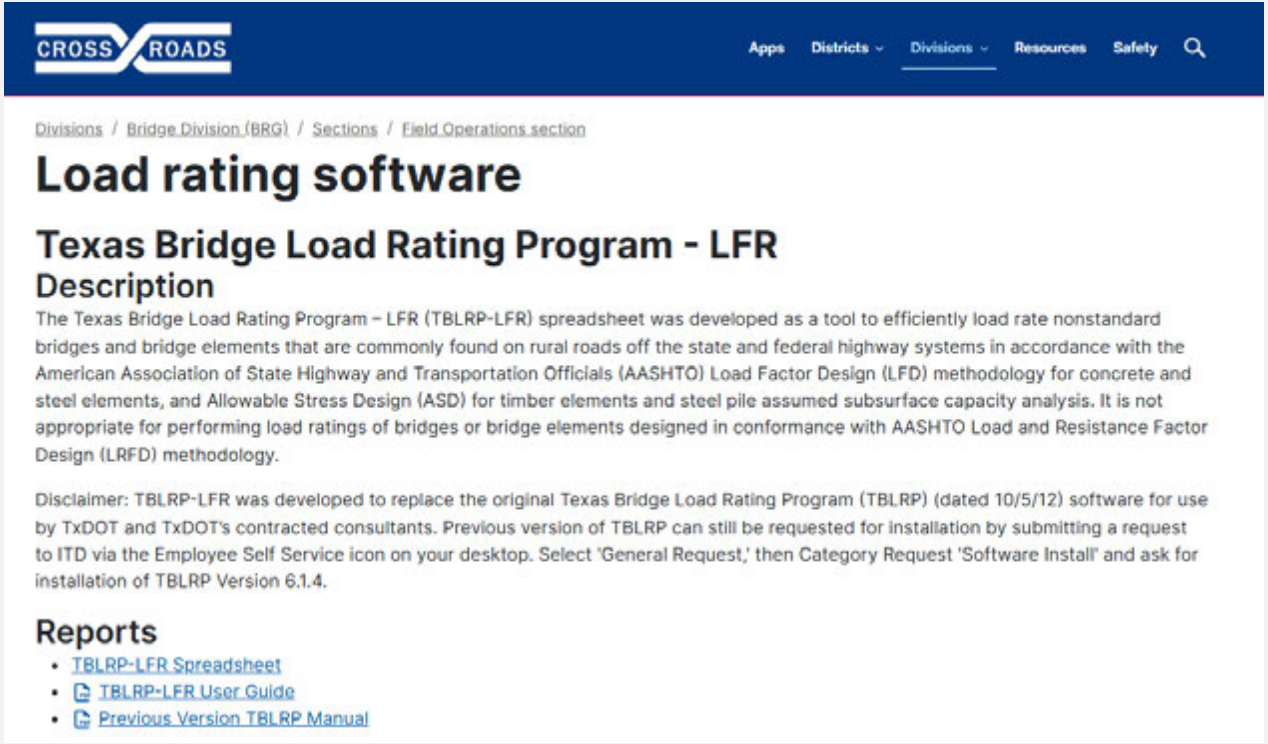
Load Rating Summary

Components and Load Ratings

Component	Description	Inventory		Operating	
		H	HS	H	HS
Steel Cap	2 - C15 x 33.9 channels	57.4	54.8	95.9	91.5
Timber Pile	12" Timber Piles	20.5	19.6	28.5	27.2

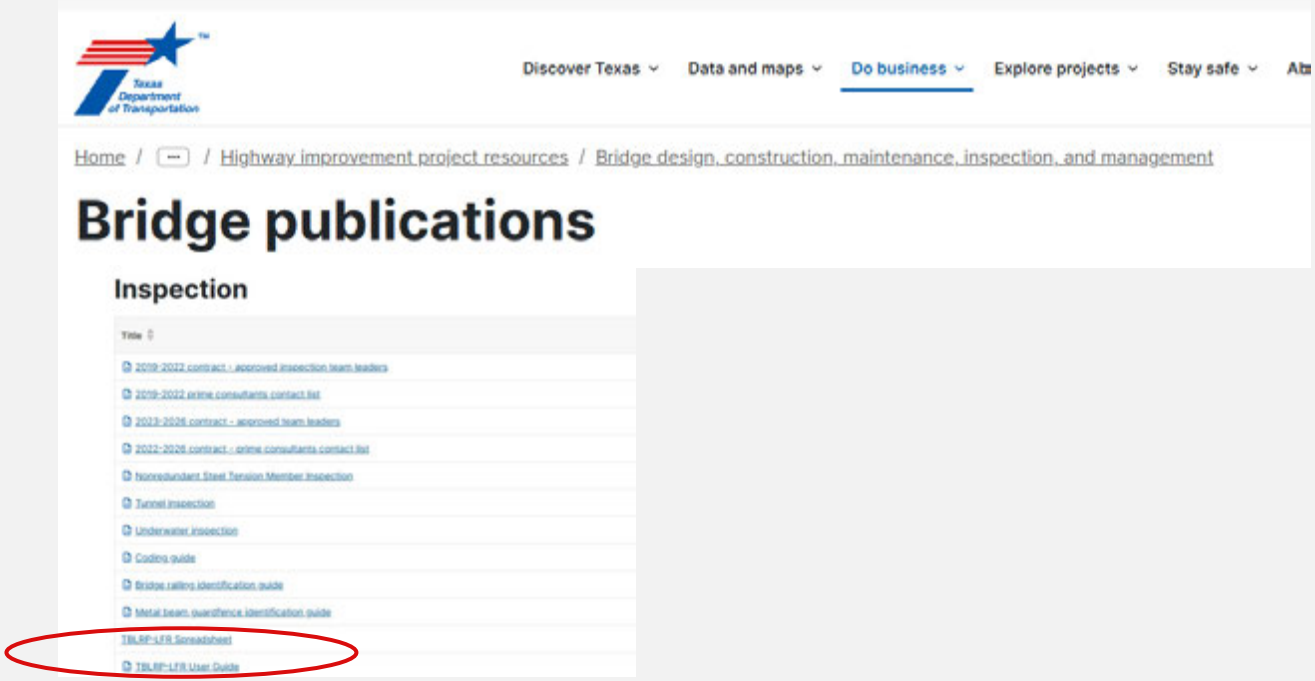


Resources (internal)



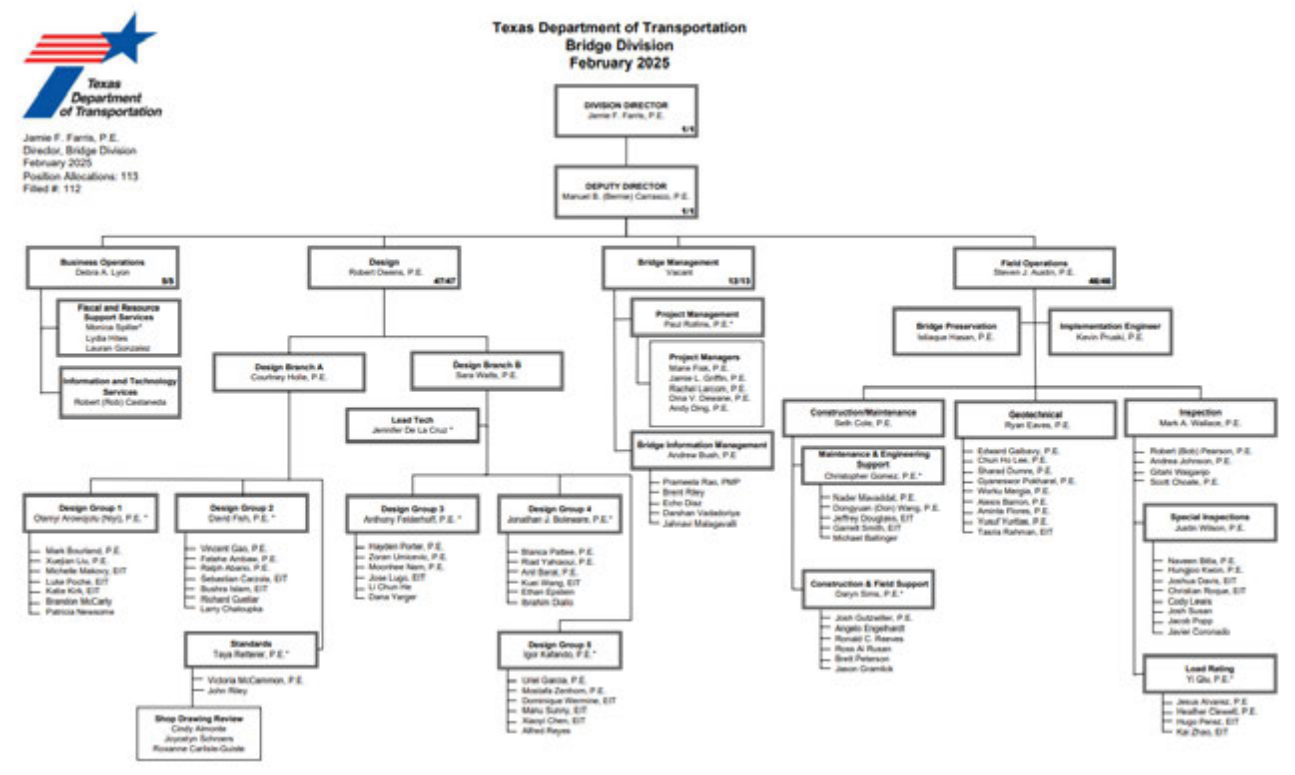
https://crossroads/divisions/brg/sections/field-operations-section/load-rating-software.html

Resources (external)

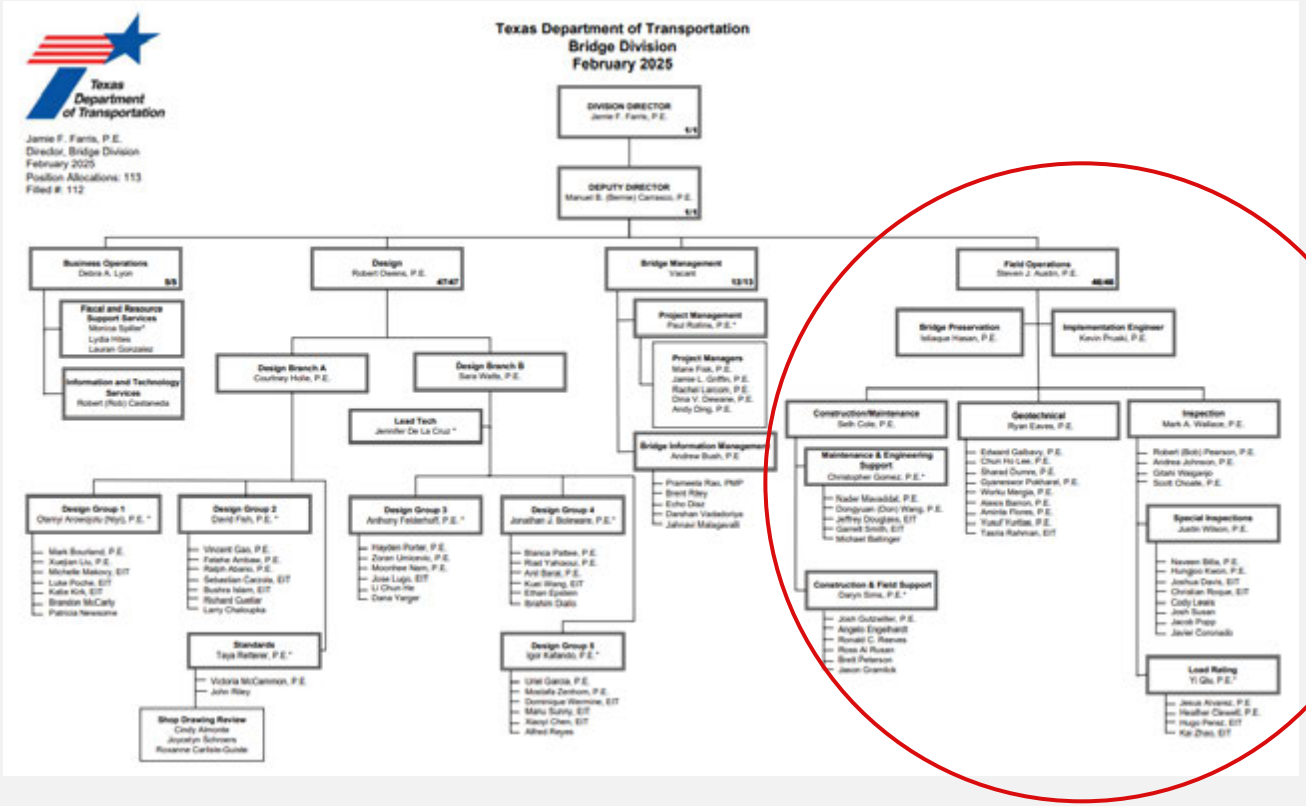


https://www.txdot.gov/business/resources/highway/bridge/bridge-publications.html

Load Rating Team



Load Rating Team



Load Rating Team

Supervisor

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Load Rating Team Lead

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Load Rating Team Members:

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- Hugo Perez, E.A. Hugo.Perez@txdot.gov
- Kai Zhao, E.A. Kai.Zhao1@txdot.gov

Q&A