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SCDOT Load Rating Process Training Course

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Load Rating Process Training Course

- Welcome
  - Housekeeping
  - Introductions
  - Overview of Training Course
  - Objectives
  - Training Course Schedule

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Welcome - Housekeeping

- Breaks
- Chat
- Polling
- Silence Phones

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Welcome - Introductions

- Rachel Sharp, P.E.
- Michael Baker International
- BSCE and MS: West Virginia University
- 19 years bridge experience
- 12+ years load rating experience

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Welcome - Introductions

- Cassie Lloyd, P.E.
- Michael Baker International
- BSCE: Bucknell University
- 11 years bridge experience
- 10 years load rating experience

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Overview of the Training

- What are load ratings? What role does the LRGD play?

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Objectives

- Objectives
  - Load Rating Basics → "What is it? Why do it? When?"
  - SCDOT Process → "What's Involved?"
    - LRGD
    - Load Rating Documentation
    - Bridge Postings
    - Help / Guidance Documents and Resources

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Training Course Schedule

SCDOT Load Rating Process

Course Schedule

Day 1

			Est. Duration	Lesson	
8:00 AM	-	8:05 AM	0:05	0	Welcome (Housekeeping)
8:05 AM	-	8:15 AM	0:10	1	Course Introduction
8:15 AM	-	8:40 AM	0:25	2	Introduction to Load Rating of Highway Bridges
8:40 AM	-	9:45 AM	1:05	3	Load Rating Guidance Document (LRGD) Highlights
9:45 AM	-	9:55 AM	0:10		Break
9:55 AM	-	10:55 AM	1:00	4	Load Rating Documentation for SCDOT Bridge File
10:55 AM	-	11:05 AM	0:10		Break
11:05 AM	-	11:40 AM	0:35	5	Bridge Posting
11:40 AM	-	11:50 AM	0:10	6	Help / Guidance Documents
11:50 AM	-	12:00 PM	0:10	7	Wrap Up - Questions and Answers
					End of Course

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Welcome - Questions

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Introduction to Load Rating of Highway Bridges

- Understanding the FHWA requirements for Load Ratings
- Demonstrate the LRFR process and the General Load Rating Equations
- Questions / Open Discussion

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Introduction to Load Rating of Highway Bridges

- What bridge is this?

A. Silver Bridge in Point Pleasant, WV
B. Tacoma Narrows "Gallopin Gertie"
C. I-35 W Bridge in Minneapolis
D. Florida Intl University Bridge in Miami

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Introduction to Load Rating of Highway Bridges

- Understanding the FHWA requirements for Load Ratings

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Introduction to Load Rating of Highway Bridges

- Understanding the FHWA requirements for Load Ratings

Why Do We Load Rate Bridges?

Load rating is required by NBIS regulations: 23 CFR Subpart C

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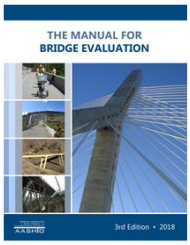
Introduction to Load Rating of Highway Bridges

- From the "MBE" (AASHTO Manual for Bridge Evaluation, 3rd Edition), Section 6.1:

> Bridge load rating provides a basis for determining the safe load capacity of a bridge. Load rating requires engineering judgment in determining a rating value that is applicable to maintaining the safe use of the bridge and arriving at posting and permit decisions.



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Introduction to Load Rating of Highway Bridges

- Why Load Rate?

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 to the NBI for national bridge administration and are also used in local bridge management systems.

This Section is intended for use in evaluating the of highway bridges commonly in use in the United S

→Load Posting

→Bridge Strengthening

→Overweight Permits

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Demonstrate the LRFR process and the General Load Rating Equations

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Rating Factor = (C – DL) / LL [MBE 6A.4.2.1-1] – LRFR

[MBE 6B.4.1-1] – ASR/LFR

$$RF = \frac{C - A_1 D}{A_2 L(1+I)}$$

C: member capacity

DL: dead load on member (+ other permanent loads)

LL: live load demand on member

"How much reserve capacity does the member have after I subtract out the dead load currently being carried by the member?"

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Demonstrate the LRFR process and the General Load Rating Equations

Capacity (moment, shear, axial, flexural stress, etc.)

→ AASHTO LRFD Bridge Design Specifications
→ AASHTO Standard Specifications for Highway Bridges

Dead Loads

→ Compute Based on Bridge Plans / Site Assessment
→ Loads Applied Later (wearing surface, traffic signs, utilities, etc.)

Live Load

→ Design: HL-93 [LRFR], H-20, HS-20 [LFR/ASR]
→ Legal: legal trucks with unrestricted access to the bridge inventory
→ Permit: "heavy" trucks above the legal limits; need approval to cross bridges

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Demonstrate the LRFR process and the General Load Rating Equations

Example 1:

W30x108 bridge girder
Moment capacity, C = 1,929 kip-ft
Dead load, DL = 407 kip-ft
Live Load (HL-93), LL = 1,091 kip-ft

RF = (C – DL) / LL
RF = (1929 – 407) / 1091 = 1.39

Girder rates out for HL-93 (it has additional reserve capacity)

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Demonstrate the LRFR process and the General Load Rating Equations

Example 2:

W30x108 bridge girder with flange deterioration (say)
Moment capacity, C = 1,200 kip-ft
Dead load, DL = 407 kip-ft
Live Load (SC Type 3S2), LL = 975 kip-ft

RF = (C – DL) / LL
RF = (1200 – 407) / 975 = 0.81
RF < 1.0 for legal load → bridge posting is required

19.1 GENERAL

In accordance with Sections 6A.8.2 and 6B.7.2 of the MBE, when the maximum legal load under state law exceeds the safe load capacity of a bridge, restrictive posting shall be required. Before weight limit posting is recommended, posting avoidance options should be discussed with the SBME or designated representative as these options may require additional analysis (see Bridge Maintenance Office Appr Form in Appendix A20.2).

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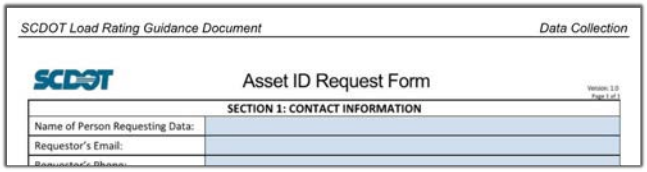
General Bridge Nomenclature

- Asset ID
  - Always 5 digits (never changes)
  - Request early in preliminary design
  - (Ref. LRGD Appendix A5.1)



SCDOT Load Rating Guidance Document — Data Collection

SCDOT Asset ID Request Form

SECTION 1: CONTACT INFORMATION	
Name of Person Requesting Data:	
Requestor's Email:	

- Structure Number
  - Always 13 digits (represent county, facility carried, etc.)
  - Possibility of change; therefore, always use ASSET ID

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Demonstrate the LRFR process and the General Load Rating Equations

- When Should a Load Rating be Performed?
  - Design stage
  - Initial inventory inspection
  - Change in the live load (FAST Act EVs for example)
  - Special permit loads
  - Change in the dead load on the structure
  - Physical change in any structural member of the bridge
  - Change in load rating method requirements

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The Process

In General, Each Load Rating Includes the Following:

1. Review Existing Information
2. Utilize Guidance Documents
3. Assumptions & Supplemental Calculations
4. Conspan, Midas, LEAP, Excel, BrR or Other Input [A3.1]
5. Load Rating Summary Form (LRSF)
6. QC Review Checklist
7. Data Correction Form
8. Labeling Diagram
9. Posting Avoidance (if applicable)

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The Process

Specifically, Interim Load Rating Procedure in Design:

1. Load Rating Input File
2. Load Rating Summary Form (LRSF)
3. Supplemental Calculations
4. QC Review Checklist
5. Data Correction Form
6. Labeling Diagram
7. Asset ID Request Form
8. Bridge Maintenance Office Approvals Request Form (BMO), if needed
9. Final Design Plans
10. Final As-Built Plans

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Load Ratings

- Goal: BrR File for Every Bridge
  - Other Software Permissible [A3.1]

Table A3.1. Preferred Alternative Load Rating Software

Preferred Alternative Software	Software Purpose
CSI Bridge	General Finite Element Analysis & Complex Steel
LARSA	General Finite Element Analysis & Complex Steel
SAP	General Finite Element Analysis
GT STRUDL	General Finite Element Analysis
STAAD.Pro	General Finite Element Analysis
MIDAS	General Finite Element Analysis
CANDE	Complex Culvert

- Follow Provisions of the LRGD!

The procedures outlined in the LRGD shall be followed in their entirety, unless stated otherwise in this scope of services. This includes, but is not limited to, substructure load rating when required or if judgement during site assessment predicts it governing, data entry into rating software, completing the load rating process, post-processing the results, and completing the Load Rating Summary Form for each site.

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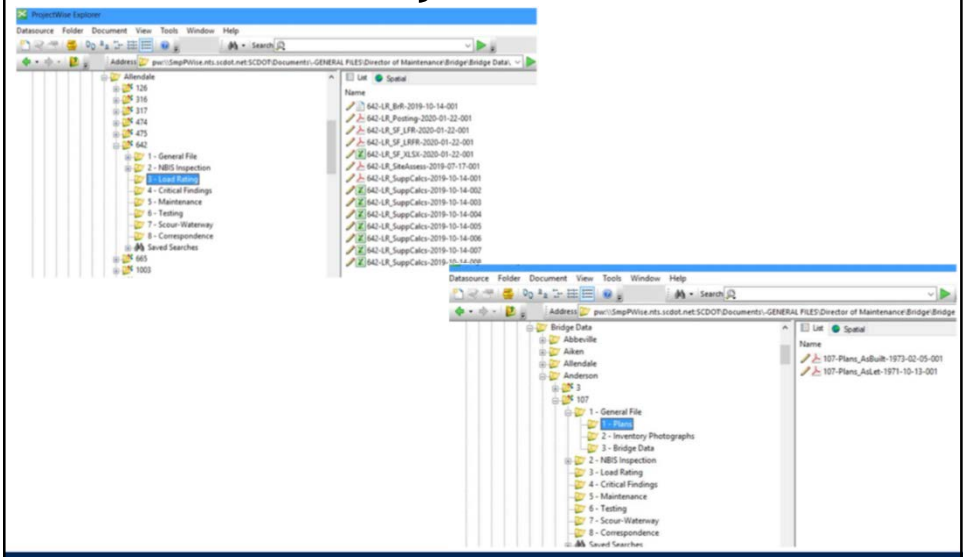
ProjectWise



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Load Rating Intro - Questions

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Load Rating Guidance Document (LRGD) Highlights

- Chapter 4 – Load Rating Process
- Chapter 6 – General Requirements
- Chapter 9 – Reinforced Concrete Superstructures
- Chapter 10 – Prestressed Concrete Girder
- Chapter 11 – Steel Superstructures
- Chapters 12, 13, 17, 18 Guidance for Other Superstructures
- Chapters 14, 15, 16 Guidance for Substructures
- Questions / Open Discussion

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LRGD Highlights

- FHWA requires that new bridges and bridge replacements designed after October 1, 2010 be designed in accordance with LRFD Bridge Design Specifications and shall be load rated prior to opening the bridge to the public.

A. True
B. False

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LRGD Highlights

- Load Rating Submittal Packages shall be delivered at the same time as Final Plans and updated as needed with As-Built plans as a result of changes.
- If no changes are made that affect the load rating, provide a certification signed by the EOR stating that the original load rating remains accurate.

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LRGD Highlights

- Chapter 4 – Load Rating Process
  - ALL primary superstructure bridge components and connections should be load rated
  - Elements not routinely load rated include:
    -Deck (unless bridge is a deck slab type)
    -Bearings
    -Substructure (unless it will control ratings)
    -Foundations

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LRGD Highlights

- Chapter 4 – Load Rating Process
  - All spans and live load carrying components shall be rated
    - Moment
    - Shear
    - Axial (where appropriate)

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LRGD Highlights

- Chapter 4 – Load Rating Process
  - When is new load rating to be done?
    - Reconstruction that changes bridge's roadway width, load carrying capacity, structural or geometric configuration

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LRGD Highlights

- Chapter 4 – Load Rating Process
  - When is updated load rating to be done?
    - Re-decking
    - Deck Overlays
    - Addition of New Spans
    - Converting Simple Spans to Continuous
    - Converting Pins and Hangers to Continuous
    - FCM
    - Fatigue Prone Details
    - Bridge Widening
    - Stringer Replacement
    - Superstructure Replacement
    - Substructure Replacement or Modifications
    - Emergency Repairs
    - Substantial Member Section Loss or Damage

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LRGD Highlights

- Chapter 4 – Load Rating Process
  - NBI Condition Ratings
    - Deck, Superstructure, Substructure or Culvert

      ≤ 4 or ↓ 2 Points
  - Increased Dead Load during Inspection
  - Bridge Inspection Team Leader Request
  - Program Manager Request

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LRGD Highlights

- LRFR Load Rating Equation

$$RF = (C - DL) / LL$$

$$RF = (C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P) / (\gamma_{LL})(LL + IM)$$

C = Capacity (bridge member/ element)
DC, DW = Dead Loads
P = Permanent Loads
LL = Vehicular Live Loads
IM = Impact Factor
γ = Load Factors

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LRGD Highlights

- Components of LRFR Load Rating Equation

$$C = \phi_c \phi_s \phi R_n$$

For the Strength Limit State

$$C = f_R$$

For the Service or Fatigue Limit States

$\phi_c \phi_s \geq 0.85$

ϕ_c = LRFR Condition Factor
ϕ_s = LRFR System Factor
ϕ = LRFD Resistance Factor
R_n = Nominal Resistance
f_R = Allowable Stress

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LRGD Highlights

- Factored Permanent Loads

$$-(\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm -(\gamma_{P})(P)$$

  - LRFD values
  - LRFR modifications

  - (γ_{DC}) = 1.25 normally
  - (γ_{DW}) = 1.50 normally
  - (γ_{DW}) = 1.25 if field measured

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LRGD Highlights

- Factored Live Loads

  - $(\gamma_{LL})(LL + IM)$

    LRFR calibrated values for load factors

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LRGD Highlights

- Chapter 6 – General Requirements
  - Loading Types
    - Permanent loads or dead loads (DL)
      - Structure self-weight
      - Superimposed dead loads (barriers, overlays, utilities)
      - Construction-induced forces
    - Vehicular live load (LL)
      - Design load (national)
      - Legal loads (national and state)
      - Permit loads (state or local)

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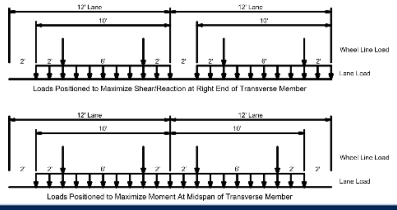
LRGD Highlights

- Chapter 6 – General Requirements
  - Other Loads
    - Pedestrian loads need not be considered simultaneously with vehicular loads
    - Sidewalk dead load shall be considered
    - Wind loads
  - Impact - SCDOT does not allow use of the reduced impact allowance (DLA) in Table C6A.4.4.3-1 unless authorized
  - Live Load Distribution



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LRGD Highlights

- Chapter 6 – AASHTO Legal Load Vehicles
  - Routine commercial traffic
    - AASHTO trucks and lane type models
  - Specialized Hauling Vehicles (SHV)
    - Multi-axle single-unit trucks
  - Emergency Vehicles (EV)
    - Based on the FAST Act
    - Legal in all states on Interstates and within reasonable access to Interstates

EV2 (29 Tons)
Two Single Axles

EV3 (43 Tons)
One Single Axle
One Tandem Axle

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LRGD Highlights

- Chapter 6 – SC Modified Vehicles

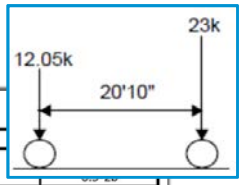
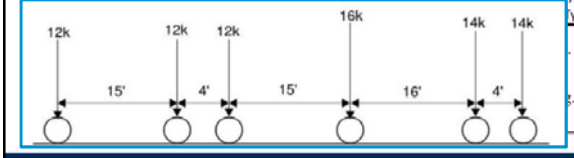


Table 6.5-1. Suite of Posting Vehicles

Truck Type	Axle Configuration	Vehicle	
Single Unit	2 Axles	SC-SU2	
		SC Representative School Bus	
	3 Axles	SC-SHV1A (65k) - Non-Interstate Only	6.5-2b
		SC- Type 3 (AASHTO modified)	6.5-1
	4 or More Axles	SC-SHV2A (66k) - Non- Interstate Only	6.5-2b
		SU4	6.5-2a
		SU5	6.5-2a
		SU6	6.5-2a
		SU7	6.5-2a
Combination Unit	5 or More Axles	SC-SHV3A (85k) - Non- Interstate Only	6.5-2b
		SC-SHV3B (90k) - Non- Interstate Only	6.5-2b
		SC - Type 3S2 (AASHTO Modified)	6.5-1
		Type 3-3 (AASHTO)	6.5-1
	Lane Type Loading (Neg. M only)	2-0.75 AASHTO Type 3-3 + .2 klf Lane	6.5-1
		Type 3-3 + .2 klf Lane	6.5-1

. 6.5-2b) for load ratings of non-

g. 6.5-2b) for load rating of non-



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LRGD Highlights

- Chapter 6 – ASR and LFR Vehicles
  - HS20-44 live load (truck and lane) at the Inventory and Operating Level
  - AASHTO or SC Modified Legal Vehicles at the Inventory and Operating Level
  - SHVs at the Inventory and Operating Level
  - Ev2 and EV3 at Operating
  - Permit Vehicles at the Operating Level

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LRGD Highlights

- Chapter 6 –LRFR Vehicles
  - HL-93 at the Inventory and Operating Level
  - AASHTO or SC Modified Legal Vehicles at the Legal Load Rating Level

    (even though MBE doesn't require if HL-93> 1.0)
  - SHVs at Legal Load Rating Level
  - EV2 and EV3 at Legal Load Rating Level
  - Permit Vehicles at the Permit Load Rating Level

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LRGD Highlights

- Chapter 6 –Material Properties
  - Based on plans or info in SCDOT Standard Specification for Construction for year built
  - Unknown Steel Yield Strengths, Fy
    - MBE Table 6A.6.2.1-1
    - MBE Table 6B5.2.1-1 to 6B5.2.1-4
    - Built after 2006, 50 ksi
    - Weathering Steel, 50 ksi
  - Unknown Steel Rivets
    - MBE Table 6A.6.12.5.1-1

Table 6A.6.2.1-1—Minimum Mechanical Properties of Structural Steel by Year of Construction

Year of Construction	Minimum Yield Point or Minimum Yield Strength, F_y, ksi	Minimum Tensile Strength, F_u, ksi
Prior to 1905	26	52
1905 to 1936	30	60
1936 to 1963	33	66
After 1963	36	66

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LRGD Highlights

- Chapter 6 – Material Properties Cont'd
  - Unknown Reinforcing Steel, Fy
    - MBE Table 6A.5.2.2-1
    - Built after 2000, 60 ksi

Table 6A.5.2.2-1—Yield Strength of Reinforcing Steel

Type of Reinforcing Steel	Yield Strength, f_y, ksi
Unknown steel constructed prior to 1954	33.0
Structural grade	36.0
Billet or intermediate grade, Grade 40, and unknown steel constructed during or after 1954	40.0
Rail or hard grade, Grade 50	50.0
Grade 60	60.0

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LRGD Highlights

- Chapter 6 –Material Properties Cont'd
  - Unknown Prestressing Strand
    - MBE Table 6A.5.2.3-1
    - Built before 2006, SR strands
    - Built after 2006, LR strands
  - Unknown PS Concrete, f'c
    - Built before 2000, 3.125 ksi
    - Built after 2000, 5.0 ksi

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LRGD Highlights

- Chapter 6 – Material Properties Cont'd
  - Unknown Reinforced Concrete, f'c
    - Built before 2006, MBE Table 6A.5.2.1-1
    - Built after 2006, 4.0 ksi

Table 6A.5.2.1-1—Minimum Compressive Strength of Concrete by Year of Construction

Year of Construction	Compressive Strength, f'_c, ksi
Prior to 1959	2.5
1959 and Later	3.0

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LRGD Highlights

- Chapter 6 – Material Properties Cont'd
  - Unknown Timber
    - Built before 1972, 1972 AASHTO Interims Table 1.10.1
    - 1972 to October 1, 2010, Refer to 17th Ed. AASHTO Std
    - Built after October 1, 2010, Refer to 2020 9th Ed. AASHTO Table 8.4.1.1.4-1

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(LRGD) Highlights

Q: What are the key difference between the LRFR rating equation and the LFR equation?

A: Resistance modifiers, separation of DC and DW, use of permanent loads other than dead loads.

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LRGD Highlights

- Chapter 6 – Analysis Methods
  - Use LRFR method FIRST, except for Timber and Masonry is rated using ASR/LFR
  - Use LFR if LRFR Legal Load is < 1.0
  - Bridges designed after October 1, 2010 shall not be rated using LFR / ASD unless approved

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LRGD Highlights

- Chapter 6 – Analysis Methods
  - Load Factors
    - For LRFR, use MBE based on ADTT
    - ADTT = Average Daily Traffic (ADT) * (% Truck/100)

      ADT

      Direction of traffic

      One direction 100%

      Two direction 55% (AASHTO LRFD C3.6.1.4.2)

      Truck %

      Unknown Use AASHTO LRFD Table C3.6.1.4.2-1

      =>> NBI, AASHTO LRFD or Traffic Engineers

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LRGD Highlights

- Chapter 6 – Analysis Methods
  - Load Factors

Table C3.6.1.4.2-1—Fraction of Trucks in Traffic

Class of Highway	Fraction of Trucks in Traffic
Rural Interstate	0.20
Urban Interstate	0.15
Other Rural	0.15
Other Urban	0.10

Classification:

(112) NBIS Bridge Length:	Yes
(104)Hwy Sys of Inv Rte:	Not on NHS
(026) Functional Class:	Urban - Minor Arterial
(100) STRAHNET Desig:	Not on STRAHNET route
(101) Parallel Desig:	Not parallel structure
(102) Direction of Traffic:	2-way traffic
(103) Temp Struc Desig:	N/A

Age and Service:

(027) Year Built:	1936	
(106) Year Recon:	1976	
(42A) Type Serv on Bridge:	Highway-Pedestrian	
(42B) Type Serv under Br:	Waterway	
(28A) #Lanes on Struct:	2	
(28B) #Lanes under Struct:	0	
(029) ADT & (030) Year:	6600	2017
(109) Truck ADT	6 %	
(019) Bypass Det. Length:	3.1 miles	

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LRGD Highlights

- Chapter 6 – Analysis Methods
  - Condition Factors MBE Table 6A.4.2.3-1
    - Reduction of Load Rating for Uncertainty in the Deteriorated Members and Increased Future Deterioration
    - New Bridges Condition Factor = 1.0

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

Table C6A.4.2.3-1—Approximate Conversion in Selecting φ_c

Superstructure Condition Rating (SI & A Item 59)	Equivalent Member Structural Condition
6 or higher	Good or Satisfactory
5	Fair
4 or lower	Poor

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LRGD Highlights

- Chapter 6 – Analysis Methods
  - System Factors MBE Table 6A.4.2.4-1
    - Redundancy in Superstructure System

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

Superstructure Type	φ_s
Welded Members in Two-Girder/Truss/Arch Bridges	0.85
Riveted Members in Two-Girder/Truss/Arch Bridges	0.90
Multiple Eyebar Members in Truss Bridges	0.90
Three-Girder Bridges with Girder Spacing 6 ft	0.85
Four-Girder Bridges with Girder Spacing ≤4 ft	0.95
All Other Girder Bridges and Slab Bridges	1.00
Floorbeams with Spacing >12 ft and Noncontinuous Stringers	0.85
Redundant Stringer Subsystems between Floorbeams	1.00

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LRGD Highlights

- Chapter 6 – Analysis Methods
  - Load Rating Input File:
    - Provide a BrR input file (.XML file) or other approved computer program input files and Excel, Mathcad, or other design aid tools, as applicable (no hard copy).

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LRGD Highlights

- All superstructure types
  - Sacrificial layer for bridge deck

    Include weight in dead load calculations

    Don't consider to provide structural contribution

Prior to September 12, 1990, bridge decks were designed for no sacrificial layer and a 2" top clear cover. Therefore, for bridges designed prior September 12, 1990, consider the top 2" as effective in load rating analyses unless noted otherwise on the as-built drawings.

Design Memorandum DM08/90 dated September 12, 1990 designated the top ¼" of a bridge deck as sacrificial and Design Memorandum DM0196 dated February 14, 1996 increased the top clear cover from 2" to 2 ½", which is consistent with the current BDM. Therefore, for bridges designed between September 12, 1990 and February 14, 1996, consider the top 1 ¾" as effective, and consider the top 2 ¼" as effective for bridges designed after February 14, 1996, unless noted otherwise on the as-built plans.

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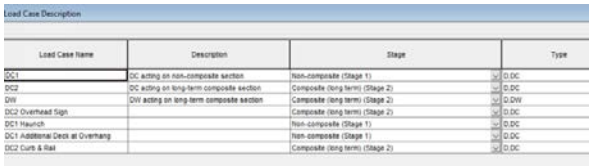
LRGD Highlights

- All superstructure types:
  - Supplemental Calcs (if applicable)
    - Parapet & Railing Loads (if BrR is not capable)
    - Diaphragm/Cross-Frame Loads
    - Effective Width (if BrR is not capable; user input)
    - Haunch (Do not use Haunch Window in BrR; use member loads)
    - Member Deterioration
    - SIP Form Loads
    - Square Rebar
    - Utility
    - Signs



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LRGD Highlights

- Chapter 9 – Reinforced Concrete Superstructures
  - BrR Input
    - Use Girder System Superstructure when inputting RC girder / stringer bridges
    - Use Reinforced Concrete Slab System when inputting slab (don't rate edge girder) – don't check for shear
    - Girder Property input should be schedule – based, if possible
    - Do not input end diaphragms if they are not contributing
    - Service I check for permit loads for LRFR

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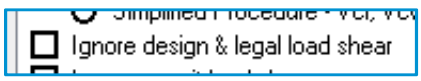
LRGD Highlights

- Chapter 9 – Reinforced Concrete Superstructures
  - BrR Input
    - Control Options
    - RC Girder (t-beam)



    - Uncheck by default, use as posting avoidance

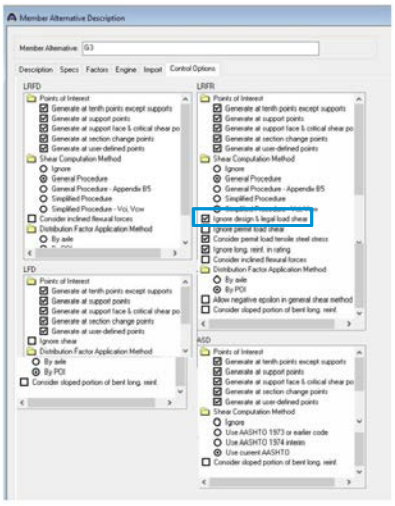


Figure 9.2.1.2-1. Control Options in BrR for Reinforced Concrete Girder Bridge

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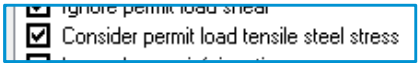
LRGD Highlights

- Chapter 9 – Reinforced Concrete Superstructures
  - BrR Input
    - Control Options
    - RC Slab



- Check as per LRGD Section 9.2.6

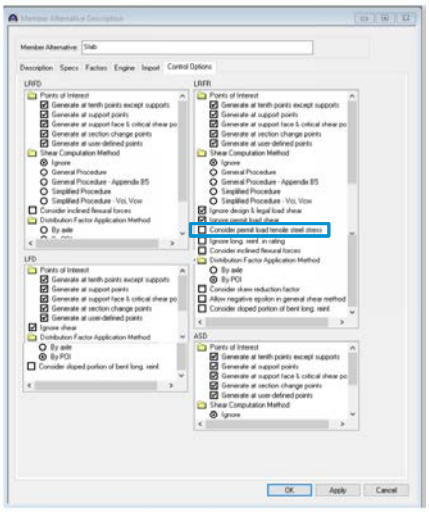


Figure 9.2.1.2-2. Control Options in BrR for Reinforced Concrete Slab Bridge

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LRGD Highlights

- Chapter 10 – Prestressed Concrete Girder
  - BrR Input
    - Use Girder System Superstructure when inputting
    - Do not use elastic shortening applied to the transformed beam section because the transformed section already accounts for this.
    - Multi-Span Composite
      - Simple Span for both dead and live loads
      - Simple Span for dead load and continuous for live loads
    - Input actual strand pattern if available
    - Average humidity 70%

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LRGD Highlights

- Chapter 10 – Prestressed Concrete Girder Cont'd
  - BrR Input
    - Do not input end diaphragms if they are not contributing
    - Loss Method as AASHTO Approximate
    - Jacking Stress Ratio based on strand type
    - Input composite if noted on plans
    - Input shear stirrups as indicated on plans and check "Extends into deck if deck and girder are structurally composite
    - Service III check for legal loads for LRFR
    - Service I check for permit loads for LRFR (no yielding of steel)

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LRGD Highlights

- Chapter 10 – Prestressed Concrete Girder Cont'd

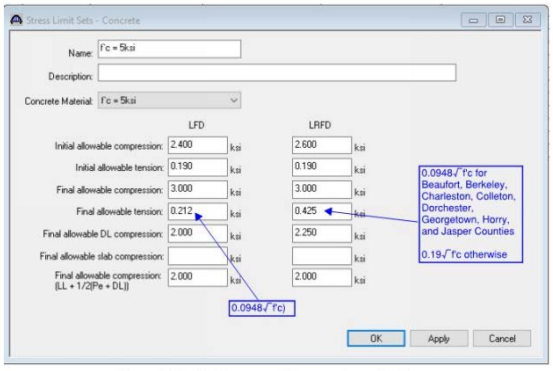

Figure 10.2.1.2-3. Prestressed Concrete Stress Limit Input

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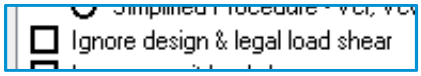
LRGD Highlights

- Chapter 10 – Prestressed Concrete Girder Cont'd
  - BrR Input
    - Control Options



    - Uncheck by default, use as posting avoidance

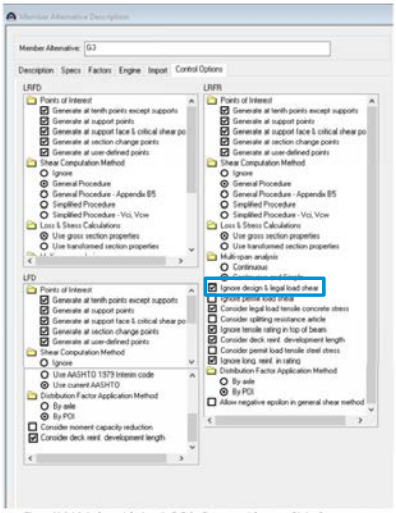


Figure 10.2.1.2-1. Control Options in BrR for Prestressed Concrete Girder Superstructure

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LRGD Highlights

- Chapter 11 – Steel Superstructures
  - BrR Input
    - The plastic capacity of a girder can be used after required checks
    - Composite if plans indicate shear connectors
    - Input rebar in negative moment region if continuous
    - Don't model top flange or bottom flange lateral bracing unless approved; if include, treat as primary member and load rate
    - In-span hinges shall be load rated for bending, shear and bearing

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LRGD Highlights

- Chapter 11 – Steel Superstructures Cont'd
  - BrR Input
    - Top flanges of "Through Girder" bridges shall be considered unbraced unless approved
    - Rate bolted splices in Fracture Critical girders
    - Rate cross members resisting primary loads (i.e. floorbeams or cross frames supporting a substringer)
    - No fatigue rating required (typically)
    - For I-section in flexure, if no plans and it is unknown if composite, refer to MBE 6A6.9
    - Load rate pin and hanger connections

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LRGD Highlights

- Chapter 11 – Steel Superstructures Cont'd
  - BrR Input
    - Use Girder System Superstructure when inputting
    - Do not input end diaphragms if they are not contributing
    - Additional 5% (without field splices) or 10% (with field splices)
    - Add cross frame and stiffener weight manually for tangent bridges
    - 3D cross frame weight is calculated by BrR but stiffener weight is not
    - Service II check for permit loads for LRFR

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LRGD Highlights

- Chapter 11 – Steel Superstructures Cont'd
  - BrR Input
    - Control Options

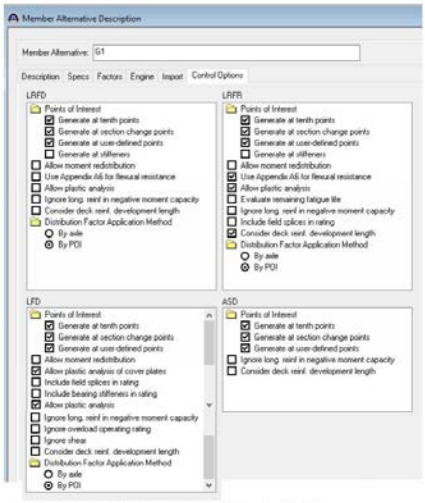

Figure 11.2.2.2-1. Control Options in BrR for Steel Girder Superstructure

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LRGD Highlights

- Chapter 11 – Steel Superstructures Cont'd
  - Tangent analysis options
    - Line Girder
    - 3D
    - Grid
  - Curved analysis options
    - Line Girder utilizing the V-load method
    - 3D
    - Grid

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LRGD Highlights

- Chapter 12 –Steel Truss
  - Rating required
    -All primary truss members
    -Cross frames of deck truss supporting stringers
    -Interior floorbeam (Critical)
    -End floorbeam
    -Interior stringer (Critical)
    -Exterior stringer
    -Gusset plates (MBE)
    -Main chord splices
    -Main chord pins
  - Rating not required
    Zero-force member, portal bracing, sway bracing

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LRGD Highlights

- Chapter 12 –Steel Truss Cont'd
  - Supplemental Calculations (if applicable)
    - All the loads previously mentioned
    - Effective area reduction for rivets or bolts
    - Section properties for nondetailed section
    - Additional weight of panel point loads including gusset plates
    - Additional weight of splice plates, rivets, lacing, batten plates, etc
    - Truss LLDF (lever rule)
    - Member capacity (override)

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LRGD Highlights

- Chapter 13 – Timber Superstructure
  - Use ASR built before Oct 1, 2010
  - Use LRFR built after Oct 1, 2010
  - No impact
  - Check horizontal shear (usually controls)
  - Check vertical shear
  - Account for bending and shear stresses
    - Stringer defects/imperfections
      - » Cracked, broken, split, checked, shaked, decayed

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LRGD Highlights

- Chapter 14 - Concrete and Masonry Substructures
- Chapter 15 - Steel Bents
  - Not normally load rated unless (RF ≤ 4 or less)
    - Substructure detrimental deterioration
    - Piles scour and deterioration
    - Pier cap deterioration and structural issues
    - Unusual geometry or configuration
    - Heavy overweight permit loads
    - Use spreadsheet or proprietary software

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LRGD Highlights

- Chapter 16 - Timber Substructures
  - Rate ASR
  - Condition rating ≤ 5 latest IR
    - Substructure detrimental deterioration
    - Piles scour and deterioration
    - Pier cap deterioration and structural issues
  - Use spreadsheet or proprietary software

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LRGD Highlights

- Chapter 17 – Culverts (20 ft or greater)
  - Single span, fill < 8 ft or Multi span, fill < distance between faces of end walls & Ext. Wall BrR LR =0.0
    - If no distress and carries normal traffic, increase rebar until wall doesn't control (MBE 6.1.4)
    - Coordinate with BMO if deteriorated

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LRGD Highlights

- Chapter 17 – Culverts (20 ft or greater)
  - Single span, fill > 8 ft or Multi span, fill > distance between faces of end walls & BrR LR = 99.9
    - LL distributed through large fill and culvert only sees DL
  - Single span, fill > 8 ft or Multi span, fill > distance between faces of end walls & BrR LR = 0.0
    - If no distress and carries normal traffic, increase rebar until top slab, bottom slab, walls doesn't control (MBE 6.1.4)
    - Coordinate with BMO if deteriorated

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LRGD Highlights

- Chapter 17 – Culverts (20 ft or greater)
  - BrR Input
    - Calculate min. and max fill heights, if needed
    - Live load surcharge heights
    - Input bent bars as straight bars checked fully developed
    - Use subgrade modulus of 200 lb/in^3
    - Input soil properties

For LFR ratings, if the maximum and minimum fill fall in different impact zones but are within 6" +/- of each other, run only the upper limit of the larger impact zone.

a. Example: Max. fill = 14", Min. Fill = 9" => Use 12" fill with 30% impact
b. Example: Max. fill = 3'-1", Min. fill = 2'-10" => Use 3'-0" fill with 10% impact

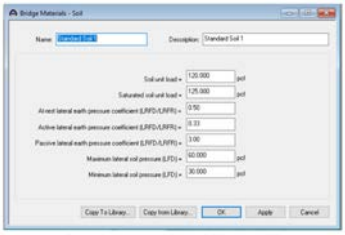

Figure 17.2.1.1-1. Concrete Box Culvert Soil Properties for BrR

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LRGD Highlights

- Chapter 17 – Culverts (20 ft or greater)
  - BrR Input
    - Control Options

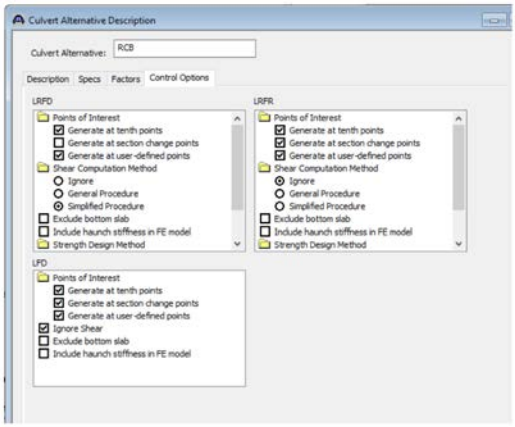

Figure 17.2.1.1-2. Control Options in BrR for Concrete Box Culvert

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LRGD Highlights

- Chapter 18 - Complex and Non-Typical Bridges (App A18.1)
  - Steel arch
  - Concrete arch
  - Cable stay
  - Suspension
  - Segmental concrete
  - Complex or cantilevered steel truss
- Summary document – methodology and software

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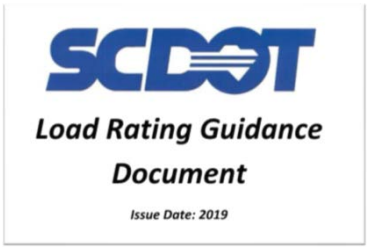
General – LRGD Review



- Building the BrR Model
- Calculations
- Assumptions
- Different Requirements per Bridge Type
- BrR Control Options
- Guidance on Consistency of Input

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LRGD Highlights

- When is a substructure load rating warranted?

A. Excessive Deterioration (Substructure condition is poor)
B. Special Characteristics
C. Special Loadings
D. All of Above

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LRGD Highlights

- How do we model haunch?

A. Dead Load and Section Properties
B. Dead Load only but not Section Properties
C. Section Properties only but not Dead Load
D. Neither Dead Load or Section Properties

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LRGD Highlights

What load case is a haunch?

A. DC1
B. DC2
C. DW
D. LL

What load case is a barrier generally unless noted on plans?

A. DC1
B. DC2
C. DW
D. LL

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Load Rating Guidance Document (LRGD) Highlights - Questions

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Break

- Let's Take a 10 Minute Break

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Load Rating Documentation

- General
- Calculations and Supporting Data
- Standard Assumptions
- Load Rating Summary Form
- Data Correction Form
- File Naming Convention
- Questions / Open Discussion

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General – Load Rating Process

- References
  - Bridge Plans → structure geometry, materials, shapes, etc.
  - NBI Datasheet → general bridge data
  - Inspection Report → deterioration, damage, overlays, etc.
  - Site Assessment → field conditions (& schematic dwgs)
  - Photos → deck conditions, utilities
  - Google → verify location

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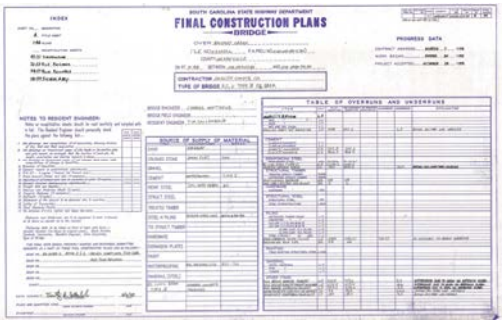
General – Load Rating Process

- Bridge Plans
  - As-Built
  - As-Let
  - Standard Plans
  - Shop Drawings



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General – Load Rating Process

- NBI Datasheet

2018 National Bridge Inventory
Bridge Report

Bridge Identification:

Structure Number: 9020

(001) State:	0C	(009) Location:	1MI S OF GREENVILLE
(003) County:	Greenville		
(002) Highway Agency Dist:	3		
(007) Facility Carried:	I-85 NB		
(006) Feature Crossed:	BRUSHY CREEK	(6C) Level of Service:	Mainline
		(6B) Route Signing Prefix:	Interstate Highway
(016) Latitude:	34° 47' 40.74"	(6D) Route Number:	085
(017) Longitude:	082° 23' 18.62"	(6E) Directional Suffix:	North
(011) Kilometer Point:	44.822	(13A) LRS Inventory Route:	00I-000850
(012) Base Hwy. Network:	Route on base highway network	(13B) Subroute:	00
(099) Border Br. Struct. No:	N/A	(98A) Neighbor State Code:	N/A
		(98B) % Responsibility	N/A

Classification:

(112) NBIS Bridge Length:	Yes	(100) Federal Lands Hwy:	N/A
(104)Hwy Sys of Inv Rte:	N/A	(110) Desig National Netw:	Part of national network for trucks
(026) Functional Class:	Urban - Principal Arterial - Interstate	(020) Toll:	On free road
(100) STRAHNET Desig:	On Interstate STRAHNET route	(021) Maintenance Respon:	State Highway Agency
(101) Parallel Desig:	Right Bridge	(022) Owner:	State Highway Agency
(102) Direction of Traffic:	1-way traffic	(037) Historical Value:	Historical significance not determinable
(103) Temp Struc Desig:	N/A		

Age and Service:

(027) Year Built:	1998		
(106) Year Recon:	N/A		
(42A) Type Serv on Bridge:	Highway		
(42B) Type Serv under Br:	Waterway		
(28A) #Lanes on Struct:	4		
(28B) #Lanes under Struct:	0		
(029) ADT & (030) Year:	53000 2017		
(109) Truck ADT	12 %		
(019) Bypass Det. Length:	N/A		

Structure Type and Material:

(045) # Main Spans:	3
(43A) Main Struct Material:	Prestressed concrete continuous
(43B) Main Struct Type:	Stringer/Multi-beam or Girder
(046) # Appr Spans:	0
(44A) Appr Struct Material:	N/A
(44B) Appr Struct Type:	N/A
(107) Deck Struct Type:	Concrete Cast-in-Place
(108A) Type Wearing Sur:	Monolithic Concrete
(108B) Type Membrane:	Unknown
(108C) Deck Protection:	Unknown

- Existing Data to be Confirmed by SA Team
- Contains General Bridge Data for Input into BrR

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General – Load Rating Process

- Inspection Report
  - Use Latest Report
  - Condition Factors
  - Deterioration?
  - Wearing Surface?
  - SIP Forms?

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General – Load Rating Process

- Site Assessment Form

  LRGD Appendix [A5.4]

SCDOT Site Assessment Form

Version: 1.0
Page 1 of 3

SECTION 1: GENERAL BRIDGE DATA

(8) Asset ID:	(2) District:	(3) County:	(9) Bridge Location:	Site Assessment Date:
	Select Distric	Select County		

Bridge Coordinates:

(16) Latitude:	degrees	minutes	seconds	(17) Longitude:	degrees	minutes	seconds

(7) Facility Carried:	(6) Feature Crossed:	(43, 44) Bridge Description:	
(45) Number of Main Spans:	(46) Number of Approach Spans:	(49) Structure Length:	(52) Structure Width (out-to-out)

SECTION 2: FIELD NOTES

In this section, include information on items that affect the load rating, such as SIP forms, utilities, attached signs, overlays, etc. Include notes about deterioration of members to be rated. Do not include information that does not affect the load rating, such as minor deck cracking and spalling. Only include site assessment findings which impact the load rating; however, all critical findings should be reported in the attachment "Critical Deficiencies Form" in Bridge Inspection Guidance Document.

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General – Load Rating Process

- Input
- Check
- Revise Based on Checker's Comments
- Quality Control
  - BrR Input
  - Assumptions
  - Calculations
  - Load Rating Summary Form

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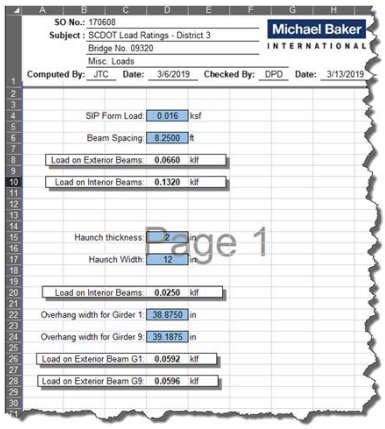
Calculations and Supporting Data

- Supplemental Calculations
  - Parapet & Railing Loads
  - Diaphragm/Cross-Frame Loads
  - SIP Form Loads
  - Square Rebar
  - Effective Width
  - Haunch
  - Member Deterioration
  - Complex Geometry
  - Etc.


SO No.: 170608
Subject : SCDOT Load Ratings - District 3
Bridge No. 09320
Misc. Loads
Computed By: JTC Date: 3/6/2019 Checked By: DPD Date: 3/13/2019
SIP Form Load: 0.016 ksf
Beam Spacing: 8.2500 ft
Load on Exterior Beams: 0.0660 klf
Load on Interior Beams: 0.1320 klf
Haunch thickness: 2 in
Haunch Width: 12 in
Load on Interior Beams: 0.0250 klf
Overhang width for Girder 1: 38.8750 in
Overhang width for Girder 9: 39.1875 in
Load on Exterior Beam G1: 0.0592 klf
Load on Exterior Beam G9: 0.0596 klf

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Calculations and Supporting Data

- MathCAD or Excel File for Supp Calcs
- PDF of the MathCAD or Excel File for the Supp Calcs

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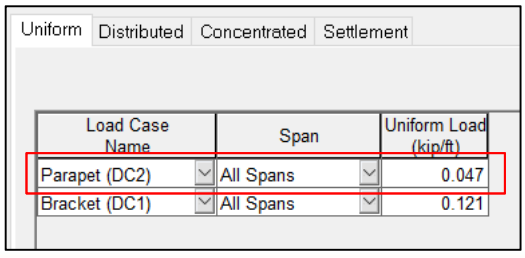
Barrier Loads

- Barrier Loads
  - Only Three Outer Girders/Beams Receive the Barrier Load
  - If < 6 Girders/Beams, Input Barrier Load in Appurtenances Unless Barriers are Different Geometry
  - If More than 6 Girders, Calculate Barrier Load and Apply to the Appropriate Girders/Beams



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Sign / Utility Loads

- Sign Loads
  - Apply the Sign Load to the Adjacent Beams / Girders
  - DW Load Case
- Utility Loads
  - Apply the Utility Load to the Adjacent Beams / Girders
  - DW Load Case

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Deterioration

- For Steel Beams, Use a Thickness Loss for the Web and Flange
- Exposed Strands in P/S Beams
- Broken Wire in P/S Strand - ineffective
- Condition Factors

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Calculations and Supporting Data - Questions

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Assumptions

- General Overview of Assumption
  - Short List
  - Don't List Information that can be Found in the Plans
- Follow SCDOT Policies and Guidelines in the LRGD for the Various Superstructure Types

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Assumptions

- Load Rating Assumptions
  - Material Properties
  - Additional Dead Loads (WS thickness, etc.)
  - Traffic data (truck %, direction factor)
  - Others…analysis, member sizes, load distribution, etc. (anything critical to the load rating)

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Assumptions

- What traffic data would you assume if given the following NBI Data (direction factor and truck %)?

Classification:

(112) NBIS Bridge Length:	Yes	**(105) Federal Lands Hwy:**	N/A
(104)Hwy Sys of Inv Rte:	Not on NHS	**(110) Desig National Netw:**	Not part of national network for trucks
(026) Functional Class:	Urban - Collector	**(020) Toll:**	On free road
(100) STRAHNET Desig:	Not on STRAHNET route	**(021) Maintenance Respon:**	State Highway Agency
(101) Parallel Desig:	Not parallel structure	**(022) Owner:**	State Highway Agency
(102) Direction of Traffic:	2-way traffic	**(037) Historical Value:**	Not eligible for National Register
(103) Temp Struc Desig:	N/A		

Age and Service:

(027) Year Built:	1960	
(106) Year Recon:	N/A	
(42A) Type Serv on Bridge:	Highway	
(42B) Type Serv under Br:	Waterway	
(28A) #Lanes on Struct:	2	
(28B) #Lanes under Struct:	0	
(029) ADT & (030) Year:	7400	2017
(109) Truck ADT	5 %	
(019) Bypass Det. Length:	1.2 miles	

Structure Type and Material:

(045) # Main Spans:	3
(43A) Main Struct Material:	Concrete
(43B) Main Struct Type:	Tee Beam
(046) # Appr Spans:	0
(44A) Appr Struct Material:	N/A
(44B) Appr Struct Type:	N/A
(107) Deck Struct Type:	Concrete Cast-In-Place
(108A) Type Wearing Sur:	Monolithic Concrete
(108B) Type Membrane:	None
(108C) Deck Protection:	Unknown

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Assumptions

- What traffic data would you assume if given the following NBI Data (direction factor and truck %)?

A. 100% and 5%
B. 0% and 5%
C. 55% and 5%
D. 55% and 15%

(102) Direction of Traffic:	2-way traffic
(103) Temp Struc Desig:	N/A
Age and Service:	
(027) Year Built:	1960
(106) Year Recon:	N/A
(42A) Type Serv on Bridge:	Highway
(42B) Type Serv under Br:	Waterway
(28A) #Lanes on Struct:	2
(28B) #Lanes under Struct:	0
(029) ADT & (030) Year:	7400 2017
(109) Truck ADT	5 %
(019) Bypass Det. Length:	1.2 miles

Traffic data was input into BrR using Directional % = 55% (in accordance with LRGD Section 6.11.1.2) and Truck % = 5% (per 2018 NBI Datasheet).

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Assumptions

- What traffic data would you assume if given the following NBI Data (direction factor and truck %)?

Classification:			
(112) NBIS Bridge Length:	Yes	(105) Federal Lands Hwy:	N/A
(104)Hwy Sys of Inv Rte:	Not on NHS	(110) Desig National Netw:	Not part of national network for trucks
(026) Functional Class:	Rural - Local	(020) Toll:	On free road
(100) STRAHNET Desig:	Not on STRAHNET route	(021) Maintenance Respon:	State Highway Agency
(101) Parallel Desig:	Not parallel structure	(022) Owner:	State Highway Agency
(102) Direction of Traffic:	2-way traffic	(037) Historical Value:	Not eligible for National Register
(103) Temp Struc Desig:	N/A		

Age and Service:		**Structure Type and Material:**	
(027) Year Built:	1962	(045) # Main Spans:	2
(106) Year Recon:	N/A	(43A) Main Struct Material:	Prestessed concrete
(42A) Type Serv on Bridge:	Highway	(43B) Main Struct Type:	Stringer//Multi-beam or Girder
(42B) Type Serv under Br:	Waterway	(046) # Appr Spans:	0
(28A) #Lanes on Struct:	2	(44A) Appr Struct Material:	N/A
(28B) #Lanes under Struct:	0	(44B) Appr Struct Type:	N/A
(029) ADT & (030) Year:	120 2017	(107) Deck Struct Type:	Concrete Precast Panels
(109) Truck ADT	N/A	(108A) Type Wearing Sur:	Bituminous
(019) Bypass Det. Length:	N/A	(108B) Type Membrane:	Unknown
		(108C) Deck Protection:	Unknown

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Assumptions

- What traffic data would you assume if given the following NBI Data (direction factor and truck %)?

A. 100% and 5%
B. 0% and 5%
C. 55% and 5%
D. 55% and 15%

(026) Functional Class:	Rural - Local
(100) STRAHNET Desig:	Not on STRAHNET route
(101) Parallel Desig:	Not parallel structure
(102) Direction of Traffic:	2-way traffic

(109) Truck ADT	N/A

Table C3.6.1.4.2-1—Fraction of Trucks in Traffic

Class of Highway	Fraction of Trucks in Traffic
Rural Interstate	0.20
Urban Interstate	0.15
Other Rural	0.15
Other Urban	0.10

Traffic data was input into BrR using Directional % = 55% (in accordance with LRGD Section 6.11.1.2) and Truck % = 15% (in accordance with LRFD Table C3.6.1.4.2-1).

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Assumptions - Example

1. As-let plans 40.582.6 dated 5/4/1964 were used for the rating.

2. Based on the 2/25/2019 inspection report and 11/11/2019 site assessment, there is no measurable deterioration to warrant a Deteriorated structure model in BrR.

3. Parapet dead loads were equally distributed to all girders.

4. Traffic data was input into BrR using Directional % = 55 % and Trucks % = 6 %

5. Condition factor of 1.00 was used based on the Site Assessment Report dated 11/11/2019.

6. Spans 1-4 are all linked together under one superstructure definition in BrR. Results shown on LRSF for Span 1 (i.e., Controlling Location 1.X) apply to all 4 spans.

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Assumptions - Linking

- Linking of Spans and/or Girders
  - Clearly Define and Add a Note to Assumptions
  - Spans 1, 2, 3 and 4 are Linked
  - G1 is Linked to G5 and G2 is Linked to G4

6. Spans 1-4 are all linked together under one superstructure definition in BrR. Results shown on LRSF for Span 1 (i.e., Controlling Location 1.X) apply to all 4 spans.

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Assumptions - Controlling Member

- Controlling Member and Location
  - (X.X) on the LRFR or LFR LRSF
  - Ex: 2 Span Bridge: 2.5 for Span 2 Mid-span

SECTION 2 - INVENTORY AND OPERATING LOAD RATINGS				
Rating Vehicle	Rating Level	Controlling Member	Controlling Location	Controlling Limit State
HL-93 Truck + Lane	Inventory	G14-G18	2.4	SERVICE-III PS Tensile Stress
HL-93 Truck Train + Lane (90%)	Inventory	-	-	-
HL-93 Tandem + Lane	Inventory	G14-G18	2.5	SERVICE-III PS Tensile Stress
HL-93 Truck + Lane	Operating	G14-G18	2.1	STRENGTH-I Concrete Shear
HL-93 Truck Train + Lane (90%)	Operating	-	-	-
HL-93 Tandem + Lane	Operating	G14-G18	2.1	STRENGTH-I Concrete Shear

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Assumptions

- Use Caution for Multiple Structures Modeled and Linking of Spans and Girders / Beams
- Note when Ratings Apply to Other Locations / Members
  - Example: Spans 1 and 3 are Linked, G1 is Linked to G5, G1 Controls The Rating
  - Controlling: G1 and G5, Location 1.5 and 3.5

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Assumptions - Questions

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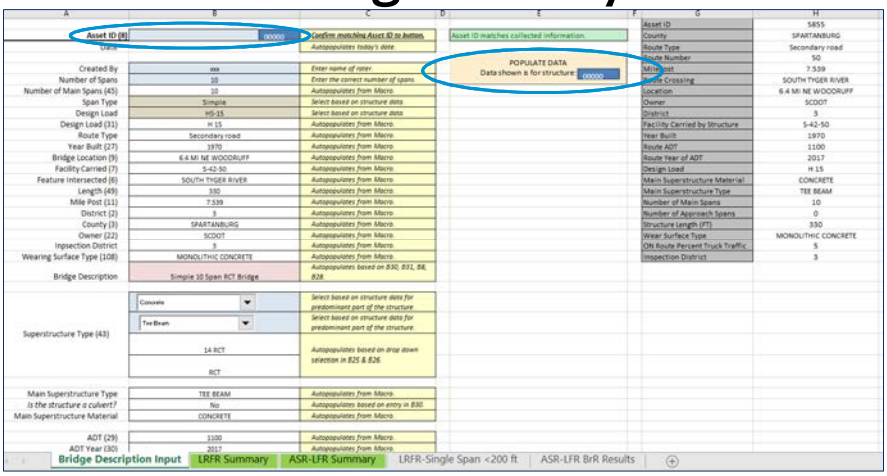
Load Rating Summary Form (LRSF)

- Appendix A20.1: Load Rating Summary Form - 01/27/2020
- See e-notifications or Technical Notes for Frequently Asked Questions on Input or Coding
- Provide a completed LRSF in .PDF and .XLSX format
- PDF shall be digitally signed and sealed.

111

Load Rating Summary Form



112

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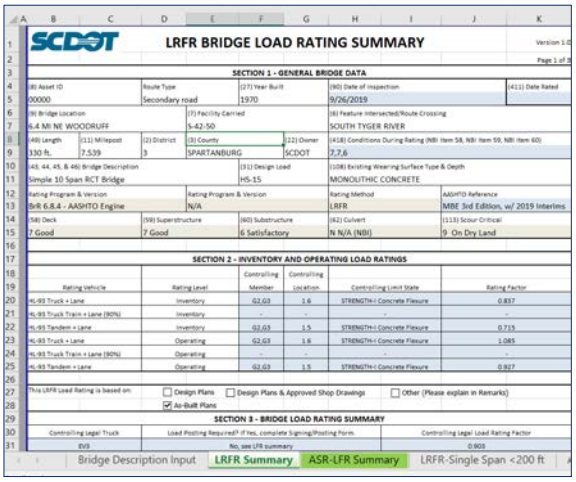
Load Rating Summary Form



LRFR BRIDGE LOAD RATING SUMMARY

SECTION 1 - GENERAL BRIDGE DATA

(8) Asset ID	Route Type	(27) Year Built	(90) Date of Inspection	(411) Date Rated
00000	Secondary road	1970	9/26/2019	

(9) Bridge Location	(7) Facility Carried	(6) Feature Intersected/Route Crossing
6.4 MI NE WOODRUFF	S-42-50	SOUTH TYGER RIVER

(49) Length	(11) Milepost	(2) District	(3) County	(22) Owner	(41B) Conditions During Rating (NBI Item 58, NBI Item 59, NBI Item 60)
130 ft.	7.539	3	SPARTANBURG	SCDOT	7,7,6

(43, 44, 45, & 46) Bridge Description	(31) Design Load	(108) Existing Wearing Surface Type & Depth
Simple 10 Span RCT Bridge	HS-15	MONOLITHIC CONCRETE

Rating Program & Version	Rating Program & Version	Rating Method	AASHTO Reference
BrR 6.8.4 - AASHTO Engine	N/A	LRFR	MBE 3rd Edition, w/ 2019 Interims

(58) Deck	(59) Superstructure	(60) Substructure	(62) Culvert	(113) Scour Critical
7 Good	7 Good	6 Satisfactory	N N/A (NBI)	9 On Dry Land

SECTION 2 - INVENTORY AND OPERATING LOAD RATINGS

Rating Vehicle	Rating Level	Controlling Member	Controlling Location	Controlling Limit State	Rating Factor
HL-93 Truck + Lane	Inventory	G2,G3	1.6	STRENGTH-I Concrete Flexure	0.837
HL-93 Truck Train + Lane (90%)	Inventory	-	-	-	-
HL-93 Tandem + Lane	Inventory	G2,G3	1.5	STRENGTH-I Concrete Flexure	0.715
HL-93 Truck + Lane	Operating	G2,G3	1.6	STRENGTH-I Concrete Flexure	1.085
HL-93 Truck Train + Lane (90%)	Operating	-	-	-	-
HL-93 Tandem + Lane	Operating	G2,G3	1.5	STRENGTH-I Concrete Flexure	0.927

This LRFR Load Rating is based on: ☐ Design Plans ☐ Design Plans & Approved Shop Drawings ☐ Other (Please explain in Remarks) ☑ As-Built Plans

SECTION 3 - BRIDGE LOAD RATING SUMMARY

Controlling Legal Truck	Load Posting Required? If Yes, complete Signing/Posting Form	Controlling Legal Load Rating Factor
EV3	No, see LFR summary	0.903

Bridge Description Input | LRFR Summary | ASR-LFR Summary | LRFR-Single Span <200 ft

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Load Rating Summary Form

- Section 5B of the LRFR LRSF Does Not Apply to Interstate Bridges
- These Vehicles should be Considered at the Permit Level as per SCDOT LRGD Section 6.5
- Cross-hatch this Area for Interstate Bridges

SECTION 5B - LEGAL RATINGS - SC Specialized Hauling Vehicles (SHV) - Legal on Non-Interstate Only (Permit on Interstate)

Rating Vehicle	Rating Level	Weight (Tons)	Controlling Member	Controlling Location	Controlling Limit State	Rating Factor	Rating (Tons)
SC-SHV1A	Legal	32.5	G14-G18	2.5	SERVICE-III PS Tensile Stress	0.795	25
SC-SHV1B	Legal	35	G14-G18	2.5	SERVICE-III PS Tensile Stress	0.750	26
SC-SHV2A	Legal	33	G14-G18	2.5	SERVICE-III PS Tensile Stress	0.796	26
SC-SHV2B	Legal	40	G14-G18	2.5	SERVICE-III PS Tensile Stress	0.676	27
SC-SHV3A	Legal	42.5	G14-G18	2.4	SERVICE-III PS Tensile Stress	0.828	35
SC-SHV3B	Legal	45	G14-G18	2.4	SERVICE-III PS Tensile Stress	0.783	35

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Data Correction Form

- Appendix A5.2: Data Correction Form - 02/19/2020
- For Existing Asset ID, enter *Incorrect Data & Recommended Correct Data*
  - *Incorrect Data* is data as it appears in the SCDOT database
  - After Site Assessment Data and Inspection Reports review, make sure *Recommended Corrected Data* is shown in the Load Rating Files (BrR, Assumptions, LRSF, etc.)
- For New Asset ID, the Data Correction Form will need *Recommended Corrected Data* for most fields

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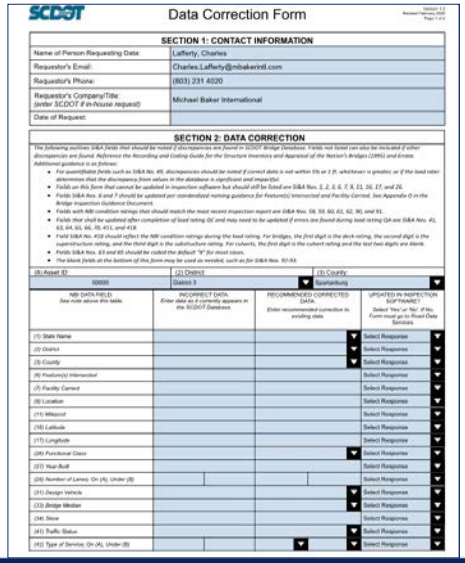
Data Correction Form



SCDOT Data Correction Form

SECTION 1: CONTACT INFORMATION

Name of Person Requesting Data:	Lafferty, Charles
Requestor's Email:	Charles.Lafferty@mbakerintl.com
Requestor's Phone:	(803) 231 4020
Requestor's Company/Title: (enter SCDOT if in-house request)	Michael Baker International
Date of Request:	

SECTION 2: DATA CORRECTION

(8) Asset ID	(2) District	(3) County
00000	District 3	Spartanburg

NBI DATA FIELD See note above this table.	INCORRECT DATA Enter data as it currently appears in the SCDOT Database.	RECOMMENDED CORRECTED DATA Enter recommended correction to existing data	UPDATED IN INSPECTION SOFTWARE? Select 'Yes' or 'No'. If No, Form must go to Road Data Services.
(1) State Name			Select Response
(2) District			Select Response
(3) County			Select Response
(5) Feature(s) Intersected			Select Response
(7) Facility Carried			Select Response
(9) Location			Select Response
(11) Milepost			Select Response
(16) Latitude			Select Response
(17) Longitude			Select Response
(26) Functional Class			Select Response
(27) Year Built			Select Response
(28) Number of Lanes: On (A); Under (B)			Select Response
(31) Design Vehicle			Select Response
(33) Bridge Median			Select Response
(34) Skew			Select Response
(41) Traffic Status			Select Response
(42) Type of Service: On (A); Under (B)			Select Response

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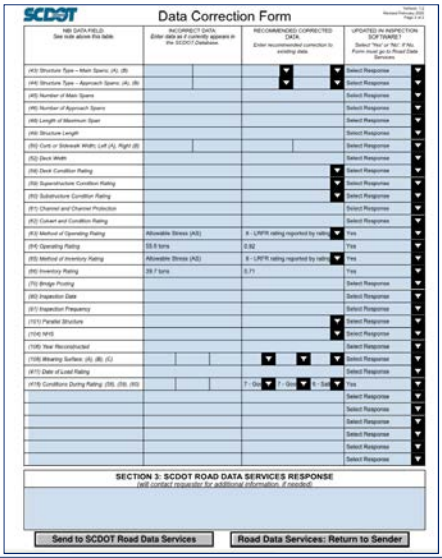
Data Correction Form


Data Correction Form

NBI DATA FIELD: See note above this table.	INCORRECT DATA: Enter data as it currently appears in the SCDOT Database.	RECOMMENDED CORRECTED DATA: Enter recommended correction to existing data.	UPDATED IN INSPECTION SOFTWARE? Select "Yes" or "No". If No, Form must go to Road Data Services
(43) Structure Type – Main Spans: (A), (B)			Select Response
(44) Structure Type – Approach Spans: (A), (B)			Select Response
(45) Number of Main Spans			Select Response
(46) Number of Approach Spans			Select Response
(48) Length of Maximum Span			Select Response
(49) Structure Length			Select Response
(50) Curb or Sidewalk Width: Left (A), Right (B)			Select Response
(52) Deck Width			Select Response
(58) Deck Condition Rating			Select Response
(59) Superstructure Condition Rating			Select Response
(60) Substructure Condition Rating			Select Response
(61) Channel and Channel Protection			Select Response
(62) Culvert and Condition Rating			Select Response
(63) Method of Operating Rating	Allowable Stress (AS)	8 - LRFR rating reported by rating	Yes
(64) Operating Rating	55.6 tons	0.92	Yes
(65) Method of Inventory Rating	Allowable Stress (AS)	8 - LRFR rating reported by rating	Yes
(66) Inventory Rating	39.7 tons	0.71	Yes
(70) Bridge Posting			Select Response
(90) Inspection Date			Select Response
(91) Inspection Frequency			Select Response
(101) Parallel Structure			Select Response
(104) NHS			Select Response
(106) Year Reconstructed			Select Response
(108) Wearing Surface: (A), (B), (C)			Select Response
(411) Date of Load Rating			Select Response
(412) Conditions During Rating: (58), (59), (60)		7 - Go 7 - Go 8 - Sat	Yes
			Select Response
			Select Response
			Select Response
			Select Response
			Select Response

SECTION 3: SCDOT ROAD DATA SERVICES RESPONSE
(will contact requester for additional information, if needed)

Send to SCDOT Road Data Services | Road Data Services: Return to Sender

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Data Correction Form

- Field 63 and 65 - Should be Coded as 8
- Field 64 and 66 - Should Provide the Govern Ratings for the HL-93 Vehicle
- LRFR Rating Reported by Rating Factor Method Using HL-93 Loading

(63) Method of Operating Rating	1	8	Yes
(64) Operating Rating	87	1.27	Yes
(65) Method of Inventory Rating	1	8	Yes
(66) Inventory Rating	68	0.77	Yes
	Incorrect Data	Corrected Data	

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LRSF & DC - Questions

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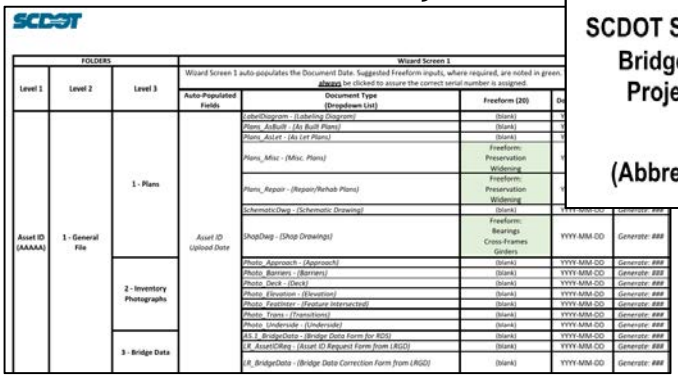
File Naming – BFP

- SCDOT Bridge File Policy (BFP)
- Use Pages 20 & 21 of BFP
- BFP can be found in ProjectWise



SCDOT

FOLDERS			Wizard Screen 1			
Level 1	Level 2	Level 3	Auto-Populated Fields	Document Type (Dropdown List)	Freeform (20)	
Asset ID (AAAAA)	1 - General File	1 - Plans	Asset ID Upload Date	Label/Diagram - (Labeling Diagram)	(blank)	
				Plans_AsBuilt - (As Built Plans)	(blank)	
				Plans_AsLet - (As Let Plans)	(blank)	
				Plans_Misc - (Misc. Plans)	Freeform: Preservation Widening	
				Plans_Repair - (Repair/Rehab Plans)	Freeform: Preservation Widening	
				Schematic/Dwg - (Schematic Drawing)	(blank)	
				ShopDwg - (Shop Drawings)	Freeform: Bearings Cross-Frames Girders	YYYY-MM-DD
		2 - Inventory Photographs		Photo_Approach - (Approach)	(blank)	YYYY-MM-DD
				Photo_Barriers - (Barriers)	(blank)	YYYY-MM-DD
				Photo_Deck - (Deck)	(blank)	YYYY-MM-DD
				Photo_Elevation - (Elevation)	(blank)	YYYY-MM-DD
				Photo_Featinter - (Feature Intersected)	(blank)	YYYY-MM-DD
				Photo_Trans - (Transitions)	(blank)	YYYY-MM-DD
				Photo_Underside - (Underside)	(blank)	YYYY-MM-DD
		3 - Bridge Data		AS_1_BridgeData - (Bridge Data Form for BDS)	(blank)	YYYY-MM-DD
				LR_AssetIDReq - (Asset ID Request Form from LRGD)	(blank)	YYYY-MM-DD
				LR_BridgeData - (Bridge Data Correction Form from LRGD)	(blank)	YYYY-MM-DD

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File Naming - BFP

- Load Rating Input File Naming Convention:
  - BrR File: *[Asset ID]-LR_BrR-YYYY-MM-DD-001.xml*
  - Non-BrR File (if used): *[Asset ID]-LR_Non-BrR-[FREEFORM]-YYYY-MM-DD-001.xxx*
- Load Rating Summary Form (LRSF) File Naming Convention:
  - .PDF File: *[Asset ID]-LR_SF_LRFR-YYYY-MM-DD-001.pdf*
  - .XLSX File: *[Asset ID]-LR_SF_XLSX-YYYY-MM-DD-001.xlsx*

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File Naming - BFP

- Supplemental Calculations File Naming Convention:
  - Excel/Mathcad/Other File: *[Asset ID]-LR_SuppCalcs-YYYY-MM-DD-001.xxx*
  - .PDF of Calculations File: *[Asset ID]-LR_SuppCalcs-YYYY-MM-DD-002.pdf*
- QC Review Checklist File Naming Convention:
  - QC Review Checklist File: *[Asset ID]-LR_QCList-YYYY-MM-DD-001.pdf*
- Data Correction Form File Naming Convention:
  - Data Correction Form File: *[Asset ID]-LR_BridgeData-YYYY-MM-DD-001.pdf*

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File Naming - BFP

- Labeling Diagram File Naming Convention:
  - .DGN File: *[Asset ID]-LabelDiagram-YYYY-MM-DD-001.dgn*
  - .PDF File: *[Asset ID]-LabelDiagram-YYYY-MM-DD-002.pdf*
- Asset ID Request Form File Naming Convention:
  - Asset ID Request Form File: *[Asset ID]-AssetIDReq-YYYY-MM-DD-001.pdf*

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File Naming - BFP

- Bridge Maintenance Office Approvals Request Form (if necessary) File Naming Convention:
  - BMO Approvals Form File: *[Asset ID]-LR_BMOApprove-YYYY-MM-DD-001.pdf*
- Final Design Plans File Naming Convention:
  - .PDF File: *[Asset ID]-Plans_AsLet-YYYY-MM-DD-001.pdf*
- Final As-Built Plans File Naming Convention:
  - .PDF File: *[Asset ID]-Plans_AsBuilt-YYYY-MM-DD-001.pdf*

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File Naming - Questions

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Load Rating Documentation

What are some Categories of Documentation included in each load rating ?

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Load Rating Documentation

In General, Each Load Rating Includes the Following:

1. Existing Information
2. Guidance Documents
3. Assumptions & Supplemental Calcs
4. Conspan, Midas, LEAP, Excel, BrR or Other Input [A3.1]
5. Load Rating Summary Form (LRSF)
6. QC Review Checklist
7. Data Correction Form
8. Labeling Diagram
9. Posting Avoidance (if applicable)

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Load Rating Documentation - Questions

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Break

- Let's Take a 10 Minute Break

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Bridge Posting Overview

- LRGD Guidelines
- Posting Vehicles
- Posting Avoidance Measures
- Bridge Signing / Posting Form

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Bridge Posting

- When do you load post a bridge?

A. For HL-93 < 1.0 but other vehicles are > 1.0
B. For LRFR Legal Load Ratings < 1.0 and LFR Legal Load Ratings < 1.0
C. Legal Load Ratings < 1.05
D. For LRFR Legal Load Ratings < 1.0 and LFR Legal Load Ratings > 1.0

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Bridge Posting

- LRGD Guidelines
  - The minimum load posting for gross weight is 3 TONS
  - As per AASHTO MBE, bridges not capable of carrying a min. gross legal load of 3 TONS shall be closed

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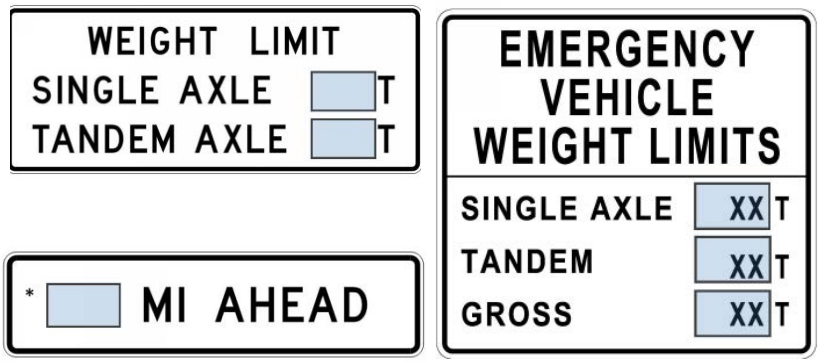
Bridge Posting

- Posting Signs



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Bridge Posting

- Posting Vehicles
  - Governing AASHTO Legal Loads or SC Legal Loads
  - Use Operating Capacity for ASR/LFR Postings
  - Follow MBE for LRFR Postings
  - Current State Practice – Use ASR / LFR for Postings

RF ≥ 1.0 Safe for unrestricted indefinite use

RF < 1.0 Need for posting or bridge strengthening

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Bridge Posting

- LRGD Guidelines and Load Posting Flowchart

Bridge Load Rating & Evaluation
Engineering Services - S-239-19

SCDOT

Technical Note e-Notification No. 03 October 21, 2019 Updated: Jan 29, 2020	**Technical Note 03 with Updated Item 3 Bullet 19.2.2 and Updated Bridge Posting Flowchart**

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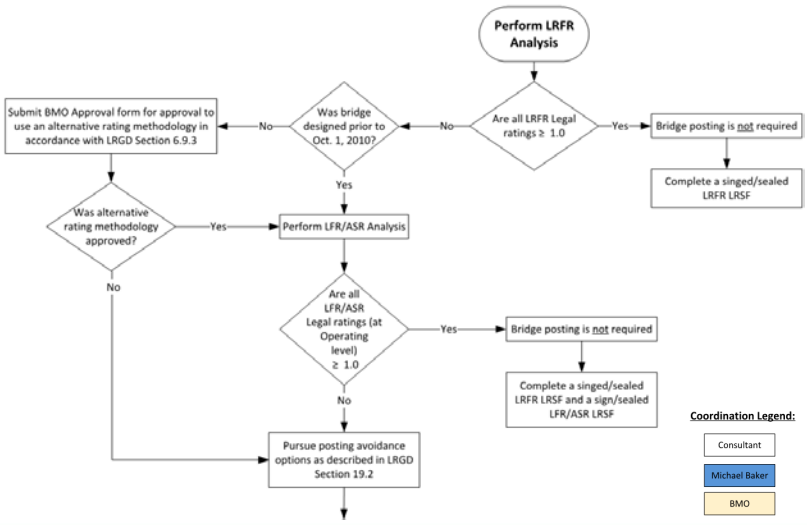
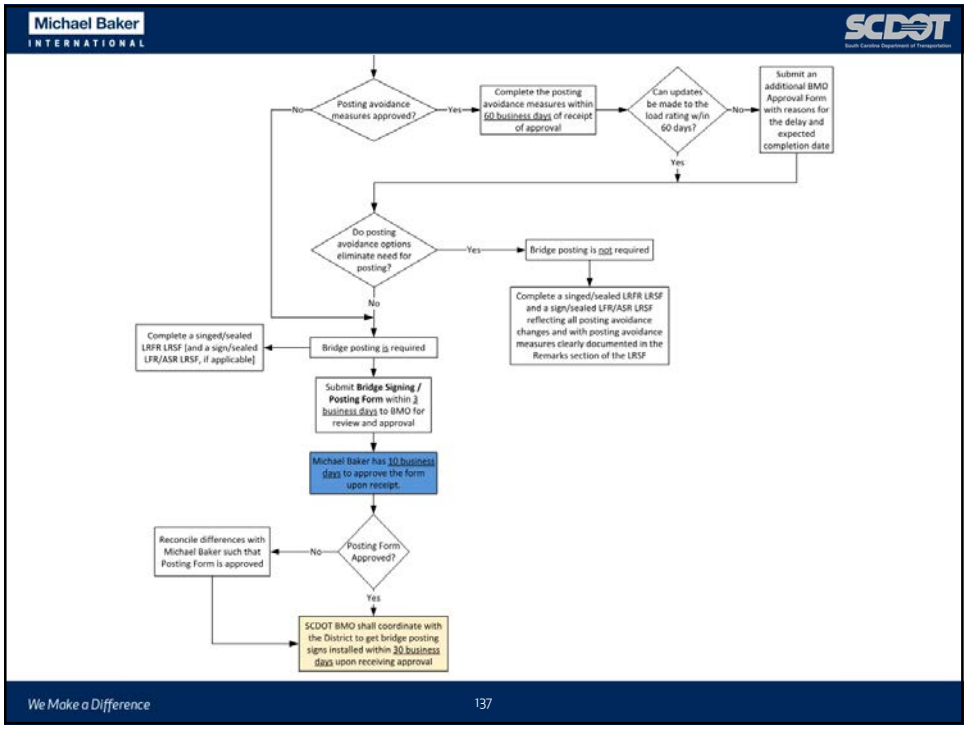
SCDOT Load Rating Bridge Posting Flowchart



136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SCDOT
Posting avoidance measures approved?
No
Yes
Complete the posting avoidance measures within 60 business days of receipt of approval
Can updates be made to the load rating w/in 60 days?
No
Submit an additional BMO Approval Form with reasons for the delay and expected completion date
Yes
Do posting avoidance options eliminate need for posting?
Yes
Bridge posting is not required
Complete a singed/sealed LRFR LRSF and a sign/sealed LFR/ASR LRSF reflecting all posting avoidance changes and with posting avoidance measures clearly documented in the Remarks section of the LRSF
No
Complete a singed/sealed LRFR LRSF [and a sign/sealed LFR/ASR LRSF, if applicable]
Bridge posting is required
Submit Bridge Signing / Posting Form within 3 business days to BMO for review and approval
Michael Baker has 10 business days to approve the form upon receipt.
Reconcile differences with Michael Baker such that Posting Form is approved
No
Posting Form Approved?
Yes
SCDOT BMO shall coordinate with the District to get bridge posting signs installed within 30 business days upon receiving approval
We Make a Difference
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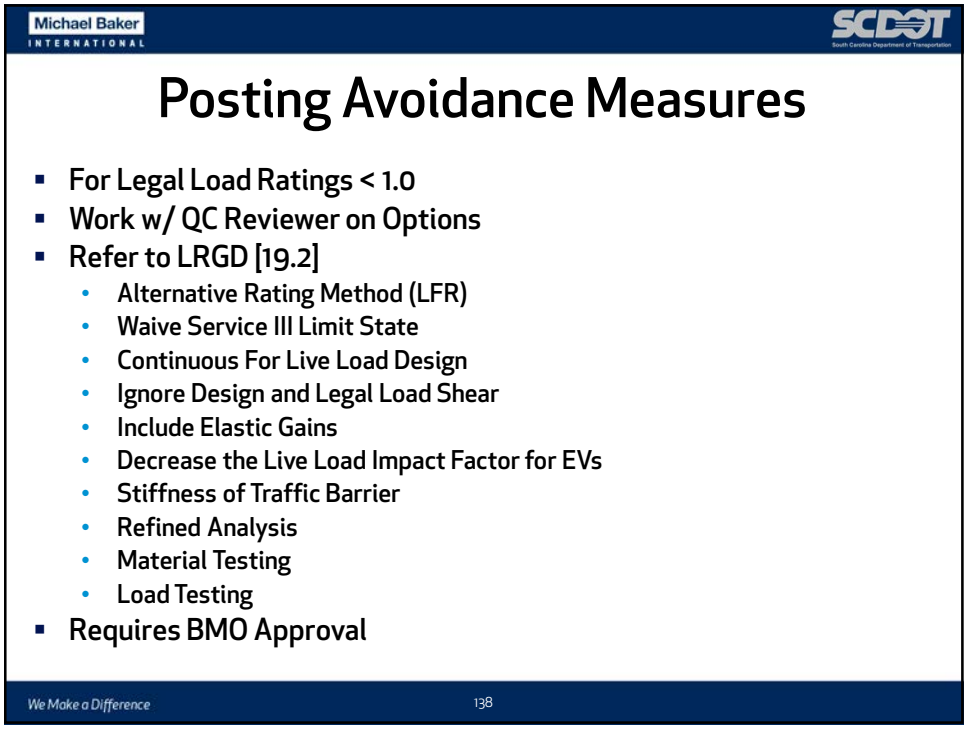
Michael Baker INTERNATIONAL
SCDOT
Posting Avoidance Measures
For Legal Load Ratings < 1.0
Work w/ QC Reviewer on Options
Refer to LRGD [19.2]
Alternative Rating Method (LFR)
Waive Service III Limit State
Continuous For Live Load Design
Ignore Design and Legal Load Shear
Include Elastic Gains
Decrease the Live Load Impact Factor for EVs
Stiffness of Traffic Barrier
Refined Analysis
Material Testing
Load Testing
Requires BMO Approval
We Make a Difference
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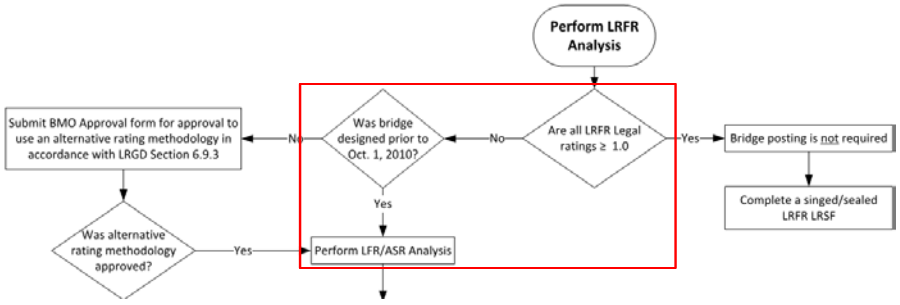
Posting Avoidance Flowchart

- If LRFR Legal Load Ratings are < 1.0 and Bridge Designed Prior to 10/01/2010, Perform an LFR Analysis



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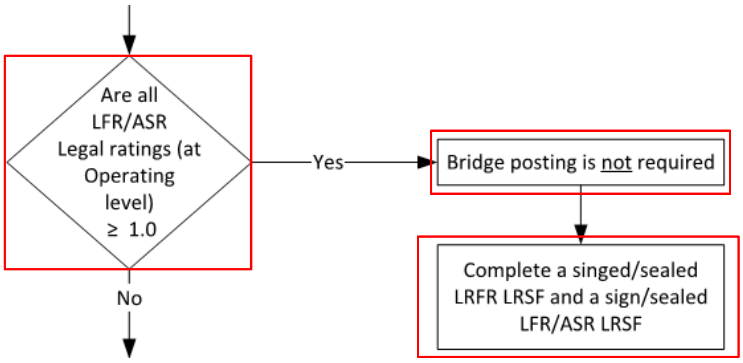
Posting Avoidance Flowchart

- If LFR Legal Ratings at Operating Level are >1.0, Posting Not Required
- Provide Both LRFR and LFR LRSF



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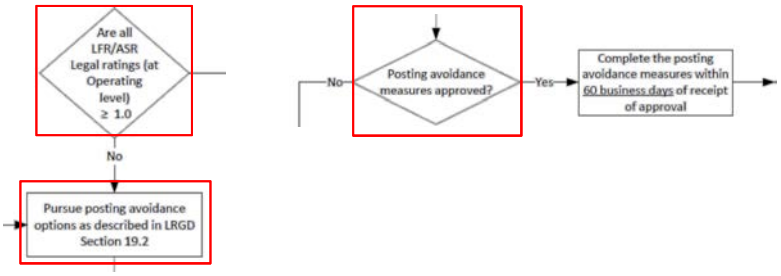
Posting Avoidance Flowchart

- If LFR Legal Ratings at Operating < 1.0 then Pursue Posting Avoidance Procedures
  - See the Service III Limit State Rating Waiver
  - Provide the Revised LRFR Ratings Utilizing Service III Limit State and LFR ratings



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Posting Avoidance Measures

- Service III Limit State Rating Waiver (Tech. Note 6)

Bridge Load Rating & Evaluation
Engineering Services - S-239-19

SCDOT

Technical Note e-Notification No. 06 January 29, 2020	**Technical Note 06**

This requirement applies to bridges rated by the LRFR method. For prestressed concrete bridges, the Service III limit state shall be considered in the legal load rating analysis. If the Service III limit state yields a controlling rating factor lower than 1.0, the Service III limit state may be waived ***if there is no evidence of cracking in the prestressed girders under normal traffic (refer to MBE Section C6A.5.4.2.2a).***

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The intent of this modification is to alleviate the extra effort required to complete a BMO approval form and submit all additional documentation each time the Service III check drops the legal ratings less than 1.0. The load rater is now permitted to waive the Service III check without BMO approval as long as there is no evidence of cracking under normal traffic. Justification for ignoring Service III shall be documented in the Remarks section of the Load Rating Summary Form.

Reminder: In accordance with the second paragraph of Section 19.2.2 of the LRGD and Section 6A.5.11.5.1 of the MBE, the Service III limit state is mandatory for the legal load ratings of post-tensioned concrete segmental bridges and may not be waived.

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Posting Avoidance Measures

- P/S Beams – Continuous for Live Load (Tech. Note 6)

Bridge Load Rating & Evaluation
Engineering Services - S-239-19

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Technical Note e-Notification No. 06 January 29, 2020	Technical Note 06

The presence of continuity diaphragms and/or supplemental deck reinforcing over the intermediate supports on multi-span prestressed concrete bridges do not necessarily indicate continuous span behavior in the prestressed girders under superimposed dead loads (SDL) and live loads (LL). The AASHTO LRFD Bridge Design Specifications (LRFD) Section 5.12.3.3.5 states some additional requirements. Therefore, continuous span behavior (for SDL and LL) shall only be modeled when either of the below requirements are satisfied:

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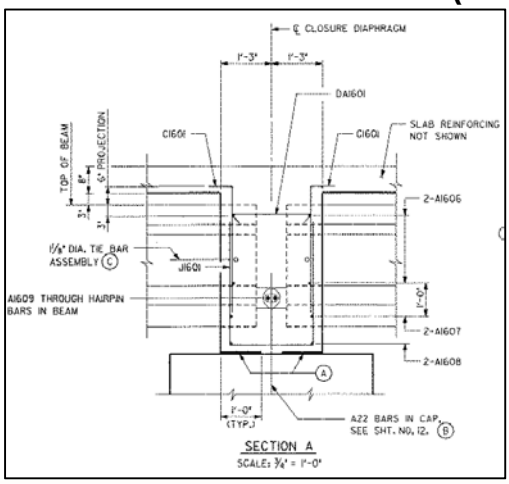
- P/S Beams – Continuous for Live Load (Tech. Note 6)



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- P/S Beams – Continuous for Live Load (Tech. Note 6)

- The plans clearly state the bridge was designed continuous for live load.
- One of the requirements of LRFD Section 5.12.3.3.5 are satisfied and a BMO Approvals Form has been submitted and approved. This request shall be made in the "Other" category of the BMO Approvals Form. Section 4 of the form shall provide the reason(s)/justification for analyzing as continuous span and all supporting analysis files (i.e., calculated stress at the bottom of the continuity diaphragm under the load combination provided in LRFD 5.12.3.3.5) shall be submitted with the request.

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- P/S Beams – Continuous for Live Load (Tech. Note 6)

Note: If the Service III concrete tensile stress limit state governs the simple span ratings, LRGD Section 19.2.2 and MBE Section 6A.5.4.2.2a allow the Service III limit state to be ignored for bridges which show no signs of flexural distress. This could potentially eliminate the necessity to account for continuous span behavior in multi-span prestressed bridges where the simple span ratings are greater than 1.0 when Service III is ignored. If Service III is ignored in accordance with the guidance set forth in Item 5 of this Technical Note, then add a note to the rating assumptions stating that the Service III limit state was ignored and there are no signs of flexural distress.

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- P/S Beams – Continuous for Live Load (Tech. Note 6)

When continuous span behavior is warranted by a note on the plans stating the bridge was designed continuous for live load and/or via an approved BMO Approvals Form, the multi-span analysis member control option in AASHTOWare BrR shall be set to "*Continuous*", as shown in Figure 1 below.

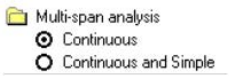

Figure 1 – Control Option for Multi-Span PS Beams Analyzed as Continuous

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Posting Avoidance Measures

- P/S Beams – Continuous for Live Load (Tech. Note 6)

If simple span ratings of a multi-span prestressed girder bridge are lower than anticipated and/or would require bridge posting and would benefit from continuous span behavior, then proceed with the additional analysis described in LRFD Section 5.12.3.3.5 as part of a posting avoidance option and submit a BMO Approvals Form as described in this Technical Note. If approved, add a note to the rating assumptions stating that the bridge was rated as a continuous structure and there are no signs of flexural distress.

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Posting Avoidance Measures

- For LRFR, if Shear Controls the Ratings, then Pursue Posting Avoidance Procedures
  - LRGD 10.2.1.2 (#8):

8. For Control Options in BrR, see the screenshot in Figure 10.2.1.2-1. For an Example Load Case Description input, see Figure 10.2.1.2-2. For Prestressed Concrete Stress Limit input, see Figure 10.2.1.2-3. Note: the "Ignore design and legal load shear" box should only be checked if the requirements set forth in the MBE are met.

  - MBE referenced in LRGD 10.2.1.2 (#8):

6A.5.8—Evaluation for Shear

The shear capacity of existing reinforced and prestressed concrete bridge members should be evaluated for permit loads. In-service concrete bridges that show no visible signs of shear distress need not be checked for shear when rating for the design load or legal loads.

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Posting Avoidance Measures

- Stiffness of Traffic Barrier
  - Field Verify
    - Physical condition
    - Interface between barrier and bridge superstructure
    - Condition of joints
  - If stiffness is consider for LR, also LR barrier and interfacial connection (rebar)
  - Consider the possible difference in modulus of elasticity between the deck and barrier

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Posting Avoidance Measures

- Refined Analysis

In some cases refined analysis is *required* to complete the design according to AASHTO LRFD. These are instances for which the specification approximate methods do not apply. *Furthermore, there are reasons why using a refined analysis might be advantageous, including but not limited to:*

- *Capturing behavior not adequately accounted for by approximate methods and/or outside the limits of the Specifications. Even within the limits of applicability, approximate methods can give erroneous indications of a structure's true behavior.*
- *Obtaining more accurate, and less conservative, demands for existing structures, especially when approximate methods result in conservative demands which in turn result in extensive repair or replacement of structures.*

Having listed some of what refined analysis is not, a definition of what refined analysis might include can begin to be constructed. *A refined analysis might:*

- *Account for shear lag in deck and planar elements*
- *Account for the distortion of a cross-section*
- *Explicitly model cross-frames*
- *Explicitly model the deck as a plate (rather than a grid) in two dimensions*
- *Distribute load to girder lines based on interconnecting stiffness*
- *Assess capacity through the use of plastic hinges, such as by pushover analysis.*

Refined analyses are more sophisticated, and when correctly applied, generally more accurate than the current approximate methods contained in the AASHTO Specifications.

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Posting Avoidance Measures

- For Prestressed Girders - Include Elastic Gains
  - Previously included in prestressed bridge design
  - BMO recently enacted guidance to neglect effects for design to be conservative.
  - BrR neglects by default
  - Including elastic gains can now be used to increase ratings
  - Reference Tech Note 05

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Posting Avoidance Measures

- Decreasing the Live Load Factor Impact [LRGD 6.7.1]
- Material Testing [LRGD 6.12]
- Load Testing [LRGD 6.12]

All need BMO approval

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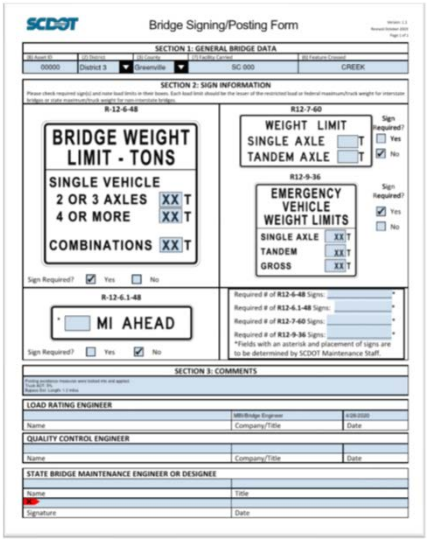
Bridge Signing / Posting Form



Bridge Signing/Posting Form

SECTION 1: GENERAL BRIDGE DATA

00000	District 3	Greenville	SC 000	CREEK

SECTION 2: SIGN INFORMATION

R-12-6-48

BRIDGE WEIGHT LIMIT - TONS

SINGLE VEHICLE
2 OR 3 AXLES XX T
4 OR MORE XX T

COMBINATIONS XX T

Sign Required? ☑ Yes ☐ No

R12-7-60

WEIGHT LIMIT
SINGLE AXLE T
TANDEM AXLE T

Sign Required? ☐ Yes ☑ No

R12-9-36

EMERGENCY VEHICLE WEIGHT LIMITS

SINGLE AXLE	XX T
TANDEM	XX T
GROSS	XX T

Sign Required? ☑ Yes ☐ No

R-12-6.1-48

* MI AHEAD

Sign Required? ☐ Yes ☑ No

Required # of R12-6-48 Signs: *
Required # of R12-6.1-48 Signs: *
Required # of R12-7-60 Signs: *
Required # of R12-9-36 Signs: *
*Fields with an asterisk and placement of signs are to be determined by SCDOT Maintenance Staff.

SECTION 3: COMMENTS

LOAD RATING ENGINEER

Name	MBI/Bridge Engineer Company/Title	XX/XX/2020 Date

QUALITY CONTROL ENGINEER

Name	Company/Title	Date

STATE BRIDGE MAINTENANCE ENGINEER OR DESIGNEE

Name	Title
Signature	Date

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Bridge Posting - Questions

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Help / Guidance Documents

- Help Desk
- Technical Notifications
- SCDOT Manuals / Policies
- SCDOT Websites

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General – Help Desk & Technical Notifications

- Sign Up for E-Notifications
- Ask Questions and Review the Responses
- Utilized for Consistent Evaluation
- Helpful Information for All Aspects of the Load Rating Process

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General - Good Sources of Information

- SCDOT Bridge Design Manual (BDM)
- SCDOT Bridge File Policy (BFP)
- SCDOT Bridge Inspection Guidance Document (BIGD)
- SCDOT Digital Signatures Manual
- SCDOT Load Rating Guidance Document (LRGD)
- SCDOT Load Rating Procedure for Bridges with Unknown or Partial Plans TN 07 – use std or sister plans, field measurements, similar design rebar
- SCDOT Interim Load Rating Procedure for Bridges in Design

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General - Good Sources of Information

- SCDOT Load Rating Website

https://projects.mbakerintl.com/SCDOT_BLR/Pages/Home.aspx

- SCDOT Load Rating Guidance

https://www.scdot.org/business/load-rating-guidance-doc.aspx

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General - Good Sources of Information

- Simple Span Prestressed I-Beam Example
  PS1 – Simple Span PS I Beam.pdf
- Simple Span Steel Plate Girder Example
  STL1 – Simple Span Plate Girder Example.pdf
- A Lot More BrR Training Here:
  https://aashto.mbakercorp.com/Pages/Training.aspx

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Learning Outcomes

- Load Rating Basics → "What is it? Why do it? When?"
- SCDOT Process → "What's Involved?"
  - LRGD
  - Load Rating Documentation
  - Bridge Postings
  - Help / Guidance Documents and Resources

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Load Ratings→ "What is it?"

- From the "MBE" (AASHTO Manual for Bridge Evaluation, 3rd Edition), Section 6.1:

> Bridge load rating provides a basis for determining the safe load capacity of a bridge. Load rating requires engineering judgment in determining a rating value that is applicable to maintaining the safe use of the bridge and arriving at posting and permit decisions.

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Load Ratings→ "Why do it?"

- Ensure bridge safety
- Comply with federal regulations - National Bridge Inspection Standards (NBIS)
- Determine rehabilitation or replacement needs
- Determine posting needs
- Process of overload permits

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Load Ratings→ "When?"

- Design stage
- Initial inventory inspection
- Change in the live load
- Change in the dead load on the structure
- Physical change in any structural member of the bridge
- Change in load rating method requirements

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SCDOT Process → "What's Involved?"

- LRGD
- Load Rating Documentation
- Bridge Postings
- Help / Guidance Documents and Resources

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Questions / Open Discussion

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