Montana Department of Transportation

Bridge Load Rating Summary

Insert Consultant Logo Here

Rating prepared by:

General Bridge Information

MDT Bridge ID	**02738**	MDT District	BILLINGS	Year Built	1979
NBI Bridge ID	L14012004+01001	County	FERGUS	Design Load	Unknown
Feature Intersected	WOLF CREEK 089	Location	7M E DENTON	Deck Type	Wood or Timber
Facility Carried	BALLY DOME RD	Inspection Date	8/28/2019	Wearing Surface	Wood or Timber...
Route Number	14012	Accumulated Miles	4.224	Depth of Cover (inches)	0
Structure Length (feet)	76	Bridge Owner	County Hwy Agency	Maintenance Responsibility	County Hwy Agency

Span Data

Main Span(s)		Approach Span(s)	
Number of Spans	1	Number of Spans	0
Material Type	Steel	Material Type	Wood or Timber
Superstructure Type	Stringer|Multi-beam or Girder	Superstructure Type	Stringer|Multi-beam or Girder

EXAMPLE
Steel Girder/Timber Deck - Both control rating

Load Rating Information

Load Rating Method Used	LRFR	Load Rating Program Used	BrR
Load Rating Status	Final	Version	6.8.3.3001

Truck / Load Type	Vehicle Weight *(Tons)*	Rating Factor	Controlling Load†	Controlling Member	Controlling Location‡	Limit State	Safe Load Capacity *(Tons)*	Calculated Safe Posting Load* *(Tons)*
HL-93 Inventory	36	0.413	1	Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	15	
HL-93 Operating	36	0.535	1	Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	19	
Type 3	25	0.832		Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	21	**19**
Type 3S2	36	0.855		Interior Girder (G2)	1.40	Strength-I Steel Flexure Moment	31	**29**
Type 3-3	40	0.930		Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	37	**36**
SU4	27	0.729		Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	20	**17**
SU5	31	0.670		Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	21	**16**
SU6	34.75	0.602		Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	21	**15**
SU7	38.75	0.555		Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	22	**14**
EV2	28.75							
EV3	43	0.527	Single Lane	Interior Girder (G2)	1.50	Strength-I Steel Flexure Moment	23	**REFER TO LOAD POSTING FORM**

Calculate LRFR deck rating factor for EV2

†1 = Truck
= Tande
= (0.9 T
EVs = Sin

** Recommended values based on MBE Equation 6A.8.3-1. If posting is required, refer to supplemental Load Posting Form for final determination on load posting values.*
***If RF < 0.3, vehicle type should not be allowed on span (MBE 6A.8.3)*

Use summary sheet for LRFR, note mixed methodology (see example wording)

Don't need to include overall bridge rating results from Explorer. Instead, please include rating result printouts for each member alternative.
Preference - highlight member at top of each sheet, highlight controlling rating factors. Note factors that are re-calculated outside of BrR.

Include Calculations/Additional Assumptions/ Measurements sheets like normal
Include LRFR deck rating calculations

Include vehicle templates for both rating methods

Posting Required for Legal Vehicles?	**Yes**

Posting is required if Rating Factor is < 1 for any of the AASHTO

Posting Required for Emergency Vehicles?	

*Posting is required if Rating Factor is < 1 for either EV **and** the an interstate or within 1 mile from any interstate interchange*

Comments and Assumptions *Attach ad*

Include:
Basis for Load Rating (i.e. measurements from xxxx year, as-built plans/shop drawings/construction plans)
References (i.e. MBE edition, AASHTO LRFD edition)
Anything unique about rating (i.e. alternate superstructure was created in BrR for xxx reason, mixed materials)
Anything that needs to be flagged for attention (i.e. reduced capacity for timber members, EV live load factor (if different than defa 1.3), removal of optional limit state checks)

The intent of this section is to provide a brief overview/summary; it's encouraged to attach more detailed documentation of engineering judgement and calculations as additional pages. Please include a note referencing any additional comments/assumptions/calculations (i.e. "Additional assumptions and calculations are detailed within the attached load rating rep

Example wording:

References:
AASHTO MBE (3rd Ed.)
AASHTO LRFD Bridge Design Specifications (8th Ed.) - steel girders
AASHTO Standard Specifications (17th Ed.) - timber decking

Due to BrR limitations, ASR analysis was used for the timber deck and LRFR analysis was used for steel girders. Controlling values (based on ASR Operating and LRFR rating factors) were determined to be a mix of methodologies. LRFR values are reported - see hand calculations for determination of LRFR deck rating factor for EV2.

OR

Timber deck analysis was performed using ASR methodology and references the provisions of the AASHTO MBE (3rd ed.) and AASHTO Standard Specifications (17th ed.) The results of deck analysis controlled the EV2 rating, so hand calculations were performed to determine an LRFR deck rating for that vehicle (see attached calcs).

Steel Girder analysis was performed using LRFR methodology and references the provisions of the AASHTO MBE (3rd ed.) and AASHTO LRFD Bridge Design Specifications (8th ed.) The Legacy AASHTO LRFR analysis module was selected to account for timber deck loads (BrR bug workaround).

Rating Results Summary Report

Name:
Struct-Def: Span 1 - 54.7 Steel Girder

Bridge ID: 02738
Member: Deck

Deck results don't include indication of member - please add

NBI: L14012004+01001

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating	Rating Factor	Location	Limit State	Impact	Lane
EV2	Axle Load	ASD	Inventory	13.81	0.480		Flexure - One-lane	As Requested	As Requested
EV2	Axle Load	ASD	Operating	18.41	0.640		Flexure - One-lane	As Requested	As Requested
EV3	Axle Load	ASD	Inventory	22.32	0.519		Flexure - One-lane	As Requested	As Requested
EV3	Axle Load	ASD	Operating	29.75	0.692		Flexure - One-lane	As Requested	As Requested
HS 20-44	Axle Load	ASD	Inventory	18.11	0.503		Flexure - One-lane	As Requested	As Requested
HS 20-44	Axle Load	ASD	Operating	24.13	0.670		Flexure - One-lane	As Requested	As Requested
SU4	Axle Load	ASD	Inventory	26.67	0.988		Flexure - One-lane	As Requested	As Requested
SU4	Axle Load	ASD	Operating	35.53	1.316		Flexure - One-lane	As Requested	As Requested
SU5	Axle Load	ASD	Inventory	30.62	0.988		Flexure - One-lane	As Requested	As Requested
SU5	Axle Load	ASD	Operating	40.79	1.316		Flexure - One-lane	As Requested	As Requested
SU6	Axle Load	ASD	Inventory	34.32	0.988		Flexure - One-lane	As Requested	As Requested
SU6	Axle Load	ASD	Operating	45.73	1.316		Flexure - One-lane	As Requested	As Requested
SU7	Axle Load	ASD	Inventory	38.27	0.988		Flexure - One-lane	As Requested	As Requested
SU7	Axle Load	ASD	Operating	50.99	1.316		Flexure - One-lane	As Requested	As Requested
Type 3	Axle Load	ASD	Inventory	24.86	0.995		Flexure - One-lane	As Requested	As Requested
Type 3	Axle Load	ASD	Operating	33.14	1.326		Flexure - One-lane	As Requested	As Requested
Type 3-3	Axle Load	ASD	Inventory	42.36	1.059		Flexure - One-lane	As Requested	As Requested
Type 3-3	Axle Load	ASD	Operating	56.45	1.411		Flexure - One-lane	As Requested	As Requested
Type 3S2	Axle Load	ASD	Inventory	39.39	1.094		Flexure - One-lane	As Requested	As Requested
Type 3S2	Axle Load	ASD	Operating	52.50	1.458		Flexure - One-lane	As Requested	As Requested

*Preference - add note that indicates alternate LRFR deck rating was calculated for EV2

Rating Results Summary Report

Name:
Struct-Def: Span 1 - 54.7 Steel Girder

Bridge ID: 02738
Member: G1

NBI: L14012004+01001
Member Alt: Exterior Girder 1

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HL-93 (US)	Truck + Lane	LRFR	Inventory	15.51	0.431	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Truck + Lane	LRFR	Operatin	20.11	0.559	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Tandem + Lan	LRFR	Inventory	16.86	0.468	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Tandem + Lan	LRFR	Operatin	21.86	0.607	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3	Axle Load	LRFR	Legal	21.71	0.868	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3-3	Axle Load	LRFR	Legal	38.83	0.971	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3S2	Axle Load	LRFR	Legal	32.11	0.892	21.88	1 - (40.0)	STRENGTH-I Steel Flexure Moment	As R	As
Lane-Type Legal Load	Truck + Lane	LRFR	Legal	3960.00	99.000	0.00	1 - (0.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU4	Axle Load	LRFR	Legal	20.55	0.761	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU5	Axle Load	LRFR	Legal	21.68	0.699	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU6	Axle Load	LRFR	Legal	21.81	0.628	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU7	Axle Load	LRFR	Legal	22.44	0.579	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV2m (Single Lane)	Axle Load	LRFR	Legal	24.33	0.846	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV3m (Single Lane)	Axle Load	LRFR	Legal	23.62	0.549	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV2m (Multi-Lane	Axle Load	LRFR	Permit	29.20	1.016	27.35	1 - (50.0)	STRENGTH-II Steel Flexure Moment	As R	As
EV3m (Multi-Lane	Axle Load	LRFR	Permit	28.35	0.659	27.35	1 - (50.0)	STRENGTH-II Steel Flexure Moment	As R	As

Legacy AASHTO LRFR Engine Version 6.8.3.3001
Analysis Preference Setting: None
Analysis Time: 10/17/2019 12:33:37
Print Time: 10/17/2019 12:35:32

Analyzed By: ops$u5801

Rating Results Summary Report

Name:
Struct-Def: Span 1 - 54.7 Steel Girder

Bridge ID: 02738
Member: G6

NBI: L14012004+01001
Member Alt: Exterior Girder 2

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HL-93 (US)	Truck + Lane	LRFR	Inventory	18.39	0.511	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Truck + Lane	LRFR	Operatin	23.83	0.662	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Tandem + Lan	LRFR	Inventory	19.99	0.555	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Tandem + Lan	LRFR	Operatin	25.91	0.720	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3	Axle Load	LRFR	Legal	25.73	1.029	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3-3	Axle Load	LRFR	Legal	46.02	1.151	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3S2	Axle Load	LRFR	Legal	38.06	1.057	21.88	1 - (40.0)	STRENGTH-I Steel Flexure Moment	As R	As
Lane-Type Legal Load	Truck + Lane	LRFR	Legal	3960.00	99.000	0.00	1 - (0.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU4	Axle Load	LRFR	Legal	24.36	0.902	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU5	Axle Load	LRFR	Legal	25.69	0.829	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU6	Axle Load	LRFR	Legal	25.85	0.744	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU7	Axle Load	LRFR	Legal	26.60	0.686	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV2m (Single Lane)	Axle Load	LRFR	Legal	28.84	1.003	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV3m (Single Lane)	Axle Load	LRFR	Legal	28.00	0.651	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV2m (Multi-Lane	Axle Load	LRFR	Permit	34.60	1.204	27.35	1 - (50.0)	STRENGTH-II Steel Flexure Moment	As R	As
EV3m (Multi-Lane	Axle Load	LRFR	Permit	33.60	0.781	27.35	1 - (50.0)	STRENGTH-II Steel Flexure Moment	As R	As

Legacy AASHTO LRFR Engine Version 6.8.3.3001
Analysis Preference Setting: None
Analysis Time: 10/17/2019 12:33:37
Print Time: 10/17/2019 12:36:05

Analyzed By: ops$u5801

Rating Results Summary Report

Name:
Struct-Def: Span 1 - 54.7 Steel Girder

Bridge ID: 02738
Member: G2

NBI: L14012004+01001
Member Alt: Interior Girder

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HL-93 (US)	Truck + Lane	LRFR	Inventory	14.87	0.413	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Truck + Lane	LRFR	Operatin	19.27	0.535	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Tandem + Lan	LRFR	Inventory	16.16	0.449	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
HL-93 (US)	Tandem + Lan	LRFR	Operatin	20.95	0.582	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3	Axle Load	LRFR	Legal	20.81	0.832	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3-3	Axle Load	LRFR	Legal	37.22	0.930	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
Type 3S2	Axle Load	LRFR	Legal	30.78	0.855	21.88	1 - (40.0)	STRENGTH-I Steel Flexure Moment	As R	As
Lane-Type Legal Load	Truck + Lane	LRFR	Legal	3960.00	99.000	0.00	1 - (0.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU4	Axle Load	LRFR	Legal	19.70	0.729	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU5	Axle Load	LRFR	Legal	20.78	0.670	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU6	Axle Load	LRFR	Legal	20.91	0.602	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
SU7	Axle Load	LRFR	Legal	21.51	0.555	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV2m (Single Lane)	Axle Load	LRFR	Legal	23.32	0.811	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV3m (Single Lane)	Axle Load	LRFR	Legal	22.64	0.527	27.35	1 - (50.0)	STRENGTH-I Steel Flexure Moment	As R	As
EV2m (Multi-Lane	Axle Load	LRFR	Permit	27.98	0.973	27.35	1 - (50.0)	STRENGTH-II Steel Flexure Moment	As R	As
EV3m (Multi-Lane	Axle Load	LRFR	Permit	27.17	0.632	27.35	1 - (50.0)	STRENGTH-II Steel Flexure Moment	As R	As

Legacy AASHTO LRFR Engine Version 6.8.3.3001
Analysis Preference Setting: None
Analysis Time: 10/17/2019 12:33:37
Print Time: 10/17/2019 12:35:48

Analyzed By: ops$u5801

Include additional sheets (as needed) for:

- Calculations
    - **LRFR deck calculation for EV2**
    - *Include any calculations not included in the rating program's analysis (i.e. LLDFs, dead loads, section loss, etc.). Include appropriate references to equations and relevant code articles, and format with a level of detail that's easy to follow for checking purposes.*

- Additional Assumptions/Comments
    - Details about unique rating processes/checks
        - *i.e. additional superstructure definition used for alternate rating, check for failed girder condition, etc.*
    - BrR issues that affect model
        - *Include JIRA ticket (if applicable), brief statement of issue and how model/rating is affected, workaround procedure performed*
    - Document all rationale and justification
        - *i.e. reduction of timber member capacity, removal of optional limit state checks, EV live load factor override, etc.*

Vehicle Templates – please include following:

***Only the analysis template that's applicable to rating methodology used needs to be attached. For mixed material/mixed code bridges, please include both.*

- Vehicle Summary (Analysis Template)
- Vehicle Properties (Advanced Settings)
    - *Hint – cannot adjust size of this window; may have to adjust column widths to fit in one screenshot*
    - *Note – this will need to be updated for LRFR if EV live load factor is changed*
- Any non-standard library vehicle definitions
    - For ASR/LFR
        - Use standard definitions for all vehicles
        - No additional screenshots necessary, please note that standard vehicle definitions were used for all vehicles
    - For LRFR
        - Use modified contact area for EVs
        - Include screenshots of agency defined vehicles (i.e. EVs, Adjacent Type 3-3)

Note – please ensure that the attached template is the actual template used in the rating

Example Vehicle Template for LFR/ASR Analysis

Analysis Settings:

Vehicle Summary:

- Rating Vehicles
  - LRFR
  - LFD/ASD
    - Inventory
      - EV2
      - EV3
      - HS 20-44
      - SU4
      - SU5
      - SU6
      - SU7
      - Type 3
      - Type 3-3
      - Type 3S2
    - Operating
      - EV2
      - EV3
      - HS 20-44
      - SU4
      - SU5
      - SU6
      - SU7
      - Type 3
      - Type 3-3
      - Type 3S2
    - Legal Operating
    - Permit Inventory
    - Permit Operating

Advanced Settings:

Vehicle Properties

Vehicle	Tandem Train	Scale Factor	Impact	Single Lane Loade	Lega Pair	Override	Legal Live Load	Frequency	Loading Condition	Override	Permit Live Load
EV2	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
EV3	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
HS 20-44	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
SU4	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
SU5	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
SU6	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
SU7	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
Type 3	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
Type 3-3	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	
Type 3S2	☐	1		☐	☐	☐		Single Trip	Mixed with traffic	☐	

Permit lane load: kip/ft

Adjacent vehicle live load factor:

☐ Exclude permit lane load from permit vehicle location

Standard library definitions used for all vehicles

Example Vehicle Template for LRFR Analysis

Analysis Settings:

Vehicle Summary:

- Rating Vehicles
  - LRFR
    - Design Load Rating
      - Inventory
        - HL-93 (US)
      - Operating
        - HL-93 (US)
      - Fatigue
        - LRFD Fatigue Truck (US)
    - Legal Load Rating
      - Routine
        - Lane-Type Legal Load
        - Type 3
        - Type 3-3
        - Type 3S2
      - Specialized Hauling
        - SU4
        - SU5
        - SU6
        - SU7
        - EV2m (Single Lane)
        - EV3m (Single Lane)
    - Permit Load Rating
      - EV2m (Multi-Lane)
        - Adjacent Vehicle
          - Adjacent Type 3-3
      - EV3m (Multi-Lane)
        - Adjacent Vehicle
          - Adjacent Type 3-3

Advanced Settings:

Vehicle Properties

Vehicle	Tandem Train	Scale Factor	Impact	Single Lane Loade	Lega Pair	Override	Legal Live Load	Frequency	Loading Condition	Override	Permit Live Load
HL-93 (US)	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
Lane-Type Legal Load	☐	1		☐	☑	☐		Single Trip	Mixed with traffi	☐	
LRFD Fatigue Truck (US)	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
SU4	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
SU5	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
SU6	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
SU7	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
Type 3	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
Type 3-3	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
Type 3S2	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☐	
EV2m (Multi-Lane)	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☑	1.3
EV2m (Single Lane)	☐	1		☑	☐	☑	1.3	Single Trip	Mixed with traffi	☐	
EV3m (Multi-Lane)	☐	1		☐	☐	☐		Single Trip	Mixed with traffi	☑	1.3
EV3m (Single Lane)	☐	1		☑	☐	☑	1.3	Single Trip	Mixed with traffi	☐	

Permit lane load: kip/ft

Adjacent vehicle live load factor: 1.300

☐ Exclude permit lane load from permit vehicle location

EVs and Adjacent Type 3-3 are Agency Defined vehicles – see next page

Standard library definitions used for all other vehicles

Example Vehicle Template for LRFR Analysis – Agency Defined Vehicles









