



Evaluation of State Legal Loads

Ralph DeStefano, PE — ProMiles

Legal Loads – AASHTO – Type 3 Series

- a. *AASHTO Trucks*—Apply for all span lengths and load effects.

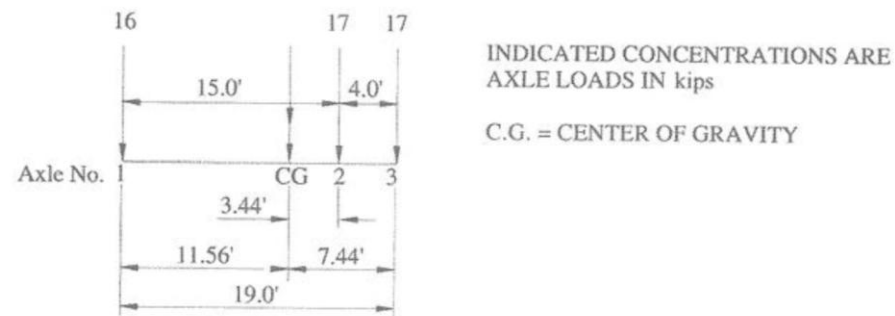


Figure D6A-1—Type 3 Unit; Weight = 50 kips (25 tons)

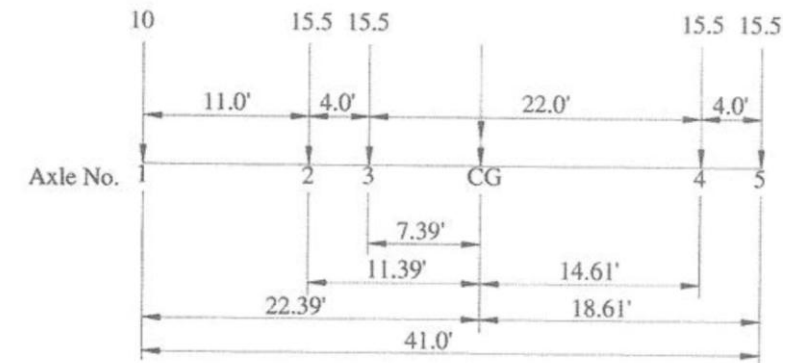


Figure D6A-2—Type 3S2 Unit; Weight = 72 kips (36 tons)

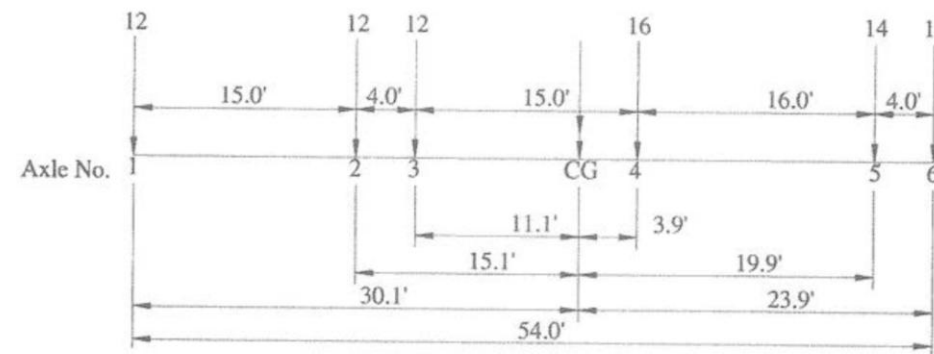


Figure D6A-3—Type 3-3 Unit; Weight = 80 kips (40 tons)

Legal Loads – AASHTO – Lane-type Legal

- b. *Lane-Type Legal Load Model*—Apply for spans greater than 200 ft and all load effects.

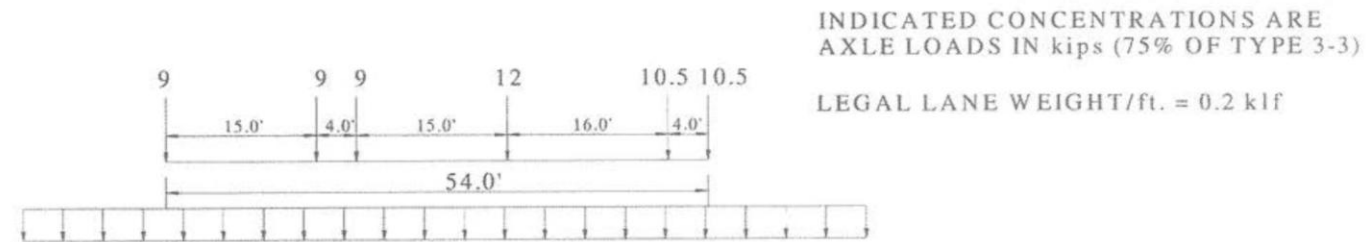


Figure D6A-4—Lane-Type Loading for Spans Greater than 200 ft

- c. *Lane-Type Legal Load Model*—Apply for negative moment and interior reaction for all span lengths.

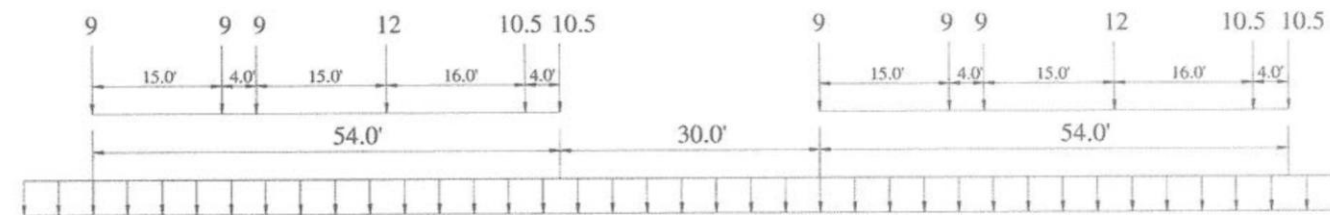
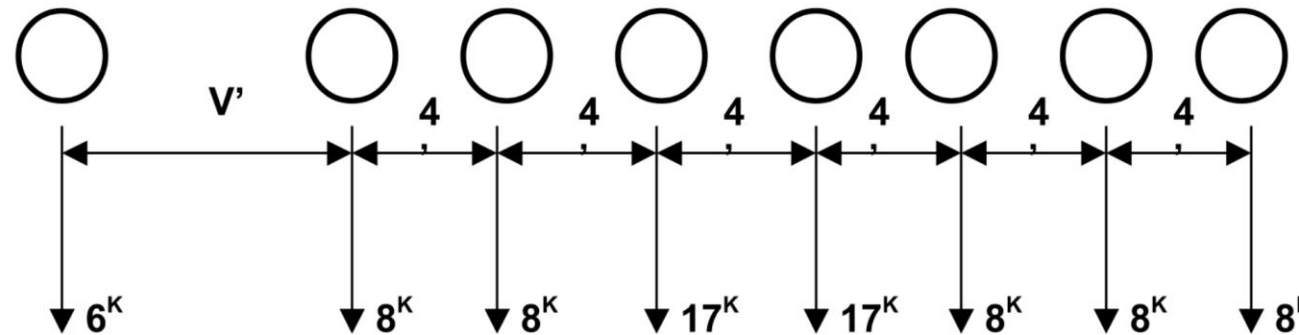


Figure D6A-5—Lane-Type Loading for Negative Moment and Interior Reaction

Legal Loads – AASHTO – Notional Rating Load

- d. *Notional Rating Load*—Apply for all span lengths and load effects.



V=VARIABLE DRIVE AXLE SPACING—6'0" TO 14'0". SPACING TO BE USED IS THAT WHICH PRODUCES MAXIMUM LOAD EFFECTS.

AXLES THAT DO NOT CONTRIBUTE TO THE MAXIMUM LOAD EFFECTS UNDER CONSIDERATION SHALL BE NEGLECTED.

NOTIONAL ASPECT OF LOADING

MAXIMUM GVW = 80 KIPS

AXLE GAGE WIDTH = 6'0"

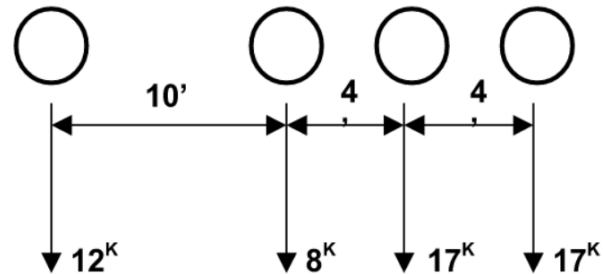
Figure D6A-6—Notional Rating Load (NRL) for Single-Unit SHVs that Meet Federal Bridge Formula B

Legal Loads – AASHTO – Special Hauling

e. Single-Unit Bridge Posting Loads

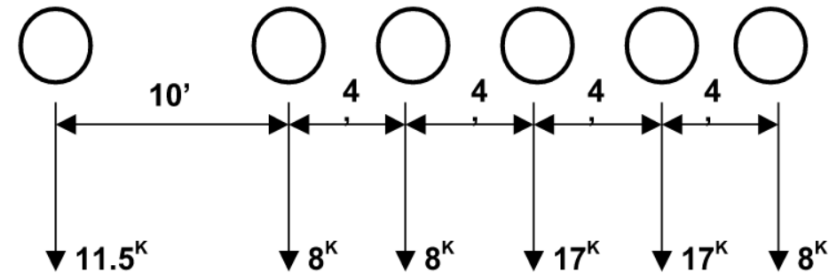
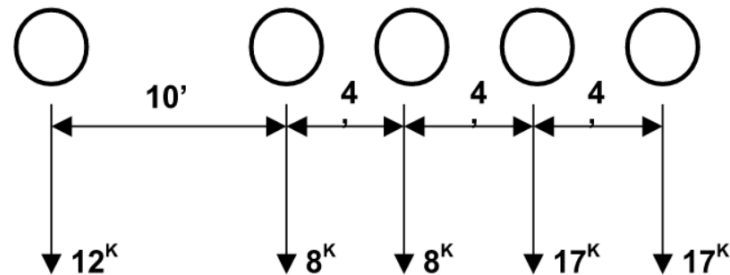
SU4 TRUCK

GVW = 54 KIPS



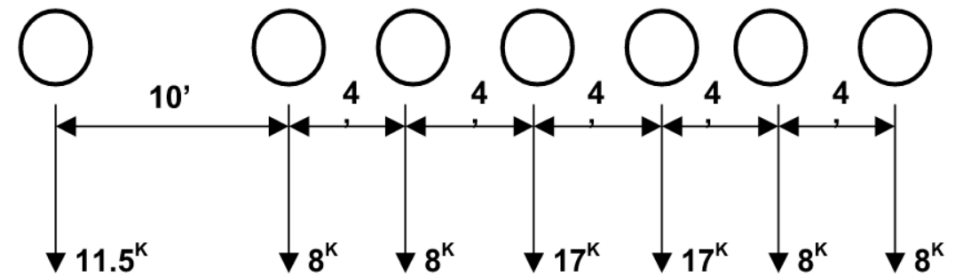
SU5 TRUCK

GVW = 62 KIPS



SU6 TRUCK

GVW = 69.5 KIPS



SU7 TRUCK

GVW = 77.5 KIPS

Figure D6A-7—Bridge Posting Loads for Single-Unit SHVs that Meet Federal Bridge Formula B

Legal Loads – FAST Act – Emergency Vehicles



Memorandum

Subject: **ACTION:** Load Rating for the FAST Act's
Emergency Vehicles

Date: November 3, 2016

From: /Original signed by/
Joseph L. Hartmann, Ph.D., P.E.
Director, Office of Bridges and Structures

In Reply Refer To: HIBS-1

To: Division Administrators
Federal Lands Highway Division Directors

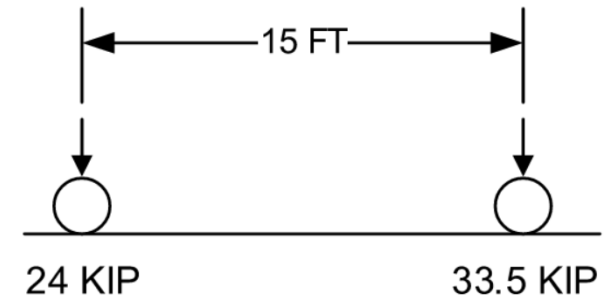
On December 4, 2015, the President signed into law the *Fixing America's Surface Transportation Act* (FAST Act) (Pub. L. 114-94). Section 1410 of the FAST Act amended 23 U.S.C. 127, *Vehicle weight limitations—Interstate System*, by revising the weight limits for certain vehicles on the Interstate System. The purpose of this memorandum is

1. Type **EV2** - for single rear axle emergency vehicles

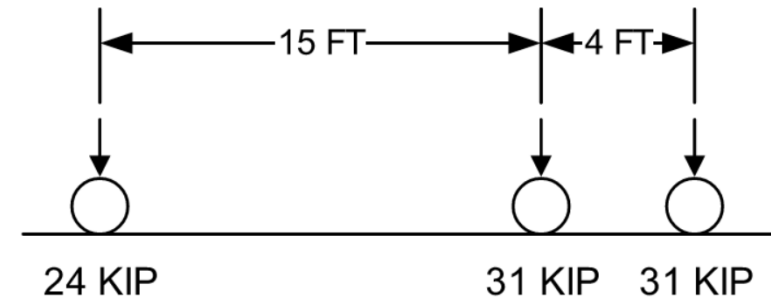
Front Single Axle: 24,000 pounds
Rear Single Axle: 33,500 pounds
Wheelbase: 15 ft.

2. Type **EV3** – for tandem rear axle emergency vehicles

Front Single Axle: 24,000 pounds
Rear Tandem Axle: 62,000 pounds (two 31,000 pound axles spaced at 4 ft.)
Wheelbase: 17 ft. (distance from front axle to the centerline of rear tandem axle)



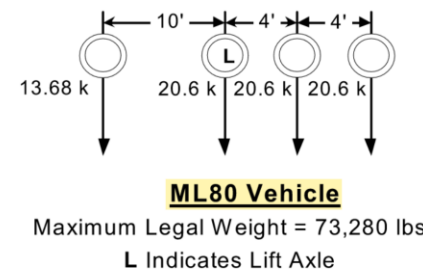
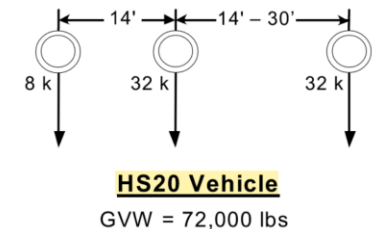
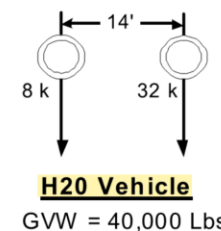
EV2 (Single Rear Axle Emergency Vehicle)



EV3 (Tandem Rear Axle Emergency Vehicle)

Legal Loads - Pennsylvania

- Other than standard H20 & HS20 vehicles, Pennsylvania considers only two other vehicle configurations for load posting evaluation
- ML-80 and TK527 vehicle configurations have been found to envelope the force effects of AASHTO Type 3 series, Special Hauling series & FAST ACT EV2 & EV3



ML80 and TK527
Axle Weights Include
3% Additional for
Scale Tolerance

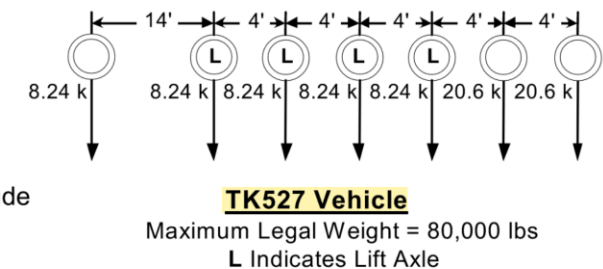


Figure IP 3.2.2.2-1 Bridge Posting Vehicles – Axle Configuration and Axle Weights

Legal Loads – Pennsylvania (continue)

Publication 238 (2026 Edition), Appendix IP 04-A
 Bridge Load Posting Recommendation Form

BRIDGE RATING ANALYSIS:									
Controlling Member(s):						Controlling Span(s):			
☐ Non-Redundant		☐ Fatigue Sensitive		☐ Interior/Fascia Girder (if multi-girder)					
Inventory Ratings:	Full Lanes:	H	tons	HS	tons	ML-80	tons	TK527	tons
	One Truck:	H	tons	HS	tons	ML-80	tons	TK527	tons
Operating Ratings:	Full Lanes:	H	tons	HS	tons	ML-80	tons	TK527	tons
	One Truck:	H	tons	HS	tons	ML-80	tons	TK527	tons
SLC Ratings:	Full Lanes:	H	tons	HS	tons	ML-80	tons	TK527	tons
	One Truck:	H	tons	HS	tons	ML-80	tons	TK527	tons
☐ AASHTO Line Girder with Simplified (S-Over) LL Distribution Factors ☐ AASHTO Line Girder with NCHRP LL Distribution Factors ☐									

'Legal' & 'Permit' Vehicle Categories for ASR & LFR Analyses

6B.2—RATING LEVELS

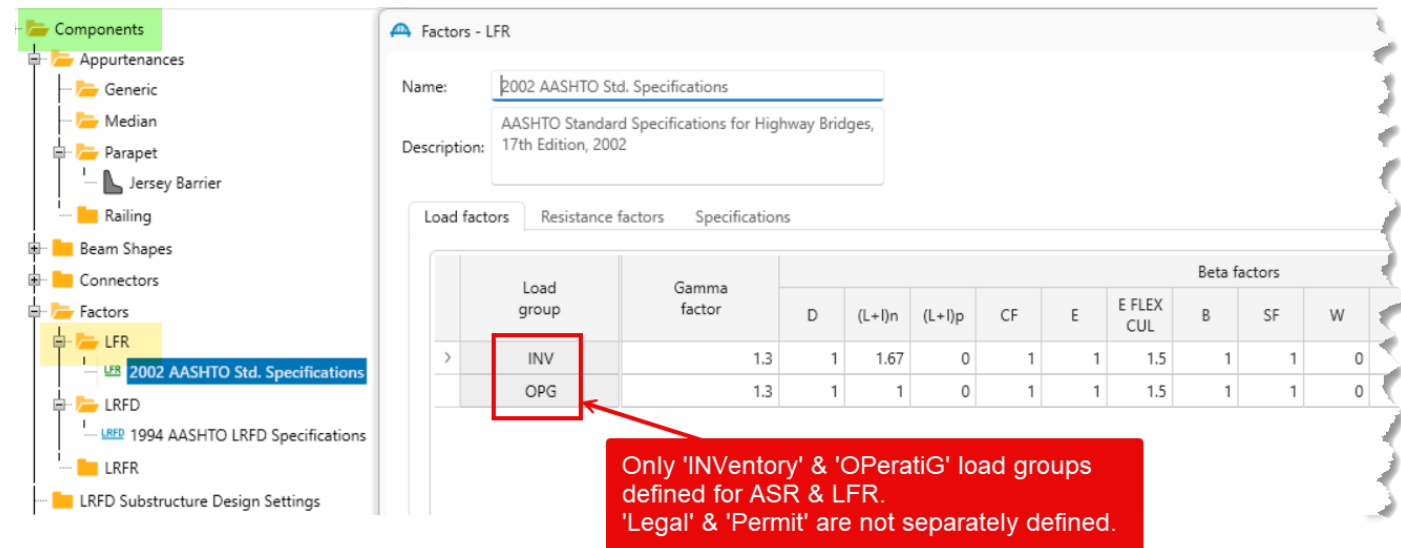
Each highway bridge should be load rated at two levels, inventory and operating levels.

6B.2.1—Inventory Rating Level

The inventory rating level generally corresponds to the customary design level of stresses but reflects the existing bridge and material conditions with regard to deterioration and loss of section. Load ratings based on the inventory level allow comparisons with the capacity for new structures and, therefore, results in a live load, which can safely utilize an existing structure for an indefinite period of time.

6B.2.2—Operating Rating Level

Load ratings based on the operating rating level generally describe the maximum permissible live load to which the structure may be subjected. Allowing unlimited numbers of vehicles to use the bridge at operating level may shorten the life of the bridge.



Components

- Appurtenances
 - Generic
 - Median
 - Parapet
 - Jersey Barrier
 - Railing
- Beam Shapes
- Connectors
- Factors
 - LFR
 - 2002 AASHTO Std. Specifications
 - LRFD
 - 1994 AASHTO LRFD Specifications
 - LRFR
- LRFD Substructure Design Settings

Factors - LFR

Name: 2002 AASHTO Std. Specifications

Description: AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002

Load factors Resistance factors Specifications

Load group	Gamma factor	Beta factors								
		D	(L+I)n	(L+I)p	CF	E	E FLEX CUL	B	SF	W
INV	1.3	1	1.67	0	1	1	1.5	1	1	0
OPG	1.3	1	1	0	1	1	1.5	1	1	0

Only 'INVENTORY' & 'OPERATING' load groups defined for ASR & LFR. 'Legal' & 'Permit' are not separately defined.

'Legal' & 'Permit' Vehicle Categories for ASR & LFR Analyses

- 'Legal' & 'Permit' vehicle categories are used in BrR only for purpose of performing 'adjacent vehicle' analysis
- If 'adjacent vehicle' effect is not being considered in analysis, 'Inventory' or 'Operating' categories should be used to avoid confusion

The screenshot displays the 'Analysis Settings' window. At the top, there are radio buttons for 'Design review' and 'Rating' (selected). To the right, 'Rating method' is set to 'ASR'. Below these, 'Analysis type' is 'Line Girder', 'Analysis option' is 'DL, LL and Spec-Checking', and 'Apply preference setting' is 'None'. A 'Lane / Impact loading type' dropdown is set to 'As Requested'. The main section has tabs for 'Vehicles', 'Output', 'Engine', and 'Description'. Under 'Vehicles', 'Traffic direction' is 'Both directions'. A 'Vehicle selection' list on the left includes various vehicle types, with 'PA TK527' highlighted. To the right of this list are 'Add to' and 'Remove from' buttons. On the far right, a 'Vehicle summary' tree shows a hierarchy: 'Rating vehicles' (expanded) -> 'Inventory' -> 'HS 20-44' -> 'Operating' -> 'HS 20-44' -> 'Legal operating' (highlighted) -> 'PA ML-80' -> 'Adjacent vehicle' (highlighted in green). Below this, 'PA TK527' is listed with another 'Adjacent vehicle' (highlighted in green). Further down, 'Permit inventory' -> 'Permit operating' (highlighted) -> 'PA P-82' -> 'Adjacent vehicle' (highlighted in green) is shown. Buttons for 'Refresh', 'Temporary vehicles', and 'Advanced' are at the top right of the summary section.

'Legal' & 'Permit' Vehicle Categories for ASR & LFR Analyses

- If an 'adjacent vehicle' is assigned, the 'adjacent vehicle' is used for all vehicles in all categories
- 'Adjacent vehicle live load factor' must be entered on 'Advanced' window or runtime error occurs
- 'Allow distribution factors ...' check box must be selected on 'Live Load Distribution' factor input window only if override LLDFs have been entered

Check box must be selected only if LLDFs are explicitly entered

Lanes loaded	Distribution factor (wheels)			
	Shear	Shear at supports	Moment	Deflection
> 1 Lane	1.538462	1.538462	1.538462	0.5
Multi-lane	2.363636	2.538462	2.363636	1.35

Analysis Settings

Design review ☐ Rating ☒

Rating method: ASR

Analysis type: Line Girder

Analysis option: DL, LL and Spec-Checking

Lane / Impact loading type: As Requested

Apply preference setting: None

Vehicles Output Engine Description

Traffic direction: Both directions

Refresh Temporary vehicles Advanced

Vehicle selection

Vehicle summary

Rating vehicles

Inventory

HS 20-44

Operating

HS 20-44

Legal operating

PA ML-80

Adjacent vehicle

Adj Lane_HS 20-44

PA TK527

Adjacent vehicle

Adj Lane_HS 20-44

Permit inventory

Permit operating

PA P-82

Adjacent vehicle

Adj Lane_HS 20-44

Vehicle Properties

Superstructure analysis Substructure analysis

Vehicle	Tandem train	Scale factor	Impact	Single lane loaded
> HS 20-44	☐	1	☐	☐
PA ML-80	☐	1	☐	☐
PA TK527	☐	1	☐	☐
PA P-82	☐	1	☐	☐

Adjacent vehicle live load factor: 0.7

'Legal' & 'Permit' Vehicle Categories for ASR & LFR Analyses

- If LLDFs are entered in 'Live Load Distribution' input window and '*Allow distribution factors to be used ...*' is NOT checked, analysis does not include 'Adjacent vehicle' effect even if an 'adjacent vehicle' is assigned in analysis settings

Live Load Distribution

Standard LRFD

Distribution factor input method

☒ Use simplified method ☐ Use advanced method ☐ Use advanced method with 1994 guide specs

☐ Allow distribution factors to be used to compute effects of permit loads with routine traffic

Lanes loaded	Distribution factor (wheels)			
	Shear	Shear at supports	Moment	Deflection
> 1 Lane	1.538462	1.538462	1.538462	0.5
Multi-lane	2.363636	2.538462	2.363636	1.35

Check box not selected but LLDFs are entered

Spec Check Detail for 6B.4 Steel Flexure Stress

Part B - ALLOWABLE STRESS RATING AND LOAD FACTOR RATING

6B.4 RATING EQUATION

6B.4.1 General - Steel Flexure Stress
(AASHTO Manual for Bridge Evaluation, Third Edition with 2024 Interims)

Steel Plate - At Location = 80.5000 (ft) - Left Stage 3

Section within Top Flange Continuous Bracing Region

Allowable Stress Flexure Rating Calculations

$$RF = \frac{C - A1 * (fDC + fDW)}{A2 * fLL} \quad (6B.4.1-1)$$

where,

C = Capacity flange stress
fDC = Stage 1 dead load flange stress
fDW = Stage 2 dead load flange stress
fLL = Stage 3 live load flange stress (including impact)

'Adjacent vehicle' portion of RF equation not included

Component: Bot Flange

Load	Vehicle	Type	LL (kip-ft)	Adj. LL (kip-ft)	A1	A2	fDL1 (ksi)	fDL2 (ksi)	fLL (ksi)	Adj. fLL (ksi)	fR (ksi)	fR (Override) (ksi)	RF	Capacity (Ton)
Inventory	1	Pos	3885.1	---	1.00	1.00	25.32	5.39	11.47	---	27.50	---	0.000	0.00
Inventory	1	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	27.50	---	0.000	0.00
Operating	1	Pos	3885.1	---	1.00	1.00	25.32	5.39	11.47	---	37.50	---	0.592	21.31
Operating	1	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	3564.00
Inventory	2	Pos	3634.9	---	1.00	1.00	25.32	5.39	10.73	---	27.50	---	0.000	0.00
Inventory	2	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	27.50	---	0.000	0.00
Operating	2	Pos	3634.9	---	1.00	1.00	25.32	5.39	10.73	---	37.50	---	0.633	22.78
Operating	2	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	3564.00
Legal Opera-	3	Pos	3970.8	---	1.00	1.00	25.32	5.39	11.72	---	37.50	---	0.579	21.86
Legal Opera-	3	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	3736.26
Permit Oper-	4	Pos	8928.3	---	1.00	1.00	25.32	5.39	26.35	---	37.50	---	0.258	26.28
Permit Oper-	4	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	10098.00
Legal Opera-	5	Pos	4147.2	---	1.00	1.00	25.32	5.39	12.24	---	37.50	---	0.555	22.85
Legal Opera-	5	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	4078.80

Load Combination Legend:

Code	Vehicle
1	HS 20-44 - Lane
2	HS 20-44 - Truck
3	PA ML-80 - Legal Truck
4	PA P-82 - Permit Truck
5	PA TK527 - Legal Truck

No 'adjacent vehicle' effect

'Legal' & 'Permit' Vehicle Categories for ASR & LFR Analyses

- If 'Allow distribution factors to be used ...' check box is not selected but LLDFs have not been explicitly entered, 'Adjacent vehicle' effect will be considered

Live Load Distribution

Standard LRFD

Distribution factor input method

☒ Use simplified method ☐ Use advanced method ☐ Use advanced method with 1994 guide specs

☐ Allow distribution factors to be used to compute effects of permit loads with routine traffic

Lanes loaded	Distribution factor (wheels)			
	Shear	Shear at supports	Moment	Deflection
> 1 Lane				
Multi-lane				

Check box not selected, but program will compute LLDFs

Following message is included in 'LLDF computation' engine output:

The lever rule criteria of LRFD 4.6.2.2.5 are satisfied so the 'Allow distribution factors to be used to compute effects of permit loads with routine traffic' box will be checked on the Live Load Distribution window and adjacent vehicles will be considered. This can be overridden through the 'Live Load Distribution' window by using the 'Compute from typical section...' button or directly entering the distribution factors then manually unchecking the box.

Spec Check Detail for 68.4 Steel Flexure Stress

Part B - ALLOWABLE STRESS RATING AND LOAD FACTOR RATING
6B.4 RATING EQUATION
6B.4.1 General - Steel Flexure Stress
(AASHTO Manual for Bridge Evaluation, Third Edition with 2024 Interims)

Steel Plate - At Location = 80.5000 (ft) - Left Stage 3
Section within Top Flange Continuous Bracing Region

Allowable Stress Flexure Rating Calculations

$$RF = \frac{C - A1 \cdot (fDC + fDW) - A3 \cdot AdjfLL}{A2 \cdot fLL}$$

where,

C = Capacity flange stress
fDC = Stage 1 dead load flange stress
fDW = Stage 2 dead load flange stress
fLL = Stage 3 live load flange stress (including impact)
AdjfLL = Adjacent vehicle live load stress (including impact)
A3 = Adjacent vehicle LL factor = 0.700

A3 = adjacent vehicle load factor (user-specified)

Component: Bot Flange

Load	Vehicle	Type	LL (kip-ft)	Adj. LL (kip-ft)	A1	A2	fDL1 (ksi)	fDL2 (ksi)	fLL (ksi)	Adj. fLL (ksi)	fR (ksi)	fR (Override) (ksi)	RF	Capacity (Ton)
Inventory	1	Pos	3885.1	---	1.00	1.00	25.32	5.39	11.47	---	27.50	---	0.000	0.00
Inventory	1	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	27.50	---	0.000	0.00
Operating	1	Pos	3885.1	---	1.00	1.00	25.32	5.39	11.47	---	37.50	---	0.592	21.31
Operating	1	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	3564.00
Inventory	2	Pos	3634.9	---	1.00	1.00	25.32	5.39	10.79	---	27.50	---	0.000	0.00
Inventory	2	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	27.50	---	0.000	0.00
Operating	2	Pos	3634.9	---	1.00	1.00	25.32	5.39	10.79	---	37.50	---	0.633	22.78
Operating	2	Pos	0.0	---	1.00	1.00	25.32	5.39	0.00	---	37.50	---	99.000	3564.00
Legal Opera~	3	Pos	2584.5	1268.99	1.00	1.00	25.32	5.39	7.63	3.745	37.50	---	0.546	20.61
Legal Opera~	3	Pos	0.0	0.00	1.00	1.00	25.32	5.39	0.00	0.000	37.50	---	99.000	3736.26
Permit Oper~	4	Pos	5811.3	1268.99	1.00	1.00	25.32	5.39	17.15	3.745	37.50	---	0.243	24.78
Permit Oper~	4	Pos	0.0	0.00	1.00	1.00	25.32	5.39	0.00	0.000	37.50	---	99.000	10098.00
Legal Opera~	5	Pos	2699.4	1268.99	1.00	1.00	25.32	5.39	7.97	3.745	37.50	---	0.523	21.55
Legal Opera~	5	Pos	0.0	0.00	1.00	1.00	25.32	5.39	0.00	0.000	37.50	---	99.000	4078.80

Load Combination Legend:

Code	Vehicle
1	HS 20-44 - Lane
2	HS 20-44 - Truck
3	PA ML-80 - Legal Truck
4	PA P-82 - Permit Truck
5	PA TK527 - Legal Truck

For ASR, user has no control over 'A1' & 'A2' -- hardcoded to 1.0.

'Legal' & 'Permit' Vehicle Categories for ASR & LFR Analyses

- LRFD Article 4.6.2.2.5 'adjacent lane' analysis approach for **line girder** analysis

TrainingBridge1

Simple Span Structure

G2

Plate Girder

AASHTO_LFR

Live Load Distribution Factors Calculations Sum

Live Load Distribution Factors Calculations (W)

Stage 3 Infl Lines Span Model

Stage 1 Span Model

Stage 1 Span Model Actions

Stage 2 Span Model

Stage 2 Span Model Actions

Stage 3 Span Model Actions

Log File

AASHTO_LRFR

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Moment Distribution Factors

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Concrete Deck on Interior Beams
(Article 3.23.2.2 and Table 3.23.1)

Compute Moment Distribution Factors

Input:

S = 13.00 (ft)

One Design Lane Loaded:

Use Simple Beam DF = 1.54 wheels

Two or More Design Lanes Loaded:

DF = S / 5.50 = 2.36 wheels

=====

Shear Distribution Factors

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Concrete Deck on Interior Beams
(Article 3.23.1)

4.6.2.2.5—Special Loads with Other Traffic

Except as specified herein, the provisions of this Article may be applied where the approximate methods of analysis for the analysis of beam-slab bridges specified in Article 4.6.2.2 and slab-type bridges specified in Article 4.6.2.3 are used. The provisions of this Article shall not be applied where either:

- The lever rule has been specified for both single-lane and multiple-lane loadings; or
- The special requirement for exterior girders of beam-slab bridge cross-sections with diaphragms specified in Article 4.6.2.2d has been utilized for simplified analysis.

Force effects resulting from heavy vehicles in one lane with routine traffic in adjacent lanes, such as might be considered with Load Combination Strength II in Table 3.4.1-1, may be determined as:

$$G = G_p \left(\frac{g_l}{Z} \right) + G_D \left(g_m - \frac{g_l}{Z} \right) \quad (4.6.2.2.5-1)$$

where:

- G = final force effect applied to a girder (kip or kip-ft)
- G_p = force effect due to overload truck (kip or kip-ft)
- g_l = single-lane live load distribution factor
- G_D = force effect due to design loads (kip or kip-ft)
- g_m = multiple-lane live load distribution factor
- Z = a factor taken as 1.20 where the lever rule was not utilized, and 1.0 where the lever rule was used for a single-lane live load distribution factor

C4.6.2.2.5

Because the number of loaded lanes used to determine the multiple-lane live load distribution factor, g_m , is not known, the multiple-lane multiple presence factor, m , is implicitly set equal to 1.0 in this equation, which assumes only two lanes are loaded, resulting in a conservative final force effect over using the multiple presence factors for three or more lanes loaded.

The factor Z is used to distinguish between situations where the single-lane live load distribution factor was determined from a specified algebraic equation and situations where the lever rule was specified for the determination of the single-lane live load distribution factor. In the situation where an algebraic equation was specified, the multiple presence factor of 1.20 for a single lane loaded has been included in the algebraic equation and must be removed by using $Z = 1.20$ in Eq. 4.6.2.2.5-1 so that the distribution factor can be utilized in Eq. 4.6.2.2.5-1 to determine the force effect resulting from a multiple-lane loading.

This formula was developed from a similar formula presented without investigation by Modjeski and Masters, Inc. (1994) in a report to the Pennsylvania Department of Transportation in 1994, as was examined in Zokaie (1998).

Structures/Components having 'Adjacent Vehicle' Limitations

- Timber decks, corrugated metal decks and metal & concrete culverts are analyzed on a 'per unit width' basis; therefore, 'adjacent vehicle' concept **does not apply**
- Since 'adjacent vehicle' concept does not apply to these structure types/components, the 'Legal' & 'Permit' vehicle categories produce same results as being assigned to 'Operating' category
- For corrugated metal decks and RC culverts, LFR analysis is not currently performed for vehicles assigned to the 'Legal' or 'Permit' categories
- Inconsistent reporting of load rating results for ASR & LFR analyses has been identified, and future changes are in-progress

MBE LRFR Legal-lane Type Loading

- Article 6A.4.4.2.1a – Special live load model with specific application rules
- Use AASHTO legal vehicles and/or STATE legal loads

6-98

THE MANUAL FOR BRIDGE EVALUATION, THIRD EDITION

- b. *Lane-Type Legal Load Model*—Apply for spans greater than 200 ft and all load effects.

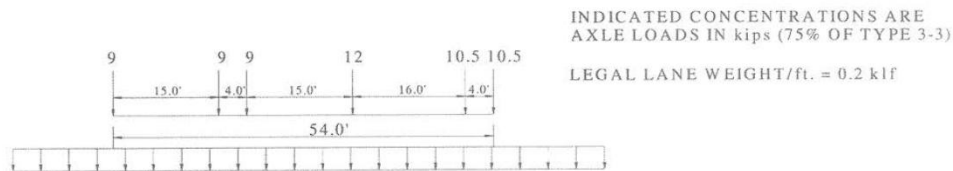


Figure D6A-4—Lane-Type Loading for Spans Greater than 200 ft

- c. *Lane-Type Legal Load Model*—Apply for negative moment and interior reaction for all span lengths.

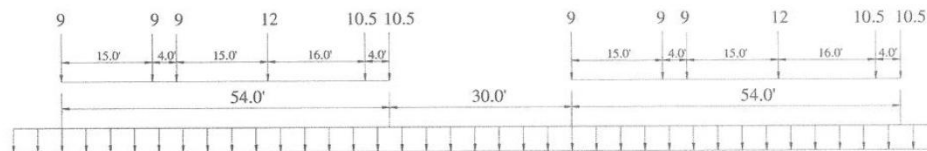


Figure D6A-5—Lane-Type Loading for Negative Moment and Interior Reaction

6A.4.4.2—Live Loads and Load Factors

6A.4.4.2.1—Live Loads

6A.4.4.2.1a—Routine Commercial Traffic

The AASHTO legal vehicles and lane-type load models shown in Figures D6A-1 through D6A-5 shall be used for load rating bridges for routine legal commercial traffic.

For all span lengths the critical load effects shall be taken as the larger of the following:

- For all load effects, AASHTO legal vehicles (Type 3, Type 3S2, Type 3-3; applied separately) or state legal loads.
- For negative moments and reactions at interior supports, a lane load of 0.2 klf combined with two AASHTO Type 3-3 vehicles or state legal loads multiplied by 0.75 heading in the same direction separated by 30 ft.

Take the largest of Type 3, Type 3S2, Type 3-3 vehicles, or state legal loads plus lane loads. The lane load model is common to all truck types. In addition, for span lengths greater than 200 ft, critical load effects shall be created by:

- AASHTO Type 3-3 or state legal load multiplied by 0.75 and combined with a lane load of 0.2 klf.

Dynamic load allowance shall be applied to the AASHTO legal vehicles and state legal loads but not the lane loads. If the *ADTT* is less than 500, the lane load may be excluded and the 0.75 factor changed to 1.0 if, in the Engineer's judgment, it is warranted.

MBE LRFR Legal-lane Type Loading

- Important to recognize BrR has built-in vehicle definition interpretation rules
- For a STATE legal-lane type loading to be recognized and correct application rules used, vehicle definition must be assigned to one of the 'Legal load rating' categories
- For truck PAIR to be applied correctly for negative moment and interior support reactions, **'Legal pair' check box must be selected** on 'Advanced' vehicle properties window. The 30' separation distance between truck pairs is hardcoded.

The screenshot shows the 'Analysis Settings' window with the 'Rating' method selected. The 'Rating method' is set to 'LRFR', 'Analysis type' is 'Line Girder', 'Analysis option' is 'DL, LL and Spec-Checking', and 'Apply preference setting' is 'None'. The 'Vehicles' tab is active, showing a list of vehicle definitions. The 'Vehicle selection' list includes various vehicle types, with 'PA ML-80~0.2 klf Lane-Type Legal' selected. The 'Vehicle summary' panel on the right shows the 'Rating vehicles' tree, with 'PA ML-80~0.2 klf Lane-Type Legal' highlighted under the 'Legal load rating' category. A blue callout box points to this entry with the text: 'Interpretation of vehicle configuration depends on the rating vehicle category it is placed within.'

Below the 'Vehicle Properties' window, a table shows the properties for the selected vehicle:

Vehicle	Tandem train	Scale factor	Impact	Single lane loaded	Legal pair	Override	Legal live load factor	Frequency	Lo cor
> PA ML-80~0.2 klf Lane-Type Legal	☐	1	☐	☐	☒	☐		Single Trip	Mixed wit

Below the table, there are input fields for 'Permit lane load' and 'Adjacent vehicle live load factor', and a checkbox for 'Exclude permit lane load from permit vehicle location'. A blue callout box points to the 'Legal pair' checkbox with the text: 'Legal pair must be checked for two legal trucks spaced 30' apart to be considered.'

MBE LRFR Legal-lane Type Loading

- Two separate state legal load definitions need defined and used for complete force generation coverage:
 - Standard vehicle definition
 - Special definition with axle weights reduced by 25% with non-zero lane load (*lane load can be any non-zero value*)

Vehicle: Standard Gauge: PA ML-80~0.2 klf Lane-Type Legal

Name: PA ML-80~0.2 klf Lane-Type Legal

Description: PA Maximum Legal Load w/ 0.2 klf Lane Load to be used for MBE-3 Article 6A.4.4.2-1a 'Lane-type Legal Load Model'

Store units as: ☒ US ☐ SI

Library: ☐ Standard ☐ Agency defined ☒ User defined

Truck Tandem Lane

Axle no.	Axle load (kip)	Gage dist. (ft)	Wheel contact width (in)	Axle spacing (ft)	
				Minimum	Maximum
1	10.26	6	12		
2	15.45	6	16	10	10
3	15.45	6	16	4	4
4	15.45	6	16	4	4

Load per axle line

Uniform lane load: 0.2 kip/ft

Concentrated load for moment: kip

Concentrated load for shear: kip

Add a second, equal magnitude concentrated load in one other span to determine maximum negative moment for continuous spans

Totals: 56.61 kip 18.00 18.00

New Duplicate Delete

Axle loads have been reduced by 25%.

Must be non-zero for program to interpret vehicle as 'Lane-type legal load'

Analysis Settings

Design review ☐ Rating ☒

Rating method: LRFR

Analysis type: Line Girder

Analysis option: DL, LL and Spec-Checking

Lane / Impact loading type: As Requested

Apply preference setting: None

Vehicles Output Engine Description

Traffic direction: Both directions

Refresh Temporary vehicles Advanced

Vehicle selection

Vehicle summary

Rating vehicles

LRFR

Design load rating

Inventory

Operating

Fatigue

Legal load rating

Routine

PA ML-80~0.2 klf Lane-Type Legal

PA ML-80

Specialized naming

Permit load rating

Vehicle Properties

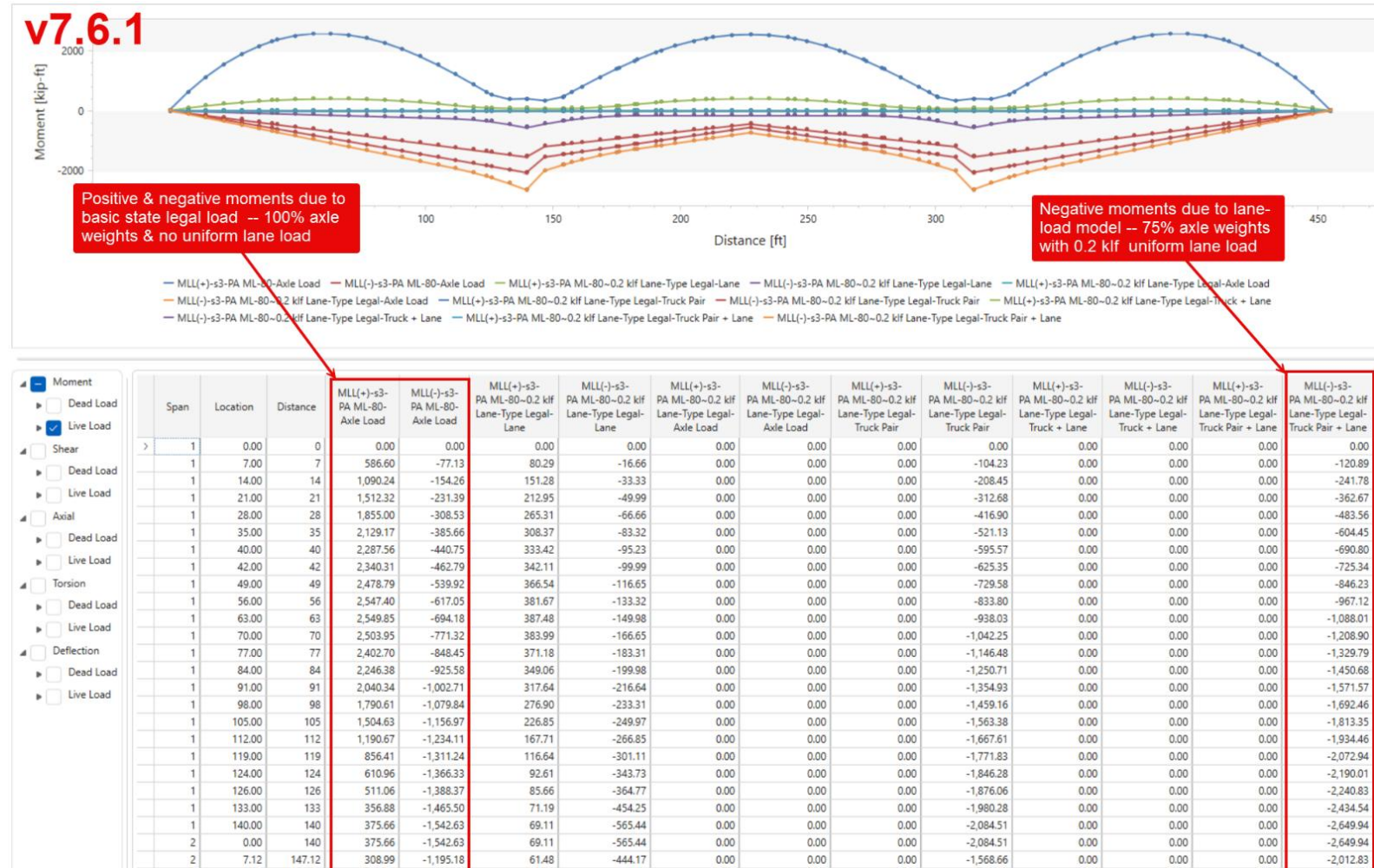
Vehicle	Tandem train	Scale factor	Impact	Single lane loaded	Legal pair	Override	Legal live load factor	Frequency
PA ML-80~0.2 klf Lane-Type Legal	☐	1	☐	☐	☒	☐		Single Trip
PA ML-80	☐	1	☐	☐	☐	☐		Single Trip

Permit lane load: kip/ft Adjacent vehicle live load factor:

Exclude permit lane load from permit vehicle location

MBE LRFR Legal-lane Type Loading

- Standard vehicle generates 100% (+) & (-) moment with single truck + lane full bridge length
- Special vehicle generates (-) moments only with truck pair + lane full bridge length



MBE LRFR Legal-lane Type Loading

- Legal-lane load vehicle assigned to categories other than 'Legal load rating' gets interpreted differently:
 - For the 'Design load rating' category, a 'Truck + Lane' load combination is only generated when 'HL-93' appears in vehicle name
 - For 'Permit load rating' category, 'Permit lane load' entered on Advanced window is used

Separate 'Truck' & 'Lane' moments

'Truck + Lane' load combination is not generated

	Span	Location	Distance	MLL(+)-s3- PA ML-80~0.2 kif Lane-Type Legal- Lane	MLL(-)-s3- PA ML-80~0.2 kif Lane-Type Legal- Lane	MLL(+)-s3- PA ML-80~0.2 kif Lane-Type Legal- Axle Load	MLL(-)-s3- PA ML-80~0.2 kif Lane-Type Legal- Axle Load
>	1	0.00	0	0.00	0.00	0.00	0.00
	1	7.00	7	80.29	-16.66	439.95	-57.85
	1	14.00	14	151.28	-33.33	817.68	-115.70
	1	21.00	21	212.95	-49.99	1,134.24	-173.55
	1	28.00	28	265.31	-66.66	1,391.25	-231.39
	1	35.00	35	308.37	-83.32	1,596.88	-289.24
	1	40.00	40	333.42	-95.23	1,715.67	-330.56

Analysis Settings

Design review ☐ Rating ☒

Rating method: LRFR

Analysis type: Line Girder

Analysis option: DL, LL and Spec-Checking

Lane / Impact loading type: As Requested

Apply preference setting: None

Vehicles Output Engine Description

Traffic direction: Both directions

Vehicle selection

Vehicle summary

Rating vehicles

LRFR

Design load rating

Inventory

PA ML-80~0.2 kif Lane-Type Legal

Operating

Fatigue

Legal load rating

Routine

Specialized hauling

Permit load rating

Vehicle Properties

Vehicle	Tandem train	Scale factor	Impact	Single lane loaded	Legal pair	Override	Legal live load factor	Frequency
PA ML-80~0.2 kif Lane-Type Legal	☐	1	☐	☐	☒	☐		Single Trip

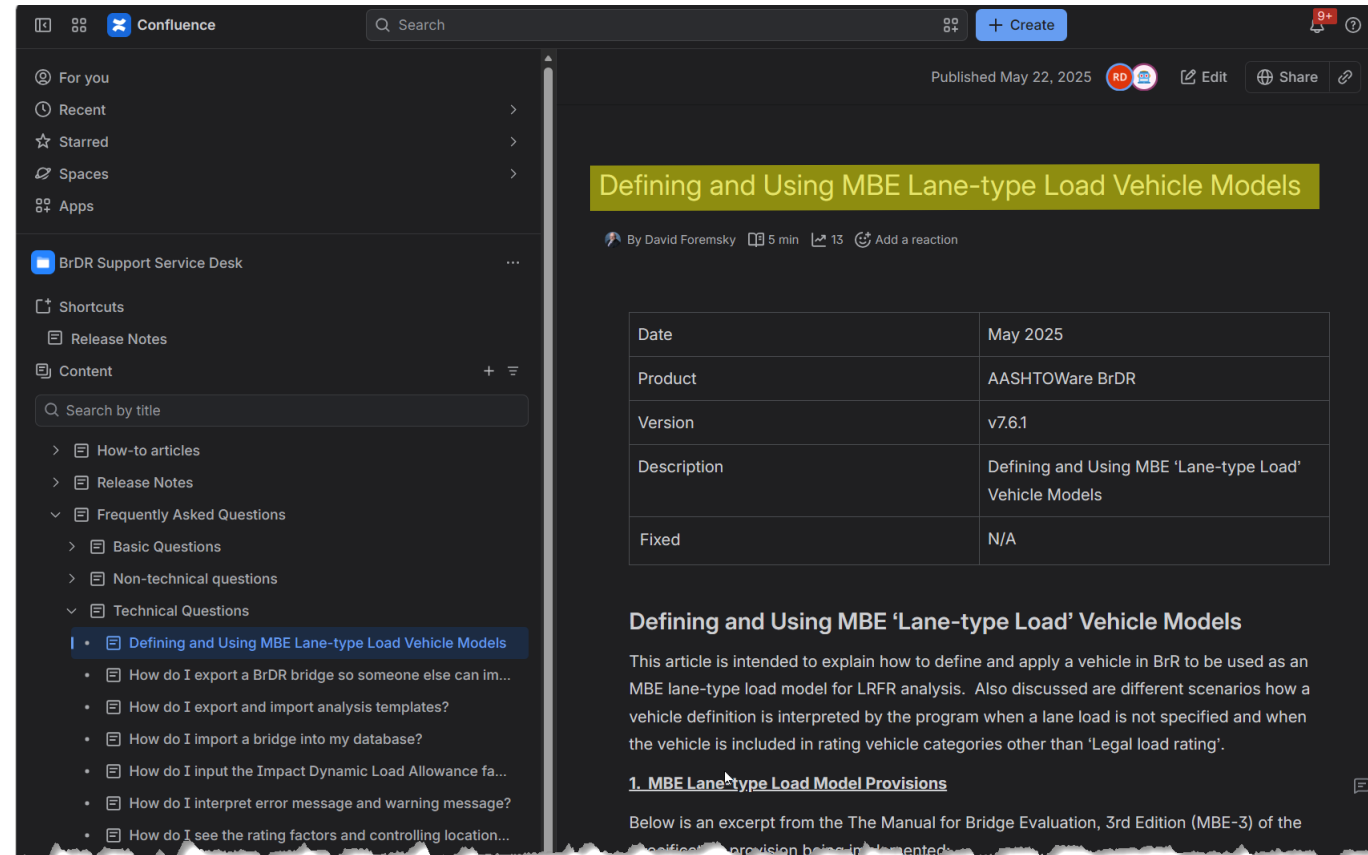
Permit lane load: kip/ft Adjacent vehicle live load factor:

☐ Exclude permit lane load from permit vehicle location

MBE LRFR Legal-lane Type Loading

- Jira Confluence Article available:

[BrDR Support Service Desk -
Confluence - Defining and Using MBE
Lane-type Load Vehicle Models](#)



The screenshot shows a Confluence page with a dark theme. On the left is a sidebar with navigation links: 'For you', 'Recent', 'Starred', 'Spaces', 'Apps', 'BrDR Support Service Desk', 'Shortcuts', 'Release Notes', 'Content', and a search bar. The main content area displays the article title 'Defining and Using MBE Lane-type Load Vehicle Models' in a yellow box. Below the title, it says 'By David Foremsky', '5 min', '13', and 'Add a reaction'. A table with two columns is shown, containing metadata. Below the table, the article title is repeated, followed by a paragraph of text and a section heading '1. MBE Lane-type Load Model Provisions'.

Date	May 2025
Product	AASHTOWare BrDR
Version	v7.6.1
Description	Defining and Using MBE 'Lane-type Load' Vehicle Models
Fixed	N/A

Defining and Using MBE 'Lane-type Load' Vehicle Models

This article is intended to explain how to define and apply a vehicle in BrR to be used as an MBE lane-type load model for LRFR analysis. Also discussed are different scenarios how a vehicle definition is interpreted by the program when a lane load is not specified and when the vehicle is included in rating vehicle categories other than 'Legal load rating'.

1. MBE Lane-type Load Model Provisions

Below is an excerpt from the The Manual for Bridge Evaluation, 3rd Edition (MBE-3) of the

The background of the slide is a photograph of a bridge spanning a body of water, with a rocky shoreline in the foreground. The entire image is covered with a semi-transparent blue overlay. The text "THANK YOU!" and "QUESTIONS?" is centered in white, bold, sans-serif font.

THANK YOU!

QUESTIONS?