

 Office of Structures <i>Guidelines and Procedures</i> <i>Memorandum</i>	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	Approval: 

All highway bridges in Maryland shall be load rated for both inventory and operating stress levels. As a minimum for ratings performed by SHA staff, all ratings shall be performed by a load rating engineer and checked by another engineer with experience in load ratings. The load rating engineer shall be a graduate engineer. The engineer checking the rating shall be a graduate engineer and be PE eligible. The Division Chief in charge of the load rating program shall be a Professional Engineer.

As a minimum for ratings performed by an engineering consultant firm, all ratings shall be performed by a load rating engineer and checked by another engineer with experience in load ratings. The load rating engineer shall be a graduate engineer. The engineer checking the rating shall be a professional engineer licensed in Maryland. P.E. Stamped load rating calculations and supporting data shall be submitted to the Deputy Director, Office of Structures – Remedial and Inspection Engineering for review and documentation.

For new bridges, the load rating shall be performed when the final design is complete. The load rating shall appear on the advertised plans. This load rating shall be revised, if necessary following construction of the bridge, to account for any changes to the structure as the result of addendums, red line revisions and as-built revisions. The rating methodology to be used for rating a new bridge shall be consistent with the design methodology used in the design of that bridge. Since all new bridges designed after October 2007 are required to be designed by the AASHTO Load and Resistance Factor Design (LRFD) method, all bridges designed by this methodology shall therefore be rated using the AASHTO Load and Resistance Factor Rating (LRFR) method.

For existing bridges which are undergoing a major rehabilitation and not designed by LRFD method, the load rating or re-rating shall utilize the Load Factor Rating (LFR) method. The only exception to this is for timber and masonry bridges, which shall continue to be rated using the Allowable Stress Rating (ASR) method.

All ratings, both in house and by Consultants, shall be performed using the LARS program. If the LARS program is not capable of providing an accurate rating, then a request to utilize another program shall be submitted in writing to the SHA Division Chief in charge of load ratings or the County/Local Agency Program Manager. All final load rating computer files shall be submitted to SHA Division Chief in charge of load ratings for storage.

For SHA bridges, a re-evaluation of the current bridge load ratings shall be done for all bridge inspections that result in an Engineering Request. (An Engineering Request is a request made by a field inspector to have a structural engineer perform a field inspection of a bridge element(s). The requests are usually associated with deleterious changes to a bridge element(s) since the last inspection.) This re-evaluation may necessitate new bridge load ratings being established. This evaluation must be documented for each Engineering Request and shall include the date of the evaluation, who performed and checked the evaluation, and the reasons behind the decision to

 Office of Structures <i>Guidelines and Procedures</i> <i>Memorandum</i>	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	Approval: See Sheet 1

perform a new load rating or not. Any required load rating shall be given a “P” priority, shall be completed within 6 months of receipt, and rated utilizing the Load Factor Rating (LRF) method. (The Structural Inspection and Remedial Engineering Division uses a job priority scale consisting of E, P, A, B, C, and D with “E” emergency being the top priority and “D” being the lowest priority.) The only exception to this is for timber and masonry bridges, which shall continue to be rated using the Allowable Stress Rating (ASR) method.

For County/Local Agency bridges, an evaluation based on criteria contained in this GPM of the existing ratings on all bridges shall be performed to ensure the current condition is reflected in the current rating. This evaluation shall be documented as part of each new inspection report.

All load rating computations shall be completely documented, scanned, and inputted into the SHA Structure Asset Management (SAM) program for future reference. The document must include inspection reports and all calculations with support material such as rating assumptions, controlling members and the condition they were assumed to be in, material properties and load test data if available. The required methodology for rating of highway structures is summarized in the table as follows.

 Office of Structures Guidelines and Procedures Memorandum	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	
Approval: See Sheet 1	

ORIGINAL DESIGN OR MAJOR REHABILITATION SPECIFICATION USED	EXISTING RATING	LOAD RATING OR RE-RATING METHODOLOGY
Load and Resistance Factor Design (LRFD)	None or	LRFR
	Load and Resistance Factor Rating (LRFR)	LRFR
Load Factor Design (LFD) or Allowable Stress Design (ASD)	None or	LFR
	Allowable Stress Rating (ASR) or	LFR
	Load Factor Rating (LFR)	LFR
Combination of Specifications (LRFD, LFD, ASD) or Unknown	None or	LFR
	Allowable Stress Rating (ASR) or	LFR
	Load Factor Rating (LFR)	LFR
ASD for Existing Timber and Masonry Bridges	None or ASR	ASR

 Office of Structures <i>Guidelines and Procedures</i> <i>Memorandum</i>	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	Approval: See Sheet 1

Load and Resistance Factor Rating (LRFR) Procedure

Rating shall follow the latest edition of the AASHTO “The Manual for Bridge Evaluation” (MBE) Section 6, Part A. The rating shall be reported as a factor for the HL-93 vehicle and tons for all other rating vehicles.

The HL-93 vehicle is the Design Load Rating Vehicle. The Legal Load Rating Vehicles shall be rated and recorded as an Operating Rating. No Inventory Rating shall be recorded. The Permit Load Rating Vehicles shall be rated in accordance with the Permit Load Factors shown in the MBE Table 6A.4.5.4.2a-1 for the Routine or Annual Permit Type. No Inventory Rating shall be recorded.

If the Inventory Rating factor for the HL-93 vehicle is less than 1.0, or the Operating Rating of the Legal Load Rating Vehicles is less than the vehicle weight, the Deputy Director – Structural Inspection and Remedial Engineering shall be notified in writing within three (3) work days of completion of the load rating calculations that indicate the potential need for a posting situation and a recommendation of what the posting should be. The notification shall include the load ratings for all legal vehicles and the same ratings using other rating methods such as ASR or LFR for comparison. The notification should also provide ratings for site specific vehicles such as local business and emergency vehicles. The Deputy Director shall respond to the notification in writing within seven (7) days of receiving the notification. If a response is not received within seven (7) days, a follow up email shall be made to the Deputy Director asking for a response to the potential posting situation.

Load Factor Rating (LFR) Procedure

Rating shall follow the latest edition of the AASHTO “The Manual for Bridge Evaluation” Section 6, Part B. The rating shall be reported in tons calculated for each of rating vehicles except for the HL-93 loading.

If the operating rating is less than any of the Legal Load Rating Vehicles’ weight, the Deputy Director – Structural Inspection and Remedial Engineering shall be notified in writing within three (3) work days of completion of the load rating calculations that indicate the potential need for a posting situation and a recommendation of what the posting should be. The notification shall include the load ratings for all legal vehicles and the same ratings using other rating methods, such as ASR or LRFR for comparison. The notification should also provide ratings for site specific vehicles such as local business and emergency vehicles. The Deputy Director shall respond to the notification in writing within seven (7) days of receiving the notification. If a response is not received within seven (7) days, a follow up email shall be made to the Deputy Director asking for a response to the potential posting situation.

 Office of Structures <i>Guidelines and Procedures</i> <i>Memorandum</i>	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	Approval: See Sheet 1

Load Rating for the Serviceability Limit State:

Load ratings shall not include serviceability computations, unless the bridge has specific concerns related to serviceability such as unusual deformation or cracking. Generally, an existing bridge with a successful performance history will not require a serviceability evaluation. SHA must be notified for concurrence before considering serviceability in a load rating.

Bridges with Unknown Structural Components:

For bridges where necessary information is unavailable, such as concrete or masonry bridges with unknown structural details, an approximate load rating may be established through an evaluation by a qualified engineer, with the following guidelines:

- If the structure has been carrying normal traffic for an appreciable period of time, and the current field conditions indicate no signs of structural distress from loads, the inventory and operating rating factor for each legal vehicle may be taken as 1.0, and the ratings for the permit vehicles shall be left blank.
- If the engineer determines that the structure shows signs of distress or otherwise feels that engineering judgment should not apply, the SIREN will be notified and an assessment will be made regarding the need for posting, load testing or repair.

Concrete Culverts:

For concrete culverts under at least 2.0 ft of fill, whether there are known structural details or not, a load rating may be established through an evaluation by a qualified engineer. This engineering judgment rating is acceptable if the structure has been carrying normal traffic for an appreciable period of time and the current condition is fair or better with no signs of structural distress. Under these conditions, the inventory and operating rating factor for each legal vehicle may be taken as 1.0, and the ratings for the permit vehicles shall be left blank.

Proof Load Test Ratings:

When lack of plans and/or inability to achieve a reliable computational rating cannot be achieved, then a proof load test may be required. Any bridge that has a successful proof load test shall have the inventory and operating ratings indicated in tons for those vehicles. For example, the T-4 rating would be 35 Tons Inventory and 35 Tons Operating. In addition, any of the other rating vehicles that can be shown to induce lower stresses than the proof load vehicle, the inventory and operating ratings can indicate the tons of the vehicles. For example, if the HS20 vehicle induces lower stresses than the T4, then the HS20 ratings would be 36 Tons Inventory and 36 Tons Operating. Those vehicles that cannot be shown to induce lower stresses than the proof load vehicle shall be restricted from crossing the bridge.

	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	
Approval: See Sheet 1	

Live Load Distribution Factors:

For all bridges on Interstate Routes and any other bridge carrying an ADT of 20,000 or greater, both the legal and the permit vehicles shall be rated using multi-lane distribution factors. For all other bridges, multi-lane distribution factors shall be used for the legal vehicles, and a “modified distribution factor” shall be used for the permit vehicles. The “modified distribution factor” is to be calculated as the average of the single-lane distribution factor and the multi-lane distribution factor.

For permit vehicles on bridges with an ADT of 20,000 or greater, the “modified distribution factor” may be used if there are only two lanes of traffic on the bridge with one lane in each direction. This “modified distribution factor” shall not be used on two lane bridges with an ADT of 20,000 or greater where both lanes are in the same direction.

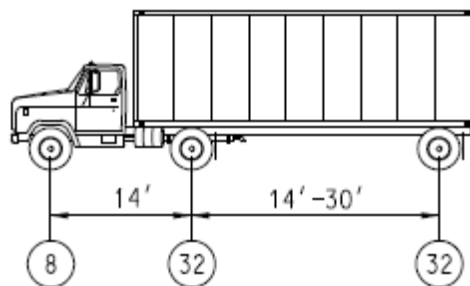
Rating Vehicles:

All bridges are to be rated for each of the legal and permit vehicles described in the following section. Note that the AASHTO Manual for Bridge Evaluation describes a set of Specialized Hauling Vehicles (SHV's) which are single-unit trucks that are legal in Maryland. However, these vehicles have been determined to have a low probability of affecting any posting requirements that would result from rating these vehicles. Because the Maryland Type 3 and Type 4 trucks adequately govern the posting requirements for single-unit vehicles, the AASHTO SHV's are not required to be evaluated.

RATING VEHICLES

(All numbers in circles are axle loads in 1,000 lbs i.e. (8) – 8,000 lb axle load)

LRFR Design Vehicle (Non-Permit Load rating):

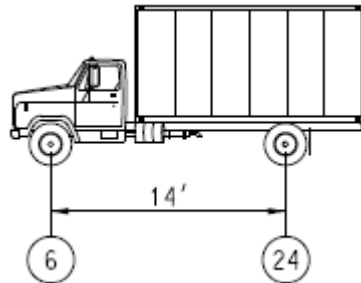


HL-93 (SIA Items 401 and 402)

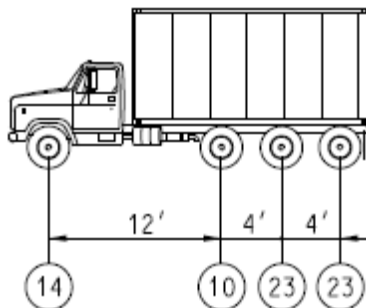
72,000 pounds include AASHTO Lane Load and tandem where applicable
(If the LRFD method was used in the design of the structure)

 Office of Structures Guidelines and Procedures Memorandum	DESIGN
	Number: D-97-47(4)
	Date: 08-10-2018
Structural Load Ratings	
Approval: See Sheet 1	

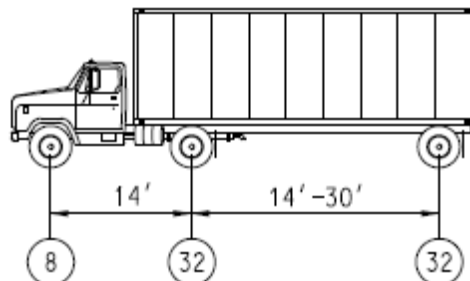
Legal Load Rating Vehicles:



H-15 (SIA Items 403 and 404)
30,000 pounds

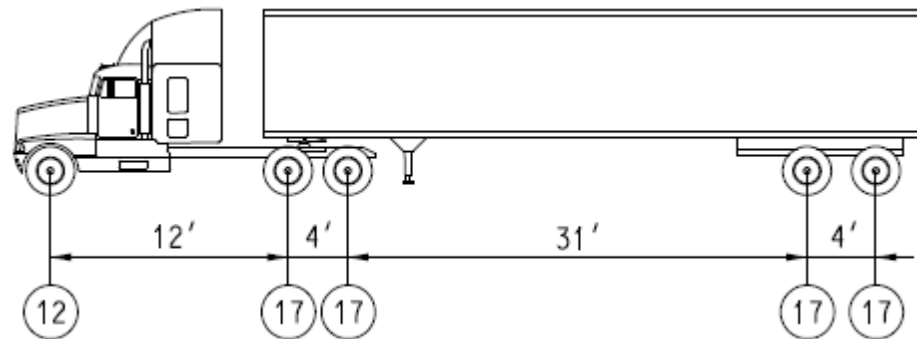


Type 4 – Reduced Lift Axle (10 kips maximum on lift) (SIA Items 407 and 408)
70,000 pounds



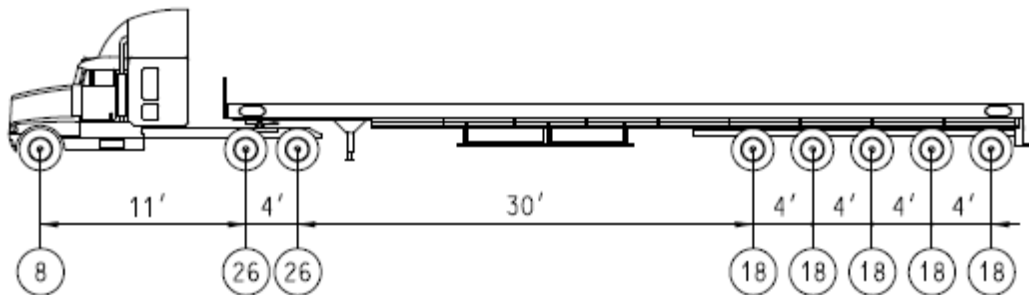
HS-20 (items 409 and 410)
72,000 pounds
(Evaluation not required if HL-93 is rated)

 MDOT MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION	DESIGN	
	Number:	D-97-47(4)
	Date:	08-10-2018
Structural Load Ratings		Approval: See Sheet 1

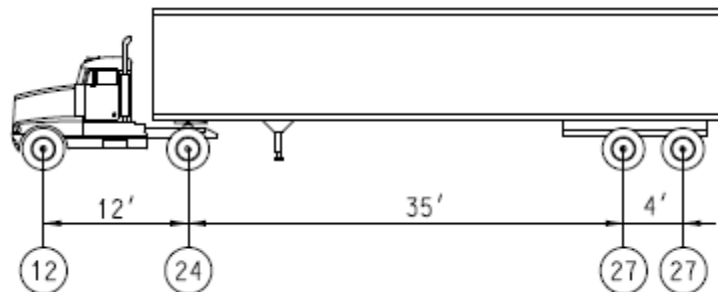


*3S2 (SIA Items 411 and 412)
80,000 pound*

Permit Load Rating Vehicles:

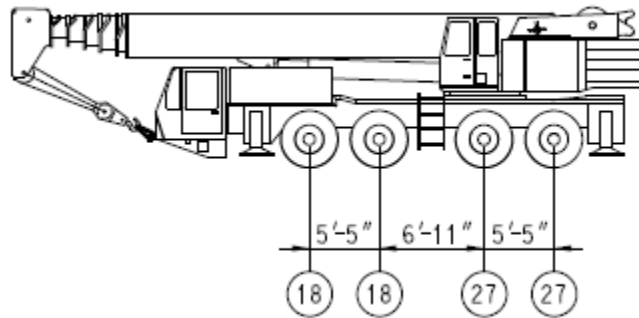


150,000-pound Vehicle (SIA Items 413 and 414)

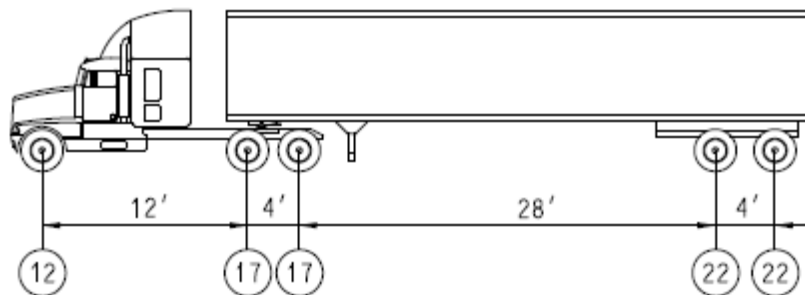


90,000-pound Permit Combination Vehicle (SIA Items 415 and 416)

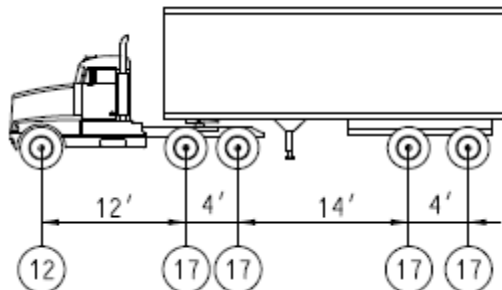
Structural Load Ratings



90,000-pound Mobile Crane Vehicle (SIA Items 417 and 418)

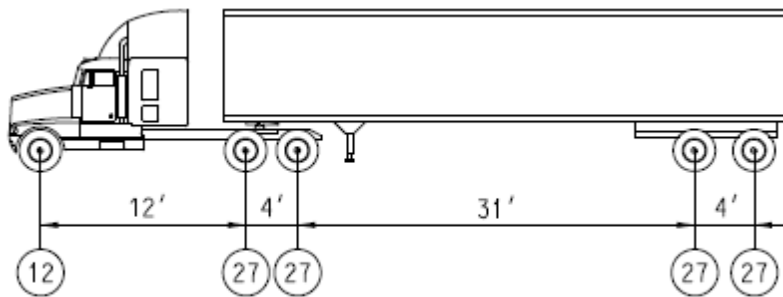


90,000-pound Cargo Vehicle (SIA Items 419 and 420)

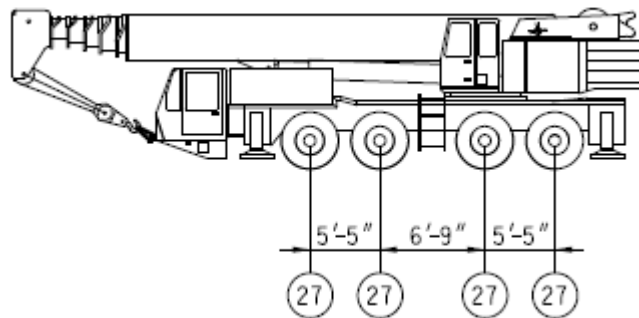


80,000-pound Cargo Vehicle (SIA Items 421 and 422)

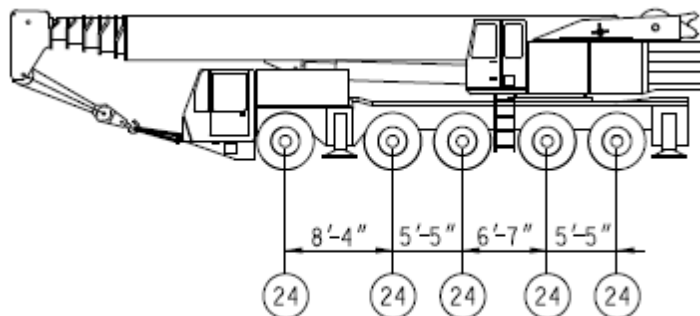
Structural Load Ratings



120,000-pound Combination Vehicle (SIA Items 423 and 424)



108,000-pound Mobile Crane Vehicle (SIA Items 425 and 426)



120,000-pound Mobile Crane Vehicle (SIA Items 427 and 428)