# Implementation of Special Hauling Vehicles in the ODOT Load Rating Process

## 1.0 Implementation of SHV for New and Revised Load Ratings

In addition to the current Ohio legal trucks, the Special Hauling Vehicles (SHV) as per AASHTO Manual for Bridge Evaluation, Second Edition, shall be used for all new load rating analyses. The load rating analysis shall be performed according to one of the procedures given below. When revising the load rating analysis of an existing bridge previously rated by Allowable Stress or Load Factor methods, the load rater can use either the LFR (Load Factor Rating) or LRFR (Load and Resistance Factor Rating). When revising the load rating of an existing bridge previously rated by LRFR, new ratings shall be performed by LRFR method, as well. A General Load Rating Flow Chart is given in Appendix E.

## 2.0 Implementation of SHV Rating on the Existing Bridge Load Ratings

The existing bridges, for which the load ratings have been completed, will be divided into Groups A, B or C.

**Group A.** Any bridge with the current controlling Ohio Legal RF $\geq$ 1.35 will not require any revisions unless a change in bridge conditions occurs which would require an updated load rating analysis, e.g., a new wearing surface or any deterioration that will require a new load rating analysis and may cause the bridge to be in Group B or C. ODOT is conducting a study of a set of bridges in Group A (Ohio Legal RF $\geq$ 1.35) to ensure those bridges will not require any posting for SHV. The study will be completed before the FHWA Memo deadline of December 31, 2022.

**Group B.** All bridges with the current controlling Ohio Legal RF $\geq$ 1.0 and RF < 1.35

a. Re-rate all bridges according to the method of analysis (LFR or LRFR) as set forth in Section 1.0 above and as per Section 3.0 (for LFR) or 4.0 (for LRFR)
b. Prepare an updated BR-100 and posting recommendations, if needed
c. Update the rating factor information in the SMS
d. Post the bridge with new bridge posting sign, if needed within the period specified in the BDM Section 900
e. Tentative completion date of calculations: December 31, 2022.

**Group C.** All bridges that are currently posted, i.e., with controlling Ohio Legal RF<1.0

a. Re-rate all bridges according to the method of analysis (LFR or LRFR) as set forth in Section 1.0 above and as per Section 3.0 (for LFR) or 4.0 (for LRFR)
b. Prepare an updated BR-100 and new posting recommendation, if needed
c. Update the rating factor information in the SMS
d. Post the bridge with new bridge posting sign, if needed within the period specified in the BDM Section 900
e. Tentative completion date: January 1, 2018

## 3.0 Procedure for Load Rating for AASHTO HS20, Ohio Legal Trucks and SHV by LFR Method

Inventory or design level load rating shall be performed for the following load (Appendix B):

- AASHTO HS20-44 Truck or HS20-44 Lane

Operating level load rating shall be performed for the following load:

- AASHTO HS20-44 Truck or HS20-44 Lane
- Ohio Legal load rating shall be performed for the following loads (Appendix C):
    a. 2F1 Truck
    b. 3F1 Truck
    c. 4F1 Truck
    d. 5C1 Truck
- SHV rating shall be performed for the following AASHTO loads (Appendix D):
    a. SU4
    b. SU5
    c. SU6
    d. SU7

Load rate the bridge for the 2F1, 3F1, 4F1, 5C1, SU4, SU5, SU6 and SU7 trucks. If all rating factors are 1.00 or more, prepare the Load Rating Summary Form (BR100, Appendix F). If any one or more of the rating factors for these trucks are less than 1.0, a special weight reduction posting will be required. Determine the controlling rating factors for each 2, 3, 4, 5, & 6 axle trucks (4F1 vs SU4, 5C1 vs SU5 and SU6 vs SU7) for the load posting signage. Prepare the BR100 form and posting recommendations.

## 4.0 Procedure for Load Rating for AASHTO HL-93, Ohio Legal Trucks and SHV by LRFR Method

Inventory or design level load rating shall be performed for the following load (Appendix B):

- AASHTO HL93 Truck plus Lane

Operating level load rating shall be performed for the following load:

- AASHTO HL93
- Ohio Legal load rating shall be performed for the following loads (Appendix C):
    a. 2F1 Truck
    b. 3F1 Truck
    c. 4F1 Truck
    d. 5C1 Truck
- SHV rating shall be performed for the following AASHTO loads (Appendix D):
    a. SU4
    b. SU5
    c. SU6
    d. SU7

Load rate the bridge for the 2F1, 3F1, 4F1, 5C1, SU4, SU5, SU6 and SU7 trucks. If all rating factors are 1.00 or more, prepare the Load Rating Summary Form (BR100, Appendix F). If any one or more of the rating factors for these trucks are less than 1.0, a special weight reduction posting will be required. Determine the controlling rating factors for each 2, 3, 4, 5, & 6 axle trucks (4F1 vs SU4, 5C1 vs SU5 and SU6 vs SU7) for the load posting signage. Prepare the BR100 form and load posting recommendations.

# 5.0 Documentation

## 5.1 New Rating Analysis

A revised rating summary form (BR100, see Appendix F) will be used to document the rating factors for Inventory, Operating, Ohio Legal Loads and SHV ratings.

## 5.2 Existing Ratings

### 5.2.1 Group A

For bridges in Group A, ODOT will maintain a SHV Analysis Exempt List (SAEL) in the form of a spreadsheet of bridges that currently have an Ohio Legal RF of 1.35 or more and mark them as exempt from re-analysis for SHV until such time as a new analysis is warranted. If any bridge on the SAEL receives a new rating analysis, it will be removed from the SAEL. The spreadsheet has been posted in the ODOT "O:\Bridges" folder.

### 5.2.2 Group B & C

Bridges in Groups B & C, will be re-analyzed and in the due course a new BR100 Rating Summary form will be prepared and stored in the bridge file by the bridge owners.

# 6.0 Signage

For bridges that will require posting for reduced Ohio legal and SHV loads, new bridge load posting signs (Appendices G & H) will be used. The signs will show the maximum safe loads that can be carried on 2-axle, 3-axle, 4-axle, 5-axle and 6 or more axle trucks on the bridge.

All existing load posting signs will be replaced as the posted bridges are re-analyzed for the SHVs.

*Amjad Waheed, PE*

*Revised: 2016-06-02*

U.S. Department of Transportation
Federal Highway Administration

# Memorandum

Subject: **ACTION:** Load Rating of Specialized Hauling Vehicles
*/s/ Original Signed by*
From: Joseph S. Krolak
Acting Director, Office of Bridge Technology

Date: November 15, 2013

In Reply Refer To:
HIBT-10

To: Federal Lands Highway Division Engineers
Division Administrators

The purpose of this memorandum is to clarify FHWA's position on the analysis of *Specialized Hauling Vehicles* (SHVs) as defined in the AASHTO Manual for Bridge Evaluation (MBE) during bridge load rating and posting to comply with the requirements of the *National Bridge Inspection Standards* (NBIS). The intent of the load rating and posting provisions of the NBIS is to insure that all bridges are appropriately evaluated to determine their safe live load carrying capacity considering all unrestricted legal loads, including State routine permits, and that bridges are appropriately posted if required, in accordance with the MBE.

The SHVs are closely-spaced multi-axle single unit trucks introduced by the trucking industry in the last decade. Examples include dump trucks, construction vehicles, solid waste trucks and other hauling trucks. SHVs generally comply with Bridge Formula B and are for this reason considered legal in all States, if a States' laws do not explicitly exclude the use of such vehicles.

NCHRP Project 12-63 (Report 575, 2007) studied the developments in truck configurations and State legal loads and found that AASHTO Type 3, 3-S2 and 3-3 legal vehicles are not representative of all legal loads, specifically SHVs. As a result, legal load models for SHVs were developed and adopted by AASHTO in 2005 , recognizing that there is an immediate need to incorporate SHVs into a State's load rating process, if SHVs operate within a State. The SHV load models in the MBE include SU4, SU5, SU6 and SU7 representing four- to seven-axle SHVs respectively, and a Notional Rating Load (NRL) model that envelopes the four single unit load models and serves as a screening load. If the load rating factor for the NRL model is 1.0 or greater, then there is no need to rate for the single-unit SU4, SU5, SU6 and SU7 loads. However, if the load rating factor for the NRL is less than 1.0, then the single-unit SU4, SU5, SU6 and SU7 loads need to be considered during load rating and posting.

The SHVs create higher force effects, and thus result in lower load ratings for certain bridges, especially those with a shorter span or shorter loading length such as transverse floor beams, when compared to AASHTO Type 3, 3-S2 and 3-3 legal loads and HS20 design load. Therefore, SHVs, i.e., SU4, SU5, SU6 and SU7 or NRL, are to be included in rating and posting analyses in accordance with Article 6A.2.3 and Article 6B.9.2 of the 1st Edition of the MBE (Article 6B.7.2 of the 2nd Edition of the MBE), unless one of the following two conditions is met:

**Condition A**: The State verifies that State laws preclude SHV use; or

**Condition B**: The State has its own rating vehicle models for legal loads and verifies that the State legal load models envelope the *applicable* AASHTO SHV loading models specified in Appendix D6A and Figure 6B.9.2-2 of the 1st Edition of the MBE (Figure 6B.7.2-2 of the 2nd Edition of the MBE), and the State legal load models have been included in rating/posting analyses of all bridges. The SHV types, e.g. six- or seven-axle SHVs, precluded by State laws need not be considered.

The SHV load models apply to Allowable Stress Rating, Load Factor Rating, and Load and Resistance Factor Rating in accordance with Section 6A and 6B of the MBE.

The FHWA recognizes that there are bridges in the inventory that have not been rated for SHVs and that it is not feasible to include SHVs in the ratings for the entire inventory at once. FHWA is establishing the following timelines for rating bridges for SHVs, if neither Condition A or B is met:

**Group 1**: Bridges with the shortest span not greater than 200 feet should be re-rated after their next NBIS inspection, but no later than December 31, 2017, that were last rated by:

a) either Allowable Stress Rating (ASR) or Load Factor Rating (LFR) method and have an operating rating for the AASHTO Routine Commercial Vehicle either Type 3, Type 3S2, or Type 3-3 less than 33 tons (English), 47 tons (English), or 52 tons (English) respectively; or
b) Load and Resistance Factor Rating (LRFR) method and have a legal load rating factor for the AASHTO Routine Commercial Vehicle, either Type 3, Type 3S2 or Type 3-3, less than 1.3.

**Group 2**: Rate those bridges not in Group 1 no later than December 31, 2022.

For either group, if a re-rating is warranted due to changes of structural condition, loadings, or configuration, or other requirements, the re-rating should include SHVs.

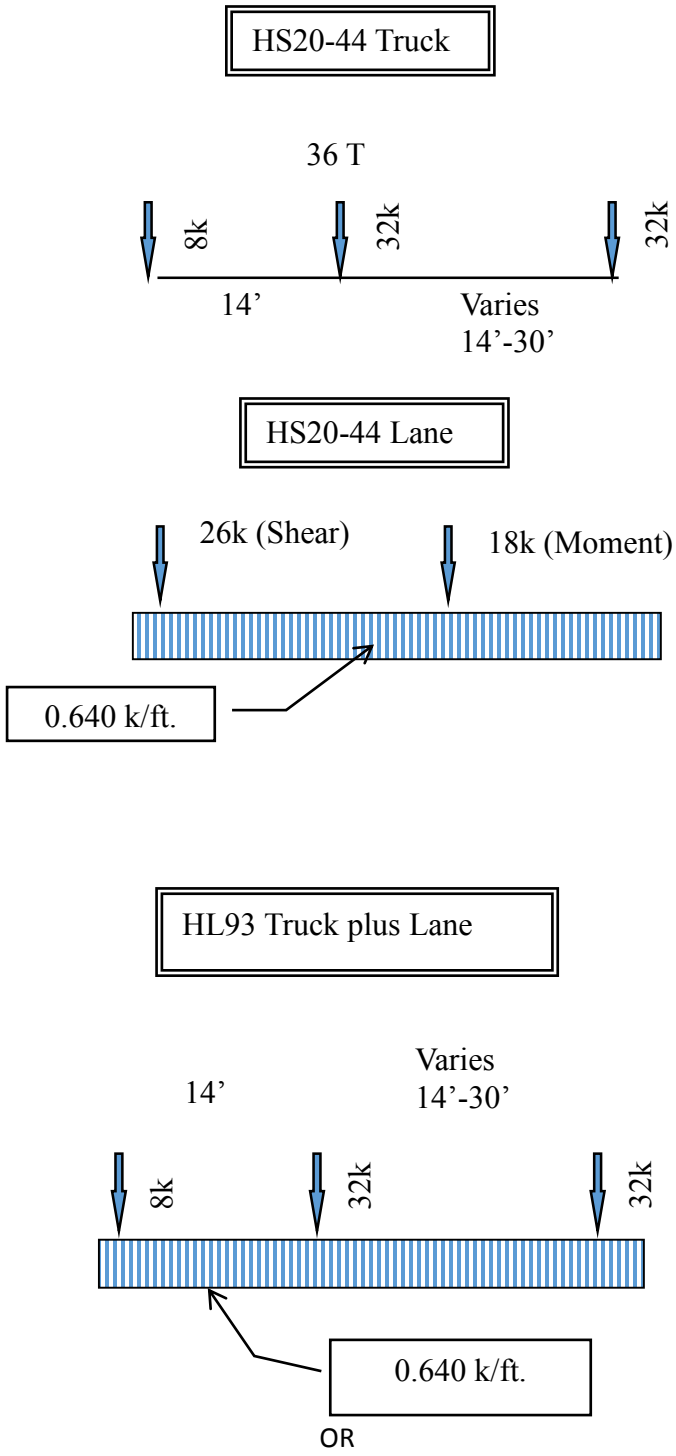
The selection of load rating method should comply with FHWA's Policy Memorandum *Bridge Load Ratings for the National Bridge Inventory*, dated October 30, 2006.

A State may utilize an alternative approach in lieu of the above to address the load rating for SHVs for bridges in their inventory; however, the approach must be reviewed and formally accepted by FHWA.

The timeline presented above will be incorporated into the review of Metric 13 under the National Bridge Inspection Program (NBIP); specifically, it is expected that all bridges meeting Group 1 criteria be load rated for SHVs by the end of 2017. Please work with your State to assist them in developing appropriate actions to meet those timelines. If your State is currently developing or implementing a Plan of Corrective Actions (PCA) for load rating bridges, the PCA should be reviewed and modified as necessary to take into account the rating of SHVs for those bridges and these timelines.

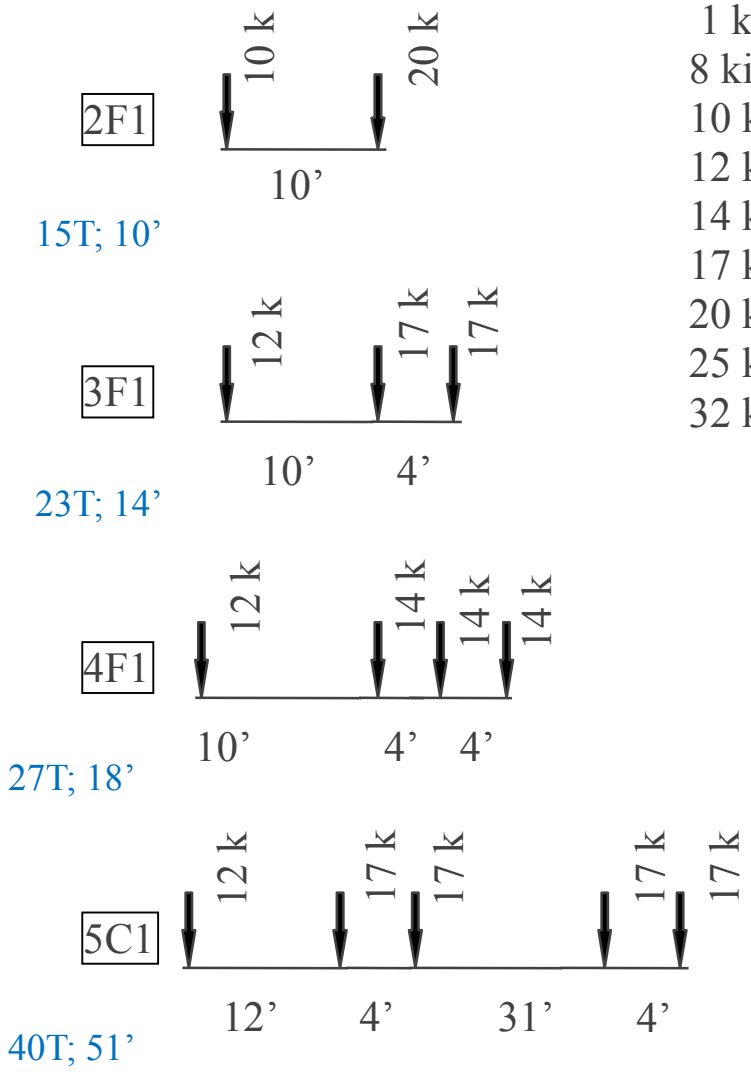
We request that you share this memorandum with your State or Federal agency partner. All questions that cannot be resolved at the Division Office level should be directed to Lubin Gao at lubin.gao@dot.gov or at 202-366-4604.

# Appendix B




**LOADS FOR INVENTORY AND OPERATING RATING**

# Appendix C

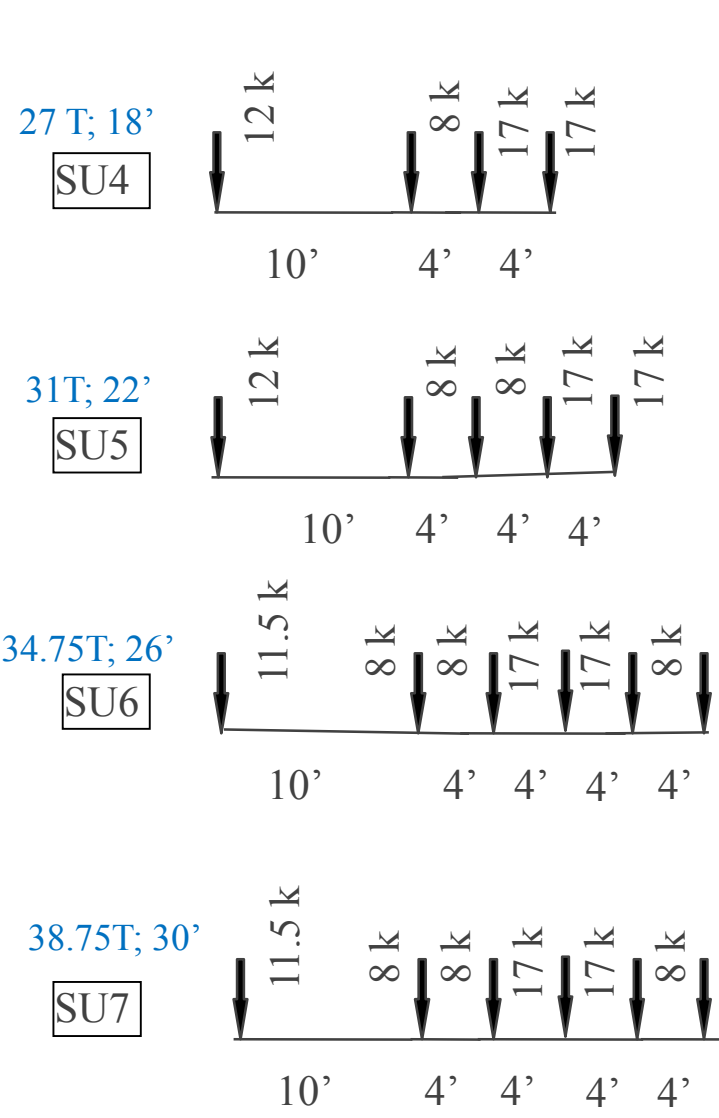



1 k or kip = 1,000 lbs
8 kips = 35.6 kN
10 kips = 44.5 kN
12 kips = 53.4 kN
14 kips = 62.3 kN
17 kips = 75.6 kN
20 kips = 89.0 kN
25 kips =111.2 kN
32 kips =142.3 kN

4 ft. = 1.22 m
10 ft. = 3.05 m
12 ft. = 3.66 m
14 ft. = 4.27 m
18 ft. = 5.49 m
30 ft. = 9.14 m
31 ft. = 9.45 m
51 ft. = 15.54 m

**OHIO LEGAL LOADS**

# Appendix D

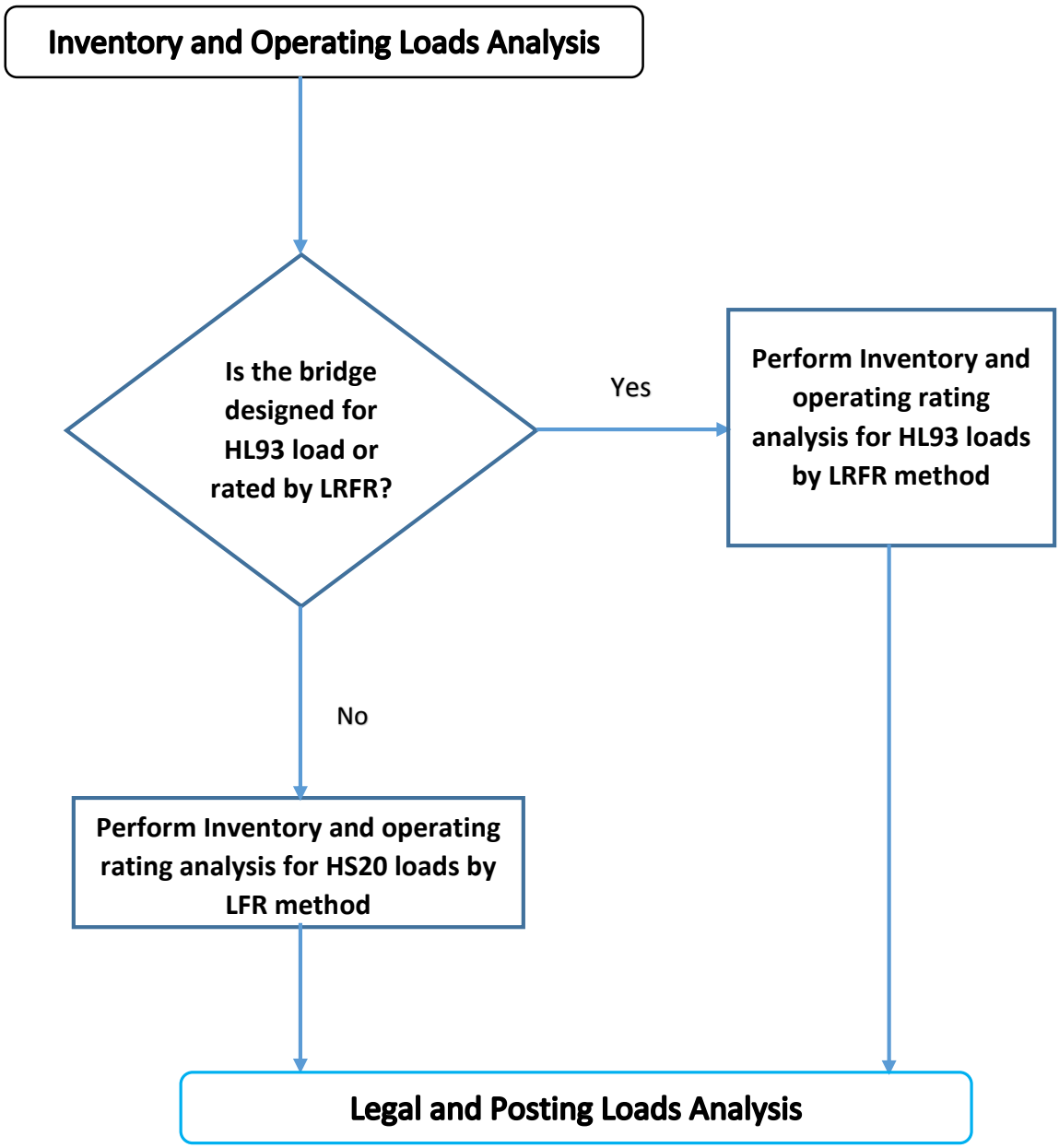



6.0 k = 26.7 kN
8.0 k = 35.6 kN
11.5 k = 51.2 kN
12.0 k = 53.4 kN
17.0 k = 75.6 kN

4’ = 1.22 m
6’ = 1.83 m
14’ = 4.27 m
18’ = 5.49 m
22’ = 6.71 m
26’ = 7.92 m
30’ = 9.14 m

**SPECIAL HAULING VEHICLES**

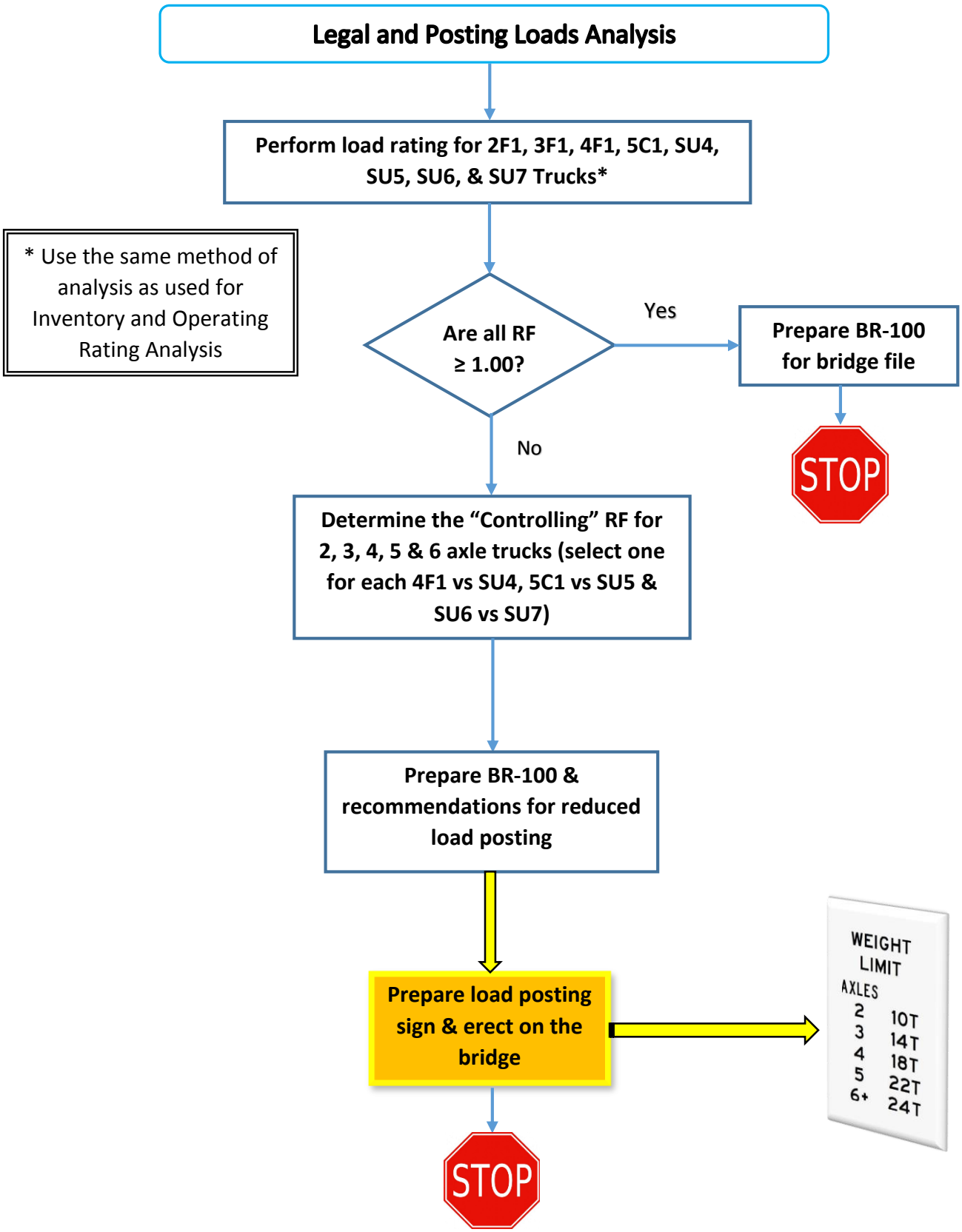
## Appendix E (a)




**Flow Chart for Load Rating Analysis**

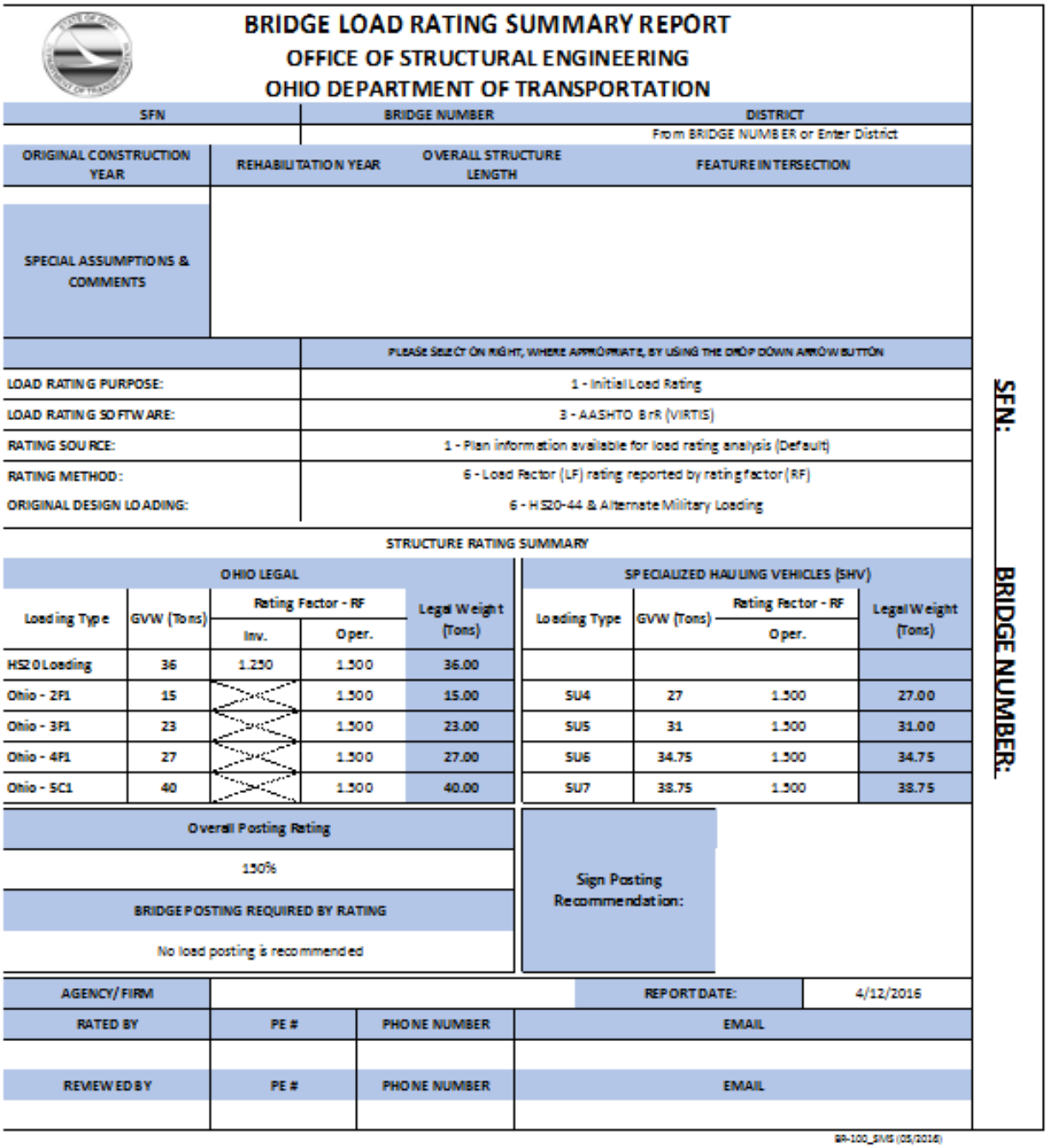
**(Continued on next page)**

## Appendix E (b)


Legal and Posting Loads Analysis
Perform load rating for 2F1, 3F1, 4F1, 5C1, SU4, SU5, SU6, & SU7 Trucks*
* Use the same method of analysis as used for Inventory and Operating Rating Analysis
Are all RF ≥ 1.00?
Yes
Prepare BR-100 for bridge file
STOP
No
Determine the "Controlling" RF for 2, 3, 4, 5 & 6 axle trucks (select one for each 4F1 vs SU4, 5C1 vs SU5 & SU6 vs SU7)
Prepare BR-100 & recommendations for reduced load posting
Prepare load posting sign & erect on the bridge
WEIGHT LIMIT
AXLES
2 10T
3 14T
4 18T
5 22T
6+ 24T
STOP

# Flow Chart for Load Rating Analysis

## Appendix F



**BRIDGE LOAD RATING SUMMARY REPORT**
**OFFICE OF STRUCTURAL ENGINEERING**
**OHIO DEPARTMENT OF TRANSPORTATION**

SFN: BRIDGE NUMBER:

| SFN | BRIDGE NUMBER | DISTRICT |
|---|---|---|
| | | From BRIDGE NUMBER or Enter District |

| ORIGINAL CONSTRUCTION YEAR | REHABILITATION YEAR | OVERALL STRUCTURE LENGTH | FEATURE INTERSECTION |
|---|---|---|---|
| | | | |

| SPECIAL ASSUMPTIONS & COMMENTS | |
|---|---|
| | |

| | PLEASE SELECT ON RIGHT, WHERE APPROPRIATE, BY USING THE DROP DOWN ARROW BUTTON |
|---|---|
| LOAD RATING PURPOSE: | 1 - Initial Load Rating |
| LOAD RATING SOFTWARE: | 3 - AASHTO BrR (VIRTIS) |
| RATING SOURCE: | 1 - Plan information available for load rating analysis (Default) |
| RATING METHOD: | 6 - Load Factor (LF) rating reported by rating factor (RF) |
| ORIGINAL DESIGN LOADING: | 6 - HS20-44 & Alternate Military Loading |

STRUCTURE RATING SUMMARY

| OHIO LEGAL | | | | |
|---|---|---|---|---|
| Loading Type | GVW (Tons) | Rating Factor - RF | | Legal Weight (Tons) |
| | | Inv. | Oper. | |
| HS20 Loading | 36 | 1.250 | 1.500 | 36.00 |
| Ohio - 2F1 | 15 | | 1.500 | 15.00 |
| Ohio - 3F1 | 23 | | 1.500 | 23.00 |
| Ohio - 4F1 | 27 | | 1.500 | 27.00 |
| Ohio - 5C1 | 40 | | 1.500 | 40.00 |

| SPECIALIZED HAULING VEHICLES (SHV) | | | |
|---|---|---|---|
| Loading Type | GVW (Tons) | Rating Factor - RF | Legal Weight (Tons) |
| | | Oper. | |
| | | | |
| SU4 | 27 | 1.500 | 27.00 |
| SU5 | 31 | 1.500 | 31.00 |
| SU6 | 34.75 | 1.500 | 34.75 |
| SU7 | 38.75 | 1.500 | 38.75 |

| Overall Posting Rating |
|---|
| 150% |
| **BRIDGE POSTING REQUIRED BY RATING** |
| No load posting is recommended |

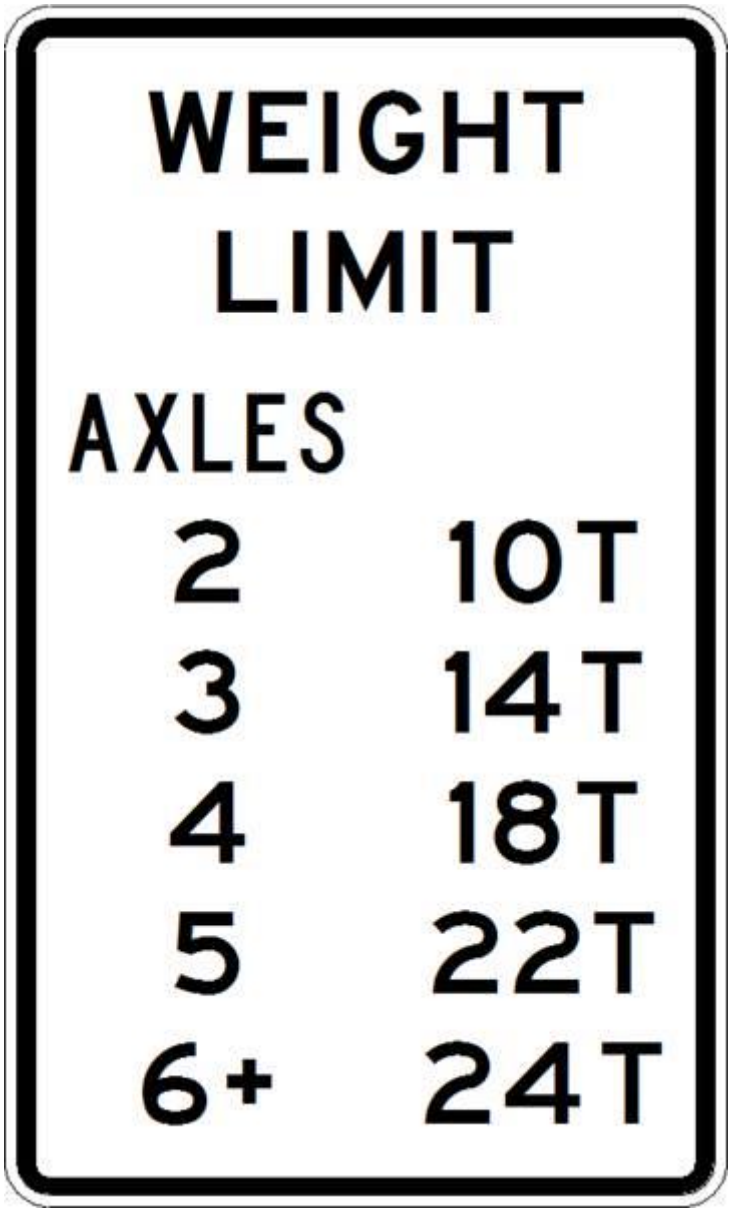
Sign Posting Recommendation:

| AGENCY/FIRM | | | REPORT DATE: | 4/12/2016 |
|---|---|---|---|---|
| RATED BY | PE # | PHONE NUMBER | EMAIL | |
| | | | | |
| REVIEWED BY | PE # | PHONE NUMBER | EMAIL | |
| | | | | |

BR-100_SMS (05/2016)

**ODOT LOAD RATING SUMMARY (BR-100 Revised 2016/06)**

## Appendix G

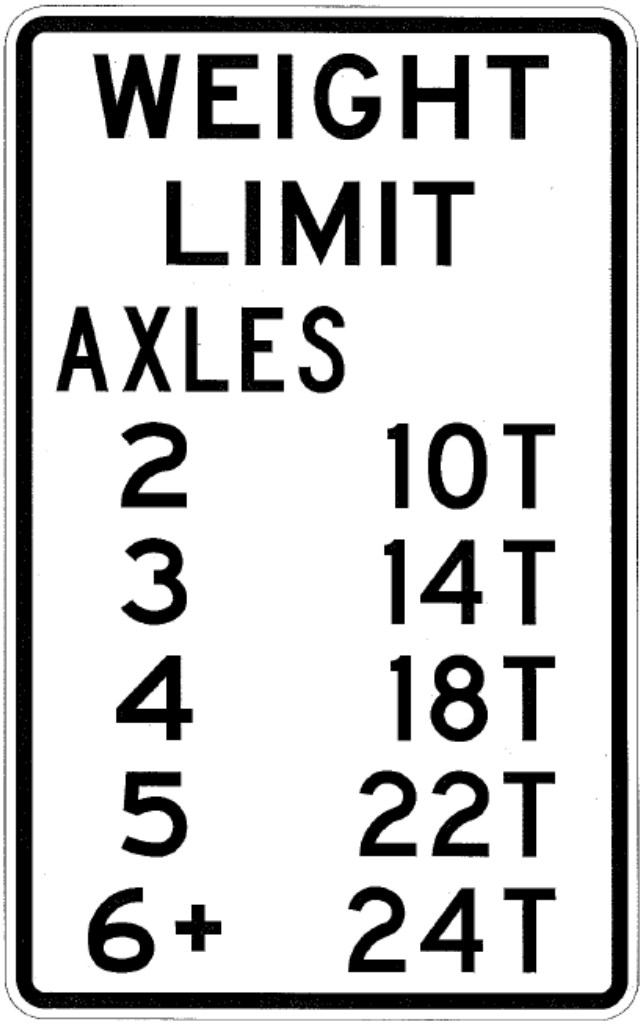



**NEW BRIDGE LOAD POSTING SIGN**

(Size: 36 inches by 60 inches)

New Bridge Load Posting Sign

## Appendix H




New Bridge Load Posting Sign
(for small roads)