MEMORANDUM

U.S. Department of Transportation
Federal Highway Administration

Subject: **INFORMATION**: Bridge Load Ratings for the National Bridge Inventory

Date: October 30, 2006

From: */s/ Original Signed by*
M. Myint Lwin, P.E., S.E.
Director, Office of Bridge Technology

Reply to Attn of: HIBT-30

To: Directors of Field Services
Division Administrators
Federal Lands Highway Division Engineers

Several State and FHWA Bridge Engineers have suggested that we clarify our policy regarding the appropriate methodology and loads to be used in reporting operating and inventory rating data (Items 63, 64, 65 and 66 of the 1995 Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Coding Guide), Report No. FHWA-PD-96-001) to the National Bridge Inventory (NBI). An overview of our past bridge load rating policies are provided in the attached appendix and our current policy and future direction is provided herein.

With the adoption of the AASHTO Load and Resistance Factor Design (LRFD) Specifications, our June 28, 2000, policy memorandum requiring all new bridges to be designed by the LRFD Specifications after October 1, 2007, and the ongoing effort to merge the Manual for Condition Evaluation of Bridges and the Guide Manual for Condition Evaluation and Load and Resistance Factor Rating of Highway Bridges (LRFR Manual), we believe that it is necessary to accommodate and support Load and Resistance Factor Rating (LRFR), while continuing to accept Load Factor Rating (LFR) for the large inventory of in-service bridges that have been designed by another method other than LRFD. The FHWA does not intend to mandate re-rating existing and valid bridge load ratings by LRFR.

Therefore, FHWA's policy for Items 63, 64, 65, and 66 of the Coding Guide is as follows (see **Table 1** for more information):

1. For bridges and total replacement bridges designed by LRFD Specifications using HL-93 loading, prior to October 1, 2010, Items 63, 64, 65 and 66 are to be computed and reported to the NBI as either a Rating Factor (RF) or in metric tons. Rating factors shall be based on LRFR methods using HL-93 loading (see **Appendix A - Example 1**) or LFR methods using MS18 loading (see **Appendix A - Example 2**). Metric ton rating values shall be reported in terms of MS18 (32.4 metric tons) loading derived from a RF calculated using LRFR methods and HL-93 loading, or LFR methods using MS18 loading (see **Appendix A - Example 3**).
2. For bridges and total replacement bridges designed by LRFD Specifications using HL-93, after October 1, 2010 Items 63, 64, 65 and 66 are to be computed and reported to the NBI as a RF based on LRFR methods using HL-93 loading (see **Appendix A - Example 1**).
3. For bridges designed or reconstructed by either Allowable Stress Design (ASD) or Load Factor Design (LFD) Specifications, Items 63, 64, 65 and 66 are to be computed and reported to the NBI as a RF or in metric tons. Rating factors shall be based on LRFR methods using HL-93 loading (see **Appendix A - Example 1**) or LFR methods using MS18 loading (see **Appendix A - Example 2**). Metric ton rating values shall be reported in terms of MS18 (32.4 metric tons) loading derived from a RF calculated using LRFR methods and HL-93 loading, or LFR methods using MS18 loading (see **Appendix A - Example 3**)
4. For bridges partially reconstructed resulting in the use of combination specifications (e.g. a reconstructed superstructure designed by LRFD supported by the original substructure designed by ASD) or unknown specifications, Items 63, 64, 65 and 66 are to be computed and reported to the NBI as a RF or in metric tons. Rating factors shall be based on LRFR methods using HL-93 loading (see **Appendix A - Example 1**) or LFR methods using MS18 loading (see **Appendix A - Example 2**). Metric ton rating values shall be reported in terms of MS18 (32.4 metric tons) loading derived from a RF calculated using LRFR methods and HL-93 loading, or LFR methods using MS18 loading (see **Appendix A - Example 3**)
5. For bridges designed or reconstructed by either ASD or LFD Specifications and for bridges partially reconstructed resulting in the use of combination specifications or unknown specifications, after October 1, 2010, Items 63, 64, 65 and 66 are to be computed and reported to the NBI as a RF or in metric tons. Rating factors shall be based on LRFR methods using HL-93 loading (see **Appendix A - Example 1**) or LFR methods using MS18 loading (see **Appendix A - Example 2**). Metric ton rating values shall be based on LFR methods using MS18 loading (see **Appendix A - Example 3**). The NBI Code of 3 (Load and Resistance Factor Rating reported in metric tons using MS loading) for Items 63 and 65 will no longer be valid for new load ratings of new or existing bridges after October 1, 2010 (see **Appendix C**).
6. For bridges load rated by load testing methods, Items 63, 64, 65 and 66 are to be computed and reported to the NBI as Load Testing in metric tons based on MS18 loading, even though the actual load test was likely performed with another vehicle configuration.
7. For those cases where the condition or the loading of a bridge warrants a re-rating (existing load rating is invalid), follow the Load Rating Methodology Options presented in **Table 1** for computing and reporting Items 63, 64, 65 and 66.

It is recognized that there will be situations that require engineering judgment with respect to the selection of an appropriate rating method for computing and reporting Items 63, 64, 65 and 66. For example, States have the option of LRFR, LFR, or Allowable Stress Rating (ASR) for

timber and masonry bridges. Please work with your State DOT to develop consistent procedures for these exceptions to policy.

Policy exceptions and reporting procedures to the NBI may be revised in the future once LRFR methods and software are further developed and the Coding Guide is updated. For example, as proposed in the update to the Coding Guide, future reporting of load ratings in the NBI will likely be based entirely on RF rather than tons. The options in Table 1 will be revised to accommodate future changes as they occur.

As in the past, the load rating used to report NBI Item 70, Bridge Posting may be computed either by LRFR, LFR, or ASR methods using the maximum unrestricted legal loads to establish load limits for the purpose of load posting. Item 70 evaluates the load capacity of a bridge in comparison to the State legal loads. For load ratings based on LRFR methods using an HL-93 loading, this item represents the minimum LRFR of all legal load configurations in the State (e.g. if the minimum LRFR of all State legal loads = 0.85, then by using the current Coding Guide table, Item 70 would be coded a 3).

Please share this clarification with your State DOT counterparts and feel free to contact either Everett Matias (202) 366-6712 (everett.matias@dot.gov) or Gary Moss (202) 366-4654 (gary.moss@dot.gov) if any further questions arise.

Attachments

Table 1: RATING METHODS FOR COMPUTING AND REPORTING CODING GUIDE ITEMS 63, 64, 65 AND 66

DESIGN OR RECONSTRUCTION SPECIFICATION USED	EXISTING AND VALID LOAD RATING	LOAD RATING OR RE-RATING METHODOLOGY OPTIONS	LOADING	CODING GUIDE ITEMS			
				63	64	65	66
Load and Resistance Factor Design (LRFD)	None or Invalid	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
		LFR [1]	MS18	6	Rating Factor (RF)	6	Rating Factor (RF)
		LFR [1]	MS18	1	Metric Tons	1	Metric Tons
		ASR [4]	MS18	7	Rating Factor (RF)	7	Rating Factor (RF)
		ASR [4]	MS18	2	Metric Tons	2	Metric Tons
	Load and Resistance Factor Rating (LRFR)	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
	Load Factor Rating (LFR) or Allowable Stress	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
		LFR	MS18	6	Rating Factor (RF)	6	Rating Factor (RF)
		LFR	MS18	1	Metric Tons	1	Metric Tons
		ASR [3, 4]	MS18	7	Rating Factor (RF)	7	Rating Factor (RF)

Table 1: RATING METHODS FOR COMPUTING AND REPORTING CODING GUIDE ITEMS 63, 64, 65 AND 66							
DESIGN OR RECONSTRUCTION SPECIFICATION USED	EXISTING AND VALID LOAD RATING	LOAD RATING OR RE-RATING METHODOLOGY OPTIONS	LOADING	CODING GUIDE ITEMS			
				63	64	65	66
	Rating (ASR)	ASR [3, 4]	MS18	2	Metric Tons	2	Metric Tons
	Load Testing	Load Testing	Equivalent MS18	4	Metric Tons	4	Metric Tons
Load Factor Design (LFD) or Allowable Stress Design (ASD)	None or Invalid	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
		LFR	MS18	6	Rating Factor (RF)	6	Rating Factor (RF)
		LFR	MS18	1	Metric Tons	1	Metric Tons
		ASR [4]	MS18	7	Rating Factor (RF)	7	Rating Factor (RF)
		ASR [4]	MS18	2	Metric Tons	2	Metric Tons
	Load and Resistance Factor Rating (LRFR)	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
	Load Factor Rating (LFR) or Allowable Stress Rating (ASR)	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
		LFR	MS18	6	Rating Factor (RF)	6	Rating Factor (RF)
		LFR	MS18	1	Metric Tons	1	Metric Tons
		ASR [3, 4]	MS18	7	Rating Factor (RF)	7	Rating Factor (RF)
		ASR [3, 4]	MS18	2	Metric Tons	2	Metric Tons
	Load Testing	Load Testing	Equivalent MS18	4	Metric Tons	4	Metric Tons
Combination of Specifications (LRFD, LFD, ASD) or Unknown	None or Invalid	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
		LFR	MS18	6	Rating Factor (RF)	6	Rating Factor (RF)
		LFR	MS18	1	Metric Tons	1	Metric Tons
		ASR [4]	MS18	7	Rating Factor (RF)	7	Rating Factor (RF)
		ASR [4]	MS18	2	Metric Tons	2	Metric Tons
		Load Testing	Equivalent MS18	4	Metric Tons	4	Metric Tons
	Load and Resistance Factor Rating (LRFR)	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons

Table 1: RATING METHODS FOR COMPUTING AND REPORTING CODING GUIDE ITEMS 63, 64, 65 AND 66							
DESIGN OR RECONSTRUCTION SPECIFICATION USED	EXISTING AND VALID LOAD RATING	LOAD RATING OR RE-RATING METHODOLOGY OPTIONS	LOADING	CODING GUIDE ITEMS			
				63	64	65	66
	Load Factor Rating (LFR) or Allowable Stress Rating (ASR)	LRFR	HL-93	8	Rating Factor (RF)	8	Rating Factor (RF)
		LRFR	MS18[5]	3 [2]	Metric Tons	3 [2]	Metric Tons
		LFR	MS18	6	Rating Factor (RF)	6	Rating Factor (RF)
		LFR	MS18	1	Metric Tons	1	Metric Tons
		ASR [3, 4]	MS18	7	Rating Factor (RF)	7	Rating Factor (RF)
		ASR [3, 4]	MS18	2	Metric Tons	2	Metric Tons
	Load Testing	Load Testing	Equivalent MS18	4	Metric Tons	4	Metric Tons

[1] Bridges and Total Replacement Bridges Designed by LRFD prior to October 1, 2010. Bridges and Total Replacement Bridges Designed by LRFD after October 1, 2010 are to be computed and reported based on LRFR methods.

[2] The NBI Code of 3 for Items 63 and 65 will no longer be valid for new load ratings of new or existing bridges after October 1, 2010.

[3] Non-NHS Bridges Constructed, Replaced, Rehabilitated and Load Rated prior to January 1, 1994. Bridges Load Rated or Re-Rated after January 1, 1994 are to be computed and reported based on LFR or LRFR methods.

[4] Policy exceptions such as timber and masonry bridges.

[5] Report metric tons in terms of MS18 (32.4 metric tons) loading derived from a RF calculated using LRFR methods and HL-93 loading.

Appendix - A Examples

Input options for Coding Guide Items 63 and 65 (March 22, 2004 memorandum)

Code	Description
1	Load factor (LF) reported in metric tons using MS18 loading.
2	Allowable Stress (AS) reported in metric tons using MS18 loading.
3	Load and Resistance Factor Rating (LRFR) reported in metric tons using MS18 loading.
4	Load testing reported in metric tons using equivalent MS18 loading.
5	No rating analysis performed.
6	Load Factor (LF) rating reported by rating factor (RF) method using MS18 loading.
7	Allowable Stress (AS) rating reported by rating factor (RF) method using MS18 loading.

8 Load and Resistance Factor Rating (LRFR) rating reported by rating factor (RF) method using HL-93 loading.

Example 1

Given:

LRFR of HL-93 Loading
Computed Operating Rating Factor = 1.17
Computed Inventory Rating Factor = 0.90

Therefore:

Code Item 63: 8
Code Item 64: 117
Code Item 65: 8
Code Item 66: 090

Example 2:

Given:

LFR of MS18 Loading by Rating Factor
Computed Operating Rating Factor = 54.1/32.4 = 1.67
Computed Inventory Rating Factor = 32.4/32.4 = 1.00

Therefore:

Code Item 63: 6
Code Item 64: 167
Code Item 65: 6
Code Item 66: 100

Example 3:

Given:

LFR of MS18 Loading in metric tons
Computed Operating Rating = 54.1 metric tons
Computed Inventory Rating = 32.4 metric tons

Therefore:

Code Item 63:1
Code Item 64: 541
Code Item 65: 1
Code Item 66: 324

Appendix - B Background and History

The FHWA memoranda issued on November 5, 1993 and December 22, 1993, and the Coding Guide established a policy whereby the operating and inventory ratings (Items 64 and 66) of all bridges constructed, replaced, or rehabilitated after January 1, 1994, as reported to the NBI were to be computed by the LFR method using MS loading (HS metric equivalent) as the national standard. In addition, the load ratings of all bridges that did not have a valid load rating or required a re-rating due to changes in condition or loading were to be computed by the LFR method. Through our field offices, target dates were established with the State DOT's for updating all NBI load ratings using the LFR method, starting with all bridges on the National Highway System (NHS). For bridges off of the NHS that were constructed, replaced, or rehabilitated prior to January 1, 1994, a valid load rating computed by LFR, ASR or LRFR was acceptable. For any bridge that required posting or overweight load permits, States had the option of using LFR, ASR, or LRFR methods to establish load limits.

With the adoption of the AASHTO LRFD Specifications, FHWA issued a proposal letter, dated April 19, 2000, to the Chairman of the AASHTO Technical Subcommittee on Bridge Management, Evaluation, and Rehabilitation (T-18) requiring all new load ratings to be computed and reported to the NBI by the LRFR method. Bridges previously designed and currently under design using LRFD were to be rated by the LFR or LRFR methods, until adoption of the LRFR Manual. FHWA also proposed that within 10 years of adoption, all load ratings in the NBI would be in accordance with the LRFR Manual. In recognition of the state-of-development and understanding of the LRFR methodology, and concern by the AASHTO State members over the resources required to re-rate all bridges once again, FHWA rescinded the April 19, 2000, proposal letter via a second letter to the Chairman of T-18 on November 15, 2001.

Since that time, the bridge community's understanding of LRFD and LRFR methods has improved and several State DOT's have started using the load and resistance factor method for design and rating of bridges. On June 28, 2000, FHWA issued a policy memorandum that required all new bridges be designed by LRFD Specifications after October 1, 2007, and all new culverts, retaining walls and other standard structures be designed by LRFD Specifications after October 1, 2010. For modification to existing structures, States had the option of using LRFD Specifications or the specifications that were used for the original design.

Our March 22, 2004, memorandum revised the Coding Guide by providing three additional codes to the Method Used to Determine Operating Rating and Method Used to Determine Inventory Rating (Items 63 and 65). The additions were made to accommodate the reporting of RF determined by LRFR, LFR, or ASR methods. This memorandum did not require bridges to be rated or re-rated using LRFR methods, nor did it change our position on using LFR with MS loading as the preferred method for bridges designed by LFD or ASD. Instead, this memorandum provided the additional option of reporting RF and encouraged the use of LRFR methods with HL-93 loading for all new and reconstructed bridges that were designed by LRFD Specifications.

At the request of T-18, FHWA produced a report in June 2005 titled, the *Impact of Load Rating Methods on Federal Bridge Program Funding*. A copy of the report is available at http://www.fhwa.dot.gov/bridge/bridgeload01.cfm. The report concluded that there would be less than a 2 percent change in deck area on deficient bridges if all the inventory ratings were suddenly based on LRFR. The report also indicated that implementation of LRFR is likely to occur gradually, making any changes in deck area on deficient bridges, and therefore Federal bridge funding levels, difficult to detect.

Based on the results of our study, the advancement and development of LRFD and LRFR methodologies, and our March 22, 2004, memorandum, FHWA's current practice is to accept the reporting of operating and inventory load ratings as outlined in Table 1.

Copies of each of the referenced memorandums are available on our website at http://www.fhwa.dot.gov/bridge/memos.htm.

Appendix - C Code of 3 - Load and Resistance Factor Rating (LRFR)reported in metric tons using MS loading

The code of 3 (Load and Resistance Factor Rating (LRFR) reported in metric tons using MS loading) for Items 63 and 65 had been included in the Coding Guide prior to the full development of the LRFD Specifications and the LRFR Manual. With the adoption of the LRFR Manual, load ratings computed by LRFR methods produce a RF based on HL-93 loading. An HL-93 loading cannot be equated to an MS loading, therefore a direct conversion from RF to MS loading is not possible.

A valid code of 3 involves reporting metric tons in terms of MS18 (32.4 metric tons) loading derived from a RF calculated using LRFR methods and HL-93 loading. This procedure does not produce an equivalent MS18 load. This procedure enables those States that utilize PONTIS, which currently does not support RF's, to input a LRFR as a tonnage value.

The methodology for LRFR allows the user to verify bridge safety and serviceability through a number of distinct procedures (LRFR Manual APPENDIX A.6.1, LOAD AND RESISTANCE FACTOR RATING FLOW CHART). Following these procedures, a RF based on an HL-93 loading will always be calculated while the RF for Legal Loads may be calculated. Therefore, it is the intent of FHWA that the NBI Code of 3 for Items 63 and 65 will no longer be valid for new load ratings of new or existing bridges after October 1, 2010. Bridges currently and correctly coded a 3 are not required to be re-rated.