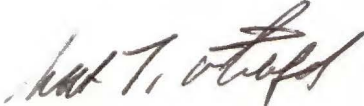




Department of Energy
Washington, DC 20585

July 5, 2017

MEMORANDUM FOR DISTRIBUTION

FROM: SCOTT L. WHITEFORD 
ACTING DIRECTOR
OFFICE OF ASSET MANAGEMENT

SUBJECT: Requirement to Conduct Load Rating and Scour Evaluations for DOE Bridges

REFERENCE: (1) Office of Engineering and Construction Management [memorandum, Requirements for Bridge Inspections](#), September 14, 2009
(2) [23 CFR 650](#), National Bridge Inspection Standards
(3) [49 CFR 237.71](#), Determination of Bridge Load Capacities
(4) Department of Energy *National Bridge Inspection Standard Compliance Review Plan of Corrective Actions*, July 28, 2014

Reference (1) established Department of Energy requirements for bridge inspections. This memorandum provides supplemental guidance to reference (1) for completing and reporting bridge load ratings and scour evaluations as required by references (2) and (3) in support of reference (4). Please distribute to the appropriate elements of your organization.

Program Offices must ensure vehicle bridges and railroad bridges within the DOE inventory are rated for safe load carrying capacity. If a load rating already exists, the rating must be peer reviewed by a qualified load rating engineer or railroad bridge engineer and certified as complete, current, and accurate, in accordance with the attached *Department of Energy Requirements for Load Rating and Scour Evaluation*. When an evaluation reveals the need for bridge posting or for establishing operational controls, appropriate action must be completed within 90 days of the load rating determination.

Program Offices must ensure each vehicle bridge and railroad bridge within the DOE inventory that crosses a waterway is evaluated for vulnerability to scour and stream instability from floods. If an evaluation already exists, it must be confirmed as complete, current, and accurate, in accordance with the attached guidance. When the evaluation reveals that a bridge is Scour Critical, Site or Field Officer Managers must develop and execute a bridge-specific Scour Critical Plan of Action.

The Attachment provides applicable references, acceptable procedures, and documentation submission requirements for required load ratings and scour evaluations. The load ratings and



scour evaluations should be completed no later than June 30, 2018 with priority given to structures included in the National Bridge Inventory. Plans and schedules for completing the assessments will be collected in January 2018 along with requests for the annual bridge inspection plan. Completed evaluations and supporting documentation should be submitted to my point of contact, Ms. Cindy Hunt, DOE Bridge Program Manager and Load Rating Engineer at 202-586-4539 or cindy.hunt@hq.doe.gov.

Attachment

Distribution:

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Department of Energy Requirements for Load Rating and Scour Evaluation

1. **Load Rating**¹. The intent of the load rating and posting provisions of the National Bridge Inspection Standards² (NBIS) and Bridge Safety Standards³ is to ensure that public access vehicle bridges and all in-service railroad bridges are appropriately evaluated to determine their safe live load carrying capacity and any load restrictions are appropriately posted. In addition, the Department of Energy (DOE) requires a load rating for each operational⁴, controlled access vehicle bridge. Load rate vehicle bridges in accordance with the American Association of State Highway and Transportation Officials (AASHTO) *The Manual for Bridge Evaluation* (MBE) (reference a). Load rate railroad bridges in accordance with the American Railway Engineering and Maintenance-of-Way Association (AREMA) *Manual for Railway Engineering* (reference b).

a. Requirements

(1) Vehicle Bridges

- i. Rate a vehicle bridge for its safe load carrying capacity of all unrestricted local State legal loads, including State routine permits loads in accordance with Section 6A of the AASHTO *Manual for Bridge Evaluation* (reference a).
- ii. The load rating must reflect the condition of the bridge as reported in the most recent bridge inspection report, if available. Any deficiencies that reduce member capacity will be reflected in the load capacity determination. If the effects of condition on capacities is unknown or uncertain, conduct a Special Inspection⁵ to adequately quantify location and extent of deficiencies. Account for any modifications to the bridge that affect loading on (e.g., change in dead loads) or response of the member being rated.
- iii. Base load ratings on as-built drawings that have been verified by field measurements. Where these drawings are not available, take field measurements. For those bridges where as-built drawings do not exist and where field measurements cannot adequately quantify capacity (e.g., bridges with reinforced concrete members), perform field testing or, alternatively, base the load rating on a field evaluation and documented engineering

¹ The measure of a bridge's load carrying capacity based on the individual components and existing structural conditions, material properties, loads, and traffic conditions at the bridge site.

² Code of Federal Regulations, 23 CFR Part 650, *National Bridge Inspection Standards*.

³ Code of Federal Regulations, 49 CFR 237, *Bridge Safety Standards*.

⁴ The Department of Energy Facilities Information Management System data validations will continue to verify *Safety Inspection Date, Status, and Usage Code*. Verification includes a drive by of every train bridge and vehicle bridge to confirm *Status and Usage Code*.

⁵ Performed when a structure requires more frequent inspection than is given by the Routine Inspection cycle, typically for a known defect or condition severe enough to warrant extra scrutiny. The frequency of Special Inspections are determined on a case-by-case basis.

Department of Energy Requirements for Load Rating and Scour Evaluation

judgment in accordance with Federal Highway Administration (FHWA) guidance, *ACTION: Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges - Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operating and Inventory Ratings* (reference c), and FHWA memorandum, *ACTION: Assigned Load Ratings* (reference d).

- iv. Coordinate with local State agencies to identify local State legal loads and if they comply with federal weight limits and the Bridge Formula (also known as Formula B) (reference e).
- v. Load rating methodology must comply with FHWA memorandum, *Bridge Load Ratings for the National Bridge Inventory* (reference f).
- vi. Evaluate bridge for the AASHTO HL 93 design vehicle for determining NBIS Data Items 64-Operating Rating⁶ and 66-Inventory Rating⁷ and to determine the need for evaluating State legal loads.
 - a. A Legal Load Rating⁸ is not required for bridges residing in States where the State legal loads do not comply with federal weight limits and Formula B AND the Inventory Rating factor is greater than 1.0.
 - b. A Legal Load Rating is not required for bridges residing in States where the State legal loads do comply with federal weight limits and Formula B AND the Operating Rating factor is greater than 1.0.
- vii. Determine load ratings and rating factors for Specialized Hauling Vehicles (SHVs) in accordance with FHWA memorandum, *Load Rating of Specialized Hauling Vehicles* (reference g).
- viii. If the Inventory Rating factor for the AASHTO HL 93 design vehicle is less than 0.9 using the Load and Resistance Factor Design (LRFD) method (reference h), determine load ratings and rating factors for Emergency Vehicles (EV2 and EV3) in accordance with FHWA memorandum, *Load Rating for the FAST Act's Emergency Vehicles* (reference i). FHWA, *Questions and Answers-Load*

⁶ Represents 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 [AASHTO MBE].

⁷ Represents the safe loading for application on a vehicle bridge on a day-to-day basis. It is the largest sustained live load that an existing structure can safely carry for an indefinite period of time without undergoing damage from repeated maximum loads [AASHTO MBE].

⁸ Represents the maximum size or weight limits permissible on a specified portion of road. The legal dimensions and weights vary between states.

Department of Energy Requirements for Load Rating and Scour Evaluation

Rating for the FAST Act's Emergency Vehicles (reference j) provides additional information.

- ix. If a load rating already exists, the rating must be peer reviewed and certified as complete, accurate, and in accordance with the MBE by a qualified load rating engineer.
- x. Post bridge for load restrictions where State legal loads exceed the calculated load capacity of the bridge.
 - a Post bridge load restrictions in accordance with the *Manual for Uniform Traffic Control Devices* (reference k) or local State requirements. Bridges may also be posted for speed to reduce impact loading.
- xi. Post bridge for load restrictions when evaluated for emergency vehicles.
 - a Post appropriately for both the governing single axle weight limit and tandem axle weight limit derived for each emergency vehicle configuration in accordance with reference (i).

(2) Railroad Bridges

- i. Rate a railroad bridge for the applicable limit states defined in the *AREMA Manual for Railway Engineering* (reference b).
- ii. Base load ratings on as-built drawings that have been verified by field measurements. Where as-built drawings do not exist and where field measurements cannot adequately quantify required dimensional data, field testing may be performed or judgment of the Railroad Bridge Engineer may be used to determine load capacity. Determinations by judgment can be based on history and current use of the bridge. For example, the bridge can be rated based on known weight of passing loads if there is no evidence of distress.
- iii. Evaluate each bridge for the Cooper E-80 Loading as defined in Figure 15-1-2 of reference (b). Consider other standard loading or loading consisting of specific equipment based on normal use of the bridge. The load rating must consider capacity of the superstructure as well as the substructure.
- iv. Conduct a Fatigue Evaluation on each bridge with Fatigue Susceptible Details following the procedures in Chapter 15 of reference (b). Live load stresses and traffic volumes must be known. A qualitative analysis may be completed for bridges with low traffic volumes and low stresses.

Department of Energy Requirements for Load Rating and Scour Evaluation

- v. Determine Normal⁹ Rating both with and without fatigue considerations. If there is a need to allow infrequent operation of loads greater than normal, determine Maximum¹⁰ Rating in accordance with reference (b). Fatigue need not be considered for maximum rating.

(3) Quality Control

- i. Conduct a Quality Control (QC) review on each load rating to include a review of calculations and procedures. Verify compliance with applicable references and criteria. Verify that reasonable assumptions were used and results were properly applied. The individual conducting the QC review must meet the same qualification requirements as the engineer conducting the load ratings.

b. Qualifications – Load Rater, Load Rate Reviewer, and Railroad Bridge Engineer

- (1) The load rating evaluation must be performed under the direction of a qualified engineer. Qualification requirements include:

- i. For vehicle bridges -
 - a Current registration as a professional engineer,
 - b At least 5 years of experience similar to load rating being performed,
 - c Completed National Highway Institute (NHI) Load Rating of Highway Bridges course or equivalent training, and
 - d Demonstrated working knowledge of the MBE and of rating methodology used in the given load rating.
- ii. For railroad bridges –
 - a Current registration as a professional engineer,
 - b At least 10 years of experience similar to that identified in 49 CFR 237.51(a), and
 - c Demonstrated working knowledge of the AREMA Manual and of rating methodology used in the given load rating.

c. Actions and Deliverables

(1) Vehicle Bridge Closing

- i. Immediately close to traffic any vehicle bridge with a load rating of 3 tons or less.

⁹ Represents that load which can be operated on a railroad bridge indefinitely without inducing damage.

¹⁰ Represents the load level that can be supported on a railroad bridge at infrequent intervals with applicable speed restrictions.

Department of Energy Requirements for Load Rating and Scour Evaluation

- ii. Notify Program management and the Office of Asset Management (MA-50) within seven (7) days of the determination of need to close a bridge. Notification to include evidence of bridge closure and an initial plan of action to mitigate impact on site operations.

(2) Vehicle Bridge Posting

- i. When the load rating evaluation reveals that the bridge requires posting, but is not, posting must be complete within ninety (90) days of load capacity determination.
- ii. Notify Program management and MA-50 within seven (7) days of the determination of posting need and provide a sign installation schedule.
- iii. Where posting is insufficient to ensure compliance with weight restrictions, engage law enforcement or install monitoring devices, including cameras, weigh-in-motion sensors, or radar stations.

(3) Railroad Bridge Restrictions

- i. For railroad bridges that have Normal Load Ratings less than normal load requirements, determine and document necessary operational restrictions within ninety (90) days of load capacity determination. These may involve speed restrictions, coordination with track operation personnel, or other operational constraints.
- ii. Issue instructions to the personnel who are responsible for the configuration and operation of trains to prevent the operation of cars, locomotives, or other equipment over a bridge that would exceed the capacity or dimensions of the bridge.

(4) Load Rating Reports

- i. Submit the load rating report within thirty (30) days of load rating to Program management and MA-50.
- ii. Report must include information about who performed the load rating, when the rating was performed, assumptions and known information about the bridge that were used in rating the bridge, loading information, capacity calculations, load rating methodology, load rating calculations and any computer input and output used to calculate the loads and/or the capacities. Identify local State legal loads as well as the State's compliance with federal weight limits and the Bridge Formula. Define terms and nomenclature used. State formulas used in the analysis and reference sources.

Department of Energy Requirements for Load Rating and Scour Evaluation

- iii. All calculations must be checked and initialed by the engineer who developed the calculations and by the engineer who checked them.
- iv. Document use of computer programs to include description of model (elements, boundary conditions, load application) and comparison of differences between the model and actual behavior. Calculations developed by computer analysis must include a cover page explaining the analysis performed and must be initialed by the engineer who developed the input and the engineer who checked the input and results. State why the differences are acceptable and how the results might be affected. Results should include load effect diagrams and deflection plots, as applicable.
- v. For vehicle bridges, include a summary of the calculation results including the inventory and operating ratings for the AASHTO Design vehicle, State Legal Loads if evaluated, and any required posting values for each vehicle type. Identify the controlling member(s).
- vi. For vehicle bridges, identify recommended data entries for NBIS Data Items 31, 41, 63 through 66, and 70 in accordance with the FHWA *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (NBIS Coding Guide) (reference I).
- vii. For railroad bridges, include a summary of the calculation methodology and results including the normal and maximum ratings for the Cooper E-80 loading, or any modified loading that is normal for the track. Identify the controlling member(s) for each load rating.
- viii. Include the qualifications of Load Rater or Railroad Bridge Engineer and Load Rate Reviewer.
- ix. Include quality control documentation.

(5) Bridge File

- i. Place all documents, including evaluator's qualifications, load rating calculations and reports, and all other deliverables in the site Bridge File.
- ii. When the bridge requires load limit posting, place evidence of bridge posting in the site Bridge File.
- iii. When operational restrictions are necessary, place evidence of such restrictions and enforcement procedures in the site Bridge File.

Department of Energy Requirements for Load Rating and Scour Evaluation

- iv. Upload documents included in the site Bridge File to DOE's Facility Information Management System (FIMS) using the Asset Level Attach Document window and Document Category "Bridge".
 - a. Begin the uploaded file name with the Usage Code and Real Property Unique ID Number (RPUID) and conclude with document date in YYYY.MM.DD format. For example: 1768-200677-Load Rating Report 2018.02.14.
 - b. Upload a separate "Table of Contents" document to identify all of the bridge documents uploaded by title and document date.
 - c. Use the "Notes" field for the property record in FIMS to record the type and date of evaluations performed.

2. **Scour Evaluation.** The intent of the scour evaluation is to identify the susceptibility of the bridge to scour, or erosion of soil surrounding a bridge foundation, which is the most common cause of highway bridge failure in the United States. The evaluation includes review of as-built foundation details; hydraulic studies, soundings, and other underwater investigations; knowledge of streambed and foundation soils; investigation of the current condition of the foundation; stream bed cross section profile measurements; stream flow rate measurements; and similar historical and current data.

a. Requirements

- (1) Evaluate each public access or operational, controlled access vehicle bridge and each in-service railroad bridge that crosses a waterway for vulnerability to scour and stream instability from floods per FHWA, *Hydraulic Engineering Circular No. 18 Evaluating Scour at Bridges* (reference m).
- (2) Conduct an underwater inspection where conditions are such that the stream bottom elevation around the foundations cannot be accurately measured by rods, poles, weighted sounding lines or other means.
- (3) Determine appropriate rating for NBIS Data Item 113- Scour Critical Bridges¹¹.
- (4) Develop and execute a bridge-specific Scour Critical Plan of Action (POA) for each bridge where NBIS Data Item 113 is coded "0", "1", "2", or "3", or where NBIS Data Item 60 is coded "1", "2", or "3" due to scour, or where foundations are unknown.

b. Qualifications. The scour evaluation must be performed by qualified personnel. Qualification requirements include:

¹¹ A scour critical bridge is one with abutment or pier foundations which are rated as unstable due to observed scour at the bridge site or a scour potential as determined from a scour evaluation study.

Department of Energy Requirements for Load Rating and Scour Evaluation

(1) Responsible Engineer

- i. Current registration as a professional engineer,
- ii. At least 5 years of experience similar to evaluation being performed,
- iii. Completed National Highway Institute (NHI) Stream Stability and Scour at Highway Bridges course or equivalent training , and
- iv. Confirmation¹² of passing an eye examination, with or without corrective lenses, to prove near vision acuity of Jaeger¹³ J-2 at 300 mm to 430 mm [12 in to 17 in] within the past three years.

(2) Team Leader

- i. Meets the requirements of 23 CFR 650.309(b), and
- ii. Confirmation of passing an eye examination, with or without corrective lenses, to prove near vision acuity of Jaeger J-2 at 300 mm to 430 mm [12 in to 17 in] within the past three years.

(3) Inspection Team Members

- i. Confirmation of passing an eye examination, with or without corrective lenses, to prove near vision acuity of Jaeger J-2 at 300 mm to 430 mm [12 in to 17 in] within the past three years, and
- ii. Completed a FHWA approved comprehensive inspection training course.
- iii. When an underwater inspection is required to complete the evaluation, diver must also meet the requirements of 23 CFR 650.309(d).

c. Actions and Deliverables.

(1) Bridge Closing

- i. Immediately close to traffic any bridge where the recommended rating code for NBIS Data Item 113 is "1" or where the recommended rating code for NBIS Data Item 60 is "1" based on scour.

¹² Do not collect medical records.

¹³ The results of visual acuity tests are used to prescribe eyeglasses or other corrective measures. The Grafco Jaeger Eye Chart has print samples of different sizes that are used to determine one's near vision. Eye examinations shall be administered by an Ophthalmologist, Optometrist, Medical Doctor, Registered Nurse or Certified Physician's Assistant or by other ophthalmic medical personnel, and must include the state or province license number.

Department of Energy Requirements for Load Rating and Scour Evaluation

- ii. Notify Program management and MA-50 within seven (7) days of the determination of need to close a bridge. Notification to include an initial plan of action to mitigate impact on site operations.
- iii. Submit a Scour Critical Plan of Action to Program management and MA-50 within sixty (60) days of the bridge closure.

(2) Scour Evaluation Report

- i. Submit the scour evaluation report within thirty (30) days of assessment to Program management and MA-50.
- ii. Report to include information about:
 - a Upstream conditions including the banks, main channel, floodplain, debris, and other features;
 - b Conditions at the bridge including the substructure, superstructure, channel protection and scour countermeasures, and waterway area; and,
 - c Downstream conditions including the banks, main channel, floodplain, and other features.
- iii. Include current streambed elevation data plotted to a common datum along with historical elevations plotted to the same datum. Present sounding data in tabular form and on an elevation drawing. Note the location and depth of the streambed at each point where a sounding was taken. Note evidence of stream migration.
- iv. Note the specific location and extent of any deterioration, damage, or undermining in stream channel or stream banks, substructure elements, or foundation. Note the condition of channel protection devices or scour countermeasures.
- v. For vehicle bridges, note data entries made in most recent inspection report for NBIS Data Items 60, 92, and 93.
- vi. Use sketches and photos to illustrate notes and findings.
- vii. For vehicle bridges, specifically identify recommended data entries for NBIS Data Items 61, 71, and 113 in accordance with the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (reference I).

Department of Energy Requirements for Load Rating and Scour Evaluation

- viii. Include the qualifications of the Responsible Engineer, Team Member(s), and Underwater Diver(s), as appropriate.

(3) Scour Critical Plan of Action (POA)

- i. Submit a written plan developed to identify the appropriate measures necessary to make the bridge less vulnerable to damage or failure due to scour. The POA should explain why the preferred actions were selected and address each of the following components:
 - a Monitoring program development and implementation,
 - b Timely installation of countermeasures to reduce the risk from scour, and
 - c Schedule for construction of appropriate countermeasures to eliminate the risk from scour.

The POA must include a commitment to quarterly progress reporting until corrective actions are satisfied. FHWA provides a customizable POA template (reference n).

- ii. Submit POA close-out report documenting completion of countermeasures and revised code for NBIS Data Element 113.

(4) Bridge File

- i. Place all documents, including qualifications for the responsible engineer, inspection team leaders and members; calculations and reports; and all other deliverables in the site Bridge File.
- ii. Upload documents included in the site Bridge File to FIMS using the Asset Level Attach Document window and Document Category, "Bridge".
 - a Begin the uploaded file name with the Usage Code and RPUID and conclude with document date in YYYY.MM.DD format. For example: 1768-206348-Scour Evaluation 2017.05.31.
 - b Upload a separate "Table of Contents" document to identify all of the bridge documents uploaded by title and date.
 - c Use the "Notes" field for the property record in FIMS to record the type and date of evaluations performed.

3. References

- a. American Association of State Highway and Transportation Officials. *The Manual for Bridge Evaluation*, Second Edition, with Interims Revisions.

Department of Energy Requirements for Load Rating and Scour Evaluation

- b. The American Railway Engineering and Maintenance-of-Way Association. *Manual for Railway Engineering*, Current Edition.
- c. Federal Highway Administration Memorandum, *ACTION: Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges (Coding Guide) - Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operating and Inventory Ratings*, February 2, 2011. <https://www.fhwa.dot.gov/bridge/110202.cfm>.
- d. Federal Highway Administration Memorandum, *ACTION: Assigned Load Ratings*, September 29, 2011. <https://www.fhwa.dot.gov/bridge/110929.cfm>.
- e. Federal Highway Administration, FHWA-HOP-06-105, *Bridge Formula Weights*, August 2006. https://ops.fhwa.dot.gov/freight/publications/brdg_frm_wgghts/index.htm
- f. Federal Highway Administration Memorandum, *INFORMATION: Bridge Load Ratings for the National Bridge Inventory*, October 30, 2006. <https://www.fhwa.dot.gov/bridge/nbis/103006.cfm>
- g. Federal Highway Administration Memorandum, *ACTION: Load Rating of Specialized Hauling Vehicles*, November 15, 2013. <https://www.fhwa.dot.gov/bridge/loadrating/131115.cfm>.
- h. American Association of State Highway and Transportation Officials, *LRFD Bridge Design Specifications*, 7th Edition with Interim Revisions. https://bookstore.transportation.org/collection_detail.aspx?ID=132
- i. Federal Highway Administration Memorandum, *ACTION: Load Rating for the FAST Act's Emergency Vehicles*, November 3, 2016. <https://www.fhwa.dot.gov/bridge/loadrating/161103.cfm>.
- j. Federal Highway Administration, *Questions and Answers, Load Rating for the FAST Act's Emergency Vehicles*, March 2017. https://www.fhwa.dot.gov/bridge/loadrating/fast1410_qa.pdf
- k. Federal Highway Administration, *Manual on Uniform Traffic Control Devices*, 2009 with revisions. https://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm.
- l. Federal Highway Administration, FHWA-PD-96-001, *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*, December 1995 with Errata Sheet, December 2003. <http://www.fhwa.dot.gov/bridge/bripub.htm>.
- m. Federal Highways Administration, FHWA-HIF-12-003, *Hydraulic Engineering Circular No. 18 Evaluating Scour at Bridges*, April 2012. <https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12003.pdf>.
- n. Federal Highways Administration, Scour Critical Bridge – Plan of Action template. <https://www.fhwa.dot.gov/engineering/hydraulics/bridgehyd/poatform.cfm>