Forest Service Handbook
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Forest Service Handbook 7709.56b – Transportation Structures Handbook
Chapter 100 - Trail Bridge Operation

Amendment: 7709.56b-2014-1

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Approved by: Gregory Smith, Acting Associate Deputy Chief, NFS

Date approved: November 18, 2014

Responsible Staff:

Explanation of changes: Following is an explanation of the changes throughout the directive by section.

7709.56b: The entire Handbook has been revised; refer to the digest for a summary of the revisions.

Zero Code: Makes minor technical and editorial changes, removes obsolete direction and terminology, and updates the coding system by changing from the one-digit to the two-digit coding system.

10: Recodes, reorganizes, and updates direction throughout the chapter. Makes minor technical and editorial changes, removes obsolete directions, and updates the coding system by changing from the one-digit to the two-digit coding system.

11: Recodes, reorganizes, and updates this section in its entirety. Replaces discussion of forest plans, ecosystem management, and least total cost method decisions with subsections on travel analysis and travel management decisions. Updates direction on road management to include direction on Trail Management Objectives and recodes the direction to section 11.3. Reduces scope of direction on alternatives to stay within limits of travel management decisions and the Road and Trail Management Objectives and recodes the direction to section 11.4. Recodes the remainder of the section to new section 11.5 entitled, "Project Development Process."

13: Sets forth new direction on inspection reports for existing structures and evaluation of load-carrying capacity of existing structures to listing of required design information.

20: Makes minor technical and editorial changes, removes obsolete direction, adds direction to meet Road and Trail Management Objectives, and updates the coding system by changing from the one-digit to the two-digit coding system throughout the chapter.

23: Adds direction to consider roadway widening needed to accommodate off-tracking of large trucks when curves are constructed close to bridges, to consider construction access to both sides of a stream, and to consider measures needed to maintain existing road traffic when replacing existing bridges.

30: Makes minor technical and editorial changes, removes obsolete direction, and updates the coding system by changing from the one-digit to the two-digit coding throughout the chapter.

34: Revises direction to conform to stream simulation requirements and to reference chapter 60.

35.4: Adds direction for identification of construction staging areas.

40: Makes minor technical and editorial changes and updates the coding system by changing from the one-digit to the two-digit coding throughout the chapter. Removes obsolete direction referencing economic analysis methods and flood insurance.

43.5: Updates direction to allow previously used materials only when they have been inspected, determined to be structurally adequate, economical and approved by the Regional Director of Engineering.

50: Changes chapter caption from "Hydrology" to "Hydrology and Geomorphology" and adds direction to require stream simulation and aquatic organism passage. Makes minor technical

and editorial changes and updates the coding system by changing from the one-digit to the two-digit coding system.

60: Changes chapter caption from “Hydraulics” to “Hydraulics and Watershed Protection” and adds direction to require stream simulation and aquatic organism passage. Makes minor technical and editorial changes and updates the coding system by changing from the one-digit to the two-digit coding system throughout the chapter. Removes obsolete direction.

70: Changes chapter caption from “Structural Design” to “Road Bridge Design” and updates the coding system by changing from the one-digit to the two-digit coding system throughout the chapter. Adds new direction and revises, reorganizes, and recodes direction throughout the entire chapter. Changes various section captions to be applicable for road bridge designs and sets forth new direction throughout the chapter. Removes obsolete direction.

80: Changes chapter caption from “Operations” to “Trail Bridge Design” and updates the coding system by changing from the one-digit to the two-digit coding system throughout the chapter. Sets forth direction for planning, design, and construction of trail bridges and other engineered trail structures.

90: Changes chapter caption from “Construction” to “Road Bridge Operation” and updates the coding system by changing from the one-digit to the two-digit coding system throughout the chapter. Revises, reorganizes, and recodes entire chapter. Major changes are: 1) removes the distinction and inspection requirements between bridges formerly known as NBIS and non-NBIS (National Bridge Inspection Standards), 2) removes all trail bridge references and guidance and 3) incorporates culvert guidance.

100: Establishes code, chapter “Trail Bridge Operation”, and sets forth direction for maintenance, inventorying, and operation of trail bridges and other engineered trail structures.

Table of Contents

100.6 - References

1. American Association of Highway and Transportation Officials (AASHTO). "AASHTO LRFD Bridge Design Specifications." Current Edition. The web address to order this publication is: https://bookstore.transportation.org/browse_bookstore.aspx.

2. AASHTO. "LRFD Guide Specification for the Design of Pedestrian Bridges". Current Edition. The web address to order this publication is: https://bookstore.transportation.org/browse_bookstore.aspx.

3. American Association of State Highway and Transportation Officials (AASHTO). "Manual for Bridge Evaluation". Current Edition. https://bookstore.transportation.org/browse_bookstore.aspx.

4. AASHTO. "Guide Specification for Strength Evaluation of Existing Steel and Concrete Bridges". https://bookstore.transportation.org/browse_bookstore.aspx.

5. U.S. Department of Agriculture, Forest Service (USDA-FS). "Identifying and Preserving Historic Bridges". 7100 Engineering. December 2000. Publication No. 0071-2854-MTDC. http://www.fs.fed.us/eng/php/eng_search.php?category=Program&srchword=05.

6. USDA-FS. "Sign and Poster Guidelines for the Forest Service". Current Edition. EM-7100-15. http://www.fs.fed.us/eng/techdev/sdtdc.htm.

7. USDA-FS. "Timber Bridges, Design, Construction, Inspection and Maintenance". EM-7100-8. August 1992. http://www.fpl.fs.fed.us/products/publications/.

8. USDA-FS. "Bridge Scour Evaluation: Screening, Analysis, and Countermeasures". EM-7700. Transportation Systems. September 1998. Publication NO. 9877 1207-SDTDC. http://www.fs.fed.us/eng/techdev/sdtdc.htm.

9. USDA-FS. "Identifying and Preserving Historic Bridges", EM-7100. December 2000. Publication No. 0071-2854-MTDC. http://www.fs.fed.us/eng/php/eng_search.php?category=Program&srchword=05.

10. U.S. Department of Transportation, Federal Highway Administration. "Bridge Inspector's Reference Manual". Current Edition. http://www.fhwa.dot.gov/bridge/elibrary.htm.

101 - Inspections

Inspect complex, major, and minor trail bridges and other engineered trail structures as specified below and in conformance with the trail bridge matrix in section 105.

Prepare and maintain inspection reports, records, and bridge inventories as prescribed in FSM 7737.3 and applicable regional guidance. Ensure that all required data are entered in Infra Trail Bridges Module.

101.1 - Scour Evaluation

Scour critical determinations and inspections are not required for trail bridges. However, trail bridges of significant value and importance or bridges whose failure could cause significant user safety or resource damage may be evaluated and inventoried for scour susceptibility per "Bridge Scour Evaluation: Screening, Analysis, and Countermeasures" (FSH 7709.56b, sec. 90.6).

101.2 - Historic Bridge Evaluation and Inventory

Record Historic Register status of bridges as outlined in USDA - Forest Service publication "Identifying and Preserving Historic Bridges".

102 - Qualifications of Inspection Personnel

1. Complex Trail Bridges. Inspectors shall be Bridge Inspection Team Leaders and shall be certified by the Regional Director of Engineering (FSM 7737.04c).

2. Major Trail Bridges. Inspectors shall be Bridge Inspection Team Leaders or shall successfully complete the National Trail Bridge Inspector Training and be certified by the Regional Director of Engineering (FSM 7737.04c).

3. Minor Trail Bridges. These bridges should be assessed by persons trained and qualified to perform Trail Assessment and Condition Surveys (TRACS).

4. Other Engineered Trail Structures. Inspector qualifications depend on the composition and complexity of the structure, the associated risk to the Inspector and the public, and the amount of any damage to the structure and should be determined by the Forest Supervisor in consultation with the Bridge Inspection Program Manager.

Review qualifications of any non-Forest Service Engineers before they perform complex trail bridge inspections and load ratings. Secure assistance from the Regional Bridge Engineer in that review.

103 - Trail Bridge Management

Record trail bridge inspection data in accordance with National and Regional guidance.

103.1 - Load Ratings

Load rate trail bridges and other engineered trail structures that have deteriorated or been damaged and that may no longer be structurally adequate to carry the intended users or snow load. A Certified Bridge Load Rating Engineer (FSM 7736.2) shall determine the safe load carrying capacity of these structures for their intended use.

New load ratings should conform to chapter 6 of AASHTO's Manual for Bridge Evaluation. Load rate trail bridges using the Load and Resistance Factor Rating (LRFR) method, regardless of bridge material. Existing trail bridges with a load rating based on a method other than LRFR do not need to be rated with LRFR, unless a new load rating is required due to changed conditions. Use LRFR for all new load ratings. Refer to FSH 7709.56b, section 82.3 for guidance on load combinations.

103.2 - Weight Limit Posting, Closing, and Signing

The Forest Supervisor, in consultation with the Bridge Inspection Program Manager, is responsible for posting or closing trail bridges or other engineered trail structures that have been determined to have inadequate capacity to carry their intended loads. Post, close, and sign trail bridges or other engineered trail structures as follows:

1. Post weight restrictions in accordance with AASHTO's Manual for Bridge Evaluation and the Sign and Poster Guidelines for the Forest Service (EM 7700-15).

2. Post the light vehicle design load for trail bridges that are at least 7 feet wide and that are accessible by motor vehicles larger than all-terrain vehicles.

3. Immediately close any trail bridge or other engineered trail structure when it is determined to be unsafe for current traffic and that traffic cannot be eliminated by posting weight restrictions or adding devices constraining use of the bridge.

4. In closing trail bridges and other engineered trail structures:

   a. Install signs and barricades at the bridge or structure. Signs and devices must meet the requirements of EM-7100-15.

   b. To the extent practicable, monitor closures to determine that signs and barricades are maintained in a satisfactory condition until they are no longer needed.

   c. Consider the possibility of vandalism of signs and devices when evaluating closure methods. When practicable, use a method that is less likely to be affected by vandalism in areas with known vandalism problems.

   d. When practicable, use physical barriers to prevent access.

   e. Post appropriate notice of the closure at trailheads and trail junctions.

   f. Issue an order under 36 CFR 261.55 when Forest Service enforcement of the closure is necessary (FSH 5309.11, ch. 32).

5. Do not rely on the prohibition against motor vehicle use on undesignated trails (36 CFR 261.13) as the sole means to prevent motor vehicle use on trail bridges and other engineered trail structures along undesignated trails. As appropriate, use the methods in FSH 7709.56b, section 103.2, paragraphs 1 through 3, for that purpose.

103.3 - Permanent Trail Bridge Files

Maintain a permanent file for each complex and major trail bridge, and each other engineered trail structure (FSM 7723.1 and 7737.1). Permanent trail bridge files should be maintained at a single location determined by Regional guidance. Permanent bridge files should be readily available to the Trail Bridge Inspection Program Manager and at a minimum should include:

1. As-built plans;
2. Inspection reports, including management summaries and photographs;
3. Load rating calculations, if applicable; and
4. A record of maintenance, repairs, and modifications.

103.4 - Object Markers

Delineate all four corners of a trail bridge on trails designated for motor vehicle use with properly located object markers installed in compliance with the current edition of the Manual on Uniform Traffic Control Devices and EM 7100-15.

104 - Privately Owned Trail Bridges and Other Engineered Trail Structures

Special-use authorizations for privately owned trail bridges and other engineered trail structures on NFS lands authorized by permit, term permit, lease, or easement (special-use authorizations) should include clauses for inspection, operation, and maintenance of these structures to adequately protect the public and National Forest System Lands and resources. The inspection, operation, and maintenance requirements within FSM 7737 and the guidance within this section are recommended for all trail structures designed and installed on NFS lands, regardless of ownership or jurisdiction.

Permit holders are responsible for compliance with these requirements and inspection, operation and maintenance costs for structures authorized by their permit.

104.1 - Inspection, Posting, and Signing

Ensure that inspections are performed on complex and major trail bridges and other engineered trail structures (FSM 7737.05) and that condition assessments are performed on minor trail bridges.

Ensure that the inspection requirements, inspection intervals, and inspector qualifications included in this chapter are followed.

Ensure that a bridge inspection file is maintained that is available to the Forest Service upon request and that at a minimum includes:

1. A current inspection report.

2. Bridge design calculations and plans, if available.

3. Photographs of the bridge, approaches, elevations, the channel upstream and downstream, and any visible deficiencies in the structure.

104.2 - Maintenance, Repair, and Replacement

Ensure that the holder provides a copy of plans for routine maintenance and any proposed repairs or replacement to the Authorized Officer for review prior to commencing the work. Ensure that the operating plan addresses how and when maintenance, repairs, and replacement will be conducted. Ensure that the operating plan allows the Authorized Officer to require the holder to develop a design, plans, and specifications for this work and abide by construction standards established by the Bridge Engineer per FSH 7709.56b, section 86.

105 - Exhibits

105.1 Trail Bridge Matrix

The following matrix (ex. 01) provides a summary of the definitions, inspection requirements, and data storage protocols for Trail Bridges, Trail Structures, and other structures commonly associated with trails.

105.1 – Exhibit 01

Trail Bridge Matrix

Structure	Definition	Inspection			Data Storage
		Inspector Requirements	Inspection Form	Inspection Interval[1]	
Trail Bridge	A trail structure, including supports, erected over a depression or obstruction such as a body of water, a road, a trail, or a railroad that provides a continuous pathway and that has a deck for carrying traffic or other loads. Trail bridges are divided into three categories for inspection purposes: 1. Complex trail bridges; 2. Major trail bridges; and 3. Minor trail bridges.				Infra Trail Bridges Module
Complex Trail Bridge	Any truss, suspension, or multi-span trail bridge; any trail bridge whose major load carrying elements[2] are not constructed of wood, regardless of width, span, or height; or any major trail bridge determined by the trail bridge inspection program manager to have increased design complexity, user or inspector risk, or decay or damage.	Requires a technical inspection by a person who: 1. Meets bridge inspection team leader requirements per the NBIS; and 2. Is certified by the Regional Director of Engineering.	Complex and Major Trail Bridge Inspection Form	60 months.[1]	Infra Trail Bridges Module

105.1 – Exhibit 01--Continued

Structure	Definition	Inspection			Data Storage
		Inspector Requirements	Inspection Form	Inspection Interval[1]	
Major Trail Bridge	Any trail bridge whose major load carrying elements[2] are constructed of wood, that has a clear span[3] greater than 20 feet, and that is not a complex trail bridge; or any minor trail bridge determined by the trail bridge inspection program manager to have increased design complexity, user or inspector risk, or decay or damage.	Requires a technical inspection by a person who: 1. Has successfully completed the National Trail Bridge Inspection Training; and 2. Is certified by the Regional Director of Engineering.	Complex and Major Trail Bridge Inspection Form (applicable sections)	60 months.[1]	Infra Trail Bridges Module
Minor Trail Bridge	Any trail bridge that is not a complex or major trail bridge.	Requires a condition assessment by a person qualified to perform TRACS.	TRACS Minor Trail Bridge Condition Assessment Form	Refer to current agency protocols.	Infra Trail Bridges Module
Other Engineered Trail Structure	A structure such as a fishing dock, elevated viewing platform, elevated boardwalk greater than 4 feet high,[4] retaining wall greater than 6 feet high,[5] or other engineered structure located on or adjacent to an NFS trail and that requires a certain level of technical expertise for design and inspection based on design complexity and potential user or inspector risk.	Depending on the structure, requires a technical inspection by a person qualified to inspect complex or major trail bridges or a condition assessment by a person qualified to perform TRACS, as deemed appropriate by the forest supervisor in consultation with the trail bridge inspection program manager.	Trail Bridge Inspection Form (applicable sections) or TRACS Form	60 months[1] for complex and major trail bridges. Refer to current agency protocols for minor trail bridges.	Infra Trail Bridge Module and Infra Trails Module

105.1 – Exhibit 01--Continued

Structure	Definition	Inspection			Data Storage
		Inspector Requirements	Inspection Form	Inspection Interval[1]	
Trail Structure	A constructed features on a trail, such as boardwalk, puncheon, or a retaining wall no more than 6 feet high.[5] See the Trail Data Dictionary for further information on identification of trail structures.	Requires a condition assessment by a person qualified to perform TRACS.	TRACS Form	Refer to current agency protocols.	Infra Trails Module

[1] A more frequent inspection interval may be appropriate due to the complexity, age, condition, and use of the structure.
[2] Main load carrying elements include the stringers or deck.
[3] The clear span is measured between abutment faces, along the centerline of the trail.
[4] Elevated boardwalk height is measured from the lowest adjacent ground surface to the top of the boardwalk deck.
[5] Retaining wall height is measured from the lowest adjacent ground surface to the top of the retaining wall.