Forest Service Handbook
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Forest Service Handbook 7709.56b – Transportation Structures Handbook
Zero Code

Amendment: 7709.56b-2014-1

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Duration: This amendment is effective until superseded or removed.

Superseded Directive: 7709.56b,contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 0 Code Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 0 Code, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 1 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,1 Amendment, 7709.56b-94-1, July 27, 1994; 7709.56b, 2 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,2, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 3 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,3, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 4 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,4, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 5 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,5, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b, 6 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,6, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b_7, Amendment 7709.56b-2005-1, August 26, 2005; 7709.56b_8, Amendment 7709.56b-2005-2, August 26, 2005; 7709.56b, 9 Contents, Amendment 7709.56b-94-1, July 27, 1994; 7709.56b,9, Amendment 7709.56b-94-1, July 27, 1994

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

02 - Objective

Plan, locate, survey, design, construct, operate, and maintain road and trail bridges and other engineered structures in a cost-effective, safe, and efficient manner, consistent with road and trail management objectives. This Handbook is intended for use by Engineers and Technicians who perform transportation program activity and management at all levels of the Forest Service.

03 - Policy

Plan, locate, survey, design, construct, operate, and maintain road and trail bridges and other engineered structures in accordance with applicable provisions of Title 23, Code of Federal Regulations (23 CFR), Executive Orders, direction in the FSM 7700 series, and this Handbook. Ensure that the above listed activities are performed and checked by qualified individuals.

05 - Definitions

In addition to definitions in FSM 7705, FSM 7720.5, FSM 7722.05, FSM 7723.05, FSM 7730.5, FSM 7736.05, FSM 7737.05, and the NBIS, the following definitions apply:

Annual Peak Flow. The maximum discharge that occurs during each year of record.

Bankfull Discharge. The flow of a stream at bankful stream width which occurs on average every 1-3 years.

Bankfull Stream Width (Bankfull). The width of a stream's surface when water has risen to a point where the banks are beginning to be overtopped and water is beginning to overflow onto the floodplain.

Clear Span. The distance between abutment faces of bridges, or between the inside of culvert corrugations, measure parallel to the centerline of the roadway.

Flow States:

1. Steady or Unsteady Flow. Indicates whether flow parameters such as discharge, depth, and velocity change with time at any cross-section.

2. Uniform or Non-uniform Flow. Indicates whether there are velocity or depth changes along the length of the channel. Non-uniform flow can be subdivided into gradually varied and rapidly varied flow.

3. Subcritical or Supercritical Flow. Indicates whether the flow at a particular cross-section is controlled by downstream conditions (subcritical low-flow velocity and high depth) or by upstream conditions (supercritical high-flow velocity and low depth).

Ford. A paved or unpaved stream crossing where the road profile has been dropped to near the stream channel bottom and all stream flow crosses over the riding surface of the crossing.

Geomorphic Design. A channel design that addresses the average bankfull channel dimensions, natural stream gradient, bedform, and planform of a stream; attempts to replicate them through a structure; reconnects the stream within the structure to the upstream and downstream channels; and meets most fish and other aquatic organism movement and habitat needs.

Hydraulic Capacity Design. A design that accommodates the maximum design flood, but which does not necessarily take into account the effects of debris and sediment transported in the flood water.

Hydrograph. A graph of flow versus time that gives the base flow of a stream prior to a rainfall event and also shows the increased flows over time, including the maximum peak flow, that result from the rainfall event.

Low-Water Structure. A structure, including a low-water bridge or a vented ford, designed to pass floods of a selected frequency over a traveled route.

Recurrence Interval. The number of years before there is a 50 percent chance a particular flood flow will have occurred.

Stream Simulation. A design approach where the stream channel through the crossing simulates the dimensions, character, and processes of the adjacent natural channel, ideally presenting no more of an obstacle to movement of organisms than the natural channel.

09 - References

The following Forest Service Handbooks are available at http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh. Reference these Handbooks to plan, design, construct, operate or maintain transportation structures:

1. Road Preconstruction Handbook, FSH 7709.56.
2. Road Construction Handbook, FSH 7709.57.
3. Road Maintenance Handbook, FSH 7709.58.
4. Trails Management Handbook, FSH 2309.18.