Washington State Department of Transportation

Publications Transmittal

Transmittal Number	Date
PT 11-067	September 2011

Publication Title / Publication Number
Bridge Design Manual M 23-50.07

Originating Organization
Engineering and Regional Operations, Bridge and Structures Office

Remarks and Instructions

The complete manual, revision packages, and individual chapters can be accessed at www.wsdot.wa.gov/publications/manuals/m23-50.htm.

Please contact Joe Fahoum at 360-705-7193 or fahoumj@wsdot.wa.gov with comments, questions, or suggestions for improvement to the manual.

For updating printed manuals, page numbers indicating portions of the manual that are to be removed and replaced are shown below.

Chapter	Remove Pages	Insert Pages
Title Page	i–ii	i–ii
Appendix 2.2-A3 Bridge Site Data Stream Crossing	2.2-A3-1 – 2.2-A3-2	2.2-A3-1 – 2.2-A3-2
Appendix 5.1-A7 Tension Lap Splice Lengths of Grade 60 Bars – Class B	5.1-A7-1 – 5.1-A7-2	5.1-A7-1 – 5.1-A7-2
Chapter 10 Signs, Barriers, Approach Slabs, and Utilities	10.8-7 – 10.8-8	10.8-7 – 10.8-8

To get the latest information, please sign up for email updates for individual manuals at www.wsdot.wa.gov/publications/manuals.

Washington State Department of Transportation
Publications Services
PO Box 47304
Olympia, WA 98504-7304

Phone: 360-705-7430
Email: engrpubs@wsdot.wa.gov

Approved By	Signature
Joe Fahoum	/s/

Washington State
Department of Transportation

TECHNICAL MANUAL

Bridge Design Manual (LRFD)

M 23-50.07

September 2011

Engineering and Regional Operations

Bridge and Structures Office

Americans with Disabilities Act (ADA) Information

Materials can be provided in alternative formats by calling the ADA Compliance Manager at 360-705-7097. Persons who are deaf or hard of hearing may contact that number via the Washington Relay Service at 7-1-1.

Title VI Notice to the Public

It is Washington State Department of Transportation (WSDOT) policy to ensure no person shall, on the grounds of race, color, national origin, or sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its federally funded programs and activities. Any person who believes his/her Title VI protection has been violated may file a complaint with WSDOT's Office of Equal Opportunity (OEO). For Title VI complaint forms and advice, please contact OEO's Title VI Coordinator at 360-705-7082 or 509-324-6018.

To get the latest information on WSDOT publications, sign up for individual email updates at www.wsdot.wa.gov/publications/manuals.

Washington State Department of Transportation

Bridge Site Data Stream Crossings

Region	Made By	Date

Bridge Information

SR	Bridge Name	Control Section	Project No.

Highway Section	Section, Township & Range	Datum (e.g. NGVD29, NAVD88, USGS)

Name of Stream	Tributary of

Elevation of W.S. *(@ Date/Time of survey)*

____

Streambed Material

☐ Fines ☐ Gravel ☐ Boulder
☐ Sand ☐ Cobble

☐ **Non-Tidal**

	Flow (CFS)	WSE (ft)
2-YR	________	________
100-YR	________	________
500-YR	________	________

☐ **Tidal**

	Flow (CFS)	WSE (ft)
2-YR	________	________
100-YR	________	________
500-YR	________	________
MLLW		________
MHHW		________

Amount and Character of Drift

____

Manning's "N" Value *(Est.)*

____

Attachments

☐ Site Contour Map *(See Sect. 710.04 WSDOT Design Manual)*

☐ Highway Alignment and Profile *(refer to base map and profiles)*

☐ Streambed: Profile and Cross Sections *(See Sect. 710.04 WSDOT Design Manual)*

☐ Photographs

☐ Character of Stream Banks *(e.g., rock, silt.)* / Location of Solid Rock

☐ Other Data Relative to Selection of Type and Design of Bridge, Including your Recommendations *(e.g., requirements of riprap, permission of piers in channel.)*

DOT Form 235-001 EF
Revised 08/2011

Tension Lap Splice Lengths of Grade 60 Uncoated Bars – Class B

Bar Size	f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 5,000 psi		f'_c = 6,000 psi	
	Top Bars	Others	Top Bars	Others	Top Bars	Others	Top Bars	Others
#3	2′-0″	2′-0″	2-0″	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″
#4	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″
#5	2′-4″	2′-0″	2′-4″	2′-0″	2′-4″	2′-0″	2′-4″	2′-0″
#6	2′-11″	2′-1″	2′-9″	2′-0″	2′-9″	2′-0″	2′-9″	2′-0″
#7	4′-0″	2′-11″	3′-6″	2′-6″	3′-3″	2′-4″	3′-3″	2′-4″
#8	5′-3″	3′-9″	4′-7″	3′-3″	4′-11″	2′-11″	3′-9″	2′-8″
#9	6′-8″	4′-9″	5′-9″	4′-2″	5′-2″	3′-9″	4′-9″	3′-5″
#10	8′-6″	6′-1″	7′-4″	5′-3″	6′-7″	4′-8″	6′-0″	4′-4″
#11	10′-5″	7′-5″	9′-0″	6′-5″	8′-1″	5′-9″	7′-4″	5′-3″
#14	Lap Splices		Lap Splices		Lap Splices		Lap Splices	
#18	Not Allowed		Not Allowed		Not Allowed		Not Allowed	

Tension Lap Splice Lengths of Grade 60 Epoxy Coated Bars – Class B

Bar Size	f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 5,000 psi		f'_c = 6,000 psi	
	Top Bars	Others	Top Bars	Others	Top Bars	Others	Top Bars	Others
#3	2′-3″	2′-0″	2′-3″	2′-0″	2′-3″	2′-0″	2′-3″	2′-0″
#4	2′-3″	2′-0″	2′-3″	2′-0″	2′-3″	2′-0″	2′-3″	2′-0″
#5	2′-10″	2′-6″	2′-10″	2′-6″	2′-10″	2′-6″	2′-10″	2′-6″
#6	3′-7″	3′-2″	3′-4″	3′-0″	3′-4″	3′-0″	3′-4″	3′-0″
#7	4′-11″	4′-4″	4′-3″	3′-9″	3′-11″	3′-5″	3′-11″	3′-5″
#8	6′-5″	5′-8″	5′-7″	4′-11″	5′-0″	4′-5″	4′-6″	4′-0″
#9	8′-1″	7′-2″	7′-0″	6′-2″	6′-3″	5′-7″	5′-9″	5′-1″
#10	10′-3″	9′-1″	8′-11″	7′-10″	8′-0″	7′-0″	7′-3″	6′-5″
#11	12′-8″	11′-2″	10′-11″	9′-8″	9′-9″	8′-0″	8′-11″	7′-11″
#14	Lap Splices		Lap Splices		Lap Splices		Lap Splices	
#18	Not Allowed		Not Allowed		Not Allowed		Not Allowed	

Top bars are so placed that more than 12″ of concrete is cast below the reinforcement.

Modification factor for spacing ≥ 6″ and side cover ≥ 3″ = 0.8.

Modification factor for reinforcements enclosed in spirals = 0.75.

Definition of splice classes:
- Class A: Low stressed bars – 75% or less are spliced
- Class B: Low stressed bars – more than 75% are spliced
  High stressed bars – 50% or less are spliced
- Class C: High stressed bars – more than 50% are spliced

Class B lap splice is the preferred and most commonly used by Bridge Office.

Modification factor for Class A = 0.77
Modification factor for Class C = 1.31
Modification factor for 3-bar bundle = 1.2

10.8.5 Conduit Types

All electrical conduits shall be galvanized Rigid Metal Conduit (RGS) or Rigid Polyvinyl Chloride Conduit (PVC).

Steel Pipe – All pipe and fittings shall be galvanized except for special uses.

PVC Pipe – PVC pipe may be used with suitable considerations for deflection, placement of expansion fittings, and of freezing water within the conduits. PVC pipe should not be placed in concrete traffic barriers when the slip form method is used due to damage and pipe separation that often occurs during concrete placement.

10.8.6 Utility Supports

The following types of supports are generally used for various utilities. Selection of a particular support type should be based on the needs of the installation and the best economy. All utility installations shall address temperature expansion in the design of the system or expansion devices.

Utility supports shall be designed so that a failure will not result in damage to the bridge, the surrounding area, or be a hazard to traffic. Utility supports shall be designed so that any loads imposed by the utility installation do not overstress the conduit, supports, bridge structure, or bridge members.

Designs shall provide longitudinal and transverse support for loads from gravity, earthquakes, temperature, inertia, etc. It is especially important to provide transverse and longitudinal support for inserts that cannot resist moment.

The Bridge Engineer should request calculations from the utility company for any attachment detail that may be questionable. Utility attachments, which exert moments or large forces at the supports, shall be accompanied by at least one set of calculations from the utility company. Bridge attachments designed to resist surge forces should always be accompanied by calculations.

Concrete Embedment – This is the best structural support condition and offers maximum protection to the utility. Its cost may be high for larger conduit and the conduit cannot be replaced.

Pipe Hangers – Utility lines shall be suspended by means of cast-in-place inserts, whenever possible. This is the most common type of support for utilities to be hung under the bridge deck. This allows the use of standard cast-in-place inserts and is very flexible in terms of expansion requirements. For heavy pipes over traffic (10″ water main or larger), a Safety Factor of 1.5 should be used to resist vertical loads for Strength design. This is to avoid complete failure of the utility hanger system by failure of one hanger. Vertical inserts will not provide resistance to longitudinal forces. Longitudinal and transverse supports shall be provided for ITS conduits. Vertical supports shall be spaced at 5 foot maximum intervals for telephone and power conduits, and at a spacing to resist design loads for all other utilities.

When 3/4″ or 7/8″ diameter hanger rods are suspended from cast-in-place inserts, at least three of the following inserts shall be identified: Cooper B-Line B22-I Series, Unistrut 3200 Series, Powerstrut 349 Series, Halfen HT5506 or similar. The specific cast-in-place insert within each series shall be identified based on the required length of insert. The cast-in-place insert shall be at least 6” long and hot dipped galvanized per AASHTO M 111 or AASHTO M 232.

The Bridge Engineer shall verify that the insert does not interfere with reinforcement in the bridge deck since the inserts are installed level longitudinally and transversely. When the superelevation of the roadway is not significant, a single, long insert may be used to support multiple hanger rods. When the superelevation becomes significant, a single insert may be used for each hanger.

Occasionally large diameter utilities require pipe rolls that only fit on 1” diameter hanger rods. When 1” diameter hanger rods are required, the Anvil Fig. 286 insert shall be used. The designer shall only specify this insert when absolutely necessary.

The Bridge Engineer shall verify that the cast-in-place insert has sufficient capacity to support the loads from the hanger rod.

Transverse supports may be provided by a second hanger extending from a girder or by a brace against the girder. The Appendix 10.8-A1-1 and 10.8-A1-2 depict typical utility support installations and placement at abutments and diaphragms. Transverse supports shall, at a minimum, be located at every other vertical support.