MaineDOT Scour Countermeasures

Camden
Bridge No. 5077
WIN 18334.00

Knox County
Route 105 (Washington Street)
Woolen Mill Bridge
over
Megunticook River

Hydraulic Design Calcuations

3/21/2013

STATE OF MAINE
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LICENSED PROFESSIONAL ENGINEER

Signature

11944
P.E. Number

4-12-13
Date

Riprap Sizing at Abutments

Designed by: OGM
Checked by: SVE

Project Number: 23921
Project Name: Bridge 5077, Woolen Mill Bridge over the Megunticook River in the town of Camden ME.
100-year flood event data

Given:

If Fr <= 0.8, $d_{50} = \frac{yK(V^2)}{(S_g - 1)(gy)}$ **If Fr > 0.8,** $d_{50} = \frac{yK(V^2)^{0.14}}{(S_g - 1)(gy)^{0.14}}$

User Input:

Acceleration due to gravity, g =	32.2 ft/s2	
English (E) or Metric (M) Units =	E	
Specific gravity of riprap (2.65 typical), S_g =	2.65	
S (Spill-through) or V (Vertical wall) Abutment =	V	
Average Velocity in Contracted Section, V_{avg} =	7.8 ft/s	PDR Report
Depth of Flow in Contracted Section, y =	10.4 ft	PDR Report
K =	1.02	
Froude Number = (V/gy)1/2 =	0.426236	

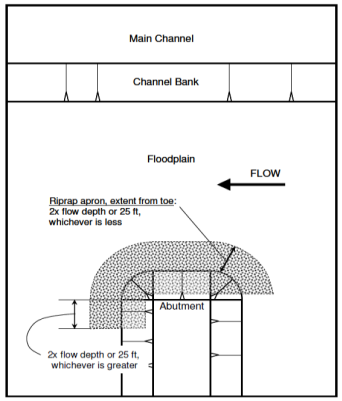

Figure 14.7 Plan view of the extent of rock riprap apron

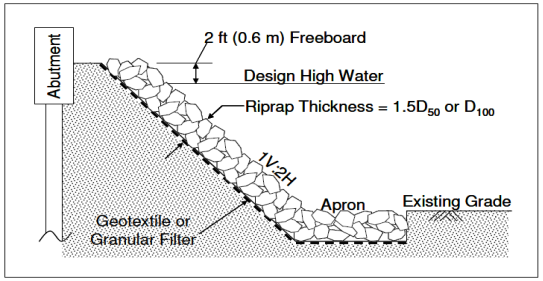

Figure 14.8 Typical cross section for abutment riprap

Result:

Median Stone Diameter, d_{50} =	**1.2 ft**
Recommended MEDOT Riprap =	**Item 610.11- Stone Blanket**
Gradation Specification =	**D50 = 2.3 ft DMax = 3.3 ft**
Layer Thickness (t), (1.5 x d_{50})=	**3.5 ft**
Extent from toe =	**20.8 ft**

Notes:

Velocity and Depth values based on PDR Report and Camden Design Plans.
Due to the uncertainty associated with the design parameters, the smallest stone fill gradation specified for installation at an abutment will be MaineDOT Stone Blanket.
Increase layer thickness by 50% if placed underwater.
Reference: U.S. Department of Transportation, Federal Highway Administration, "Hydraulic Engineering Circular No. 23, Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance - Third Edition," Volumes 1 & 2, September 2009.