Pass Creek

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 36362370 Date 8/17/11 Initials CW Region (A (B) C D)

Site _____ Location 4.1 mi E of Long Valley

Q_{100} = 12500 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. ✓

Bridge discharge (Q_2) = 8749 (should be Q_{100} unless there is a relief bridge, road overflow, or bridge overtopping)

Analytical Procedure for Estimating Hydraulic Variables Needed to Apply Method

PGRM: "RegionA", "RegionB", "RegionC", or "RegionD"

Bridge Width = 68 ft. Flow angle at bridge = 0 ° Abut. Skew = 0 ° Effective Skew = 0 °

Width (W_2) iteration = ~~[illegible]~~ 68 _____ _____ _____

Avg. flow depth at bridge, y_2 iteration = 16.7 → 13.8 _____ _____ _____

Corrected channel width at bridge Section = W_2 times cos of flow angle = 68 ft* $q_2 = Q_2/W_2$ = 128.7 ft^2/s

Bridge Vel, V_2 = 9.3 ft/s Final $y_2 = q_2/V_2$ = 13.8 ft Δh = 1.8 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 15.6 ft

** NOTE: repeat above calculations until y_2 changes by less than 0.2* *Effective pier width = L sin(q) + a cos(q)*

If y_2 is above LS, then account for Road Overflow using PRGM: RDOVREGA, RDOVREGB, RDOVREGC, or RDOVREGD,

Water Surface Elev. = _____ ft

Low Steel Elev. = 13.8 ft

n (Channel) = 0.035

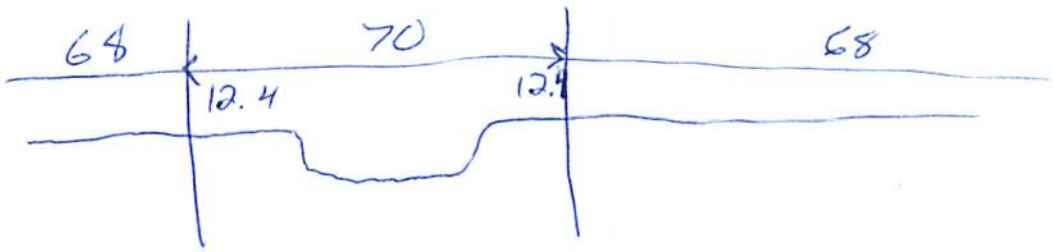
n (LOB) = 0.033

n (ROB) = 0.033

Pier Width = 1.7 ft

Pier Length = 1.7 ft

Piers for 100 yr = 2 ft



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 70 ft

Width of left overbank flow at approach, W_{lob} = 68 ft Average left overbank flow depth, y_{lob} = 12.4 ft

Width of right overbank flow at approach, W_{rob} = 68 ft Average right overbank flow depth, y_{rob} = 12.4 ft

Live Bed Contraction Scour (use if bed material is small cobbles or finer)

x = 25.06 From Figure 9 W_2 (effective) = 64.6 ft y_{cs} = 20.4 ft

PGRM: CWCSNEW

Clear Water Contraction Scour (use if bed material is larger than small cobbles)

Estimated bed material D_{50} = _____ ft Average approach velocity, $V_1 = Q_{100}/(y_1 W_1)$ = _____ ft/s

Critical approach velocity, $Vc = 11.17 y_1^{1/6} D_{50}^{1/3}$ = _____ ft/s

If $V_1 < V_c$ and $D_{50} >= 0.2$ ft, use clear water equation below, otherwise use live bed scour equation above.

$D_{c50} = 0.0006(q_2/y_1^{7/6})^3$ = _____ ft If $D_{50} >= D_{c50}$, $\chi = 0.0$

Otherwise, $\chi = 0.122 y_1 [q_2/(D_{50}^{1/3} y_1^{7/6})]^{6/7} - y_1$ = _____ From Figure 10, y_{cs} = _____ ft

PIER SCOUR CALCULATIONS

PGRM: Pier

L/a ratio = 1.0 Correction factor for flow angle of attack (from Table 1), K2 = 1.0

Froude # at bridge = 0.44 Using pier width a on Figure 11, ξ = 7.0 Pier scour y_{ps} = 6.2 ft

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 12.4 ft right abutment, y_{aRT} = 12.4 ft

Shape coefficient K_1= 1.00 for vertical-wall, 0.82 for vertical-wall with wingwalls, 0.55 for spill-through

Using values for y_{aLT} and y_{aRT} on figure 12, ψ_{LT} = 23.3 and ψ_{RT} = 23.3

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 23.3 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 23.3 ft

15.6
9.3
7.3
5.1 12.4

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 36362370 Date 6/17/11 Initials CW Region (A B C D)

Site _____ Location 4.1 mi E of Long Valley

Q50 Q_{500} = 8290 by: drainage area ratio____ flood freq. anal. ____ regional regression eq. ____

Bridge discharge (Q_2) = 8290 (should be Q_{500} unless there is a relief bridge, road overflow, or bridge overtopping)

Analytical Procedure for Estimating Hydraulic Variables Needed to Apply Method

PGRM: "RegionA", "RegionB", "RegionC", or "RegionD"

Bridge Width = 68 ft. Flow angle at bridge = 0 ° Abut. Skew = 0 ° Effective Skew = 0 °

Width (W_2) iteration = 68

Avg. flow depth at bridge, y_2 iteration = 13.4 Vert Wall

Corrected channel width at bridge Section = W_2 times cos of flow angle = 68 ft* $q_2 = Q_2/W_2$ = 121.9 ft^2/s

Bridge Vel, V_2 = 9.1 ft/s Final $y_2 = q_2/V_2$ = 13.4 ft Δh = 1.7 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 15.1 ft

** NOTE: repeat above calculations until y_2 changes by less than 0.2* *Effective pier width = L sin(q) + a cos(q)*

If y_2 is above LS, then account for Road Overflow using PRGM: RDOVREGA, RDOVREGB, RDOVREGC, or RDOVREGD,

Water Surface Elev. = _____ ft

Low Steel Elev. = _____ ft

n (Channel) = 0.035

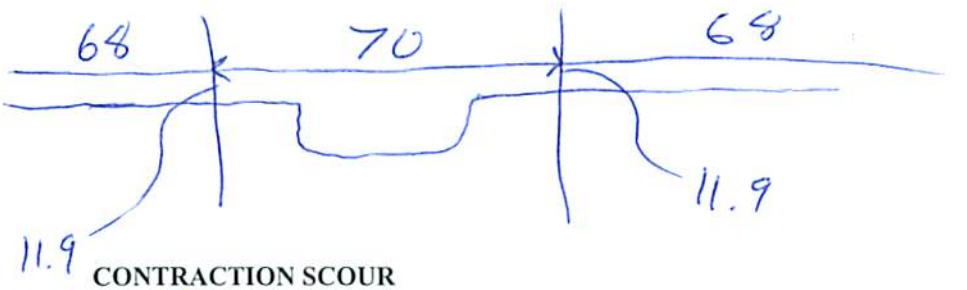
n (LOB) = 0.033

n (ROB) = 0.033

Pier Width = 1.7 ft

Pier Length = 1.7 ft

Piers for 500 yr = 2 ft



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 70 ft

Width of left overbank flow at approach, W_{lob} = 68 ft Average left overbank flow depth, y_{lob} = 11.9 ft

Width of right overbank flow at approach, W_{rob} = 68 ft Average right overbank flow depth, y_{rob} = 11.9 ft

Live Bed Contraction Scour (use if bed material is small cobbles or finer)

x = 23.93 From Figure 9 W_2 (effective) = 64.6 ft y_{cs} = 19.8 ft

PGRM: CWCSNEW

Clear Water Contraction Scour (use if bed material is larger than small cobbles)

Estimated bed material D_{50} = _____ ft Average approach velocity, $V_1 = Q_{500}/(y_1 W_1)$ = _____ ft/s

Critical approach velocity, $Vc = 11.17 y_1^{1/6} D_{50}^{1/3}$ = _____ ft/s

If $V_1 < V_c$ and $D_{50} >= 0.2$ ft, use clear water equation below, otherwise use live bed scour equation above.

$D_{c50} = 0.0006(q_2/y_1^{7/6})^3$ = _____ ft If $D_{50} >= D_{c50}$, $\chi = 0.0$

Otherwise, $\chi = 0.122 y_1 [q_2/(D_{50}^{1/3} y_1^{7/6})]^{6/7} - y_1$ = _____ From Figure 10, y_{cs} = _____ ft

PIER SCOUR CALCULATIONS

PGRM: Pier

L/a ratio = 1.0 Correction factor for flow angle of attack (from Table 1), K2 = 1.0

Froude # at bridge = 0.44 Using pier width a on Figure 11, ξ = 7.0 Pier scour y_{ps} = 6.2 ft

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 11.9 ft right abutment, y_{aRT} = 11.9 ft

Shape coefficient K_1= 1.00 for vertical-wall, 0.82 for vertical-wall with wingwalls, 0.55 for spill-through

Using values for y_{aLT} and y_{aRT} on figure 12, ψ_{LT} = 22.9 and ψ_{RT} = 22.9

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 22.9 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 22.9 ft

14 11
15.1
8.3
6.8
5.1 11.9

272 St

Route Long Valley Rd Stream Pass Clk MRM _____ Date 6/17/11 Initials CM

Bridge Structure No. 36362370 Location 4.1 mi E of Long Valley

GPS coordinates: N 43° 27' 41.8" W 101° 24' 44.4" taken from: USL abutment X centerline of ⊥ MRM end _____

Datum of coordinates: WGS84 X NAD27 _____

Drainage area = 89.70 sq. mi.

The average bottom of the main channel was 17.5 ft below top of guardrail at a point 24 ft from left abutment.

Method used to determine flood flows: ____Freq. Anal. ____drainage area ratio ✓ regional regression equations.

Pk calc'd 8/8

MISCELLANEOUS CONSIDERATIONS

Flows	Q_{100} = 12500 8749 3751			~~Q_{500}~~ Q_{50} = 8290 8290		
Consideration	Yes	No	Possibly	Yes	No	Possibly
Chance of overtopping	X					X
Chance of Pressure flow	X					X
Armored appearance to channel		X			X	
Lateral instability of channel			X			X

2	349
5	1280
10	2560
25	5240
50	8290
100	12500
500	28400

Riprap at abutments? ____Yes X No ____Marginal

Evidence of past Scour? X Yes ____No ____Don't know L. Abut piles exposed

Debris Potential? ____High ____Med X Low

Does scour countermeasure(s) appear to have been designed?

Riprap ____Yes ____No ____Don't know X NA

Spur Dike ____Yes ____No ____Don't know X NA

Other _____ ____Yes ____No ____Don't know X NA

Bed Material Classification Based on Median Particle Size (D_{50})

Material	Silt/Clay X	Sand ____	Gravel ____	Cobbles ____	Boulders ____
Size range, in mm	<0.062	0.062-2.00	2.00-64	64-250	>250

Comments, Diagrams & orientation of digital photos

1996 - ID 02 - US Face

97 - US

98 - US RB

99 - US LB

2000 - L. Abut Scour

01 - R. Abut

Summary of Results

	Q100	~~Q500~~ Q50
Bridge flow evaluated	8749	8290
Flow depth at left abutment (yaLT), in feet	12.4	11.9
Flow depth at right abutment (yaRT), in feet	12.4	11.9
Contraction scour depth (ycs), in feet	20.4	19.8
Pier scour depth (yps), in feet	6.2	6.2
Left abutment scour depth (yas), in feet	23.3	22.9
Right abutment scour depth (yas), in feet	23.3	22.9
1Flow angle of attack	0°	0°

See Comments/Diagram for justification where required

12500.0
8749
3751