Turkey Ridge Creek

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 63070165 Date 10/9/11 Initials CW Region (A B C D)

Site _____ Location 8.3 mi W + 0.4 mi S of Parker Hurley on 447 Ave

Q_{100} = 3600 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. ✓

Bridge discharge (Q_2) = 3600 (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 = ~~84~~ 90 ft. Flow angle at bridge = 5 ° Abut. Skew = 0 ° Effective Skew = 5 °

Width (W_2) iteration = 90

Avg. flow depth at bridge, y_2 iteration = 4.9 → Vert Wall

Corrected channel width at bridge Section = W_2 times cos of flow angle = 89.66 ft* $q_2 = Q_2/W_2$ = 40.2 ft²/s

Bridge Vel, V_2 = 4.5 ft/s Final $y_2 = q_2/V_2$ = 8.9 ft Δh = 0.4 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 9.3 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. = 10.3 ft

n (Channel) = 0.037

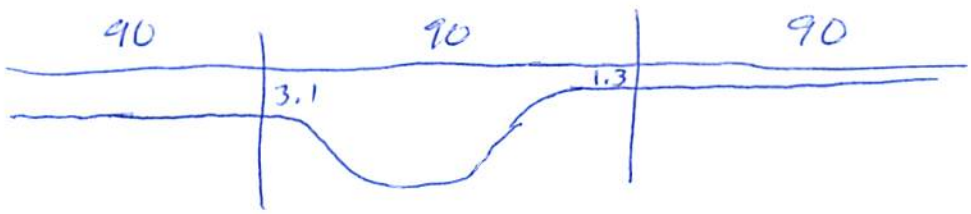
n (LOB) = 0.060

n (ROB) = 0.030

Pier Width = 1.67 ft

Pier Length = 1.68 ft

Piers for 100 yr = 3 ft



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 90 ft

Width of left overbank flow at approach, W_{lob} = 90 ft Average left overbank flow depth, y_{lob} = 3.1 ft

Width of right overbank flow at approach, W_{rob} = 90 ft Average right overbank flow depth, y_{rob} = 1.3 ft

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

x = 2.02 From Figure 9 W_2 (effective) = 84.7 ft y_{cs} = 2.6 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, $\chi = 0.122 y_1 [\dot{q}_2/(D_{50}^{1/3} y_1^{7/6})]^{6/7} - y_1$ = _____ 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 = 0.27 Using pier width a on Figure 11, ξ = 7.0 Pier scour y_{ps} = 5.7 ft

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 3.1 ft right abutment, y_{aRT} = 1.3 ft

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

Using values for y_{aLT} and y_{aRT} on figure 12, ψ_{LT} = 11.7 and ψ_{RT} = 5.5

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 11.7 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 5.5 ft

62
25
87

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 63070165 Date 10/9/11 Initials GW Region (A B C D)

Site _____ Location 8.3 mi W & 0.4 mi S of ~~Harley~~ Parker on 447 Ave

Q_{500} = 7300 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. ~~Harley~~ Parker

Bridge discharge (Q_2) = 4774 (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 = 90 ft. Flow angle at bridge = 5 ° Abut. Skew = 0 ° Effective Skew = 5 °

Width (W_2) iteration = 90

Avg. flow depth at bridge, y_2 iteration = 12.7 > 10.3 > RD Overflow

Corrected channel width at bridge Section = W_2 times cos of flow angle = 89.66 ft* $q_2 = Q_2/W_2$ = 53.3 ft^2/s

Bridge Vel, V_2 = 5.2 ft/s Final $y_2 = q_2/V_2$ = 10.3 ft Δh = 0.5 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 10.8 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. = 10.3 ft

n (Channel) = 0.037

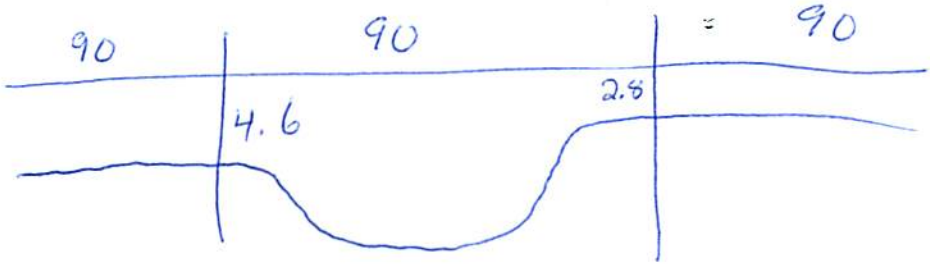
n (LOB) = 0.060

n (ROB) = 0.030

Pier Width = 1.67 ft

Pier Length = 1.65 ft

Piers for 500 yr = 3 ft



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 90 ft

Width of left overbank flow at approach, W_{lob} = 90 ft Average left overbank flow depth, y_{lob} = 4.6 ft

Width of right overbank flow at approach, W_{rob} = 90 ft Average right overbank flow depth, y_{rob} = 2.8 ft

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

x = 3.53 From Figure 9 W_2 (effective) = 84.7 ft y_{cs} = 4.5 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

PGRM: Pier

PIER SCOUR CALCULATIONS

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

Froude # at bridge = 0.29 Using pier width a on Figure 11, ξ = 7.0 Pier scour y_{ps} = 5.9 ft

PGRM: Abutment

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, y_{aLT} = 4.6 ft right abutment, y_{aRT} = 2.8 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} = 14.3 and ψ_{RT} = 11.2

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 14.3 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 11.2 ft

Route 447 Ave Stream ~~Tree~~ Turkey Ridge Ck MRM _____ Date 10/9/11 Initials CG

Bridge Structure No. 63070165 Location 6.3 mi W + 0.4 mi S of ~~Hurley~~ Burkey on 447 Ave

GPS coordinates: N 43° 15' 51.7" W 97° 15' 36.3" taken from: USL abutment X centerline of MRM end _____

Datum of coordinates: WGS84 X NAD27 ____

Drainage area = 53.44 sq. mi.

The average bottom of the main channel was 14.0 ft below top of guardrail at a point 30 ft from left abutment.

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

MISCELLANEOUS CONSIDERATIONS

Flows	Q_{100} = 3600			Q_{500} = 7300		
Estimated flow passing through bridge	3600			4778		
Estimated road overflow & overtopping				2522		
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	

8/26

2	114
5	428
10	831
25	1640
50	2490
100	3600
500	7300

Riprap at abutments? ____Yes ____No X Marginal

Evidence of past Scour? ⊗ Yes ____No X Don't know Not at bridge; bank scour US + DS from bridge

Debris Potential? ____High X Med ____Low

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

Riprap	____Yes	~~X~~ No	X Don't know	____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

~~2074~~ Photos

2074-1D

75-US

76-US RB

77-US LB

~~78~~

79-L. Abut

80-R. Abut

81-US Face

*Channel is incised

Summary of Results

	Q100	Q500
Bridge flow evaluated	3600	4778
Flow depth at left abutment (yaLT), in feet	3.1	4.6
Flow depth at right abutment (yaRT), in feet	1.3	2.8
Contraction scour depth (ycs), in feet	2.6	4.5
Pier scour depth (yps), in feet	5.7	5.8
Left abutment scour depth (yas), in feet	11.7	14.3
Right abutment scour depth (yas), in feet	5.5	11.2
1Flow angle of attack	5	5

See Comments/Diagram for justification where required