OK TCT

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 55230391 Date 8/3/12 Initials RaT Region (A B C D)

Site _____ Location 2 mi N of Corona on 472 Ave

Q_{100} = 6251/2770 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. X

Bridge discharge (Q_2) = 2770 (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 = 47 ft. Flow angle at bridge = 45 ° Abut. Skew = 0 ° Effective Skew = 45 °

Width (W_2) iteration = _____ _____ _____ _____

Avg. flow depth at bridge, y_2 iteration = _____ _____ _____ _____

Corrected channel width at bridge Section = W_2 times cos of flow angle = 33.23 ft* $q_2 = Q_2/W_2$ = 83.3 ft²/s

Bridge Vel, V_2 = 6.5 ft/s Final $y_2 = q_2/V_2$ = 12.9 ft Δh = 0.9 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 13.7 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,

0-1.6

Water Surface Elev. = 0.6 ft

Low Steel Elev. = 13.1 ft

n (Channel) = 0.040

n (LOB) = 0.040

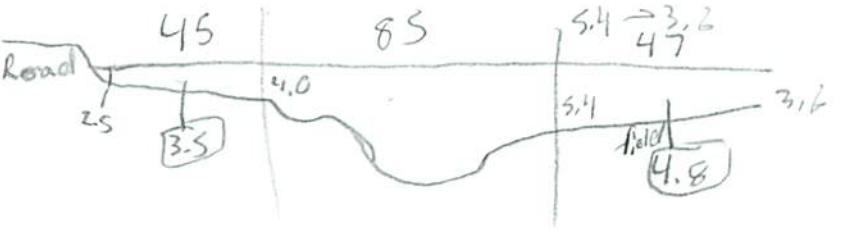
n (ROB) = 0.030

Pier Width = 0 ft

Pier Length = 0 ft

Piers for 100 yr = 0 ft

40 ÷ 4 = 10 left 25 45 45 40



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 85 ft

Width of left overbank flow at approach, W_{lob} = 45 ft Average left overbank flow depth, y_{lob} = 3.5 ft

Width of right overbank flow at approach, W_{rob} = 47 ft Average right overbank flow depth, y_{rob} = 4.9 ft

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

x = 2.75 From Figure 9 W_2 (effective) = 33.2 ft y_{cs} = 21.9 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, $V_1 = Q_{100}/(y_1W_1)$ = _____ ft/s

Critical approach velocity, $Vc = 11.17y_1^{1/6}D_{50}^{1/3}$ = _____ 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, $\chi = 0.122y_1[q_2/(D_{50}^{1/3}y_1^{7/6})]^{6/7} - y_1$ = _____ From Figure 10, y_{cs} = _____ ft

PGRM: Pier

PIER SCOUR CALCULATIONS

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

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

PGRM: Abutment

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, y_{aLT} = ~~12.9~~ 3.5 ft right abutment, y_{aRT} = ~~14.7~~ 4.8 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} = ~~22.5~~ 12.4 and ψ_{RT} = ~~26.7~~ 14.7

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 22.5 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 26.7 ft

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 55230391 Date 8/3/12 Initials RAL Region (A B C D)

Site _____ Location 2 mi N of Corona on 472 Ave

Q_{500} = Qpc 3610 by: drainage area ratio____ flood freq. anal. ____ regional regression eq. X

Bridge discharge (Q_2) = 2967 (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 = 47 ft. Flow angle at bridge = 45 ° Abut. Skew = 0 ° Effective Skew = 45 °

Width (W_2) iteration = _____ _____ _____ _____

Avg. flow depth at bridge, y_2 iteration = _____ _____ _____ _____

Corrected channel width at bridge Section = W_2 times cos of flow angle = 33.23 ft* $q_2 = Q_2/W_2$ = 86.3 ft^2/s

Bridge Vel, V_2 = 5.6 ft/s Final $y_2 = q_2/V_2$ = 13.1 ft Δh = 0.9 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 14 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,

0-1.6

Water Surface Elev. = 0.6 ft

Low Steel Elev. = 13.1 ft

n (Channel) = 0.040

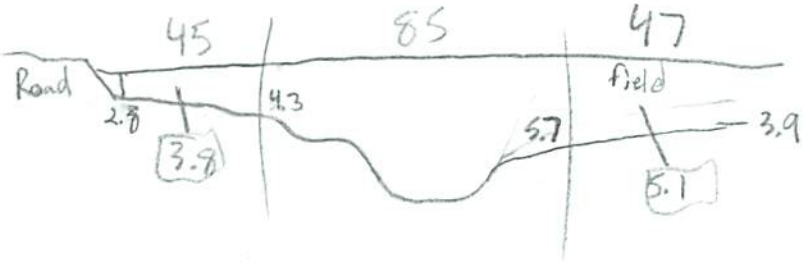
n (LOB) = 0.040

n (ROB) = 0.030

Pier Width = 0 ft

Pier Length = 0 ft

Piers for 500 yr = 0 ft



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 85 ft

Width of left overbank flow at approach, W_{lob} = 45 ft Average left overbank flow depth, y_{lob} = 3.8 ft

Width of right overbank flow at approach, W_{rob} = 47 ft Average right overbank flow depth, y_{rob} = 5.1 ft

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

x = 29.87 From Figure 9 W_2 (effective) = 33.2 ft y_{cs} = 22.5 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, $V_1 = Q_{500}/(y_1W_1)$ = _____ ft/s

Critical approach velocity, $Vc = 11.17y_1^{1/6}D_{50}^{1/3}$ = _____ 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, $\chi = 0.122y_1[q_2/(D_{50}^{1/3}y_1^{7/6})]^{6/7} - y_1$ = _____ From Figure 10, y_{cs} = _____ ft

PGRM: Pier

PIER SCOUR CALCULATIONS

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

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

PGRM: Abutment

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, y_{aLT} = 3.8 ft right abutment, y_{aRT} = 5.1 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} = 12.9 and ψ_{RT} = 15.2

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 23.5 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 27.6 ft

Route 472 Ave Stream N. Fk. Whetstone River MRM _____ Date 8/3/12 Initials [illegible]

Bridge Structure No. 55230391 Location 2 mi N of Corona on 472 Ave

GPS coordinates: N 450 22' 9.5" W96° 45' 36.6" taken from: USL abutment X centerline of ⇑ MRM end _____

Datum of coordinates: WGS84 X NAD27 _____

Drainage area = 168.95 sq. mi.

The average bottom of the main channel was 14.6 ft below top of guardrail at a point 35 ft from left abutment.

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

8/26

2	313
5	880
10	1440
25	2370
50	3210
100	4170
500	6790

MISCELLANEOUS CONSIDERATIONS

Flows	Q_{100} = Q50 2770			Q_{500} = Q100 3610		
Estimated flow passing through bridge	2770			2867		
Estimated road overflow & overtopping	0			74.2		
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

713

2	257
5	439
10	1220
25	2030
~~50~~	2770
50	3610
100	5030
500	5730

Riprap at abutments? ____Yes ____No X Marginal - riprap on outside right abutment and spilled under bridge

Evidence of past Scour? X Yes ____No ____Don't know - noticeable at abutment/ contraction

Debris Potential? ____High ____Med X Low

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

Riprap ____Yes X No ____Don't know ____NA

Spur Dike ____Yes X No ____Don't know ____NA

Other _____ ____Yes X No ____Don't know ____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

1). left OB
2). main channel
3). right OB
4-5). right abutment
6-7). left abutment
8). main channel

Summary of Results

	~~Q100~~ Q50	~~Q500~~ Q100
Bridge flow evaluated	2770	2867
Flow depth at left abutment (yaLT), in feet	3.5	3.6
Flow depth at right abutment (yaRT), in feet	4.8	5.1
Contraction scour depth (ycs), in feet	21.9	22.5
Pier scour depth (yps), in feet	N/A	N/A
Left abutment scour depth (yas), in feet	22.5	23.5
Right abutment scour depth (yas), in feet	26.7	27.6
1Flow angle of attack	45	45

See Comments/Diagram for justification where required