OK RT check

Check Flows...

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 33288023 Date 7/16/12 Initials RAJ Region (A B (C) D)

Site ______ Location nr Blunt on 308 Ave

Q_{100} = Q10 4310 by: drainage area ratio____ flood freq. anal. ____ regional regression eq. X

Bridge discharge (Q_2) = 4310 (should be Q_{100} unless there is a relief bridge, road overflow, or bridge overtopping)

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

Analytical Procedure for Estimating Hydraulic Variables Needed to Apply Method

Bridge Width = 104 ft. Flow angle at bridge = 5 ° Abut. Skew = 0 ° Effective Skew = 5 °

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 = 103.6 ft* $q_2 = Q_2/W_2$ = 41.6 ft²/s

Bridge Vel, V_2 = 4.6 ft/s Final $y_2 = q_2/V_2$ = 9.1 ft Δh = 0.4 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 9.5 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. = 0-1.0 ft

Low Steel Elev. = 12.6 ft

n (Channel) = 0.043

n (LOB) = 0.070

n (ROB) = 0.030

Pier Width = 1.65 ft

Pier Length = 1.7 ft

\# Piers for 100 yr = ~~3~~ 4 ft

PGRM: Contract

CONTRACTION SCOUR

Width of main channel at approach section W_1 = 104 ft

Width of left overbank flow at approach, W_{lob} = 0 ft Average left overbank flow depth, y_{lob} = 0 ft

Width of right overbank flow at approach, W_{rob} = 0 ft Average right overbank flow depth, y_{rob} = 0 ft

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

x = 0.69 From Figure 9 W_2 (effective) = 97 ft y_{cs} = 1.1 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 = 1.03 Correction factor for flow angle of attack (from Table 1), K2 = 1

Froude # at bridge = 0.27 Using pier width a on Figure 11, ξ = 6.9 Pier scour y_{ps} = 5.7 ft

PGRM: Abutment

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, y_{aLT} = 0 ft right abutment, y_{aRT} = 0 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} = 0 and ψ_{RT} = 0

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 0 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 0 ft

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 33288023 Date 7/10/12 Initials RLS Region (A B (C) D)

Site ________ Location nr Blunt on 308 Ave

Q_{500} = Q25 10200 by: drainage area ratio____ flood freq. anal. ____ regional regression eq. X

Bridge discharge (Q_2) = 8268 (should be Q_{500} unless there is a relief bridge, road overflow, or bridge overtopping)

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

Analytical Procedure for Estimating Hydraulic Variables Needed to Apply Method

Bridge Width = 104 ft. Flow angle at bridge = 5 ° Abut. Skew = 0 ° Effective Skew = 5 °

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 = 103.6 ft* $q_2 = Q_2/W_2$ = 79.8 ft²/s

Bridge Vel, V_2 = 6.3 ft/s Final $y_2 = q_2/V_2$ = 12.6 ft Δh = 0.8 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 13.4 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. = 0-1.0 ft

Low Steel Elev. = 12.6 ft

n (Channel) = 0.040

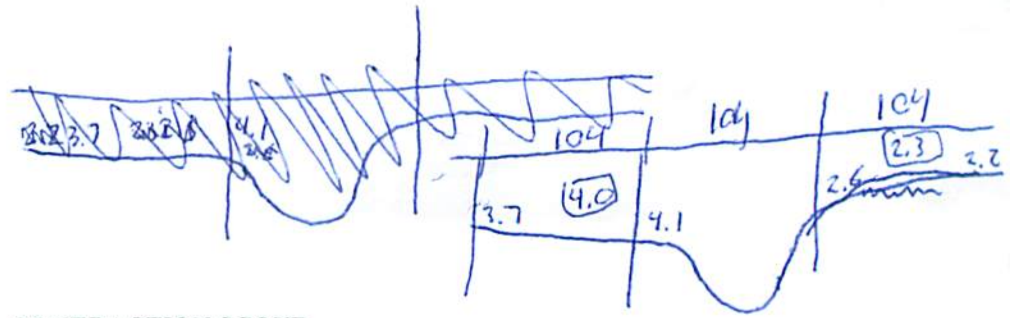
n (LOB) = 0.070

n (ROB) = 0.030

Pier Width = 1.65 ft

Pier Length = 1.70 ft

Piers for 500 yr = 4 ft



PGRM: Contract

CONTRACTION SCOUR

Width of main channel at approach section W_1 = 104 ft 4.1

Width of left overbank flow at approach, W_{lob} = 104 ft Average left overbank flow depth, y_{lob} = 4.0 ft

Width of right overbank flow at approach, W_{rob} = 104 ft Average right overbank flow depth, y_{rob} = 2.3 ft

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

x = 3.08 From Figure 9 W_2 (effective) = 97 ft y_{cs} = 3.7 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 = 1.03 Correction factor for flow angle of attack (from Table 1), K2 = 1

Froude # at bridge = 0.31 Using pier width a on Figure 11, ξ = 6.9 Pier scour y_{ps} = 5.8 ft

PGRM: Abutment

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, y_{aLT} = 4.0 ft right abutment, y_{aRT} = 2.3 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} = 13.3 and ψ_{RT} = 9.4

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 13.3 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 9.4 ft

Route 308 Ave Stream ____________ MRM ________ Date 7/10/12 Initials RaT

Bridge Structure No. 33288023 Location nr Blunt on 308 Ave

GPS coordinates: N 44° 30' 27.9" W 99° 59' 20.8 taken from: USL abutment X centerline of ⇑ MRM end ______

Datum of coordinates: WGS84 X NAD27 ______

Drainage area = 103.69 sq. mi.

The average bottom of the main channel was 16.1 ft below top of guardrail at a point 30 ft from left abutment.

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

MISCELLANEOUS CONSIDERATIONS

Flows	Q_{100} = Q_{10} 4310			Q_{500} = Q_{25} 10200		
Estimated flow passing through bridge	4310			8268		
Estimated road overflow & overtopping	0			1932		
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	

8/24

2	411
5	1900
10	4310
25	10200
50	17300
100	27500
500	68700

7/2

2	2.36
5	10.9
10	24.7
25	58.5
50	99.2
100	155
500	394

Riprap at abutments? ____Yes X No ____Marginal

Evidence of past Scour? X Yes ____No ____Don't know minor pier/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). piers
5). right abutment
6-7). left abutment
8). right abutment

9). main channel – too many trees for proper picture.

Summary of Results

	~~Q100~~ Q_{10}	~~Q500~~ Q_{25}
Bridge flow evaluated	4310	8268
Flow depth at left abutment (yaLT), in feet	0	4.0
Flow depth at right abutment (yaRT), in feet	0	2.3
Contraction scour depth (ycs), in feet	1.1	3.7
Pier scour depth (yps), in feet	5.7	5.8
Left abutment scour depth (yas), in feet	0	13.3
Right abutment scour depth (yas), in feet	0	9.4
1Flow angle of attack	5	5

See Comments/Diagram for justification where required