I did the eastern of the 2 bridges close to each other

ok-RaT

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 41256268 Date 9-20-12 Initials RFT Region ([✓ A] B C D)

Site ______ Location 0.1 mi W of Boxelder Conservation Rd

Q_{100} = 2090 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. ✓

Bridge discharge (Q_2) = 2090 (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"

15 39/54

1.14 38/52

Bridge Width = 65 ft. Flow angle at bridge = 10 ° Abut. Skew = 0 ° Effective Skew = 10 °

Width (W_2) iteration = 47 59 52 54

Avg. flow depth at bridge, y_2 iteration = 5.8 5.1 5.5 5.4

Corrected channel width at bridge Section = W_2 times cos of flow angle = 53.18 ft* $q_2 = Q_2/W_2$ = 39.3 ft²/s

Bridge Vel, V_2 = 7.3 ft/s Final $y_2 = q_2/V_2$ = 5.4 ft Δh = 1.1 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 6.5 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_1 is above LS, then account for Road Overflow using PRGM: RDOVREGA, RDOVREGB, RDOVREGC, or RDOVREGD,

Water Surface Elev. = -0.1 ft

Low Steel Elev. = 8.3 ft

n (Channel) = .050

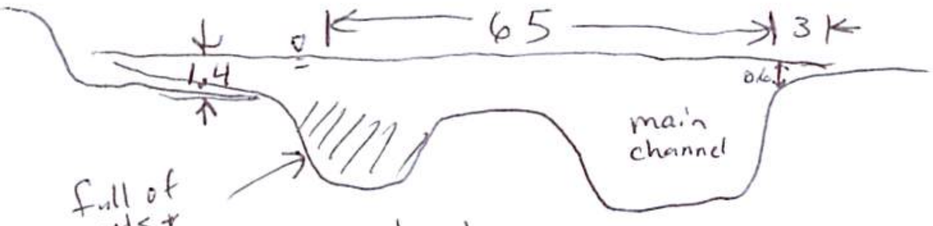
n (LOB) = .065

n (ROB) = .050

Pier Width = NA ft

Pier Length = NA ft

\# Piers for 100 yr = 0 ft



full of weeds + brush assume it doesn't affect overbank

CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 65 ft

Width of left overbank flow at approach, W_{lob} = 60 ft Average left overbank flow depth, y_{lob} = 1.4 ft

Width of right overbank flow at approach, W_{rob} = 3 ft Average right overbank flow depth, y_{rob} = 0.3 ft

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

x = ____ From Figure 9 W_2 (effective) = ____ ft y_{cs} = ____ ft

PGRM: CWCSNEW

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

Estimated bed material D_{50} = 0.4 ft Average approach velocity, $V_1 = Q_{100}/(y_1 W_1)$ = 2.51 ft/s

Critical approach velocity, $Vc = 11.17 y_1^{1/6} D_{50}^{1/3}$ = 11.24 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.

$D_{c50} = 0.0006(q_2/y_1^{7/6})^3$ = .052 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} = 0 ft

PIER SCOUR CALCULATIONS

PGRM: Pier

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

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 1.4 ft right abutment, y_{aRT} = 0.3 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} = 5.9 and ψ_{RT} = 1.4

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 5.9 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 1.4 ft

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 41250268 Date ________ Initials ________ Region ([✓ A] B C D)

Site ________ Location 0.1 mi W of Boxelder Conservation Rd

Q_{500} = 4800 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. ✓

Bridge discharge (Q_2) = 4800 (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 = 65 ft. Flow angle at bridge = 10 ° Abut. Skew = 0 ° Effective Skew = 10 °

Width (W_2) iteration = 7.7 ____ ____ ____

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

Corrected channel width at bridge Section = W_2 times cos of flow angle = 64.01 ft* $q_2 = Q_2/W_2$ = 75 ft^2/s

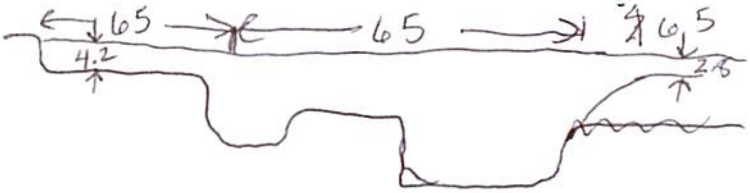
Bridge Vel, V_2 = 9.8 ft/s Final $y_2 = q_2/V_2$ = 7.7 ft Δh = 2.0 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 9.6 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. = -0.1 ft
Low Steel Elev. = 8.3 ft
n (Channel) = .050
n (LOB) = .065
n (ROB) = .050
Pier Width = NA ft
Pier Length = NA ft
\# Piers for 500 yr = 0 ft



CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 65 ft

Width of left overbank flow at approach, W_{lob} = 65 ft Average left overbank flow depth, y_{lob} = 4.2 ft

Width of right overbank flow at approach, W_{rob} = 65 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 = ____ From Figure 9 W_2 (effective) = ____ ft y_{cs} = ____ ft

PGRM: CWCSNEW

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

Estimated bed material D_{50} = 0.4 ft Average approach velocity, $V_1 = Q_{500}/(y_1 W_1)$ = 2.56 ft/s

Critical approach velocity, $Vc = 11.17 y_1^{1/6} D_{50}^{1/3}$ = 12.0 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.

$D_{c50} = 0.0006(q_2/y_1^{7/6})^3$ = .092 ft If $D_{50} >= D_{c50}$, χ = [✓ 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} = 0 ft

PIER SCOUR CALCULATIONS

PGRM: Pie

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

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 4.2 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} = 13.6 and ψ_{RT} = 11.2

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 13.6 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 11.2 ft

Route Nemo Rd Stream Boxelder Ck MRM ______ Date ______ Initials ______

Bridge *Structure* No. 41250268 Location 0.1 mi W of Boxelder Conservation Rd

GPS coordinates: 44° 12.980'
103° 33.158'

taken from: USL abutment ✓ centerline of ⇑ MRM end ______

Datum of coordinates: WGS84 ✓ NAD27 ______

Drainage area = 39.72 sq. mi.

The average bottom of the main channel was 13.2 ft below top of guardrail at a point 22 ft from left abutment.

Method used to determine flood flows: ___Freq. Anal. ___drainage area ratio ✓ regional regression equations.

MISCELLANEOUS CONSIDERATIONS

Flows	Q_{100} =			Q_{500} =		
Estimated flow passing through bridge						
Estimated road overflow & overtopping						
Consideration	Yes	No	Possibly	Yes	No	Possibly
Chance of overtopping						
Chance of Pressure flow						
Armored appearance to channel						
Lateral instability of channel						

7/3

2	71.3
5	225
10	424
25	845
50	1370
100	2090
500	4800

Riprap at abutments? ___Yes ___No X Marginal native rock in bottom, crushed rock on left abut.

Evidence of past Scour? ___Yes ✓ No ___Don't know

Debris Potential? ___High ___Med ✓ Low trees, but no piers

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

Riprap ___Yes ✓ No ___Don't know ___NA

Spur Dike ___Yes ___No ___Don't know ✓ NA

Other ______________ ___Yes ___No ___Don't know ✓ NA

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

Material	Silt/Clay___	Sand___	Gravel___	Cobbles X	Boulders___
Size range, in mm	<0.062	0.062-2.00	2.00-64	64-250	>250

rocks + cobble in channel bottom; assume cwcs

Comments, Diagrams & orientation of digital photos

str. no
approach from bridge
LOB from bridge
ROB from bridge
bridge from approach

left abut.
rt. abut.

Summary of Results

	Q100	Q500
Bridge flow evaluated	2090	4800
Flow depth at left abutment (yaLT), in feet	1.4	4.2
Flow depth at right abutment (yaRT), in feet	0.3	2.8
Contraction scour depth (ycs), in feet	0	0
Pier scour depth (yps), in feet	NA	NA
Left abutment scour depth (yas), in feet	5.9	13.6
Right abutment scour depth (yas), in feet	1.4	11.2
1Flow angle of attack	10°	10°

See Comments/Diagram for justification where required

103.55287
44.21602

44° 12.96

103° 33.172

garmin at
east bridge

44° 12.978'

103° 33.151'

garmin at
west bridge

44° 12.986'

103° 33.291'