DUP Ok-KaV

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 02186050 Date 9-27-12 Initials RFT Region (A B [✓ C] D)
Site ____________ Location 0.5 mi E of Hwy 281 on 243rd St
Q_{100}^{25} = 682 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. X
Bridge discharge (Q_2) = 682 (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

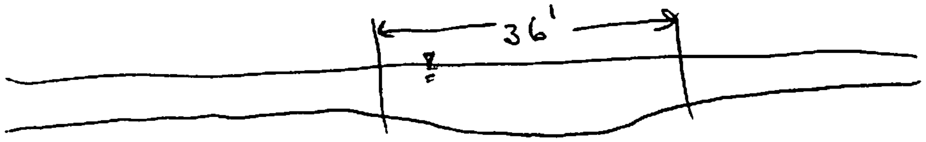
PGRM: "RegionA", "RegionB", "RegionC", or "RegionD"

Bridge Width = 36 ft. Flow angle at bridge = 8 ° Abut. Skew = 0 ° Effective Skew = 8 °
Width (W_2) iteration = 36 ____ ____ ____
Avg. flow depth at bridge, y_2 iteration = 6.2 ____ ____ ____
Corrected channel width at bridge Section = W_2 times cos of flow angle = 35.65 ft* $q_2 = Q_2/W_2$ = 19.1 ft²/s
Bridge Vel, V_2 = 3.1 ft/s Final $y_2 = q_2/V_2$ = 6.2 ft Δh = 0.2 ft
Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 6.4 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.

this site does not have a well-defined channel



Water Surface Elev. = dry ft
Low Steel Elev. = 6.8 ft
n (Channel) = .035
n (LOB) = .028
n (ROB) = .028
Pier Width = 1.0 ft
Pier Length = 1.0 ft
Piers for 100 yr = 2 ft

CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 36 ft
Width of left overbank flow at approach, W_{lob} = 36 ft Average left overbank flow depth, y_{lob} = 4.3 ft
Width of right overbank flow at approach, W_{rob} = 36 ft Average right overbank flow depth, y_{rob} = 4.3 ft

Live Bed Contraction Scour (use if bed material is small cobbles or finer)
x = 9.27 From Figure 9 W_2 (effective) = 33.7 ft y_{cs} = 10.2 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, $V_c = 11.17y_1^{1/6}D_{50}^{1/3}$ = ____ 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

PIER SCOUR CALCULATIONS

PGRM: Pier

L/a ratio = 1 Correction factor for flow angle of attack (from Table 1), K2 = 1
Froude # at bridge = 0.22 Using pier width a on Figure 11, ξ = 4.9 Pier scour y_{ps} = 3.9 ft

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 4.3 ft right abutment, y_{aRT} = 4.3 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} = 13.8 and ψ_{RT} = 13.8
Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 20.5 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 20.5 ft

This bridge appears to have spill-through abutments that are very eroded. Althoug wing walls are not present, use K_1 = 0.82 to reflect eroded abutments under bridge.

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 02186050 Date ________ Initials ______ Region (A B [✓ C] D)

Site ________ Location ________

$Q_{\cancel{500}}^{50}$ = 1010 by: drainage area ratio ____ flood freq. anal. ____ regional regression eq. X

Bridge discharge (Q_2) = 1010 (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 = 36 ft. Flow angle at bridge = ~~[illegible]~~ 8 ° Abut. Skew = 0 ° Effective Skew = 8 °

Width (W_2) iteration = 36 ____ ____ ____

Avg. flow depth at bridge, y_2 iteration = 7.5 ____ ____ ____

Corrected channel width at bridge Section = W_2 times cos of flow angle = 35.65 ft* $q_2 = Q_2/W_2$ = 28.3 ft^2/s

Bridge Vel, V_2 = 3.8 ft/s Final $y_2 = q_2/V_2$ = 7.5 ft Δh = 0.3 ft

Average main channel depth at approach section, $y_1 = \Delta h + y_2$ = 7.8 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. = dry ft

Low Steel Elev. = 6.8 ft

This bridge is probably at the verge of road overflow at Q_{50} (1010 cfs)

n (Channel) = .035

n (LOB) = .028

n (ROB) = .028

Pier Width = 1.0 ft

Pier Length = 1.0 ft

\# Piers for 500 yr = 2 ft

CONTRACTION SCOUR

PGRM: Contract

Width of main channel at approach section W_1 = 36 ft

Width of left overbank flow at approach, W_{lob} = 36 ft Average left overbank flow depth, y_{lob} = 5.8 ft

Width of right overbank flow at approach, W_{rob} = 36 ft Average right overbank flow depth, y_{rob} = 5.8 ft

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

x = 13.28 From Figure 9 W_2 (effective) = 33.7 ft y_{cs} = 14.1 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, $V_1 = Q_{500}/(y_1W_1)$ = ____ 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

PIER SCOUR CALCULATIONS

PGRM: Pie

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

Froude # at bridge = 0.24 Using pier width a on Figure 11, ξ = 4.9 Pier scour y_{ps} = 3.9 ft

ABUTMENT SCOUR CALCULATIONS

PGRM: Abutment

Average flow depth blocked by: left abutment, y_{aLT} = 5.8 ft right abutment, y_{aRT} = 5.8 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} = 16.5 and ψ_{RT} = 16.5

Left abutment scour, $y_{as} = \psi_{LT}(K_1/0.55)$ = 24.5 ft Right abutment scour $y_{as} = \psi_{RT}(K_1/0.55)$ = 24.5 ft

Route 243rd St Stream Donegan's Draw MRM ________ Date ____________ Initials ________
Bridge Structure No. 02186050 Location 0.5 E Hwy 281 on 243rd St
GPS coordinates: N43° 51.869' taken from: USL abutment ✓ centerline of ⇑ MRM end ______
W98° 26.409' Datum of coordinates: WGS84 ✓ NAD27_____
Drainage area = 14.97 sq. mi.
The average bottom of the main channel was 10.5 ft below top of guardrail at a point 9 ft from left abutment.
Method used to determine flood flows: ____Freq. Anal. ____drainage area ratio X regional regression equations.

MISCELLANEOUS CONSIDERATIONS

Flows	Q~~100~~25= 682			Q~~500~~50= 1010		
Estimated flow passing through bridge	682			1010		
Estimated road overflow & overtopping	0			0		
Consideration	Yes	No	Possibly	Yes	No	Possibly
Chance of overtopping		✓				✓
Chance of Pressure flow		✓		✓		
Armored appearance to channel		✓			✓	
Lateral instability of channel		✓			✓	

Riprap at abutments? _____Yes ✓No _____Marginal
Evidence of past Scour? ✓Yes _____No _____Don't know
Debris Potential? _____High _____Med ✓Low

Some field stone has been dumped in the up- and downstream ditch (channel) but no real riprap

contraction and abutment scour evident

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_____	Boulders_____
Size range, in mm	<0.062	0.062-2.00	2.00-64	64-250	>250

Comments, Diagrams & orientation of digital photos

Str. no.
approach from bridge
LOB from bridge
ROB from bridge
Bridge from upstream

left abut. under bridge
rt. abut. under bridge
field stone on upstream side of bridge

Summary of Results

	Q~~100~~ 25	Q~~500~~ 50
Bridge flow evaluated	682	1010
Flow depth at left abutment (yaLT), in feet	4.3	5.8
Flow depth at right abutment (yaRT), in feet	4.3	5.8
Contraction scour depth (ycs), in feet	10.2	14.1
Pier scour depth (yps), in feet	3.9	3.9
Left abutment scour depth (yas), in feet	20.5	24.5
Right abutment scour depth (yas), in feet	20.5	24.5
1Flow angle of attack	8°	8°

See Comments/Diagram for justification where required