

ok-RAT

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 03248185 Date 9-27-12 Initials RFT Region (A B C D)
Site 06476000 Location James @ 3rd St in Huron
Q100 = 18300 by: drainage area ratio flood freq. anal. regional regression eq.
Bridge discharge (Q2) = (should be Q100 unless there is a relief bridge, road overflow, or bridge overtopping)

Analytical Procedure for Estimating Hydraulic Variables Needed to Apply Method

Bridge Width = 230 ft. Flow angle at bridge = 0 degrees Abut. Skew = 0 degrees Effective Skew = 0 degrees
Width (W2) iteration =

Avg. flow depth at bridge, y2 iteration =
Corrected channel width at bridge Section = W2 times cos of flow angle = ft* q2 = Q2/W2 = ft^2/s

Bridge Vel, V2 = ft/s Final y2 = q2/V2 = ft Delta h = ft

Average main channel depth at approach section, y1 = Delta h + y2 = ft

* NOTE: repeat above calculations until y2 changes by less than 0.2 Effective pier width = L sin(q) + a cos(q)

If y2 is above LS, then account for Road Overflow using PRGM: RDOVREGA, RDOVREGB, RDOVREGC, or RDOVREGD.

Water Surface Elev. = ft
Low Steel Elev. = ft
n (Channel) =
n (LOB) =
n (ROB) =
Pier Width = ft
Pier Length = ft
Piers for 100 yr = ft

The river is impounded at this bridge due to a rock dam near 13th Street. Even though today's flow over the 3rd Street dam is approx. 32 cfs, the depth under the bridge ranges from 3-4 ft deep across most of its width.

Approach section would also be above 3rd St dam.

This site not suited to level 1.5 analysis.

CONTRACTION SCOUR

Width of main channel at approach section W1 = ft
Width of left overbank flow at approach, Wlob = ft Average left overbank flow depth, ylob = ft
Width of right overbank flow at approach, Wrob = ft Average right overbank flow depth, yrob = ft

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

x = From Figure 9 W2 (effective) = ft ycs = ft

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

Estimated bed material D50 = ft Average approach velocity, V1 = Q100/(y1 W1) = ft/s

Critical approach velocity, Vc = 11.52 y1^(1/6) D50^(1/3) = ft/s

If V1 < Vc and D50 >= 0.2 ft, use clear water equation below, otherwise use live bed scour equation above.

Dc50 = 0.0006 (q2/y1^(7/6))^3 = ft If D50 >= Dc50, chi = 0.0

Otherwise, chi = 0.122 y1 [q2 / (D50^(1/3) y1^(7/6))]^(6/7) - y1 = From Figure 10, ycs = ft

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, xi = Pier scour yps = ft

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, yaLT = ft right abutment, yaRT = ft
Shape coefficient K1 = 1.00 for vertical-wall, 0.82 for vertical-wall with wingwalls, 0.55 for spill-through
Using values for yaLT and yaRT on figure 12, psiLT = and psiRT =
Left abutment scour, yas = psiLT (K1/0.55) = ft Right abutment scour yas = psiRT (K1/0.55) = ft

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

PGRM: Contract

PGRM: CWCSNEW

PGRM: Pier

PGRM: Abutment

SCOUR ANALYSIS AND REPORTING FORM

Bridge Structure No. 03248185 Date _____ Initials _____ Region (A B C D) C
 Site 06476000 Location James @ 3rd St in Huron
 Q₅₀₀ = 32700 by: drainage area ratio _____ flood freq. anal. regional regression eq. _____
 Bridge discharge (Q₂) = _____ (should be Q₅₀₀ unless there is a relief bridge, road overflow, or bridge overtopping)

Analytical Procedure for Estimating Hydraulic Variables Needed to Apply Method

Bridge Width = _____ ft. Flow angle at bridge = _____ ° Abut. Skew = _____ ° Effective Skew = _____ °
 Width (W₂) iteration = _____
 Avg. flow depth at bridge, y₂ iteration = _____
 Corrected channel width at bridge Section = W₂ times cos of flow angle = _____ ft* q₂ = Q₂/W₂ = _____ ft²/s
 Bridge Vel, V₂ = _____ ft/s Final y₂ = q₂/V₂ = _____ ft Δh = _____ ft
 Average main channel depth at approach section, y₁ = Δh + y₂ = _____ ft

* NOTE: repeat above calculations until y₂ changes by less than 0.2 Effective pier width = L sin(q) + a cos(q)
 If y₂ is above LS, then account for Road Overflow using PRGM: RDOVREGA, RDOVREGB, RDOVREGC, or RDOVREGD.

Water Surface Elev. = _____ ft
 Low Steel Elev. = _____ ft
 n (Channel) = _____
 n (LOB) = _____
 n (ROB) = _____
 Pier Width = _____ ft
 Pier Length = _____ ft
 # Piers for 500 yr = _____ ft

CONTRACTION SCOUR

Width of main channel at approach section W₁ = _____ ft
 Width of left overbank flow at approach, W_{lob} = _____ ft Average left overbank flow depth, y_{lob} = _____ ft
 Width of right overbank flow at approach, W_{rob} = _____ ft Average right overbank flow depth, y_{rob} = _____ ft

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

x = _____ From Figure 9 W₂ (effective) = _____ ft y_{cs} = _____ ft

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

Estimated bed material D₅₀ = _____ ft Average approach velocity, V₁ = Q₅₀₀/(y₁W₁) = _____ ft/s

Critical approach velocity, V_c = 11.52y₁^{1/6}D₅₀^{1/3} = _____ ft/s

If V₁ < V_c and D₅₀ >= 0.2 ft, use clear water equation below, otherwise use live bed scour equation above.

D_{c50} = 0.0006(q₂/y₁^{7/6})³ = _____ ft If D₅₀ >= D_{c50}, χ = 0.0

Otherwise, χ = 0.122y₁[q₂/(D₅₀^{1/3}y₁^{7/6})]^{6/7} - y₁ = _____ From Figure 10, y_{cs} = _____ ft

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

ABUTMENT SCOUR CALCULATIONS

Average flow depth blocked by: left abutment, y_{aLT} = _____ ft right abutment, y_{aRT} = _____ ft
 Shape coefficient K₁ = 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} = _____ and ψ_{RT} = _____
 Left abutment scour, y_{as} = ψ_{LT}(K₁/0.55) = _____ ft Right abutment scour y_{as} = ψ_{RT}(K₁/0.55) = _____ ft

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

PGRM: Contract

PGRM: CWCNEW

PGRM: Pie

PGRM: Abutment

Route Third St. Stream James River MRM _____ Date _____ Initials _____
 Bridge Structure No. 03248185 Location James @ 3rd St in Huron
 GPS coordinates: 44° 21.807' taken from: US abutment centerline of MRM end
98° 11.954' Datum of coordinates: WGS84 NAD27
 Drainage area = 13744.10 sq. mi. 13744.24
 The average bottom of the main channel was _____ ft below top of guardrail at a point _____ ft from left abutment.
 Method used to determine flood flows: Freq. Anal. drainage area ratio regional regression equations.

use gage data

MISCELLANEOUS CONSIDERATIONS

Flows	Q ₁₀₀ = <u>18300</u>			Q ₅₀₀ = <u>32700</u>		
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 10900
 5 6170
 10 4608
 25 35100
 50 59700
 100 94900
 500 230000~~

Riprap at abutments? Yes No Marginal
 Evidence of past Scour? Yes No Don't know
 Debris Potential? High Med Low

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 (D₅₀)

Material Silt/Clay _____ Sand _____ Gravel _____ Cobbles _____ Boulders _____
 Size range, in mm <0.062 0.062-2.00 2.00-64 64-250 >250

peaks from gage data

Comments, Diagrams & orientation of digital photos

pk	Q
2	1600 1570
5	4000 3820
10	6130 6080
25	10700 10000
50	13800 13700
100	17000 18300
500	230000 32700

*str. no.
 approach (3rd St dam) from bridge
 bridge from left approach
 left abutment (near)
 left abutment (far)*

*right abut. under bridge
 right abut. upstream*

Summary of Results

	Q100	Q500
Bridge flow evaluated		
Flow depth at left abutment (yaLT), in feet		
Flow depth at right abutment (yaRT), in feet		
Contraction scour depth (yca), in feet		
Pier scour depth (ypp), in feet		
Left abutment scour depth (yaa), in feet		
Right abutment scour depth (yara), in feet		
Flow angle of attack		

See Comments/Diagram for justification where required