

BSDMS Summary Report

81 Cedar River at US 218 near Janesville, IA

Site Location:

Site ID:	81	
Site Name:	Cedar River at US 218 near Janesville, IA	
County:	Bremer	
Nearest City:	Janesville	Contact:
State:	IA	Dave Clamon
Latitude:	423913	Hydraulic Engineer, Iowa DOT
Longitude:	922752	(515) 239-1487
USGS Station ID:	05458500	or
Route Number:	218	Dave Mueller
Route Class:	US	Hydrologist, USGS
Service Level:	Mainline	(502) 493-1935
Route Direction:	North	
Highway Mile Point:		
Stream Name:	Cedar River	
River Mile:	207.7	

Site Description:

U.S. 218 over the Cedar River was relocated from the north edge of Janesville to a location further north in 1992. Maps from Delorme do not have the bridge in the correct (new) location. The highway now crosses the Cedar River near the apex of a river bend. This new location consists of two parallel bridges, each with two lanes of traffic and wide shoulders. Each bridge has six round-nose piers. The piers of the downstream bridge are located directly downstream of the piers on the upstream bridge. The piers are hammer-head type piers that are 18 ft long at the water surface and hammer-heads are 40 ft long. There was a rock dike (berm) about 100 ft upstream extending from the left abutment out the top of bank. Although the concrete portion of the abutments is not continuous between the bridges, there is only a short distance and shallow ditch between the two bridges, so the abutments have been treated for hydraulic purposes as if they were continuous abutments. The right abutment has a guidebank on the upstream side to help redirect flow from the right floodplain.

This site is used by the USGS for making streamflow measurements. The actual gage is located in a park about 0.25 miles downstream from the bridge.

The bridge is located near the apex of a bend in the river. Standing on the bridge looking upstream reveals a straight channel for about 500 ft and looking downstream, a straight channel for a much longer distance. The channel beyond 500 ft is divided by several islands. The description of the USGS gaging station states that the streambed is composed of sand, gravel, and rock.

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The left floodplain is fairly narrow, high, and thinly wooded. The right floodplain is low with trees and a bushy undergrowth. A small field is located on the upstream right floodplain and a residence with large yard is located on the downstream right floodplain. In both situations the field and yard are several hundred feet from the streambank and the area between the streambank and the field or yard is covered by trees with a bushy undergrowth. The narrow left floodplain is almost completely spanned by the bridge, but there is a significant contraction on the right side.

The USGS collected real-time data at this site on 7-23-99. During this visit the stage was just past the peak and receding. A second visit was made on 7-25-99. By this time the stage had fallen to within the top banks. A low-flow visit was completed on 8-10-99.

Elevation Reference

Datum: MSL

MSL (ft): 902.63

Description of Reference Elevation:

RP1 - U/S bridge, top of concrete wall above 1st drain (Elev = 902.63)

RP2 - D/S bridge, top of concrete wall @ marked RM (Elev = 906.96)

BM #389 - Set nail and washer in north side of 18" oak, 237' south of station 172+72 (Elev = 902.93) from bridge plans

USGS Gaging Station located approximately 2300' upstream of bridge:

Datum of stream gage is 868.26 ft above sea level, datum of 1929.
The outside reference gage is a 6" wide channel iron with staff sections located 15' streamward of gage.

RM 14 - 1/2" bolt on downstream side of gage house, 11 ft west of river.
(Elev=12.414 ft)

RM 16 - USGS monument set in concrete 3' west of gaging station (Elev = 9.693 ft)

RP 2 - Middle of float hole opening on angle iron in well (Elev = 6.61 ft)

RP 3 - Top of nail located in upper staff plate backing (Elev = 10.294 ft)

RP 4 - Top of nail located in lower staff plate backing (Elev = 3.216 ft)

Stream Data

Drainage Area 1661
(sq mi):

Floodplain Width: Narrow

Slope in 0.000379
Vicinity(ft/ft):

Natural Levees: Little

Flow Impact: Left

Apparent Incision: Unknown

Channel Evolution Unknown

Channel Boundary: Alluvial

Armoring: Unknown

Banks Tree Cover: Medium

Debris Frequency: Occasional

Sinuosity: Straight

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Debris Effect:	Local	Braiding:	None
Stream Size:	Medium	Anabranching:	Locally
Flow Habit:	Perennial	Bars:	Narrow
Bed Material:	Sand	Stream Width Variability:	Random
Valley Setting:	Low		

Roughness Data

Manning's n Values

	Left Overbank	Channel	Right Overbank
High:	0.15	0.034	0.15
Typical	0.1	0.03	0.106
Low:	0.05	0.024	0.084

Bed Material

Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
1					1.9	0.8	0.53	0.33	2.65		Non-Cohesive
2					8.8	4.9	1.5	0.43	2.65		Non-Cohesive
3					10.8	6.2	2.2	0.68	2.65		Non-Cohesive
4					11.2	3.9	0.94	0.51	2.65		Non-Cohesive
5					13	2.5	0.55	0.32	2.65		Non-Cohesive
6					1.6	0.9	0.47	0.28	2.65		Non-Cohesive
A				Pipe Dredge							Non-Cohesive

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B	Pipe Dredge	Non-Cohesive
C	Pipe Dredge	Cohesive

Bed Material Comments

Measurement No: 1

At upstream edge of bridge between piers 5 and 4 along left side of channel.

Measurement No: 2

In center of stream, 300 ft downstream from bridges.

Measurement No: 3

Left side, upstream side of bridge

Measurement No: 4

600 ft downstream from the bridges in the right third of the channel

Measurement No: 5

Just upstream of bridge

Measurement No: 6

Upstream of bridge in left third of channel.

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Measurement No: A

Just upstream of bridge between piers 6 and 5. No documentation on size analysis but field notes indicate sand.

Measurement No: B

Just upstream of bridge between piers 4 and 5. No documentation on size analysis but field notes indicate sand.

Measurement No: C

Just upstream of bridge between piers 3 and 4. No documentation on size analysis but field notes indicate clay.

Bridge Data

Structure No: F 218-8(20)
Length(ft): 674
Width(ft): 40
Number of Spans: 7
Vertical Configuration: Sloping
Low Chord Elev (ft): 895
Upper Chord Elev (ft): 902.8
Overtopping Elev (ft): 901.9
Skew (degrees): 0
Guide Banks: Elliptical
Waterway Classification: Main
Year Built: 1992
Avg Daily Traffic: 8650
Plans on File: Yes
Parallel Bridges Yes
Upstream/Downstream: N/A

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Continuous Abutment: Yes

Distance Between Centerlines: 124

Distance Between Pier Faces: 62

Bridge Description:

This is a relatively new bridge built in 1992. Maps from Delorme do not have the bridge in the correct (new) location. This site has two parallel bridges. Each bridge has six round-nose piers. The piers of the downstream bridge are located directly downstream of the piers on the upstream bridge. The piers are hammer-head type piers that are 18 ft long at the water surface and hammer-heads are 40 ft long. There was a rock dike (berm) about 100 ft upstream extending from the left abutment out the top of bank. Although the concrete portion of the abutments is not continuous between the bridges, there is only a short distance and shallow ditch between the two bridges, so the abutments have been treated for hydraulic purposes as if they were continuous abutments. The right abutment had a short guidebank on the upstream side.

Abutment Data

Left Station: 0

Right Station: 673.75

Left Skew (deg): 0

Right Skew (deg) 0

Left Abutment Length (ft): 142

Right Abutment Length (ft) 142

Left Abutment to Channel Bank (ft): 200

Right Abutment to Channel Bank (ft): 60

Left Abutment Protection: None

Right Abutment Protection None

Contracted Opening Type: III

Embankment Skew (deg): 0

Embankment Slope (ft/ft): 6

Abutment Slope (ft/ft) 2.5

Wingwalls: No

Wingwall Angle (deg): 0

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Pier Data

Pier ID	Bridge Station(ft)	Alignment	Highway Station	PierType	# Of Piles	Pile Spacing(ft)
1	95.75	0		Single	0	
2	192.25	0		Single	0	
3	288.75	0		Single	0	
4	385.25	0		Unknown	0	
5	481.75	0		Unknown	0	
6	578.25	0		Unknown	0	

Pier ID	Pier Width(ft)	Pier Shape	Shape Factor	Length(ft)	Protection	Foundation
1	3	Round		18	None	Poured
2	3	Round		18	None	Poured
3	3	Round		18	None	Poured
4	3	Round		18	None	Piles
5	3	Round		18	None	Piles
6	3	Round		18	None	Piles

Pier ID	Top Elevation(ft)	Bottom Elevation(ft)	Foot or Pile Cap Width(ft)	Cap Shape	Pile Tip Elevation(ft)
1	868.4	865.4	9	Square	
2	862.89	859.9	9	Square	
3	858.04	855.04	9	Square	
4	864.08	860.08	9	Square	839
5	863.82	859.82	9	Square	820
6	863.96	859.96	9	Square	860

Pier Description

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Pier ID 1

Piers are numbered from left to right looking downstream.
All piers have a uniform vertical profile.
Piers are 18 foot long, with hammer-head design at top.

Pier ID 2

Piers are numbered from left to right looking downstream.
All piers have a uniform vertical profile.
Piers are 18 foot long, with hammer-head design at top.

Pier ID 3

Piers are numbered from left to right looking downstream.
All piers have a uniform vertical profile.
Piers are 18 foot long, with hammer-head design at top.

Pier ID 4

Flow approached pier 4 at approximately 20 degree angle.
Piers are numbered from left to right looking downstream.
All piers have a uniform vertical profile.
Piers are 18 foot long, with hammer-head design at top.

Pier ID 5

Flow approached pier 5 at approximately 22 degree angle.
Piers are numbered from left to right looking downstream.
All piers have a uniform vertical profile.
Piers are 18 foot long, with hammer-head design at top.

Pier ID 6

Pier 6 was in eddy fence, but fence was reasonably aligned at pier.
Flow approached pier 6 at 5 degree angle.
Piers are numbered from left to right looking downstream.
All piers have a uniform vertical profile.
Piers are 18 foot long, with hammer-head design at top.

Pier Scour Data

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Abutment Scour

Contraction Scour

Measurement Number	Contracted Date	Contracted Time	Uncontracted Date	Uncontracted Time	US/DS	Scour Depth(ft)
1	7/23/1999	15:15	7/23/1999	14:45		2

Measurement Number	Accuracy	Contracted Avg Vel(ft/s)	Contracted Discharge(cfs)	Contracted Depth(ft)	Contracted Width(ft)
1	0.5	5.6	24200	24.6	190

Measurement Number	Uncontracted Avg Vel(ft/s)	Uncontracted Discharge(cfs)	Uncontracted Depth(ft)	Uncontracted Width(ft)	Channel Contraction Ratio
1	5.2	24800	22.6	210	0.29

Measurement Number	Pier Contraction Ratio	Scour Location	Eccentricity	Sediment Transport	Bed Form	Debris Effects
1	0.032	Main Channel		Live-bed	Unknown	Unknown

Measurement Number	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	Sigma Bed Material	Bed Material

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1

Non-
Cohesive

Contraction Scour Comments

Measurement No. 1

The reference surface used to determine the reported contraction scour of 2 feet was established by inspection of a longitudinal profile through the SR 218 surveyed bridge reach. The plot (shown in the longplot.jpg file in the supporting files) illustrated a natural degradation of the channel bed through the bridge opening due to the bend rather than contraction scour. The contraction scour was measured below the bed elevation in the bend rather than average channel elevation in uncontracted sections further upstream and downstream (see Janesville_Topo.jpg in supporting files). A spur dike extending upstream of the bridge's right abutment forced the right floodplain flow to enter the channel approximately 100 feet upstream of the bridge at which point scour in the channel was observed. The reference surface was established from a cross-section located upstream of the convergence between the floodplain and main channel flow. The maximum contraction scour depth was ~5.7 feet and observed upstream of the bridges between pier #4 and #5.

Stage and Discharge Data

Peak Discharge					Flow (cfs)	Qacc	Peak Stage					Stage (ft)	Water Temp (C)	Return Period(yr)
year	mo	dy	hr	mi			year	mo	dy	hr	mi			
					42200									100

Hydrograph

Supporting Files

saab.meas.outp - scour calculations output worksheet
wsp_calb.prt - WSPRO output file for calibration model using surveyed high-water marks and discharge
wsp_prel.prt - WSPRO output file for model using pre-flood geometry for scour calculations.
AllSections.xls - Excel spreadsheet with all surveyed channel bathymetry
f218.xls - Excel spreadsheet with all surveyed floodplain topography.
Janesville_Topo.jpg - plot of surveyed channel bathymetry on July 23, 1999.
LongProfile.jpg - longitudinal profile of surveyed channel reach used to establish contraction scour reference surface.
NewBridgeLocation.jpg - sketch of new bridge location and alignment relative to old bridge.

Photos:

DCP00172.jpg - DCP00207.jpg - photos taken during 1999 flood
DCP00252.jpg-DCP00344.jpg - photos taken during after 1999 flood

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receded.

DSCN0123.jpg-DSCN0138.jpg - photos taken during low-flow and floodplain survey (2000).

Janesville photos.doc - Word document description of all site photos.

Iowa_Janesville_3-25-90.jpg - Aerial photo of site taken in 1990, prior to construction of new bridges

Iowa_Janesville_5-01-94.jpg - Aerial photo of site taken in 1994, after construction of new bridges

ADCP Data Files:

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IOWA003.vel - IOWA 031.vel - output files of ADCP data collected on at site 7-23-99.

Definition of headings for ADCP files:

Transect - transect file number

Ensemble - ensemble number

BinElev - Elevation to center of depth cell in ft MSL

BinDepth - Depth to center of depth cell in ft

U - u-velocity component (east) in ft/sec

V - v-velocity component (north) in ft/sec

W - vertical velocity component in ft/sec

X-SP - x location in UTM coordinates

Y-SP - y location in UTMcoordinate

Mag - velocity magnitude in ft/sec

Dir - velocity direction referenced to north

UnitQ - discharge contain in depth cell

BotElev - Elevation of streambed in ft MSL

X-Loc - x location in local coordinate system

Y-Loc - y location in local coordinate system

U-Loc - u-velocity component in x direction in local coordinate system

V-Loc - v-velocity component in y direction in local coordinate system

Dir-Loc - velocity direction referenced to the local coordinate system