

BSDMS Summary Report

13 Arkansas River at C.R. 613 near Nepesta, CO

Site Location:

Site ID:	13	
Site Name:	Arkansas River at C.R. 613 near Nepesta, CO	
County:	Pueblo	
Nearest City:	Nepesta	Contact:
State:	CO	Robert D. Jarret, Hydrologist
Latitude:	381050	U.S. Geological Survey, Water
Longitude:	1040820	Resources Division, Colorado
USGS Station ID:	7117000	District
Route Number:	613	Building 53, Denver Federal
Route Class:	County	Center, Mail Stop 415, Box 25046
Service Level:	Other	Denver, CO 80225
Route Direction:	NA	
Highway Mile Point:		Publication:
Stream Name:	Arkansas River	U.S. Geological Survey
River Mile:		Water Resources Investigations
		Report 86-4030
		Pilot Study for Collection of
		Bridge-Scour Data
		by Robert D. Jarret and Jeanne M.
		Boyle

Site Description:

The study site is located at the County Road 613 bridge crossing the Arkansas River, 0.98 mile north of Nepesta and U.S. Highway 50. The drainage basin (9400+ sq mi) includes rolling, irrigated farmland and mountainous areas. Natural streamflow is affected by reservoirs, diversions, ground-water withdrawals and return flows. About 60 ft upstream from the bridge, there is a railroad bridge with two piers that may affect scour at this site. There is a sand-bed channel at this location. The majority of the flow is along the left side of the channel. During low flows, there is a sandbar (about 140 ft wide) in the middle of the channel that extends upstream and downstream from the bridge.

The bridge, built in 1905, is 283 ft long, and it has three concrete-filled steel-cylinder piers spaced 105 ft apart. The steel cylinders, 4 ft in diameter, are at each end of the pier, and they are connected by a solid steel web. Pier length is 21 ft, and pier height is approximately 10-12 ft. The piers are perpendicular to the bridge and are generally aligned with the flow. (Sediment samples taken from pier-scour holes are identified with a "P".)

Bridge inspections by Pueblo County officials in 1984 indicated evidence of scour-related and (or) debris-related deterioration of the left abutment, pier 1, and pier 2 (numbered from left bank). Accumulated debris on the sandbar at pier 2 hampered measurement of scour depths on occasion.

A streamflow-gaging station operated by the State of Colorado is located on the right bank about 3 miles upstream from the bridge. The range of

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discharge during data collection was from 360 to 3,690 cubic feet per second. The maximum reported at-pier approach velocity was 5.4 feet per second. The maximum peak flow for 1984 (August 22) was 13,600 cubic feet per second.

The data reported herein were collected as part of a study of general scour at bridge crossings and local scour at bridge piers at sites in Colorado in 1984 (Jarret and Boyle, 1986). The purpose of the study was to develop and test guidelines for collecting streambed-scour data at bridges during high flows. Equipment and procedures commonly used in the the U.S. Geological Survey streamflow-gaging program were employed. A secondary purpose was to evaluate local-sour-prediction equations. The four data-collection sites were selected because record or near-record snow packs were present in the basin headwaters, and the bridges at the sites did not appear to contract the main-channel flow. Estimates of local scour at piers based on the stream cross-section data collected at the upstream and downstream side of the bridge are reported here. Approach depths at piers were computed as the total depth minus the estimated scour-hole depth. At-pier approach velocity and flow skew angle are reported if available.

Elevation Reference

Datum: Local

MSL (ft):

Description of Reference Elevation:

The elevations given are referenced to a local datum, the elevation of which was not determined. A reference point on the top of the left upstream wingwall was given an arbitrary elevation of 20.0 ft.

Stream Data

Drainage Area (sq mi):		Floodplain Width:	Unknown
Slope in Vicinity(ft/ft):	0.0005	Natural Levees:	Unknown
Flow Impact:	Straight	Apparent Incision:	Unknown
Channel Evolution	Unknown	Channel Boundary:	Alluvial
Armoring:	Unknown	Banks Tree Cover:	Low
Debris Frequency:	Frequent	Sinuosity:	Unknown
Debris Effect:	Local	Braiding:	Locally
Stream Size:	Medium	Anabranching:	Locally
Flow Habit:	Perennial	Bars:	Unknown
Bed Material:	Sand	Stream Width Variability:	Unknown
Valley Setting:	Low		

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Roughness Data

Manning's n Values

Left Overbank Channel Right Overbank

High:

Typical

Low:

Bed Material

Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
1	1984	6	5	BM-54	3.02	1.1	0.55	0.31	2.65		Non-Cohesive
2	1984	6	5	BM-54 (P)	10.7	5.2	1.19	0.4	2.65		Non-Cohesive
3	1984	9	26	HAND	2.87	1.2	0.64	0.34	2.65		Non-Cohesive
4	1984	9	26	HAND	1.77	0.9	0.46	0.24	2.65		Non-Cohesive
5	1984	9	26	HAND	1.83	1.0	0.67	0.34	2.65		Non-Cohesive

Bed Material Comments

Measurement No: 1

Measurement No: 2

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Measurement No: 3

Measurement No: 4

Measurement No: 5

Bridge Data

Structure No: PUCO 0.98-601F

Length(ft): 283

Width(ft): 18

Number of Spans: 4

Vertical Configuration: Horizontal

Low Chord Elev (ft):

Upper Chord Elev (ft):

Overtopping Elev (ft):

Skew (degrees): 0

Guide Banks: Unknown

Waterway Classification: Main

Year Built: 1905

Avg Daily Traffic: 29

Plans on File: Yes

Parallel Bridges: Yes

Upstream/Downstream: Downstream

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Continuous Abutment: No

Distance Between Centerlines: 60

Distance Between Pier Faces:

Bridge Description:

Constructed in 1905, this 18-ft-wide one-lane bridge is 283 ft long, and it has three concrete-filled steel-cylinder piers (numbered left to right) spaced 105 ft apart with centerlines oriented perpendicular to the bridge centerline.

The middle spans are steel "through trusses", and the approach spans are timber stringers. A 2.5-in asphalt pavement covers timber deck planks. State inspections in 1984 indicated component of the spans are in fair to poor condition, and structural analysis indicated limited load-bearing capacity.

Undermining of the left approach fill and abutment, as well as possible foundation failures at piers 1 and 2 were also indicated. Consideration of bridge closure or replacement was recommended.

Abutment Data

Left Station: 0

Right Station: 279.5

Left Skew (deg): 0

Right Skew (deg) 0

Left Abutment Length (ft): 16

Right Abutment Length (ft) 16

Left Abutment to Channel Bank (ft): 0

Right Abutment to Channel Bank (ft): 0

Left Abutment Protection:

Right Abutment Protection

Contracted Opening Type: IV

Embankment Skew (deg): 0

Embankment Slope (ft/ft):

Abutment Slope (ft/ft)

Wingwalls: Yes

Wingwall Angle (deg): 45

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Pier Data

Pier ID	Bridge			PierType	# Of Piles	Pile Spacing(ft)
	Station(ft)	Alignment	Highway Station			
1	33.5	0	0	Single	0	
2	139.5	0	0	Single	0	
3	245.5	0	0	Single	0	

Pier ID	Pier			Length(ft)	Protection	Foundation
	Width(ft)	Pier Shape	Shape Factor			
1	4	Round		21	None	Unknown
2	4	Round		21	None	Unknown
3	4	Round		21	None	Unknown

Pier ID	Top	Bottom	Foot or Pile	Cap Shape	File Tip
	Elevation(ft)	Elevation(ft)	Cap Width(ft)		Elevation(ft)
1				Unknown	
2				Unknown	
3				Unknown	

Pier Description

Pier ID 1

The pier is constructed from two 4-ft-diameter concrete-filled steel cylinders connected with a solid steel web. The total length is 21 ft and height is approximately 10-12 ft. Detailed plans of the pier/footings are unavailable. Pier 1 is out-of-plumb, reportedly because of debris forces and scour.

Pier ID 2

The pier is constructed from two 4-ft-diameter concrete-filled steel cylinders connected with a solid steel web. The total length is 21 ft and height is approximately 10-12 ft. Detailed plans of the pier/footings are unavailable. Pier 2 is cracked and failing, possibly because of debris forces and scour. NO Pier coordinates exist for pier ID 2.

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Pier ID 3

The pier is constructed from two 4-ft-diameter concrete-filled steel cylinders connected with a solid steel web. The total length is 21 ft and height is approximately 10-12 ft. Detailed plans of the pier/footings are unavailable. NO Pier coordinates exist for pier ID 3.

Pier Scour Data

Pier ID	Date	Time	USOrDS
1	5/23/84	9:00	Upstream
1	5/23/84	10:30	Downstream
1	6/5/84	14:00	Upstream
1	6/5/84	15:00	Downstream
1	9/27/84	10:00	Upstream
1	9/27/84	11:00	Downstream
3	5/23/84	9:00	Upstream
3	5/23/84	10:30	Downstream
3	6/5/84	14:00	Upstream
3	6/5/84	15:00	Downstream

Pier ID	Scour Depth	Accuracy (ft)	Side Slope (ft/ft)	TopWidth (ft)	Apprch Vel (ft/s)	Apprch Depth(ft)	Effective Pier Width	Skew to Flow(deg)
1	2.1	0.5	3.9	15	3.3	6.9	4	12
1	1.4	0.5	5.2	12	3.3	6.9	4	12
1	4.3	1	3.7	32	5.4	7.5	4	0
1	1.5	0.5	5.7	15	5.4	7.5	4	0
1	2	0.5	4.1	15	2.7	2.3	4	19
1	1.4	0.5	4.6	15	2.7	2.3	4	19
3	1	0.5	5.4	15	2.2	2.1	4	0
3	1	0.5	3.2	6	2.2	2.1	4	0
3	1	0.5	5.7	26	3.3	3.4	4	0
3	1.1	0.5	7.4	15	3.3	3.4	4	0

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
1	Live-bed	Non-cohesive	Unknown			3.61	Unknown
1	Live-bed	Non-cohesive	Unknown			3.61	Unknown
1	Live-bed	Non-cohesive	Unknown			3.61	Unknown
1	Live-bed	Non-cohesive	Unknown			3.61	Unknown
1	Live-bed	Non-cohesive	Unknown			1.88	Unknown

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1	Live-bed	Non-cohesive	Unknown	1.88	Unknown
3	Live-bed	Non-cohesive	Unknown	3.61	Unknown
3	Live-bed	Non-cohesive	Unknown	3.61	Unknown
3	Live-bed	Non-cohesive	Unknown	3.61	Unknown
3	Live-bed	Non-cohesive	Unknown	3.61	Unknown

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
1	10.7	5.15	1.19	0.4
1	10.7	5.15	1.19	0.4
1	10.7	5.15	1.19	0.4
1	10.7	5.15	1.19	0.4
1	2.87	1.19	0.64	0.34
1	2.87	1.19	0.64	0.34
3	10.7	5.15	1.19	0.4
3	10.7	5.15	1.19	0.4
3	10.7	5.15	1.19	0.4
3	10.7	5.15	1.19	0.4

Pier Scour Comments

Pier ID 1 Time: 9:00 US/DS: Upstream

Pier ID 1 Time: 10:30 US/DS: Downstream

Pier ID 1 Time: 14:00 US/DS: Upstream

The channel thalweg coincides with the pier location for this measurement, making the accuracy less certain.

Pier ID 1 Time: 15:00 US/DS: Downstream

Pier ID 1 Time: 10:00 US/DS: Upstream

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Pier ID	1	Time:	11:00	US/DS:	Downstream
Pier ID	3	Time:	9:00	US/DS:	Upstream
Pier ID	3	Time:	10:30	US/DS:	Downstream
Pier ID	3	Time:	14:00	US/DS:	Upstream
Pier ID	3	Time:	15:00	US/DS:	Downstream

Abutment Scour

Contraction Scour

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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			
1984	9	27	10:00	0	363	1	1984	9	27	10:00	0	9.52		
1984	6	5	14:00	0	3690	10	1984	6	5	14:00	0	12.15		
1984	5	23	9:00	0	2460	10	1984	5	23	9:00	0	12.05		

Hydrograph

Hydrograph Number	Year	Month	Day	Hr	Min	Sec	Stage(ft)	Discharge (cfs)
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Supporting Files
