

# BSDMS Summary Report

11 South Platte River at S.R. 37 near Kersey, CO

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## Site Location:

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**Site ID:** 11

**Site Name:** South Platte River at S.R. 37 near Kersey, CO

**County:** Weld

**Nearest City:** Kersey

**State:** CO

**Latitude:** 402444

**Longitude:** 1043346

**USGS Station ID:** 6754000

**Route Number:** 37

**Route Class:** State

**Service Level:** Mainline

**Route Direction:** NA

**Highway Mile Point:**

**Stream Name:** South Platte River

**River Mile:**

**Contact:**  
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**Publication:**  
U.S. Geological Survey  
Water Resources Investigations  
Report 86-4030  
Pilot Study for Collection of  
Bridge-Scour Data  
by Robert D. Jarrett and Jeanne M.  
Boyle

## Site Description:

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The study site is located at the State Highway 37 bridge crossing the South Platte River, 2.5 mi downstream of Cache la Poudre River and 1.9 mi north of Kersey, Colo. The drainage basin (9,598 sq mi) includes rolling, irrigated farmland and mountainous areas. Natural streamflow is affected by reservoirs, diversions, ground-water withdrawals and return flows. There is a sand-bed channel at this location. A small channel, separated from the main channel by a large island, merges with the main channel about 100 ft upstream from the bridge on the right bank (looking downstream). There are three small islands approximately 250 ft downstream from the bridge, and during low flows, there are sandbars along the right side of the river downstream from the bridge.

The bridge, built in 1958, is 663 ft long, and it has 12 concrete piers spaced 51 ft apart, centerlines oriented at a 60-degree angle to the roadway centerline. During high flow, the piers are aligned with most of the flow, but during low flows, the piers are at angle to the flow. This angle is approximately 0 degrees at the left bank and increases to about 50 degrees on the right bank. The majority of the flow is along the left side of the river, and it is usually contained between the left bank and the 10th pier from the left bank. Scour measurements at the first nine piers from the left bank are reported herein.

A streamflow-gaging station is located on the left bank downstream of the bridge. The range of discharge during data collection was from 1,240 to 6,630 cubic feet per second. The maximum reported at-pier approach velocity was 5.8

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feet per second. The maximum peak flow for 1984 (May 17) was 9,550 cubic feet per second.

Data collection at this site was complicated by the bridge configuration, accumulation of debris, and flow skewed to the piers. The bridge deck overhangs the upstream edge of the piers by 6.4 ft. Therefore, the sounding weights were allowed to drift downstream to measure the scour at the piers. Large logs and other debris were lodged against the piers on the left side of the river, making it difficult or sometimes impossible to measure scour depths near some piers. Flow skewed to the piers on the right side of the channel complicated the scour conditions.

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

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**Datum:** MSL

**MSL (ft):**

#### Description of Reference Elevation:

The elevations given are referenced to mean sea level, based on reported gage heights and a gage datum of 4575.77 ft above mean sea level. Reference point 1 (yellow paint mark) was located above the fourth pier (from the left side looking downstream) on the sidewalk. The bench mark is a brass tablet set in the concrete sidewalk on left upstream end of the bridge at a gage elevation of 14.54 ft.

### Stream Data

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<b>Drainage Area (sq mi):</b>	9598	<b>Floodplain Width:</b>	Unknown
<b>Slope in Vicinity(ft/ft):</b>	0.00093	<b>Natural Levees:</b>	Unknown
<b>Flow Impact:</b>	Straight	<b>Apparent Incision:</b>	Unknown
<b>Channel Evolution</b>	Unknown	<b>Channel Boundary:</b>	Alluvial
<b>Armoring:</b>	Unknown	<b>Banks Tree Cover:</b>	Medium
<b>Debris Frequency:</b>	Frequent	<b>Sinuosity:</b>	Unknown
<b>Debris Effect:</b>	Local	<b>Braiding:</b>	Locally

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Stream Size:	Wide	Anabranching:	Generally
Flow Habit:	Perennial	Bars:	Unknown
Bed Material:	Sand	Stream Width Variability:	Unknown
Valley Setting:	Low		

## Roughness Data

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### Manning's n Values

	Left Overbank	Channel	Right Overbank
High:			
Typical			
Low:			

## Bed Material

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Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
1	1984	6	26	BM-54	10.4	5.1	1.1	0.43	2.65		Non-Cohesive
2	1984	10	3	HAND	14.8	7.9	1.8	0.43	2.65		Non-Cohesive

## Bed Material Comments

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Measurement No: 1

Measurement No: 2

## Bridge Data

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Structure No:

Length(ft): 663

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Width(ft): 32  
Number of Spans: 13  
Vertical Configuration: Sloping  
Low Chord Elev (ft): 4588  
Upper Chord Elev (ft): 4589  
Overtopping Elev (ft): 4590.6  
Skew (degrees): 30  
Guide Banks: Unknown  
Waterway Classification: Main  
Year Built: 1958  
Avg Daily Traffic:  
Plans on File: Yes  
Parallel Bridges No  
Upstream/Downstream: N/A  
Continuous Abutment: No  
Distance Between Centerlines:  
Distance Between Pier Faces:

## Bridge Description:

This concrete slab and beam bridge is 663 ft long and it has 12 concrete piers (numbered left to right) spaced 51 ft apart with centerlines oriented at a 60-degree angle to the roadway centerline.

## Abutment Data

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Left Station: -6.4  
Right Station: 656.6  
Left Skew (deg): 0  
Right Skew (deg) 0  
Left Abutment Length (ft): 45  
Right Abutment Length (ft) 45  
Left Abutment to Channel Bank (ft): 0

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Right Abutment to Channel Bank (ft): 0

Left Abutment Protection:

Right Abutment Protection

Contracted Opening Type: III

Embankment Skew (deg): 30

Embankment Slope (ft/ft):

Abutment Slope (ft/ft) 2

Wingwalls: No

Wingwall Angle (deg): 0

## Pier Data

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Pier ID	Bridge Station(ft)	Alignment	Highway Station	PierType	# Of Piles	Pile Spacing(ft)
1	51	30	5871	Single	0	
10	510	30	6330	Single	0	
11	561	30	6381	Single	0	
12	612	30	6432	Single	0	
2	102	30	5922	Single	0	
3	153	30	5973	Single	0	
4	204	30	6024	Single	0	
5	255	30	6075	Single	0	
6	306	30	6126	Single	0	
7	357	30	6177	Single	0	
8	408	30	6228	Single	0	
9	459	30	6279	Single	0	

Pier ID	Pier Width(ft)	Pier Shape	Shape Factor	Length(ft)	Protection	Foundation
1	1.75	Sharp		23.25	Unknown	Piles

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10	1.75	Sharp	23.25	Unknown	Piles
11	1.75	Sharp	23.25	Unknown	Piles
12	1.75	Sharp	23.25	Unknown	Piles
2	1.75	Sharp	23.25	Unknown	Piles
3	1.75	Sharp	23.25	Unknown	Piles
4	1.75	Sharp	23.25	Unknown	Piles
5	1.75	Sharp	23.25	Unknown	Piles
6	1.75	Sharp	23.25	Unknown	Piles
7	1.75	Sharp	23.25	Unknown	Piles
8	1.75	Sharp	23.25	Unknown	Piles
9	1.75	Sharp	23.25	Unknown	Piles

Pier ID	Top Elevation(ft)	Bottom Elevation(ft)	Foot or Pile Cap Width(ft)	Cap Shape	Pile Tip Elevation(ft)
1		4574.77		Other	4540
10		4574.96		Other	4540
11		4575.09		Other	4540
12		4575.23		Other	4540
2		4574.9		Other	4540
3		4575.03		Other	4540
4		4575.17		Other	4540
5		4574.8		Other	4540
6		4574.93		Other	4540
7		4575.06		Other	4540
8		4575.2		Other	4540
9		4574.83		Other	4540

## Pier Description

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### Pier ID 1

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

### Pier ID 10

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

### Pier ID 11

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

### Pier ID 12

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

### Pier ID 2

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

### Pier ID 3

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

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**Pier ID** 4

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

**Pier ID** 5

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

**Pier ID** 6

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

**Pier ID** 7

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

**Pier ID** 8

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

**Pier ID** 9

The pier encases six concrete-filled pipe piles (length 44 ft and diameter 1.1 ft) spaced at 3.8 ft on centers. The pile tip elevation was estimated from the plan drawings. Value reported as pile cap elevation is instead the bottom elevation of the pier. A 36-ft cantilever beam caps the pier.

## Pier Scour Data

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Pier ID	Date	Time	USOrDS
3	5/21/84	10:00	Upstream

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3	5/21/84	13:00	Downstream
4	5/21/84	10:00	Upstream
4	5/21/84	13:00	Downstream
4	6/26/84	14:00	Upstream
4	6/26/84	16:00	Downstream
4	10/3/84	8:00	Upstream
4	10/3/84	10:00	Downstream
5	5/21/84	13:00	Downstream
5	6/26/84	16:00	Downstream
5	10/3/84	10:00	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)
3	1.1	0.5	20	29	4.6	6	1.75	20
3	2.2	0.5	9.9	38	4.6	6	1.75	20
4	1	0.5	22	28	5.8	5.1	1.75	20
4	2.6	0.5	7.2	32	5.8	5.1	1.75	20
4	1.5	0.5	7.5	21	3.2	4.6	1.75	43
4	2.2	0.5	9.3	41	3.2	4.6	1.75	43
4	1.8	0.5	9.7	35	1.9	1.9	1.75	0
4	2.3	0.5	9.1	42	1.9	1.9	1.75	0
5	3	0.5	6.7	40	4.6	4.3	1.75	20
5	1.6	0.5	8	26	3.4	3.3	1.75	43
5	1.4	0.5	12.1	34	2.5	2.2	1.75	43

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
3	Live-bed	Non-cohesive	Unknown			3.45	Unknown
3	Live-bed	Non-cohesive	Unknown			3.45	Unknown
4	Live-bed	Non-cohesive	Unknown			3.45	Unknown
4	Live-bed	Non-cohesive	Unknown			3.45	Unknown
4	Live-bed	Non-cohesive	Unknown			3.45	Unknown
4	Live-bed	Non-cohesive	Unknown			3.45	Unknown
4	Unknown	Non-cohesive	Unknown			4.27	Substantial
4	Unknown	Non-cohesive	Unknown			4.27	Substantial
5	Live-bed	Non-cohesive	Unknown			3.45	Unknown
5	Live-bed	Non-cohesive	Unknown			3.45	Unknown

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5 Unknown Non-cohesive Unknown 4.27 Unknown

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
3	10.4	5.12	1.1	0.43
3	10.4	5.12	1.1	0.43
4	10.4	5.12	1.1	0.43
4	10.4	5.12	1.1	0.43
4	10.4	5.12	1.1	0.43
4	10.4	5.12	1.1	0.43
4	14.8	7.86	1.8	0.43
4	14.8	7.86	1.8	0.43
5	10.4	5.12	1.1	0.43
5	10.4	5.12	1.1	0.43
5	14.8	7.86	1.8	0.43

## Pier Scour Comments

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**Pier ID** 3                      **Time:** 10:00                      **US/DS:** Upstream

Flow skew to the pier was 20 degrees at the nose and 7 degrees at the tail.

**Pier ID** 3                      **Time:** 13:00                      **US/DS:** Downstream

Flow skew to the pier was 20 degrees at the nose and 7 degrees at the tail.

**Pier ID** 4                      **Time:** 10:00                      **US/DS:** Upstream

Flow skew to the pier was 20 degrees at the nose and zero degrees at the tail.

**Pier ID** 4                      **Time:** 13:00                      **US/DS:** Downstream

Flow skew to the pier was 20 degrees at the nose and zero degrees at the tail.

**Pier ID** 4                      **Time:** 14:00                      **US/DS:** Upstream

**Pier ID** 4                      **Time:** 16:00                      **US/DS:** Downstream

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Pier ID 4                      Time: 8:00                      US/DS: Upstream

The average approach velocity was 2.64 feet per second. The scour hole is probably a remnant of earlier scour activity.

Pier ID 4                      Time: 10:00                      US/DS: Downstream

The average approach velocity was 2.64 feet per second. The scour hole is probably a remnant of earlier scour activity.

Pier ID 5                      Time: 13:00                      US/DS: Downstream

Flow skew to the pier was 20 degrees at the nose and 7 degrees at the tail.

Pier ID 5                      Time: 16:00                      US/DS: Downstream

Pier ID 5                      Time: 10:00                      US/DS: Downstream

## Abutment Scour

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## Contraction Scour

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## Stage and Discharge Data

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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	5	21	11:00	0	6630	10	1984	5	21	11:00	0	4583.6		
1984	6	26	15:00	0	2250	10	1984	6	26	15:00	0	4581.09		
1984	10	3	15:00	0	1240	10	1984	10	3	15:00	0	4580.53		

## Hydrograph

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

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