BSDMS Summary Report

3 Knik River at S.R. 1 near Eklutna, AK

Site Location:

Site ID: 3

Site Name: Knik River at S.R. 1 near Eklutna, AK

County: Eklutna

Nearest City: Eklutan

State: AK

Latitude: 615000

Longitude: 1485500

USGS Station ID:

Route Number: 1

Route Class: State

Service Level: Mainline

Route Direction: NA

Highway Mile Point:

Stream Name: Knik River

River Mile:

Contact:
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218 E Street, Skyline Building
Anchorage, AK 99501

Publication:
U.S. Geological Survey
Water-Resources Investigations 32-75
Scour at Selected Bridge Sites in Alaska
By Vernon W. Norman
November 1975

Site Description:

This study site is located 7.5 miles downstream from the site at Palmer, Alaska. It is 10 miles southwest of the village of Eklutna. The bridge at this site is 1500 ft long and crosses a channel of the Knik River at a 20-degree angle. Its seven round-nosed piers are spaced about 200 ft apart and aligned with the flow.

The Knik River at this location has a braided channel, and the islands are inundated at flood stage. The channel streambed consisted of sand and gravel and was in a dune regime at the time of the peak discharge. In the study channel the river begins to widen as it flows beneath the Alaska Railroad Bridge, about 2000 ft upstream from the highway bridge, and continues to widen for about 0.5 mile where it merges with the Matanuska River to form the upper end of Knik Arm. Tides reach the highway bridge, but even at flood stage their effect probably is insignificant.

The high-water data in this report is the latest flood breakout (as of Nov 1975) in glacier-dammed Lake George. Such breakouts often caused annual peaks from 1959-1965, but they had not occurred since 1966 because the Knik Glacier, which caused the annual ice dam, began to retreat.

For this study, the fourth pier from the left bank was instrumented with a single transducer at the nose of the pier. Depth to the streambed below the transducer was recorded by fathometer.

For more information on the methods of sampling and purpose of this study, see the Location description for the Susitna River near Sunshine.

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Elevation Reference

Datum: Gage

MSL (ft):

Description of Reference Elevation:

Stream Data

Drainage Area (sq mi):		**Floodplain Width:**	Unknown
Slope in Vicinity(ft/ft):	0.001	**Natural Levees:**	Unknown
Flow Impact:	Straight	**Apparent Incision:**	Unknown
Channel Evolution	Unknown	**Channel Boundary:**	Alluvial
Armoring:	Partial	**Banks Tree Cover:**	Medium
Debris Frequency:	Unknown	**Sinuosity:**	Sinuous
Debris Effect:	Unknown	**Braiding:**	Locally
Stream Size:	Wide	**Anabranching:**	Locally
Flow Habit:	Perennial	**Bars:**	Wide
Bed Material:	Sand	**Stream Width Variability:**	Wider
Valley Setting:	Unknown		

Roughness Data

Manning's n Values

	Left Overbank	Channel	Right Overbank
High:			
Typical			
Low:			

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Bed Material

Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
1	1966	6	17	BM-54	14	4	0.58	0.08	2.65		Unknown
2	1966	6	23	BM-54	14	5	1.1	0.24	2.65		Unknown
3	1966	6	24	BM-54	22	8	1.8	0.39	2.65		Unknown
4	1966	6	17	BM-54	2.2	1.2	0.53	0.23	2.65		Unknown
5	1966	6	17	BM-54	23	11	4	1.4	2.65		Unknown
6	1966	6	17	BM-54	3.7	1.6	0.42	0.11	2.65		Unknown
7	1966	6	24	BM-54	7	4	1.4	0.54	2.65		Unknown
8	1966	6	24	BM-54	8	4	1.6	0.63	2.65		Unknown

Bed Material Comments

Measurement No: 1

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=7 and D50=0.58 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 2

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=8 and D50=1.1 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 3

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=13 and D50=1.8 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 4

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=1.6 and D50=0.53 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 5

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=16 and D50=4 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 6

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=2.3 and D50=0.42 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 7

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=4.8 and D50=1.4 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Measurement No: 8

All bed-material samples were collected at the bridge. Samples 1-3 are composites for the section. Sample 4 was collected at station 700, sample 5 at station 760, sample 6 at station 800, sample 7 at station 700, and sample 8 at station 778. Only the D90=5.4 and D50=1.6 were reported with the data. The D95, D84, and D16 were computed from the provided data. The D84 was interpolated from the D90 and D50 using a log-probability interpolation. Sigma was computed as D84/D50. D95 and D16 were computed from the equation D50 * Sigma^(standard normal deviate of 95 or 16).

Bridge Data

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Structure No: 1121

Length(ft): 1500

Width(ft):

Number of Spans: 8

Vertical Configuration: Unknown

Low Chord Elev (ft):

Upper Chord Elev (ft):

Overtopping Elev (ft):

Skew (degrees): 20

Guide Banks: Unknown

Waterway Classification: Relief

Year Built:

Avg Daily Traffic:

Plans on File: No

Parallel Bridges No

Upstream/Downstream: N/A

Continuous Abutment: No

Distance Between Centerlines:

Distance Between Pier Faces:

Bridge Description:

This bridge is 1500 ft long and crosses a channel of the Knik River at a 20 degree angle, 7.5 miles downstream from the scour site of the Knik River at Palmer, Alaska. Its seven round-nose piers are spaced about 200 ft apart and are aligned with the flow.

Abutment Data

Left Station: 0

Right Station: 0

Left Skew (deg): 0

Right Skew (deg) 0

Left Abutment Length (ft):

Right Abutment Length (ft)

Left Abutment to Channel Bank (ft):

Right Abutment to Channel Bank (ft):

Left Abutment Protection:

Right Abutment Protection

Contracted Opening Type: Unknown

Embankment Skew (deg): 0

Embankment Slope (ft/ft):

Abutment Slope (ft/ft)

Wingwalls: No

Wingwall Angle (deg): 0

Pier Data

Pier ID	Bridge Station(ft)	Alignment	Highway Station	PierType	# Of Piles	Pile Spacing(ft)
1	160	20	0	Single	0	
2	360	20	0	Single	0	
3	560	20	0	Single	0	
4	760	20	0	Single	0	
5	960	20	0	Single	0	
6	1160	20	0	Single	0	
7	1360	20	0	Single	0	

Pier ID	Pier Width(ft)	Pier Shape	Shape Factor	Length(ft)	Protection	Foundation
1	5	Round		36.9	Unknown	Piles
2	5	Round		36.9	Unknown	Piles
3	5	Round		36.9	Unknown	Piles

4	5	Round	36.9	Unknown	Piles
5	5	Round	36.9	Unknown	Piles
6	5	Round	36.9	Unknown	Piles
7	5	Round	36.9	Unknown	Piles

Pier ID	Top Elevation(ft)	Bottom Elevation(ft)	Foot or Pile Cap Width(ft)	Cap Shape	Pile Tip Elevation(ft)
1	6	3		Square	
2	2.5	-0.5		Square	
3	2.5	-0.5		Square	
4	2.5	-0.5	17	Square	
5	2.5	-0.5		Square	
6	2.5	-0.5		Square	
7	2.5	-0.5		Square	

Pier Description

Pier ID 1

This is an expansion pier. It does not have a footing as large as at Pier 4 (fixed pier), and the elevation of the top of the footing is 3.5 ft lower than the elevation of the top of footing at Pier 4. Scour depth at this pier is not affected by the foundation.

Pier ID 2

This is an expansion pier. It does not have a footing as large as at Pier 4 (fixed pier), and the elevation of the top of the footing is 3.5 ft lower than the elevation of the top of footing at Pier 4. Scour depth at this pier is not affected by the foundation.

Pier ID 3

This is an expansion pier. It does not have a footing as large as at Pier 4 (fixed pier), and the elevation of the top of the footing is 3.5 ft lower than the elevation of the top of footing at Pier 4. Scour depth at this pier is not affected by the foundation.

Pier ID 4

This is the only fixed pier at this bridge. Scour was measured here with a single fixed transducer.

Pier ID 5

This is an expansion pier. It does not have a footing as large as at Pier 4 (fixed pier), and the elevation of the top of the footing is 3.5 ft lower than the elevation of the top of footing at Pier 4. Scour depth at this pier is not affected by the foundation.

Pier ID 6

This is an expansion pier. It does not have a footing as large as at Pier 4 (fixed pier), and the elevation of the top of the footing is 3.5 ft lower than the elevation of the top of footing at Pier 4. Scour depth at this pier is not affected by the foundation.

Pier ID 7

This is an expansion pier. It does not have a footing as large as at Pier 4 (fixed pier), and the elevation of the top of the footing is 3.5 ft lower than the elevation of the top of footing at Pier 4. Scour depth at this pier is not affected by the foundation.

Pier Scour Data

Pier ID	Date	Time	USOrDS
1	6/24/66	0:00	Upstream
1	6/28/66	0:00	Upstream
2	6/24/66	0:00	Upstream
2	6/28/66	0:00	Upstream
3	6/17/66	0:00	Upstream
3	6/24/66	0:00	Upstream
3	6/28/66	0:00	Upstream
4	6/17/66	0:00	Upstream
4	6/24/66	0:00	Upstream
4	6/28/66	0:00	Upstream
5	6/17/66	0:00	Upstream
5	6/24/66	0:00	Upstream
5	6/28/66	0:00	Upstream

6	6/17/66	0:00	Upstream
6	6/24/66	0:00	Upstream
6	6/28/66	0:00	Upstream
7	6/17/66	0:00	Upstream
7	6/24/66	0:00	Upstream
7	6/28/66	0:00	Upstream

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	0.5			5	7	5	0
1	1.5	0.5			3.1	3	5	0
2	2	0.5			5.1	6.5	5	0
2	2	0.5			3.2	3	5	0
3	1	0.5			1.6	4	5	0
3	3	0.5			5.2	10	5	0
3	1.5	0.5			3.6	6	5	0
4	1	0.5			2.5	5	5	0
4	4	0.5			6.5	10.5	5	0
4	2	0.5			3.8	8	5	0
5	1	0.5			2.9	4	5	0
5	4.5	0.5			5.9	10	5	0
5	2.5	0.5			3.7	7.5	5	0
6	2.5	0.5			0.9	1.5	5	0
6	3.5	0.5			6.8	8.5	5	0
6	1.5	0.5			3.7	5	5	0
7	4	0.5			0.5	2	5	0
7	6	0.5			6	10	5	0
7	2.5	0.5			3.2	6.5	5	0

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
1	Live-bed	Non-cohesive	Dune			4.6	Unknown
1	Live-bed	Non-cohesive	Dune			4.6	Unknown
2	Live-bed	Non-cohesive	Dune			4.6	Unknown
2	Live-bed	Non-cohesive	Dune			4.6	Unknown
3	Live-bed	Non-cohesive	Dune			6.9	Unknown
3	Live-bed	Non-cohesive	Dune			4.6	Unknown
3	Live-bed	Non-cohesive	Dune			4.6	Unknown

4	Live-bed	Non-cohesive	Dune	6.9	Unknown
4	Live-bed	Non-cohesive	Dune	4.6	Unknown
4	Live-bed	Non-cohesive	Dune	4.6	Unknown
5	Live-bed	Non-cohesive	Dune	6.9	Unknown
5	Live-bed	Non-cohesive	Dune	4.6	Unknown
5	Live-bed	Non-cohesive	Dune	4.6	Unknown
6	Live-bed	Non-cohesive	Dune	6.9	Unknown
6	Live-bed	Non-cohesive	Dune	4.6	Unknown
6	Live-bed	Non-cohesive	Dune	4.6	Unknown
7	Live-bed	Non-cohesive	Dune	6.9	Unknown
7	Live-bed	Non-cohesive	Dune	4.6	Unknown
7	Live-bed	Non-cohesive	Dune	4.6	Unknown

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
1	22	8	1.8	0.39
1	22	8	1.8	0.39
2	22	8	1.8	0.39
2	22	8	1.8	0.39
3	14	4	0.58	0.08
3	22	8	1.8	0.39
3	22	8	1.8	0.39
4	14	4	0.58	0.08
4	22	8	1.8	0.39
4	22	8	1.8	0.39
5	14	4	0.58	0.08
5	22	8	1.8	0.39
5	22	8	1.8	0.39
6	14	4	0.58	0.08
6	22	8	1.8	0.39

6	22	8	1.8	0.39
7	14	4	0.58	0.08
7	22	8	1.8	0.39
7	22	8	1.8	0.39

Pier Scour Comments

Pier ID 1 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

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Pier ID 1 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 2 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 2 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 3 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 3 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 3 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 4 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes, and ambient streambed elevation was hard to describe. This is the only fixed pier of the 7 piers.

Pier ID 4 **Time:** 0:00 **US/DS:** Upstream

Footing was exposed by scour. Scour depth was hard to measure because dune heights were of the same magnitude as the apparent depth of the local-scour holes, and the ambient streambed was hard to describe.

Pier ID 4 **Time:** 0:00 **US/DS:** Upstream

Footing was exposed by scour on this pier, the only one of the 7 to be a fixed pier. Scour depth was difficult to measure because the dune heights were of the same magnitude as the apparent depth of local scour holes, and the ambient streambed was hard to describe.

Pier ID 5 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 5 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 5 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 6 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 6 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 6 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 7 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 7 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Pier ID 7 **Time:** 0:00 **US/DS:** Upstream

Scour was difficult to measure because the dune heights were of the same magnitude as the apparent depth of the local-scour holes and ambient-streambed elevation was hard to describe. This is an expansion pier and scour depth was not affected by the foundation.

Abutment Scour

ContractionScour

Stage and Discharge Data

Peak Discharge year	mo	dy	hr	mi	Flow (cfs)	Qacc	Peak Stage year	mo	dy	hr	mi	Stage (ft)	Water Temp (C)	Return Period(yr)
1966	6	24		0	73600	999	1966	6	24		0	19.4	4.5	
1966	6	28		0	26000	999	1966	6	28		0	15.4	4	
1966	6	17		0	6670	999	1966	6	17		0	12.2	9.5	

Hydrograph

Hydrograph Number	Year	Month	Day	Hr	Min	Sec	Stage(ft)	Discharge (cfs)
1	1966	6	15	12	0	0	12.1	
1	1966	6	20	0	0	0	12.1	
1	1966	6	21	0	0	0	12.7	
1	1966	6	22	0	0	0	13.3	
1	1966	6	23	0	0	0	15.5	
1	1966	6	24	0	0	0	19.6	
1	1966	6	24	8	0	0	19.9	
1	1966	6	24	9	40	0	19.3	
1	1966	6	24	14	20	0	19.6	
1	1966	6	25	12	0	0	16.8	
1	1966	6	25	0	0	0	17.6	
1	1966	6	26	0	0	0	15.6	
1	1966	6	27	0	0	0	15.4	
1	1966	6	28	9	40	0	15.4	
2	1966	6	1	0	0	0		1500

2	1966	6	10	0	0	0	6500
2	1966	6	20	0	0	0	7500
2	1966	6	23	0	0	0	95000
2	1966	6	24	0	0	0	100000
2	1966	6	27	0	0	0	35000
2	1966	6	28	0	0	0	40000
2	1966	6	30	0	0	0	32000

Supporting Files