

BSDMS Summary Report

58 Mississippi River at S.R. 3 at St. Paul, MN

Site Location:

Site ID: 58

Site Name: Mississippi River at S.R. 3 at St. Paul, MN

County: Ramsey

Nearest City: St. Paul

State: MN

Latitude: 445648

Longitude: 930444

USGS Station ID:

Route Number: 3

Route Class: State

Service Level: Mainline

Route Direction: NA

Highway Mile Point:

Stream Name: Mississippi River

River Mile:

Contact:
George H. Carlson
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Publication:

Site Description:

At east side of downtown St. Paul, MN. Undivided 4 lane freeway bridge 3,363 ft long of 29 spans with span 9, (270ft), span 10 (362 ft), and span 11 (250.5 ft) over river channel. Spans are numbered from south end. End spans carry highway 3 over streets in flood plain now protected by levees which confine flow through St. Paul to 1200ft width or less where floods previously had relief above 700 ft across 3500ft of flood plain on right bank. Piers in channel initially had riprap for 20 ft out all around the bases. Named "Lafayette Freeway Bridge."
Note: Piers 8 - 11 have wide beveled corners

Elevation Reference

Datum: MSL

MSL (ft):

Description of Reference Elevation:

Benchmarks:

#6244A, in SE corner, 0.8 ft north of south end of east concrete railing.

Elev. 730.569 ft.

#K349, set vertically in south face of southeast most concrete pier, 17.4 ft

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east of east rail of RR tracks, Elev. 763.933 ft.
#L254, in bridge pier 1.8 ft west of southeast corner of east pier in second row of piers from south end of bridge. Elev. 704.769 ft.
#W250, 34 ft north of Warner Road in east face of first pier east of river, 2.5 ft south of northeast corner or pier. Elev. 708.201 ft.
Additional marks available from MN DOT mapping unit, tel (612)296-3027.

Stream Data

Drainage Area (sq mi):	36800	Floodplain Width:	Little
Slope in Vicinity(ft/ft):	0.000222	Natural Levees:	Little
Flow Impact:	Straight	Apparent Incision:	None
Channel Evolution	Constructed	Channel Boundary:	Alluvial
Armoring:	None	Banks Tree Cover:	Low
Debris Frequency:	Rare	Sinuosity:	Sinuuous
Debris Effect:	None	Braiding:	None
Stream Size:	Wide	Anabranching:	None
Flow Habit:	Perennial	Bars:	Narrow
Bed Material:	Sand	Stream Width Variability:	Equiwidth
Valley Setting:	Moderate		

Roughness Data

Manning's n Values

	Left Overbank	Channel	Right Overbank
High:	0.04	0.03	
Typical	0.035	0.025	
Low:	0.03	0.02	

Bed Material

Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
43	1978	0	0		1.1	0.7	0.48	0.2	2.65		Non-Cohesive

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46 1980 0 0 0.75 0.4 0.12 0.01 2.65 Non-Cohesive

Bed Material Comments

Measurement No: 43

Bed material sample # 43 (1978) collected 0.22 mile upstream of bridge

Measurement No: 46

Bed material sample # 46 (1980) collected 0.28 mile downstream of bridge

Bridge Data

Structure No: 9800

Length(ft): 3383

Width(ft): 67

Number of Spans:

Vertical Configuration: Curvilinear

Low Chord Elev (ft): 744

Upper Chord Elev (ft): 748

Overtopping Elev (ft): 715

Skew (degrees): 0

Guide Banks: None

Waterway Classification: Main

Year Built: 1968

Avg Daily Traffic: 15000

Plans on File: Yes

Parallel Bridges No

Upstream/Downstream: Unknown

Continuous Abutment: No

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Distance Between Centerlines:

Distance Between Pier Faces:

Bridge Description:

Concrete bridge supported by concrete piers on piles. Only pier 9 & 10 are in the main channel. Top of pile caps for piers 9 & 10 approx elev initially, of stream bed, at 673 ft NGVD. Pile caps are 16ft thick, extending down to 657 ft under piers. Lowest part of bridge deck over channel at approx elev 744 ft. Bridge is perpendicular to channel. Confinement of flood flows to width between levees on both banks results in high velocities at bridge. Abutments are behind levees and flow does not get near them. River banks under bridge are the levees and floodwalls which are continuous for 2.25 miles US and 0.5 mile DS of bridge. There is no contraction of flow width from approach to bridge, the only contraction in area is due to presence of the piers.

Abutment Data

Left Station: 23425

Right Station: 20062

Left Skew (deg): 0

Right Skew (deg) 0

Left Abutment Length (ft):

Right Abutment Length (ft)

Left Abutment to Channel Bank (ft): 1836

Right Abutment to Channel Bank (ft): 794

Left Abutment Protection:

Right Abutment Protection

Contracted Opening Type: Other

Embankment Skew (deg): 0

Embankment Slope (ft/ft):

Abutment Slope (ft/ft)

Wingwalls: No

Wingwall Angle (deg): 0

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Pier Data

Pier ID	Bridge		Highway Station	PierType	# Of Piles	Pile Spacing(ft)
	Station(ft)	Alignment				
10	2628		21429.5	Single	0	
11	2377.5		21680	Single	0	
12	2242.5		21815	Single	0	
13	2157.5		21910	Single	0	
8	3260		20797.5	Single	0	
9	2990		21067.5	Single	0	

Pier ID	Pier		Shape Factor	Length(ft)	Protection	Foundation
	Width(ft)	Shape				
10	11.2	Square		32.3	Riprap	Piles
11	8.3	Square		30.2	Other	Piles
12	4	Square		37.3	Other	Piles
13	3.5	Square		36.5	Other	Piles
8	8.7	Square		24	None	Piles
9	11.3	Square		32	Riprap	Piles

Pier ID	Elevation(ft)		Foot or Pile Cap Width(ft)	Cap Shape	Pile Tip Elevation(ft)
	Top	Bottom			
10	673	657	31	Square	
11	703.75	699.25	15	Square	
12	702.35	697.85	13	Square	
13	702.11	697.36	13	Square	
8	691.5	687	15	Square	
9	673	657	35	Square	

Pier Description

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Pier ID 10

Pier 10 is in left 1/3 of channel. Pile cap is stepped. Lower 8 ft is 31 ft wide, upper 8 ft is 27 ft wide. Base of pier is 11.4 ft wide. Pier tapers to 7 ft wide at top at approx elev. 744 ft.

Pier ID 11

Pier 11 is in flood plain on left bank with pile cap below grade. Pier is 8.3 ft wide at base tapering to 5.5 ft wide at top. Ground level is at elev 704 ft at base. Not subject to scour.

Pier ID 12

Pier 12 is in the flood plain on left bank. Pier is two 4 ft square posts spaced 33.3 ft on center with a 4 ft square beam between posts from Elev. 705.35 to Elev. 709.35 ft. Pier is turned about 9 degrees clockwise to be parallel to railroad tracks adjacent.

Pier ID 13

Pier 13 is in the flood plain on left bank. Pier is two 3.5 ft sq posts spaced 33 ft on center with a 3.5 ft square beam between the posts from elev. 705.61 to 709.11 ft.

Pier ID 8

Pier 8 is 8.67 ft wide at base, 4.5 ft wide at top. Pier is in flood plain on right bank behind floodwall. Not subject to scour. Ground at base is at Elev. 703 ft.

Pier ID 9

Pier 9 is in right 1/3 of channel. Pile cap is stepped, Lower 8 ft is 35 ft wide, upper 8 ft is 31 ft wide. Base of pier is 11.3 ft wide. Pier tapers to 7 ft wide at top. Approx elev. of top is 742 ft, about 34 ft above highest water level expected.

Pier Scour Data

Pier ID	Date	Time	USOrDS
10	3/28/69	14:30	Upstream

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10	4/3/69	11:57	Upstream
10	4/9/69	11:52	Upstream
10	4/15/69	12:40	Upstream
10	4/23/69	11:37	Upstream
10	4/28/69	12:15	Upstream
10	6/4/69	13:35	Upstream
9	3/28/69	14:30	Upstream
9	4/3/69	11:57	Upstream
9	4/9/69	11:52	Upstream
9	4/15/69	12:40	Upstream
9	4/23/69	11:37	Upstream
9	4/28/69	12:15	Upstream
9	6/4/69	13:55	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)
10	1.7	0.1	17.7	60	2.16	14	10.9	0
10	1.4	0.1	19.4	50	2.51	15.7	10.8	0
10	2.9	0.1	9.1	75	3.88	22	10.9	0
10	2.2	0.1	13.1	50	5.16	32.1	10.3	0
10	2.6	0.1	11.8	50	4.63	32	12	0
10	1.3	0.1	23.6	60	3.77	26	12	0
10	1.6	0.1	18.6	60	1.54	15.5	13.4	0
9	3	0.1	14.3	90	2.16	19.5	16.4	0
9	2.8	0.2	13.8	75	2.51	21.2	15.9	0
9	2.7	0.2	13	100	3.88	27.8	14.9	0
9	15	0.5	3.1	100	5.16	38.6	17.3	0
9	13.8	0.5	2.84	110	4.63	31.3	17.7	0
9	10.3	0.2	4.35	95	3.77	28.6	18.1	0
9	2.2	0.1	13.8	60	1.54	18.8	16.8	0

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
10	Live-bed	Non-cohesive	Unknown			1.8	Insignificant
10	Live-bed	Non-cohesive	Unknown			1.8	Insignificant
10	Live-bed	Non-cohesive	Unknown			1.8	Insignificant
10	Live-bed	Non-cohesive	Unknown			1.8	Insignificant
10	Live-bed	Non-cohesive	Unknown			1.8	Insignificant
10	Live-bed	Non-cohesive	Unknown			1.8	Insignificant

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10	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Insignificant
9	Live-bed	Non-cohesive	Unknown	1.8	Unknown

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
10	1.1	6.7	0.48	0.2
10	1.1	6.7	0.48	0.2
10	1.1	6.7	0.48	0.2
10	1.1	0.67	0.48	0.2
10	1.1	0.67	0.48	0.2
10	1.1	0.67	0.48	0.2
10	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2
9	1.1	0.67	0.48	0.2

Pier Scour Comments

Pier ID 10 **Time:** 14:30 **US/DS:** Upstream

Note: For all measurements, the side slope of scour hole is horizontal distance per foot change in elevation of stream bed in the scour hole.
 Note: For all measurements, bed material samples were not obtained in 1969.
 Note: The width of the pier was calculated as the depth weighed average pier width.

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Pier ID 10 **Time:** 11:57 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 10 **Time:** 11:52 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 10 **Time:** 12:40 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 10 **Time:** 11:37 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 10 **Time:** 12:15 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 10 **Time:** 13:35 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 9 **Time:** 14:30 **US/DS:** Upstream

A deep scour hole did not develop around pier 10. Practically no scour occurred in the left 1/2 of channel until after peak. In 8 days following peak, the river bed to left of pier 10 scoured out nearly 5 ft which did not fill in as occurred around pier 9.

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 9 **Time:** 11:57 **US/DS:** Upstream

Note: For all measurements, side slope of scour hole is horizontal distance per foot change in stream bed elevation in the scour hole.

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 9 **Time:** 11:52 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 9 **Time:** 12:40 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 9 **Time:** 11:37 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

Pier ID 9 **Time:** 12:15 **US/DS:** Upstream

The width of the pier was calculated as the depth weighed average pier width.

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Pier ID 9

Time: 13:55

US/DS: Upstream

The width of the pier was calculated as the depth weighed average pier width.

Abutment Scour

Contraction Scour

Stage and Discharge Data

Hydrograph

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Supporting Files
