BSDMS Summary Report

76 Mississippi River at Martin Luther King Memorial Bridge (S.R. 799)

Site Location:

Site ID: 76

Site Name: Mississippi River at Martin Luther King Memorial Bridge (S.R. 799) at St. Louis, MO

County: St. Louis

Nearest City: St. Louis

State: MO

Latitude: 383753

Longitude: 0901042

USGS Station ID:

Route Number: 799

Route Class: State

Service Level: Mainline

Route Direction: NA

Highway Mile Point:

Stream Name: Mississippi River

River Mile:

Contact:

David Mueller
U.S. Geological Survey
9818 Bluegrass Parkway
Louisville, KY 40299

Publication:

Mueller, D.S., Landers, M.N., and Fischer, E.F., 1995, Scour measurements at bridge sites during 1993 Upper Mississippi River Basin flood: Transportation Research Record 1483, p. 47-55.

Site Description:

Martin Luther King Memorial Bridge is located in downtown St. Louis, Missouri. St. Louis occupies the right descending bank and there is industry along the left descending bank. The floodplain is constricted on both sides by levees.

Elevation Reference

Datum: MSL

MSL (ft):

Description of Reference Elevation:

Vertical elevations are referenced to MSL. The surveyed streambed elevations were referenced to the stage reported at the St. Louis gage, which is about 3/4 mile from the study site.

Horizontal control is approximate, no tracking or GPS was used. A paper chart was used to record the data and the location of structural members marked on the chart. The chart was then digitized and scaled.

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Stream Data

Drainage Area (sq mi):	697000	**Floodplain Width:**	Narrow
Slope in Vicinity(ft/ft):		**Natural Levees:**	Unknown
Flow Impact:	Straight	**Apparent Incision:**	None
Channel Evolution	Unknown	**Channel Boundary:**	Alluvial
Armoring:	Unknown	**Banks Tree Cover:**	Low
Debris Frequency:	Rare	**Sinuosity:**	Sinuous
Debris Effect:	None	**Braiding:**	None
Stream Size:	Wide	**Anabranching:**	None
Flow Habit:	Perennial	**Bars:**	Narrow
Bed Material:	Sand	**Stream Width Variability:**	Equiwidth
Valley Setting:	Low		

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	1993	8	2		1.19	0.8			2.65		Unknown
10	1993	8	4		1.66	1.1	0.7	0.47	2.65		Unknown
11	1993	8	4		4.97	4.0	1.27	0.76	2.65		Unknown

12	1993	8	4	2.72	1.9	0.84	0.54	2.65	Unknown
2	1993	8	2	4.35	2.4	0.8	0.46	2.65	Unknown
3	1993	8	2	2.96	1.6	0.9	0.64	2.65	Unknown
4	1993	8	2	4.79	3.5	1.17	0.54	2.65	Unknown
5	1993	8	2	4.03	2.5	0.96	0.55	2.65	Unknown
6	1993	8	4	2.2	1.4	0.84	0.64	2.65	Unknown
7	1993	8	4	2.37	1.6	0.76	0.47	2.65	Unknown
8	1993	8	4	1.69	1.1	0.66	0.43	2.65	Unknown
9	1993	8	4	3.43	2.2	0.81	0.48	2.65	Unknown

Bed Material Comments

Measurement No: 1

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
400 ft from right bank
D50 was < 0.062

Measurement No: 10

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
1200 ft from right bank

Measurement No: 11

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
1400 ft from right bank

Measurement No: 12

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
average for day

Measurement No: 2

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
800 ft from right bank

Measurement No: 3

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
1000 ft from right bank

Measurement No: 4

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
1400 ft from right bank

Measurement No: 5

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
average for day

Measurement No: 6

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
200 ft from right bank

Measurement No: 7

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
500 ft from right bank

Measurement No: 8

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
700 ft from right bank

Measurement No: 9

Bed material samples were collected at the St. Louis gage by the USGS Missouri District.
1000 ft from right bank

Bridge Data

Structure No: 082-06001

Length(ft): 4010

Width(ft): 43

Number of Spans: 35

Vertical Configuration: Curvilinear

Low Chord Elev (ft): 446

Upper Chord Elev (ft): 479.25

Overtopping Elev (ft):

Skew (degrees): 0

Guide Banks: None

Waterway Classification: Main

Year Built:

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:

The structural characteristics of the bridge are reported from rehabilitation plans provide by the Illinois Department of Transportation. This is a truss bridge with 35 spans, however, only 3 spans comprise the section over the main channel of the Mississippi River. Many of the spans are on the floodplain and behind levees.

The piers have a complex shape. The piers in the main channel consist of two columns above the flood elevation but are wall piers below the water. The wall portions of the piers have three main portions: (1) an upper section which is sharp nosed and about 14 ft wide, (2) a middle section with is also sharp nosed and about 20 ft wide, and (3) a deep footing that rests on bed rock.

Abutment Data

Left Station:

Right Station:

Left Skew (deg):

Right Skew (deg)

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:

Embankment Skew (deg):

Embankment Slope (ft/ft):

Abutment Slope (ft/ft)

Wingwalls:

Wingwall Angle (deg):

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Pier Data

Pier ID	Bridge Station(ft)	Alignment	Highway Station	PierType	# Of Piles	Pile Spacing(ft)
10	2433.25	0		Single		
11	2904.49	0		Single		
9	1470.42	0		Single		

Pier ID	Pier Width(ft)	Pier Shape	Shape Factor	Length(ft)	Protection	Foundation
10	17.2	Sharp		68	None	Poured
11	17.5	Sharp		68	None	Poured
9	14.7	Sharp		65.5	None	Poured

Pier ID	Top Elevation(ft)	Bottom Elevation(ft)	Foot or Pile Cap Width(ft)	Cap Shape	Pile Tip Elevation(ft)
10	368	303	30	Round	
11	368	293.36	30	Round	
9	378	361.46	28	Square	

Pier Description

Pier ID 10

Pier ID 11

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Pier ID 9

Pier Scour Data

Pier ID	Date	Time	USOrDS
10	7/15/93		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	13.5	2	7.1	160	8.6	65.7	17.9	0

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
10	Live-bed	Non-cohesive	Unknown			2.1	Insignificant

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
10	4.03	2.5	0.96	0.55

Pier Scour Comments

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

Channel cross sections were measured at the Martin Luther King Bridge on July 15, 1993. The cross section along the upstream edge of the bridge clearly showed a scour hole at pier 10 that is 13.5 ft deep. The width of pier 10 varies with depth; the weighted average pier width, which does not include the width of the footing or caisson is 17.9 ft. The pier is sharp nosed (but with a flat internal angle) for the main part of the pier, and the caisson and footing are round nosed. The flow was aligned with the pier. Approach velocities were estimated from a discharge measurement on the Mississippi River made the same day at the Poplar Street Bridge on I-70, which is about ¾ mile downstream from the Martin Luther King Bridge. A nearly straight channel alignment and similarity of the measured cross-sectional areas and channel shape at the two bridges allowed the discharge measurement made at Poplar Street Bridge to be transferred with little error to the Martin Luther King Bridge. The discharge measured on July 15, 1993 was 804,000 cfs and the mean velocity of the subsection of the river containing pier 10 was 8.6 ft/sec.

Abutment Scour

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ContractionScour

Stage and Discharge Data

Peak Discharge					Flow		Peak Stage					Stage	Water	Return
year	mo	dy	hr	mi	(cfs)	Qacc	year	mo	dy	hr	mi	(ft)	Temp (C)	Period(yr)
1993	8	1			1050000		1993	8	1			429.5		>100
1993	7	15			806000		1993	7	15			423.5		
1993	7	19			980000									

Hydrograph

Supporting Files

MLK.xls - contains the following worksheets:
Summary - summary of site, bridge, and scour characteristics
Hydrograph - Hydrograph from USGS station 07010000
US100 - cross section collected approximately 100 ft upstream
US0 - cross section collected along the upstream edge of the bridge
DS0 - cross section collected along the downstream edge of the bridge
DS100 - cross section collected approximately 100 ft downstream
Qmeas - Discharge measurement notes from measurement at St. Louis gage

Aerial.jpg - Satellite image of St. Louis
PierNose.jpg - Flow at nose of pier 10

PierSide.jpg - Looking at side of pier 10
X-Secs.jpg - figure of plotted cross sections collected on 7-15-93
Profile.jpg - profile view of bridge
Prof-Main.jpg - detailed profile view of main channel portion of bridge
Pier10.jpg - plan details for pier 10