BSDMS Summary Report

85 US 93 over Bitterroot River near Darby, MT

Site Location:

Site ID: 85

Site Name: US 93 over Bitterroot River near Darby, MT

County: Ravalli

Nearest City: Darby

State: MT

Latitude: 455820

Longitude: 1140826

USGS Station ID: 12344000

Route Number: 93

Route Class: US

Service Level: Mainline

Route Direction: NA

Highway Mile Point:

Stream Name: Bitterroot River

River Mile: 77.2

Contact:

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Publication:

Site Description:

The US 93 bridge over the Bitterroot River is a USGS gaging station site that has been in continuous operation since 1939 and located 4.1 miles southeast of Darby in southwestern Montana. A cable way is located between 50-100 feet upstream of the bridge. The bridge is highly skewed, therefore the distance to the cable way is about 100 feet on the left bank and approximately 50 feet on the right bank. The site is slightly regulated by Painted Rocks Lake (station number 12342000) located upstream along the West Fork of the Bitterroot River. The river is essential for irregation in the region. Diversions irrigate approximately 5000 acres of land upstream and about 500 acres immediately downstream of the site. The river bed is comprised of coarse material (mostly cobbles), having a D50 on the order of 50 mm. The channel is void of vegetation, and overbanks are lined with mostly desciduous trees and some shrubbery.

US 93 bridge is supported by one webbed pier (center of bridge) and two piers consisting of 6 separate cylindrical piles located on the abutments. The bridge spans the channel under low-flow conditions, with the center pier located along the right edge of water. The flow splits around a small island approximately 250 feet upstream of the bridge under both low- and high-flow conditions. Large debris piles have been witnessed to accumulate on the center peir during high-flow periods.

Elevation Reference

BSDMS Summary Report

85 US 93 over Bitterroot River near Darby, MT

Datum: MSL

MSL (ft):

Description of Reference Elevation:

The datum of the gage is 3,942.14 feet above sea level.

RM #4 - is top of steel fence post, painted yellow, in fence line 29 ft shoreward and 10 ft upstream from gage.
Elevation is 13.71 ft above datum, and 3,955.85 ft above sea level.
RM #5 - is top of yellow painted anchor bolt on downstream side of left bank A-frame pedestal.
Elevation is 14.22 ft above datum, and 3,956.36 ft above sea level.
RM #6 - is top of lag bolt in power pole 50 ft shoreward and 10 ft upstream at end of fence line.
Elevation is 17 ft above gage datum, and 3,959.00 ft above sea leve.

Stream Data

Drainage Area (sq mi):	1049	**Floodplain Width:**	Narrow
Slope in Vicinity(ft/ft):	.0038	**Natural Levees:**	Unknown
Flow Impact:	Straight	**Apparent Incision:**	None
Channel Evolution	Threshold	**Channel Boundary:**	Non-alluvial
Armoring:	Partial	**Banks Tree Cover:**	Medium
Debris Frequency:	Occasional	**Sinuosity:**	Sinuous
Debris Effect:	Local	**Braiding:**	None
Stream Size:	Medium	**Anabranching:**	Locally
Flow Habit:	Perennial	**Bars:**	Wide
Bed Material:	Cobbles	**Stream Width Variability:**	Random
Valley Setting:	High		

Roughness Data

Manning's n Values

	Left Overbank	Channel	Right Overbank
High:	0.055	0.03	0.055
Typical	0.04	0.03	0.045
Low:			

BSDMS Summary Report

85 US 93 over Bitterroot River near Darby, MT

Bed Material

Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
1				Grab on Bed	109	70	42	8.71			Non-Cohesive
2				Grab on Bed	114	85	56	11.2			Non-Cohesive
3				Grab on Bed	113	74	44	8.47			Non-Cohesive
4				Grab on Bed	114	84	59	11.7			Non-Cohesive

Bed Material Comments

Measurement No: 1

Diameters taken from a VA analysis of a grab sample from the bed at low flow under the downstream face of the bridge.
Results:

Size (mm)	4	5.6	8	11	16	23	32	45	64	90	128	180
% < than	8.26	10.1	14.7	20.2	27.5	42.2	52.3	65.1	81.7	91.7	98.2	100

Measurement No: 2

Diameters taken from a VA analysis of a grab sample from the bed at low flow under the upstream face of the bridge.
Results:

Size (mm)	4	5.6	8	11	16	23	32	45	64	90	128	180
% < than	10.3	12.1	15.0	15.7	25.2	30.8	41.1	56.1	69.2	87.9	99.1	100

Measurement No: 3

Diameters taken from a VA analysis of a grab sample from the bed at low flow in the approach section.
Results:

Size (mm)	4	5.6	8	11	16	23	32	45	64	90	128	180
% < than	11.3	13.4	14.8	22.5	25.4	35.2	51.4	63.4	79.6	91.5	97.2	100

Measurement No: 4

Diameters taken from a VA analysis of a grab sample from the bed at low flow upstream approx. 1/8 mile at campground/ Hannon fishing access.
Results:

Size (mm)	4	5.6	8	11	16	23	32	45	64	90	128	180
% < than	6.80	8.74	11.7	14.6	24.3	30.1	38.8	54.4	68.9	88.3	99.0	100

Bridge Data

Structure No:

BSDMS Summary Report

85 US 93 over Bitterroot River near Darby, MT

Length(ft):

Width(ft): 250

Number of Spans: 4

Vertical Configuration: Sloping

Low Chord Elev (ft):

Upper Chord Elev (ft):

Overtopping Elev (ft):

Skew (degrees): 30

Guide Banks: None

Waterway Classification: Main

Year Built:

Avg Daily Traffic:

Plans on File: 0

Parallel Bridges No

Upstream/Downstream: N/A

Continuous Abutment: 0

Distance Between Centerlines:

Distance Between Pier Faces:

Bridge Description:

US 93 bridge is supported by one webbed pier (right pier looking downstream) and two piers consisting of 6 separate cylindrical piles located on the abutments. The piers are numbered, beginning with the right pier (looking downstream). The bridge spans the channel under low-flow conditions, with the pier #2 located along the right edge of water and the left pier located on the left abutment. The piers located on the abutments (#1 and #3) are protected with rip-rap.

Abutment Data

Left Station:

Right Station:

Left Skew (deg): 0

Right Skew (deg) 0

Left Abutment Length (ft):

Right Abutment Length (ft)

Left Abutment to Channel Bank (ft): 0

Right Abutment to Channel Bank (ft): 90

Left Abutment Protection: Riprap

Right Abutment Protection Riprap

Contracted Opening Type: III

Embankment Skew (deg): 30

Embankment Slope (ft/ft):

Abutment Slope (ft/ft)

Wingwalls: 0

Wingwall Angle (deg):

Pier Data

Pier ID	Bridge Station(ft)	Alignment	Highway Station	PierType	# Of Piles	Pile Spacing(ft)
1		0		Group	6	
2		0		Single		
3		0		Group	6	

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

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

3 Unknown

Pier Description

Pier ID 1

Pier ID 2

Pier #2 has a tendency to accumulate a rather large pile of debris during high-flow events.

Pier ID 3

Pier Scour Data

Pier ID	Date	Time	USOrDS
2	6/11/96	11:35	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)
2	1.5	0.5	3.4	13	8.5	6.6	5	0

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
2	Clear-water	Non-Cohesive	Unknown			2.75	Moderate

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
2	114	84.6	56	11.2

Pier Scour Comments

Pier ID 2 **Time:** 11:35 **US/DS:** Upstream

Although pier #2 has a tendency to accumulate a rather large pile of debris during high-flow events, nothing was present during the measurements on 6/11/96.

BSDMS Summary Report

85 US 93 over Bitterroot River near Darby, MT

Abutment Scour

Measurement Number	Abutment	Date	Time	US/DS	Scour Depth (ft)	Accuracy	Sediment Transport
1					0	0	Unknown

Measurement Number	Velocity at Abut(ft/s)	Depth at Abut(ft)	Discharge Blocked(cfs)	Avg Velocity Blocked(ft/s)	Avg Depth Blocked(ft)
1					

Measurement Number	Embankment Length (ft)	Bed Material	D50 (mm)	Sigma	Debris Effect
1		Unknown			Unknown

Abutment Scour Comments

MeasurementNo	1

ContractionScour

Measurement Number	Contracted Date	Contracted Time	Uncontracted Date	Uncontracted Time	US/DS	Scour Depth(ft)
1	6/11/96	11:40	6/11/96	11:00		0.7

Measurement Number	Accuracy	Contracted Avg Vel(ft/s)	Contracted Discharge(cfs)	Contracted Depth(ft)	Contracted Width(ft)
1	0.2	7.4	7390	6.9	151

Measurement Number	Uncontracted Avg Vel(ft/s)	Uncontracted Discharge(cfs)	Uncontracted Depth(ft)	Uncontracted Width(ft)	Channel Contraction Ratio
1	7.5	8787	5.9	180	0.98

Measurement Number	Pier Contraction Ratio	Scour Location	Eccent-ricity	Sediment Transport	Bed Form	Debris Effects
1		Main Channel	0	Clear-water	Unknown	Moderate

Measurement Number	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	Sigma Bed Material	Bed Material

1	109	70	42	8.7	2.84	Non-Cohesive

Contraction Scour Comments

Measurement No. 1

All contraction is on the right portion of the approach section, therefore eccentricity is 0. It should be understood that although clear-water conditions are predicted for this flow regime, this site has the capabilities of experiencing live-bed conditions under slightly higher flows. If debris accumulates during a flood event, it could have had a significant effect on the amount of contraction scour due to the relatively minimal contraction ratio.

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)
			11:00		8,787					12:30		7.5		5

Hydrograph

Supporting Files

Darbyxsections.xls - Excel worksheet with real-time, pre- and post-flood survey data and the resulting plot of bathymetry profiles used to estimate depth of scour during the June, 1996 flood.

Photos of the Site (Dscn prefix; .jpg formats):

#	Description
208.	Looking downstream from cableway
209.	Looking downstream from cableway
210.	Looking downstream from cableway at right abutment
211.	Looking downstream from cableway at right floodplain
212.	Looking upstream from bridge
213.	Looking upstream at left floodplain and cableway
214.	Local scour at right pier
215.	Looking downstream at scour at right pier
216.	Looking downstream from bar on right bank
217.	Looking upstream along right pier
218.	Looking upstream from bar on right side
219.	Note flow line on right pier

Photos of the Site (Bitterroot River prefix; .jpg formats):

#	Description
1	Flow where some contraction probably occurred
2	TLH assisting in pebble count U/S of approach section
3	No Description

4 Note SRH standing in scour hole
5 No Description