

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

Site Location:

Site ID:	34	
Site Name:	Badger Creek at U.S. 89 near Browning, MT	
County:	Glacier	
Nearest City:	Browning	Contact:
State:	MT	Stephen R. Holnbeck or Charles Parrett (406)449-5263
Latitude:	482603	U.S. Geological Survey
Longitude:	1124214	301 South Park Ave., Fed. Bldg. Rm 428
USGS Station ID:	6092500	Helena, MT 59626
Route Number:	89	
Route Class:	US	Publication:
Service Level:	Mainline	An unpublished level-2 analysis was performed by USGS and submitted (March 1993) under the title: "Analysis of scour potential for bridge structure no. P00003096+05771 Badger Cr 15 M SE Browning, MT".
Route Direction:	NA	
Highway Mile Point:	96.577	
Stream Name:	Badger Creek	
River Mile:		

Site Description:

The bridge site is 15 miles southeast of Browning, Montana. Drainage area at the site is 239 square miles, with headwaters draining from the Rocky Mountain front. The main channel of Badger Creek is perched in relation to the right flood plain, and the main channel has a high degree of lateral instability. There is a significant right overbank flood plain and the majority of flood flows are conveyed by road overtopping to the right of the bridge. A USGS streamflow-gaging station (06092500) is located several river miles upstream of the bridge site and has a drainage area of 133 square miles. Annual-peak-discharge data were collected for 23 years at the USGS streamflow-gaging station "Badger Creek near Browning, Montana" (06092500). As reported by Omang (1992), selected flood-frequency data for the site give 100-year and 500-year peak discharge estimates equal to 13,000 cfs and 26,500 cfs, respectively. The largest recorded peak discharge at the gage was 49,700 cfs on June 8, 1964. The next two largest peak discharges occurred in 1953 (4,220 cfs) and 1970 (3,670 cfs). Although drainage area at the site is greater than at the gage, the area upstream from the gage contributes most to producing flood flows-- thus, the 100-year and 500-year peak discharges are presumed to apply at the bridge site. The streambed is composed of relatively coarse material, however, the bed is not armored and is therefore considered unstable. Bed-material sample used in the sieve analysis (performed at the Materials Bureau of MDT) was from the bridge opening, between the

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

upstream and downstream face. Two core logs shown on MDT drawing no. 7043 describe material underlying pier footings and abutments as being composed of dense sandy gravel with traces of clay. A third core log describes foundation material as dense gravelly sand with cobbles and some trace of clay. Drill holes ranged in depth from 41 feet to about 76 feet below the surface of the streambed. The gaging-station history at the USGS streamflow-gaging station "Badger Creek below Four Horns Canal near Browning, Montana" (06093200) indicated that "the channel is often unstable, especially during high flows." This gaging station was used instead of station 06092500 for interpreting stability because channel control occurs, whereas the control for station 06093200 is a diversion dam structure. Inspection of stage-discharge rating curves for the period 1973 to the present (1994) indicate a trend towards channel aggradation (filling) at high flows. Relative channel stability was also evaluated using incipient motion analysis. Hydraulic results from WSPRO, coupled with gradation curve data and shear stress calculations for the stream bed indicate channel instability at both the 100-year and 500-year floods. Because calculations indicate that live-bed scour occurs, development of an armor layer is presumed to be unlikely. There is evidence of about 2.5 ft of scour at the left and right abutments. A comparison of bridge sections for different dates show that contraction scour (to a maximum of about 0.5 ft) may occur. If the vertical changes (excluding local scour at piers and abutments) were accumulated laterally across the section, however, the net change would be zero.

Elevation Reference

Datum: Local

MSL (ft):

Description of Reference Elevation:

Reference mark number 1 (RM1) is chiseled "X" on left upstream (southwest) concrete abutment wingwall set to elevation 99.99 feet.

Stream Data

Drainage Area (sq mi):	239	Floodplain Width:	Wide
Slope in Vicinity(ft/ft):	0.0039	Natural Levees:	Little
Flow Impact:	Straight	Apparent Incision:	None
Channel Evolution	Aggradation	Channel Boundary:	Alluvial
Armoring:	None	Banks Tree Cover:	Low
Debris Frequency:	Occasional	Sinuosity:	Sinuuous
Debris Effect:	Both	Braiding:	Locally
Stream Size:	Medium	Anabranching:	None

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

Flow Habit: Perennial Bars: Unknown
Bed Material: Gravel Stream Width Variability: Unknown
Valley Setting: Moderate

Roughness Data

Manning's n Values

	Left Overbank	Channel	Right Overbank
High:	0.045	0.045	0.045
Typical	0.045	0.045	0.045
Low:	0.045	0.045	0.045

Bed Material

Measurement Number	Yr	Mo	Dy	Sampler	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)	SP	Shape	Cohesion
1	1992	3	12	std sieve	48	30	8	0.35	2.65		Non-Cohesive

Bed Material Comments

Measurement No: 1

Bridge Data

Structure No: P00003096+05771
Length(ft): 303
Width(ft): 36
Number of Spans: 5
Vertical Configuration: Horizontal
Low Chord Elev (ft): 95.6
Upper Chord Elev (ft): 95.9
Overtopping Elev (ft): 88.1
Skew (degrees): 0

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

Guide Banks: None

Waterway Classification: Main

Year Built: 1966

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:

Bridge is perpendicular to flow and consists of a five-span concrete deck with four concrete tapered piers providing support between the two abutments. Reference system for piers, abutments, and other longitudinal features is based on USGS survey work used for level-2 analysis. No flow angle of attack on piers was noted in the field. Stationing of piers is based on site surveys for level-2 work and does not relate to bridge-plan stationing. Channel-geometry measurements are not necessarily referenced from left edge of section thus, comparison of sections currently requires reference to the pier stationing data of this BSDMS file.

Abutment Data

Left Station: 0

Right Station: 303

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

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

Contracted Opening Type: III
Embankment Skew (deg): 0
Embankment Slope (ft/ft): 2
Abutment Slope (ft/ft): 2
Wingwalls: No
Wingwall Angle (deg): 0

Pier Data

Pier ID	Bridge Station(ft)	Alignment	Highway Station	PierType	# Of Piles	Pile Spacing(ft)
P1	61	0	0	Single		
P2	123	0	0	Single		
P3	184	0	0	Single		
P4	246	0	0	Single		

Pier ID	Pier Width(ft)	Pier Shape	Shape Factor	Length(ft)	Protection	Foundation
P1	3.5	Sharp		36	None	Poured
P2	3.5	Sharp		36	None	Poured
P3	3.5	Sharp		36	None	Poured
P4	3.5	Sharp		36	None	Poured

Pier ID	Top Elevation(ft)	Bottom Elevation(ft)	Foot or Pile Cap Width(ft)	Cap Shape	Pile Tip Elevation(ft)
P1				Unknown	
P2				Unknown	
P3				Unknown	
P4				Unknown	

Pier Description

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

Pier ID P1

Data is based on dimensions shown on MDT dwgs 7042 and 7045, and local datum. Although dwgs show a maximum difference of 0.35 ft in the base elevation of the four pier ftngs, ftng and pier coordinates used in this file are based on the assumption that all ftngs are at about the same base elevation.

Pier ID P2

See comments for P1. Also, pier width indicated above is average of top and base widths (excluding ftng) and may not be the same as width described under pier scour measurements.

Pier ID P3

See comments for P1 and P2.

Pier ID P4

See comments for P1 and P2.

Pier Scour Data

Pier ID	Date	Time	USOrDS
P1	5/21/91	15:30	Upstream
P1	6/4/91	12:40	Upstream
P1	6/21/91	14:50	Upstream
P3	5/21/91	15:30	Upstream
P3	6/4/91	12:40	Upstream
P3	6/21/91	14:50	Upstream
P4	5/21/91	15:30	Upstream
P4	6/4/91	12:40	Upstream
P4	6/21/91	14:50	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)
P1	1.2	0.5	10	24	5.4	1.7	3.4	0
P1	1.7	0.5	4.7	16	4.4	1.5	3.4	0

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

P1	1.5	0.5	10.7	32	4.2	1.3	3.4	0
P3	3.2	0.3	7	45	5.4	1.3	3.4	0
P3	3.4	0.3	6.6	45	4.7	1	3.4	0
P3	3.5	0.3	6.4	45	5.4	1.5	3.4	0
P4	1.6	0.3	8.8	14	4.1	0.9	3.4	0
P4	1	0.3	4.1	12	2.5	0.4	3.4	0
P4	1.2	0.3	5.2	15	2.1	0.5	3.4	0

PierID	Sediment Transport	Bed Material	BedForm	Trough (ft)	Crest (ft)	Sigma	Debris Effects
P1	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P1	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P1	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P3	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P3	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P3	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P4	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P4	Live-bed	Non-cohesive	Unknown			9.3	Moderate
P4	Live-bed	Non-cohesive	Unknown			9.3	Moderate

PierID	D95 (mm)	D84 (mm)	D50 (mm)	D16 (mm)
P1	48	30	8	0.35
P1	48	30	8	0.35
P1	48	30	8	0.35
P3	48	30	8	0.35
P3	48	30	8	0.35
P3	48	30	8	0.35
P4	48	30	8	0.35
P4	48	30	8	0.35
P4	48	30	8	0.35

Pier Scour Comments

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

Pier ID P1 **Time:** 15:30 **US/DS:** Upstream

Used soundings to left of pier to estimate approach-flow depth. Measurements made with four-wheel base and sounding weights. Velocity measurements made w/current meter for estimating approach flow velocity.

Pier ID P1 **Time:** 12:40 **US/DS:** Upstream

See comments for P1 for 5/21/91.

Pier ID P1 **Time:** 14:50 **US/DS:** Upstream

See comments for P1 for 5/21/91.

Pier ID P3 **Time:** 15:30 **US/DS:** Upstream

Sounding measurements were made from u/s face of bridge w/four-wheel base, reel, and 100-lb weight. Velocities were measured w/current meter. Reference surface was estimated from section plot and surface was used to estimate approach flow depth and other scour-hole variables.

Pier ID P3 **Time:** 12:40 **US/DS:** Upstream

See 5/21/91 comments for P3.

Pier ID P3 **Time:** 14:50 **US/DS:** Upstream

See 5/21/91 comments for P3.

Pier ID P4 **Time:** 15:30 **US/DS:** Upstream

See 5/21/91 comments for P3.

Pier ID P4 **Time:** 12:40 **US/DS:** Upstream

See 5/21/91 comments for P3.

Pier ID P4 **Time:** 14:50 **US/DS:** Upstream

See 5/21/91 comments for P3.

Abutment Scour

BSDMS Summary Report

34 Badger Creek at U.S. 89 near Browning, MT

ContractionScour

Stage and Discharge Data

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			
1991	6	21	15:00	60	1740	90					0		2	
1991	6	4	12:40	40	1450	90					0		2	
1991	5	21	15:30	30	1930	90					0		2	

Hydrograph

Hydrograph Number	Year	Month	Day	Hr	Min	Sec	Stage(ft)	Discharge (cfs)
----------------------	------	-------	-----	----	-----	-----	-----------	--------------------

Supporting Files
