MaineDOT

PRELIMINARY DESIGN REPORT

CHARLES RIVER BRIDGE #2151
OVER
CHARLES RIVER

Federal Project No:	*BR-1509(500)X*
PIN:	015095.00
County:	Oxford
Town:	Fryeburg
Date:	July 8, 2009, Rev. Sept 9, 2009

Prepared by:

Milone & MacBroom, Inc.
20 Independence Drive
Freeport, ME 04032

TABLE OF CONTENTS

Section **Page**

Appendix

Section 1

BACKGROUND INFORMATION

TOWN – Fryeburg **PIN** – 015095.00 **BRIDGE NO.** – 2151

FUNDING – Federal/State **STATE ROUTE** – N/A

TRANSPORTATION INVESTMENT PROGRAM:

YEAR 2010/2011 ESTIMATE $ 150,000
YEAR _____ ESTIMATE $ _____
FUNDS TRANSFERRED IN/OUT -$ 1,505,000
TOTAL $ 1,655,000

PROGRAM SCOPE – Bridge Replacement

PROGRAM DESCRIPTION – The removal of SA1 (Harbor Road) over Charles River (#2151), located 2.6 mile westerly junction of State Route 5 and Harbor Road.

PROJECT BACKGROUND – This project consists of the preliminary evaluation of the Charles River Bridge (#2151) carrying Harbor Road over the Charles River, and the evaluation of anticipated impacts on the Red Iron Bridge (#2708) carrying McNeil Road over the Saco River Old Course. The existing bridge is 75-feet long, steel plate girder with floor beams, stringers, and lateral angles, with a concrete deck and integral wearing surface. The existing bridge was constructed in 1930, replacing the original covered bridge on stone foundation. Based on the latest condition inspection (8/21/08), the existing bridge has a 12-ton inventory load rating, not meeting the 36-ton load requirement. Upon evaluation of the traffic conditions and comments at initial public hearing (3/19/09), the Department has modified the Program Scope from Bridge Removal to Bridge Replacement, with the understanding that the Red Iron Bridge (#2708) shall be removed when condition inspections warrant removal.

HIGHWAY SYSTEM - Non-NHS

FUNCTIONAL CLASSIFICATION – Minor Collector

URBAN/RURAL - Rural

FHWA SUFFICIENCY RATING – 20.1

LOAD POSTING - Open

POSTED SPEED – 45 mph

STRUCTURALLY DEFICIENT - Yes

FUNCTIONALLY OBSOLETE – N/A

TRAFFIC - 2007 **AADT** - 380

ACCIDENT DATA, CRF – 0.0

2029 **AADT** - 1040 **DHV** – 142

Section 2

Engineering, Landscape Architecture and Environmental Science

MILONE & MACBROOM

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PIN 15095.00
CHARLES RIVER BRIDGE (#2151)

LOCATION:
SA1 (HARBOR ROAD)
FRYEBURG, MAINE

MM #: 2763-04
DWG: VICNITY
LSH: –

LOCATION PLAN

DATE: 6-19-08
SCALE: 1"=2000'

SHEET:
1 OF 1

HYDROLOGY/HYDRAULICS/SCOUR REPORT

A. INTRODUCTION

The Charles River in Fryeburg, Maine (watershed area ~70 square miles) flows for approximately 1 mile in a south-easterly direction from Charles Pond to its confluence with the Saco River Old Course. The dune-ripple channel is flat (slope ~ 0), meandering, and slow-moving. Bed materials consist of medium sand with several feet of overlaying silt. Woody debris accumulations are evident throughout the channel.

The Charles River is part of the 22 square mile Fryeburg Harbor, a natural flood storage area associated with the Saco River Old Course. The large floodplain is nearly flat and contains large farm fields with patches of forest and rural residential areas. The large flood conveyance and sediment deposition area associated with the floodplain control channel morphology. Low flood velocities due to the large cross sectional flow area across the floodplain limit the likelihood of channel migration and scour.

River banks are primarily silt with some clay, approximately 5 feet tall near the Charles River Bridge, and covered with a mix of herbaceous and woody vegetation on the mid and upper bank. The low bank is generally not vegetated, smooth, and intact with little sign of active erosion. Exposed roots of large trees near the water line were observed in some locations where some minor erosion of the toe bank material has taken place. The potential for scour of the channel banks and bed is low due to the small flow velocity and shear stress even though fine-grained sediments are present. Bank investigations around the straight channel by the Charles River Bridge indicate that excessive scour due to ice is not likely taking place.

B. HYDROLOGY REPORT

Estimates of peak flows were provided by MaineDOT on June 1, 2009 (Table 7-1, Appendix E). The analysis was performed using regression equations for estimating peak flows for various recurrence intervals in Maine (Hodgkins, 1999).

TABLE 7-1
PEAK FLOW ESTIMATES

T (yr)	QT (ft3/s)	Designations (MEDOT, 2003)
1.1	1,183	Spring Flood
2	2,344	
5	3,594	
10	4,520	
25	5,743	
50	6,703	Design Discharge
100	7,715	Flood of Record (Check Discharge)
500	10,238	Super Flood (Scour Discharge)

Although the Charles River is shown to be included in the detailed study area on the FEMA Flood Insurance Rate Map, the effective FEMA Flood Insurance Study (Town of Fryeburg, Maine, Oxford County, January 1980) does not contain peak flow estimates for the subject site. Hydrology and hydraulic calculations were not previously performed for the Charles River as part of FEMA mapping work, yet the channel and floodplain are considered to be part of the detailed model as the backwater from the Old Course Saco covers the Charles River almost to its origin at Charles Pond. The Town of Fryeburg is not part of the current FEMA map modernization project taking place in Oxford County and thus no FEMA flow estimates are available for this study (personal communication with the Maine Floodplain Management Program).

C. HYDRAULICS REPORT

1. Existing Conditions

An existing conditions hydraulic model was created for the project site using the HEC-RAS hydraulic model (USACE, 2005). Geometry of the Charles River Bridge and nearby cross sections 100-feet above and below the bridge was obtained from field survey collected by MaineDOT on April 30, 2009. The model was extended longitudinally by copying the typical wet channel shape up and downstream to model the full system. Cross sections were extended laterally across the wide floodplain using digitized USGS topographic mapping and the US digital elevation model. All elevations in the HEC-RAS model are in the vertical datum NAVD88.

Steady state peak flow estimates generated from Maine DOT were input into the upstream end of the model. The upstream boundary condition of normal depth was used with a channel slope of 0.00001 to approximate the flat channel since HEC-RAS does not allow a slope of 0. The downstream boundary condition was set to the effective FEMA flood profile at the confluence of the Charles River and Saco River Old Course (Table 7-2). Values were interpolated to obtain the necessary boundary conditions for each flood and converted to the vertical datum NAVD88 (NAVD88 = NVGD29 - 0.397).

TABLE 7-2
FEMA KNOWN WATER SURFACE ELEVATIONS

Storm (yr)	WSE (ft NGVD29)	WSE (ft NAVD88)
1.1	-	*381.3*
2	-	*381.3*
5	-	*381.4*
10	382.0	381.6
25	-	*382.2*
50	383.5	383.1
100	385.0*	384.6
500	388.0	387.6

Italics indicate interpolated values.

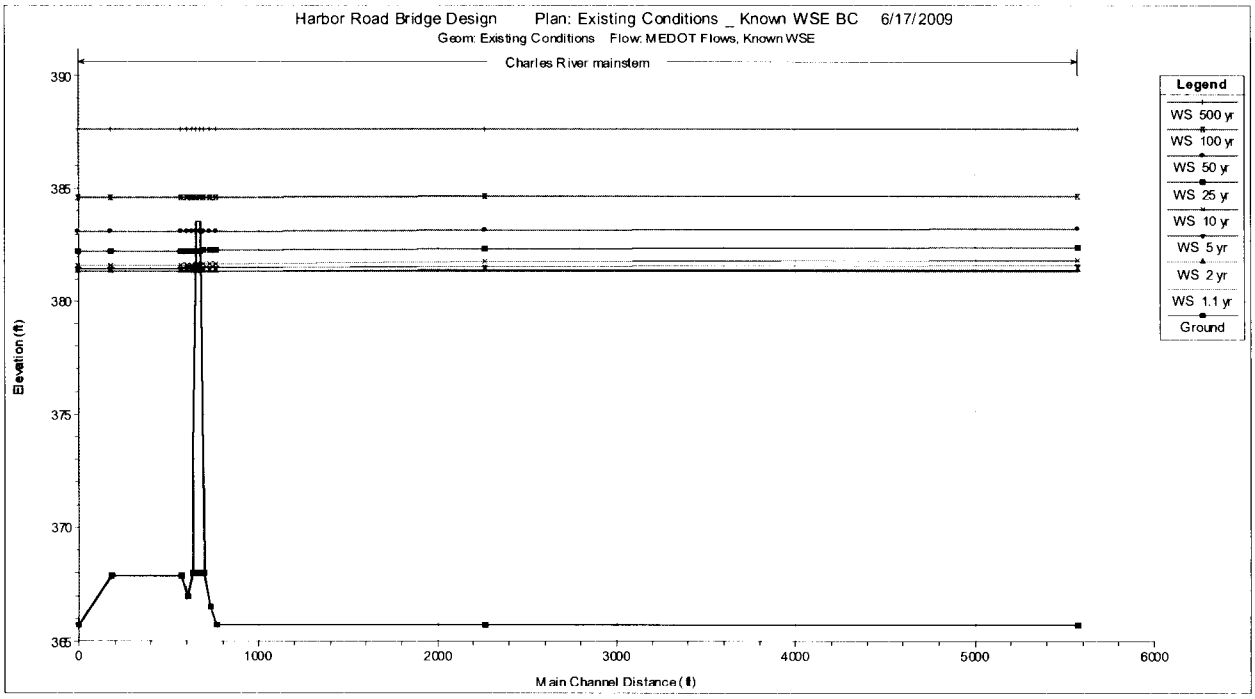
* - The flood of record for the Saco River Old Course based on Spring 1936 storm event.

Manning's roughness N-values were determined from field investigations and aerial photographs (Table 7-3). After initially setting N-values in the channel and floodplain, the values were fine-tuned to calibrate the existing conditions model to the documented intermediate regional flood, previously determined to be the 100-year flood that occurred in March of 1936 (USACE, 1971), that generated a flood water surface elevation of 384.6 NAVD88 (385.0 NGVD29) on the Charles River. The 100-year flood elevation is located between 384.6 and 384.7 NAVD88 on the existing conditions profile (Figure 7-1) confirming that model geometry, flows, boundary conditions, and assumptions are adequately representing the system.

TABLE 7-3
MANNING'S ROUGHNESS N VALUES

Location	N	Notes
Channel	0.060	winding, ineffective slope, sluggish, debris, weedy
	0.050	winding, ineffective slope, sluggish, bit less debris, less weedy
	0.045	more straight with some bends, ineffective slope, sluggish, sparse debris and weeds
Overbank	0.160	trees, dense shrub wetlands, debris
	0.100	mixed forest, shrub, overgrown lawn, edge of house, brush
	0.070	forested buffer with shrub & herb layer; mixed shrubby pasture/lawns with forest patches
	0.060	hay fields with tall grass, and some roughness features on ground
	0.050	hay fields with smoother ground
	0.040	tilled field crops

FIGURE 7-1
EXISTING CONDITIONS FLOOD PROFILES



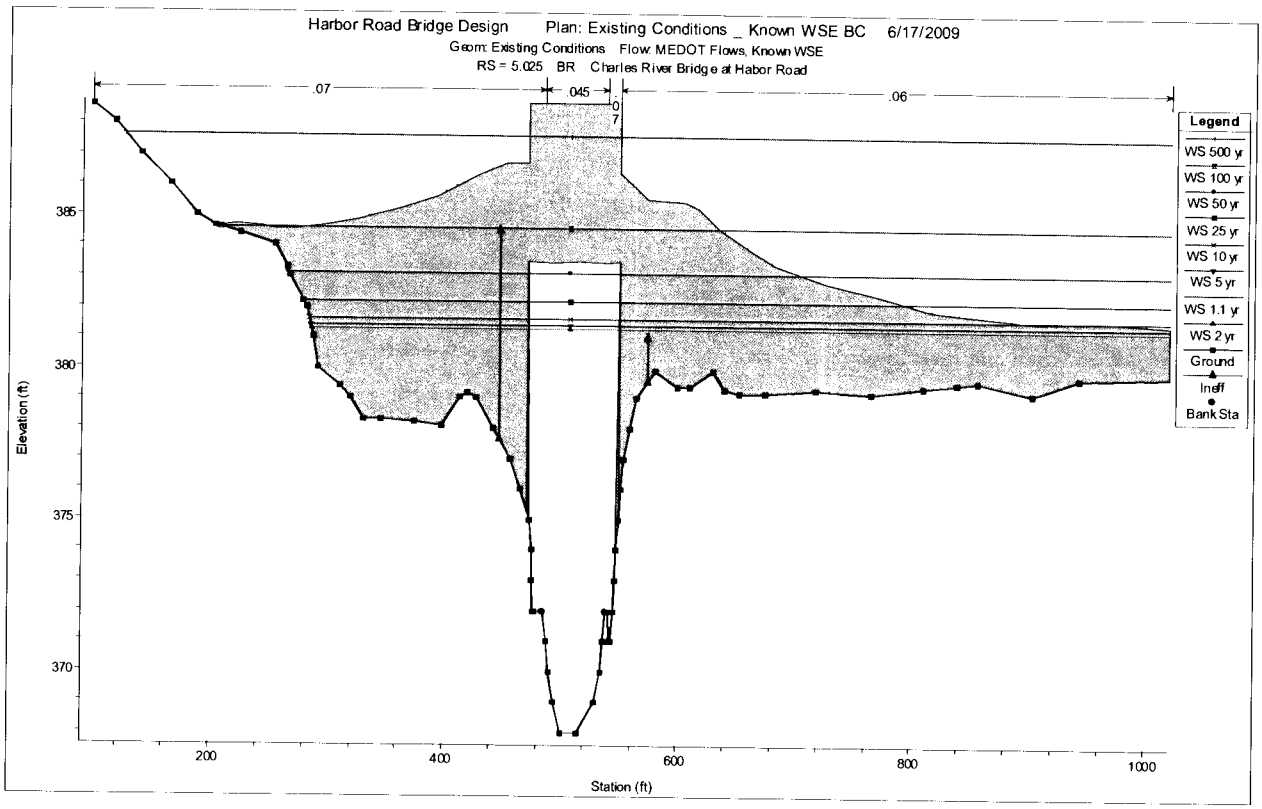
The existing Charles River Bridge is a single span steel girder bridge that is 75 feet long, 21 feet wide, and supported by concrete abutments on spread footings (with piles under the western footing). The bridge opening width is 73 feet at the low chord and 70 feet near the normal water surface elevation due to the slightly inclined abutments (~15 degrees). The existing bridge opening has a full cross sectional area of 1023 square feet. The right roadway approach has a low spot that is 2.5 feet below the low chord of the bridge that provides relief during flooding. The left roadway approach has a low spot that is located 1 foot above the low chord of the bridge.

The existing conditions hydraulic model shows that roadway overtopping takes place during all modeled floods. The 50-year flood water surface elevation is located just below the existing bridge low chord, with larger floods flowing into the bridge structure (Table 7-4, Figure 7-2, Appendix E).

TABLE 7-4
EXISTING HEADWATER AT CHARLES RIVER BRIDGE

Storm (yr)	Headwater (ft NAVD88)	Freeboard (ft)
1.1	381.3	2.2
2	381.3	2.2
5	381.5	2.1
10	381.7	1.8
25	382.2	1.3
50	383.1	0.4
	Bridge low chord at EL 383.5 NAVD88	
100	384.6	-1.1
500	387.6	-4.1

FIGURE 7-2
EXISTING CONDITIONS HEADWATER



Flood flow velocities are low on the Charles River primarily due to the flat channel, wide floodplain, and the backwatering from the Saco River Old Course. The maximum velocity in the system is just less than 2 feet per second, with most velocities being less than 1 foot per second. Flow velocities are low at the Charles River Bridge with a range of 0.3 (for the 500-year flood) to 1.1 feet per second (for the 10-year flood) (Table 7-5, Appendix E).

TABLE 7-5
EXISTING FLOOD FLOW VELOCITIES AT CHARLES RIVER BRIDGE

Storm (yr)	Upstream (ft/sec)
1.1	0.4
2	0.7
5	1.0
10	1.1
25	1.0
50	0.7
100	0.5
500	0.3

2. Proposed Conditions

Three bridge alternatives were evaluated.

1. Single-span, rolled steel beams, low chord at EL 384.52 NAVD88.
2. Single-span, pre-stressed concrete box beams, low chord at EL 384.52 NAVD88.
3. Tow-span, pre-stressed concrete box beams and center pier, low chord at EL 384.52 NAVD88.

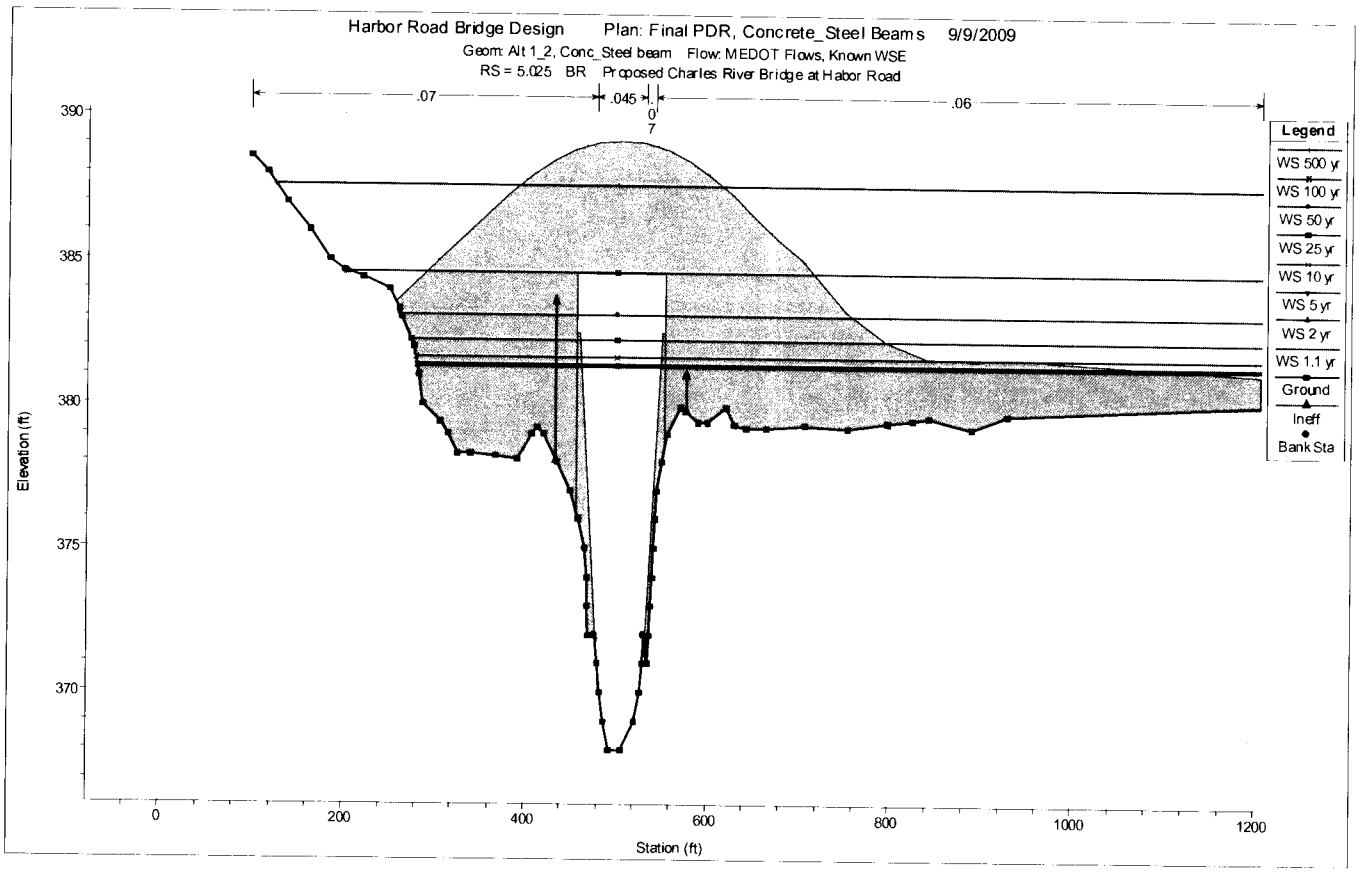
The flat and wide floodplain, which is relatively large compared to the size of bridge opening, leads to minimal changes in hydraulic conditions between existing conditions and each of the alternatives. Alternative 1 is recommended as it is the most cost-effective solution and allows maximum clearance of the design (50-year) discharge. The proposed bridge opening has a full cross sectional area of 1,112 square feet, an increase of approximately 89 square feet.

The proposed conditions hydraulic model shows that roadway overtopping remains during all modeled floods (Figure 7-3). The proposed 50-year flood water surface elevation is 1.4 feet below the bridge low chord, and the proposed 100-year flood water surface elevation is located 0.08 feet above the bridge low chord (Table 7-6, Appendix E).

TABLE 7-6
PROPOSED CHARLES RIVER BRIDGE HEADWATER ELEVATIONS

Storm (yr)	Headwater (ft NAVD88)	Freeboard (ft)
1.1	381.3	3.2
2	381.3	3.2
5	381.5	3.0
10	381.7	2.8
25	382.2	2.3
50	383.1	1.4
Bridge low chord at EL 384.52NAVD88		
100	384.6	-0.1
500	387.6	-3.1

FIGURE 7-3
PROPOSED CONDITIONS HEADWATER



Flow velocities remain low at the proposed Charles River Bridge (Table 7-7, Appendix E).

TABLE 7-7
CHANNEL FLOOD FLOW VELOCITIES AT PROPOSED CHARLES RIVER BRIDGE AT UPSTREAM FACE

Storm (yr)	Velocity (ft/sec)
1.1	0.4
2	0.8
5	1.0
10	1.1
25	1.0
50	0.7
100	0.5
500	0.3

The findings of the hydraulic analysis are summarized in Table 7-8.

TABLE 7-8
CHARLES RIVER BRIDGE HYDRAULIC SUMMARY

Storm (yr)	Variable	Existing Bridge	Proposed Bridge
1.1	Headwater EL (ft)*	381.3	381.3
	Velocity (ft/s)	0.4	0.4
	Freeboard (ft)	2.2	3.2
	Conveyance Area (sq ft)	876.6	946.1
50	Headwater EL (ft)	383.1	383.1
	Velocity (ft/s)	0.7	0.7
	Freeboard (ft)**	0.4	1.4
	Conveyance Area (sq ft)	1018.8	1118.5
100	Headwater EL (ft)	384.6	384.6
	Velocity (ft/s)	0.5	0.5
	Freeboard (ft)	-1.1	-0.1
	Conveyance Area (sq ft)	1136.3	1261.0

*Elevations in vertical datum NAVD88.
**A depth of 2 feet minimum is recommended on smaller streams where there has been no history of ice jams (MEDOT, 2003).

D. SCOUR ANALYSIS

Level 1 Analysis

Previous assessments of the Charles River Bridge by Maine DOT have indicated a low likelihood for scour. The past Maine DOT Bridge Scour Evaluation Summary states,

> *"No history of scour is evident in the bridge files. The channel has experienced 1 to 2 feet of degradation since 1929, with deposition of muck in the center of the channel. The potential for contraction scour is low due to the consistent width of the channel through the bridge and the flow relief provided by roadway overtopping. No downstream deposits were evident, although some debris had collected at the downstream bend."*

A preliminary field assessment of the Charles River Bridge reveals no signs of excessive scour or erosion. The channel currently appears stable in both the lateral and vertical directions. Some sediment and debris are accumulated in the channel, yet this material does not appear to be substantially reducing conveyance area.

Several residential structures are located approximately 200+ feet northeast of the Charles River Bridge along Harbor Road. These structures are on high ground relative to the low spot on the southwestern approach to the bridge and are thus not in immediate danger of flooding. Survey indicates elevations around the home closest to the channel to be 385.3 feet NAVD88, while the 100-year flood is located at elevation 384.5 feet NAVD88.

The Charles River Bridge is aligned well with the channel, and does not limit fish passage. The size of the opening of the bridge will be increased as part of the preliminary design.

Level 2 Analysis

Bridge scour analysis was completed in HEC-RAS, which uses the methods described in Hydraulic Engineering Circular No. 18 (FHWA, 2001). Contraction and abutment scour were estimated. Piers do not exist and are not a part of the recommended alternative so pier scour is not evaluated. Long-term channel degradation has taken place slowly in the past (about 2 feet of incision since 1929), yet the channel profile shows some sediment accumulation at the bridge so these processes are not anticipated to contribute to significant bed and bank movement.

The HEC-RAS estimations of contraction and abutment scour are unrealistically high for the back-water controlled Charles River. Previous studies comparing actual and predicted scour depths have confirmed that predictions with HEC-RAS can be high by one or two orders of magnitude (Lombard and Hodgkins, 2008). The scour calculations in RAS are used for a relative comparison between existing and proposed conditions. Low flow velocity (0.3-1.1 feet per second) and shear stress (0.0-0.03 pound per square foot) suggest little scour around the existing and proposed Charles River Bridge.

Contraction scour is remains zero or is lower for proposed conditions, and abutment scour is reduced for all storms excluding the 50-year flood on the left abutment (Table 7-9).

TABLE 7-9
RESULTS OF CHARLES RIVER BRIDGE HEC-RAS SCOUR ANALYSIS

Storm	**Contraction scour (ft)**			**Left abutment scour (ft)**			**Right abutment scour (ft)**		
(yr)	EX	PR	Change	EX	PR	Change	EX	PR	Change
1.1	0.0	0.0	0.0	8.5	7.2	-1.3	11.3	4.2	-7.1
2	4.3	4.1	-0.2	10.6	8.9	-1.7	14.1	5.3	-8.8
5	10.3	10.0	-0.3	12	10.1	-1.9	15.9	6.0	-9.9
10	12.0	11.7	-0.3	12.7	10.7	-2.0	16.7	6.6	-10.1
25	7.4	7.1	-0.3	13.1	11.1	-2.0	16.8	7.3	-9.5
50	0.3	0.3	0.0	7.4	11.5	4.1	16.6	8.0	-8.6
100	0.0	0.0	0.0	8.4	8.2	-0.2	16.4	9.1	-7.3
500	0.0	0.0	0.0	10.8	10.6	-0.2	17.6	11.4	-6.2

Scour Countermeasures and Slope Protection

The scour analysis and geomorphology of the Charles River indicates that the proposed bridge replacement options will reduce the overall scour potential. The hydraulic analysis indicates a low-velocity stream channel with approximately 1.1 fps velocity during the 10-year storm event.

Utilizing the scour countermeasures analysis described in Hydraulic Engineering Circular No. 23 (FHWA, 2001) and Design Guideline 12 for Revetments, the slope protection shall be a 3-foot thick plain riprap embankment per standard MaineDOT details. The slope protection shall include a filter fabric separation layer to the underlying sandy material and a keyed-in toe protection extending a minimum of 1-foot into the existing streambed.

Reference List:

FHWA, 2001. Evaluating Scour at Bridges (Hydraulic Engineering Circular No. 18), Fourth Edition. Publication No. FHWA NHI 01-001. Federal Highway Administration, U.S. Department of Transportation, Washington, DC.

FHWA, 2001. Bridge Scour and Stream Instability Countermeasures (Hydraulic Engineering Circular No. 23), Second Edition. Publication No. FHWA NHI 01-003. Federal Highway Administration, U.S. Department of Transportation, Washington, DC.

Hodgkins, G., 1999. Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals. Water-Resources Investigations Report 99-4008. US Geological Survey, Augusta, Maine.

Lombard, P. J. and G. A. Hodgkins, 2008. Comparison of Observed and Predicted Abutment Scour at Selected Bridges in Maine. Scientific Investigations Report 2008–5099. U.S. Geological Survey, Reston, VA.

MEDOT, 2003. Bridge Design Guide. Prepared by Guertin Elkerton & Associates for Maine Department of Transportation, Augusta, ME.

USACE, 1971. Flood Plain Information, Saco River, Fryeburg, Maine. Department of the Army, New England Division, Corps of Engineers, Waltham, MA.

USACE, 2005. Hydrologic Engineering Center River Analysis System (HEC-RAS) (V. 4.0). U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, CA.

Section 8

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

SPECIFICATIONS

Design: AASHTO LRFD Bridge Design Specifications, Fourth Edition 2007 and Interim Specifications through 2008.

DESIGN LOADING

Live Load ..... HL - 93 Modified

TRAFFIC DATA

Current (2007) AADT	380
Future (2009) AADT	1040
DHV - % of AADT	12
Design Hour Volume	142
% Heavy Trucks (AADT)	8
% Heavy Trucks (DHV)	6
Directional Distribution (DHV)	60
18 kip Equivalent P 2.0	42
18 kip Equivalent P 2.5	40
Design Speed (mph)	40

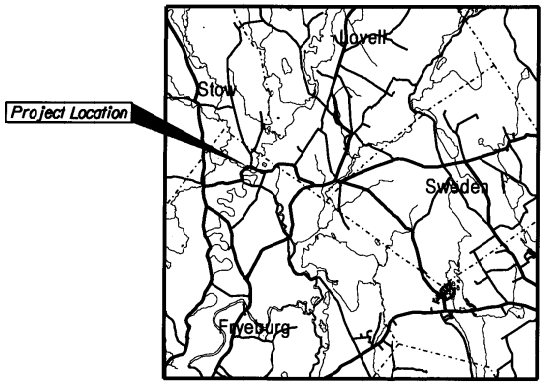
HYDROLOGIC DATA

Drainage Area	70 sq mi
Design Discharge (Q50)	6703 cfs
Check Discharge (Q100)	7715 cfs
Headwater Elevation (Q50)	383.1 ft
Headwater Elevation (Q100)	384.6 ft
Discharge Velocity (Q50)	0.7 fps
Discharge Velocity (Q100)	0.5 fps

UTILITIES

Central Maine Power Company
Time Warner
Northland Telephone

FRYEBURG
OXFORD COUNTY
CHARLES RIVER BRIDGE
OVER
CHARLES RIVER
HARBOR ROAD
PROJECT NO. BR-1509(500)X
PROJECT LENGTH 0.123 mi.
BRIDGE REPLACEMENT
BRIDGE NO. 2151



LOCATION MAP

2 0 2 4
Scale in Miles

LIST OF DRAWINGS

PIN 15095.00

BR-1509(500)X

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

	APPROVED	DATE
COMMISSIONER:		
CHIEF ENGINEER:		

PROJECT INFORMATION

PROGRAM	BRIDGE	
PROJECT MANAGER	STEVE BODGE, II	SIGNATURE
DESIGNER	Cr PAM JARVIS	
CONSULTANT	MALONE & MACBROOM, INC.	P.E. NUMBER
PROJECT RESIDENT		
CONTRACTOR		DATE
PROJECT COMPLETION DATE		

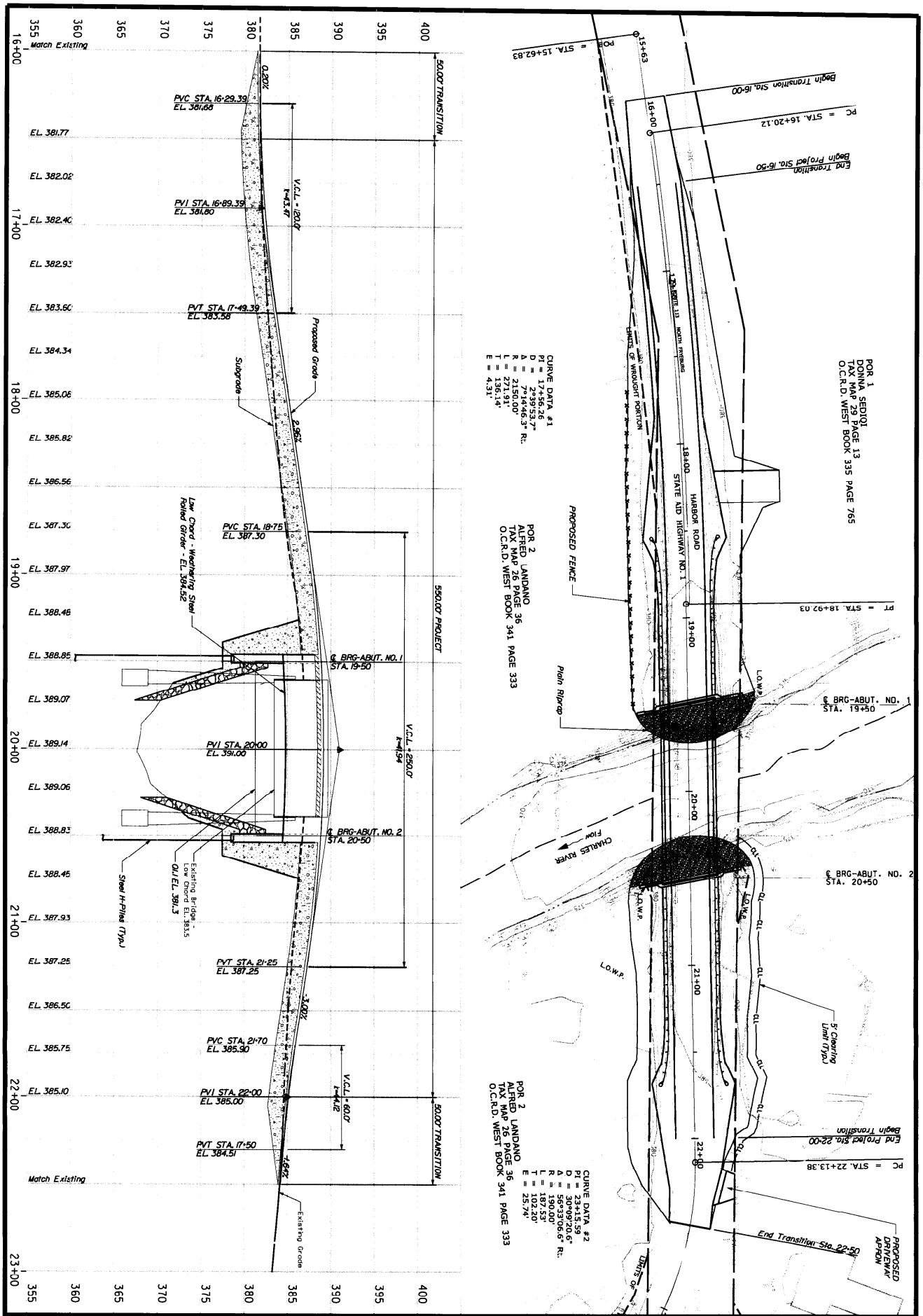
FRYEBURG
CHARLES RIVER BRIDGE

TITLE SHEET

SHEET NUMBER
1
OF 3

Filename: ...\00\BRIDGE\MSTA\001_Title.dgn Division: BRIDGE Username: skipb Date:9/10/2009

Filename: ...\00\BRIDGE\MSTA\002_Bridge.dgn Division: BRIDGE Username: skipb Date:9/10/2009



SHEET NUMBER 2 OF 3

CHARLES RIVER BRIDGE
CHARLES RIVER
FRYEBURG OXFORD COUNTY

PLAN / PROFILE

PROJ. MANAGER	S. BODGE	BY	DATE
DESIGN-DETAILED	K. PATEL	S. BURNS	
CHECKED-REVIEWED	G. JARVIS	A. MANNING	
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

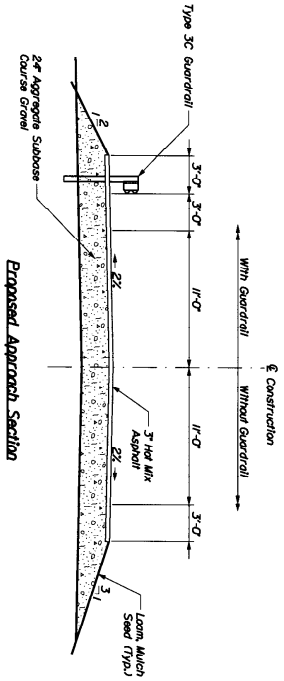
P.E. NUMBER

DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BR-1509(500)X

BRIDGE NO. 2151 PIN 15095.00 BRIDGE PLANS



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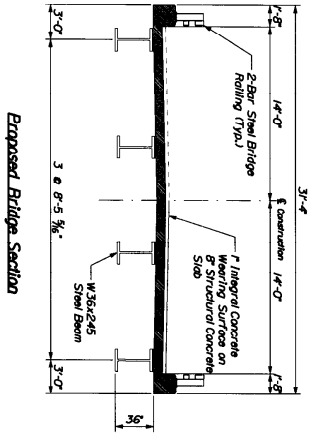
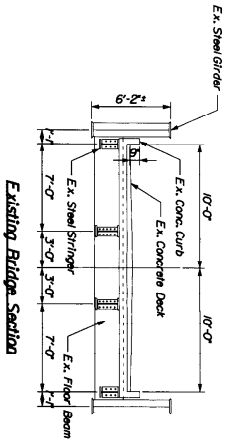
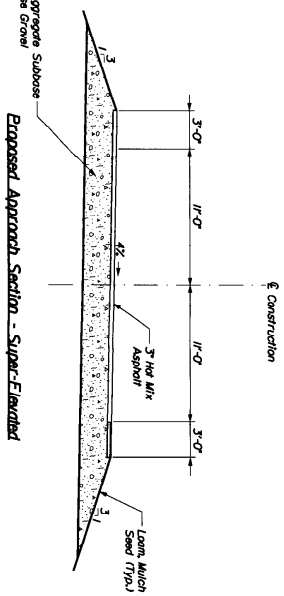


Proposed Bridge Section



Existing Bridge Section



Proposed Approach Section - Super-Elevated

SHEET NUMBER 3 OF 3	CHARLES RIVER BRIDGE CHARLES RIVER FRYEBURG OXFORD COUNTY PLANS	PROJ. MANAGER	S. BODGE	BY	DATE
		DESIGN-DETAILED	K. PATEL	S. BURNS	
		CHECKED-REVIEWED	G. JARVIS	A. MANNING	
		DESIGN2-DETAILED2			
		DESIGN3-DETAILED3			
		REVISIONS 1			
		REVISIONS 2			
		REVISIONS 3			
		REVISIONS 4			
		FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BR-1509(500)X

BRIDGE NO. 2151 PIN 15095.00 BRIDGE PLANS

MaineDOT

CHARLES RIVER BRIDGE #2151
OVER THE CHARLES RIVER

PRELIMINARY DESIGN REPORT

APPENDIX A

PHOTOGRAPHS

Eastern approach from center of the bridge

Western approach from center of the bridge

Bridge view from east end of structure

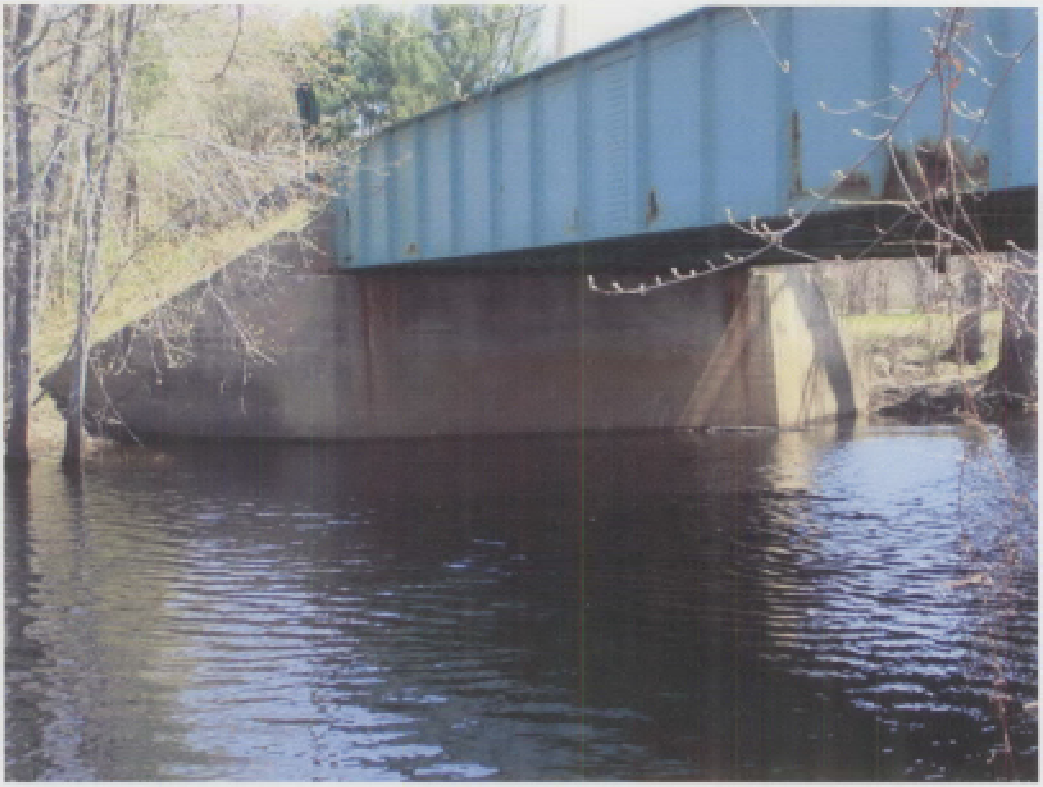
Bridge view from west end of structure

Looking downstream from center of the bridge

Looking upstream from center of the bridge

Downstream face of bridge from east bank

Upstream face of bridge from west bank



East abutment view

West abutment view

Close-up: Upstream face deterioration

Close-up: West abutment bearing plate

Downstream, eastern side-slope

Upstream, eastern side-slope

Downstream, western side-slope

Upstream, western side-slope

Eastern approach from Union Hill Road intersection

Eastern approach from Union Hill Road intersection

MaineDOT

CHARLES RIVER BRIDGE #2151
OVER THE CHARLES RIVER

PRELIMINARY DESIGN REPORT

APPENDIX B

BRIDGE MAINTENANCE REPORT

Structure Inventory and Appraisal Sheet (English Units)

Bridge Key: 2151 **Agency ID:** 2151 **SR:** 20.1 **SD/FO:** SD

IDENTIFICATION

State 1	23 Maine	Struc Num 8	2151
Facility Carried 7	HARBOR ROAD	Location 9	1.9 MI E OF JCT RTE 113
Rte (On/Under)5A	Route On Structure	Rte. Signing Prefix 5B	4 County Hwy
Level of Service 5C	0 None of the below	Rte. Number 5D	00000
Directional Suffix 5E	0 N/A (NBI)	% Responsibility	0
SHD District 2	01 Southern	County Code 3	017 Oxford
Place Code 4	17090 Fryeburg	Mile Post 11	0.000 mi
Feature Intersected 6	CHARLES RIVER		
Latitude 16	44d 07' 49"	Longitude 17	070d 56' 54"
Border Bridge Code 98	Not Applicable (P)		
Border Bridge Number 99	n/a		

STRUCTURE TYPE AND MATERIALS

Number of Approach Spans 46: 0 Number of Spans Main Unit 45: 1

Main Span Material/Design 43A/B:

3 Steel 03 Girder-Floorbeam

Deck Type 107	1 Concrete-Cast-in-Place
Wearing Surface 108A	2 Integral Concrete
Membrane 108B	0 None
Deck Protection 108C	None

AGE AND SERVICE

Year Built 27	1930	Year Reconstructed 106	0
Type of Service on 42A	1 Highway		
Type of Service under 42B	5 Waterway		
Lanes on 28A	2	Lanes Under 28B	0
Detour Length 19	1.1 mi		
ADT 29	403	Truck ADT 109	8 %
Year of ADT 30	2008		

GEOMETRIC DATA

Length Max Span 48	75.0 ft	Structure Length 49	80.0 ft
Curb/Sdwlk Width L 50A	0.5 ft	Curb/Sidewalk Width R 50B	0.5 ft
Width Curb to Curb 51	20.1 ft	Width Out to Out 52	21.1 ft
Approach Roadway Width 32 (w/ shoulders)	23.0 ft	Median 33	0 No median
Deck Area	1,687.9 sq. ft		
Skew 34	0.00 °	Structure Flared 35	0 No flare
Vertical Clearance 10	99.99 ft	Horiz. Clearance 47	20.00 ft
Minimum Vertical Clearance Over Bridge 53		327.8 ft	
Minimum Vertical Underclearance Reference 54A		N Feature not hwy or RR	
Minimum Vertical Underclearance 54B		0.0 ft	
Minimum Lateral Underclearance Reference R 55A		N Feature not hwy or RR	
Minimum Lateral Underclearance R 55		327.8 ft	
Minimum Lateral Underclearance L 56		327.8 ft	

INSPECTION

Frequency 91	12 months	Inspection Date 90	8/21/2008	Next Inspection	08/21/2010
FC Frequency 92A	24 months	FC Inspection Date 93A	8/21/2008	Next FC Inspection	8/21/2010
UW Frequency 92B	NA	UW Inspection Date 93B	NA	Next UW Inspection	NA
SI Frequency 92C	NA	SI Date 93C	NA	Next SI	NA
Element Frequency	12 months	Element Inspection Date	08/21/2008	Next Elem. Insp. Due	08/21/2010

CLASSIFICATION

Defense Highway 100	0 Not a STRAHNET hwy	Parallel Structure 101	No || bridge exists
Direction of Traffic 102	2 2-way traffic	Temporary Structure 103	Not Applicable (P)
Highway System 104	0 Not on NHS	NBIS Length 112	Long Enough
Toll Facility 20	3 On free road	Functional Class 26	08 Rural min Collector
Defense Hwy 110	0 Not a STRAHNET	Historical Significance 37	2 Bridge eligible for NRHP
Owner 22	01 State Highway Agency		
Custodian 21	01 State Highway Agency		

CONDITION

Deck 58	5 Fair	Super 59	3 Serious	Sub 60	7 Good
Culvert 62	N N/A (NBI)	Channel/Channel Protection 61		7 Minor Damage	

LOAD RATING AND POSTING

Inventory Rating Method 65	2 AS Allowable Stress	Operating Rating Method 63	2 AS Allowable Stress
Inventory Rating 66	HS11.7	Operating Rating 64	HS22.2
Design Load 31	4 M 18 (H 20)	Posting 70	5 At/Above Legal Loads
Posting status 41	A Open, no restriction		

APPRAISAL

Bridge Rail 36A	0 Substandard	Approach Rail 36C	0 Substandard
Transition 36B	0 Substandard	Approach Rail Ends 36D	1 Meets Standards
Str. Evaluation 67	3	Deck Geometry 68	3 Intolerable - Correct
Underclearance, Vertical and Horizontal 69	N Not applicable (NBI)		
Waterway Adequacy 71	7 Above Minimum	Approach Alignment 72	8 Equal Desirable Crit
Scour Critical 113	8 Stable Above Footing		

PROPOSED IMPROVEMENTS

Bridge Cost 94	$ 1,079,000	Type of Work 75	31 Repl Load Capacity
Roadway Cost 95	$ 108,000	Length of Improvement 76	66.0 ft
Total Cost 96	$ 1,618,000	Future ADT 114	605
Year of Cost Estimate 97	2004	Year of Future ADT 115	2028

NAVIGATION DATA

Navigation Control 38	0 Permit Not Required		
Vertical Clearance 39	0.0 ft	Horizontal Clearance 40	0.0 ft
Pier Protection 111	Not Applicable (P)	Lift Bridge Vertical Clearance 116	0.0 ft

ELEMENT CONDITION STATE DATA

Str Unit	Elm/Env	Description	Units	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4	% in 5	Qty. St. 5
1	22/2	P Conc Deck/Rigid Ov	(SF)	1,688	0 %	0	0 %	0	100 %	1,688	0 %	0	0 %	0
1	113/2	Paint Stl Stringer	(LF)	320	51 %	163	12 %	38	20 %	64	17 %	54	0 %	0
1	121/2	P/Stl Thru Truss/Bot	(LF)	160	0 %	0	10 %	16	10 %	16	70 %	112	10 %	16
1	152/2	Paint Stl Floor Beam	(LF)	63	35 %	22	30 %	19	15 %	9	20 %	13	0 %	0
1	215/2	R/Conc Abutment	(LF)	42	90 %	38	10 %	4	0 %	0	0 %	0	0 %	0
1	218/2	Undefined Wall Elem	(LF)	99	80 %	79	15 %	15	5 %	5	0 %	0	0 %	0

Structure Inventory and Appraisal Sheet (English Units)

Str Unit	Elm/Env	Description	Units	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4	% in 5	Qty. St. 5
1	311/2	Moveable Bearing	(EA)	4	0 %	0	100 %	4	0 %	0	0 %	0	0 %	0
1	334/2	Metal Rail Coated	(LF)	160	0 %	0	0 %	0	0 %	0	80 %	128	20 %	32
1	363/2	Section Loss SmFlag	(EA)	1	0 %	0	0 %	0	100 %	1	0 %	0	0 %	0
1	385/2	Wear.Surf. - Rigid	(SF)	1,608	70 %	1,126	10 %	161	10 %	161	10 %	161	0 %	0
1	388/2	Paint	(SF)	7,550	25 %	1,888	25 %	1,888	25 %	1,888	25 %	1,888	0 %	0

BRIDGE SCOUR EVALUATION SUMMARY

Bridge Name: Charles River | Town: Fryeburg | Bridge Number: 2151

Route/Name: Stow Road | Stream: Charles River | River Basin: Saco

Review Date: 11-Oct-95

Note : See Office/Field Review Report for Additional Data.

SUMMARY AND CONCLUSIONS

This single span half-through steel girder bridge constructed in 1930 is supported by mass concrete abutments on spread footings. The bridge files indicated that a construction change order was made to include piles for the westerly (right) abutment, but no details were available. The bridge spans the Charles River at about a 10 degree angle on a fairly straight stream section. Bends are located several hundred feet upstream and downstream.

No flood history for this site is available in the bridge files. The upstream flood plain is broad and relatively flat. The roadway approach will be overtopped for a significant length at an elevation of ±4 feet below the low chord of the bridge. The roadway overtopping elevation is ±3 feet below the "high water" elevation on the 1929 plans; therefore, overtopping would reduce flood flows and velocities at the bridge.

Comparison of the 1995 stream cross-section at the bridge to the 1929 design plans indicate that the channel bottom relief and thalweg have changed, and is currently about 1½ to 2 feet lower now than it was in 1929. The channel width appears stable upstream and downstream, with the faces of the abutments at about the edge of channel. The thalweg is centered in the channel through the bridge and is about 1½ feet above the bottom of footings. Channel bottom was penetrated a maximum of 1 foot in sand and gravel.

No history of scour is evident in the bridge files. The channel has experienced 1 to 2 feet of degradation since 1929, with deposition of muck in the center of the channel. The potential for contraction scour is low due to the consistent width of channel through the bridge and the flow relief provided by roadway overtopping. No downstream deposits were evident, although some debris had collected at the downstream bend. The bridge abutments are inclined to the flow at a 10 degree angle, and there is approximately 6 feet of cover at the footings.

An Item 113 rating of 8L is recommended based on approximately 6 feet of cover at the footings (similar to 1929 construction plans); flow and velocity relief provided by roadway overtopping ± 4 feet below low chord; and no history of scour. Because of the scourable bed material and observed change of stream channel cross-section at the bridge since original construction, this rating should be reviewed after routine bridge inspections and re-evaluated if conditions change. Routine monitoring is recommended.

RECOMMENDATIONS

Countermeasures: Routine Monitoring -

Recommended Repair Code: Element: Work: Priority: Effort:

Level Two Analysis: Not Required -

RECOMMENDED SCOUR VULNERABILITY RATING (PER FHWA)

Scour Vulnerability: -

Recommended NBI Rating: Item 61: 8 Item 71: 8 Item 113: 8L

BRIDGE SCOUR EVALUATION SUMMARY

BRIDGE DESCRIPTION

Bridge Description: Single Span
Number of Spans: 1
Bridge Datum: Assumed
Date Built: 1930
Date of Widening/Major Repairs: None
Low Chord Elev (ft): 102.50 -
Bridge Deck Elev (ft): 106.11 -
Thalweg Elev (ft): 86.3
Overtopping Elev (ft): 98.6
Overtopping Location: Right Approach

ABUTMENTS	Left Abutment	Right Abutment
Type:	Vertical Wall w/Wingwall	Vertical Wall w/Wingwall
Support:	Fixed	Expansion
Foundation Type:	Spread Footings	Spread Footings w/ piles
Footing Exposed:	No	No
Top of Footing Elev (ft):	88.0	88.0
Footing Height (ft):	3.0	3.0
Exposure (ft):	0	0
Piles Exposed:	NA	No
Pile Tip Elev (ft):	NA	Unknown
Rock Elev (ft):	Unknown	Unknown
Riprap (Type/Size):	None	None
Riprap Condition:	NA	NA
Other Protection:	None	None
Condition:	NA	NA
Scour		
Tilt/Settlement:	No	No
Max Depth Undermining (ft):	0	0
Scour Holes:	No	No
Location:	NA	NA

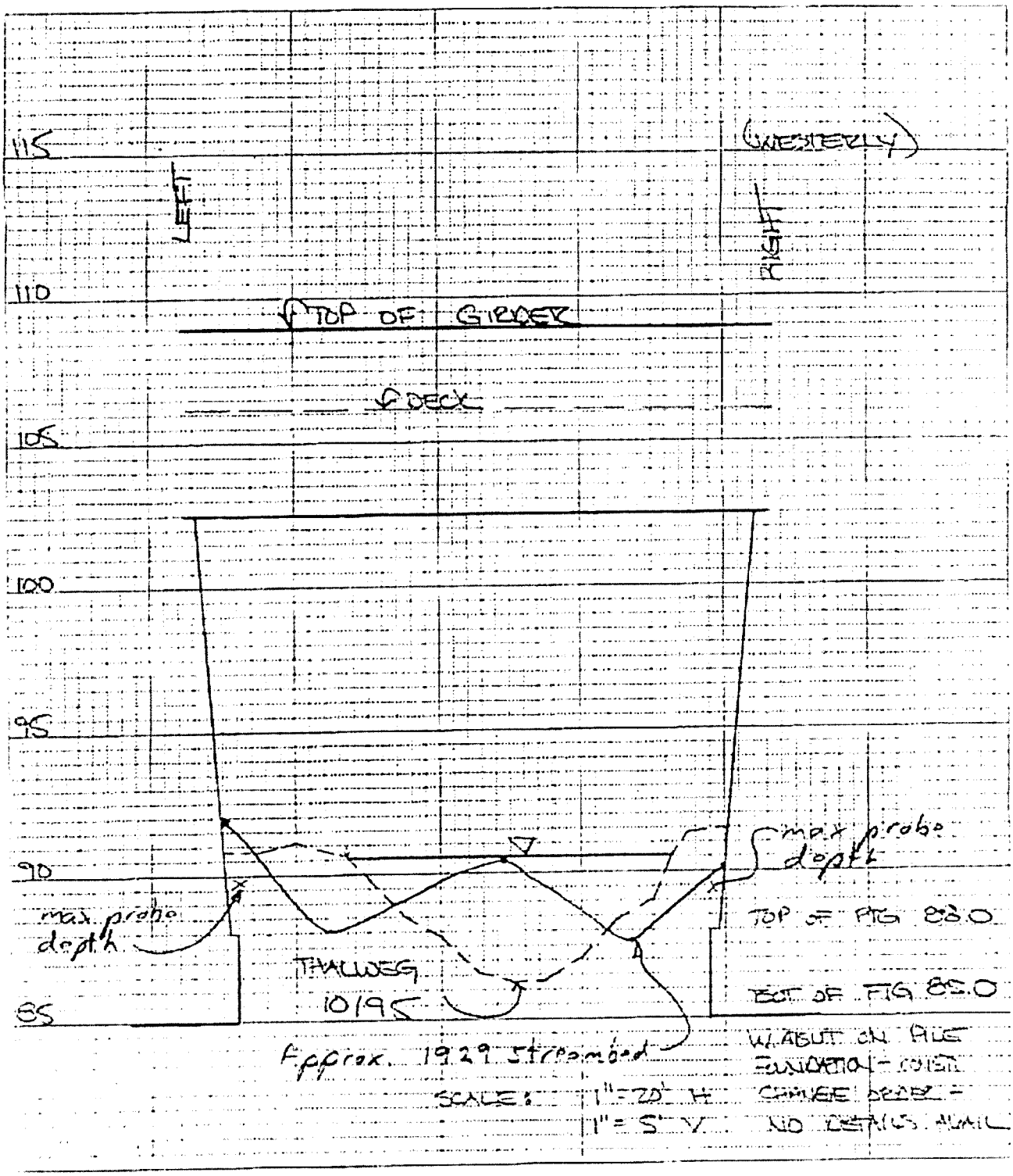
PIERS

OFFICE/FIELD REVIEW REPORT

Bridge Name: CHARLES RIVER	Town: FRANKLIN	Bridge #: 215/
Route No./Name STATE RD	Stream: CHARLES RIVER	Review Date: 10-11-95

Stream Cross Section at Bridge (Facing Downstream)

Upstream Side: ✓ Downstream Side: _____



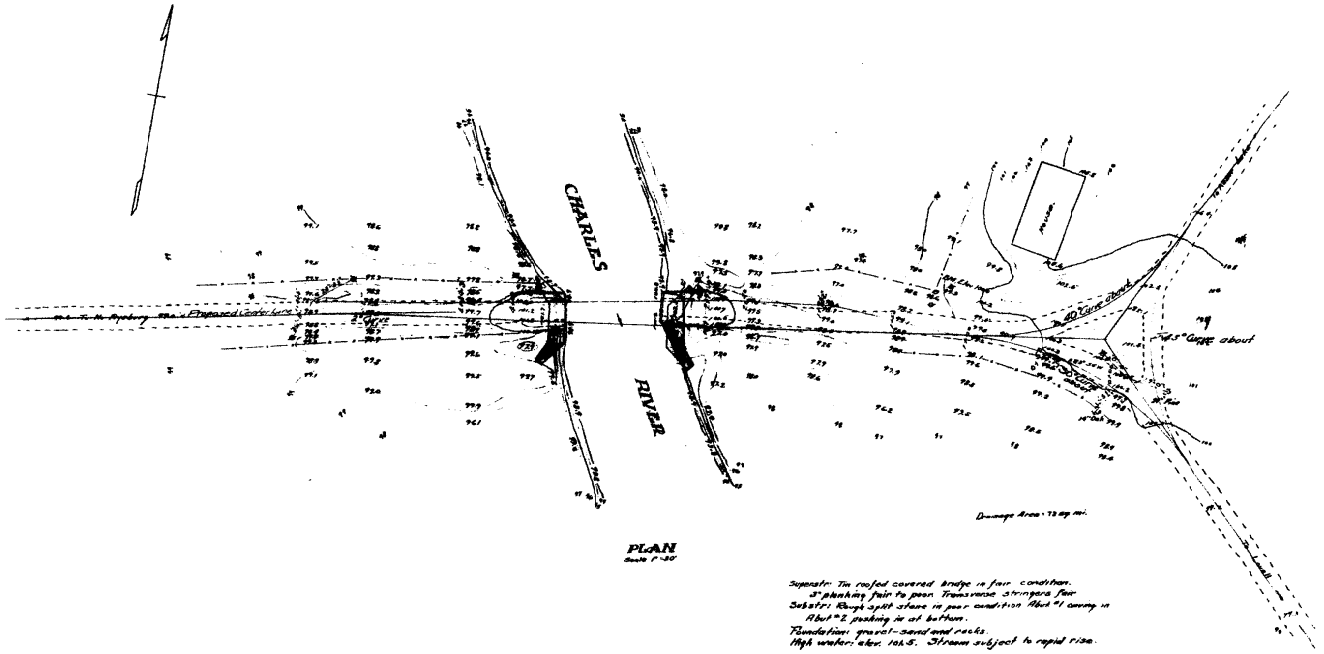
MaineDOT

CHARLES RIVER BRIDGE #2151
OVER THE CHARLES RIVER

PRELIMINARY DESIGN REPORT

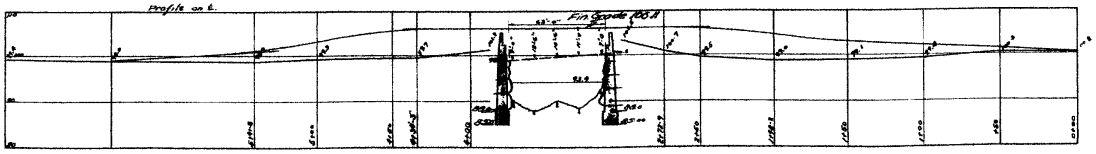
APPENDIX C

EXISTING BRIDGE PLANS



PLAN
Scale 1"=30'

Superstr: Tin roofed covered bridge in fair condition.
3" planking fair to poor. Transverse stringers fair.
Substr: Rough split stone in poor condition. Abut #1 caving in.
Abut #2 pushing in at bottom.
Foundation: gravel-sand and rocks.
High water: elev. 1ok.s. Stream subject to rapid rise.



PROFILE
SCALE H:1"=30'
V:1"=10'

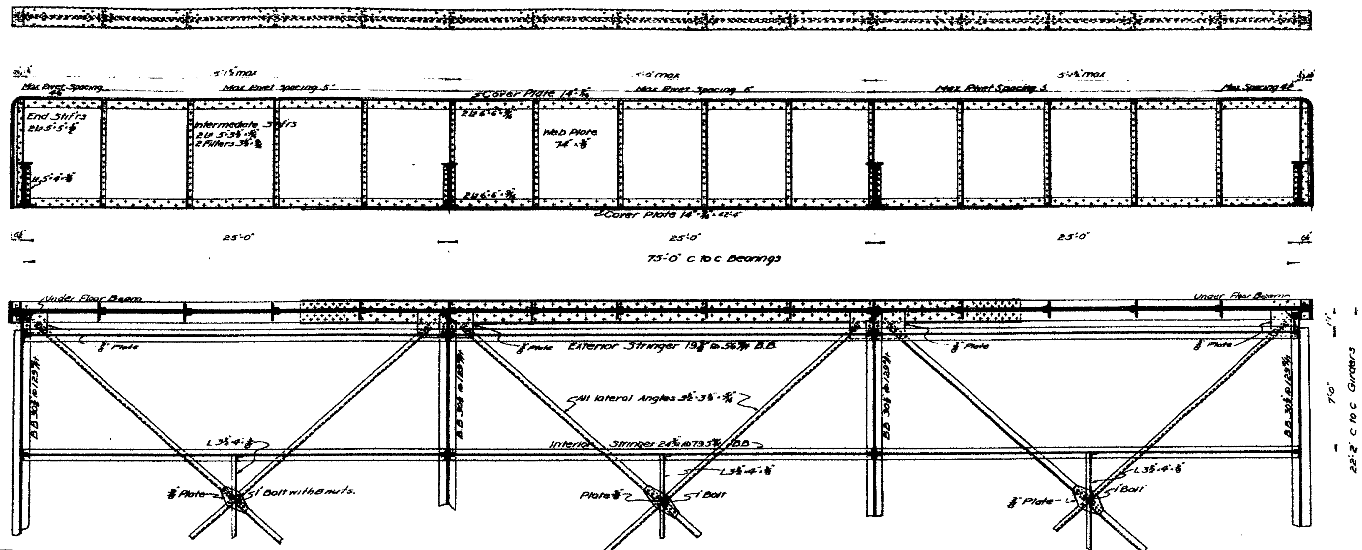
MAINE HIGHWAY COMM.
BRIDGE DIVISION

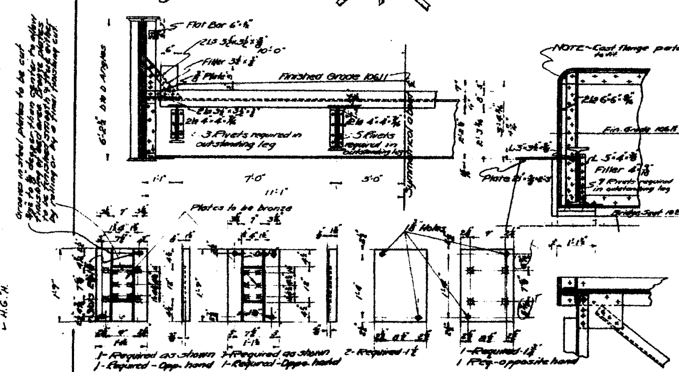
CHARLES RIVER BRIDGE

IN THE TOWN OF
FRYEBURG OXFORD CO.
SURVEY PLAN
SHEET 1 of 4 AUGUSTA, ME., FEB 3, 1929

9-16

0 1 2 3 4 5 INCHES





LOADING

DEAD LOAD 2065# Per linear foot of Girder

LIVE LOAD Floor System 2-15 Ton trucks. Truss H-15 (Uniform Load 522# Per linear ft of Girder + Concentration of 14,700# for moment 21,344 for shear

Impact coefficient = 50/(L+125) For all parts of structure L = Loaded length of span. All rivets 7/8" Diam

INTERIOR STRINGER

Dead Load: Surface 366#
8" Slab 650#
Stringer 79.5#
1095.5# Per linear foot

Dead Load Moment 1095.5 × 25² × 1.5 = 1027000
L.L.M + I = 6000 × 12.5 × 12 × 1.33 × 6.5/4.5 = 1729000
2756000

S = 4,485,000/24000 = 181.0 Use B.B 24-24 1/2 @ 73.5#/ft

I/C = 188.2

Loading for Max. Moment

EXTERIOR STRINGER

DEAD LOAD Surface and slab 490#
Curb 125#
Stringer 56#
671# Per linear foot

Dead Load Moment = 671 × 25² × 1.5 = 629,100
LL.M + Impact 12000/2 × 12.5 × 12 × 1.33 × 5.5/7 = 942,900
1572000 in#

S = 2,514,900/24000 = 104.7 Use BB 20-19 1/8 @ 56# I/C = 109.3

FLOOR BEAMS

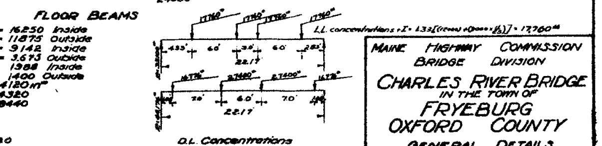
Dead Load Slab (0.67 × 25 × 150 × 6.5) = 16250 Inside
(0.67 × 25 × 150 × 4) + (1 × 0.5 × 25 × 150) = 11875 Outside
Surface (0.375 × 25 × 150 × 6.5) = 9142 Inside
(0.28 × 25 × 150 × 3.5) = 3.673 Outside
Stringer (25 × 79.5) 1988 Inside
(25 × 56) 1400 Outside

Dead Load Moment [(44,176 × 8.08) − (16,176 × 7)] × 12 = 2874120 in#
LL + I [(33,100 × 10.33) − (17760 × 6)] × 12 = 2824320
5698440

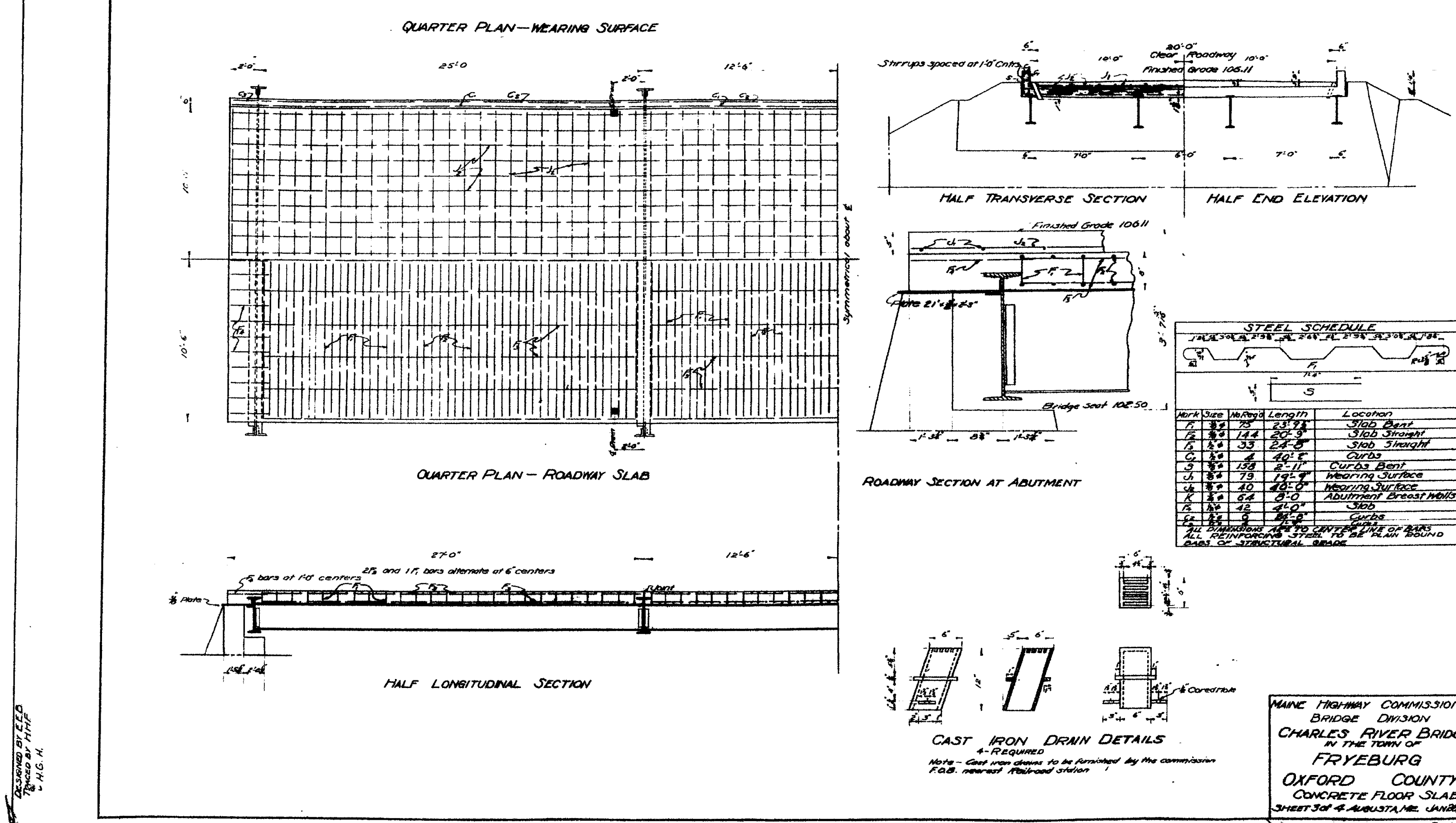
Floor Beam = 123#
M = 123 × 22.17²/8 × 12 = 45,100 in#

Total Dead Load M = 2,363,220 S = 8817,860/24000 = 358.0
Live + Impact M = 2,826,320

Use B.B. 30-30 1/2 @ 123#/ft I/C = 373.3



MAINE HIGHWAY COMMISSION
BRIDGE DIVISION
CHARLES RIVER BRIDGE
IN THE TOWN OF
FRYEBURG
OXFORD COUNTY
GENERAL DETAILS
SHEET 2 of 4 AUGUSTA ME JAN 31, 1930

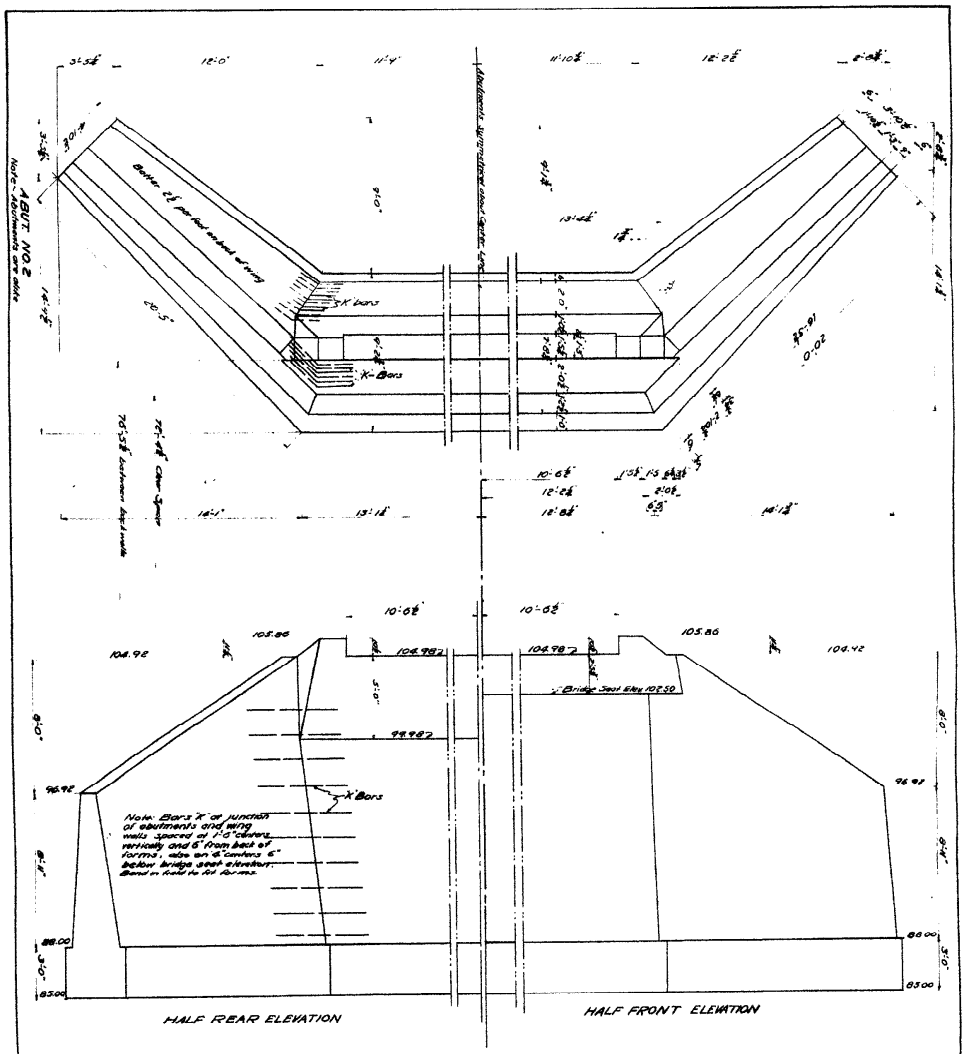


STEEL SCHEDULE

Mark	Size	No. Reqd.	Length	Location
F₁	[illegible]	75	23'-9⅞"	Slab Bent
F₂	[illegible]	144	20'-9"	Slab Straight
F₃	½" φ	33	24'-8"	Slab Straight
C₁	½" φ	4	40'-6"	Curbs
S	[illegible]	158	2'-11"	Curbs Bent
J₁	[illegible]	79	19'-9"	Wearing Surface
J₂	[illegible]	40	40'-0"	Wearing Surface
K	[illegible]	64	8'-0	Abutment Breast Walls
F₄	½" φ	42	4'-0"	Slab
C₂	½" φ	6	24'-8"	Curbs
C₃	[illegible]	[illegible]	[illegible]	Curbs

ALL DIMENSIONS ARE TO CENTER LINE OF BARS
ALL REINFORCING STEEL TO BE PLAIN ROUND BARS OF STRUCTURAL GRADE

MAINE HIGHWAY COMMISSION
BRIDGE DIVISION
CHARLES RIVER BRIDGE
IN THE TOWN OF
FRYEBURG
OXFORD COUNTY
CONCRETE FLOOR SLAB
SHEET 3 of 4 AUGUSTA, ME. JAN. 28, 30

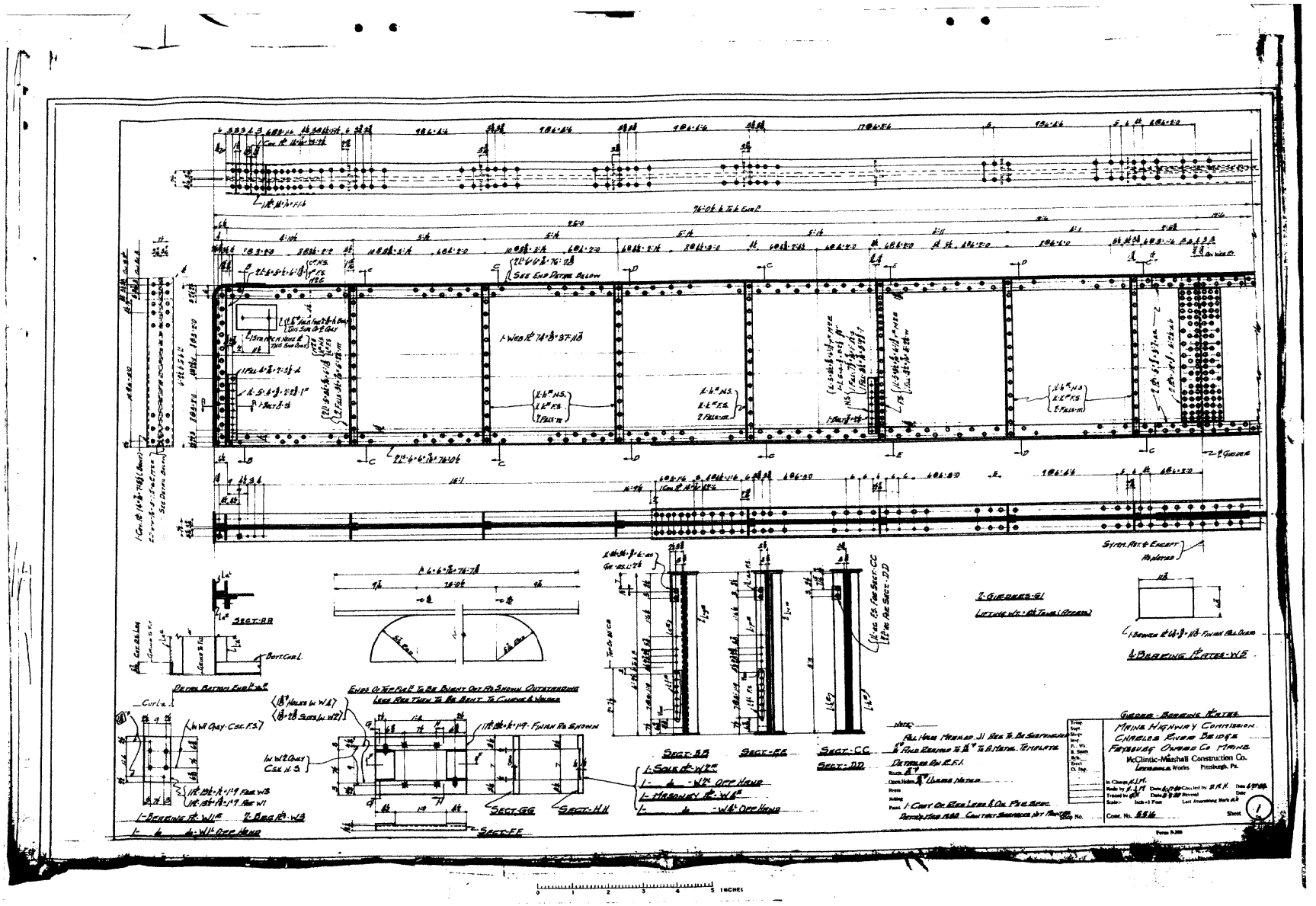


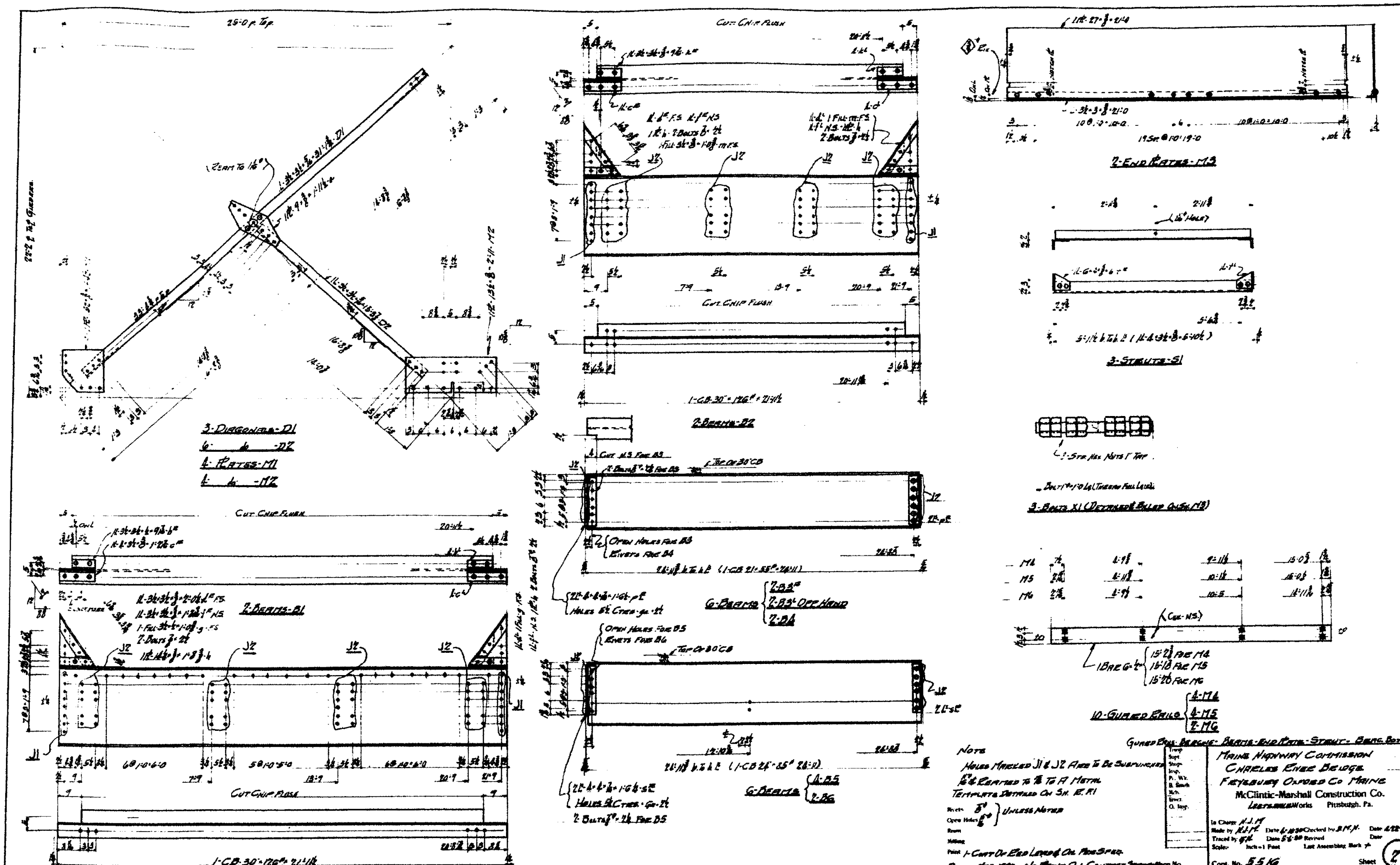
MAINE HIGHWAY COMMISSION
BRIDGE DIVISION

CHARLES RIVER BRIDGE

IN THE TOWN OF
FRYEBURG OXFORD CO.
SUBSTRUCTURE

Stuart H. Greene Augusta, Me. June 29, 1938


SECT-BB
SECT-CC
SECT-DD
SECT-EE
SECT-FF
SECT-GG
SECT-HH
2-GIRDERS-GI
4-BEARING PLATES-WS
GIRDER-BEARING PLATES
MAINE HIGHWAY COMMISSION
CHARLES RIVER BRIDGE
FARMINGTON CUMBERLAND CO MAINE
McClintic-Marshall Construction Co.
Pittsburgh, Pa.
Cont. No. 5816
Sheet 1



Note

Holes Marked J1 & J2 Are To Be Subpunched ¹¹⁄₁₆ & Reamed To ¹⁵⁄₁₆ To A Metal Template Detailed On Sh. E. R1

Rivets ⅞" } Unless Noted
Open Holes ¹⁵⁄₁₆" }

Paint 1-Coat Of Red Lead & Oil Per Spec.

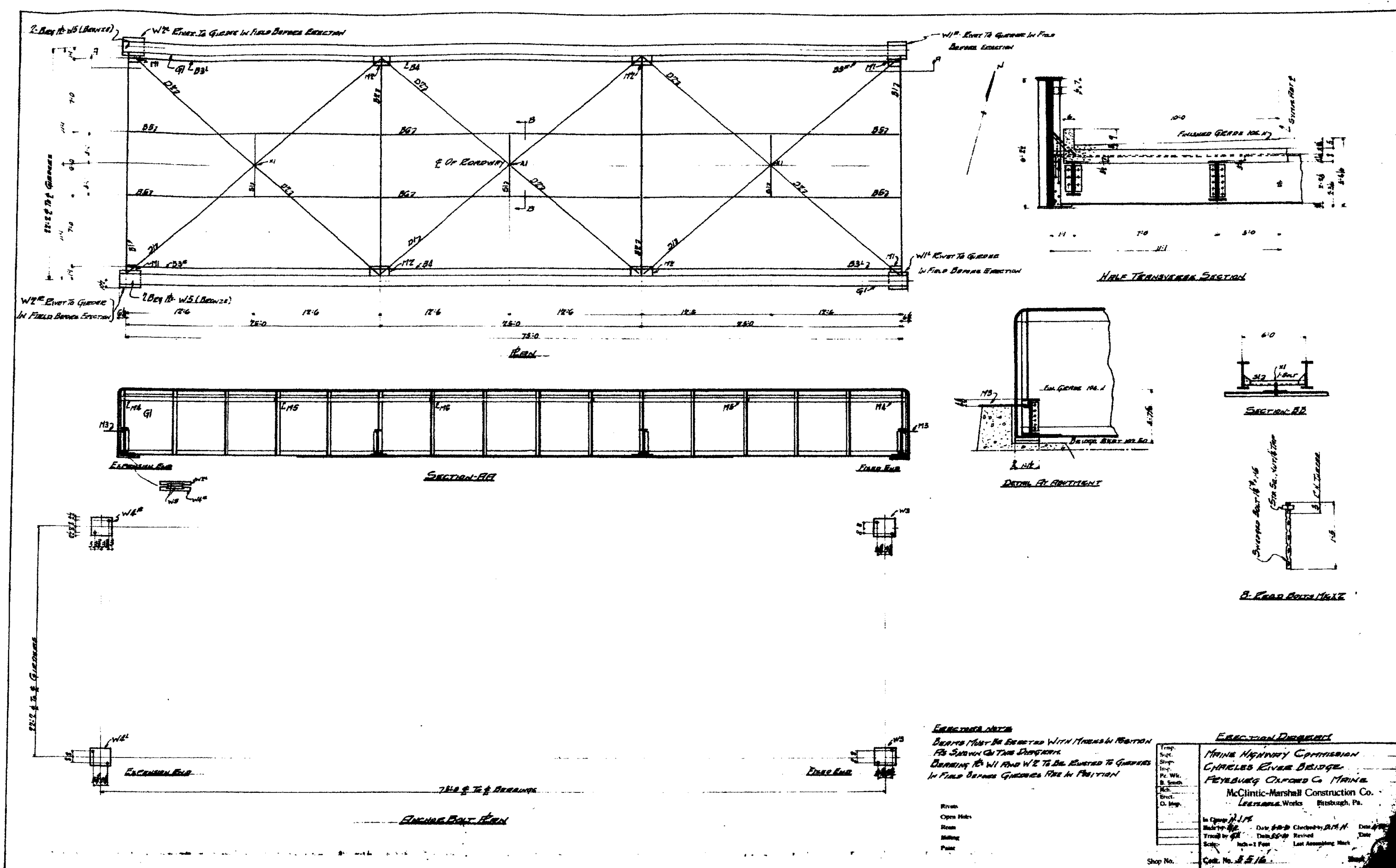
Dated Mar. 1930 No Paint On Contact Surfaces

Guard Rails - Bracing - Beams - End Plates - Strut - Bearing Bolts

Maine Highway Commission
Charles River Bridge
Fryeburg Oxford Co Maine
McClintic-Marshall Construction Co.
Leetsdale Works Pittsburgh, Pa.

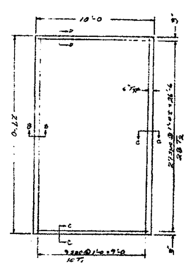
In Charge N.J.M.
Made by N.J.M. Date 4-1930 Checked by B.M.N. Date 4-22-30
Traced by G.H. Date 5-6-30 Revised
Scale: Inch = 1 Foot
Cont. No. 5516
Sheet 2

Form R-380


Plan
Section-AA
Anchor Bolt Plan
Half Transverse Section
Detail at Abutment
Section-BB
Expansion End
Fixed End
Erection Notes
Beams Must Be Erected With Marks in Position As Shown On This Diagram.
Bearing Pl. W1 And W2 To Be Riveted To Girders In Field Before Girders Are In Position
Rivets
Open Holes
Ream
Milling
Paint
Erection Diagram
Maine Highway Commission
Charles River Bridge
Fryeburg Oxford Co. Maine
McClintic-Marshall Construction Co.
Works Pittsburgh, Pa.
Temp.
Supt.
Shop.
Insp.
Pc. Wk.
B. Smith
Mch.
Erect.
O. Insp.
Checked by
Revised
Last Assembling Mark
Shop No.
Contr. No. 3516

PRELIM. | BY L.E. Morse DATE 1-19-73 PROJ. NO. 2151 FILE NO. ___ OF ___
FINAL | CHK. BY DoBak DATE 1-22-73 LOCATION Fryeburg SH. NO. 4 OF 6
ITEM NO. ___ SUBJECT Charles River Br. Wearing Surface

Panel A

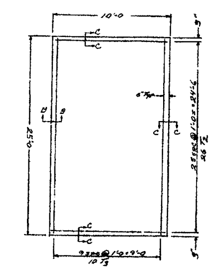


Note:
Four A Panels required
Repair curbs as required

STATE OF MAINE — DEPARTMENT OF TRANSPORTATION 132:131

PRELIM. | BY L.E. Morse DATE 1-19-73 PROJ. NO. 2151 FILE NO. ___ OF ___
FINAL | CHK. BY DoBak DATE 1-22-73 LOCATION Fryeburg SH. NO. 5 OF 6
ITEM NO. ___ SUBJECT Charles River Br. Wearing Surface

Panel B



Note:
Two B Panels required
Repair curbs as required

STATE OF MAINE — DEPARTMENT OF TRANSPORTATION 132:131

PRELIM. | BY L.E. Morse DATE 1-19-73 PROJ. NO. 2151 FILE NO. ___ OF ___
FINAL | CHK. BY DoBak DATE 1-22-73 LOCATION Fryeburg SH. NO. 6 OF 6
ITEM NO. ___ SUBJECT Charles River Br. Wearing Surface

Reinforcing Steel Schedule

Mark	Size	Length	Number	Description
T_1	#3	25'-8	40	Panel A
T_2	#3	9'-8	164	Panel A+B
T_3	#3	24'-3	20	Panel B

Total length = 3146.05 ft

.376 #/ft × 3146.05 ft = 1183 lbs

Concrete Quantities

Total length = 79'-0
width = 20'-0

79'-0 × 20'-0 × (.42+.38)/2 = 526.7 cu.ft.

526.7 / 27 = 19.5 cu.yds.

Joint Sealant Quantities

Total length = 2(79'-0) + 2(20'-0) = 198'-0

Area of joint ¾" × ¾" = .5625 sq.in.

198-0 × 12"/ft × .5625" = 1336.5 cu.in.

1336.5 cu.in. / 231 cu.in./gal = 5.8 gal Use 6 gals

Pipe Quantities

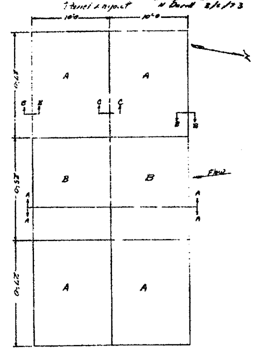
4 - 6" ø × 3'-7 Total length 14'-4

STATE OF MAINE — DEPARTMENT OF TRANSPORTATION 132:131

PRELIM. | BY L.E. Morse DATE 1-19-73 PROJ. NO. 2151 FILE NO. ___ OF ___
FINAL | CHK. BY DoBak DATE 1-22-73 LOCATION Fryeburg SH. NO. 1 OF 6
ITEM NO. ___ SUBJECT Charles River Br. Wearing Surface

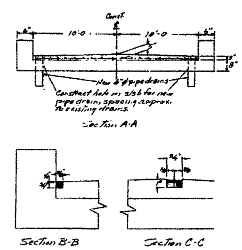
Panel Layout

E. Pepper Sand to H. Bond 2/6/73



STATE OF MAINE — DEPARTMENT OF TRANSPORTATION 132:131

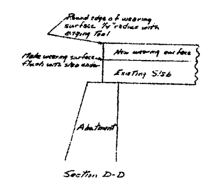
PRELIM. | BY L.E. Morse DATE 1-19-73 PROJ. NO. 2151 FILE NO. ___ OF ___
FINAL | CHK. BY DoBak DATE 1-22-73 LOCATION Fryeburg SH. NO. 2 OF 6
ITEM NO. ___ SUBJECT Charles River Br. Wearing Surface



Note:
Sand blast joints before placing joint sealer.
Place masking tape at bottom of joint to break bond.
Edges of joints to be rounded (¼" radius)

STATE OF MAINE — DEPARTMENT OF TRANSPORTATION 132:131

PRELIM. | BY L.E. Morse DATE 1-19-73 PROJ. NO. 2151 FILE NO. ___ OF ___
FINAL | CHK. BY DoBak DATE 1-22-73 LOCATION Fryeburg SH. NO. 3 OF 6
ITEM NO. ___ SUBJECT Charles River Br. Wearing Surface



STATE OF MAINE — DEPARTMENT OF TRANSPORTATION 132:131

MaineDOT

CHARLES RIVER BRIDGE #2151
OVER THE CHARLES RIVER

PRELIMINARY DESIGN REPORT

APPENDIX D

HYDROLOGY/HYDRAULIC DATA

Project Name:	Charles River Bridge	**PIN:**	15095
Stream Name:	Charles River	**Town:**	Fryeburg
Bridge Name:	Charles River Bridge	**Bridge No.**	2151
Route No.		**USGS Quad:**	
Analysis by:	CSH	**Date:**	6/1/2009

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999)

Enter data in blue cells only!

	km²	mi²	ac	
A	180.72	69.776	44656.9	*Enter data in [mi²]* Watershed Area
W	8.38	3.235	2070.5	Wetlands area (by NWI)
P_c	339700	4896150		watershed centroid (E, N; UTM 19N; meters)
County	Cumberland NW			*choose county from drop-down menu*
pptA	43.4			mean annual precipitation (inches; by look-up)
SG	0.00			sand & gravel aquifer as decimal fraction of watershed A

Worksheet prepared by:
Charles S. Hebson, PE
Chief Hydrologist
Maine Dept. Transportation
Augusta, ME 04333-0016
207-287-1105
Charles.Hebson@maine.gov

A (km²)	180.72	Conf Lvl	0.67
W (%)	4.64		

Ret Pd T (yr)	Peak Flow Estimate Lower	Q_T (m³/s)	Upper	Q_T (ft³/s)
1.1		33.49		1182.7
2	47.53	66.38	92.70	2343.8
5	72.58	101.79	142.75	3594.1
10	90.47	128.00	181.11	4519.8
25	113.41	162.65	233.28	5743.1
50	130.85	189.82	275.36	6702.5
100	148.86	218.49	320.70	7715.0
500	191.46	289.96	439.12	10238.4

Reference:

Hodgkins, G., 1999.
Estimating the magnitude of peak flows for streams in Maine for selected recurrence intervals
Water-Resources Investigations Report 99-4008
US Geological Survey, Augusta, Maine

$Q_T = b \times A^a \times 10^{-ww}$

Project Name:	Charles River Bridge	**PIN:**	15095
Stream Name:	Charles River	**Town:**	Fryeburg
Bridge Name:	Charles River Bridge	**Bridge No.**	3987
Route No.	0	**USGS Quad:**	
Analysis by:	CSH	**Date:**	12/1/2008

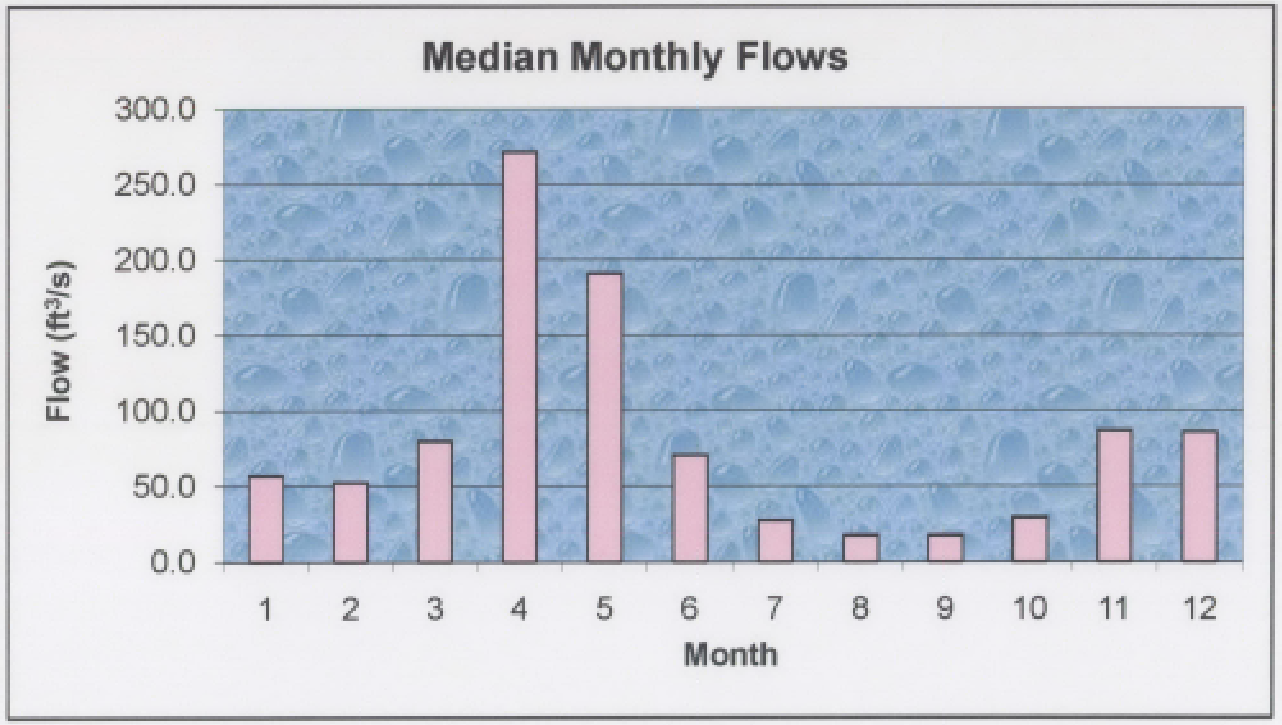
DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED

MAINE MONTHLY MEDIAN FLOWS BY USGS REGRESSION EQUATIONS (2004)

Worksheet prepared by:
Charles S. Hebson, PE
Chief Hydrologist
Maine Dept. Transportation
Augusta, ME 04333-0016
207-624-3073
Charles.Hebson@maine.gov

Value		Variable	Explanation
	69.776	*A*	Area (mi^2)
339700	4896150	P_c	Watershed centroid (E,N; UTM; Zone 19; meters)
	85.10	*DIST*	Distance from Coastal reference line (mi)
	43.4	*pptA*	Mean Annual Precipitation (inches)
	0.00	*SG*	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q_{median} (ft3/s)	(m^3/s)
Jan	56.97	1.6146
Feb	52.51	1.4879
Mar	79.80	2.2615
Apr	271.25	7.6869
May	190.88	5.4092
Jun	70.72	2.0040
Jul	27.58	0.7817
Aug	17.65	0.5002
Sep	17.50	0.4960
Oct	29.33	0.8311
Nov	86.73	2.4577
Dec	85.67	2.4279



APPENDIX E: HEC-RAS OUTPUT

CHARLES RIVER BRIDGE (#2151), Fryeburg, PIN 15095.00
MMI #2764-03

Reach	River Sta	Profile	EXISTING CONDITIONS Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	PROPOSED CONDITIONS Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)
mainstem	6.1	1.1 yr	1,183	381.3	0.3	1,183	381.3	0.3
mainstem	6.1	2 yr	2,344	381.4	0.5	2,344	381.4	0.5
mainstem	6.1	5 yr	3,594	381.6	0.8	3,594	381.6	0.8
mainstem	6.1	10 yr	4,520	381.8	0.9	4,520	381.8	0.9
mainstem	6.1	25 yr	5,743	382.4	1.0	5,743	382.4	1.0
mainstem	6.1	50 yr	6,703	383.2	0.9	6,703	383.2	0.9
mainstem	6.1	100 yr	7,715	384.7	0.8	7,715	384.7	0.8
mainstem	6.1	500 yr	10,238	387.6	0.7	10,238	387.6	0.7
mainstem	6.0	1.1 yr	1,183	381.3	0.5	1,183	381.3	0.5
mainstem	6.0	2 yr	2,344	381.4	1.0	2,344	381.4	1.0
mainstem	6.0	5 yr	3,594	381.5	1.5	3,594	381.5	1.5
mainstem	6.0	10 yr	4,520	381.7	1.8	4,520	381.7	1.8
mainstem	6.0	25 yr	5,743	382.3	2.0	5,743	382.3	2.0
mainstem	6.0	50 yr	6,703	383.1	1.9	6,703	383.1	1.9
mainstem	6.0	100 yr	7,715	384.6	1.6	7,715	384.6	1.6
mainstem	6.0	500 yr	10,238	387.6	1.1	10,238	387.6	1.1
mainstem	5.05	1.1 yr	1,183	381.3	0.3	1,183	381.3	0.3
mainstem	5.05	2 yr	2,344	381.3	0.7	2,344	381.3	0.7
mainstem	5.05	5 yr	3,594	381.5	0.9	3,594	381.5	0.9
mainstem	5.05	10 yr	4,520	381.7	1.0	4,520	381.7	1.0
mainstem	5.05	25 yr	5,743	382.2	0.9	5,743	382.2	0.9
mainstem	5.05	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	5.05	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	5.05	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	5.04	1.1 yr	1,183	381.3	0.4	1,183	381.3	0.4
mainstem	5.04	2 yr	2,344	381.3	0.7	2,344	381.3	0.7
mainstem	5.04	5 yr	3,594	381.5	1.0	3,594	381.5	1.0
mainstem	5.04	10 yr	4,520	381.7	1.0	4,520	381.7	1.0
mainstem	5.04	25 yr	5,743	382.2	0.9	5,743	382.2	0.9
mainstem	5.04	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	5.04	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	5.04	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	5.03	1.1 yr	1,183	381.3	0.4	1,183	381.3	0.4
mainstem	5.03	2 yr	2,344	381.3	0.7	2,344	381.3	0.8
mainstem	5.03	5 yr	3,594	381.5	1.0	3,594	381.5	1.0
mainstem	5.03	10 yr	4,520	381.7	1.1	4,520	381.7	1.1
mainstem	5.03	25 yr	5,743	382.2	1.0	5,743	382.2	1.0
mainstem	5.03	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	5.03	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	5.03	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	5.025		Bridge			Bridge		

APPENDIX E: HEC-RAS OUTPUT

CHARLES RIVER BRIDGE (#2151), Fryeburg, PIN 15095.00

MMI #2764-03

Reach	River Sta	Profile	EXISTING CONDITIONS Q Total (cfs)	EXISTING CONDITIONS W.S. Elev (ft)	EXISTING CONDITIONS Vel Chnl (ft/s)	PROPOSED CONDITIONS Q Total (cfs)	PROPOSED CONDITIONS W.S. Elev (ft)	PROPOSED CONDITIONS Vel Chnl (ft/s)
mainstem	5.02	1.1 yr	1,183	381.3	0.4	1,183	381.3	0.4
mainstem	5.02	2 yr	2,344	381.3	0.7	2,344	381.3	0.7
mainstem	5.02	5 yr	3,594	381.4	1.0	3,594	381.4	1.0
mainstem	5.02	10 yr	4,520	381.6	1.1	4,520	381.6	1.1
mainstem	5.02	25 yr	5,743	382.2	0.9	5,743	382.2	0.9
mainstem	5.02	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	5.02	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	5.02	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	5.01	1.1 yr	1,183	381.3	0.3	1,183	381.3	0.3
mainstem	5.01	2 yr	2,344	381.3	0.7	2,344	381.3	0.7
mainstem	5.01	5 yr	3,594	381.4	0.9	3,594	381.4	0.9
mainstem	5.01	10 yr	4,520	381.6	1.0	4,520	381.6	1.0
mainstem	5.01	25 yr	5,743	382.2	0.9	5,743	382.2	0.9
mainstem	5.01	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	5.01	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	5.01	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	5.00	1.1 yr	1,183	381.3	0.3	1,183	381.3	0.3
mainstem	5.00	2 yr	2,344	381.3	0.7	2,344	381.3	0.7
mainstem	5.00	5 yr	3,594	381.4	1.0	3,594	381.4	1.0
mainstem	5.00	10 yr	4,520	381.6	1.0	4,520	381.6	1.0
mainstem	5.00	25 yr	5,743	382.2	0.9	5,743	382.2	0.9
mainstem	5.00	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	5.00	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	5.00	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	4.1	1.1 yr	1,183	381.3	0.4	1,183	381.3	0.4
mainstem	4.1	2 yr	2,344	381.3	0.7	2,344	381.3	0.7
mainstem	4.1	5 yr	3,594	381.4	1.0	3,594	381.4	1.0
mainstem	4.1	10 yr	4,520	381.6	1.1	4,520	381.6	1.1
mainstem	4.1	25 yr	5,743	382.2	0.9	5,743	382.2	0.9
mainstem	4.1	50 yr	6,703	383.1	0.7	6,703	383.1	0.7
mainstem	4.1	100 yr	7,715	384.6	0.5	7,715	384.6	0.5
mainstem	4.1	500 yr	10,238	387.6	0.3	10,238	387.6	0.3
mainstem	4.0	1.1 yr	1,183	381.3	0.3	1,183	381.3	0.3
mainstem	4.0	2 yr	2,344	381.3	0.6	2,344	381.3	0.6
mainstem	4.0	5 yr	3,594	381.4	0.8	3,594	381.4	0.8
mainstem	4.0	10 yr	4,520	381.6	0.8	4,520	381.6	0.8
mainstem	4.0	25 yr	5,743	382.2	0.7	5,743	382.2	0.7
mainstem	4.0	50 yr	6,703	383.1	0.5	6,703	383.1	0.5
mainstem	4.0	100 yr	7,715	384.6	0.4	7,715	384.6	0.4
mainstem	4.0	500 yr	10,238	387.6	0.2	10,238	387.6	0.2

MaineDOT

CHARLES RIVER BRIDGE #2151
OVER THE CHARLES RIVER

PRELIMINARY DESIGN REPORT

APPENDIX F

MISCELLANEOUS INFORMATION

Engineering,
Landscape Architecture
and Environmental Science

MILONE & MACBROOM®

MEMORANDUM

TO: Steve Bodge
MaineDOT

FROM: Andrew Manning
Milone & MacBroom, Inc.

DATE: March 27, 2009

RE: Charles River Bridge (#2151) - PIN# 15095.00
Summary of Issues and Comments

In review of comments and concerns expressed during project initiation and the initial public meeting, we have compiled the attached table of positive and negative impacts due to the following scenarios:

Removal of the Charles River Br. (#2151) and Replacement of the Red Iron Br. (#2708)
Replacement of the Charles River Br. (#2151) and Removal of the Red Iron Br. (#2708)

This information has been compiled from a variety of sources and materials, including our meeting notes, bridge documents and inspections, our experience in bridge design and costs, public meeting comments, and direct communications with the following people:

Martin Krauter, Town Manager – Town of Fryeburg
David Powers, Facilities/Transportation Director – MSAD #72
Aaron Bennett, Owner/MSAD #72 Transportation Contractor – Bennett Transportation
Julia Dawson, Bicycle Plan Consultant/Facilitator – SMRPC
Karen Grey, Trail Groomer – Interstate Snogoers Snowmobile Club

While most of the comments from these individuals have been combined on the summary, the Town Manager did not offer any formal comments or additional information. A few residents did ask where they could offer comments in writing but offered nothing in person; comments may be turned into town hall and forwarded to Leanne Timberlake per the public notification form at a later date.

The Town Manager is putting the removal of the Charles River Bridge on the Selectman's Agenda for March 26, 2009. A formal town comment may be issued as a result of the discussion but nothing was received as of the morning of March 27. As far as turnout during the public meeting, the Town Manager stated that is was well attended as far as town meetings are concerned but a few people noted the short notice period in the local newspaper.

One comment received from a few people was the option of a pedestrian/trail bridge as a replacement. While the impacts at each location may be problematic, some issues may be resolved with the installation of a smaller structure to maintain existing patterns of pedestrian/bicycle traffic – i.e crossing the Red Iron Bridge on foot/bicycle to reach the church or continue on a bicycle tour.

MaineDOT

CHARLES RIVER BRIDGE #2151
OVER THE CHARLES RIVER

PRELIMINARY DESIGN REPORT

APPENDIX G

TRAFFIC AND ACCIDENT DATA