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LIST OF STANDARDS

B-5M	1/3/2000
B-71	7/8/2005
E-100	1/2/2004
E-100A	1/2/2004
E-101	5/30/2003
E-102	6/30/2003
E-102A	5/1/2004
E-106	3/1/2004
E-107	6/30/2003
E-121	8/8/1995
E-138	5/30/2003
E-141	9/20/1995
E-143	6/15/2004
E-160	5/20/1999
E-164	5/20/1999
E-190	6/20/2003
G-1M	1/3/2000
G-1DM	1/3/2000
SB-R6-82M	7/10/1997

FINAL HYDRAULIC REPORT

**HYDROLOGIC DATA** Date: December 1999

DRAINAGE AREA : 60.4 sq. km  
 CHARACTER OF TERRAIN : Mountainous, mostly forested  
 STREAM CHARACTERISTICS : Perennial but flashy, incised, sinuous, and laterally unstable.  
 NATURE OF STREAMBED : Mostly cobbles, with some gravel and boulders.

PEAK FLOW DATA

Q 2.33 =	28.3 cms	Q 50 =	100.5 cms
Q 10 =	60.9 cms	Q 100 =	117.5 cms
Q 25 =	85.0 cms	Q 500 =	145.0 cms

DATE OF FLOOD RECORD : Unknown  
 ESTIMATED DISCHARGE : Unknown  
 WATER SURFACE ELEV. : Unknown  
 NATURAL STREAM VELOCITY : @ Q25 = 3.0 mps  
 ICE CONDITIONS : Moderate  
 DEBRIS : Moderate  
 DOES THE STREAM REACH MAXIMUM HIGHWATER ELEV. RAPIDLY? Yes  
 IS ORDINARY RISE RAPID? Yes  
 IS STAGE AFFECTED BY UPSTREAM OR DOWNSTREAM CONDITIONS? No  
 IF YES, DESCRIBE:

WATERSHED STORAGE: 1% HEADWATERS:  
 UNIFORM: X  
 IMMEDIATELY ABOVE SITE:

**EXISTING STRUCTURE INFORMATION**

STRUCTURE TYPE: Single span bridge with wood deck on steel beams  
 YEAR BUILT: 1919  
 CLEAR SPAN(NORMAL TO STREAM): 7.6 m  
 VERTICAL CLEARANCE ABOVE STREAMBED: 2.7 m  
 WATERWAY OF FULL OPENING: 19.0 sq. m  
 DISPOSITION OF STRUCTURE: Remove  
 TYPE OF MATERIAL UNDER SUBSTRUCTURE: Unknown

WATER SURFACE ELEVATIONS AT:

Q2.33 =	252.1 m	VELOCITY =	2.7 mps
Q10 =	253.5 m	"	2.8 mps
Q25 =	253.7 m	"	3.0 mps
Q50 =	253.7 m	"	3.1 mps
Q100 =	254.0 m	"	3.2 mps

LONG TERM STREAMBED CHANGES: Minor scour and some channel instability noted upstream. No changes noted at the bridge.

IS THE ROADWAY OVERTOPPED BELOW Q100: yes  
 FREQUENCY: Below Q10.  
 RELIEF ELEVATION: 253.4 m  
 DISCHARGE OVER ROAD @Q100: 57.5 cms

**UPSTREAM STRUCTURE**

TOWN: Granville DISTANCE: 100 m +/-  
 HIGHWAY #: Railroad STRUCTURE #: Unknown  
 CLEAR SPAN: 21.3 m CLEAR HEIGHT: 3.4 m  
 YEAR BUILT: Unknown FULL WATERWAY: 71 sq. m +/-  
 STRUCTURE TYPE: Single span side girder bridge

**DOWNSTREAM STRUCTURE**

TOWN: Braintree DISTANCE: 0.8 km  
 HIGHWAY #: T.H. 15 STRUCTURE #: 13  
 CLEAR SPAN: 9.8 m CLEAR HEIGHT: 2.6 m  
 YEAR BUILT: 1971 FULL WATERWAY: 23 sq. m +/-  
 STRUCTURE TYPE: Single span bridge with timber deck on steel beams

**LOAD FACTOR - LOAD RATING (METRIC TONS)**

LOADING LEVELS	TRUCK					
	M	M5	3S2	6 AXLE	3A STR.	4A STR. 5A SEMI
INVENTORY	29	42				
POSTED	40	60	79		46	49 78
OPERATING		71	94	89	55	58

COMMENTS:  $RF = \frac{M}{M_N} - 1.3 \frac{M_{DL}}{M_{LL} + 1}$

**TRAFFIC DATA**

YEAR	ADT	DHV	% D	% T	ADTT
2001	40	5	--	1	<5
2021	55	10	--	1	<5

20 year ESAL for flexible pavement from 2001 to 2021 : <50,000  
 20 year ESAL for flexible pavement from 2001 to 2041 : <50,000  
 Design Speed : 30 km/h

**PROPOSED STRUCTURE**

STRUCTURE TYPE: Single span concrete slab bridge

CLEAR SPAN(NORMAL TO STREAM): 10.0 m  
 VERTICAL CLEARANCE ABOVE STREAMBED: 3.1 m  
 WATERWAY OF FULL OPENING: 28 sq. m

WATER SURFACE ELEVATIONS AT:

Q2.33 =	252.1 m	VELOCITY =	2.0 mps
Q10 =	252.8 m	"	3.2 mps
Q25 =	253.2 m	"	4.1 mps
Q50 =	253.7 m	"	2.8 mps
Q100 =	253.7 m	"	3.2 mps

IS THE ROADWAY OVERTOPPED BELOW Q100: Yes  
 FREQUENCY: Above Q30  
 RELIEF ELEVATION: 253.4  
 DISCHARGE OVER ROAD @Q100: 49 cms

AVERAGE LOW ELEVATION OF SUPERSTRUCTURE: 253.3 m  
 VERTICAL CLEARANCE: @ Q25 = 0.1 m

SCOUR: 0.3 m of contraction scour up to Q500.  
 The greatest contraction scour occurs at the roadway overtopping frequency, Q30.  
 REQUIRED CHANNEL PROTECTION: Stone Fill, Type III

**PERMIT INFORMATION**

AVERAGE DAILY FLOW: 1.3 cms DEPTH OR ELEVATION:  
 ORDINARY LOW WATER: 0.6 cms 0.3 m  
 ORDINARY HIGH WATER: 12.2 cms 0.7 m

**TEMPORARY BRIDGE REQUIREMENTS**

STRUCTURE TYPE: Single span bridge, to be removed before winter  
 CLEAR SPAN (NORMAL TO STREAM): 7.6 m minimum  
 VERTICAL CLEARANCE ABOVE STREAMBED: bottom elev. 253.5 minimum  
 WATERWAY AREA OF FULL OPENING: 20 sq. m minimum

**ADDITIONAL INFORMATION**

Streambed elevation at upstream Approach section = 250.6.  
 Streambed elevation at bridge section = 250.2.  
 Water surface elevations are listed at a location approximately 20 m upstream of the bridge.  
 Velocities are listed in the area of the bridge and roadway.

- DESIGN CRITERIA**
- DESIGN LIVE LOAD AASHTO MS 22.5
  - DESIGN SPAN 11.4 m
  - ALLOWABLE LOAD FOR SPREAD FOOTINGS ON SOIL ON LEDGE 500 Kpa N/A
  - ALLOWABLE LOAD FOR PILING N/A TYPE N/A ESTIMATED LENGTH N/A
  - STRUCTURAL STEEL AASHTO GRADE N/A
  - REINFORCING STEEL GRADE 420
  - CONCRETE CLASS HPC A f'c : 30 Mpa  
CONCRETE CLASS HPC B f'c : 25 Mpa
  - SOIL UNIT WEIGHT 22 KN/m3
  - DESIGN LOAD FOR SPREAD FOOTINGS ON LEDGE 275 Kpa

- TRAFFIC MAINTENANCE**
- IS TRAFFIC TO BE MAINTAINED? YES  
 IF YES, ON EXISTING STRUCTURE NO  
 OR ON TEMPORARY BRIDGE YES
  - TEMPORARY BRIDGE REQUIREMENTS: ONE OF TWO WAY ONE-WAY  
 TRAFFIC CONTROL SIGNALS REQUIRED NO  
 MINIMUM CLEAR SPAN (NORMAL TO STREAM): 7.6 m minimum  
 WATERWAY OF FULL OPENING: 20 sq. m minimum  
 VERTICAL CLEARANCE ABOVE STREAMBED: bottom elev. 253.5 minimum  
 ARE SIDEWALKS REQUIRED? NO  
 IF SO, ON WHAT SIDE? N/A  
 STRUCTURE TYPE:

PROJECT NAME: Granville  
 PROJECT NUMBER: BRO 1444(34)  
 FILE NAME: pw94j100/s94j100.xls.dgn PLOT DATE: 12/29/2005  
 PROJECT LEADER: C.P. Williams DRAWN BY: P. Rowe  
 DESIGNED BY: P. Rowe CHECKED BY: K.M. Higgins  
 PRELIMINARY INFORMATION SHEET #1 SHEET 2 OF 39