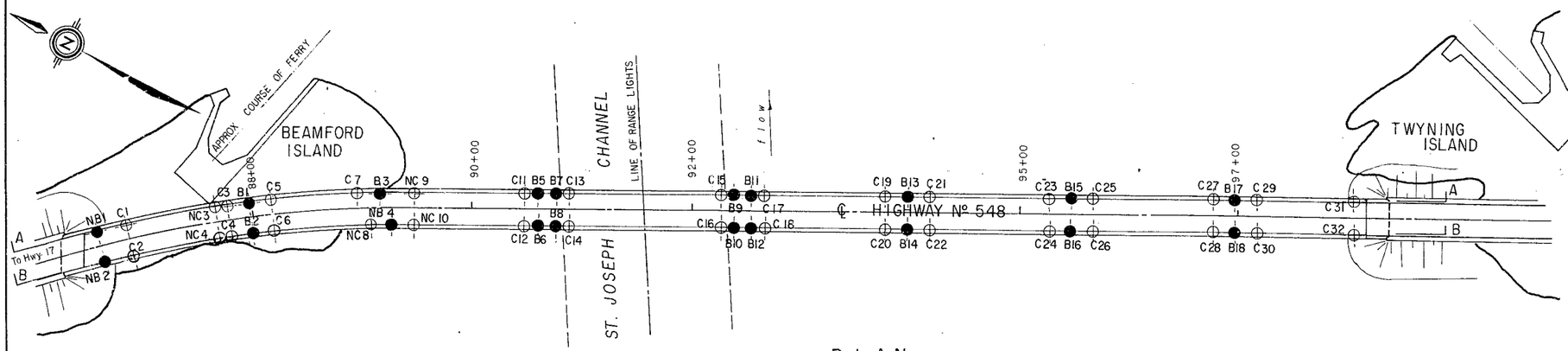
#69-F-217C

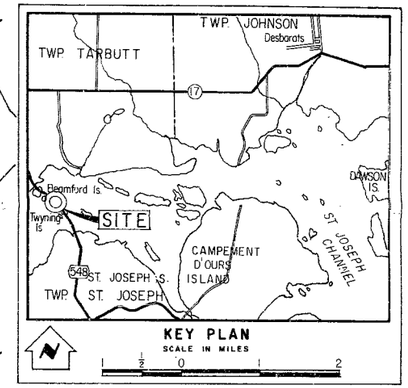
W.P. 98-66

H.W.Y. #548

ST. JOSEPH ISLAND

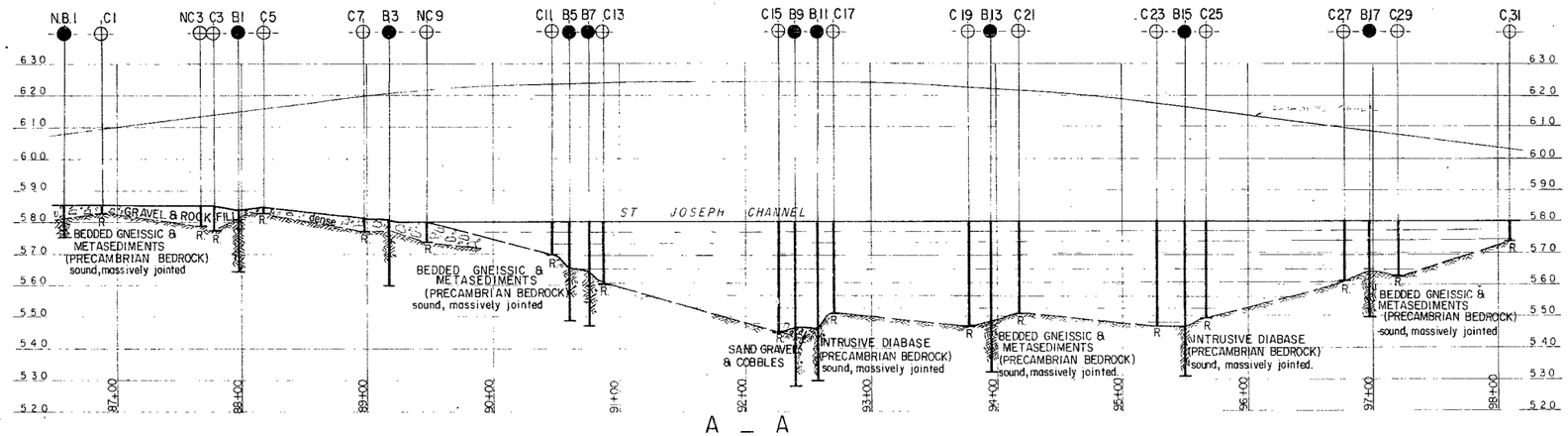
BRIDGE.



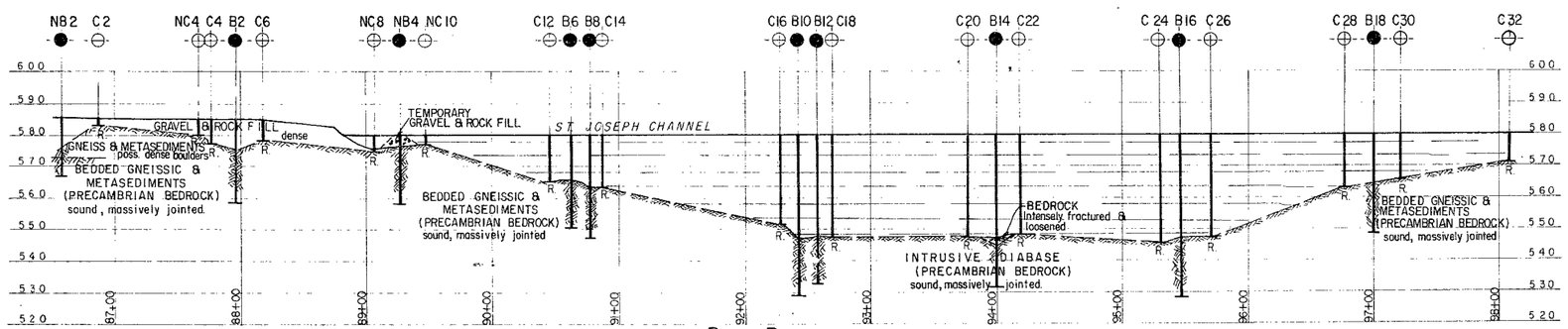


PLAN

50 25 0 SCALE 50 100 FT



A – A



HORIZONTAL SCALE 50 25 0 50 100 FT

VERTICAL SCALE 20 10 0 20 40 FT

B – B SECTIONS

NO	ELEVATION	STATION	OFFSET
C14	580.0	90+88	15' Rt.
C15	580.0	92+28	15' Lt.
C16	580.0	92+28	15' Rt.
B9	580.0	92+40	15' Lt.
B10	580.0	92+42	15' Rt.
B11	580.0	92+58	15' Lt.
B12	580.0	92+57	15' Rt.
C17	580.0	92+70	15' Lt.
C18	580.0	92+69	15' Rt.
C19	580.0	93+78	15' Lt.
C20	580.0	93+78	15' Rt.
B13	580.0	93+96	15' Lt.
B14	580.0	94+00	15' Rt.
C21	580.0	94+18	15' Lt.
C22	580.0	94+18	15' Rt.
C23	580.0	95+27	15' Lt.
C24	580.0	95+29	15' Rt.
B15	580.0	95+50	15' Lt.
B16	580.0	95+46	15' Rt.
C25	580.0	95+67	15' Lt.
C26	580.0	95+69	15' Rt.
C27	580.0	96+77	15' Lt.
C28	580.0	96+78	15' Rt.
B17	580.0	96+98	15' Lt.
B18	580.0	96+98	15' Rt.
C29	580.0	97+20	15' Lt.
C30	580.0	97+20	15' Rt.
C31	580.0	98+08	15' Lt.
C32	580.0	98+08	15' Rt.
NC8	580.0	89+08	15' Rt.

NO	ELEVATION	STATION	OFFSET
NB1	585.5 ±	86+58	15' Lt.
NB2	585.5 ±	86+58	12' Rt.
C1	585.3	86+88	15' Lt.
C2	585.2	86+88	14' Rt.
NC3	585.0	87+68	15' Lt.
NC4	585.0	87+68	14' Rt.
C3	585.0	87+78	15' Lt.
C4	584.3	87+78	13.5' Rt.
B1	584.0	87+98	14' Lt.
B2	584.8	87+98	14' Rt.
C5	584.9	88+18	15' Lt.
C6	584.8	88+18	14' Rt.
C7	585.8	98+98	15' Rt.
B3	580.8	89+18	15' Lt.
NB4	585.0	89+28	15' Rt.
NC9	585.0	89+48	15' Lt.
NC10	585.0	89+48	12' Rt.
C11	580.0	90+48	15' Lt.
C12	580.0	90+46	15' Rt.
B5	580.0	90+62	15' Lt.
B6	580.0	90+63	15' Rt.
B7	580.0	90+76	13' Lt.
B8	580.0	90+78	17' Rt.
C13	580.0	90+88	15' Lt.

LEGEND

- Bore Hole
- Probe Hole
- R Probe Refusal on Bedrock Surface
- Water Levels established at time of field investigation. JUNE 1969

– NOTE –

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

WILLIAM TROW ASSOCIATES LIMITED

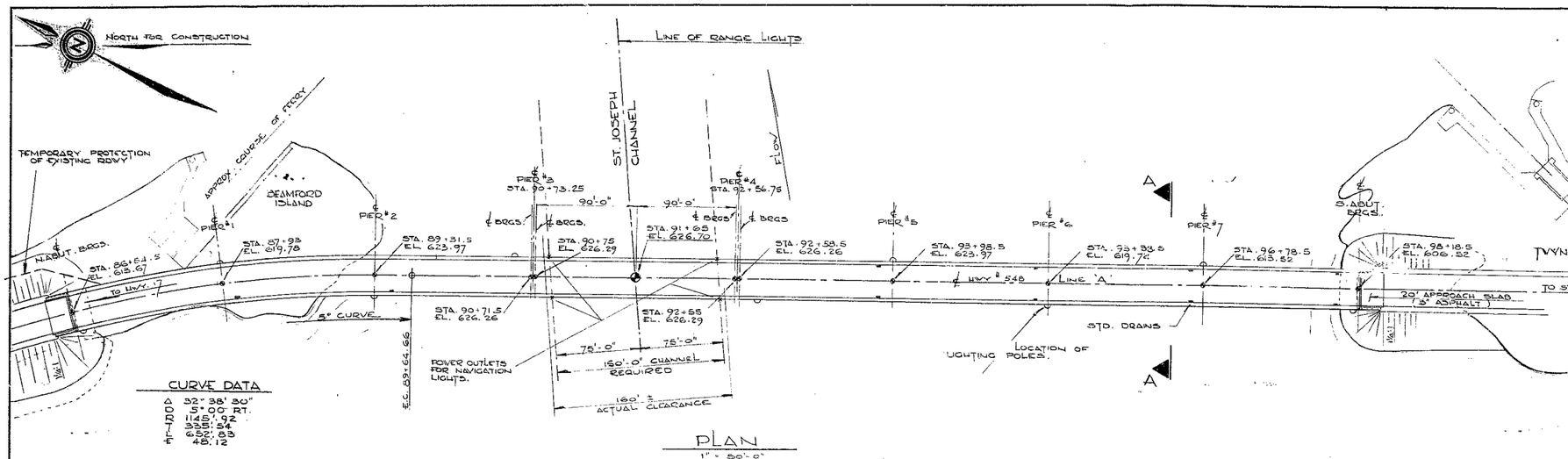
DEPARTMENT OF HIGHWAYS – ONTARIO
MATERIALS & TESTING OFFICE – FOUNDATION SECTION

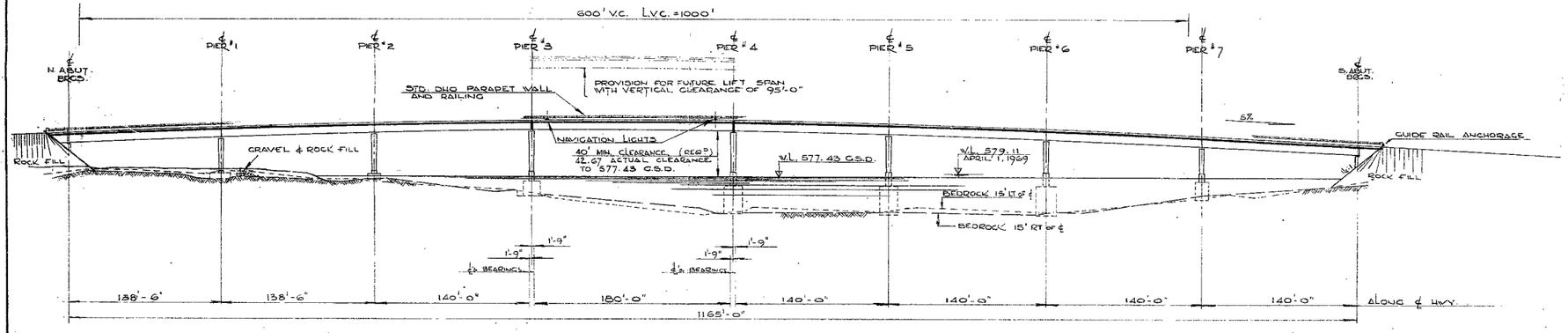
ST. JOSEPH ISLAND BRIDGE

KING'S HIGHWAY NO. 548 DIST. NO. 18
DIST SAULT STE. MARIE
TWP ST. JOSEPH LOT 38-176 CON.

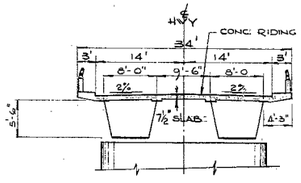
BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D.	CHECKED K.P.	W.P. NO. 98-66	DRAWING NO. J-5159
DRAWN E.F.K.	CHECKED E.F.K.	JOB NO.	
DATE JULY 1969		SITE NO. 38 S-177	BRIDGE DRAWING NO.
APPROVED PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

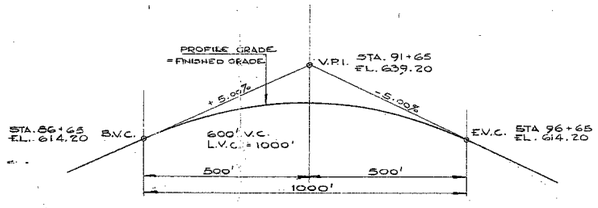




ELEVATION
1" = 50'-0"



SECTION A-A
1" = 10'-0"



NOTES

CLASS OF CONCRETE :

DECK, CURBS, PARAPET WALLS AND PIER SHAFTS (ABOVE EL. 582.0) . . . . . 4000 P.S.I.
REMAINDER . . . . . 3000 P.S.I.

CLEAR COVER ON REINFORCING STEEL

FOOTING & ABUTMENTS . . . . 3"
PIERS . . . . . 2½"
DECK TOP . . . . . 1½"
" BOT. . . . . 1"
CURBS . . . . . 2"
OR AS NOTED

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± ⅛ INCH.

UNLESS SHOWN OTHERWISE, NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

LIST OF DRAWINGS

B.M. ELEV. 584.70
GEODETIC DATUM
CUT X ON CONC. DOCK
111.0' LT. OF STA. 87+91

NOTE :-
FOR THE PRESENT, THE 180' CHANNEL SPAN WILL PROVIDE 40' MIN. VERTICAL CLEARANCE. PROVISION WILL BE MADE FOR THE 180' SPAN TO BE CONVERTED INTO A LIFT SPAN WITH MIN. VERTICAL CLEARANCE OF 95' WHEN REQUIRED.

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

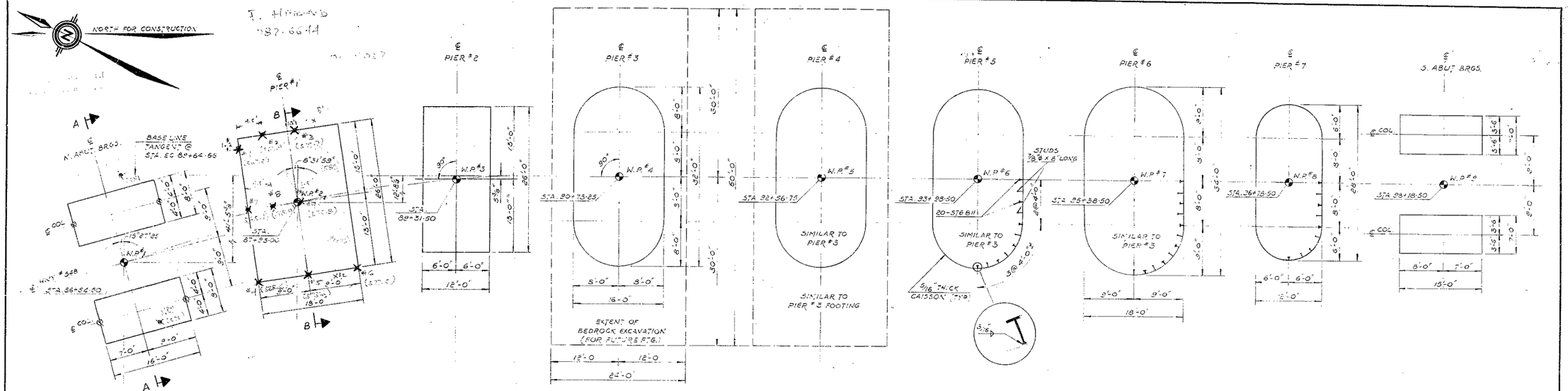
ST. JOSEPH ISLAND BRIDGE

KING'S HIGHWAY No. 548 DIST. No. 18
CO.
TWP. LOT 38 S-76 CON.

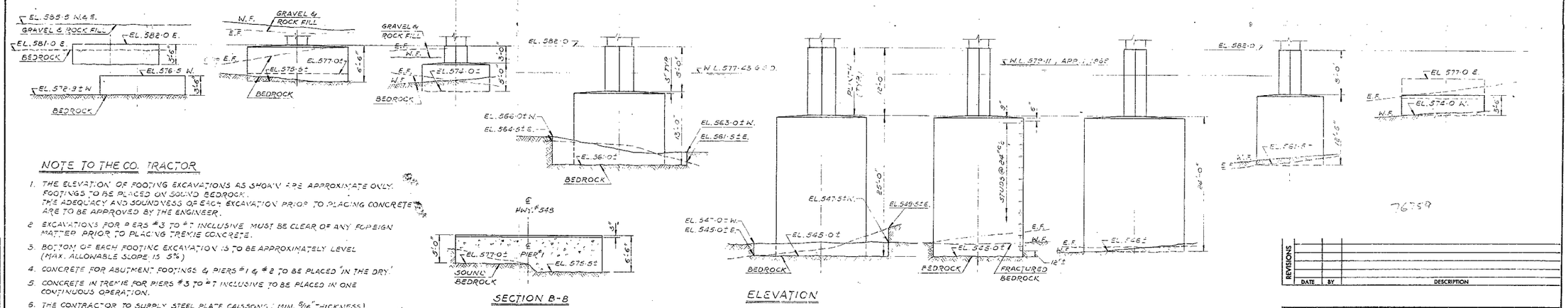
GENERAL LAYOUT

APPROVED BRIDGE ENGINEER

DESIGN	A.R.	CHECK	P.O.L.	SITE No. 58 S-176	W.P. No. 98-66
DRAWING	W.V.	CHECK	A.R.	CONTRACT Nos.	
DATE		LOADING	H 20-44	DRAWING No.	D-6684-1



FOOTING LAYOUT PLAN



SECTION B-B

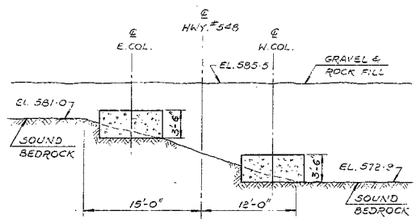
ELEVATION

NOTE TO THE CO. TRACTOR

1. THE ELEVATION OF FOOTING EXCAVATIONS AS SHOWN ARE APPROXIMATE ONLY. FOOTINGS TO BE PLACED ON SOUND BEDROCK. THE ADEQUACY AND SOUNDNESS OF EACH EXCAVATION PRIOR TO PLACING CONCRETE ARE TO BE APPROVED BY THE ENGINEER.
2. EXCAVATIONS FOR PIERS #3 TO #7 INCLUSIVE MUST BE CLEAR OF ANY FOREIGN MATTER PRIOR TO PLACING TREMIE CONCRETE.
3. BOTTOM OF EACH FOOTING EXCAVATION IS TO BE APPROXIMATELY LEVEL (MAX. ALLOWABLE SLOPE IS 5%)
4. CONCRETE FOR ABUTMENT FOOTINGS & PIERS #1 & #2 TO BE PLACED 'IN THE DRY'
5. CONCRETE IN TREMIE FOR PIERS #3 TO #7 INCLUSIVE TO BE PLACED IN ONE CONTINUOUS OPERATION.
6. THE CONTRACTOR TO SUPPLY STEEL PLATE CAISSONS (MIN. 5/16" THICKNESS). THESE CAISSONS ARE TO BE ADEQUATELY BRACED FOR ALL IMPOSED LOADS AND LATERAL PRESSURES. CAISSON ARE TO BE LEFT IN PLACE.
7. TWO 3" DIA. CORE DRILL SAMPLES OF THE TREMIE CONCRETE 12" INTO THE BEDROCK ARE TO BE TAKEN BY THE CONTRACTOR AT PIER #6, AT LOCATIONS INDICATED, 7 DAYS AFTER PLACING OF TREMIE.
   AFTER PLACING CORES THE HOLES TO BE GROUTED WITH NON-SHRINK APPROVED GROUT.

LIST OF SUBSTRUCTURE DWGS.

D-6684-2 BORE HOLE LOCATIONS & SOIL STRATA.
-3 FOOTING LAYOUT
-4 NORTH ABUTMENT
-5 SOUTH ABUTMENT
-6 PIERS #1 & #2
-7 PIERS #3 & #4
-8 PIERS #5, #6 & #7



SECTION A-A

SCALE: 1/8" = 1'-0"

FOR REDUCED PLAN
USE SCALE BELOW
10 11 12 13
3 INCHES ON ORIGINAL PLAN

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

ST. JOSEPH ISLAND BRIDGE

KING'S HIGHWAY No. 548 DIST. No. 18
CO.
TWP. LOT CON.

FOOTING LAYOUT

APPROVED		BRIDGE ENGINEER		SITE No. 585-176	W.P. No. 98-66
DESIGN	A.R.	CHECK		CONTRACT Nos.	
DRAWING	H.N.	CHECK			
DATE	MAY, 70	LOADING	HS20-44	DRAWING No.	D-6684-3

TRANSLAR 214-3-69

FOUNDATION INVESTIGATION
PROPOSED ST. JOSEPH ISLAND BRIDGE
HIGHWAY 548, DISTRICT 18
SITE 385-177, W.P. 98-66
NEAR SAULT STE. MARIE, ONTARIO

69-F-217C

Prepared for

DEPARTMENT OF HIGHWAYS OF ONTARIO

WILLIAM TROW ASSOCIATES LIMITED
Toronto, Hamilton, Sudbury, Ottawa, St. John's

Project: J 5159
July 23, 1969.

90 Milvan Drive,
Weston 486, Ontario.
749-1290

TABLE OF CONTENTS

TEXT

ENCLOSURES

FOUNDATION INVESTIGATION
PROPOSED ST. JOSEPH ISLAND BRIDGE
HIGHWAY 548, DISTRICT 18
SITE 385-177, W.P. 98-66
NEAR SAULT STE. MARIE, ONTARIO

INTRODUCTION

William Trow Associates Limited have been retained by the Department of Highways of Ontario, to supervise the rock drilling and probing operations and comment on the quality of the rock at the proposed pier locations for the St. Joseph Island Bridge near Sault Ste. Marie, Ontario.

BORING PROGRAMME

The fiedwork programme consisted of putting down 20 borings and 34 soundings at the proposed pier locations shown on the site plan accompanying this report.

Because of the swift current in the open water channel, a large steel barge equipped with four 60 foot spuds was required to maintain drill platform stability. A small tug was needed to move the barge and for personnel transportation. Two standard hydraulic head drillings were mounted on movable platforms on the barge, one at each end, to carry out the action drilling and probing programme.

In order to ensure plumbness of the borings and soundings a 6 inch heavy-wall casing was suspended by a collar from the drilling platform and allowed to project vertically downward into the water. Drilling casings were lowered to channel bottom inside the heavy-wall casing.

All off-shore and on-shore borings and probe locations were established by D.H.O. survey crew, using stadia survey methods.

The drilling programme was conducted as follows:

On-shore work: - June 11th to 14th, 1969, inclusive.

Off-shore work: - June 16th to 27th, 1969, inclusive.

On-shore work completion: - June 28th and July 2nd to 5th, 1969, inclusive.

OVERBURDEN AND BEDROCK CONDITIONS

The only significant overburden section occurring at this site is limited to the three northernmost pier locations, where a dense gravel and rock fill has been constructed over the bedrock surface as a rock base and extension of Beamford Island. At one point the fill overlies a blasted bedrock section, where a low knob of rock was removed to provide the necessary present grade. Elsewhere, overburden is restricted to the occasional scattered loose boulder or

bedrock block and minor sand and gravel wedged into bedrock surface, fissures and jointed depressions. Such minor pockets of sand or gravel are restricted almost solely to the water edge, and to a joint-controlled depression at Sta. 90 + 68, and seven eights of the bottom profile across the channel is clean, bare, smooth hard Precambrian Bedrock.

Bedrock contour established along the upstream and downstream limits of the proposed pier foundations, at the borehole and sounding locations, are given in the Site Plan accompanying this report. From this it will be noted that the exposed rock of the channel bottom appears to be slightly stepped, with relatively smooth southward-dipping sections following the bedding of the pre-metamorphosed sediments. Abrupt changes in the level of the bedrock contact/channel bottom are joint-controlled and appear limited to a foot or two in magnitude. The line of elevation change is likely to be random, in view of the somewhat random nature of the joint pattern of the rock.

A note of caution must be expressed concerning the apparent pattern of bedrock contact, since it is possible that some of the borings and soundings located within the channel may have been located on the top of loosened blocks of bedrock, rather than on solid rock. This cautionary note is based on the observation of divers securing the mooring line of a dislodged navigation buoy in the vicinity of Sta. 90 + 68,

that a number of randomly strewn large boulders and rock blocks up to 6 feet maximum dimension, existed on the bottom of the channel, generally wedged into joint-controlled irregularities.

In addition, it must be pointed out that the bottom contour shown on the profiles of Dwg. 1 is interpolated between each pier location. Check sounding was not performed.

In all cases observed, both from core and adjacent rock outcrops, the hard Precambrian bedrock is sound commencing right at surface. However, in one or two instances intense fracturing of the upper rock was noted, possibly the result of previous blasting, for example Boreholes 10 and 14. Some cases of poor initial core recovery also reflect the need to "set" in one or two casings before being able to commence core drilling with the AX barrel.

On the basis of core examination and existing geological information*, it is reported that the bridge site is located in an area of southward dipping metasediments which have been intruded by diabase or gabbroic sills and dykes prior to the main regional metamorphism. Lightish grey coloured gneissic or granitized metasediments occur mainly to the north of the navigation channel, and at Boreholes B-17 and B-18. The rocks show some signs of folding, prior to metamorphism. A coarser grained dark grey bedrock occurs to the south of the centre channel,

* Ontario Department of Mines Preliminary Geological Map P303 (1965) and Ontario Department of Mines Provincial Geological Map 1958B.

possibly amphibolite or metamorphosed intrusive rock of the Quartz Diabase-Gabbro types.

Both rock types are Precambrian in age, and are extremely hard and resistant to both chemical and mechanical erosion.

Numerous hair-line fissures and cracks occur within the bedrock at random orientation, and range from being tightly recemented to slightly open. Larger more massively distributed (i.e. at wider interval) iron-stained fissures were also noted, representing the main stress-induced joint pattern. The pattern is somewhat random, with a preferred dissection apparently restricted to the former bedding planes of the original sedimentary or stratified igneous rock.

At outcrop many of the major joints are open, and temporary loss (non-return) of drill water was reported at some locations. However, estimating the likely frequency and volume in flow induced through such open fissures and cracks in the rock, on the basis of the type of standard drilling programme conducted, is liable to considerable error. About all that can be said with certainty is that open water bearing joint fissures do exist within the bedrock at all explored depths, and are liable to be encountered within any one specific pier foundation area.

The rock is capable of safely bearing loads in excess of anything likely to be exerted by the proposed bridge. However, a design cut-off at 25 tons per square foot is recommended to conform with generally accepted codes. No further test drilling or jack-hammering would be necessary to confirm this recommended loading.

CONCLUSIONS

This investigation has shown that the bedrock surface exposed throughout the open-water channel at this site is generally smooth and southward dipping, with frequent small joint 'steps' occurring between individual bedding planes. Some random-strewn boulders and massive angular blocks occur, resting on the bedrock surface or partly wedged into jointed depressions. Sudden changes of bedrock elevation over short distances are therefore to be anticipated, though the amount of change in level is likely to be small and possibly a few inches to a foot or two at any one instance.

The bedrock is sound from surface except for minor shattering and the rare presence of sand and gravel along some of the more prominent joint planes. As noted, a safe allowable bearing pressure of 25 tsf is recommended for pier footing design.

Dewatering schemes which may be proposed for pier construction within sheet pile caissons (coffer dams) must take into account the fact that water will enter the dewatered area through continuous open fissures and irregularities between the bedrock and the tip of the sheeting. The greater portion of such flow should be cut-off by re-tapping the sheeting after the pre-assembled coffer dam is in place and by dumping sand-cement filled sacks around the outer perimeter, before commencing un-watering. Careful placement from surface should preclude the use of a diver. Remaining inflow occurring through the open joint-pattern should be handled by pumps. Internal erosion of the rock during maximum drawdown will not occur. Final placement of cement will be difficult, since the drawdown is significant.

The only other foundation construction procedure appearing feasible at this site is by underwater (tremi) concrete placement, again utilizing sheet pile coffer dams.

Horizontal restraint required to resist lateral hydrostatic and ice pressures must be provided by pinning the foundation to the rock. Dowel lengths should be at least 15 feet below foundation cut off, to ensure that the footings are not tied to potentially loose bedrock blocks. No problems in drilling and grouting in the dowels is anticipated. If

any dowel and hole should exhibit heavy grout loss (i.e. a connecting fissure) additional dowels should be put in the adjacent sound rock.

WILLIAM TROW ASSOCIATES LIMITED

R.A. LaForge, P.Eng.

W.A. Trow, P.Eng.

RALaF/gh
Encls.

Dist: - Department of Highways of Ontario, (11)
Materials and Testing Division,
MacDonald Cartier Freeway and
Keele Street,
Downsview, Ontario.
Attention: Mr. A. Stermac, P.Eng.

BOREHOLE LOG

JOB No. J 5159 | BOREHOLE No. N B-1 | DRAWING No. 1

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

FWG	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		GRAVEL AND ROCK FILL-dense	585.5	0			50%
		GNEISSIC METASEDIMENTS (BEDROCK)-sound, lt. grey; few fracture planes, seams of dark grey gabbro from 6.6 ft. to 7.6 ft. depth.	581.0	5			83% 85%
		END OF BOREHOLE	575.5	10			100%
				15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 86 + 58, 15 ft. left of centreline. Borehole advanced in AX size using conventional drilling equipment on July 5, 1969.
2) Borehole put down at this location because results of cone penetration tests were inconclusive in defining bedrock surface.
3) Generally good water return in bedrock.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. N C-2 | DRAWING No. 2

PROJECT: St. Joseph Island Bridge

LOCATION: Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		GRAVEL AND ROCK FILL-dense Ran AX casing through boulders and cleaned out with AX core barrel.	585.5	0			
		GNEISS METASEDIMENTS-possibly loose boulders, poor core recovery.	576.0	10			
		GNEISSIC METASEDIMENTS (BEDROCK)-sound, few cobbles and fissures, light grey: poor recovery from 13.8 to 15.7 ft. depth due to grinding of rock in core barrel.	572.9	15			83% 21% 100%
		END OF BOREHOLE	567.0	20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 86 + 58, 12 ft. right of centreline. Cone Penetration Test driven on June 28, 1969, results inconclusive. Borehole advanced using conventional diamond drilling equipment from June 28 to July 3, 1969.
2) Generally good water return in bedrock.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C1 DRAWING No. 3

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
	F	GRAVEL AND ROCK FILL-dense,	585.3	0			
		CONE REFUSAL	583.0	5			
		NOTE: Sta. 86 + 88; 13.7 feet left of centreline. -Dynamic penetration driven on June 11th, 1969. -Cone refusal at 2.3 feet depth. Results inconclusive.		10			
				15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-2 DRAWING No. 4

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED P
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE (0, 5, 10, 15)

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 / SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
	F	GRAVEL AND ROCK FILL-dense.	585.2	0			
		CONE REFUSAL PROBABLE BEDROCK SURFACE	582.9	5			
				10			
				15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

Sta. 86 + 88; 14 feet right of centreline.
-Dynamic penetration test driven on June 11, 1969.
-Cone refusal at 2.3 feet, results inconclusive.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. N C-3 DRAWING No. 5

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
		GRAVEL AND ROCK FILL-dense	585.0	0			
		CONE REFUSAL	578.9	5			
				10			
				15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 87 + 68, 15 ft. left of centreline.
2) Cone Penetration Test driven on July 3, 1969; bouncing refusal at 6.1 ft. depth, result inconclusive.
3) Test pit excavated to 7.0 ft. depth (i.e. limit of equipment) on July 3, 1969. Bedrock surface not established within this depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. N C-4 DRAWING No. 6

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
		GRAVEL AND ROCK FILL-dense	585.0	0
		CONE REFUSAL PROBABLE BEDROCK	580.0	5

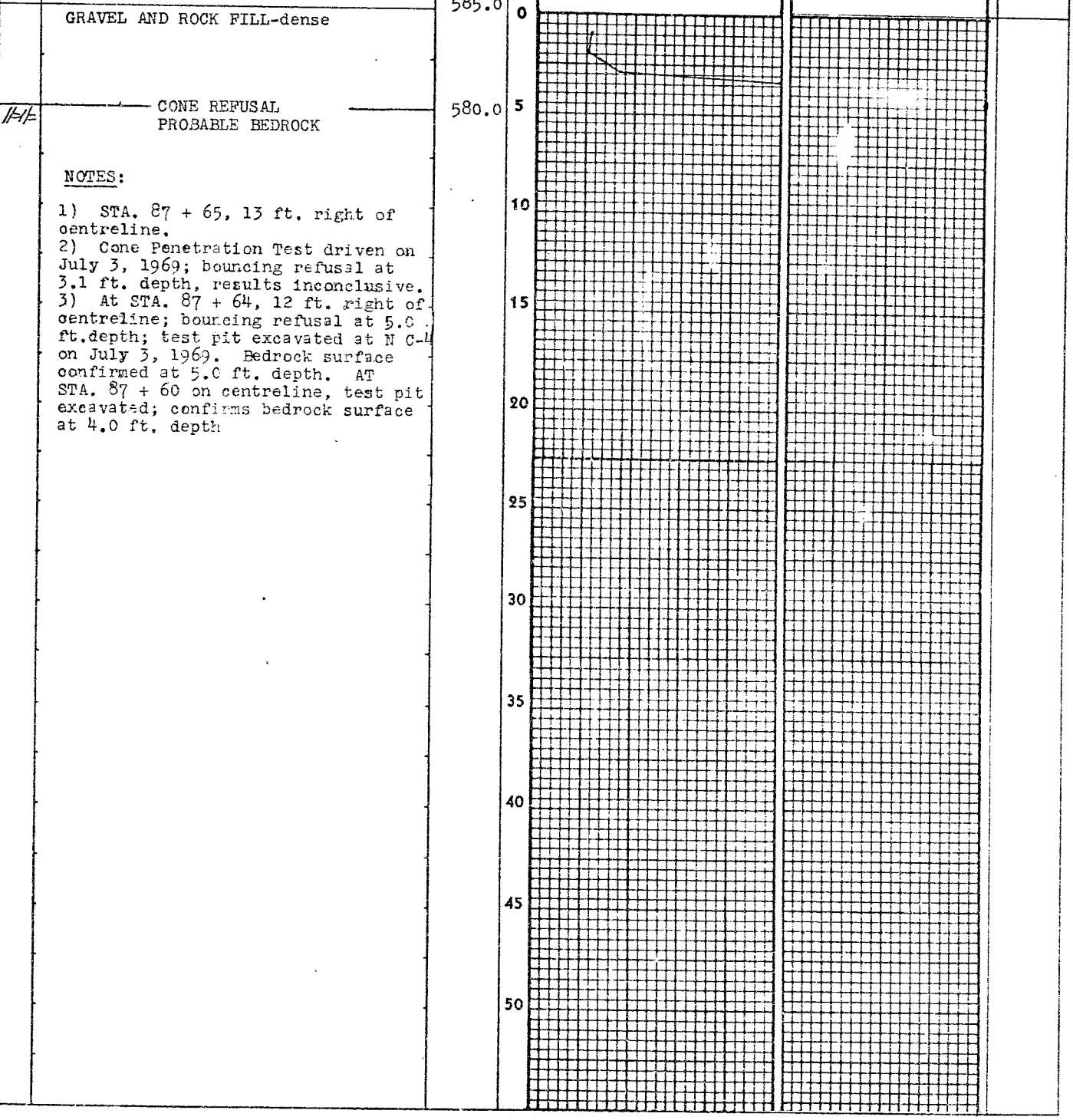
NOTES:

1) STA. 87 + 65, 13 ft. right of centreline.
2) Cone Penetration Test driven on July 3, 1969; bouncing refusal at 3.1 ft. depth, results inconclusive.
3) At STA. 87 + 64, 12 ft. right of centreline; bouncing refusal at 5.0 ft.depth; test pit excavated at N C-4 on July 3, 1969. Bedrock surface confirmed at 5.0 ft. depth. AT STA. 87 + 60 on centreline, test pit excavated; confirms bedrock surface at 4.0 ft. depth

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.



William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-3 DRAWING No. 7

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

WATER LEVEL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
	F	GRAVEL AND ROCK FILL-dense.	585.0	0
	F			5
		CONE REFUSAL		
		PROBABLE BEDROCK SURFACE	577.8	10
		NOTES:		
		-Sta. 87 + 78; 15 feet left of centreline.		15
		-Dynamic penetration test driven on June 13, 1969.		20
				25
				30
				35
				40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-4 | DRAWING No. 8

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GRAPHIC LOG	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
	F	GRAVEL AND ROCK FILL-dense.	584.3	0
	F	CONE REFUSAL PROBABLE BEDROCK SURFACE	577.2	5
		NOTES: -Sta. 87 + 78, 15 feet right of centreline. -Dynamic penetration test driven on June 13, 1969.		10
				15
				20
				25
				30
				35
				40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

100/1"

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. B-1 DRAWING No. 9

PROJECT St. Joseph Island Bridge
LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.
HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		GRAVEL AND ROCK FILL-dense.	584.0	0			
		GNEISSIC METASEDIMENTS (BEDROCK)-sound, light grey; numerous mechanical fractures and weathered surfaces at various inclinations; occasional thin quartz layers; 6 inch weathered layer below 15.5 ft. depth.	581.0	5			100% 100% 100%
				10			96%
				15			96% 80%
		END OF BOREHOLE	564.7	20			100%
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 87 + 98, 14 ft. left of centreline. Borehole advanced in AX size using conventional diamond drilling equipment on June 11 and 12, 1969.
2) Continuous water lost beneath BX casing in fill.
3) Test pit excavated at borehole location on July 5, 1969.
4) Bedrock surface confirmed at 3.0 ft. depth (El. 581.0 ft.)
5) At STA. 87 + 98, 9 ft. left of centreline, bedrock surface occurs at 0.5 ft. depth (i.e. rock surface slopes up from B-1)

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B-2 DRAWING No. 10

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 3

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		GRAVEL AND ROCK FILL-dense AX casing run and cleared out with core barrel.	584.8	0			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound; fractured and iron stained to 12.5 ft., then sound, light grey with occasional small (12" and 6") mechanically fractured zone at 14.5 ft. and 17.5 ft. depth.	575.5	10			60% 65% 100% 99% 90%
		END OF BOREHOLE	558.6	25			
		NOTES: 1) STA. 87 + 98, 14 ft. right of centreline. Borehole advanced in AX size using conventional diamond drilling equipment on June 12, 1969.		30 35 40 45 50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-5 | DRAWING No. 11

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED — P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE — 0, 5, 10, 15

% STRAIN AT FAILURE

G W P	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
		GRAVEL AND ROCK FILL-dense.	584.9	0			
		CONE REFUSAL BEDROCK SURFACE	583.0				

NOTES:

-Sta. 88 + 18; 15 feet left of centreline.
-Dynamic penetration test driven on June 13, 1969.
-Small pit hand excavated at cone location: bedrock surface visually confirmed.

0 5 10 15 20 25 30 35 40 45 50

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-6 DRAWING No. 12

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Maried, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.I.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
		GRAVEL AND STONE FILL-dense.	584.8	0
		CONE REFUSAL PROBABLE BEDROCK SURFACE	578.1	5
		NOTES: Sta. 88 + 18; 14 feet right of centreline. -Dynamic penetration test driven on June 13, 1969.		10
				15
				20
				25
				30
				35
				40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-7 DRAWING No. 13

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▼	F	GRAVEL AND ROCK FILL-dense	580.8	0
		CONE REFUSAL PROBABLE BEDROCK SURFACE	577.1	5

NOTES:

1) STA. 88 + 98, 15 ft. right of centreline.
2) Dynamic Penetration Test driven on June 13, 1969.
3) Cone refusal at 3.7 ft. depth, results inconclusive.

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. N C-8 DRAWING No. 14

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE X
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
		WATER LEVEL IN CHANNEL Depth of Water: 4.5 ft.	580.0	0
		6 inches GRAVEL	475.5 475.0	5
		REFUSAL BEDROCK SURFACE		

NOTES:

1) STA. 89 + 08, 15 ft. right of centreline.
2) Sounding made from small boat using AX rods on July 4, 1969.
3) Refusal noted at 5.0 ft. depth; no hammer used on rods.

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. B-3 DRAWING No. 15

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE x
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

WATER	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		GRAVEL AND BACKFILL-dense	580.8	0			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey, lightly fractured at 7.5, 15.8, 16.2 and 19.5 ft.depth; iron staining in fractures at 15.8 and 16.2 ft. depth.	577.8	5			75%
							95%
				10			93%
							93%
				15			100%
							89%
		END OF BOREHOLE	560.1	20			100%
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 89 + 18, 15 ft. left of centreline. Borehole advanced in AX size using conventional drilling equipment on June 13 and 14, 1969.
2) Generally good water return in bedrock.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. N B-4 DRAWING No. 16

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		GRAVEL AND ROCK FILL-(i.e. placed to accommodate drilling equipment)	580.0	0			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey; fractured and iron stained zone from 7.5 to 8.2 ft. depth; few thin fissures elsewhere.	574.9	5			80%
				10			98%
				15			91% 98%
				20			90% 98%
		END OF BOREHOLE	558.2	25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 89+28, 15 ft. right of centreline. Borehole advanced using conventional drilling equipment on July 4, 1969.
2) Generally good water return in bedrock.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. N C-9 DRAWING No. 17

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
1	F	WATER LEVEL IN CHANNEL GRAVEL AND LOOSE FILL-compact (made ground)	580.0	0			
	F			5			
	11-11	CONE REFUSAL BEDROCK SURFACE	574.0	10			
		NOTES: 1) STA. 89 + 48, 15 ft. left of centreline. 2) Gravel and rock fill dumped in channel to permit use of land drilling equipment. 3) Cone test driven on July 4, 1969.		15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. N C-10 DRAWING No. 18

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT |—O

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽	F	WATER LEVEL IN CHANNEL GRAVEL AND ROCK FILL-compact (made ground)	580.0	0			
		CONE REFUSAL BEDROCK SURFACE	577.2	5			
				10			
				15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 89 + 48, 12 ft. right of centreline.
2) Gravel and rock fill dumped in channel to permit use of land drilling equipment.
3) Cone test driven to refusal through fill on July 4, 1969.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-11 | DRAWING No. 19

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE % STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water; 10.7 feet	580.0	0			
		REFUSAL BEDROCK SURFACE	569.5	10			
		NOTES: -Sta. 90 + 48; 15 feet left of centreline. -Sounding made from barge with plumb AX rods on June 20, 1969. -Rods bouncing at 10.5 feet with no penetration.		15 20 25 30 35 40 45 50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-12 | DRAWING No. 20

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWT	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽		WATER LEVEL IN CHANNEL Depth of water 14.8 feet.	580.0	0
	//E//	REFUSAL BEDROCK SURFACE	565.2	15

NOTES:

-Sta. 90 + 46; 15 feet right of centreline.
-Sounding made from barge with plumb AX rods on June 20, 1969.
-Rods bouncing at 14.8 feet with no penetration.

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B5 DRAWING No. 21

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water 14.8 ft.	580.0	0			
				5			
				10			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey, numerous thin hairline fissures at random orientation; iron stained zone at 11.0 ft. depth; water loss only at about 10 ft.	565.2	15			92%
				20			
				25			99%
		END OF BOREHOLE	563.7	30			100%
		NOTES: 1) STA. 90 + 62, 15 ft. left of centreline. Borehole advanced using conventional diamond drilling equipment mounted on steel barge on June 19 and 20, 1969.		35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. B-6 DRAWING No. 22

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE ×

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery.
		Depth of Water: 14.2 ft.	580.0	0			
				5			
				10			
			565.8	15			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey, few fissures and mechanical fractures from 11.4 to 11.9 ft. depth and from 12.3 to 12.5 ft. depth; water loss during drilling from 11.4 to 11.9 ft. depth.		20			100%
				25			98%
		END OF BOREHOLE	550.4	30			
		NOTES: 1) STA. 90 + 63, 15 ft. right of centreline. Borehole advanced using conventional drilling equipment mounted on steel barge on June 19, 1969.		35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B-7 DRAWING No. 23

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GRAPHIC SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
	Depth of Water: 15.5 ft.	580.0	0			
			5			
			10			
		564.5	15			
	GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey; small fractured zones from 19.6 to 19.9 ft. and 20.5 to 20.8 ft.; iron stained seam at 25.5 ft. depth; generally good water return; loss of water occurring at 22.8 ft. depth.		20			86% 96% 67% 100%
			25			96% 100%
			30			100%
	END OF BOREHOLE	547.2	35			
	NOTES: 1) STA. 90 + 76, 13 ft. left of centreline. Borehole advanced using conventional drilling equipment mounted on steel barge on June 17 and 18, 1969.		40			
			45			
			50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. B-8 DRAWING No. 24

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

WATER CONTENT	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	
			580.0	0			
		Depth of Water: 16.5 ft.		5			
				10			
				15			
			563.5				
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey, few hairline fissures; iron stained fissures at 21.3 and 27.9 ft. depth; generally good water return during drilling; water loss occurring for short distance (1 inch) below 27.8 ft. depth.		20			100% 88% 100%
				25			100%
				30			98%
		END OF BOREHOLE	547.2				100%
				35			
				40			
				45			
				50			

NOTES:

1) STA. 90 + 78, 17 ft. right of centreline. Borehole advanced in AX size using conventional drilling equipment mounted on steel barge on June 17 and 18, 1969.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-13 DRAWING No. 25

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED P
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽		WATER LEVEL IN CHANNEL Depth of water; 19.2 feet.	580.0	0
				5
				10
				15
		REFUSAL BEDROCK SURFACE	560.5	20
		NOTES: -Sta. 90 + 88; 15 feet left of centreline. -Sounding made from barge with plumb AX rods on June 20, 1969. -Rods slipped to the south on first blow, then bounding refusal without penetration at 19.5 feet depth.		25
				30
				35
				40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-14 DRAWING No. 26

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE % STRAIN AT FAILURE 0 15 5 10

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water; 16.2 feet.	580.0	0			
				5			
				10			
				15			
	//=//	REFUSAL BEDROCK SURFACE	563.5	20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

-Sta. 90 + 88; 15 feet right of centreline.
-Sounding made from barge with plumb AX rods on June 20, 1969
-Rods slipped to the south on first blow, then bouncing refusal at 16.5 feet depth

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-15 DRAWING No. 27

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT |—o

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
		WATER LEVEL IN CHANNEL Depth of Water; 35 feet.	580.0	0			
				5			
				10			
				15			
				20			
				25			
				30			
		REFUSAL BEDROCK SURFACE	544.7	35			
				40			
				45			
				50			

NOTES:

-STA. 92 + 28, 15 ft. left of centreline.
-Sounding made from barge with plumb rods on June 25, 1969.
-Rods penetrated 4 inches on 10 blows, then bouncing refusal at 35.3 ft. depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-16 | DRAWING No. 28

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE ×

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽		WATER LEVEL IN CHANNEL Depth of water; 28.1 feet.	580.0	0
				5
				10
				15
				20
				25
		REFUSAL BEDROCK SURFACE	551.9	30
				35
				40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

NOTES:

-Sta. 92 + 28; 15 feet right of centreline.
-Sounding made from barge with plumb AX rods on June 25, 1969.
-Bouncing refusal at 28.1 feet depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. B-9 DRAWING No. 29

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE ×

PLASTIC AND LIQUID LIMIT |—o

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

CORE RUN	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 / SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water 33.5 ft.	580.0	0			
		NOTES: 1) STA. 92 + 40, 15 ft. left of centreline. Borehole advanced using conventional diamond drilling equipment mounted on steel barge on June 26, 1969.		5			
				10			
				15			
				20			
				25			
				30			
		SAND, GRAVEL, COBBLES-dense	546.5	35			
		INTRUSIVE DIABASE (BEDROCK)-sound, dark grey, coarse grained; numerous well healed fissured and occasional iron stained fissures at random inclinations and few mechanical fractures; generally good water return during drilling.	544.4	40			100% 80% 95%
				45			96%
		END OF BOREHOLE	528.1	50			98%
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 | BOREHOLE No. B-10 | DRAWING No. 30

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 / SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 32.7 ft.	580.0	0			
		NOTES: 1) STA. 92 + 42, 15 ft. right of centreline. Borehole advanced using conventional diamond drilling equipment mounted on steel barge on June 27 and 28, 1969.		5			
				10			
				15			
				20			
				25			
				30			
		INTRUSIVE DIABASE (BEDROCK)-surface weathered and fractured to 34.5 ft. depth, then sound, dark grey, coarse grained; numerous random oriented thin fissures with iron stained fissures at 43.3 ft. depth; generally good water return during drilling; water loss from 41.0 to 49.2 ft. depth; probably due to poor seating of BX casing at bedrock surface.	547.3	35			70%
				40			79% 84%
				45			97%
		END OF BOREHOLE	529.1	50			
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B-11 DRAWING No. 31

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT |—o

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	Recovery
		Depth of Water: 33.6 ft.	580.0	0			
		NOTES: 1) STA. 92 + 58, 15 ft. left of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 25, 1969.		5			
				10			
				15			
				20			
				25			
				30			
			546.4	35			100%
		INTRUSIVE DIABASE (BEDROCK)-sound, dark grey, coarse grained; numerous well healed fissures, occasionally quartz filled; generally bad mechanical fractures below 39.9 ft. depth; effortless drilling noted at 40.9, 41.8 and 42.9 ft.; seams of soft rock probably ground away; generally good water recovery.		40			100%
				45			80%
		END OF BOREHOLE	529.4	50			
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. B-12 DRAWING No. 32

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GRAPHIC LOG	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 33.0 ft.	580.0	0			
		NOTES: 1) STA. 92 + 57, 15 ft. right of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 25, 1969. 2) Generally good water return during drilling.		5			
				10			
				15			
				20			
				25			
				30			
		INTRUSIVE DIABASE (BEDROCK)-sound, dark grey, coarse grained; numerous hairline fissures at random inclinations; iron stained fine fissures at 47.9 and 48.2 ft. depth; effortless drilling noted from 33.5 to 34.5 ft. depth; light coloured wash water return; material probably ground during drilling.	547.0	35			78%
				40			91%
				45			
		END OF BOREHOLE	531.8				98%
		NOTES: see above		50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-17 DRAWING No. 33

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽		WATER LEVEL IN CHANNEL Depth of water - 29.3 feet.	580.0	0
				5
				10
				15
				20
				25
				30
				35
				40
				45
				50
		REFUSAL BEDROCK SURFACE	550.7	

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

NOTES:

-Sta. 92 + 69.5; 15 feet left of centreline.
-Sounding made from barge with plumb AX rod on June 25, 1969.
-Bouncing refusal at 29.3 feet depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-18 | DRAWING No. 34

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE ×

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE % STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽ 1		WATER LEVEL IN CHANNEL Depth of water; 32.7 feet	580.0	0
				5
				10
				15
				20
				25
				30
				35
				40
				45
				50
1/11/		REFUSAL BEDROCK SURFACE	547.3	

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

NOTES:

-Sta. 92 + 68.5; 15 feet right of centreline.

-Sounding made from barge with plumb AX rods on June 25, 1969.

-Bouncing refusal at 32.7 feet depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-19 | DRAWING No. 35

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT |—O

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽		Water level in channel. Depth of water: 33.7 feet depth.	580.0	0
				5
				10
				15
				20
				25
				30
	/F/F	REFUSAL BEDROCK SURFACE	546.3	35
		NOTE: -Sta. 93 + 78; 15 feet left of centreline. -Sounding made from barge with plumb AX rods on June 25, 1969. -Bouncing refusal at 33.7 feet.		40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-20 DRAWING No. 36

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water - 32.4 feet	580.0	0			
				5			
				10			
				15			
				20			
				25			
				30			
		REFUSAL BEDROCK SURFACE	547.6	35			
		NOTE: -Sta. 93 + 78; 15 feet right of centreline. -Sounding made from barge with plumb AX rods on June 25th, 1969. -Cone penetration 1 inch with 3 blows then bouncing refusal without penetration at 32.4 feet depth.		40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B-13 DRAWING No. 37

PROJECT St. Joseph Island Bridge
LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.
HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED P
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 31.3 ft.	580.0	0			
		NOTES: 1) STA. 93 + 96, 15 ft. left of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 24, 1969.		5 10 15 20 25 30			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey with bands of sound dark grey gabbro from 34.3 to 35.3 ft. depth and from 45.3 to 47.3 ft. depth; few hairline fissures; iron stained seam at 34.8 ft. depth; effortless drilling occurring for short distance (i.e. 1-2 inches) at 35.7, 36.6, 38.4 and 45.3 ft.; generally good water return during drilling.	548.7	35 40 45			51% 90% 92%
		END OF BOREHOLE	532.6	50			
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 | BOREHOLE No. B-14 | DRAWING No. 38

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE % STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water 32.8 ft.	580.0	0			
		NOTES: 1) STA. 94 + 00, 15 ft. right of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 24 and 25, 1969.		5			
				10			
				15			
				20			
				25			
				30			
		Intensely fractured and loosened bedrock. Material ground away during drilling.	547.2	35			0%
		INTRUSIVE DIABASE (BEDROCK)-sound, dark grey; coarse grained; numerous well healed fine fissures at random inclinations; iron stained fissures at 39.5 and 41.8 ft. depth; generally good water return during drilling.	544.8				90%
				40			98%
							100%
				45			100%
		END OF BOREHOLE	531.4	50			
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-21 DRAWING No. 39

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▼		WATER LEVEL IN CHANNEL Depth of Water: 29.2 ft.	580.0	0			
				5			
				10			
				15			
				20			
				25			
		REFUSAL BEDROCK SURFACE	550.7	30			
				35			
				40			
				45			
				50			

NOTES:

1) STA. 94 + 18, 15 ft. left of centreline.
2) Sounding made from barge with plumb AX rods on June 24, 1969.
3) Bouncing refusal at 29.2 ft.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-22 | DRAWING No. 40

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No.

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water: 31.5 ft.	579.9	0			
				5			
				10			
				15			
				20			
				25			
				30			
		REFUSAL BEDROCK SURFACE	548.4				
				35			
				40			
				45			
				50			

NOTES:

1) STA. 94 + 18, 15 ft. right of centreline.
2) Sounding made from barge with plumb AX rods on June 24, 1969.
3) Bouncing refusal at 31.5 ft. depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-23 DRAWING No. 41

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water - 33.1 feet.	580.0	0			
				5			
				10			
				15			
				20			
				25			
				30			
		REFUSAL BEDROCK SURFACE	546.8	35			
		NOTES: -Sta. 95 + 29; 15 feet right of centreline. -Sounding made from barge with plumb AX rods on June 24, 1969. -Bouncing refusal at 33.1 feet.		40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-24 DRAWING No. 42

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT |—o

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 0, 15, 5, 10

% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water 34.0 ft.	580.0	0			
				5			
				10			
				15			
				20			
				25			
				30			
		REFUSAL BEDROCK SURFACE	545.9	35			
				40			
				45			
				50			

NOTES:

1) STA. 95 + 29, 15 ft. right of centreline.
2) Sounding made from barge with plumb AX rods on June 24, 1969.
3) Refusal at 34.0 ft.; rods probably wedged in crack in rock.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 | BOREHOLE No. B-15 | DRAWING No. 43

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT |—o

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 33.1 ft.	580.0	0			
		NOTES: 1) STA. 95 + 50, 15 ft. left of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 23, 1969.		5			
				10			
				15			
				20			
				25			
			546.9	30			
		INTRUSIVE DIABASE (BEDROCK)-sound, dark grey; coarse to medium grained at depth; numerous random oriented fine quartz healed fissures; iron stained fissures occurring from 33.1 to 37.9 ft. depth; generally good water return during drilling.		35			97%
				40			99%
				45			99%
		END OF BOREHOLE	530.8	50			
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 | BOREHOLE No. B-16 | DRAWING No. 44

PROJECT: St. Joseph Island Bridge

LOCATION: Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE ×

PLASTIC AND LIQUID LIMIT |—o

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W F	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 32.6 ft.	580.0	0			
		NOTES: 1) STA. 95 + 46, 15 ft. right of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 23, 1969.		5			
				10			
				15			
				20			
				25			
				30			
		INTRUSIVE DIABASE (BEDROCK)-sound, dark grey, coarse grained, numerous random oriented quartz, healed fine fissures; iron staining in fissures at 39.9 ft. and 40.1 ft.; generally good water return during drilling.	547.4	35			94%
				40			94%
				45			
		END OF BOREHOLE	528.5	50			100%
		NOTES: see above					

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-25 | DRAWING No. 45

PROJECT St. Joseph Island Bridge
LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED P
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X
PLASTIC AND LIQUID LIMIT |—o
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of water - 31.0 feet.	580.0	0			
				5			
				10			
				15			
				20			
				25			
		REFUSAL BEDROCK SURFACE	549.0	30			
				35			
				40			
				45			
				50			

NOTES:

-Sta. 95 + 67 15 feet left of centreline.
-Sounding made from barge with plumb AX rods on June 23, 1969.
-Bouncing refusal at 31 feet depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-26 DRAWING No. 46

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of water - 32.4 feet	580.0	0			
				5			
				10			
				15			
				20			
				25			
				30			
		REFUSAL BEDROCK SURFACE	547.6	35			
		NOTES: -Sta. 95 + 69; 15 feet right of centreline. -Sounding made from barge with plumb AX rods on June 23, 1969. -Bounding refusal at 32.4 feet depth.		40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-27 DRAWING No. 47

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 / SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▽		WATER LEVEL IN CHANNEL Depth of Water 18.2 feet.	580.0	0			
				5			
				10			
				15			
		REFUSAL BEDROCK SURFACE	561.8	20			
		NOTES: -Sta. 96 + 76.5; 15 feet left of centreline. -Sounding made from barge with plumb AX rods on June 22, 1969 -Bouncing refusal at 18.2 feet depth.		25			
				30			
				35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-28 DRAWING No. 48

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE ×

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE % STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▼		WATER LEVEL IN CHANNEL Depth of Water - 17.2 feet.	580.0	0			
				5			
				10			
				15			
	//=//	REFUSAL BEDROCK SURFACE	562.8	20			
				25			
				30			
				35			
				40			
				45			
				50			

NOTES:

-Sta. 96 + 77.5; 15 feet right of centreline.
-Sounding made from barge with plumb AX rods on June 22, 1969.
-Bouncing refusal at 17.2 feet depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B-17 DRAWING No. 49

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED P
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x
PLASTIC AND LIQUID LIMIT |—o
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 14.9 ft.	580.0	0			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey, numerous fissured, random oriented; effortless drilling noted for 1 inch at 28.6 ft. depth. Generally good water return during drilling.	565.1	15			98%
				25			99%
		END OF BOREHOLE	549.3	30			
		NOTES: 1) STA. 96 + 98, 15 ft. left of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 21, 1969.		35 40 45 50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J 5159 BOREHOLE No. B-18 DRAWING No. 50

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED P
VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	% Recovery
		Depth of Water: 15.8 ft.	580.0	0			
				5			
				10			
			564.2	15			
		GNEISSIC METASEDIMENTS (BEDROCK)- sound, light grey; numerous random oriented fissures; some mechanical fracturing during drilling; no water return during drilling; BX casing probably poorly seated in rock surface.		20			84%
				25			89%
				30			92%
		END OF BOREHOLE	548.1				
		NOTES: 1) STA. 96 + 98, 15 ft. right of centreline. Borehole advanced in AX size using conventional diamond drilling equipment mounted on steel barge on June 21, 1969.		35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-29 DRAWING No. 51

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18
Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE PUSHED
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
▼		WATER LEVEL IN CHANNEL Depth of water; 17.8 feet.	580.0	0			
	//=//	REFUSAL BEDROCK SURFACE	562.2	5 10 15 20 25 30 35 40 45 50			

NOTES:

-Sta. 97 + 19.5; 15 feet left of centreline.
-Sounding made from small boat using AX rods on June 21, 1969.
-Bouncing refusal at 17.8 feet depth.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-30 | DRAWING No. 52

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▼		WATER LEVEL IN CHANNEL Depth of water; 14.7 feet depth.	580.0	0
				5
				10
		REFUSAL BEDROCK SURFACE	565.3	15
		NOTES: -Sta. 97 + 20; 15 feet right of centreline. -Sounding made from small boat using AX rods on June 21, 1969. -Bouncing refusal at 14.7 feet depth.		20
				25
				30
				35
				40
				45
				50

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 BOREHOLE No. C-31 DRAWING No. 53

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE PUSHED P

VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE 0, 5, 10, 15

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80 SHEAR STRENGTH K.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
		WATER LEVEL IN CHANNEL Depth of water: 6.5 feet.	580.0	0			
		REFUSAL BEDROCK SURFACE	573.5	5			
		NOTES: -Sta. 98 + 08; 15 feet left of centreline. -Sounding made from small boat using AX rods on July 4, 1969. -Sound rock surface noted at 6.5 feet depth.		10			
				15			
				20			
				25			
				30			
				35			
				40			
				45			
				50			

William Trow Associates Ltd.

BOREHOLE LOG

JOB No. J-5159 | BOREHOLE No. C-32 | DRAWING No. 54

PROJECT St. Joseph Island Bridge

LOCATION Highway 548, District 18

Near Sault Ste. Marie, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE x

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE

% STRAIN AT FAILURE

G.W.L.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
▽		WATER LEVEL Depth of water; 9.5 feet.	580.0	0
		REFUSAL BEDROCK SURFACE	570.5	10
		NOTES: -Sta. 98 + 08; 15 feet right of centreline. -Sounding made from samll boat using AX rods on July 4, 1969. -Sound rock surface noted at 9.5 feet.		

PENETRATION RESISTANCE
350 FT. LB. BLOWS/FT.
20 40 60 80
SHEAR STRENGTH K.S.F.

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

NATURAL UNIT WEIGHT P.C.F.

William Trow Associates Ltd.

Lie 4K-1

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: A. McKim
Assistant Construction Eng.
Construction Office
3rd Floor, Central Bldg.

FROM: Structural Design Office
West Bldg.
Downsview

ATTENTION:

DATE: November 23, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT: St. Joseph Island Bridge
Contract 70-204, District 18
Dowels for footings of
Piers 2 & 6

This will acknowledge receipt of a copy of my memo to you dated October 25, recommending Scheme 'B' signed as approved by J.E. Callaghan.

We believe there is some urgency to getting this work done and recommend this be done as soon as possible.

C.S. Grebski
Structural Design Engineer

CSG:AMF

c.c. A. Radkowski
A. Stermac ✓

Ontario
Department of Transportation and Communications

MEMORANDUM

cc: Foundations Files (110)

TO: Mr. J. L. Forster,
Regional Director,
Northwestern Region,
THUNDER BAY, Ontario.

Attention: Mr. P. D. Lester,
Regional Bridge
Planning Engineer.

FROM: Mr. A. G. Stermac,
Foundation Section,
Design Services Branch,
Downsview

DATE: July 26, 1971

IN REPLY TO

SUBJECT: Need For Collecting and Relaying Pertinent Information

The purpose of this memorandum is to advise you of a situation that has come to our attention, and which we feel is of great interest and importance to you as well as to us.

The site for the proposed St. Joseph's Island Bridge was investigated for the Department by a consultant. Because of some unfortunate experience on another job, we asked the consultant to put down at least two borings at the location of each abutment and each pier, supplemented by an appropriate number of cone tests, in order to make sure that the bedrock would be well defined. In total, 20 boreholes and 34 cone tests were carried out at this site. By any standards, this amount and type of investigation is considered sufficient, possibly even somewhat on the conservative side.

However, in spite of all this work, a problem at the location of Pier No. 1 (most northerly pier) was encountered. During the excavation of the pier foundation, bedrock in the north part of the footing was not found - not even at considerable depth below the elevations indicated in the foundation report. Four cone tests covered this area.

As requested by the District, we have carried out an additional investigation and have found that there was an excavation into which a pipe was laid, which was subsequently covered (backfilled) with rock fill. Cones driven in this area met refusal as soon as they penetrated to the rock fill.

During the additional investigation, it was found out that this pipe was placed there in order to allow the water, pushed into the dock by a docking vessel, to escape into the adjoining bay. Not having known about this pipe, the results of the cone tests were taken at their face value. However, had we known of the existence of the pipe, we would have had the previously excavated area well defined, and would have supplied the designer with accurate bedrock elevations.

..... 2

- Need for Collecting and Relaying Pertinent Information .....

We are now advised that the existence of the pipe was known to quite a few persons, and that its presence was mentioned at the Regional Contract Review meeting. It appears to us that a breakdown in communications has occurred somewhere and this fact, which has now become quite important, was not relayed to those persons who should have known about it.

The foregoing incident clearly shows the utmost importance of collecting and relaying all the pertinent information to those persons who need to know about it. I would like to draw your attention to the "Field Reconnaissance Report" which accompanies your requests for foundation investigations. Under "Existing Structure(s) - Other Observations", you should mention and draw our attention to occurrences, such as the aforementioned buried pipe. In instances where a similar matter comes to your attention at a later date, you should advise us of it immediately.

Due to the fact that you are closer to the site(s), and that the location of the structure in the most appropriate site is your responsibility, we feel that, searching for and gathering the above discussed type of information, is also part of your assignments. This, of course, does not mean that we will not make every effort while doing the field investigation, to collect and record all the information that is pertinent and which could influence the Department's work at any one time. There is no doubt that every effort on your part in this respect, will be most useful and very much worthwhile.

Your cooperation in this matter will be greatly appreciated.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Copies to:
Messrs. P. D. Billings - Regional Director, Eastern Region
Attn: Mr. T. C. Kingsland, Reg. Bridge Plan. Engr.
R. G. Gascoyne - Regional Director, Central Region
Attn: Mr. G. C. E. Burkhardt, Reg. Bridge Plan. Engr.
W. S. Aitken - Regional Director, Northern Region
Attn: Mr. J. C. McAllister, Reg. Bridge Plan. Supvr.
J. H. Blevins - Regional Director - Southwestern Region
Attn: Mr. A. P. Watt, Reg. Bridge Plan. Engr.
J. Walter - Executive Director - Design Division
L. R. Eadie - Executive Director - Operations Division
F. G. Allen - Director - Construction Branch
A. J. Argue - Director - Design Services Branch

✓Foundations Files

Mr. L. R. Ladie
Executive Director
Operations Division

J. W. MacDougall
Claims Engineer

September 23, 1971

Re: Claim on Contract 70-204
McNamara Corporation Limited
District 18 - Sault Ste. Marie

Attached please find for your information copy of Notification of Intent to Claim dated September 9, 1971 from McNamara Corporation Limited regarding the above contract.

JWM/er.
Att.

J. W. MacDOUGALL
CLAIMS ENGINEER

c. c. D. M. Hopper
G. R. Browning
J. Walter ✓

ONTARIO

DEPARTMENT OF HIGHWAYS

NOTIFICATION OF INTENT TO CLAIM

ASSISTANT DEPUTY MINISTER, (ENGINEERING),
DEPARTMENT OF HIGHWAYS ONTARIO.

Date Sept. 9 19 71

Against Contract No. DHO 70-204

District Sault Ste. Marie Location Highway #548

Contractor McNAMARA CORPORATION LIMITED, St. Joseph Island Bridge

101 Dundas Street West, Whitby, Ont.

In accordance with Section 104 "Control of the Work" of the "General Conditions of the Contract" D.H.O. Form 100, I/We declare my/our intention to file a claim against the above contract due to the following (Give complete details, attaching separate sheets if necessary.)

Ref: The construction of footing of Pier #2, as drawing #D-6684-3.

The changes in site conditions encountered at Pier #2 where bedrock was located as low as 4.8 feet below that shown on the drawing and the existance of crevices or cracks in the bedrock making it impossible to unwater the caisson, has necessitated a change in footing design.

On August 26th, 1971, the new design instructions were received from the D.T.C. and the method of payment was agreed at a jobsite meeting.

As at Pier #1 and the North Abutment where similar foundation problems have occurred, there has resulted overall project delays. The financial impact of these delays attributed to Pier #2, when fully known, will be the subject of this claim.

NOTE: Contractor must give this notice to the Assistant Deputy Minister, (Engineering) and District Engineer within 7 days of his date of commencement on the work out of which this claim arises - Refer - Section 104 "General Conditions of the Contract" D.H.O. Form 100.

McNAMARA CORPORATION LIMITED

Signed B. Gallant
Contractor or Authorized Representative

B. Gallant.

TO BE MADE IN QUINTUPLICATE BY THE CONTRACTOR

COPIES 1, 2, 3, TO BE SENT TO ASSISTANT DEPUTY MINISTER, (ENGINEERING)
COPY 4 TO BE SENT TO DISTRICT ENGINEER
COPY 5 TO BE RETAINED BY CONTRACTOR

(1) ASSISTANT DEPUTY MINISTER (ENGINEERING)

Ontario
Department of Transportation and Communications
xxxxxxxxxxxxxxxxxxxxx

Mr. A. E. Argue, Director,
Design Services Branch,
West Bldg., Downsview.

Foundations Office,
Design Services Branch,
Central Bldg., Downsview.

September 29, 1971.

Claim on Contract 70-204, McNamara Corporation Ltd.,
St. Joseph's Island Bridge, W.P. 98-66, W.O. 71-11057,
District #18, Sault Ste. Marie.

With respect to the Notification of Intention to Claim by the above contractor, dated September 9, 1971, we wish to submit the following comments for your information.

This Office was involved with the problems that arose at the Pier #1 location. The attached correspondence, I believe, sheds the necessary light on the events that took place.

About problems at the north abutment and Pier #2 locations we only heard but were never asked nor did we ever get involved. Consequently, we cannot comment on those.

In view of the fact that at Pier #1 (and apparently at the other two mentioned locations as well) conditions different from those shown on the plans were encountered the contractor is entitled to some compensation.

This particular contract, i.e. the problem at Pier #1, was discussed at the meeting (July 1971) between yourself, Messrs. Walter, Eadie, Allen and myself. At that time I showed the plans and described the extent of the field investigation carried out for the Department by the geotechnical consultant, W. A. Trow Associates Ltd. It was agreed that the investigation was certainly extensive enough to provide the necessary information. However, this site seems to have been one where all the circumstances worked against the investigation. It can be best described as one of those unfortunate instances where nature chose to have it its own way.

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER.

AGS/ao
Attach.

cc: Foundations Files
Documents

1. COPY OF LETTER TO A. RUTKA DATED JUNE 28/71
2. COPY OF LETTER BY W.G. SAWYER DATED JUNE 23/71
3. COPY OF LETTER (SHORT REPORT) TO C. GREBSKI DATED JUNE 22/71

AGS

cc: Foundati[illegible]s Files (Rm. 110)

Mr. A. Rutka,
Materials & Testing Engineer,
Room 102, Lab. Bldg.

Foundation Section,
Design Services Branch,
Room 107, Lab. Bldg.

June 28, 1971

Claim on Contract 70-204 --
McNamara Corporation Ltd.
St. Josephs Island Bridge
W.P. 98-66, W.O. 71-11057
District 18, Sault Ste. Marie

The foundation investigatinn at the above mentioned site was carried out for the Department, during the months of June and July, 1969, by the consulting firm of William Trow Associates Ltd. A report containing all the investigation results and recommendations was submitted to the Department by the Consultant on July 23, 1969. We have reviewed this report and have approved it.

On June 7, 1971, we received a call from the Sault Ste. Marie District Office for assistance in resolving the bedrock elevations at the Pier #1 location. Apparently bedrock was not found at the elevations indicated on the construction drawings. Preliminary probings indicated, in places, the bedrock to be some 8 ft. deeper than expected.

On June 8, 1971, Mr. P. Payer, representative for this Section, started the requested field investigation. By reviewing the Consultant's report, it was concluded that he had carried out what would appear to have been a sufficient amount of investigation to define the bedrock surface at the Pier #1 location. At this location he put down two boreholes and six cones. Both boreholes were advanced some 15 ft. into bedrock, which was found to be basically sound.

The six additional cone tests met refusal at the approximate elevations at which bedrock was established in the above mentioned boreholes. In view of this, it was concluded that the bedrock surface at the Pier #1 location was reasonably level and well defined.

During construction, the conditions were found to be different. Our additional investigation has disclosed that bedrock on the north side of the footing is about 10 ft. lower than on the south side. A buried pipe was found in this location, and it is believed that the

..... 2

original bedrock at this location was blasted and removed to accommodate the pipe. The hole was backfilled with rock fill on which the cones met refusal. The existence of this pipe was not known to anybody, and its discovery came as quite a surprise.

In summary, it can be said that, although the original foundation investigation was quite elaborate, it did not disclose the presence of a hole in the bedrock at this location. The Contractor, therefore, encountered a condition that neither he nor ourselves anticipated. Immediate action was taken by this Section to provide factual information which was promptly forwarded to the designer who, in turn, altered the footing design in order to accommodate the change in bedrock elevations. The District personnel will have to supply the information as to how much delay and extra expenditure this has caused the Contractor.

AGS/MdeF

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Files

Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To:	Mr. Tony Stermac, Foundation Section, Downsview, Ontario.	**From:**	Mr. W. G. Sawyer, District Construction Engineer, 18-Sault Ste. Marie, Ontario.
Attention:		**Date:**	June 23, 1971.
Our File Ref.		**In reply to**	

Subject: Contract 70-204
Highway 548, District 18
Saint Joseph Island Bridge

The District would like to thank your Section very much for the promptness in which assistance was extended when we ran into problems on Pier # 1, on the above-mentioned structure.

Your Mr. Payer and the Drilling Crew from the North Bay Region gave us the promptest attention, and have now supplied us with sufficient information to proceed with the construction and negotiate with the Contractor. It is highly possible that your promptness has saved the Department a Claim. Again, accept the District's thanks.

WGS:my

W. G. Sawyer,
District Construction Engineer,

for G. R. Browning,
District Engineer.

c.c. Mr. F. Allen

Ontario
Department Transportation and Commun ations

MEMORANDUM

TO: C. Grebski,
Bridge Design Engineer,
Bridge Office, Administion Building

FROM: K.G. Selby,
for
A.G. Stermac

ATTENTION. C. Radkowski,
Regional Bridge Design Engineer

DATE: June 22, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT:

St. Joseph Island Bridge
W.P. 98-66 W.O. 71-11057
District 18, Sault Ste. Marie

Following are the results of borings recently carried out for No. 1 Pier footing of the abovementioned structure. The locations of the borings are shown on the attached sketch.

B.H.	Ground Level	Bedrock Surface	Sound Bedrock
1	El. 575.3	El. 567.8	El. 566.2
2	575.2	567.9	565.3
3	578.1	577.7	573.5
4	578 ±	568.6	567.6
5	577.0	575.6	571.7
6	578.5	577.5	575.7
7	578 ±	565.1	562.1
8	576.1	568.9	565.8
9	578 ±	575.8	567.8

The overburden consists of a mixture of clay, sand, gravel and boulders. Between the bedrock surface and the sound bedrock exists a zone of fissured rock partly due to normal weathering and partly due to what appears to be the results of blasting. During the field work, a steel pipe was discovered at the location of B.H.'s #4 and #7. The approximate elevation

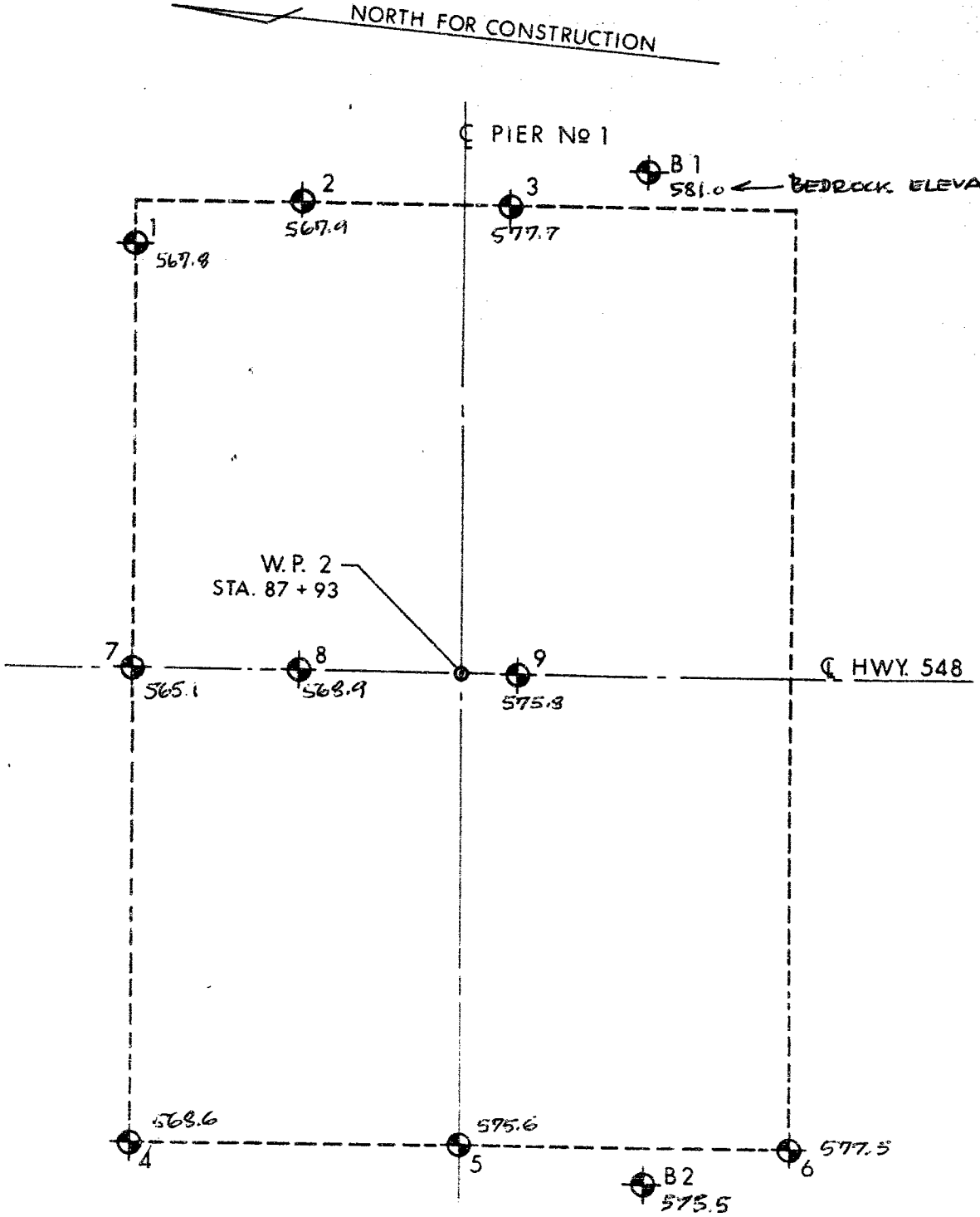
..... 2.

of the bottom of this pipe is 570 +. The exact location of the pipe at this time is not known.

It is recommended that all overburden, and loose rock from the fissured zone be removed and replaced with mass concrete (tremied if desired), prior to pouring the main structure foundation.

K. C. Selby,
Supervising Foundation Engineer
for: A. G. Stermac,
Principal Foundation Engineer

c.c.:
E.C. Allen
C.R. Browning
D. Hopper
C. Grebski
Foundation Files
General Files



BORE HOLE LOCATIONS AT PIER Nº 1 FOOTING

ST. JOSEPH ISLAND BRIDGE & HWY. NO. 548

Scale : $\frac{1}{4}$" = 1'-0"

W.P. 98 - 66

JOB 71-11057

A. G. Stermac

File R93

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
MEMORANDUM

REPORT BY WILLIAM TROW ASSOC

TO: Mr. J. W. MacDougall
Claims Engineer.

FROM: A. Rutka,
Materials and Testing Engineer.

ATTENTION: Mr. G. Martens

DATE: June 29, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT: Contract 70-204
St. Josephs Island Bridge W.P. 98-66

With reference to your memorandum of June 18, 1971, to Mr. Eadie regarding the intent to claim on the foundations for Pier #1, I am enclosing a copy of a memorandum from Mr. Stermac dated June 28, 1971 in this connection. I believe Mr. Stermac's memorandum is self-explanatory.

ar.

A. Rutka,
Materials and Testing Engineer

AR/jm
encl.

cc: J. Gruspier
F. G. Allen
A. G. Stermac

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Building

From: C.S. Grebski,
Bridge Office

Attention:

Date: June 2, 1970

Our File Ref.

In reply to

Subject: St. Joseph Island Bridge
W.P. 98-66, Site 38S-176
Highway 548, District 18

Trow 69.
Mylar sent to D.O.
July 69.

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

No comments

~~APr~~ 8/6/70

M. L. Barclay

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To:	Mr. R. Morgenroth Regional Materials Engineer Fort William Region	From:	B. K. Glassford Materials and Testing Office Downsview
Attention:		Date:	October 27, 1969
Our File Ref.		In reply to	

Subject: Foundation Site 38-S-177
St. Joseph Island Structure Approaches
W.P. 98-66
Highway 548, District 18

Trow/67

The examination of rock outcrops in the immediate vicinity of the proposed bridge structure for above and below water rock fill material, indicates a favourable rock type in the granitic bedrock. These sources and others are summarized as follows:

1. Rock Quarry

An old rock quarry is located approximately 350 feet south of Garden River and to the east of station 117 + 00, Highway 548, Work Project 16-68-02, with a haul distance of 0.2 miles to the south limit of Work Project 98-66.

The rock appears to be a granophyre granite type, of igneous origin, extremely hard, of excellent structure, and resistant to abrasion and weathering forces. This is a recommended rock source for underwater fill material. The quarry would require assessing to determine the quantity of available fill. Previously it appears that this quarry was used to supply rock fill for the south approach to the Ferry Dock. Examination of the fill in the south approach site shows the rock to be performing its need satisfactorily. The ownership is not known.

2. Rock Quarry Site

An area of granitic type rock (granophyre) is located approximately 0.3 miles south of the Garden River and to the east of Station 130 + 00, Highway 548, Work Project 16-68-02, with a haul distance of 0.5 miles to the south limit of Work Project 98-66. The characteristics of the rock at this location are similar to the description given in 1. above.

The area is tree covered with a minimum of stripping (1 - 2 feet). Contained in the stripping are large granitic blocks up to 2 cubic yards dimension, as well as numerous smaller blocks. This is a recommended rock source for underwater fill material. The ownership is not known.

3. Limestone Quarry

An old limestone quarry is located approximately 0.7 miles south of the Garden River and on both sides of Highway 548 at Station 150 + 00, Work Project 16-68-02 with a haul distance of 0.9 miles to the south limit of Work Project 98-66.

The history of use of this quarry is unknown, however, local information indicates it was used as a rock fill source for the south approach to the Ferry Dock mainly in the vicinity of the Garden River structure and was deemed responsible for the foundation problems experienced at this site at a later date.

The limestone rock is of undifferentiated classification (probably classified as Black River). The upper 6 feet of the quarry face appears as a high calcium limestone type, cryptocrystalline to fine grained texture, hard, friable, some fossils present, and with a conchoidal breakage. The 6 to 8 feet exposed face below this limestone appears as a thinly bedded shaly limestone and shale formation. This lower portion is soft, poorly indurated, friable and with poor resistance to the physical and chemical weathering forces. Approximately up to 6 feet of overburden is present. This is a poor quality rock source for the intended use as underwater rock fill material. This source is not to be used for this project where underwater rock fill is required. Ownership of this quarry is not known.

4. Rock Quarry Site

The same rock type as described in 1. and 2.; that is, a granophyre granitic type is located along Highway 548 between Knights Corners and Desjardins Bay area. Rock from this area would qualify for underwater fill. Maximum haul distance to the south Ferry Dock area would be 2.8 miles. Ownerships are not known.

5. Rock Quarry Site

An area of exposed bedrock is located adjacent and west of Highway 548 at the north limit of the work project. This area has not been used as a material source, but appears sufficiently durable and weather resistant for use as rock fill. A minimum of stripping would be required. This area was not examined and hence it is assumed to be of igneous origin. If it should be a limestone outcropping the area should not be considered as an underwater rock fill source. Ownership is not known. The description of this area was taken from the Soils Report for work project 98-66.

The Kirk Pit

This pit is located in a bedrock controlled till deposit approximately 0.25 miles southwest of the junction of Highways 17 and 548. The haul distance to the north limit of Work Project 98-66 is 2 miles.

The bedrock in this pit is a granophyre granitic type with possible areas of quartzite and greywacke also composing the surface as yet uncovered. All these rock types are hard and resistant to physical and chemical weathering forces and could feasibly be utilized as underwater rock fill for the north approach area on the mainland. Granular type borrow would have to be removed to quarry out the bedrock.

Rock Quarry Site

The area in the vicinity of the north approach is composed of the granitic rock type granophyre. Possibly in this area material could be quarried for underwater rock fill for the north approach site. Ownership is not known.

Recommendations

It is recommended that rock material for underwater fill for the south and north approaches come from the igneous rock sources described in this memo. Number 3 source is not to be used for this project where underwater rock fill is required. This statement also applies to source area No. 5 if the bedrock there be a limestone.

B. K. Glassford
Geologist

BKG:nm

c.c.: W. R. Bennett
G. A. Wrong
Z. Katona
R. D. Gunter
A. G. Stermac

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Office,
Admin. Bldg.

Attention: Mr. S. McCombie

Our File Ref.

From: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

Date: July 24, 1969

In reply to

Subject: FOUNDATION INVESTIGATION REPORT BY:
William Trow Associates Limited -
Prepared for Department of Highways, Ont.
Proposed St. Joseph Island Bridge, Hwy. 548,
Site 38 S-177, District 18 (Sault Ste. Marie)
-- W.P. 98-66 --

Attached, please find the above mentioned report prepared and submitted by the Consultant, William Trow Associates Ltd.

We have reviewed the report and believe that it contains all the necessary data and information required for the foundation design.

Should you wish to discuss this report, or any part of it, please feel free to call on this Office.

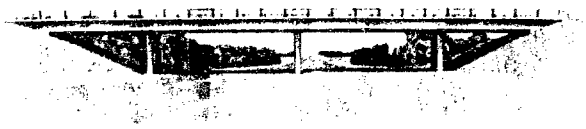
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
H. Hurrell
S. B. Davidson
J. H. Blevins
F. Norman
B. A. Singh
Foundations Office Files
Gen. Files

HON. GEORGE E. GOMME
MINISTER

A. T. C. McNAB
DEPUTY MINISTER



Telephone:
248-3266
Area Code:
416

DEPARTMENT OF HIGHWAYS
Downsview 464, Ont.

May 28, 1969

William A. Trow Associates Ltd.,
Consulting Engineers,
90 Milvan Drive,
WESTON, Ont.

Attention: Mr. Wm. A. Trow

Re: LETTER OF AUTHORITY - FOUNDATION INVESTIGATION
St. Joseph Island Bridge, Hwy. 548, Site 38 S-177
District No.18 (Sault Ste. Marie) - W.P.98-66

Dear Sirs,

Please consider this your authority to carry out the necessary foundation investigation at the above mentioned site.

The site plan and other pertinent available information was given to you on Tuesday, May 20, 1969.

Regarding the laying out of pier and borehole locations within the channel, you should contact Mr. K. Roberts, Regional Superintendent of Surveys, 229 Pearl Street, Port Arthur, Telephone: 345-1231, and arrange for the surveying to be carried out at a mutually convenient time.

You are requested to keep the Foundation Section advised of the progress of the field work, and also to contact the Section should any problems arise.

Eleven (11) copies of the final report should be submitted to the Department not later than July 11, 1969. Should you find difficulties in meeting this date, please contact the Foundation Section as early as possible.

The field work should, at all times, be supervised by a qualified Soils Engineer. Any deviation from this agreement has to meet our prior approval.

/cont'd....

Since the drawing accompanying the foundation report, showing the location of borings, the inferred subsoil conditions, etc., is to become a contract drawing, you are requested to prepare it in accordance with the D.H.O. Standards. To enable you to do this, we are supplying you with a sample drawing with all the necessary explanations, together with linen sheet for your drawing. You are also requested to provide us with a Cronaflex copy of the drawing.

Charges for the work performed will be in accordance with your Schedule of Rates, dated January 30, 1969, and invoice to be addressed to the attention of the undersigned.

Yours very truly,

A. Rutka,
Materials and Testing Engineer

AGS/MdeF

cc: Messrs. S. McCombie
K. A. Roberts
S. B. Davidson
H. Hurrell
J. H. Blevins
F. Norman
H. Konings
H. Szymanski
D. A. Barr
Mrs. I. Steinberg

Foundations Files
Gen. Files