

MEMORANDUM

To: Mr. T. J. Kovich,  
Regional Materials Engineer,  
Central Region -  
Room 134-A, Lab. Bldg.

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

ATTENTION:

DATE: January 3, 1969

OUR FILE REF:

IN REPLY TO

JAN 15 1969

SUBJECT:

FUNCTIONAL  
SOILS INVESTIGATION REPORT  
At the Site of the  
Proposed Relocation of Hwy. #2 and  
At Bridge #3  
District No. 4 (Hamilton)  
W.J. 68-P-78 -- W.P. 113-66 - 42

Attached, we are forwarding to you, our Functional Soil Investigation Report pertaining to the above site. The report outlines the sub-soil conditions existing at this location, and presents general comments and recommendations concerning embankment stability and structure foundations.

We believe that the factual data and recommendations will prove adequate for your immediate use. Should you require any additional information, please do not hesitate to contact this Office.

*A. G. Stermac*

A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF  
Attach.

cc: Messrs.

B. R. Davis (2)  
H. A. Tregaskes T. J. Kovich  
D. W. Farren  
I. C. Campbell  
H. E. Clelland  
W. Wigle  
H. Greenland  
G. K. Hunter (2)  
W. S. Melinyshyn  
C. R. Hopkins (C.C. Parker & Associates)  
B. A. Singh  
Foundations Files  
Gen. Files

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FUNCTIONAL  
SOILS INVESTIGATION REPORT  
At the Site of the  
Proposed Relocation of Hwy. #2 and  
At Bridge #3  
District No. 4 (Hamilton)  
W.J. 68-F-78      --      W.P. 113-66

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1. INTRODUCTION:

In a memo dated October 17, 1968, Mr. T. J. Kovich, Regional Materials Engineer, Central Region, requested a soil and foundation investigation at the site of the proposed relocation of Hwy. #2 and at Bridge #3 just outside of Hamilton.

Three alternative proposals were put forth for the reconstruction of this section of Hwy. #2, as follows:

- (a) relocation of the highway along Line G, G-1 or G-2,
- (b) reconstruction of the high level Bridge #3 over the pond to four lanes, and (c) construction of a high embankment to replace Bridge #3.

By adopting the relocation of the highway along Line G (G-1, G-2), the reconstruction of Bridges #3, 4 and 5 could be avoided, but it would require the construction of high embankments along the pond and a subway under the C.N.R. and C.P.R. tracks.

The purpose of the investigation was two-fold: first, to study the feasibility of the realignment and the construction of the high embankment replacing Bridge #3, and second, to investigate soil and bedrock conditions for the foundations of a new bridge.

Presented in this report are the results of the investigations, together with comments and recommendations concerning embankment stability and structure foundations.

## 2. DESCRIPTION OF THE SITE:

The proposed Hwy. #2 Line G (G-1 & G-2) runs between the existing Hwy. #403 and the pond. Between Sta. 202+00 and 215+00 the line is proposed to be on a fill with heights up to 60 ft. adjacent to the Hwy. #403 embankment. The grade of Hwy. #403 is around el. 320 - 330 ft., some 80 - 90 ft. higher than the pond bottom. From the pavement the ground drops with approx. 2:1 slopes down to the water's edge. Between proposed Stations 220+00 and 225+00 the lines would cross the railway tracks in a subway, after which another fill is proposed over Mercer Glen. The south shore of the pond rises up to approx. el. 340 with 1 horizontal to 1 vertical slopes.

Geologically, the area belongs to the physiographic region known as the Iroquois Plain. Lake Iroquois was the forerunner of Lake Ontario in the late Pleistocene times. Its old shorelines, including cliffs, bars, beaches and boulder pavements, are easily identifiable features. In our particular area the great gravel bar, which separates Coot's Paradise from Hamilton Harbour, marks the shoreline of the glacial lake. This vast sand and gravel bar, partially cemented to conglomerate, carries Hwy. #2, the railroads and the famous Royal Botanical Rock Garden adjacent to the pond.

## 3. FIELD AND LABORATORY INVESTIGATIONS:

The field investigation consisted of some 18 boreholes and, adjacent to the holes, some 15 cone penetration tests. Eleven holes were lowered for the proposed realignment and 7 for the contemplated embankment replacing Bridge #3. The latter were also used for the foundation investigation of the new bridge over the pond. (See Drawing #68-F-78A.)

Along Line G, around Sta. 207+60, five boreholes were placed perpendicular to the centre-line in order to determine soil conditions below the proposed, some 60-ft. high fill (B.H.'s #8 to 12). Four boreholes were put on the railway embankment to



3. FIELD AND LABORATORY INVESTIGATIONS: (cont'd.) ...

gain information for the foundations of the proposed subway under the railway tracks (B.H.'s #17 to 20). After completion of the above holes and some laboratory testing of soil samples, it has become quite clear that the construction of high fills near the pond, on account of the very poor soil conditions, would involve extreme difficulties and prohibitive costs. For this reason, further investigations for Line G were called to a halt. As was mentioned in our letter dated December 2, 1968, this decision was reached during a meeting between representatives of the consultant, C. C. Parker & Associates, the Bridge Office, Soil Section, and the Foundation Section.

The field work was carried out by means of a continuous flight auger and two conventional diamond rigs adapted for soil sampling purposes. Boreholes on the water were performed by utilizing rafts. Soil samples were taken at regular intervals using split-spoon samplers, generally for granular deposits, and thin-walled Shelby tubes for "undisturbed" fine-grained specimens. Standard penetration tests and field vane tests were implemented according to conventional techniques, to measure densities and in situ undrained shear strengths.

One porous brass piezometer (Geonor) was installed at proposed Sta. 208+00, 130 ft. Lt. of centre-line, right adjacent to the pond in order to register pore water pressure relative to the ground elevation.

Upon arrival in the laboratory, all samples were visually examined and identified by performing simple tests. Samples were further subjected to laboratory testing to determine the Atterberg limits, natural moisture contents, grain-size distributions, organic contents and undrained shear strengths. The undrained shear parameters were obtained by laboratory vane, unconfined compression and unconsolidated undrained triaxial tests. Field and laboratory test results are plotted on the Borelog sheets accompanying this report.

#### 4. SUBSOIL CONDITIONS:

##### 4.1) General:

Soil conditions change considerably within the area investigated due to the geological history of the terrain. The high ground north of the lake is built up mainly of shale bedrock, which near the surface and along the slopes, is weathered to such an extent that it may be regarded as a cohesive, fine-grained deposit. The south shore of the pond consists of sands and gravels, which are cemented to form a conglomerate. The chemical bond is likely due to the high calcium carbonate content of the old lake-shore. The embankment, carrying the C.N.R. and C.P.R. tracks, is predominantly gravelly sand, whereas at the bottom of the pond and near the shores, the deposits were found to be highly organic clays, silts and sands of recent lacustrine origin. A concise description of each soil type is presented below.

##### 4.2) Clayey Silts with Fragments of Shale (Decomposed Shale Bedrock):

The material is derived from the underlying red shale bedrock. The transition from solid rock to a plastic clayey silt, with only some rock fragments, is very gradual. At certain locations a second layer of this red, clayey silt was also observed overlying organic clays. This material is not "in situ", but was likely transported by means of landslides or erosions. The consistency of the natural deposit, measured by standard penetration tests, is usually very high, averaging over 100 blows/ft.; the consistency of the transported upper layers vary between 16 and 34 blows/ft., corresponding to very stiff consistency. The undrained shear strength of the soil, based on field vane, laboratory unconfined and triaxial compression tests, ranged from 700 PSF to over 4000 PSF. For stability analyses, 1000 PSF shear strength was assigned to the transported layers, while the lower stratum was considered to have 4000 PSF undrained shear strength.

The average value of plastic limits may be taken to be 16%, the liquid limit 28%, and the average bulk density around 140 PCF.

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.3) Organic Deposits:

This recent organic sediment forms the lake bottom and was also observed in B.H. #12 near the edge of the pond between layers of decomposed shale. The overall thickness of the layer in the boreholes was found to be between 50 ft. and 75 ft. Owing to the high organic contamination and the very soft, loosely packed nature of the deposit, it is an entirely unaccentable engineering material. The large percentage of organic matter renders the stratum very highly plastic, with limits of plasticity around 80% and liquid limits of 130% and over. The natural moisture contents lie around or above the liquid limits, indicating unstable, soft and weak structure. Bulk densities of as low as 70 - 80 PCF were measured. In lower elevations, irregular seams of silts and sands were noticed, again with layers of pure organic and vegetable matter. This portion of the stratum has low plasticity and somewhat higher bulk densities.

Field and laboratory shear tests on the upper portion of the deposit yielded values around  $C = 200 - 250$  PSF, gradually increasing with depth up to  $C = 800 - 1000$  PSF. For stability analyses within the upper portion  $C = 300$  PSF, and within the lower  $C = 600$  PSF shear strength values were used.

4.4) Sands (Fill):

In boreholes #17 to 20 inclusive - drilled on the railway embankment - sands, gravelly sands and silty sands were found extending down to approx. el. 230 ft., some 20 ft. below pond water level. This granular material had probably been excavated from the cuts within the sand and gravel bar south of the pond. The overall relative density of the fill is quite poor, ranging from loose to compact, with penetration 'N' values between 8 and 15 blows/ft. Tests of grain-size analyses resulted in 15 - 17% gravel, 60 - 70% sand, and 15 - 20% silt and clay binder within the samples tested. The natural moisture contents were relatively low, around 8 - 12%.

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.5) Shale Bedrock:

The bedrock was proved by diamond drilling at 8 borehole locations. As was mentioned earlier, the transition between the decomposed and sound rock was somewhat ambiguous, nevertheless, it was clearly established that the rock surface dips rather steeply towards the pond. The highest sound rock surface was hit at el. 235 ft. in B.H. #9, while the rock at the middle of the pond was found at el. 154 - 155 ft. The shale belongs to the calcareous Queenston formation, having predominantly red colour with inter-bedded greenish layers. This type of rock is known to weather badly and quite fast when exposed to the atmosphere, however, in situ it is a competent foundation material.

5. GROUNDWATER CONDITIONS:

The pond water level during the time of field investigation, was around el. 249.5 ft. The depth of water at the middle of the pond may be taken to be 10 ft.

The groundwater level in the boreholes, placed on the low-lying land north of the pond (B.H.'s #9, 10, 12 and 16) was established near ground level, draining towards the pond. In two locations (B.H.'s #9 and 12) some slight artesian pressure was noticed within the sandy seams.

The groundwater level below the railway embankment at the Mercer Glen's side was hit at el. 255 ft.; at the big pond's side, at el. 252 ft. This observation is indicative that seepage occurs through the railway fill from the higher-lying Mercer Glen (water level el. 255 ft.) toward the big pond (water level el. 249.5 ft.).

6. DISCUSSION AND RECOMMENDATIONS:

The investigation was carried out in order to determine the feasibility of the three alternative proposals, presented by the consultant, C. C. Parker & Associates.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

Comments and recommendations concerning each proposal are dealt with separately in the subsequent paragraphs.

6.1) Realignment of the Highway Along Line G (G-1 & G-2):

(a) This proposal would involve the construction of an up to 65-ft. high embankment adjacent to the existing 75-ft. high Hwy. #403 fill. During the construction of the Hwy. #403 fill in 1961, a failure took place, which displaced the soft material under the toe and heaved it up in the form of a mudwave. By placing additional fill to act as a berm, the embankment regained its equilibrium, notwithstanding some shallow failures caused along the slopes during recent years and, at present, longitudinal cracks are also visible at and near the crest of the fill.

(b) No soft organic material was found below the toe of the existing fill, but the toe of the proposed new fill between Sta. 203+00 and 215+00 would extend to, or well beyond the edge of water, where the subsoil consists of 50 - 75 ft. deep, soft organic stratum.

Stability analyses, carried out by an electronic computer, proved that such an embankment will not be stable even by using extensive berms. The construction of a stable section would be a major engineering undertaking, and would probably involve not only a number of counter-balancing berms, but dredging or displacing a portion of the soft organics and staging the construction. It is very likely that under such an embankment large differential settlements would occur, due to the high compressibility and the lateral displacement of the remaining soft, organic subsoil. The settlements would continue for a considerable period of time; this, in turn, would result in frequent and expensive maintenance.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.1) Realignment of the Highway Along Line G (G-1 & G-2): - (cont'd.)...

(c) Similar problems, probably even on a larger scale, could be encountered by building the high embankment over Mercer Glen. Subsoil consists of an extensive deposit of soft, organic clay, some 30 - 40 ft. depth of which was dredged from the Hwy. #403 crossing and disposed of here.

(d) The existing railway embankment separating Mercer Glen from the big pond, shows no signs of instability at present. It is, however, significant that below the approx. 80-ft. high granular fill some 20 ft. of organic soil was found to be missing, displaced by decomposed shale and gravelly sand fill material. The displacement of the organic material might have been caused either by dredging prior to the construction of the fill, or by earlier failures during or right after construction, or by large, long-term settlements. It could, of course, also have occurred by the combination of above circumstances.

(e) Based upon the foregoing reasons, it is felt that the engineering and economic feasibility of the above scheme is very poor, consequently it is recommended that Line G (G-1 & G-2) be abandoned.

6.2) Replacement of Bridge #3 by a High Embankment:

(a) This proposal calls for the replacement of Bridge #3 by a high embankment, with the stipulation that traffic be maintained across the bridge during the construction of the fill. The existing approx. 600-ft. long bridge crosses the big pond at a level some 100 ft. higher than the bottom of the lake.

(b) Subsoils below the pond, consist of an approx. 65 - 66 ft. thick, very soft to stiff, dark grey organic clay, underlain by about 20 ft. of clayey silt (decomposed shale) of stiff to hard consistency, which, in turn, is followed by shale bedrock.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.2) Replacement of Bridge #3 by a High Embankment: (cont'd.) ...

(c) The construction of an embankment of about 100-ft. height, over a very deep deposit of soft, organic clay, would involve all the problems discussed under Section (6.1). In addition, the placing of the enormous quantities of fill will almost certainly damage the piles below the footings of the bridge.

It is, therefore, concluded that the construction of such an embankment is not economical, thus the proposal should be discarded.

6.3) Reconstruction of Bridge #3 to Four Lanes:

(a) The reconstruction of the bridge is planned to be carried out by maintaining the traffic during construction. The centre-line of the new bridge would be shifted approx. half of its width either eastward or westward, depending upon soil conditions. Subsoils below the pond were discussed previously.

At the location of the north abutment, hard decomposed shale was found, gradually becoming shale bedrock at the lower elevations. At the site of the south abutment sand and gravel deposits (conglomerate) were encountered, the relative density of which was measured to be very dense below el. 320 ft.

(b) Based upon soil and bedrock conditions, the scheme to replace Bridge #3 by an improved bridge, appears to be the acceptable one. It is therefore recommended that the structure be replaced by another bridge. From a foundation or stability point of view, constructing the new bridge either to the east or west side of the existing bridge, would pose no special problem.

(c) Assuming the abutments of the proposed bridge to be at or near the locations of the existing ones, they may be supported on spread footings. The base of the footing of the north abutment may be placed at or below el. 325.0 ft., and that of the south abutment at or below el. 319.0 ft. A minimum of four ft. cover

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.3) Reconstruction of Bridge #3 to Four Lanes: (cont'd.) ...

(c) (cont'd.) ...

for frost protection should be provided on the footings. Up to 7.0 TSF safe design loads may be recommended on the footings at aforementioned elevations.

The piers of the proposed bridge should be supported on end-bearing piles, driven to refusal in the shale bedrock. The locations of the proposed piers are not decided upon as yet. Additional borings will be necessary at the exact locations of the piers in order to establish bedrock elevations. For information purposes, the elevations of the shale bedrock at the locations of the existing piers, are listed as follows:

Location of Pier	Borehole No.	Elevation of Bedrock (Ft.)
North	2	198.5
Centre	3	155.7
South	4	181.0

The full structural strength of the particular pile used might be employed as design load, provided the piles are supported on sound bedrock.

7. MISCELLANEOUS:

The field investigation, carried out during the period November 5 - December 2, 1968, was supervised by Messrs. P. Payer, G. Allen and H. Szymanski, Project Foundation Engineers. Equipment used was owned and operated by F. E. Johnston Drilling Co. Ltd. of Toronto. Mr. A. K. Barsvary, Senior Foundation Engineer, was in charge of the entire project, and also prepared this report. The report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

December 1968



APPENDIX I



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 68-F-78

LOCATION Hwy. #2, Sta. 207 + 05, 30' Lt. of C

ORIGINATED BY HS

W.P. 113-66

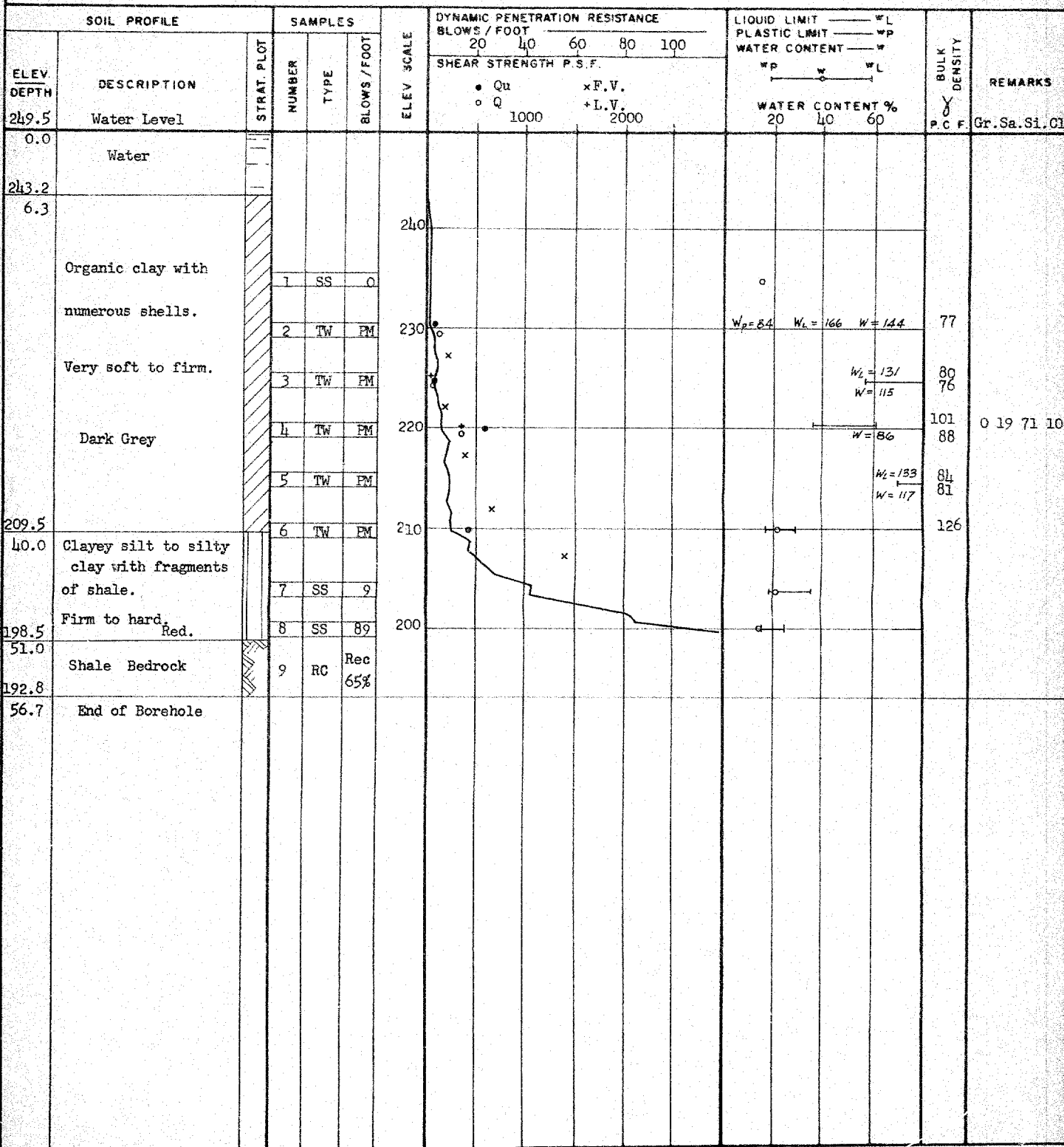
BORING DATE Nov. 19-20, 1968

COMPILED BY akb

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing

CHECKED BY



## MATERIALS &amp; TESTING DIVISION

RECORD OF BOREHOLE NO.3

FOUNDATION SECTION

JOB 68-F-78

LOCATION Hwy. #2 Sta. 208 + 70; 30' Lt. of C

ORIGINATED BY HS

W. P. 113-66

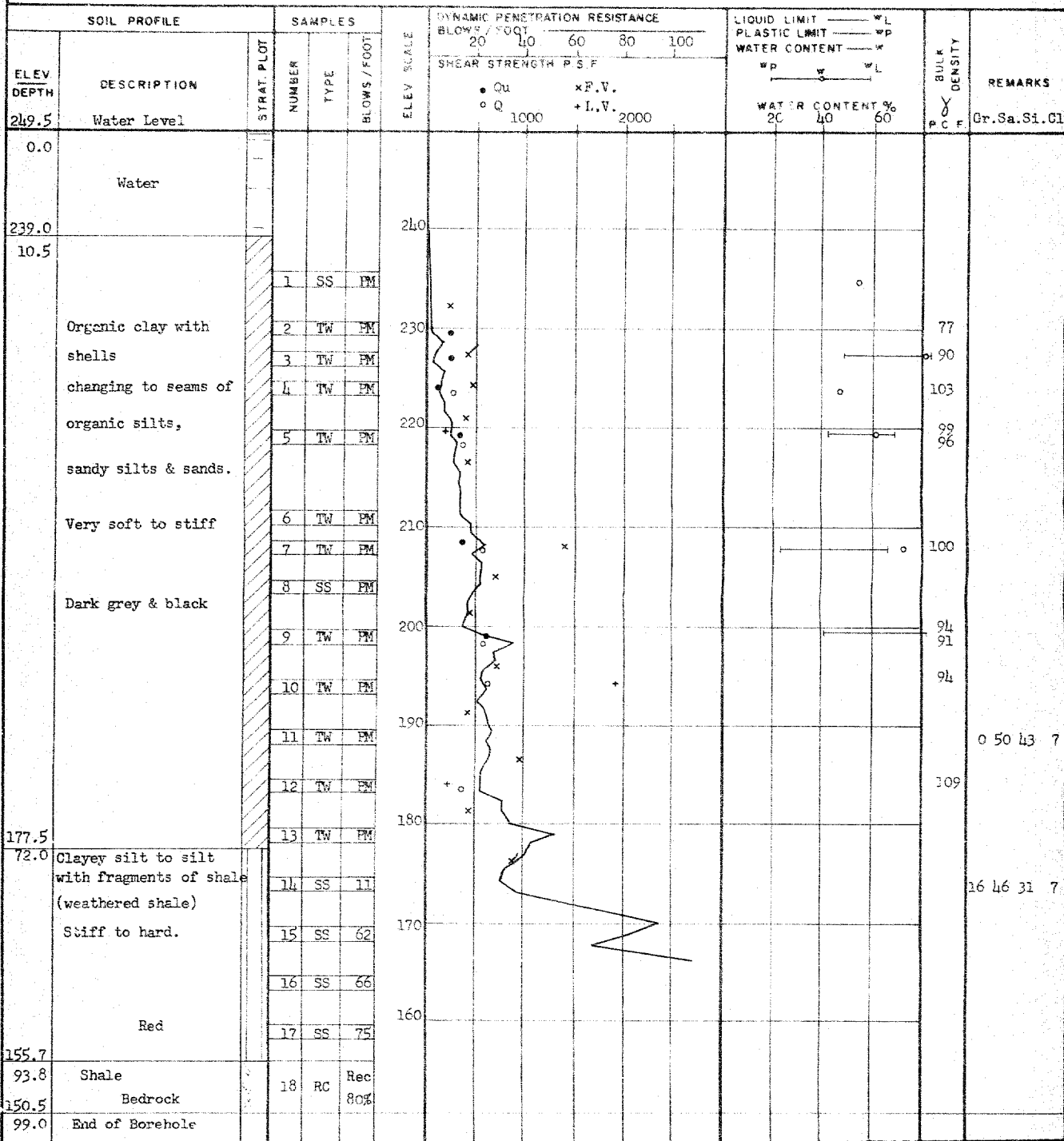
BORING DATE Nov. 22 - 25, 1968

COMPILED BY \_\_\_\_\_ AKB

DATUM Geodetic

Washboring, NX Casing

CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 68-F-78

LOCATION Hwy. #2 Sta. 210 + 32, 30' Rt. of C

ORIGINATED BY HS &amp; GA

W.P. 113-66

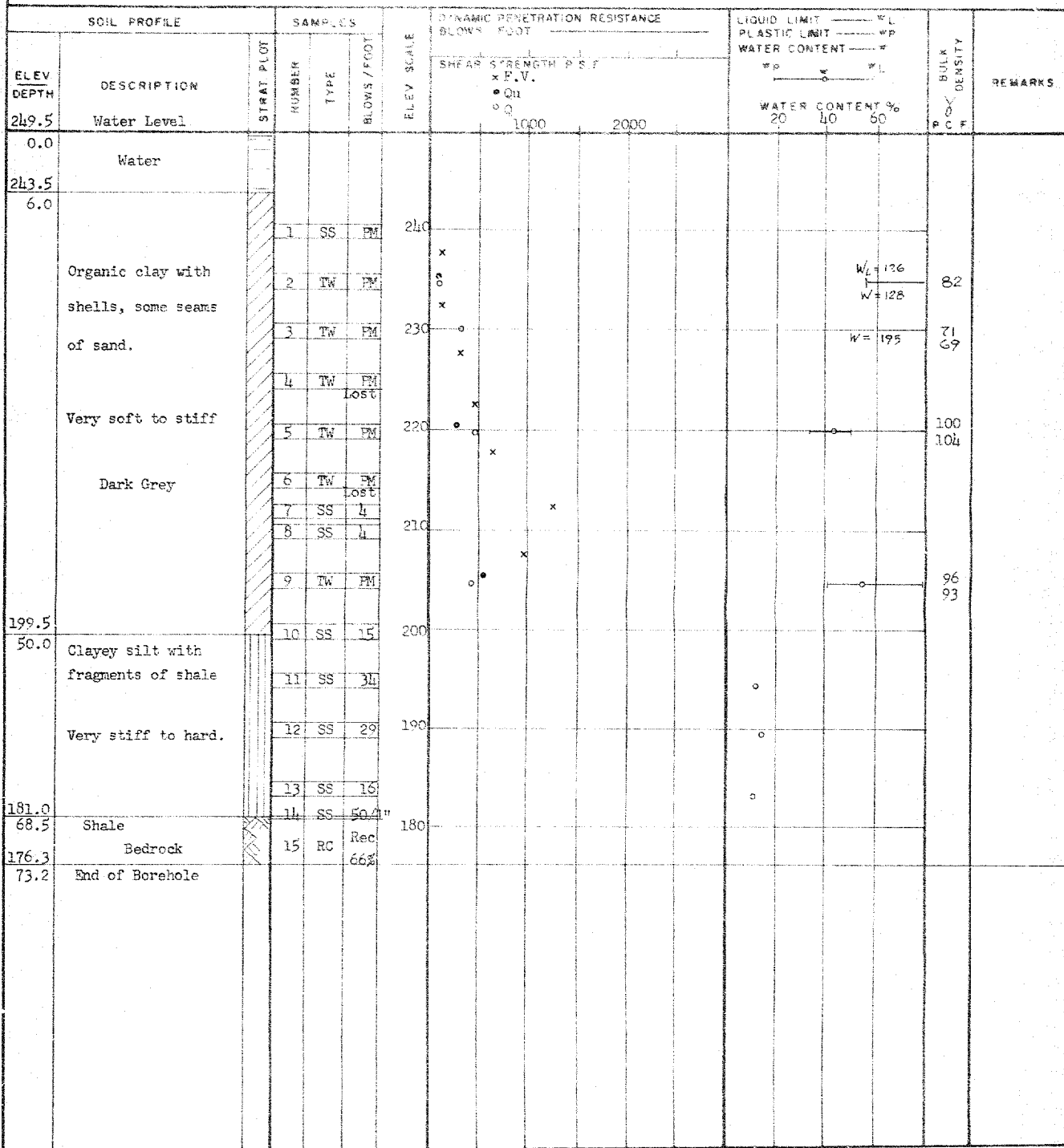
BORING DATE Nov. 27-29, 1968

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing

CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 68-F-78

LOCATION Hwy. #2 Sta. 211 + 75, 25' Lt. of C

ORIGINATED BY GA

W P 113-66

BORING DATE Nov. 25, 1968

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY

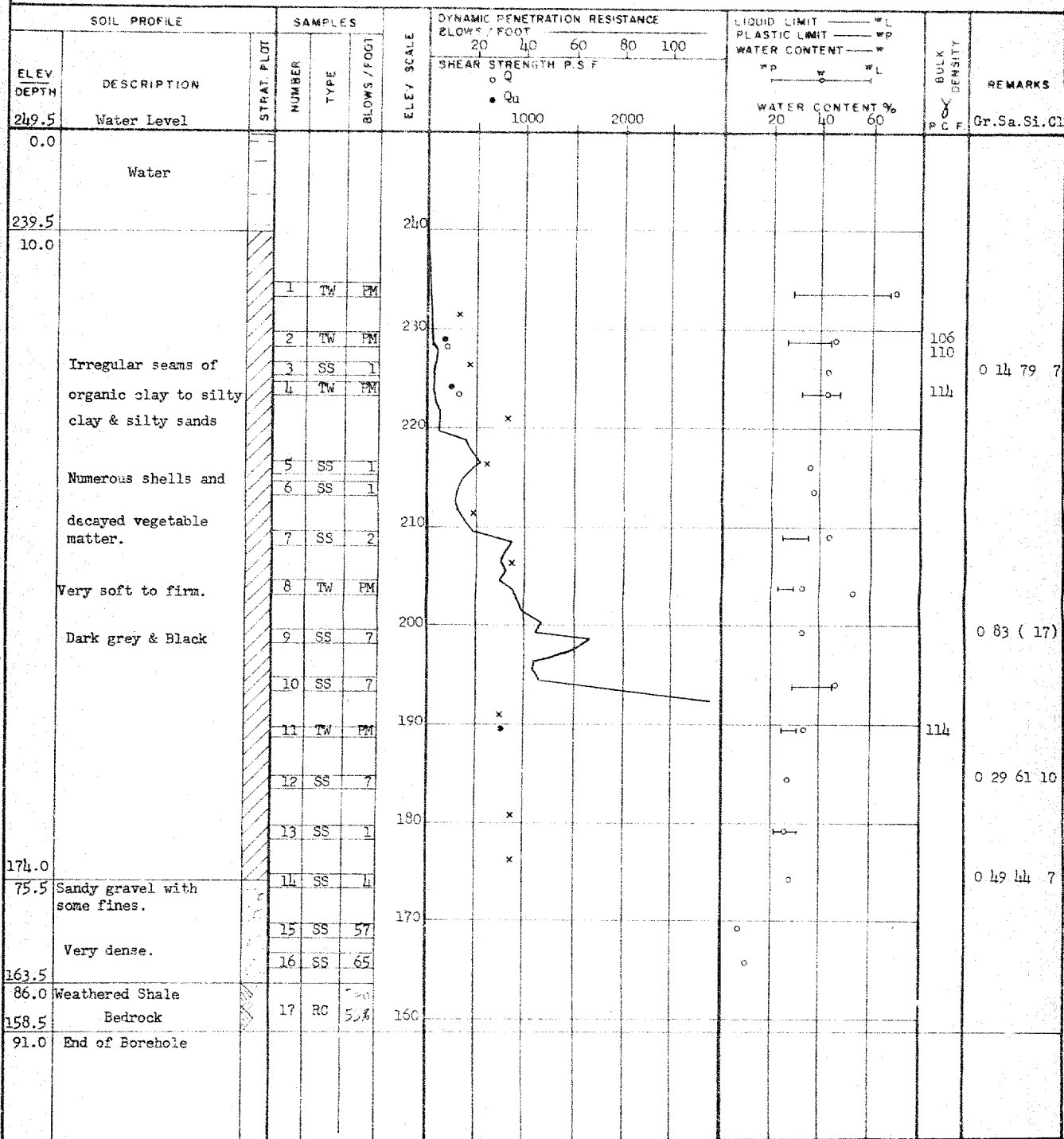
SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — %		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOW / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — %	WATER CONTENT — %		
339.5	Ground Level										
0.0	Silty sand with gravel.	1	SS	6							
	Loose to very dense	2	SS	24	330						0.68 ( 32 )
		3	SS	15							
316.5		4	SS	80	320						
23.0	End of Borehole	5	SS	100	0"						

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 68-F-78 LOCATION Hwy. #2, Sta. 208 + 20 250' Lt. of Ø ORIGINATED BY HS  
 W.P. 113-66 BORING DATE Nov. 19 = 22 1968 COMPILED BY AKB  
 DATUM Geodetic BOREHOLE TYPE \_\_\_\_\_ CHECKED BY AK







FOUNDATION SECTION

ORIGINATED BY AKB

COMPILED BY AKB

CHECKED BY

[illegible]

## RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

## MATERIALS &amp; TESTING DIVISION

JOB 68-F-78 LOCATION Line G; Sta. 207 + 75 70' Lt. of C ORIGINATED BY AKB  
 W.P. 113-66 BORING DATE Nov. 8, 1968 COMPILED BY AKB  
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY JH

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$		BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	WATER CONTENT %			
256.4	Ground Level										Gr.Sa.Si.Cl
0.0	Clayey silt with numerous fragments of shale.  Soft to firm.  Red		1	SS	3						
			2	TW	FM/3"	250					
			3	SS	6						
			4	TW	FM/3"						
			5	SS	12	240					
235.4			6	SS	50/2"						
21.0	Weathered shale		7	RC	20"						
231.4	Bedrock				Rec						
25.0	End of Borehole										

DYNAMIC PENETRATION RESISTANCE: BLOWS / FOOT (20, 40, 60, 80, 100)  
 SHEAR STRENGTH P.S.F. (1000, 2000)  
 •  $Q_u$   
 WATER CONTENT % (20, 40, 60)  
 BULK DENSITY  $\gamma$  (144)  
 REMARKS: 34 26 33 7  
 235.2  
 Rises to 257.

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 68-F-78

LOCATION Line G; Sta. 208 + 08, 230' Lt. of C

ORIGINATED BY AKB

W.P. 113-66

BORING DATE Nov. 5 - 6, 1968

COMPILED BY AKCB

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

JDB 68-F-78

LOCATION Line G; Sta. 268 + 30, 370' Lt. of Ø

ORIGINATED BY PP

W. P. 113-66

BORING DATE Nov. 5 - 6, 1968

COMPILED BY AKCB

DATUM \_\_\_\_\_ Geodetic

BOREHOLE TYPE Washboring, NX Casing

CHECKED BY                     

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT	W <sub>L</sub>	W <sub>P</sub>		
249.5	Water Level									Gr.Sa.Si.Cl
0.0										
242.5	Water									
7.0	Heavily organic clay, stratified.									
	Very soft to soft.		1	SS	0					
	Dark Brown		2	TW	PM					
224.5			3	SS	1.5					0 20 76 4
25.0			4	SS	3					4 42 44 10
	Irregularly laminated silts & silty sands with organic matters.		5	SS	5					0 68 28 4
			6	SS	29					
	Very loose to compact &		7	SS	6					0 66 29 5
	Soft to stiff		8	SS	5					0 68 28 4
			9	SS	0					0 36 57 7
			10	SS	1					0 17 73 10
	Brown & Grey		11	SS	4					0 66 28 6
			12	SS	1.5					9 51 36 4
174.0			13	SS	16					
75.5	End of Borehole									
170.5										
79.0	End of Cone Test									



FOUNDATION SECTION

ORIGINATED BY DE

COMPILED BY AKB

CHECKED BY

[illegible]

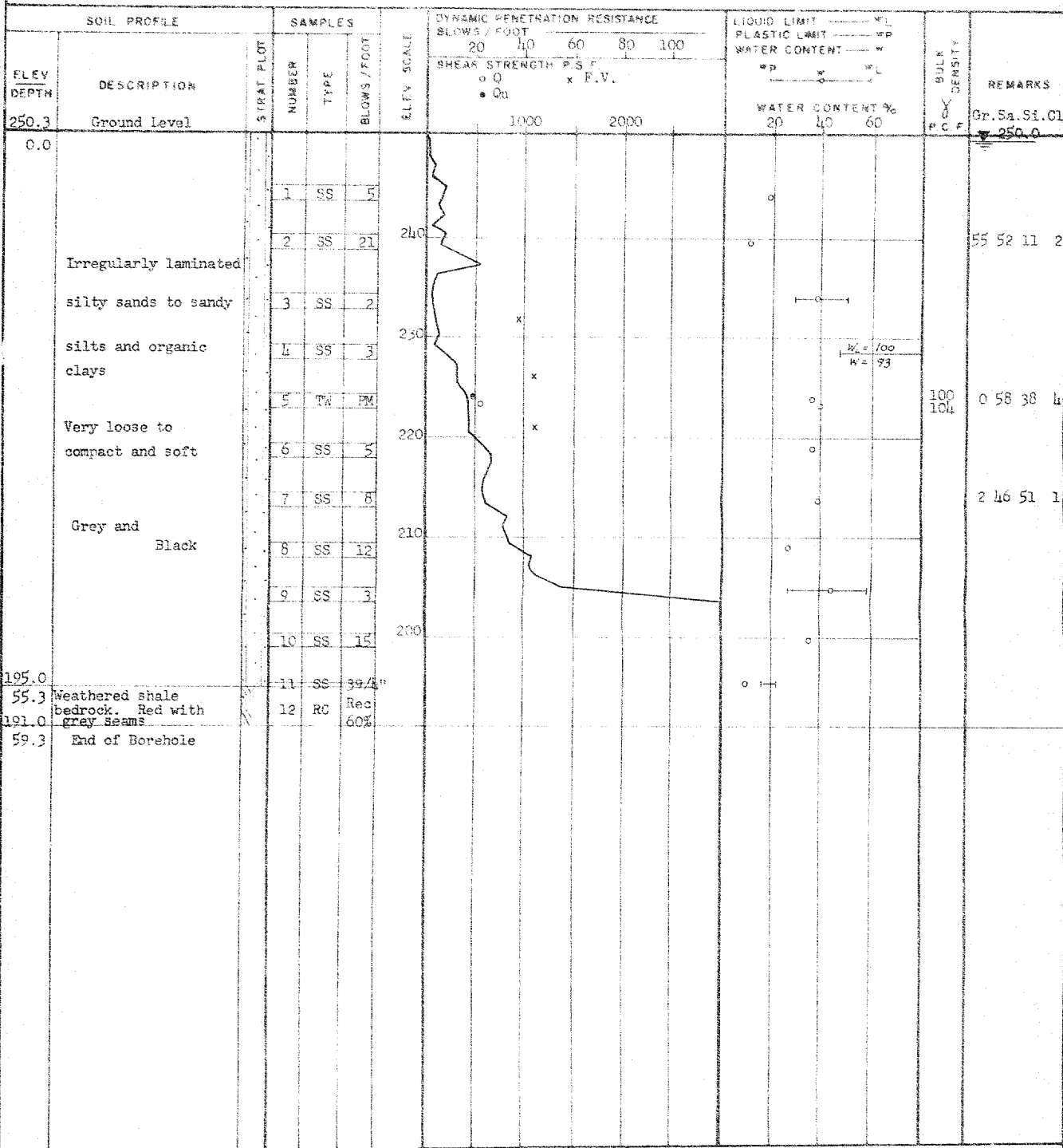
DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

JOB 68-F-78 LOCATION Line G; Sta. 220 + 05 155' Lt. of E  
 W.P. 113-66 BORING DATE Nov. 8-12, 1968 ORIGINATED BY PP  
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing COMPILED BY AKB  
 CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 68-F-78

LOCATION Line G; Sta. 220 + 85, 30' Lt. of G

ORIGINATED BY GA

W.P. 113-66

BORING DATE Nov. 20 + 21, 1968

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— %		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	W.P.		
318.7	Ground Level												
0.0	Clayey silt, some sand. Fill		1	SS	5								
	Firm to stiff		2	SS	8	310							
305.7			3	SS	12								
13.0			4	SS	9	300							
			5	SS	14								
	Gravelly sand with some silt & clay		6	SS	12	290							
	Fill					280							
	Loose to compact					270							
	Brown					260							
						250							
						240							
						230							
229.7	Clayey silt with fragments of shale. Red		7	SS	10								
	Soft.					220							
218.7	Organic clay and clayey silt with shells.		8	A.S.A.									
100.0	Very soft to firm					210							
203.7	Grey												
115.0	End of Borehole												

17 63 17 3

252.



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 18

FOUNDATION SECTION

JOB 68-F-78

LOCATION Line G; Sta. 221 + 90 ✓

ORIGINATED BY AKB

W. P. 113-66

BORING DATE Nov. 14, 1968

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY

SOIL PROFILE		SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LQUID LIMIT ——— % PLASTIC LIMTY ——— WP WATER CONTENT ——— W	BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT				
315.3	Ground Level					
0.0	Clayey silt fill.					
305.3	Very stiff	1 SS 21				
10.0		2 SS 10				
		3 SS 11				17 65 13 5
		4 SS 8				
	Silty sand with some gravel.	5 SS 13				9 72 13 6
	traces of clay fill.	6 SS 15				
	Loose to compact					
						$\nabla$ 255.0
235.8		7 SS 13				
79.5	End of Borehole					

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

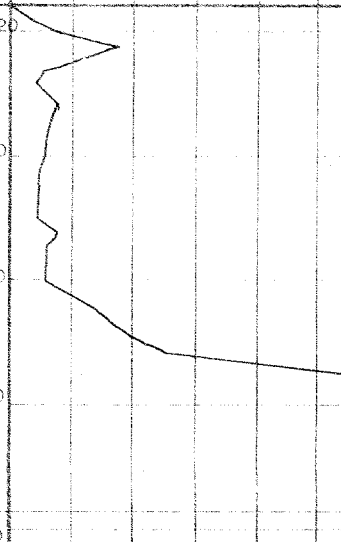
JOB 68-F-78 LOCATION Line G; Sta. 219 + 90, 125' Rt. of W ORIGINATED BY GA  
 W P 113-66 BORING DATE Nov. 19 - 20, 1968 COMPILED BY AKS  
 DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY AKS

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT	WATER CONTENT %		
321.7	Ground Level								
0.0	Gravelly sand with some silt.	1	SS	15	320				
	Black and Brown	2	SS	11	310				
	Compact	3	SS	11					
304.7		4	SS	31	300				
17.0	Clayey silt with traces of sand	5	SS	39					
	Disintegrated shale	6	SS	100	290				
	Reddish brown	7	SS	100/3"					
	Hard	8	SS	100/2"					
281.2		9	SS	100/3"					
40.5	End of Borehole				280				

DYNAMIC PENETRATION RESISTANCE  
 BLOWS / FOOT  
 20 40 60 80 100  
 SHEAR STRENGTH P.S.F.

LIQUID LIMIT ——— %  
 PLASTIC LIMIT ——— %  
 WATER CONTENT ——— %  
 "P" ——— "L"  
 WATER CONTENT %  
 20 40 60

BULK DENSITY  
 γ<sub>POF</sub>  
 REMARKS  
 Gr.Sa.Si.Cl  
 271 (20)



## FOUNDATION SECTION

ORIGINATED BY GA

COMPILED BY AKR

CHECKED BY

SOIL PROFILE		SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWE / FOOT	LIQUID LIMIT ———— PLASTIC LIMIT ———— WATER CONTENT ————	BULK DENSITY UNIT WEIGHT	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER TYPE BLOWS / FOOT	20 40 60 80 100		
320.6	Ground Level					Cr.Sa.Si.Cl
0.0	Clayey silt traces of gravel. Stiff.		1 SS 13			
309.6	Grey Brown		2 SS 15			
11.0	Gravelly sand with some silt.		3 SS 10			2 73 21 L
			4 SS 15			
			5 SS 14			16 71 ( 13)
	Compact		6 SS 15			
	Brown					
273.6						
47.0	Clayey silt with traces of sand		7 SS 70			
264.6	Disintegrated shale Hard		8 SS 27			
56.0	Reddish Brown End of Borehole					

## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

<u>CONSISTENCY</u>	<u>'N' BLOWS/FT.</u>	<u>c LB./SQ.FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS/FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

### TYPE OF SAMPLE

SS	SPLIT SPOON	TW	THINWALL OPEN
WS	WASHED SAMPLE	TP	THINWALL PISTON
SB	SCRAPER BUCKET SAMPLE	OS	OESTERBERG SAMPLE
AS	AUGER SAMPLE	FS	FOIL SAMPLE
CS	CHUNK SAMPLE	RC	ROCK CORE
ST	SLOTTED TUBE SAMPLE		
	PH		SAMPLE ADVANCED HYDRAULICALLY
	PM		SAMPLE ADVANCED MANUALLY

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	LV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FV	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

## ABBREVIATIONS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
s	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_c$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$c_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
	INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
$\mu$	COEFFICIENT OF FRICTION
$S_r$	SENSITIVITY

### GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF $\sigma$
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF $\sigma$ TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

### STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

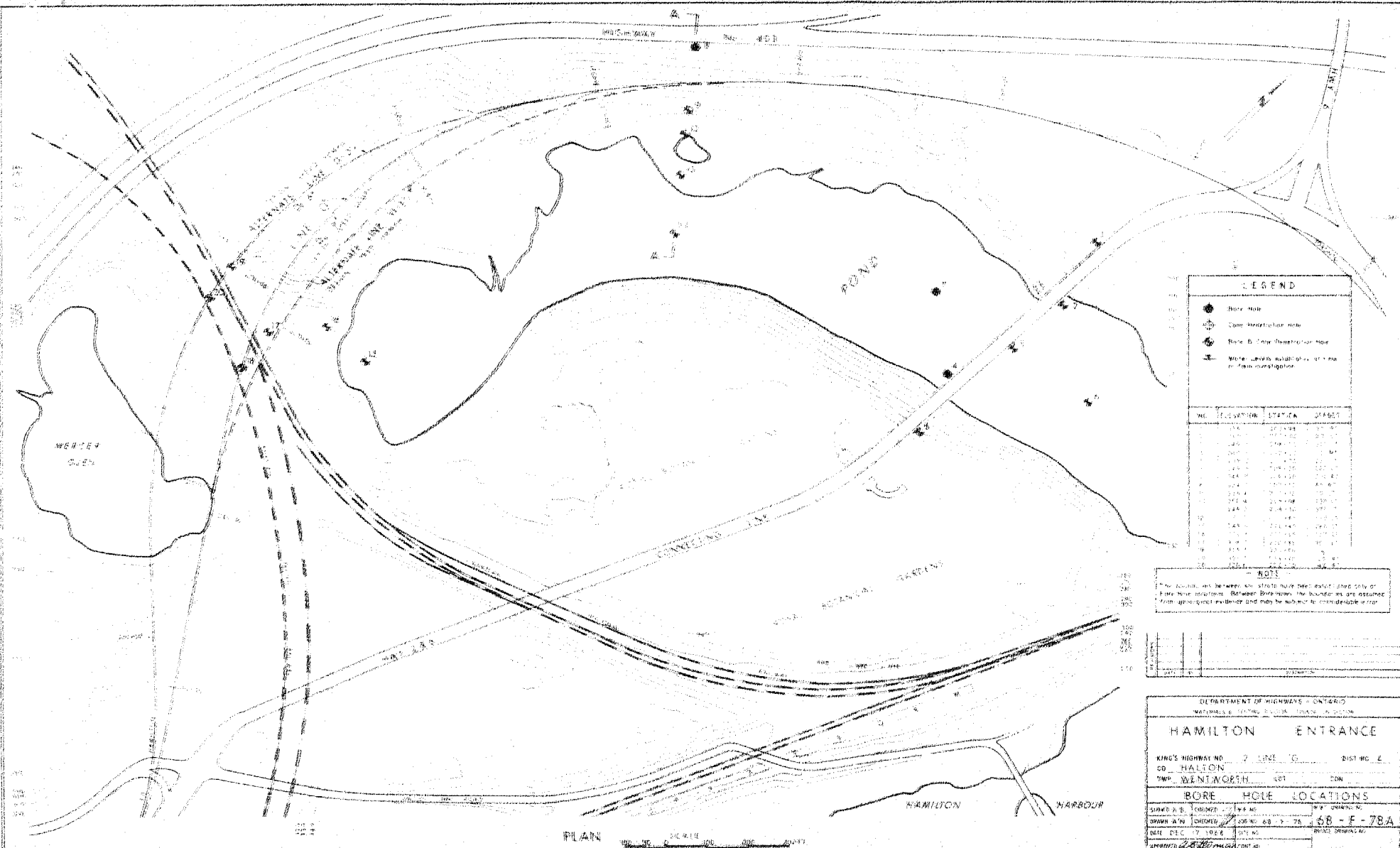
$a$	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT USED WITH VARIOUS SUFFIXES & EXPRESSIONS RELATING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



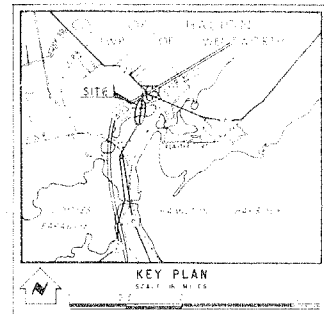
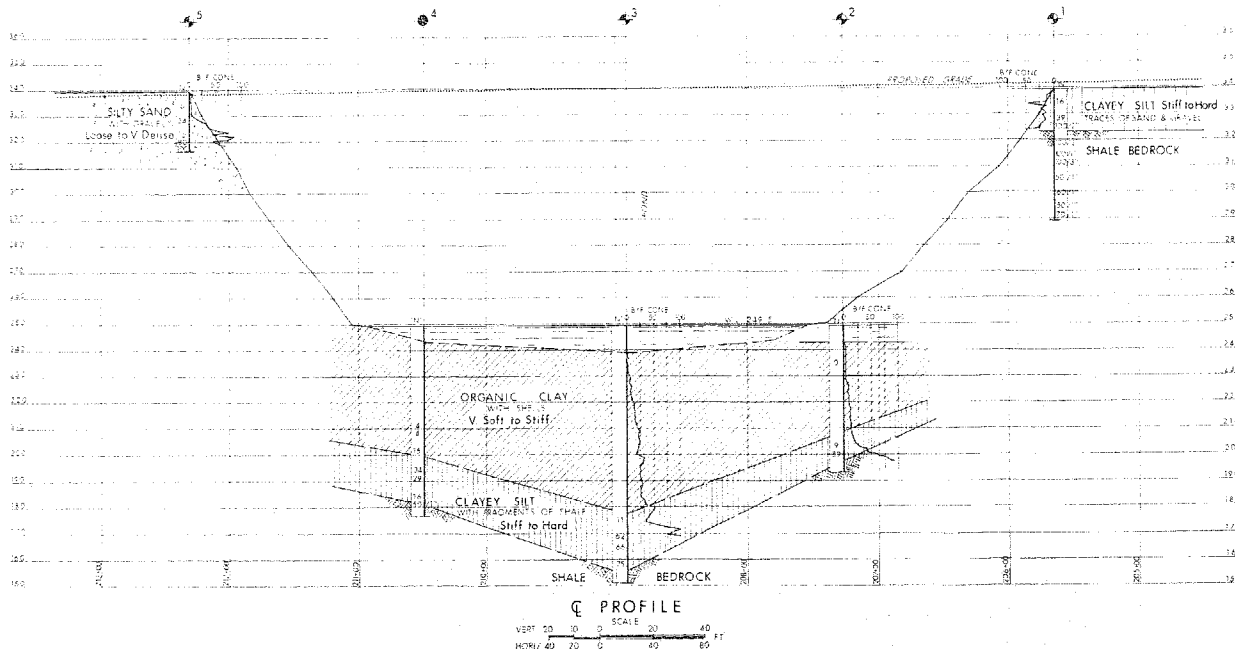
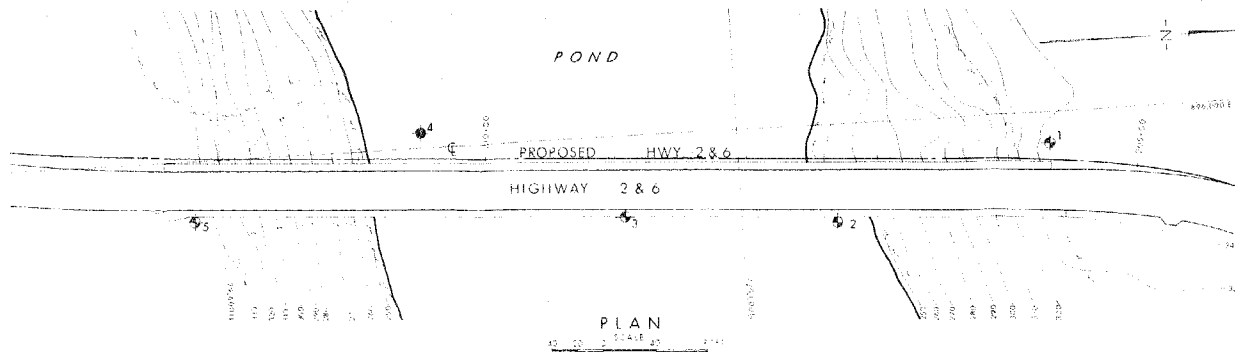
LEGEND			
	Bore Hole		
	Contour line		
	Bore Hole (Investigation)		
	Water level (Investigation)		
NO.	ELEVATION	STATION	DEPTH
1	100.00	100.00	10.00
2	100.00	100.00	10.00
3	100.00	100.00	10.00
4	100.00	100.00	10.00
5	100.00	100.00	10.00
6	100.00	100.00	10.00
7	100.00	100.00	10.00
8	100.00	100.00	10.00
9	100.00	100.00	10.00
10	100.00	100.00	10.00
11	100.00	100.00	10.00
12	100.00	100.00	10.00
13	100.00	100.00	10.00
14	100.00	100.00	10.00
15	100.00	100.00	10.00
16	100.00	100.00	10.00
17	100.00	100.00	10.00
18	100.00	100.00	10.00
19	100.00	100.00	10.00
20	100.00	100.00	10.00

NOTES  
The figures are between and above the bore holes and are not to be taken as absolute. Between bore holes the boundary is assumed from geophysical evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO			
HAMILTON ENTRANCE			
KING'S HIGHWAY NO.	7 LINE 'G'	DIST NO.	E
CD.	HAMILTON		
TWP.	WENTWORTH	LOT	CON.
BORE HOLE LOCATIONS			
SURVED BY	ENGINEER	DATE	DEC 17 1928
DRAWN BY	CHECKED	DATE	DEC 17 1928
APPROVED	BY	DATE	DEC 17 1928
PROJECT NO.		68-F-78A	

PLAN  
SCALE 1" = 100'





LEGEND				
	Bore Hole			
	Cone Penetration Hole			
	Bore & Cone Penetration Hole			
	Water Levels established on the of field investigation			
NO	ELEVATION	CONCRETE	REINFORCING	BAR
1	164.1	920.128	920.128	
2	164.3	730.374	730.374	
3	164.3	719.971	719.971	
4	164.4	714.171	714.171	
5	164.4	714.171	714.171	

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

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE - TOWN OF WENTWORTH

**BRIDGE N° 3**

KING'S HIGHWAY NO. 2 & 6 RELOCATED DIST NO. 4  
CO. HALTON  
TWP. WENTWORTH LOT 1 CON. 1

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBNO. A B CHECKED / W.P. NO. 113-00-02 W.P. DRAWING NO. 68-F-78C  
DRAWN S.O. CHECKED / JOB NO. 60-F-63  
DATE 2 OCT 1969 SITE NO. 1 BRIDGE DRAWING NO. 1  
APPROVED [Signature] JOINT NO. 1



## DEPARTMENT OF HIGHWAYS ONTARIO

## MEMORANDUM

To: Mr. E. C. Lovick,  
 Technical Materials Eng.,  
 4410 Section,  
 Room 14-A, Lab. Bldg.

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

ATTENTION:

DATE: October 10, 1969

OUR FILE REF.

IN REPLY TO

## SUBJECT:

## FOUNDATION INVESTIGATION REPORT

For

Hamilton Entrance Bridge No. 3,  
 Hwy. #2, District #4 (Hamilton)  
 K.C. 68-P-78 -- M.P. 113-66-03

We have reviewed the above mentioned foundation report with regard to the present proposals for the design of Bridge #3. We are of the opinion that sufficient information is contained in this report for your purposes. Accordingly, we have prepared a new Drawing #68-P-78C which can be included in the future Contract Documents. At the same time, we have found it necessary to revise Drawing #68-P-78B. Since we have recalled all of the copies of Report #68-P-78, we are now reissuing these with the new drawings inserted.

It would be of advantage to also attach this memo to your copy of the report.

If further information is required, please contact this office.

ATG/DeP  
 Attach.

*A. G. Sternac*  
 A. G. Sternac  
 PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. G. A. Davis (2)  
 J. A. Tremaskes  
 D. C. Farren  
 I. C. Campbell  
 G. E. Clelland  
 K. Wagle  
 H. Greenland  
 G. K. Hunter (2)  
 W. S. Melinyshyn  
 C. R. Hopkins (C. C. Parker & Associates)  
 B. A. Singh

Foundations Files  
 Gen. Files

## MEMORANDUM

FILES  
A48

C. S. Grebski  
Structural Design Engineer  
Design Services Branch  
West Bldg.

FROM: Foundation Office  
Design Services Branch  
Central Bldg. Room 107

DATE: December 13, 1971

ATTENTION:

OUR FILE REF.

IN REPLY TO

SUBJECT:

W. P. 113-66-01 Hamilton Entrance Bridge #1  
W.P. 113-66-03 Hamilton Entrance Bridge #3

68-F-78

Due to the sloping nature of the bedrock surface at the location of Pier E. Bridge #1, and the South Pier of Bridge #2, we recommend that these footings be supported on cast insitu concrete caissons installed with permanent steel liners and socketed into sound bedrock. For 36 inch dia. concrete caissons with 5 ft. sockets at Bridge #1 and 8 ft. sockets Bridge #3 a design capacity of 500 tons per caisson should be achieved.

We recommend that the work be written in the contract as three separate items and for your information and use we have prepared the necessary special provision which we believe will reduce the possibility of unreasonable claims by a contractor. These are as follows:

1. SUPPLY ALL EQUIPMENT NECESSARY TO INSTALL CAISSONS:

Under this item the Contractor shall supply all equipment necessary to install 36 inch diameter concrete caissons, caisson reinforcing steel and permanent steel liners as shown on the Drawings. Rock core samples recovered during the foundation investigation are available for inspection at the D.T.C. Laboratory in Downsview. Contractors are advised to inspect these samples prior to bidding in order to satisfy themselves as to the type and quality of the rock.

.....2

2. INSTALL CAISSONS IN OVERBURDEN:

Under this item the Contractor shall provide all materials and shall carry out all work necessary to install 36 inch diameter concrete caissons including 36 inch i.d. permanent liners and reinforcing steel within the overburden as shown on the drawings. Suitable holes to ensure a snug fit of the permanent liners shall be drilled to the bedrock surface. As the drilling proceeds the steel liners shall be installed in the holes and advanced so as to prevent cave in of the walls of the holes. When the holes have been drilled and lined to the bedrock they shall be unwatered and bases visually inspected by lowering a man into the hole to confirm the presence of bedrock. The holes shall then be advanced within the bedrock to a depth of five (or eight) feet below the surface of the sound bedrock as determined by the Engineer. The steel liners shall then be advanced to an elevation one foot below the sound bedrock surface as determined by the Engineer. The Contractor shall then unwater the holes and shall remove all soil or broken rock from the bases of the holes and shall provide facilities for inspection by the Engineer. After the holes have been inspected and found to be satisfactory by the Engineer, the reinforcing steel shall be placed and the concrete poured. Concrete shall be placed in the caissons in the dry and in sufficiently small quantities so as to prevent the formation of voids and shall be compacted by vibrating continuously from the bottom upwards. The  $\phi$  of each caisson installed shall not deviate from that shown on the drawings by more than 2% of the distance between the point considered and the top of the caisson.

For purposes of these special provisions the bedrock surface is defined as the actual surface of the bedrock, weathered or unweathered as it exists, immediately below the overburden, and the sound bedrock is defined as that portion of the bedrock which is unweathered and is considered to be structural sound.

All materials supplied by the Contractor must be approved by the Engineer.

Payment for this item shall be unit price per lin.ft. and the payment quantity for each caisson shall be the distance in lin. ft. along the caisson  $\phi$  between the caisson top as shown on the Drawings and the bedrock surface encountered within the caisson.

3. INSTALL CAISSONS IN BEDROCK:

Under this item the Contractor shall provide all materials and shall carry out all work necessary to install 36 inch diameter concrete caissons including 36 inch i.d. permanent steel liners and reinforcing steel, within the bedrock, as shown on the Drawings. Procedures to be followed are as described in the S.P. for Item No. . Payment for this item shall be unit price per lin. ft. and the payment quantity for each caisson shall be equal to the distance in lin. ft. along the caisson  $\frac{1}{2}$  between the bedrock surface and the base of the caisson.

For estimating purposes we would advise you that we consider the average depth of weathered rock at Bridge #1 to be 3 feet, and at Bridge #3 to be 5 feet. We suggest that you ammend the foregoing special provisions so as to be in accordance with normal Department procedures.

We would be pleased to discuss the foregoing with you at any time.

K. G. Selby

KGS:mt

K. G. Selby  
Supervising Foundation Engineer

cc: W. Lin  
B. Richardson  
M. Stoyanoff

Department of Transportation and Communications

XXXXXXXXXXXXXXXXXXXX

MEMORANDUM

Mr. G. R. Davis, (2)  
Structural Engineer,  
Design Services Branch,  
West Bldg., Downsview.

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

ATTENTION:

DATE: November 30, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation Report for  
Hamilton Entrance Bridge #3, District #4  
(Hamilton), W.O. 68-11078 - W.P. 113-66-03.

Please refer to our letter and attachment dated October 19,  
1971, on the above-noted subject and remove Drawings No.  
H 1078/4 and H 1078/6. Then replace these with the enclosed  
revised Drawings No. H 1078/4 and H 1078/6.

AGS/ao  
Attach.

cc: Messrs. D. W. Parren  
C. K. Hunter (2)  
C. R. Robertson  
G. O. E. Burkhardt  
T. J. Kovich  
A. Rutka  
B. J. Giroux  
B. A. Singh

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER.

Foundations Files  
Documents

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. Stermac,  
Principal Foundation Engineer,  
Foundation Office,  
Central Building.

FROM: C. S. Grebski,  
Structural Office.

ATTENTION:

DATE: November 4, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT: Hamilton Entrance Bridge #3,  
W.P. #113-66-03, Site #10-125,  
Highway #2 & #6, District #4.

*Trans 1/71*  
*68-F-78*

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*  
C. S. Grebski.  
Structural Design Engineer.

CSG/mh  
ENCL\*

cc: Foundation Office.

*All required corrections have been made. No comments.*

*ASR*

*9/1/72*

MEMORANDUM

Mailing Address:

Hwy. 401 & Keele Street, Box 2  
Downsview, Ontario.

UP 113-66-9  
REF: FUN. SOILS INVE.  
REPORT SITE  
of the proposed  
Relocation of  
Hwy. 401  
Dist. 4

TO: Mr. T. J. Kovich,  
Regional Materials Engr.,  
Soils Section,  
Room 134-A, Lab. Bldg.

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

ATTENTION:

DATE: October 3, 1969

OUR FILE REF.

IN REPLY TO

SUBJECT: Re: Functional Soils Investigation Report  
At the Site of the Proposed Relocation  
Of Hwy. #2 and at Bridge #3 --  
District No. 4 (Hamilton)  
W.J. 68-P-78 -- W.P. 113-66

(Report distributed January 15, 1969)

AMENDMENTS:

1. Existing Drawing 68-P-78B -- to be modified.
2. Drawing 68-P-78C -- to be added.

In order that these changes can be expedited quickly,  
and the report(s) returned to you, we would request that  
you return your copy(s) to the

Foundation Section,  
Materials & Testing Office,  
Room 107, Lab. Bldg.,  
Downsview, Ontario,

as soon as possible.

Thank you for your cooperation.

AGS/KdeP

cc: Messrs. B. R. Davis (2)

H. A. Tregaskes

D. W. Farren

I. C. Campbell

H. E. Clelland

A. Wiele

H. Greenland

G. K. Hunter (2)

W. S. Melnyshyn

C. R. Hopkins (C. C. Parker & Associates)

B. A. Singh

A. G. Sternbac  
PRINCIPAL FOUNDATION ENGINEER

68-F-78

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A.E. McKim,  
Asst. Construction Engineer,  
Structures,  
Central Building.

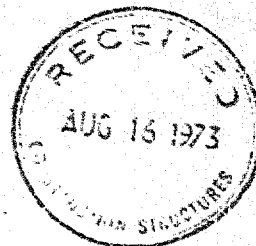
FROM: Structural Office,  
West Building.

ATTENTION:

DATE: August 15th, 1973.

OUR FILE REF.

(IN REPLY TO)



SUBJECT:

RE: Hamilton Entrance Bridge #3,  
W.P. 113-66-03,  
Site 10-125, Hwy. 2, District 4,  
Contract 72-119.

68-F-78  
(73-11-069)

Mr. K. Saarits of Hamilton District has contacted us regarding the embankment stability at the South abutment of the above structure. The existing slope appears fairly steep after the removal of trees & plants to accommodate the construction of the abutment foundation. A rain storm last week washed out some more of the embankment material. Since the abutment footing is supported by end bearing piles there is no immediate danger of failure, for the structure itself. However, to prevent further falling off of the embankment material some immediate measure has to be taken.

Mr. Saarits suggested to use the old concrete removed from the existing bridge deck as rip-rap material for the embankment. We think it is a good idea since it is probably the cheapest method.

Would you please get in contact with the District to proceed with the work. The rip-rap should be carried out from the top of pier footing to the top of the abutment footing with a thick<sup>ness</sup> of 2 ft. at toe tapered to 1 ft. at the top. The area will be determined in the field.

WL/sm

cc. K. Selby.

W. Lin

W. Lin,  
Regional Structural  
Design Engineer.



68-F-78

Mr. C.R. Robertson, P. Eng.,  
District Engineer,  
Hamilton.

Mr. P. McWatt.

August 21, 1973.

W.P. 113-66-03, Site 10-125, Contract 72-119,  
Hamilton Entrance Bridge No. 3, Hwy. 2 & 6, Dist. 4. (73-11-069)

This is in answer to the District query regarding suitable treatment of the slope at the south abutment of the above structure.

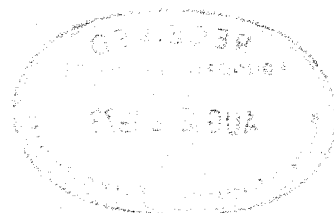
Because of rain, some of the embankment material has already been washed away. Although there is no fear of failure in the structure at present steps must be taken to prevent further erosion of the slope. The District suggestion of using the concrete from the old bridge as rip-rap would seem to be a good one and probably the cheapest. The Design section, Foundation section and ourselves are in agreement with this. Work should start as soon as practicable. We would suggest using an approximate thickness of 2 ft. at the toe reducing in thickness to about 1 ft. at the top. The area where rip-rap is to be used should be determined in the field to suit site conditions.

It is suggested also that the area where thickness of rip-rap changes should be a site decision to suit existing conditions and the material being used. Provision should also be made to keep surface water run-off from the road away from where it will do damage to the road.

PM/JC

P. McWatt, P. Eng.,  
Bridge Construction Engineer.

c.c. B. Davis, P. Eng.  
K. Selby, P. Eng. ✓  
K. Saarits  
R. Jasper



Mr. C. S. Grabski,  
Structural Design Engineer,  
Design Services Branch,  
West Bldg., Downsview.

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

September 3, 1973.

Mr. W. S. Lin.

Hamilton Entrance Bridge #3, South  
Abutment, East Structure W.P. 113-66-03  
Contract 72-119, W.O. 73-11069

*68-F-78*

This memo confirms recommendations given to you verbally by the writer on August 30, 1973, concerning the foundations for the south abutment of the above-mentioned structure presently under construction.

Six borings were carried out at the footing location in question by this Office during the period of August 24, to 30, 1973. These borings revealed the following subsoil stratigraphy below the footing base elevation of 319.0: about 10 ft. of very dense cemented sand and gravel followed by about 12 ft. of hard clayey silt with sand and gravel followed by about 12 ft. of hard clayey silt, all underlain by shale bedrock. In one borehole the cemented sand and gravel deposit was missing and contained instead, about 12 ft. of loose sand and gravel fill material. Depth to bedrock ranged from 26 to 36 ft. below elevation 319. The upper 2 to 3 ft. of the bedrock is weathered to varying degrees.

It is recommended that the new footing be supported on steel H piles driven about 2 ft. into the shale bedrock. These piles should be fitted with standard flange plates for reinforcement. The maximum allowable design capacity may be assumed in this case. For estimating purposes the following final tip elevations may be assumed:

Front Row	El. 290 - El. 281	(West to East)
Back Row	El. 287	

The foregoing was discussed with Mr. D. Waller, District Construction Engineer, on August 30, 1973.

Attached for your information are copies of the Record of Borehole sheets, Stratigraphical X Sections and a plan of Borehole Locations.

*K. G. Selby*

KGS/so  
Attch.

K. G. Selby,  
SUPERVISING FOUNDATIONS ENGINEER.

c.c. A. Rutka  
J. W. MacDougall  
D. A. Waller (2)  
J. M. Crannie  
B. J. Giroux

Foundations Files ✓  
Documents

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 1

JOB 73-11069

LOCATION STA 212+10.5 33' LT

ORIGINATED BY PK

W.P. 115-66-03

BORING DATE AUG 28 AND 29 1973

COMPILED BY PK

DATUM 1985 T.I.C.

BOREHOLE TYPE AUGER

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____		LIQUID LIMIT _____ $w_l$ PLASTIC LIMIT _____ $w_p$ WATER CONTENT _____ $w$ $w_p$ — $w$ — $w_l$ 10 20 30		BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT %			
329.2 0.0	GROUND LEVEL											
328.0 1.2	SOFT CLAY WITH CLAY GRAVEL SAND		1	SS	19	320						
327.0 2.0	HARD BROWN CLAY											
326.0 3.0	HARD CLAY		2	SS	100/1	320						
			3	SS	100/1	"						
	(GRAVEL) BROWN CLAY/FAUSE		4	SS	100/1	"						
311.2 20.0	CLAYEY SILT SAND SAND & GRAVEL FINE GRAVEL		5	SS	97	310						
			6	SS	40							
298.5 40.7	HARD CLAYEY SILT SILT HARD		7	SS	30	300						
						290						
283.7 55.5	PROBABLE BEDROCK END OF BORE HOLE		8	SS	50/2							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

(68-F-78)

## RECORD OF BOREHOLE NO 2

JOB 73-11669

LOCATION STA 212+10.5 23' LT

ORIGINATED BY PK

W.P. 113-66-03

BORING DATE AUG 27 1973

COMPILED BY PK

DATUM GEODETIC

BOREHOLE TYPE AUGER

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$ 10 20 30	BULK DENSITY $\gamma$	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT						SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE
359.4 0.0	GROUND LEVEL									P.C.F.	GR.SA.SI.CL.
	SANDY SILT WITH CLAY										
	LEADISH BROWN										
358.4 1.0	COMPACT		1	SS	14	530					
	SANDY BROWN										
	COMPACT										
357.4 2.0	SANDY SILT		2	SS	100%	320					
	GRAVEL AND (EXPANDED) SILT		3	SS	100%						
	BROWN		4	SS	100%						
	WIDE TO NARROW		5	SS	32	310					
356.4 3.0	SANDY SILT		6	SS	42						
355.4 4.0	SANDY GRAVEL TILL (HARD)										
354.4 5.0	CLAYEY SILT		7	SS	36	300					
	CLAY										
353.4 6.0	HARD		8	SS	100%						
	6 INCHES		9	SS	28%	270					
352.4 7.0	SANDY SILT										
351.4 8.0	SANDY SILT										
350.4 9.0	SANDY SILT										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## (68-F-78) RECORD OF BOREHOLE NO 3

JOB 73-11069

LOCATION

STA 212+10.5 12' LT

ORIGINATED BY PK

W.P. 113-66-03

BORING DATE

AUG 29 1973

COMPILED BY PK

DATUM GEODETIC

BOREHOLE TYPE

PUGER

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$	BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
339.0 0.0	GROUND LEVEL									
	SANDY SILT WITH CLAY (Brown)									
	compact		1	SS	19	330				
327.0 12.0	SAND SOME GRAVEL AND CLAY		2	SS	5	320				
	Blownd		3	SS	1					
	VERY LOOSE (fill) sand		4	SS	4	310				
307.0 32.0	SANDY SILT WITH SAND AND GRAVEL		5	SS	55					
302.0 37.0	SANDY SILT (CRS)		6	SS	31	300				
294.2 44.8	SANDY SILT (CRS) END OF BOREHOLE		7	SS	10 1/2					

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

(68-F-78)

## RECORD OF BOREHOLE NO 4

JOB 73-11069

LOCATION

STA 212+28.5 33' LT

ORIGINATED BY PK

W.P. 113-66-03

BORING DATE

AUG 23 &amp; 24 1973

COMPILED BY PK

DATUM CRODATIC

BOREHOLE TYPE

AUGER

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$ 10 20 30	BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
339.4 0.0	GROUND LEVEL									P.C.F. GR.SA.SI.CL
	SAND									
	REDISH		1	SS	6	330				
	BROWN									
	LOOSE		2	SS	6					
327.4 12.0	SANDY SILT WITH CLAY									
323.7 15.0	SANDY SILT		3	SS	100/ft					
	SAND GRAIN GRAVEL		4	SS	49	320				
	AND SHT		5	SS	100/ft					
	(GRAVEL) MEDIUM		6	SS	100/ft					
313.4 26.0	CLAYEY SILT WITH									
	SAND FILL		7	SS	26	310				
306.4 33.0	GRAVEL									
	CLAYEY SILT WITH		8	SS	41					
301.4 38.0	GRAVEL									
	CLAYEY SILT		9	SS	64	300				
	GRAVEL		10	SS	43					
289.7 50.0	RED BROWN SHALE		11	SS	100/ft	290				
276.3 53.2	END OF BOREHOLE		12	SS	100/ft					

DESIGN SERVICES BRANCH

(68-1-78)

RECORD OF BOREHOLE NO 5

FOUNDATIONS OFFICE

JOB 75-11061

LOCATION STA 212 + 28.5 23' 67"

ORIGINATED BY PK

WP 113-66-03

BORING DATE AUG. 27 AND 28 1973

COMPILED BY PK

DATUM GROUND SURFACE

BOREHOLE TYPE AUGER

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$		BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % $W_P$ $W$ $W_L$ 10 20 30			
889.0 00	GROUND LEVEL											P.C.F. GR.SA.SI.CL
	CLAYEY SILT WITH CLAY					280						
	REDISH BROWN LOOSE											
			1	SS	7							
314.8 177			2	SS	7	320						
	AND SOME GRAVEL AMBI-SKY (CLAYEY)		3	SS	1094							
	BROWN WIND TO SURFICINE		4	SS	1094							
307.8 312			5	SS	37	310						
	CLAYEY SILT SOME GRAVEL FINL		6	SS	58							
	MILD.											
278.0 280			7	SS	70	300						
	CLAYEY SILT GREY HARD		8	SS	58							
272.8 272.8	END OF BOREHOLE		9	SS	1094	290						

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## (68-F-78) RECORD OF BOREHOLE NO 6

JOB 73-11069

LOCATION STA 212+28.5 12' LT

ORIGINATED BY PK

W.P. 113-66-03

BORING DATE AUG 29 1973

COMPILED BY PK

DATUM GEO DETIC

BOREHOLE TYPE AUGER

CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT $W_L$		BULK DENSITY	REMARKS
			NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		PLASTIC LIMIT $W_P$	WATER CONTENT $W$		
339.0	GROUND LEVEL						O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE		WATER CONTENT % 10 20 30			
0.0												
	SAND SOME GRAVEL											
	REDISH BROWN		1	SS	7	330						
324.8			2	SS	100							
311.7	SAND SOME GRAVEL		3	SS	43	320						
	SAND SILT		4	SS	100 1/2"							
	BROWN (CEMENTED)		5	SS	100 1/2"							
	CONTACT TO VERY DENSE		6	SS	29	310						
306.0												
320	CLAYEY SILT SOME SANDY GRAVEL		7	SS	116							
302.0												
310	CLAYEY SILT		8	SS	51	300						
	GRAVEL											
	HARD.											
	PROBABLE BEDROCK					290						
284.4			9	SS	100 1/2"							
274.6	END OF BOREHOLE											

OFFICE REPORT ON SOIL EXPLORATION







File Copy  
(68-F-78)

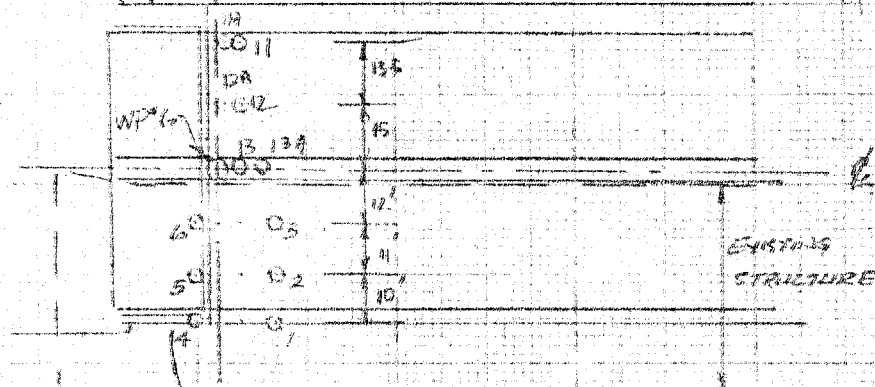
73-10612

HOLES 11, 14, 12, 12A, 13, 13A  
 DONE ON PREVIOUS JOB.

Hamilton

Page 3

Aug 20/23



212 + 28 in

8/27/10

Department of Transportation and Communications

~~XXXXXXXXXXXXXXXXXXXX~~

MEMORANDUM

30M5-9

GEOCREC No.

TO: Mr. E. R. Davis, (2)  
Structural Engineer,  
Design Services Branch,  
West Bldg., Downsview.

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

ATTENTION: DATE: October 19, 1971.

OUR FILE REF. IN REPLY TO

SUBJECT: Foundation Investigation Report for  
Hamilton Entrance Bridge #3, District #4  
(Hamilton), W.O. 68-11078 - W.P. 113-66-03.

Attached please find Foundation Investigation Report H 1078  
by William Trow Associates Ltd. The report contains Borehole  
Logs No.'s 101-115 and Drawing No.'s H 1078/1 - H 1078/6.  
This work supplements the work already carried out by us under  
our project W.O. 68-11078.

We believe you will find the factual information in the report  
sufficient for your design purposes. If any questions arise,  
please contact this Office.

AGS/so  
Attech.  
cc: Messrs.

D. W. Farren  
G. K. Hunter (2)  
C. R. Robertson  
G. C. E. Burkhardt  
T. J. Kovich  
A. Rutka  
B. J. Giroux  
E. A. Singh

Foundation Files  
Documents

*A. G. Stern*  
A. G. Stern, *Principal*  
PRINCIPAL FOUNDATION ENGINEER.

30 M 5-9
GEOCRES No.



HAMILTON ENTRANCE BRIDGE #3  
HIGHWAYS #2 & #6 OVER POND  
WEST BURLINGTON, ONTARIO

Prepared for:  
THE DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Project: H1078	WILLIAM TROM ASSOCIATES (HAMILTON) LTD.
October 18, 1971	1870 Barton Street East
	Hamilton, Ontario
	Telephone: 547-6385



## BOREHOLE LOG






JOB No. H1078





BOREHOLE No. 101

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ont.

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 

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBURG LIMITS % DRY WEIGHT	NATURAL LIQUID WEIGHT P.C.F.
				300 FT. LB. 20	BLOWS FT. 40		
				SHEAR STRENGTH K.S.F.			
	CLAYEY SILT TO SILTY CLAY - possibly old fill, occ. coarse sand & fine to coarse gravel sizes, some weathered shale, moist, red, very stiff	258.7	0				SOIL CORE
	SHALE BEDROCK - weathered with occ. soft shale layers in upper 2 ft., more sound with some fractures & occasional softer layers below 6 feet	254.7	5				72/13
	depth, red with green mudstone/shale bands & interbeds	246.9	10				92/86
	TERMINATED		15				
	NOTES:		20				
	1. Borehole cased & advanced by conventional diamond drilling techniques June 30, 1971.		25				
	2. Cone Penetration Test 6 feet east of Borehole.		30				
	3. Water Level Record on completion of borehole.		35				
	Date/Time W.L. (ft) P.O.T. (ft)		40				
	Sept. 8/11:00 Dry 3.8		45				
			50				



## BOREHOLE LOG







JCE No. H1078

BOREHOLE NO. 102

DRAWING NO.

PROJECT Hamilton Entrance Bridge #3LOCATION Avys. #2 & #6 over PondWest Burlington, Ont.

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 

P.C.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE 250 FT. L.D. BLOWS - FT.				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					20	40	60	80		
					SHEAR STRENGTH K.S.F.					
		CLAYEY SILT TO SILTY CLAY-product of shale weathering, shale frag- ments, moist, red with green in- clusions, very stiff.	266.7	0						
		SHALE BEDROCK-severely weathered & fractured, with many softer shale & shaley clay bands in upper 3.3ft., more sound with some fractures & occ. softer layers below 8.5ft. depth; red with green mudstone/shale bands & inter- beds	261.7 258.4	5 8						BXL CORR REC/RCD 2
		TERMINATED	253.2	13						17/0 95/41
NOTES:										
1. Borehole cased & advanced by conventional diamond drilling techniques June 29, 1971.										
2. Cone Penetration Test 5 feet west of Borehole.										
3. Water Level Record on com- pletion of borehole.										
Date/Time    W.L. (ft)    H.O.T. (ft)										
Sept. 8/12:00    Dry    8.0										



## BOREHOLE LOG

JOB No. H1076

BOREHOLE No. 103






DRAWING No.

PROJECT Hamilton Entrance Bridge #3

LOCATION

Hwys. #2 &amp; #6 over Pond

West Burlington, Ont.

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

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

DEPTH FEET	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE				NATURAL MOISTURE CON-TENT AND ATTERBERG LIMITS % DRY WEIGHT			NATURAL UNIT WEIGHT P.C.F.	
					350 FT. LB. 20	40	BLOWS FT. 60	80	SHEAR STRENGTH K.S.F.				
		WATER - (red brown clayey silt with some sand & gravel on bottom)	249.4	0						20	40	60	
		PEAT - pseudo-fibrous to amorphous peat with occ. bands of organic silt; numerous small shells; stratified peat, silt, fine sand & red-brown silty clay below 35ft. depth; wet, black to dark brown, very soft	244.4	5									
				10									
				15									
				20									
				25									
				30									
				35									
				40									
				45									
				50									
		SILT & FINE SAND - organic silt with bands of fine sand; occ.	199.4	50									
		continued											

lost  
sample

William Trow Associates Ltd.






## BOREHOLE LOG





JOB No. H1078

BOREHOLE No. 103 (continued)

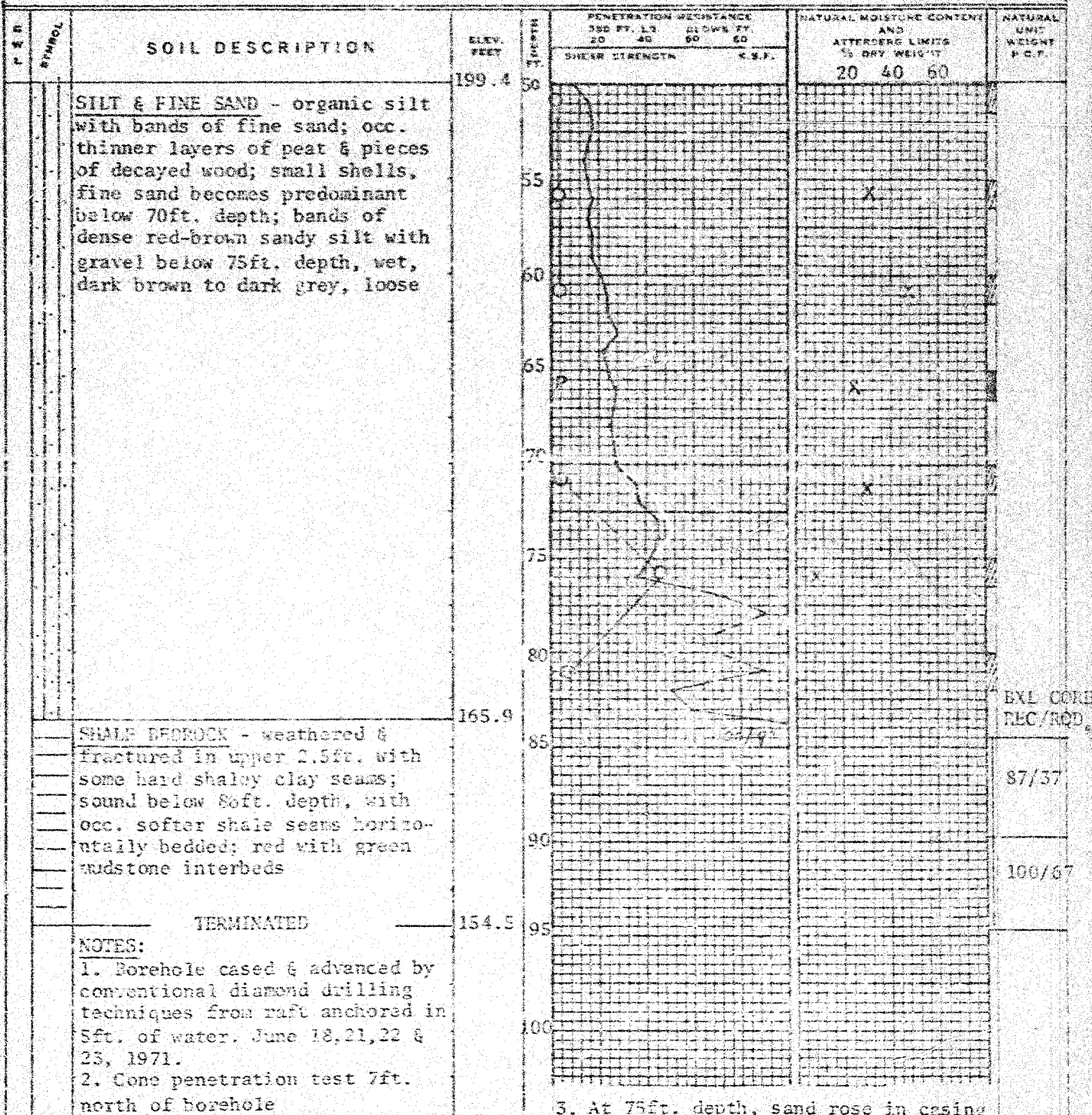
DRAWING No.

PROJECT Hamilton Entrance Bridge #3  
 LOCATION Hwys. #2 & #6 over Pond,  
West Burlington, Ont.

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 

HOLE LOCATION AND DATUM SEE DRAWING NO. 1



3. At 75ft. depth, sand rose in casing to 70ft. depth.



William Trow Associates Ltd.




# BOREHOLE LOG





JOB No. H1078

BOREHOLE No. 104

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3  
 LOCATION Hwys. #2 & #6 over Pond  
West Burlington, Ont.

2" O.D. SPLIT TUBE   
 2" I.D. SHELBY TUBE   
 2" DIA. CONE   
 PUSHED \_\_\_\_\_ P  
 VANE TEST AND SENSITIVITY (S) +5

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

HOLE LOCATION AND DATUM SEE DRAWING No. 1

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT			NATURAL UNIT WEIGHT P.C.F.
				250 FT. LB. 25	BLOWS FT. 40	60	80	20	40	60	
		249.4	0								
	WATER (red brown clayey silt with some sand & gravel on bottom)		5								
		242.4	10								
	PEAT - pseudo-fibrous to amorphous peat with occ. bands of organic silt, numerous small shells, wet, bl. to dk. brown, very soft		15								
		232.4	20								
	SILT & FINE SAND - organic silt with bands & layers of fine sand; occ. thinner layers of peat; occ. small shells & pieces of decayed wood; fine sand becomes predominant below about 60ft. depth. Band of dense red-brown sandy silt with gravel 68ft. - 70ft. depth; wet, dark brown to dark grey; loose		25								
			30								
			35								
			40								
			45								
			50								

continued



William Trow Associates Ltd.



## BOREHOLE LOG

JOB No. H1078BOREHOLE No. 104 (continued)

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over Pond,  
West Burlington, Ont.2" O.D. SPLIT TUBE 2" I.D. SHELBY TUBE 

2" DIA. CONE

PUSHED \_\_\_\_\_

VANE TEST AND SENSITIVITY (S) +5

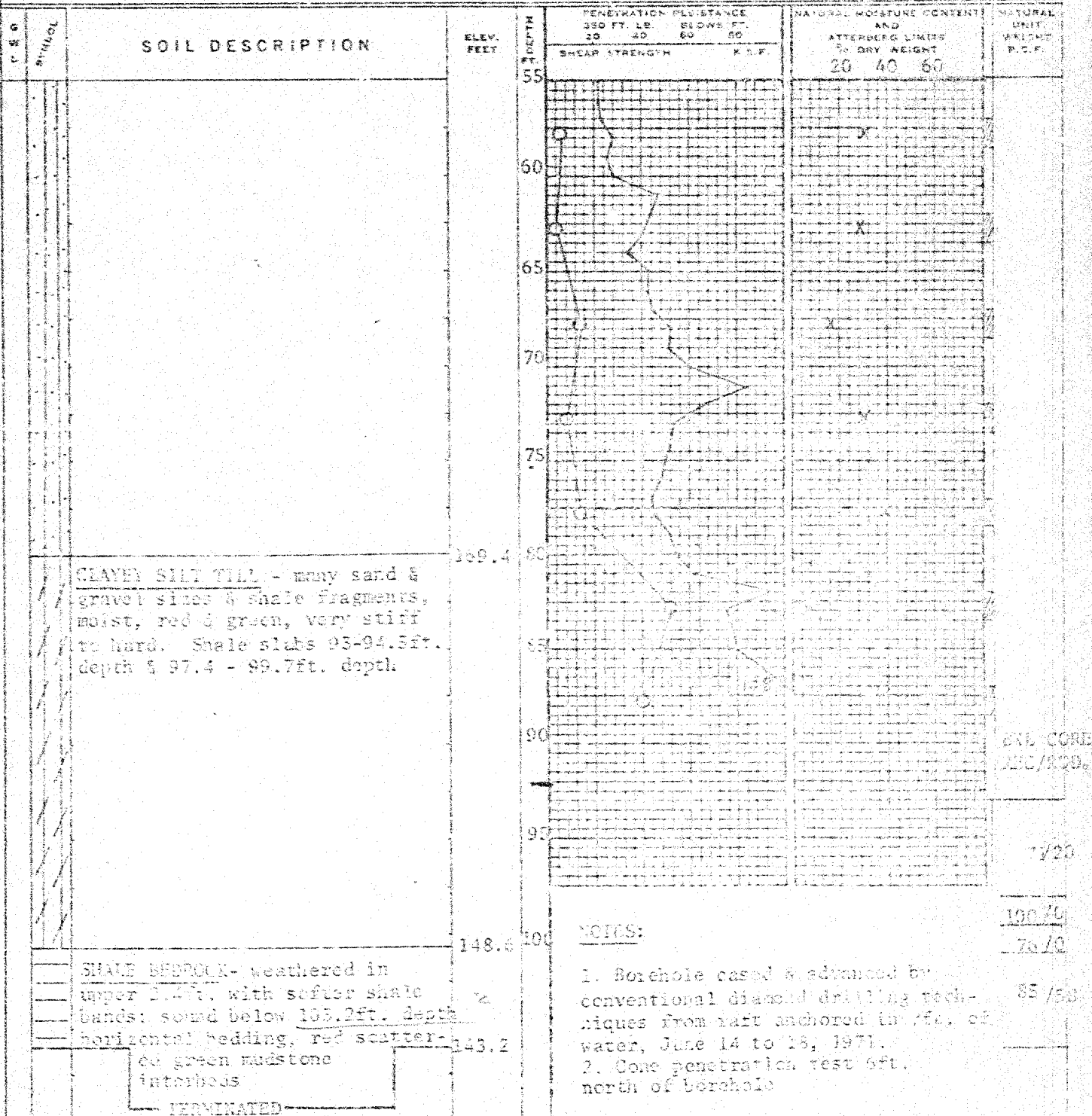
NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE

E STRAIN AT FAILURE

HOLE LOCATION AND DATUM SEE DRAWING No. 1







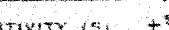
## BOREHOLE LOG





PROJECT No. H1078

BOREHOLE No. 103

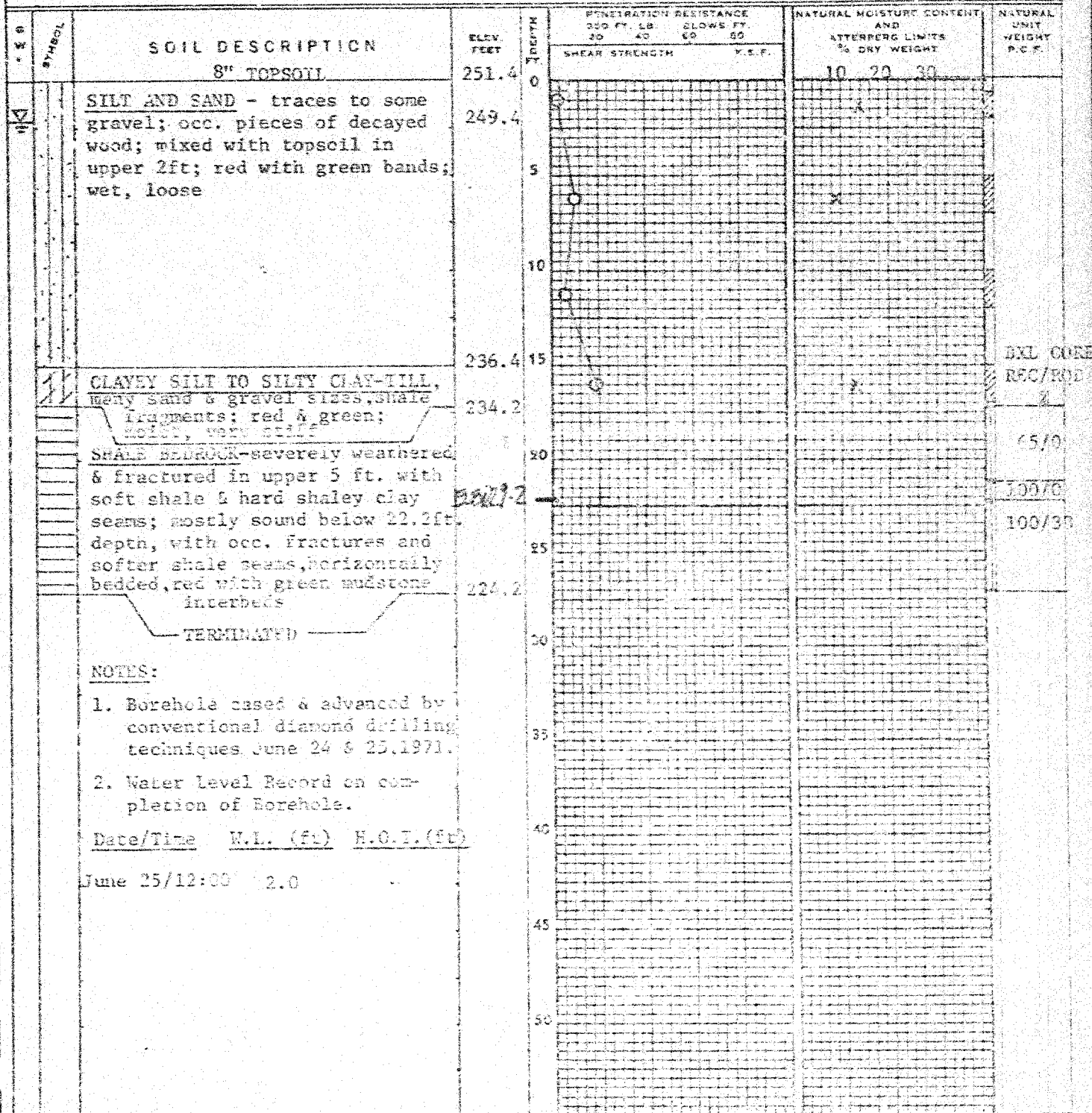
DRAWING No.

PROJECT Hamilton Entrance Bridge #3  
 LOCATION Hwys. #2 & #6 over Pond  
West Burlington, Ontario.

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

NATURAL MOISTURE  X  
 PLASTIC AND LIQUID LIMIT   
 UNDRY'ED TRIAXIAL AT OVERBURDEN PRESSURE  15 5 10  
 % STRAIN AT FAILURE 

HOLE LOCATION AND DATUM SEE DRAWING NO. 1



William Trow Associates  
 (Hamilton) Ltd.




# BOREHOLE LOG


PROJECT NO. B1078

CORE A

DRAWING NO. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3  
 LOCATION Hwys. #2 & #6 over Pond  
West Burlington, Ontario

2" O.D. SPLIT TUBE   
 2" I.D. SHELBY TUBE   
 2" DIA. CONE   
 PUSHED \_\_\_\_\_ P  
 VANE TEST AND SENSITIVITY (S) +5

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

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

L.S.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					350 FT. L.S.	40	50	60		
					SPEAR STRENGTH K.S.F.					
		Cone "A" located 10' south of Borehole #105. Driven June 28/71.	253.8	0						
				5						
				10						
				15						
		TERMINATED	239.8	15						
				20						
				25						
				30						
				35						
				40						
				45						
				50						






William Trow Associates  
(Hamilton) Ltd.





## BOREHOLE LOG

PROJECT No. H1078

CONE B

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #13 O.D. SPLIT TUBE   
 LOCATION Hwys. #2 & #6 over Pond 2" I.D. SHELBY TUBE   
West Burlington, Ontario 2" DIA. CONE   
 PUSHED \_\_\_\_\_ P  
 VANE TEST AND SENSITIVITY (S) +5

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

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

LEG	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					350 FT. LB.	BLOWS/FT.		
					20	40		
					SHEAR STRENGTH		K.S.F.	
		Cone "B" located 10' north of Borehole #105. Driven June 28/71	250.5	0				
				5				
				10				
				15				
				20				
				25				
		TERMINATED	220.5	30				
				35				
				40				
				45				
				50				



William Troy Associates  
(Hamilton) Ltd.




## BOREHOLE LOG

JOB No. 111078

CONE C

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over Pond,West Burlington, Ont.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 

HOLE LOCATION AND DATUM SEE DRAWING No. 1

F.T.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					350 FT. LB. 20	40	BLOWS FT. 60	80		
					SHEAR STRENGTH K.S.F.					
		Cone C located 20 ft. north of Borehole #105, Driven June 28, 71	249.5	0						
				5						
				10						
				15						
				20						
				25						
				30						
				35						
		TERMINATED	213.5	35						
				40						
				45						
				50						



William Trow Associates Ltd.

## BOREHOLE LOG

JOB No. H1078

BOREHOLE No. 106

DRAWING No. \_\_\_\_\_

PROJECT: Hamilton Entrance Bridge #3

LOCATION: Hwys. #2 &amp; #6 over Pond

West Burlington, Ontario

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED

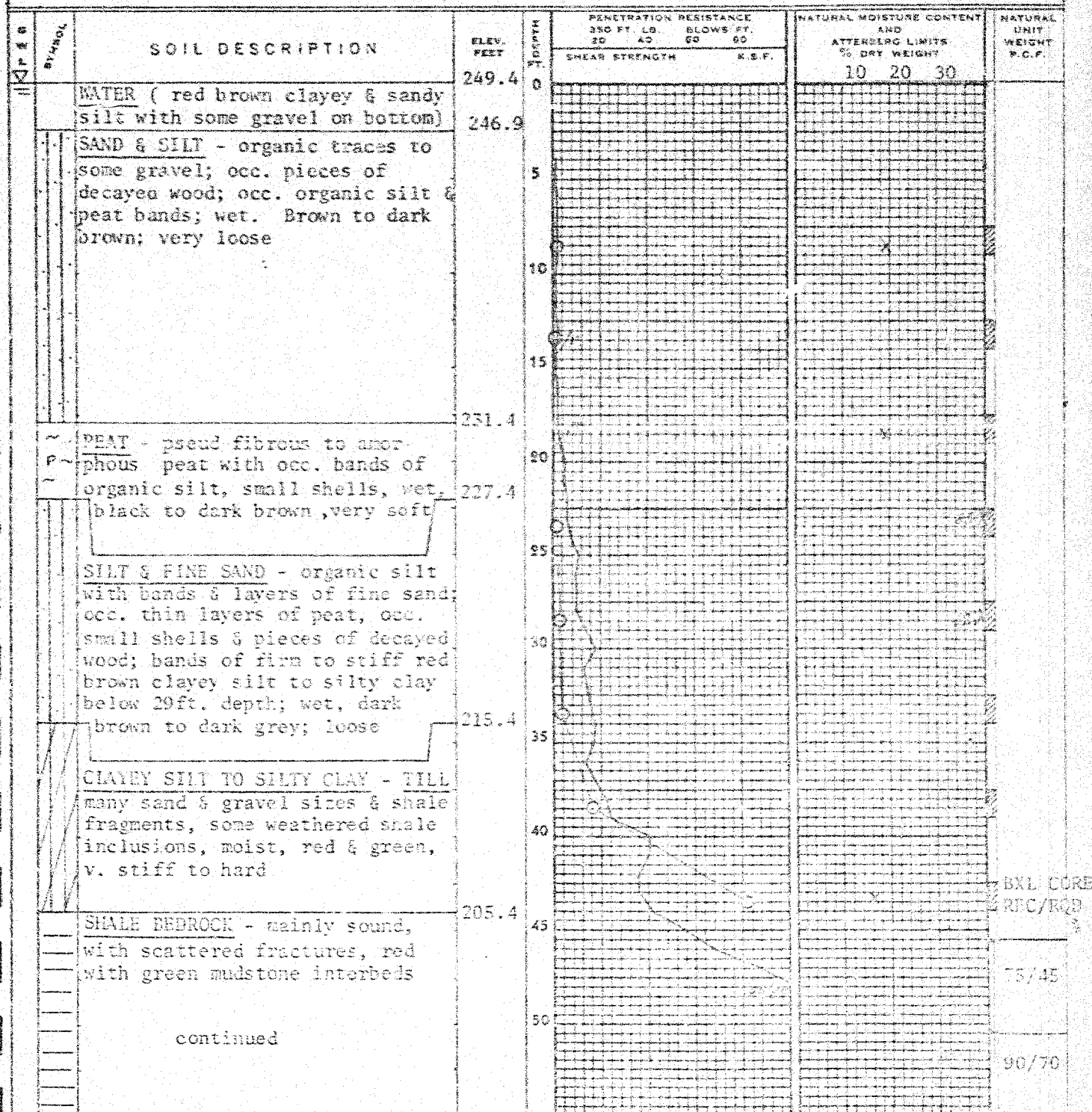
VANE TEST AND SENSITIVITY (SI)

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE  
% STRAIN AT FAILURE

HOLE LOCATION AND DATUM SEE DRAWING No. 1



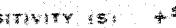




## BOREHOLE LOG

JOB No. H1078

BOREHOLE No. 106 (continued)

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ontario2" O.D. SPLIT TUBE 2" I.D. SHELBY TUBE 2" DIA. CONE PUSHED  PVANE TEST AND SENSITIVITY (S)  + SNATURAL MOISTURE  XPLASTIC AND LIQUID LIMIT  10UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE  15 10% STRAIN AT FAILURE 

HOLE LOCATION AND DATUM SEE DRAWING No. 1

G W L	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT.		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	EXL CORE REC/ROD
					20	40		
					SHEAR STRENGTH		K.S.F.	
				50				
				55				90/70
				60				100/90
		TERMINATED	188.9	60				
				65				
				70				
				75				
				80				
				85				
				90				
				95				
				100				
		NOTES:						
		1. Borehole cased & advanced by conventional diamond drilling techniques from raft anchored in 2.5ft. of water, July 21, 22, 23 & 26, 1971.						
		2. Cone penetration test 5ft. north & 2ft. west of borehole.						

## NOTES:

1. Borehole cased & advanced by conventional diamond drilling techniques from raft anchored in 2.5ft. of water, July 21, 22, 23 & 26, 1971.

2. Cone penetration test 5ft. north & 2ft. west of borehole.




## BOREHOLE LOG

JOB No. H1078

BOREHOLE No. 107


DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ontario2" O.D. SPLIT TUBE 2" I.D. SHELBY TUBE 2" DIA. CONE 

PUSHED \_\_\_\_\_ P

VANE TEST AND SENSITIVITY (S) +5

NATURAL MOISTURE X

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

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

ELEV. FEET	DEPTH FEET	SOIL DESCRIPTION	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBURG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.V.
			300 FT. LB.	600 FT. LB.	900 FT. LB.	1200 FT. LB.		
269.3	0	12" Topsoil						
		SILT & SAND - traces to some gravel; occ. pieces of decayed wood; moist, red-brown, loose to compact						
264.3	5	CLAYEY SILT TO SILTY CLAY - till many shale fragments; red, almost dry, Hard						BXL CORE REC/REQ. %
261.8								
	10	SHALE BEDROCK - severely weathered & fractured in upper 2.5ft., sound below 10ft., but with fractured zone 11.5 - 12 ft. depth; red with occasional green mudstone interbeds						94/17
252.7								
	15							91/79
	20							88/72
248.2		TERMINATED						
NOTES:								
1. Borehole cased & advanced by conventional diamond drilling techniques July 27 & 28, 1971.								
2. Cone penetration test 3.5ft. east of borehole.								
3. Water level record on completion of borehole.								
Date/Time	W.L. (ft.)	H.O.T. (ft.)						
Jly. 27th/10:00	16.6	20.1						
Jly. 27th/17:00	16.6	20.1						



William Trow Associates Ltd.



## BOREHOLE LOG

JOB No. H1078

BOREHOLE No. 108

DRAWING No.

PROJECT Hamilton Entrance Bridge #3

LOCATION Hwys. #2 &amp; #6 over Pond

West Burlington, Ontario

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED

VANE TEST AND SENSITIVITY (SI) + S

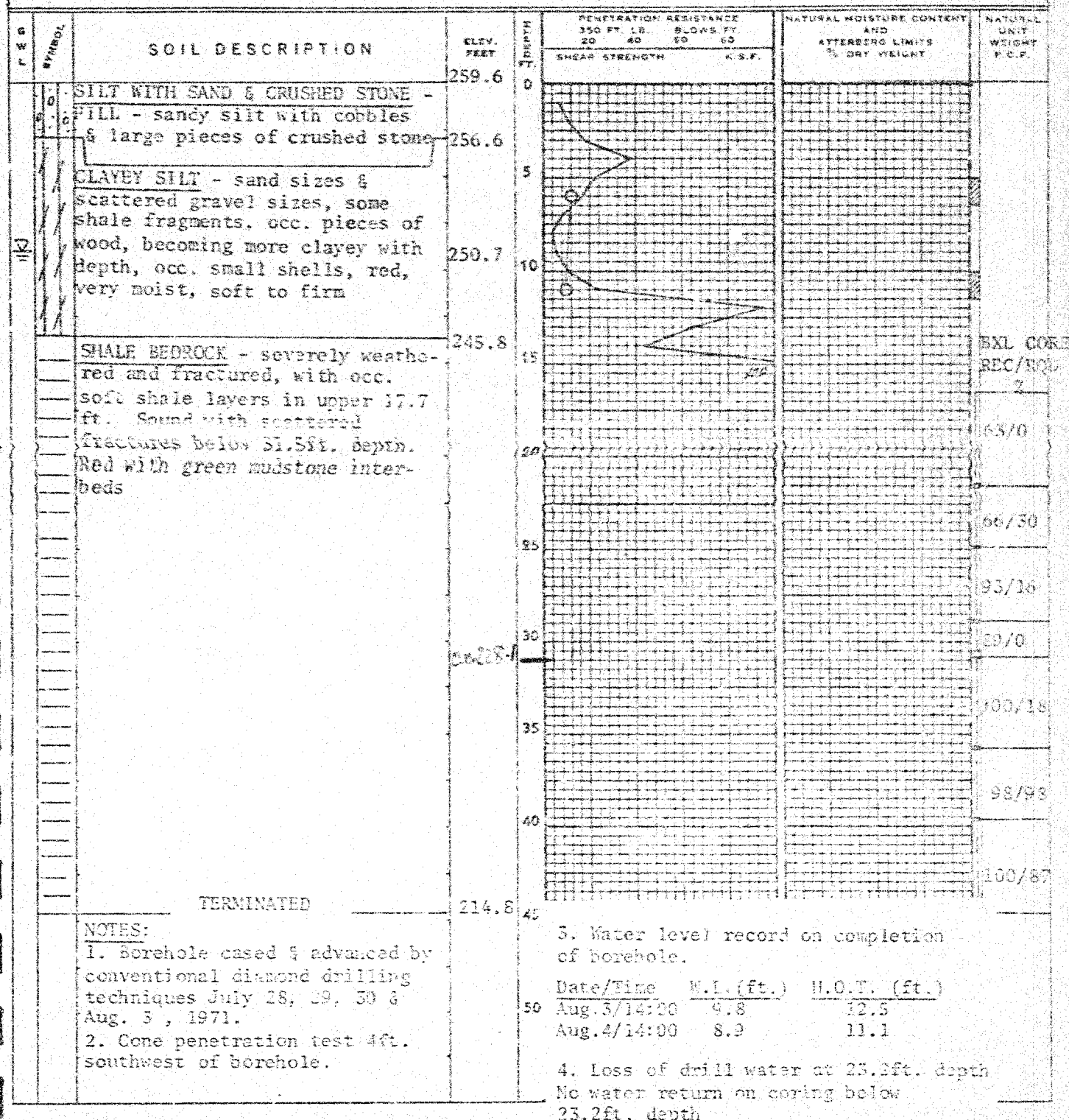
NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE

% STRAIN AT FAILURE

HOLE LOCATION AND DATUM SEE DRAWING No. 1



## BOREHOLE LOG


JOB No. H1078

BOREHOLE No. 100


DRAWING No. \_\_\_\_\_

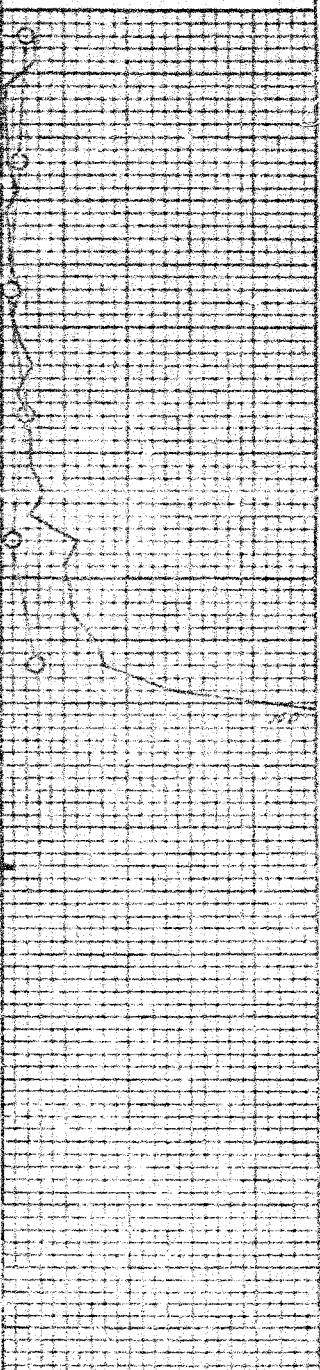
PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ont.

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

3" O.D. SPLIT TUBE 2" I.D. SHELBY TUBE 2" DIA. CONE 

PUSHED \_\_\_\_\_

VANE TEST AND SENSITIVITY (S)  + SNATURAL MOISTURE PLASTIC AND LIQUID LIMIT UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE STRAIN AT FAILURE 

LOG SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE 150 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.
H	SILT & SAND - traces to some gravel; occ. pieces of decayed wood, occ. organic layers & peat bands, occ. bands of red brown clayey silt to silty clay with sand & gravel sizes below about 10ft. depth; moist becoming wet below 3ft. depth; reddish brown near surface, becoming dark brown to dark grey; loose	252.2	0			
		249.7	5			
		234.7	10			
P	PEAT - psuedo-fibrous to amorphous peat with occ. bands of organic silt, many small shells, wet, black to dark brown, very soft		15			
P	CLAYEY SILT TO SILTY CLAY TILL many sand & gravel sizes, shale fragments; red & green, moist, very stiff	225.2	20			
		223.4	25			
	SHALE BEDROCK - weathered with some fracturing to 34ft. depth, mainly sound with occ. fractures 34.0 to 39.5 ft. depth, heavily fractured from 39.5ft. to 41.5ft. depth; sound below 41.5ft. depth; red with green mudstone interbeds		30			
			35			68/12
			40			100/80
			45			86/22
			50			91/28
						100/91
						100/87

continued



William Trox Associates Ltd.

## BOREHOLE LOG






JOB No. H1076





BOREHOLE No. 109 (continued)

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwy's. #2 & #6 over PondWest Burlington, Ont.

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

2" C.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 

F.S.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE			NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					350 FT. LB. 25	BLOWS/FT 40	60		
					SHEAR STRENGTH K.S.F.				
				50					
				55					
		TERMINATED	196.2	55					
				60					
				65					
				70					
				75					
				80					
				85					
				90					
				95					
				100					

## NOTES:

1. Borehole cased & advanced by conventional diamond drilling techniques August 3, 4 & 5, 1971.

2. Water level record on completion of borehole

Date/Time    W.L. (ft.)    H.O.T. (ft.)

Aug.  
5th/17:30        2.5        24.0

3. Cone penetration test 6ft. east of borehole.

4. Loss of drill water at 33.5ft. depth. No water return on coring below 33.5ft. depth.






## BOREHOLE LOG





JOB No. H1078

BOREHOLE No. 110

DRAWING No.

PROJECT Hamilton Entrance Bridge #3  
 LOCATION Hwys. #2 & #5 over Pond  
West Burlington, Ontario

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 

MOLE LOCATION AND DATUM SEE DRAWING No. 1

F.S.A. SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
				300 FT. LB. 20	BLOWS FT. 40 60 80		
	SILT & SAND-traces to some gravel occ. pieces of decayed wood, slightly moist becoming moist at 7 ft., red with occasional green inclusions, compact be- coming loose	258.2	0				
		249.9	5				
		245.6	10				
		245.8	10				
	SHALE BEDROCK-weathered & heavily fractured in upper 12 ft. approx.; sound with scattered fractures below 24.5 ft. depth; red with green mudstone inter- beds.		15				16/0
			20				43/0
		233.7	25				100/38
			30				95/81
			35				97/88
			40				99/95
	TERMINATED	215.6					

## NOTES:

1. Borehole cased & advanced by conventional diamond drilling techniques Aug. 5, 6 & 9, 1971.
2. Cone Penetration test 2.5 ft. North West of borehole.

3. Water level record on completion of borehole.

Date/Time Aug. 9/1630 W.L. (ft.) 8.3 H.C.T. (ft.) 16.0



William Trow Associates Ltd.



## BOREHOLE LOG

JOB No. H1078

BOREHOLE No. 111

DRAWING No.

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ont.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" C.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

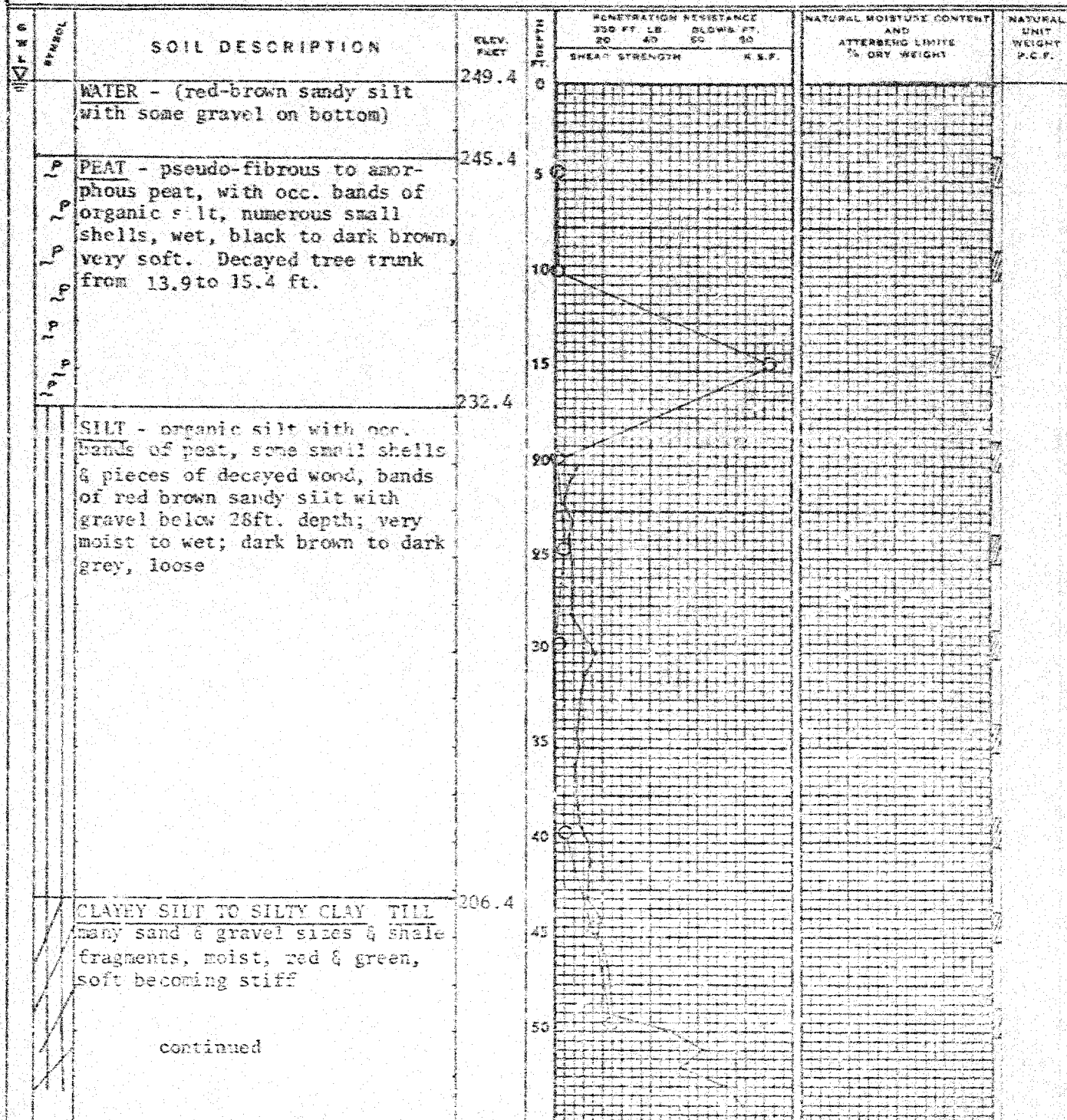
PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE

% STRAIN AT FAILURE

X

10



William Trow Associates Ltd.

## BOREHOLE LOG


JOS No. H1078

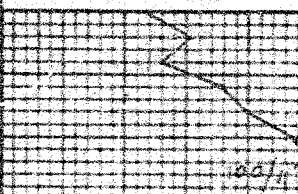
BOREHOLE No. 111 (continued)

DRAWING No.

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over Pond,West Burlington, Ont.

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 

L.S.D.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					100 FT. LB 10	BLOWS FT. 40 60 80		
					SHEAR STRENGTH K.S.F.			
			195.7	50				RXL CORE REC/RCD.
		SHALE BEDROCK - weathered and fractured in upper 4.8ft., mainly sound with occ. fractures below 58.5 ft. depth; sound below 78ft. depth; red with green mudstone interbeds and inclusions		55				
				60				86/47
				65				86/71
				70				96/81
				75				100/83
				80				86/53
				85				95/87
				90				95/94
		TERMINATED	157.6	95				
		NOTES: 1. Borehole cased & advanced by conventional diamond drilling techniques from raft anchored in 4ft. of water, Aug. 10, 11, 12, 13 & 16, 1971. 2. Cone penetration test 5ft. north of borehole.		100				



William Trow Associates Ltd.

## BOREHOLE LOG






JOB No. H1078

BOREHOLE No. 112

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ont.

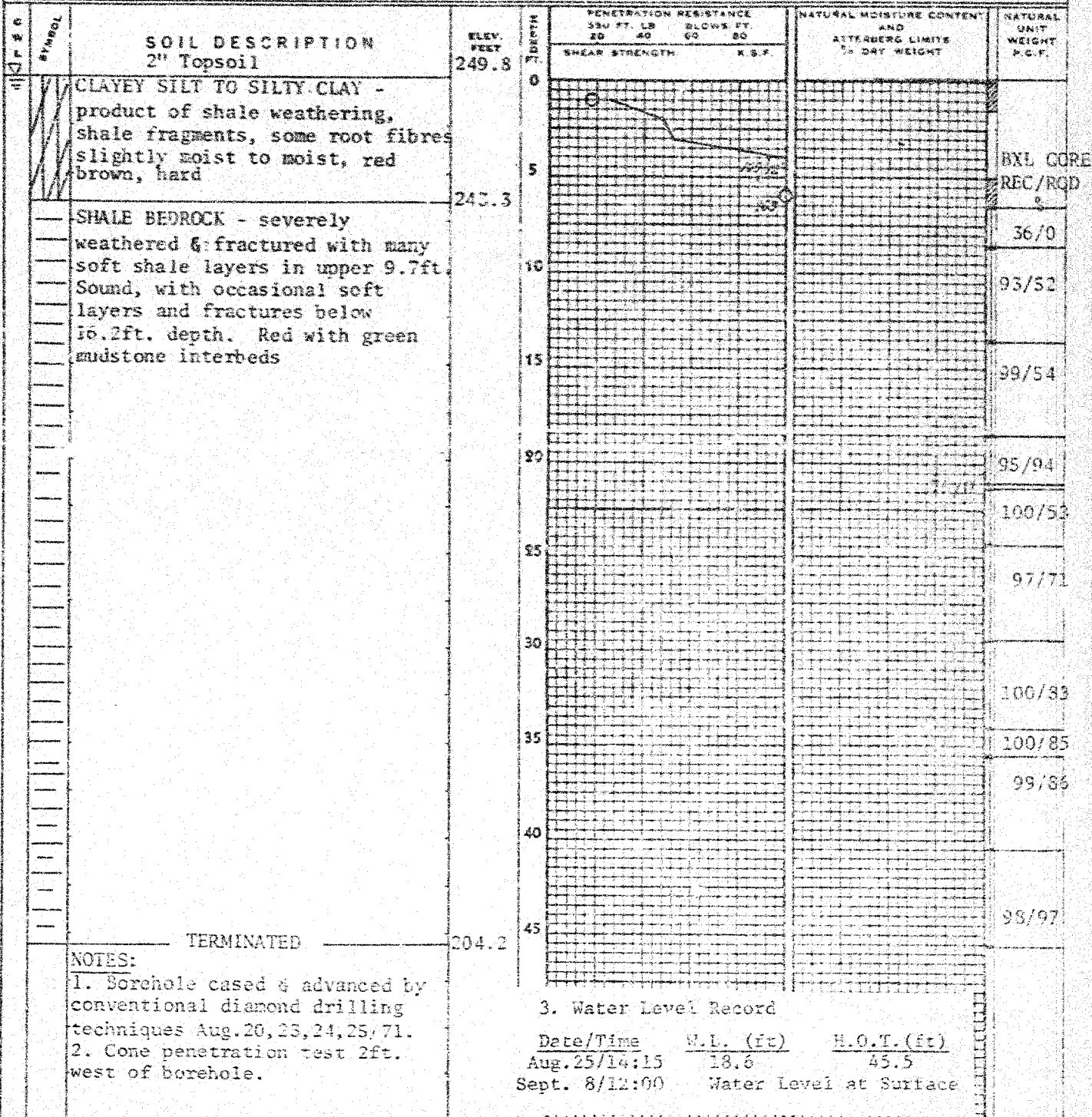
HOLE LOCATION AND DATUM SEE DRAWING No. 1

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

NATURAL MOISTURE

X

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE5% STRAIN AT FAILURE 

William Trow Associates Ltd.






## BOREHOLE LOG

JOB No. H1078BOREHOLE No. 113

DRAWING No. \_\_\_\_\_

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, 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)  + 5

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE

% STRAIN AT FAILURE

X

—○—

0

15

10

F.T.S.	SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT P.C.F.
					300 FT. LB. 25	BLOWS/FT. 60 85		
					SHEAR STRENGTH K.S.F.			
		CLAYEY SILT TO SILTY CLAY - product of shale weathering, shale fragments, some root fibres sandy near surface, with traces of topsoil, sl. moist to moist, red, brown, hard	269.5	0				
				5				BXL CORE REC/RQD. %
		SHAILE BEDROCK - severely weathered & fractured with soft shale & hard shaley clay bands in upper 8.2ft. Mainly sound with some fractures from 15.1ft. to 27.1ft. depth; sound below 27.1ft. depth; red with occ. green mudstone interbeds.	262.6	10				67/0
				15				92/37
				20				79/29
			249.3	25				89/73
				30				97/53
				35				100/98
				40				97/96
		TERMINATED	230.8	45				
		NOTES: 1. Borehole cased & advanced by conventional diamond drilling techniques Aug. 17, 18, 19, 20/71 2. Cone penetration test 5ft. east & 3ft. north of borehole. 3. Water level record on completion of borehole. Date/Time W.L. (ft.) H.O.T. (ft.) Aug. 20th/15:00 3.0 37.0 Sept. 8th/12:00 20.2 -		50				



William Trow Associates Ltd.



## BOREHOLE LOG

JOB No. H1078

BOREHOLE No. 114

DRAWING No.

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ont.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELLEY TUBE

2" DIA. CONE

PUSHED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

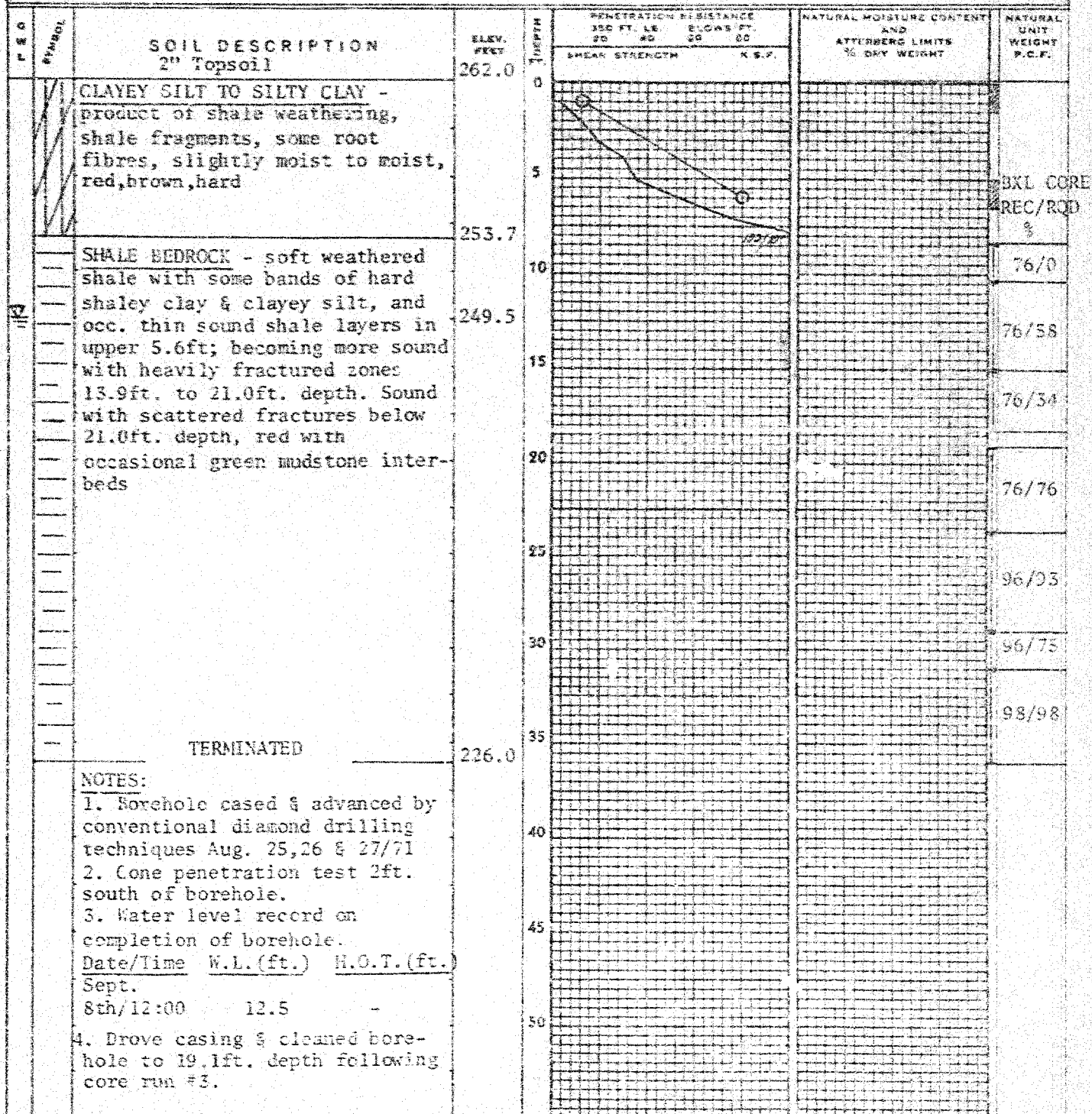
PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE

% STRAIN AT FAILURE

X

10

0  
15  
10

William Trow Associates Ltd.

## BOREHOLE LOG

JCS No. H1078

BOREHOLE No. 115

DRAWING No.

PROJECT Hamilton Entrance Bridge #3LOCATION Hwys. #2 & #6 over PondWest Burlington, Ont.

HOLE LOCATION AND DATUM SEE DRAWING No. 1

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

2" DIA. CONE

PURKED

VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE

PLASTIC AND LIQUID LIMIT

UNDRAINED TRIAXIAL AT  
OVERBURDEN PRESSURE

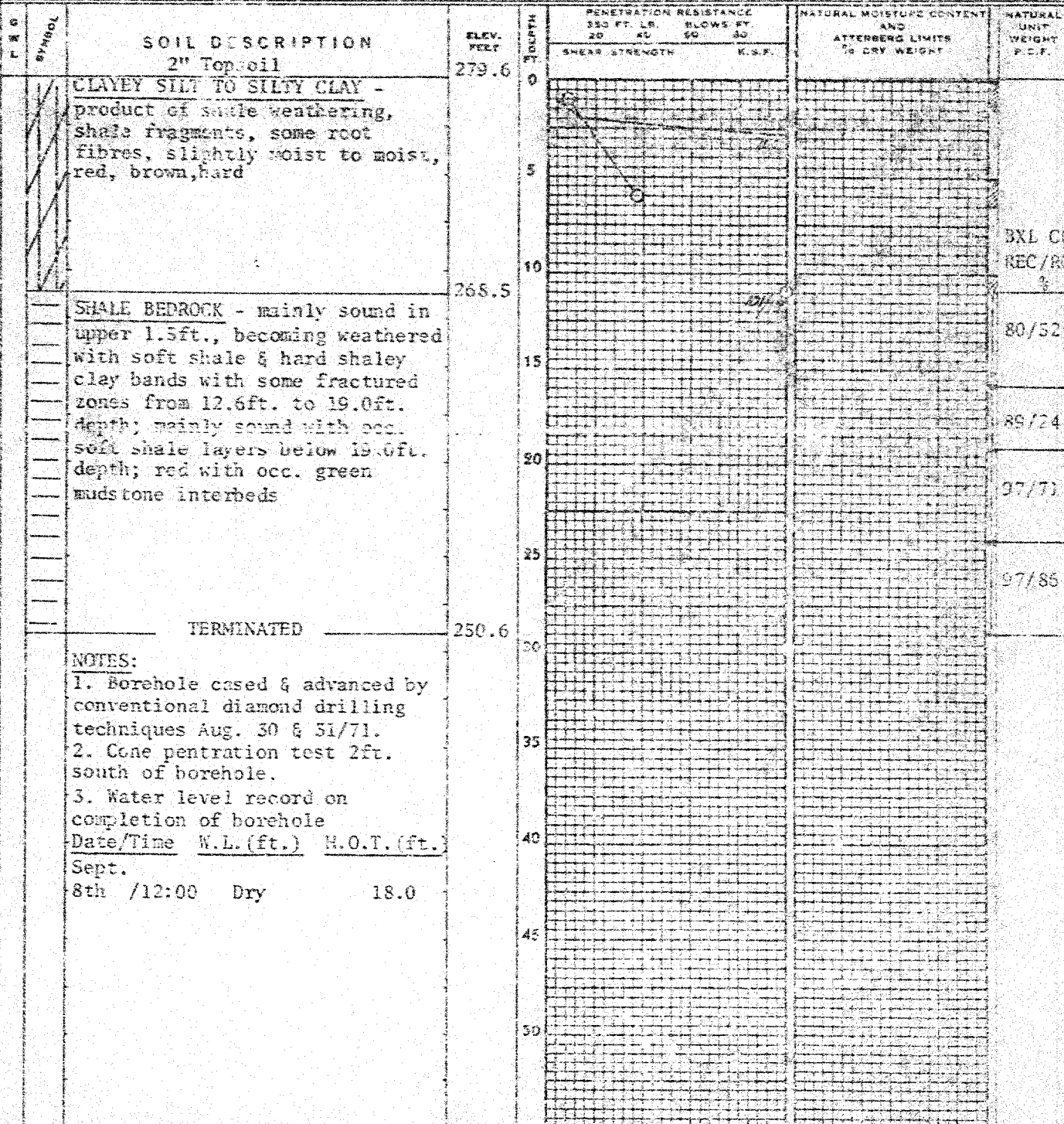
% STRAIN AT FAILURE

X

C

S

10



Project: H1078

1870 Barton Street East  
Hamilton 31, Ontario  
547-6285

**William Trow  
Associates**

Soil Mechanics  
Consultants

W. A. Trow,  
M.Sc., M.E.I.C., P.Eng.

K. Peaker,  
Ph.D., M.E.I.C., P.Eng.

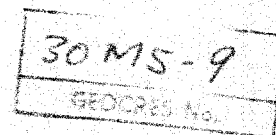


**(Hamilton) Ltd.**

C. D. Thompson, M.Sc., M.E.I.C., P.Eng.  
Manager

October 18, 1971

Department of Transportation and Communications  
Foundation Section  
Room 107, Lab. Building  
Highway 401 and Keele Street  
Downsview 464, Ontario



Attention: Messrs. A. Stermac and K. Selby

Foundation Investigation  
W.P. 113-6603, Site 10-125  
Hamilton Entrance Bridge #3  
Highways #2 and #6, District 4 (Hamilton)

Dear Sirs:

We have completed the additional foundation investigation for Hamilton Entrance Bridge #3 in accordance with your letter of authorization dated June 8, 1971.

Thirteen copies of the borehole logs and drawings together with the original drawings are enclosed. The copies of the drawings were requested verbally by your Mr. K. Selby.

We trust that this information together with the preliminary data already supplied will enable you to complete your assessment of foundation soil and rock conditions at the site. If you have any questions about it, please do not hesitate to contact this office.

Yours very truly,  
WILLIAM TROW ASSOCIATES (HAMILTON) LTD.

C. D. Thompson, P. Eng.

CDT/ml  
Encl.

Dist: Department of Transportation  
and Communications

(13)

# 68-F-78

W.P. # 113-66-03

Hwy. # 286

HAMILTON

ENTRANCE

BRIDGE # 3

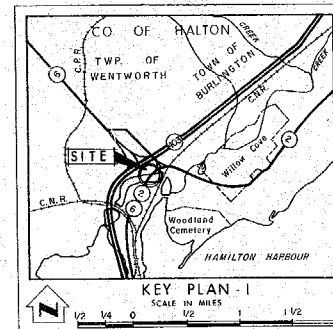
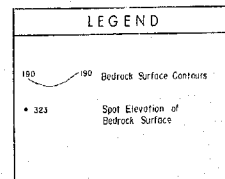






SCALE

40 20 0 40 80 FT



- NOTE -

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

NOV/71	D.L.W.	CONTOUR LINES CORRECTED FROM ELEVATIONS 230 TO 260
DATE	BY	DESCRIPTION

WILLIAM TROW  ASSOCIATES LTD.

DEPARTMENT OF TRANSPORTATION & COMMUNICATION  
DESIGN SERVICES BRANCH - FOUNDATION OFFICE

HAMILTON ENTRANCE BRIDGE N° 3

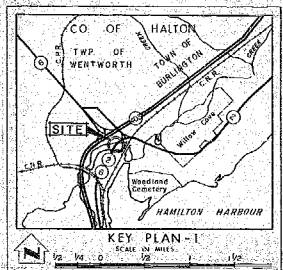
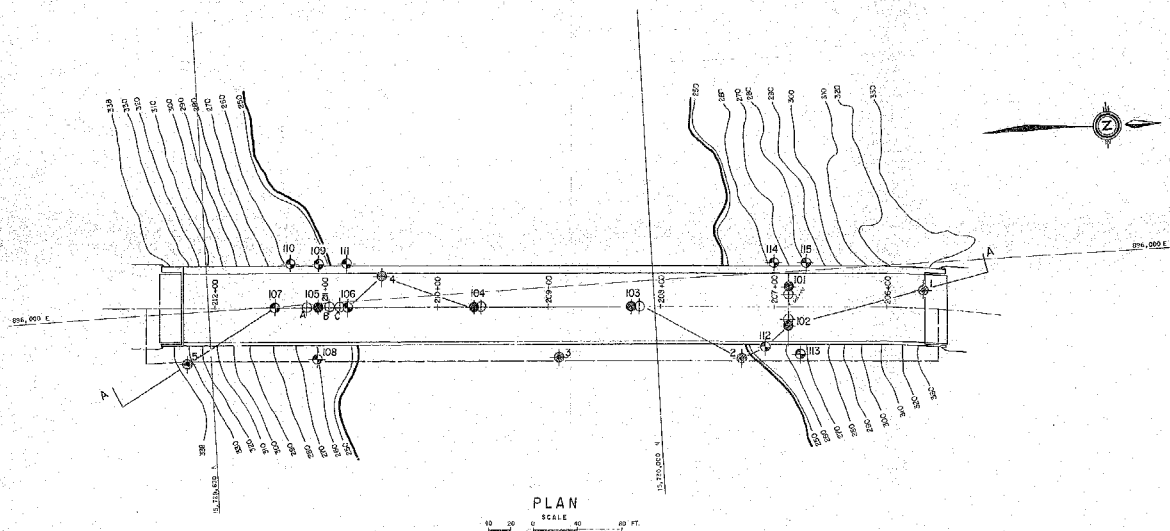
HIGHWAY NO. 2 & 6 DIST. NO. 4

CO. HALTON  
TOWN OF BURLINGTON (LOT \_\_\_\_\_ CON. \_\_\_\_\_)

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD	CHECKED C.D.T.	W.P. NO. 113-66-03	DRAWING NO.
DRAWN M.N.	CHECKED R.C.	JOB NO. H 1078	H 1078/6
DATE Oct. 18, 1971	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONF. NO.	D-6965-7	
PRINCIPAL FOUNDATION ENGINEER			

PRINCIPAL: ECONOMICS



NO.	ELEVATION	GRID REFERENCE	
		NORTHING	EASTING
1	339.1	15,730,239	896,026
2	299.5	15,730,074	896,076
3	289.5	15,729,982	896,063
4	249.5	15,729,757	896,088
5	339.1	15,729,278	896,046

NO.	ELEVATION	GRID REFERENCE	
		NORTHING	EASTING
101	238.7	15,730,119	896,014
102	236.7	15,729,917	896,048
103	245.4	15,729,590	896,022
104	249.4	15,729,538	896,041
105	251.4	15,729,508	896,001
106	249.4	15,729,725	896,006
107	295.3	15,729,696	896,001
108	239.8	15,729,590	896,048
109	252.2	15,729,702	896,065
110	226.2	15,729,670	896,068
111	249.4	15,729,714	896,067
112	249.8	15,729,053	896,066
113	269.5	15,730,166	896,070
114	262.0	15,730,106	896,091
115	279.6	15,730,136	896,094

LEGEND	
	Bore Hole
	Cone Penetration Test
	Bore Hole C. Cone Test
	Water Levels established at time of field investigation JUNE - SEPTEMBER
	Bore Hole by CHD, November 1968
	Bore Hole E. Cone Test by CHD, November 1968

**NOTE**  
The boundaries between well zones 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.

3045-9  
GEOTECH. 94

DATE	BY	DESCRIPTION

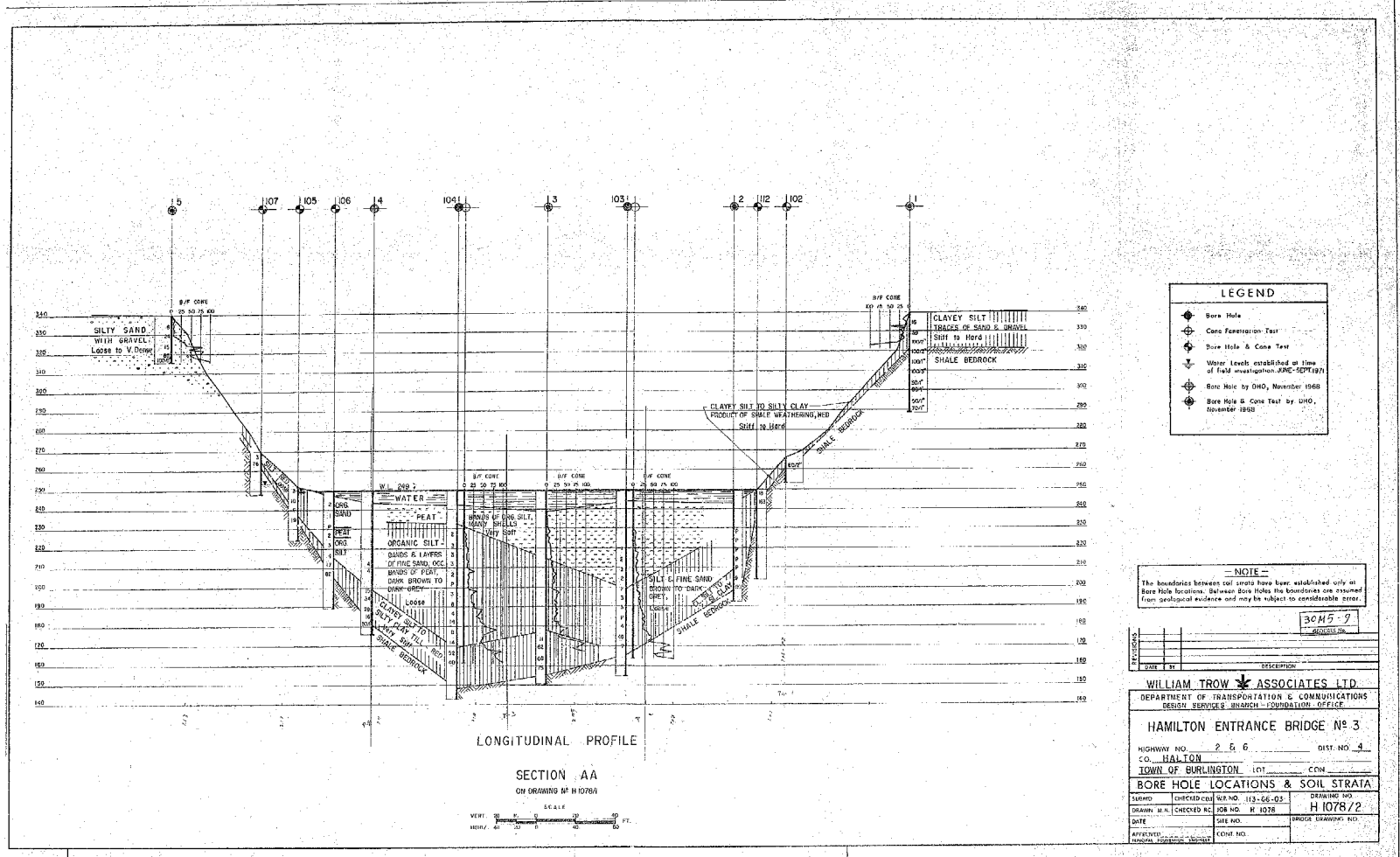
**WILLIAM TROW ASSOCIATES LTD.**  
DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH - FOUNDATION OFFICE

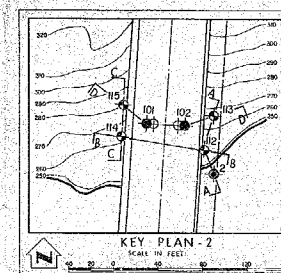
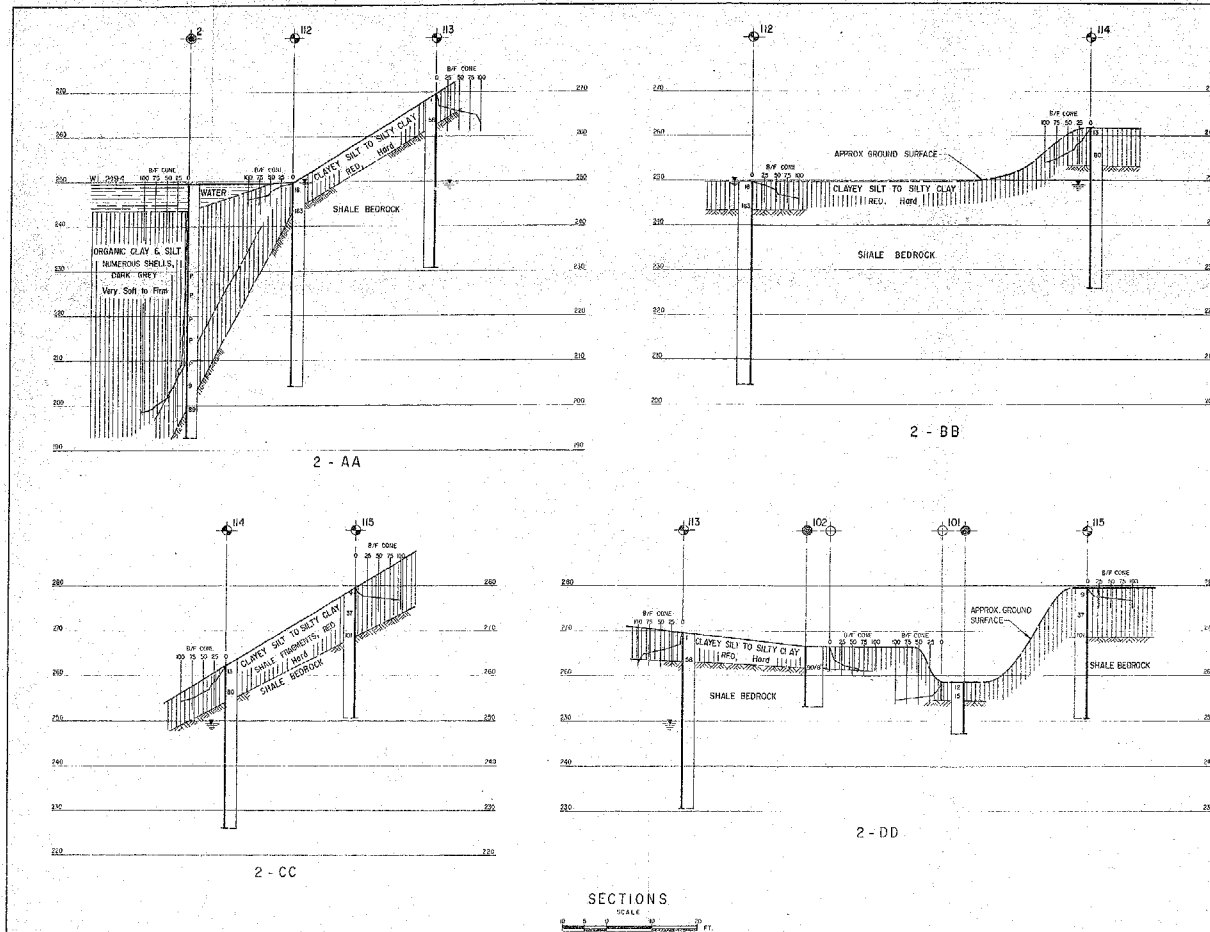
**HAMILTON ENTRANCE BRIDGE No 3**

HIGHWAY NO. **2 E 6** DIST. NO. **4**  
CO. **HALTON**  
TOWN OF **BURLINGTON** LOT  CON.

**BORE HOLE LOCATIONS & SOIL STRATA**

SURV. NO. <b>104000001</b>	MAP NO. <b>113-86-03</b>	BRIDGE NO. <b> </b>
DRAWN BY <b> </b>	CHECKED BY <b> </b>	FILE NO. <b>H 1078/1</b>
DATE <b> </b>	SHEET NO. <b> </b>	BRIDGE DRAWING NO. <b> </b>
APPROVED <b> </b>	CONT. NO. <b> </b>	



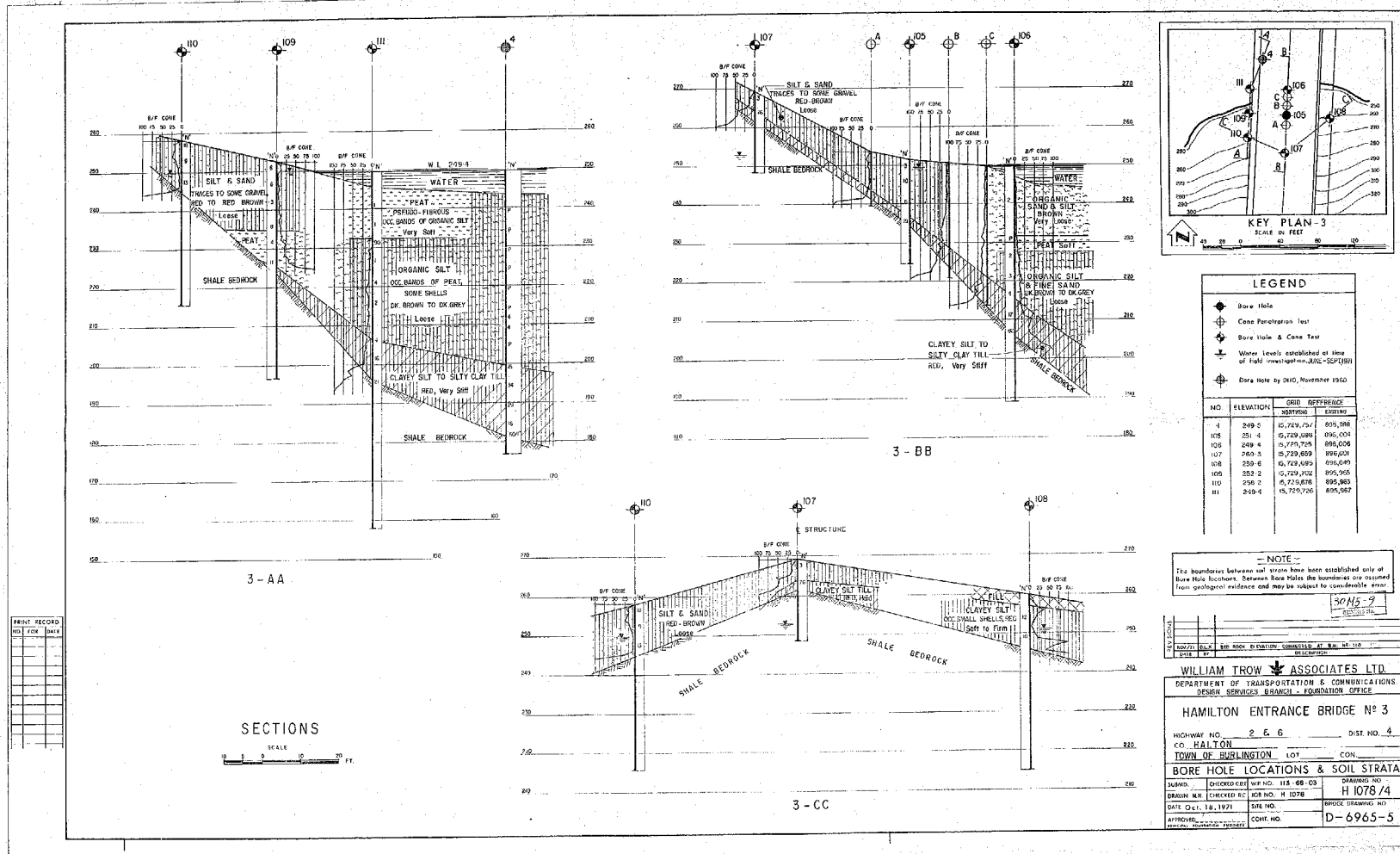


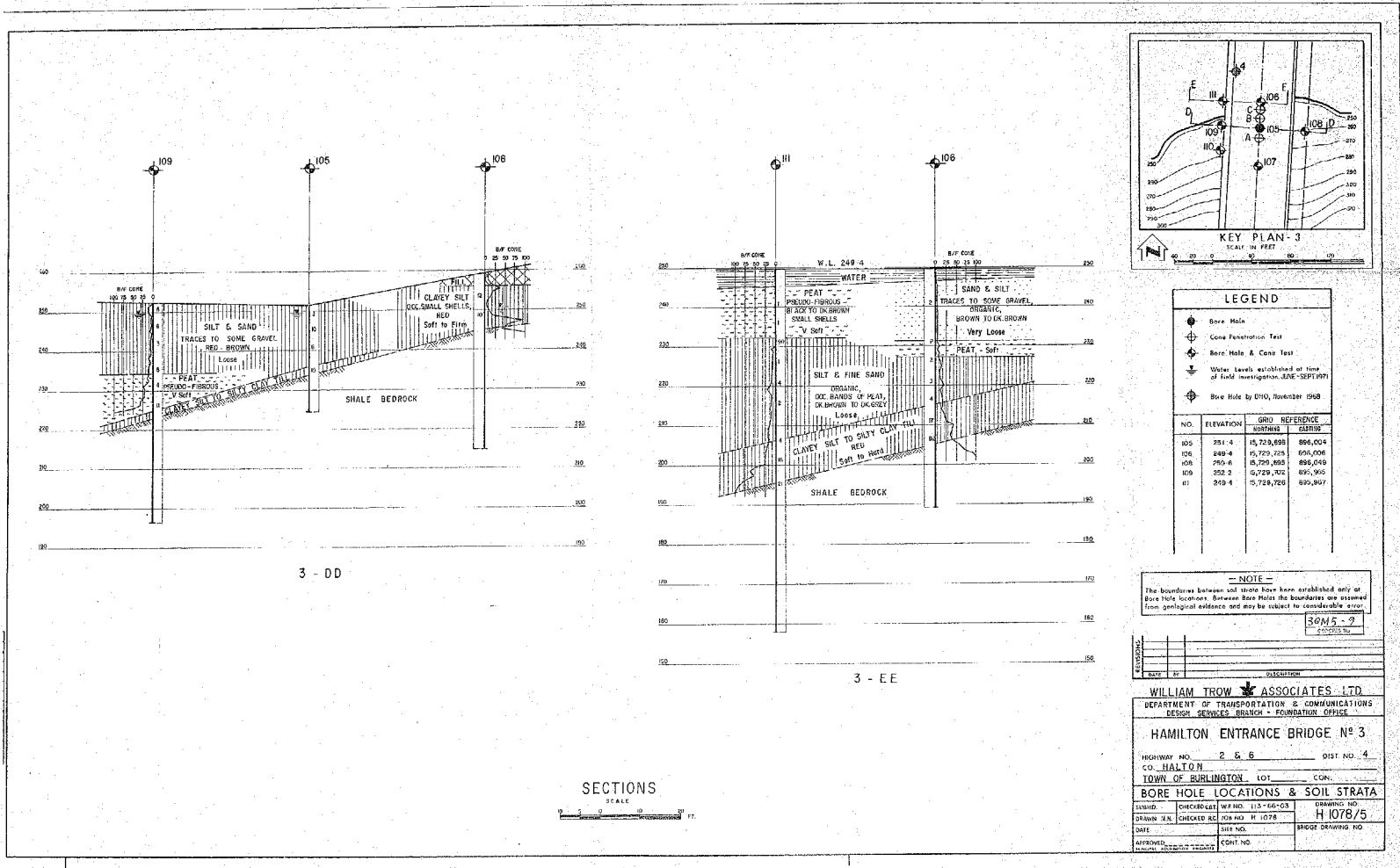
LEGEND			
◆	Bore Hole		
⊕	Cone Penetration Test		
⊕	Bore Hole & Cone Test		
+	Water Levels established at time of field investigation - DEC. SEPT. 1971		
⊕	Bore Hole & Cone Test by DHO, November 1969		
NO.	ELEVATION	GRID REFERENCE	
		NORTHING	EASTING
2	249.5	5,750,074	606,019
101	250.7	5,750,119	605,044
102	250.7	5,750,117	605,018
112	249.8	5,750,096	605,066
113	250.5	5,750,120	605,075
114	252.0	5,750,108	605,081
115	279.0	5,750,135	605,994

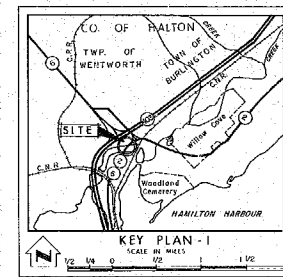
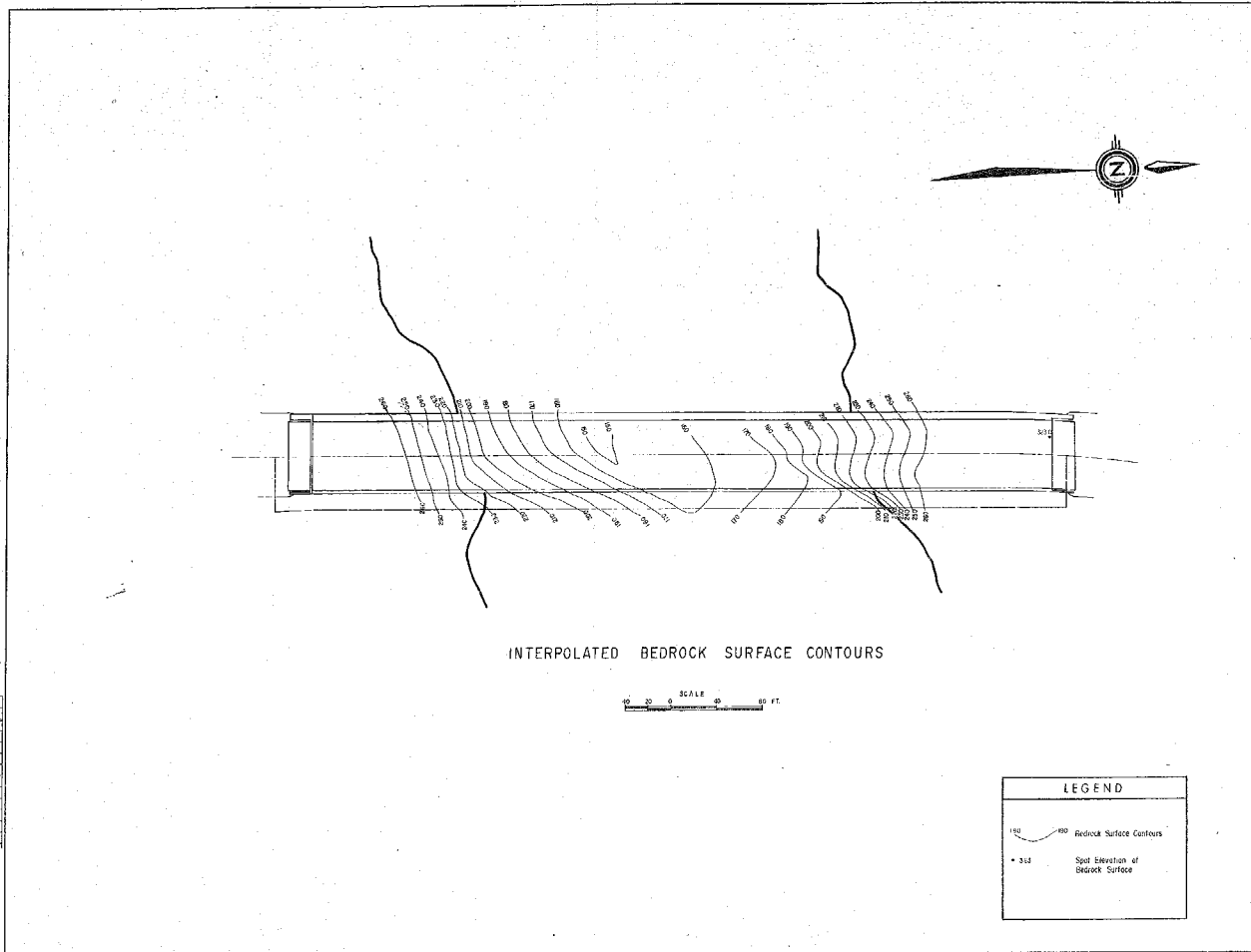
— NOTE —  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

3045-9

DATE	BY	DESCRIPTION
		WILLIAM TROW & ASSOCIATES LTD.
		DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
		DESIGN SERVICES BRANCH - FOUNDATION OFFICE
		HAMILTON ENTRANCE BRIDGE No 3
HIGHWAY NO.	2 E 6	DIST NO. 4
CO. HALTON		
TOWN OF BURLINGTON	LOT	C. X
BORE HOLE LOCATIONS & SOIL STRATA		
DRAWN	CHECKED	BY NO. 113 - 88 - 03
DATE	LIFE NO.	DRAWING NO. H 1078/3
APPROVED	CONTR. NO.	DESIGN DRAWING NO.







INTERPOLATED BEDROCK SURFACE CONTOURS

SCALE 0 20 40 60 FT.

**LEGEND**

— Bedrock Surface Contours

• 365 Spot Elevation of Bedrock Surface

**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.

NO.	DATE	BY	REVISION
1	11/1/78	W.T.	1.0

**WILLIAM TROW ASSOCIATES LTD.**  
DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH - FOUNDATION OFFICE

**HAMILTON ENTRANCE BRIDGE No 3**

HIGHWAY NO. 2 E 6 DIST NO. 4  
CO. HALTON TOWN OF BURLINGTON LOT CON.

**BORE HOLE LOCATIONS & SOIL STRATA**

SURVISED	CHECKED	DATE	NO.	113-66-03	DRAWING NO.	H 1078/6
DRAWN	NO.	CHECKED	NO.	H 1078	BRIDGE TRAVEL NO.	
DATE	Oct 18, 1971	SITE NO.				
APPROVED		DATE				

PROJECT NO. D-6965-7