DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 31E-79

DIST. 11 REGION

W.P. No. 74-74-06

CONT. No. 79-86

W. O. No.

STR. SITE No. 42-169

HWY. No. 11

LOCATION Muskoka Rd #3
Muskoka

No OF PAGES - 1

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

31E-79
GEOCRES No.

TO: J. McAllister (2)
Head, Structural Section
Northern Region, North Bay

FROM: Soil Mechanics Section
Geotechnical Office
West Bldg., Downsview

ATTENTION:

DATE: April 6, 1976 APR 20 1976

OUR FILE REF. W.P. 74-74-06

IN REPLY TO

SUBJECT: CONT 79-86

FOUNDATION INVESTIGATION REPORT

For

W.P. 74-74-06
Hwy 11 District 11, Huntsville
Muskoka Road No. 3
South Junction to Huntsville
2.6 Miles South of Hwy 60

Attached we are forwarding to you our detailed Foundation Investigation Report on the subsoil conditions existing at the above mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your requirements. Should additional information be required, please do not hesitate to contact our Office.

K.G. Selby
Supervising Engineer

KGS/bp

cc: D.A. White
M.J. Bernhardt
C.G. Campbell
C.S. Grebski
B.J. Giroux
S. McCombie
R.S. Pillar
G.A. Wrong

R. Hore

J. Anderson)
R. Murphy) Memo only
G. Sloan)

Files

TABLE OF CONTENTS

FOUNDATION INVESTIGATION REPORT

For

W.P. 74-74-06
Hwy 11 District 11, Huntsville
Muskoka Road No. 3
South Junction to Huntsville
2.6 Miles South of Hwy 60

1. INTRODUCTION

In conjunction with the improvement of Hwy. #11, an underpass structure is proposed for grade separation at the above-mentioned location to carry Muskoka Rd. #3 over Hwy. #11.

Contained in this report is factual and interpreted subsoil information, together with comments and recommendations for the design and construction of the structure foundations and approaches.

2. SITE DESCRIPTION

The structure site is located approximately 150 ft. north and 200 ft. west of the intersection of existing Hwy. #11 and Muskoka Rd. #3, about 1½ miles west of Huntsville. Both the northeast and the northwest quadrants of the intersection are water logged, swampy areas. While the southwest quadrant is a heavily treed hill, the southeast quadrant is relatively level, sparsely wooded terrain.

Geologically, the site is located in the Canadian Shield. Bedrock in the vicinity is found to be a micaceous schist of Pre-Cambrian age. The overburden, in general, consists of post glacial lacustrine deposits of clayey silt, and silt, as well as a glacio-fluvial deposit of sand and gravel.

3. SUBSURFACE CONDITION

A total of 7 sampled boreholes was put down to determine subsoil conditions. In general, subsoil at the site consists of 20 to 35 ft. of clayey silt overlying 10 to 15 ft. of silt, which in turn is underlain by a layer of sand and gravel which contains cobbles and boulders. In addition to the above-mentioned subsoil types, muck is also encountered in the swamp. Although

bedrock is not proven due to numerous cobbles and boulders, from information obtained from adjacent sites, the sand and gravel layer is believed to be underlain by bedrock.

Locations of the boreholes and the inferred subsoil stratigraphy are shown in Dwg. 747406-A. A detailed description of the subsoil is given below:

(3.1) Muck

This material is encountered mainly in the swamp area, with a thickness of 4 to 8 ft. It is amorphous and is composed mainly of organic clay and silt. It has a very high moisture content, sometimes in excess of 300%. Its shear strengths are very low, and its compressibility very high.

On the south side of Muskoka Rd. #3, within the boundary of this project, no organic muck is encountered.

(3.2) Clayey Silt

This material is encountered throughout the area. It has a thickness of about 20 to 35 ft. It is stratified, with frequent silt seams. Because of the presence of numerous more permeable silt seams, this material is known to have a very high rate of consolidation.

The consistency of this material, in general, can be considered as soft to firm, on the basis of its undrained shear strengths which vary from 250 p.s.f. to slightly over 1000 p.s.f. The clayey silt deposits revealed in BH 3 and 5, however, are relatively stiffer, suggesting that they may have been somewhat overly-consolidated. The effective shear strength parameters of the clayey silt are estimated to be $C' = 100$ p.s.f. and $\emptyset' = 26^{\circ}$, for design purposes.

The moisture contents and Atterburg limits of the clayey silt show a wide range of variation, reflecting the stratified nature of the material.

A plot of the plasticity indices and the grain size distribution envelope are shown in Fig. 1 and 4.

(3.3) Silt

Underneath the clayey silt is a layer of silt 10 to 15 ft. thick, which is slightly layered with occasional clay seams. The sorted grain sizes of this material and geology of the region suggests that it is a post glacial lacustrine deposit. On the basis of 'N' values, the relative densities of this material are classified as 'compact'. The occasional low 'N' values are attributed to 'boiling' of the silt during sampling operation.

A plot of grain size distribution envelope is contained in Fig. 2.

(3.4) Sand & Gravel

The silt layer is found to be underlain by a deposit of sand and gravel. Because of frequent cobbles and boulders, the lower boundary of this deposit was not determined, but it is believed to be underlain by schist bedrock. At the footing locations, this deposit is found to have a thickness of at least 30 ft.

In view of the augularity of its particles, and the unsorted grain sizes, which range from very fine sand to large boulders, this material is probably of glacio-fluvial origin.

The relative densities of this material are difficult to determine. They cannot be reliably inferred from the 'N' values or from the cone test results, because of the presence of very large size particles. On the basis of the advancement of the NX casings, which were driven by means of a 300 lb. hammer dropping at a free fall of 3 to 4 ft., it is our opinion that the sand and gravel may have a relative density of dense to very dense.

(3.5) Groundwater Conditions

Groundwater levels were observed in the open boreholes and are reported in the Borehole Record Sheets. For practical purposes, they may be assumed equal to the prevailing water level in the swamp, which is at about elev. 932 $\pm$. Artesian conditions were also noted in the sand and gravel layer, with a head up to about

elev. 941 ±. This artesian head may change from season to season, depending on the groundwater conditions in the nearby hills.

4. COMMENTS AND RECOMMENDATIONS

The underpass is proposed to be a two-span 240 ft. long structure. The proposed profile grade of Muskoka Rd. #3 is at Elev. 967 ±, and that of Hwy #11 is at elev. 947 ±, respectively.

Based on our subsoil information, the following recommendations are given:

(4.1) Structure Foundation

Spread footing foundation is impracticable because of the very low bearing capacity of the surficial clayey silt deposit. The most suitable type of foundation, in our opinion, would be steel piles driven into the sand and gravel layer for end-bearing. Because of frequent cobbles and boulders, the piles should be composed of H-sections, reinforced with flange plates at tips. If the piles are driven in accordance with Hiley Formular (MTC Standard SS-3-10 or SS-3-11), the piles can be designed for their maximum allowable capacities. It is difficult to determine accurately the founding elevations of the pile tips because of cobbles and boulders. It is our estimation that the piles may attain the design capacities at elev. 870 ± at the east abutment, elev. 880 ± at the center pier, and elev. 885 ± at the west abutment. Lateral forces acting on the structure can be resisted by battered piles. For frost protection, all pile cap bases should have at least 6 ft. cover. To minimize the height of the abutments, it would be advantageous to design the abutments as perched type. According to the profile grade of Hwy #11, the pile cap bases will be well above groundwater level; therefore, no dewatering problem is anticipated. Differential settlements of the structure founded on end-bearing piles would be negligible.

(4.2) Approaches

The muck existing at the east abutment location, about 8 ft.

thick, should be excavated and backfilled with sandy type material, as shown in Fig. 6. If this is done and the forward slopes are constructed at 2H:1V, no stability problems are anticipated for the forward slopes of both abutments. The south side-slopes of both approaches are found to be stable at 2:1 slopes. The north side-slopes, which constitute part of the ramps, will be discussed in the following section. To accomodate the differential settlements between the abutment and the approach fill, a 35 ft. approach slab should be provided.

(4.3) Ramps

Both the W-N Ramp and the N-E Ramp, with the latter following more or less the alignment of an existing gravel road, are found to be stable if 2:1 slope is adopted. For the E-N Ramp, as recommended in our memo dated April 10, 1975, berms will be required for fills in excess of 15 ft. high. The requirements for berm design are contained in Fig. 7 and the above-mentioned memo.

The EW-S Ramp is bounded by Muskoka Rd #3, Hwy #11 SBL, and South Service Road. Since berms are required to stabilize the various embankments and in some areas the berms are overlapped or close together, we suggest that the area bounded by Muskoka Rd #3, Hwy #11 SBL and the CNR tracks be filled up to elev. 940, prior to the construction of the embankments. The west boundary of this fill will be discussed in Foundation Report W.P. 74-74-02, as this fill is intended to be a berm for the South Service Rd. The side slopes of the embankments in this area, including those of the EW-S Ramp, should not be steeper than 2.0:1. Prior to the placement of the fill, muck should be removed by excavation and replaced by sandy type material. Bottom of muck excavation is recommended at elev. 920 $\pm$. Placement of fill underwater in the swamp should proceed outward from Hwy. #11, so as to displace any remaining soft material. and to avoid trapping soft material within the fill, which will cause undesirable differential settlements.

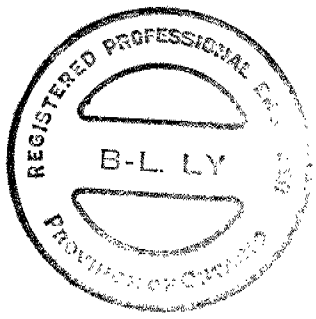
(4.4) Settlements

Under a fill height of 30 ft., settlements due to consolidation of the subsoil would be in the order of 18 to 22" in the swamp area, and 10 to 13" at the W-N Ramp and N-E Ramp. These settlements would occur over a period of 2 to 3 years.

These settlements may cause pavements to crack and may be harmful to some underground utilities.

Ly BL

B. Ly, P. Eng.
Project Engineer



K. G. Selby

K.G. Selby, P. Eng.
Supervising Engineer

APPENDIX

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

WP 74-74-06 LOCATION Co-ords. 16,466,528 N; 1,065,533 E. ORIGINATED BY BL

DIST 11 HWY 11 BORING DATE September 10, 1975 COMPILED BY BL

DATUM Geodetic BOREHOLE TYPE Washboring with NX & BX Casings CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
936.7	Ground Level					
0.0	Peat – fibrous and silty		1	SS	3	
928.7						930
8.0	Clayey silt Soft to firm, with frequent clay seams and fine sand partings Sensitive		2	SS	7	
			3	TW	PM	920
			4	SS	3	
	Becoming silty below El. 910.0		5	TW	PM	910
904.7			6	SS	28	
	Silt Loose to Compact trace of clay & sand		7	SS	16	900
			8	SS	6	
891.7						
	Sand – fine to medium Dense to Very Dense some gravel		9	SS	31	890
						880
	frequent boulders below el. 870.±		10	SS	85/6"	870
			11	RC	58%	
862.7			12	RC	47%	
74.0	End of Borehole					

N.B.:
1. G.W.L. at elev. 934.2 on Sept. 15/75.
2. Artesian pressure encountered at El. 890.± with a head 3'-9" above ground surface.

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
1000 2000

+ s7.0
+ s4.8
+ > 2000

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
w_P w w_L
WATER CONTENT %
10 20 30

69
106
116

UNIT WEIGHT γ

REMARKS	GR	SA	SI	CL
8.9% Org.				
	0	0	86	14
	0	0	71	29
	0	0	99	1

▽ Art. Head encountered

20
15 ○ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

WP 74-74-06 LOCATION Co-ords. 16,466,504 N; 1,065,423 E. ORIGINATED BY BL

DIST 11 HWY 11 BORING DATE September 15, 1975 COMPILED BY BL

DATUM Geodetic BOREHOLE TYPE Washboring with NX & BX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES
936.5	Ground Level				
0.0	Clayey silt, with frequent clay seams & fine sand partings		1	SS	16
			2	SS	3
			3	SS	9
	Grey				
913.5			4	SS	20
23.0	Silt		5	SS	15
	Compact Grey		6	SS	2/6"
903.5					
33.0	Sand, fine to medium dense to very dense some gravel		7	SS	14
	frequent cobbles and boulders below		8	SS	60/6"
	El. 896.±		9	WS	-
			10	WS	-
866.5					
70.0	End of Borehole				

N.B.: Artesian pressure encountered at El. 900.± with a head 4' above ground surface.

GROUND WATER ELEV

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
w_P w w_L
WATER CONTENT %
10 20 30

UNIT WEIGHT γ

REMARKS
▽ Artesian Head
%
GR SA SI CL

930 920 910 900 890 880 870

0 1 66 33
0 0 89 11
0 0 99 1

▽ Art. Head encountered

20
15 ○ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

WP 74-74-06 LOCATION Co-ords. 16,466,533 N; 1,065,302 E. ORIGINATED BY BL

DIST 11 HWY 11 BORING DATE September 10, 1975 COMPILED BY BL

DATUM Geodetic BOREHOLE TYPE Washboring with NX & BX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
941.0	Ground Level					
0.0	Clayey silt - stiff, with frequent clay seams and fine sand partings		1	SS	19	940
			2	SS	10	930
			3	SS	20	
	Grey		4	SS	22	920
918.0						
	Silt Compact traces of clay		5	SS	17	
			6	SS	21	910
908.0						
33.0	Sand-fine to medium, dense to very dense some gravel		7	SS	25	
			8	SS	45	900
	frequent cobbles and boulders below El. 900.±		9	SS	100/5"	890
879.5			10	SS	90/3"	880
61.5	End of Borehole					

N.B.: Artesean pressure encountered at El.907± with a head up to ground surface.

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
w_P w w_L
WATER CONTENT %
10 20 30

UNIT WEIGHT γ

REMARKS	% GR	SA	SI	CL
Art. Head				
	0	0	72	28
	0	0	95	5
▽ Art. Head encountered				
	0	90	(10)	

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

WP 74-74-06 LOCATION Co-ords. 16,466,478 N; 1,065,885 E. ORIGINATED BY

DIST 11 HWY 11 BORING DATE October 24, 1974 COMPILED BY GP

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
935.5	Ground Level					
0.0	Clayey silt to silty clay layers of silt — Firm, soft		1	SS	24	
			2	TW	PH	
			3	TW	PH	
			4	TW	PM	
			5	TW	PH	
	— firm		6	TW	PH	
905.5						
30.0	Silt, some clay		7	SS	10	
			8	TW	PH	
890.5						
888.5	Silty sand, some clay Very Loose		9	SS	33	
47.0	End of Borehole					
876.5						
	End of Cone Test					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (1000 2000)

LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w (w_P w w_L)

WATER CONTENT % (10 20 30)

UNIT WEIGHT γ P.C.F

REMARKS

ELEV	UNIT WEIGHT P.C.F	REMARKS % GR SA SI CL
930	124.5	
	104	
920	123	0 2 72 26
		0 2 86 12
910	115	
888.5		17 48 34 1

+s5.4 +s3.5 +s2.6 +s3.7 +s3.9 +s4.5 +s4.0 +s3.4 +s2.8 +s3.8 +S=3.3 +s5.4 +s5.1 +s4.3 >2000

20
15 ⊕ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

WP 74-74-06 LOCATION Co-ords. 16,466,462 N; 1,065,682 E. ORIGINATED BY AP

DIST 11 HWY 11 BORING DATE October 25, 1974 COMPILED BY GP

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
937.9	Ground Level					
0.0	Clayey silt stiff to very stiff with layers of silt		1	TW	PH	
			2	TW	PH	
			3	TW	PH	
			4	TW	PH	
919.9						
18.0	Silt trace of clay		5	TW	PH	
			6	SS	8	
909.0						
28.9	Silty sand, fine, some gravel		7	SS	7	
899.9			8	SS	9	
38.0	End of Borehole					
891.1						
46.8	End of Cone Test					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE
1000 2000

LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w
w_P w w_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ

REMARKS

ELEV	WATER CONTENT %	UNIT WEIGHT	% GR SA SI CL
930	114		0 0 58 42
920	119		
910			0 0 91 9
			11 53 (36)

+s3.3 +s2.6 s2.5+ +s3.3 +s1.6 +4.4 100/10"

20
15 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 43

WP 74-74-06 LOCATION Co-ords. 16,466,790 N; 1,065,300 E. ORIGINATED BY BVV

DIST 11 HWY 11 BORING DATE February 10, 1976 COMPILED BY BVV

DATUM Geodetic BOREHOLE TYPE Washboring with NX Casing CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
930.0	Ice Surface					
0.0 / 926.0	Water					
4.0	Muck		1	SS	PM	
	Very Soft					
918.5			2	SS	PM	920
11.5	clayey silt		3	TW	PM	
	Stratified					
909.0			4	SS	1	910
21.0	Silty clay to clayey silt		5	SS	PM	
	Stratified					
	Soft to Firm		6	TW	PM	900
	Firm to stiff		7	TW	PM	
891.0						
39.0	Silt, Compact trace of clay and stratified		8	SS	15	890
			9	SS	11	880
	Possible sand & gravel at 61.5'					
868.0			10	SS	17	870
62.0	End of Hole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 1000 2000

+5 (920); +2, +11 (910); +2, +8, ○, +9 (900); +5 (890)

LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w (w_P — w — w_L)

WATER CONTENT %: 10 20 30

UNIT WEIGHT γ

REMARKS	% GR	SA	SI	CL
54% Org.				
64% Org.				
122				
108				
	0	0	92	8
	0	11	71	18

20
15 ⊹ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 44

WP 74-74-06 LOCATION Co-ords. 16,466,275 N; 1,065,875 E. ORIGINATED BY BL

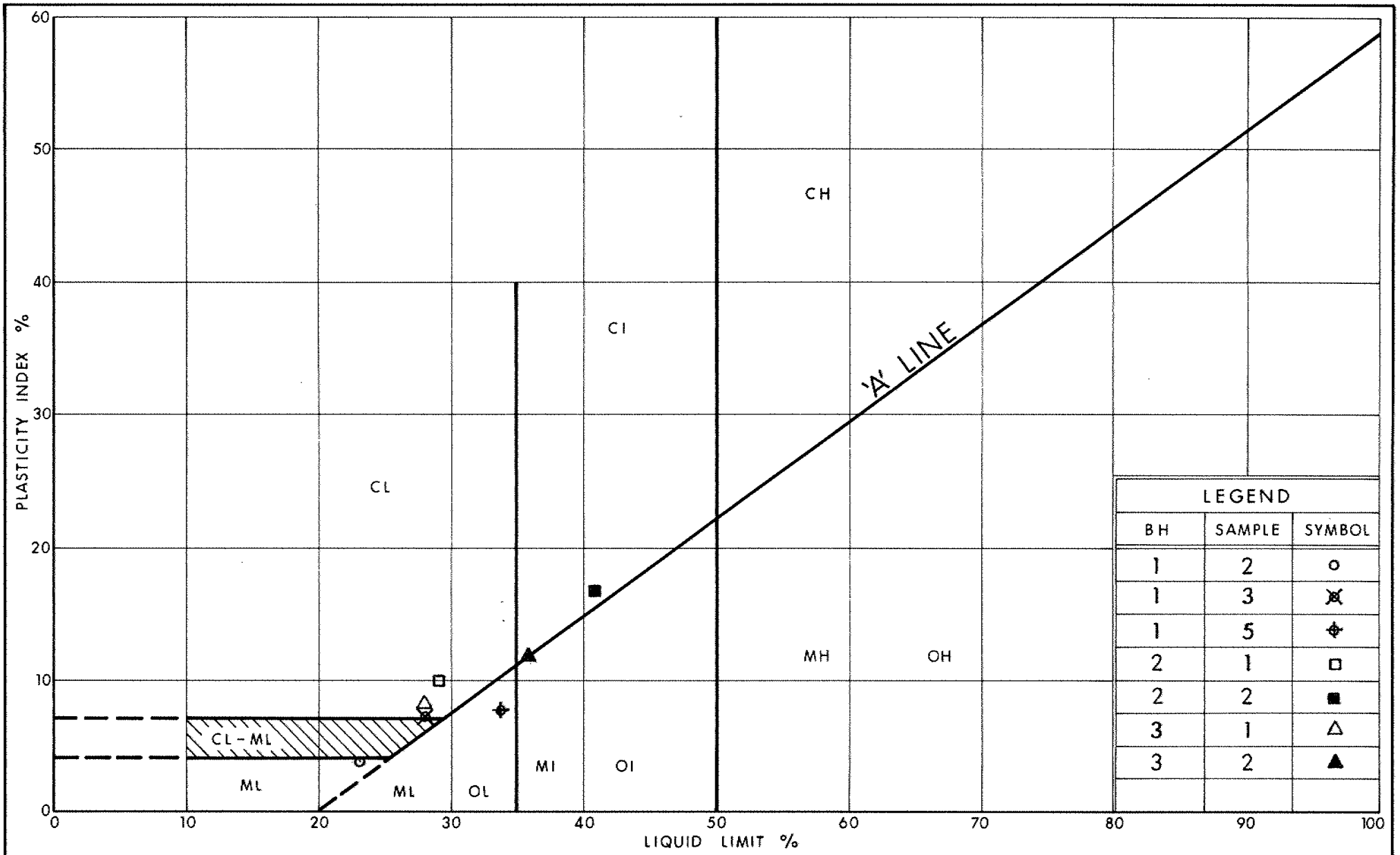
DIST 11 HWY 11 BORING DATE February 11, 1976 COMPILED BY BVV

DATUM Geodetic BOREHOLE TYPE Washboring with NX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	UNIT WEIGHT	REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 — SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (1000 / 2000)	w_P — w — w_L WATER CONTENT %	γ	% GR SA SI CL
934.0	Ground Level									
0.0	Topsoil									
	Clayey silt, stratified with clay and silt seams Stiff / Soft		1	SS	24	930				
			2	SS	2		+ 5			
						920				
			3	SS	8		+ 6			
	becoming very silty									
912.0			4	SS	17		+ > 2000			
22.0	Silt Compact occ. clay seams					910				
			5	SS	15					
900.0										
34.0	Sand, gravel					900				
897.5	Very Dense		6	SS	105/10"					
36.5	End of Borehole									

20
15 ⊹ 5 % STRAIN AT FAILURE
10

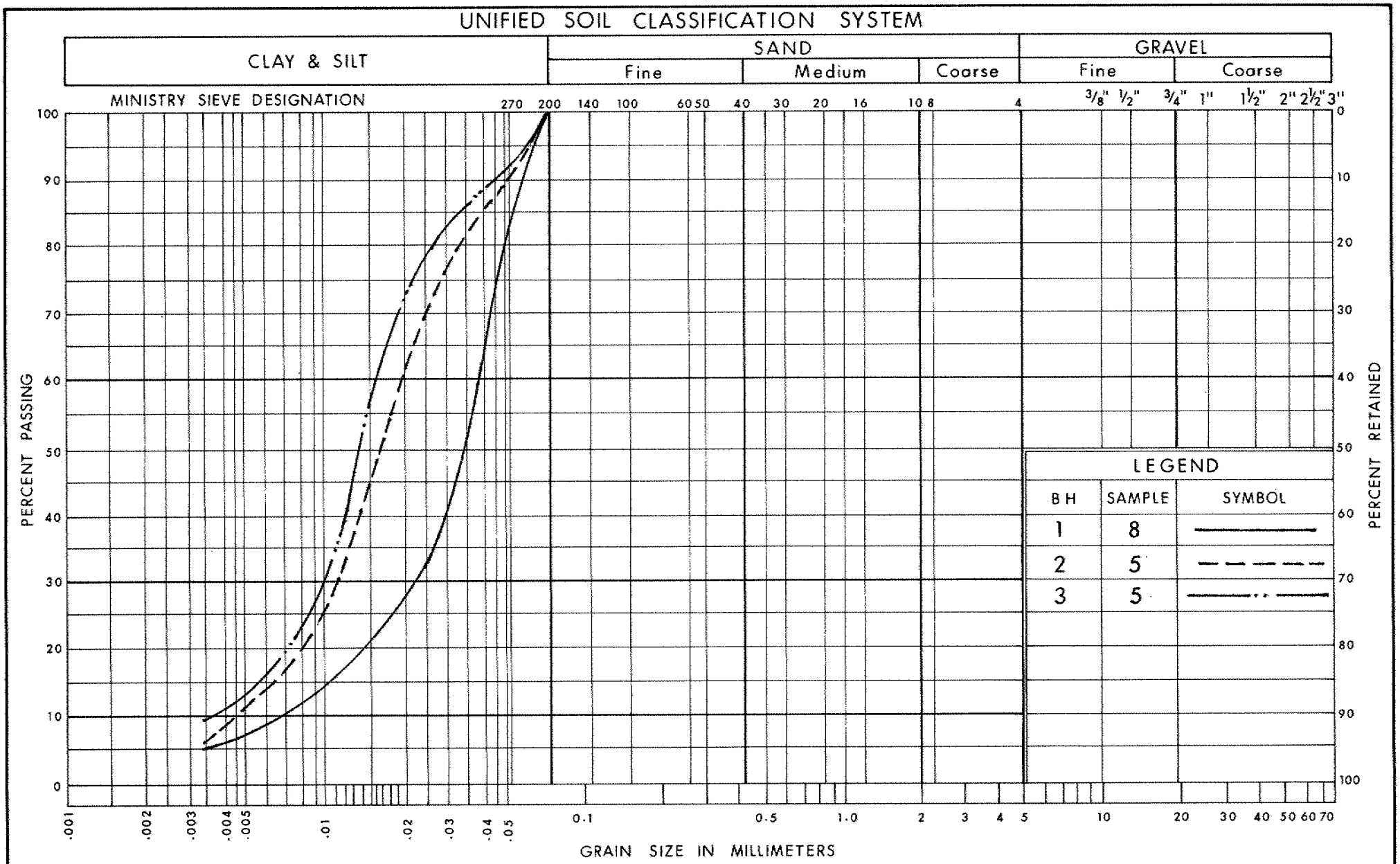
OFFICE REPORT ON SOIL EXPLORATION



Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

PLASTICITY CHART
SILTY CLAY TO CLAYEY SILT

FIG No 1
W P 74 – 74 – 06



Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

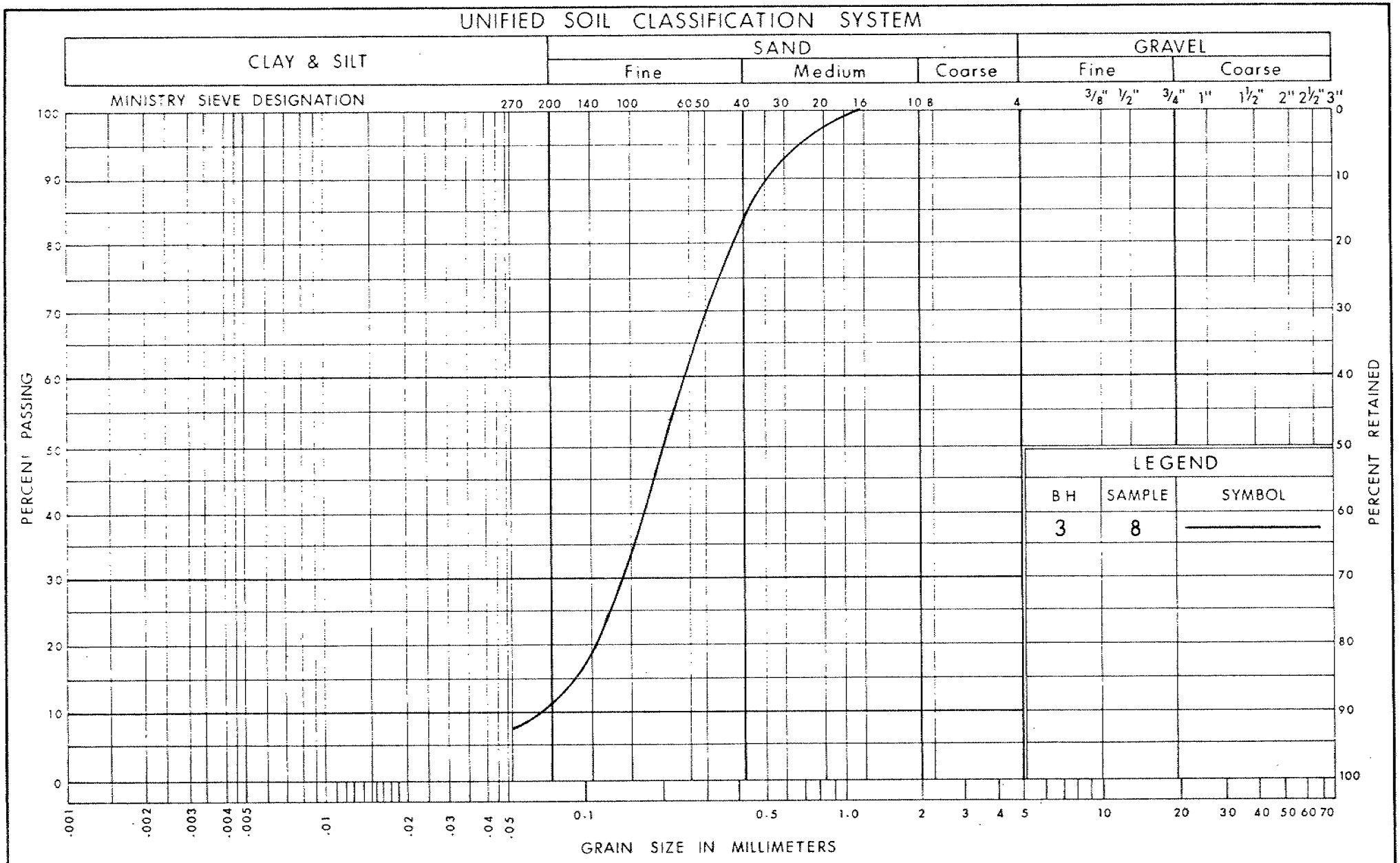
GRAIN SIZE DISTRIBUTION

SILT

TRACES OF VERY FINE SAND & CLAY

FIG No 2

W P 74-74-06

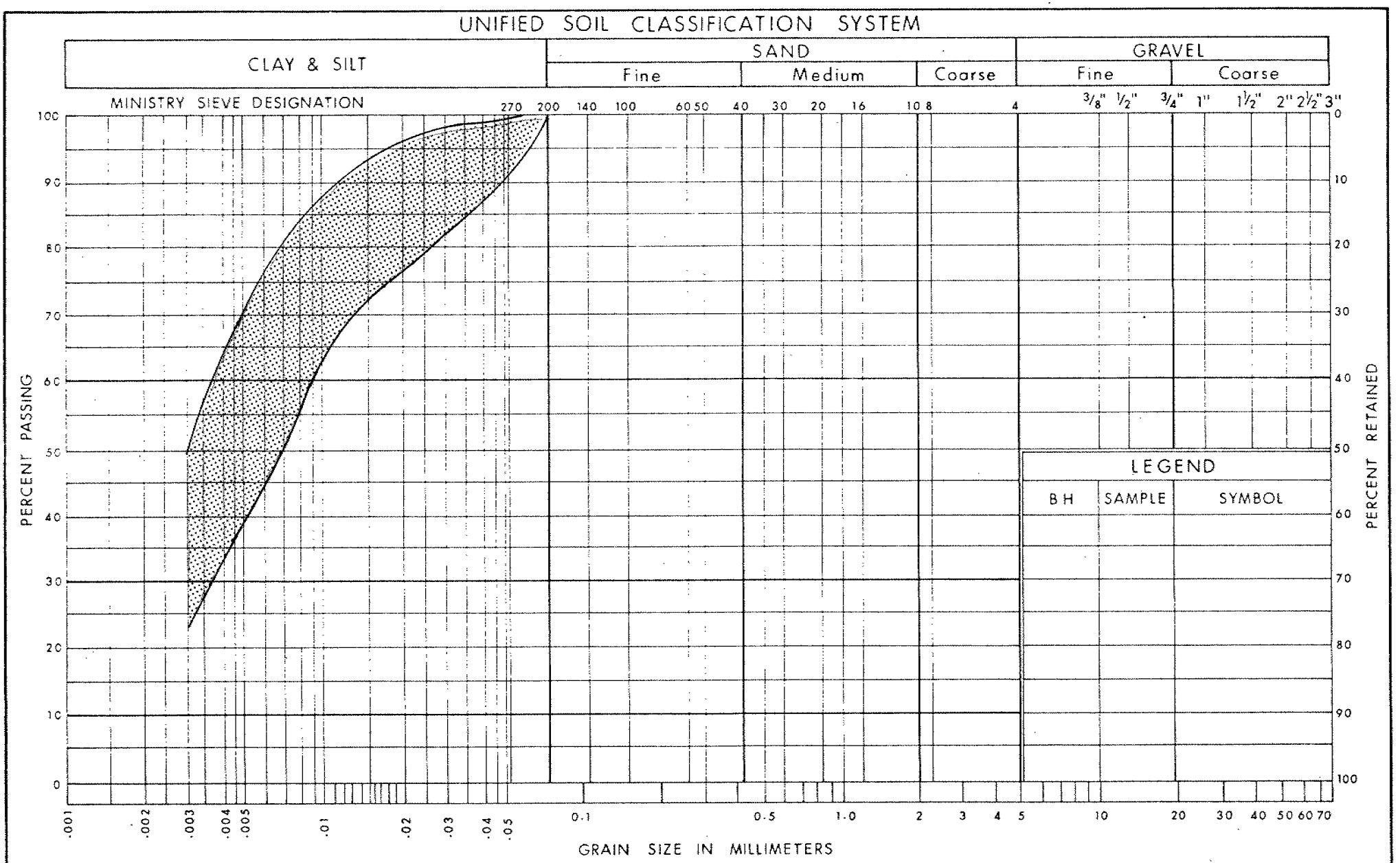


Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
SAND
MEDIUM

FIG No 3

W P 74-74-06



Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

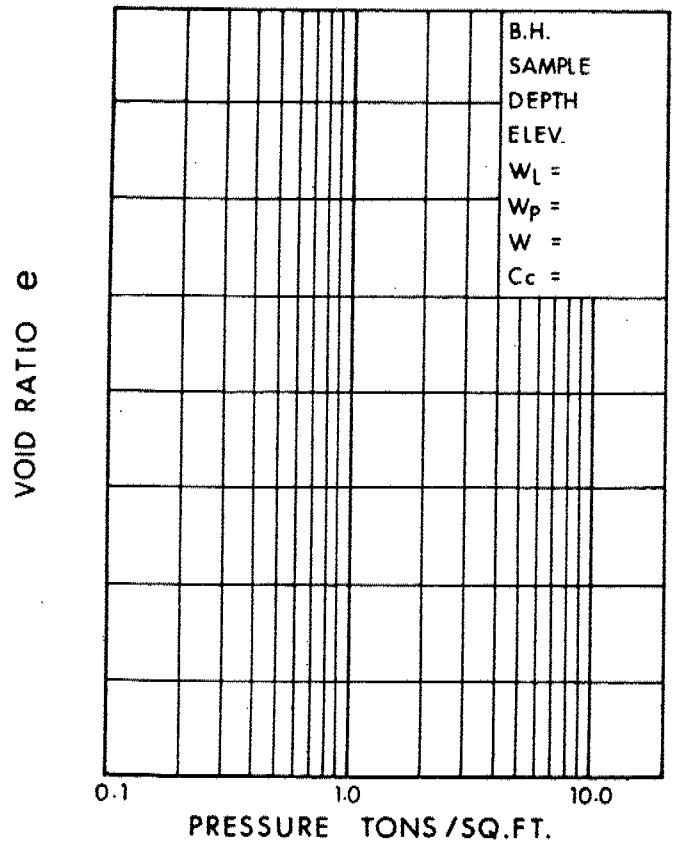
GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAYEY SILT

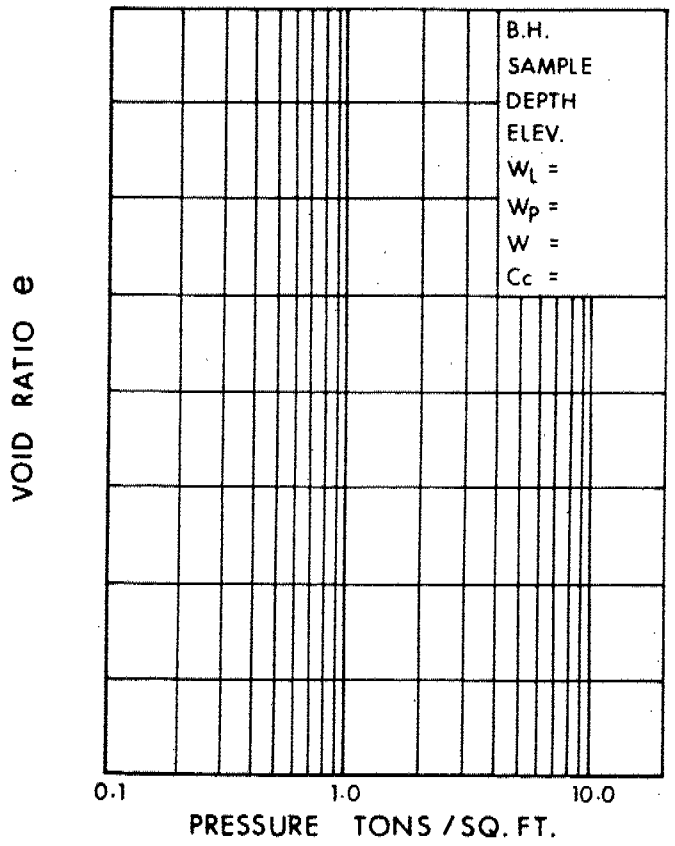
FIG No 4

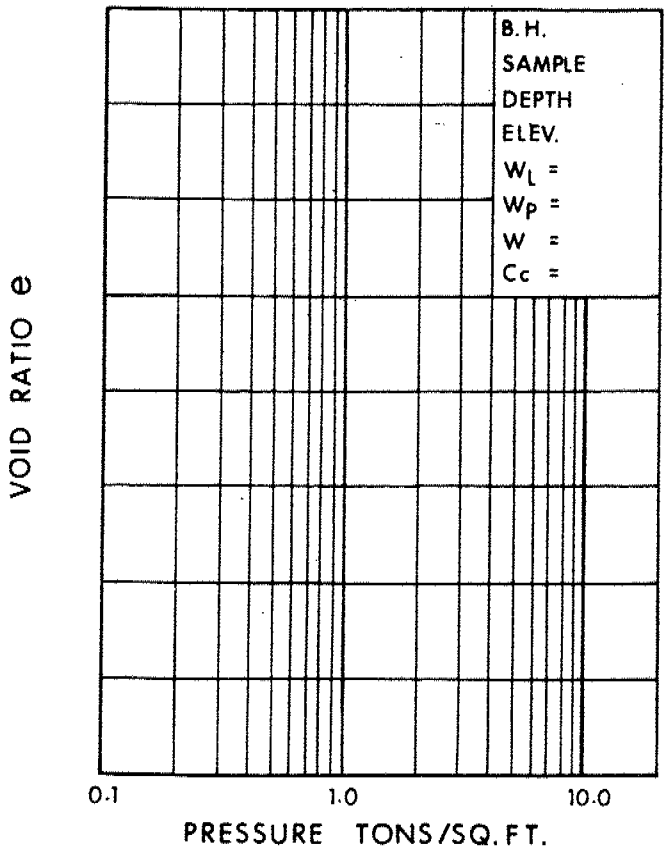
W P 74-74-06

VOID RATIO – PRESSURE CURVES

JOB NO. 74-74-06







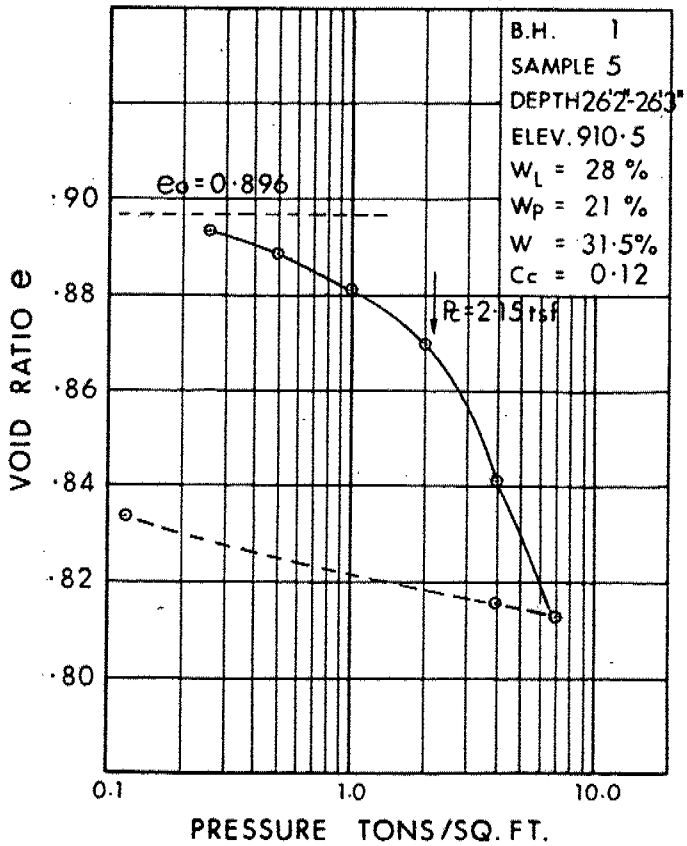
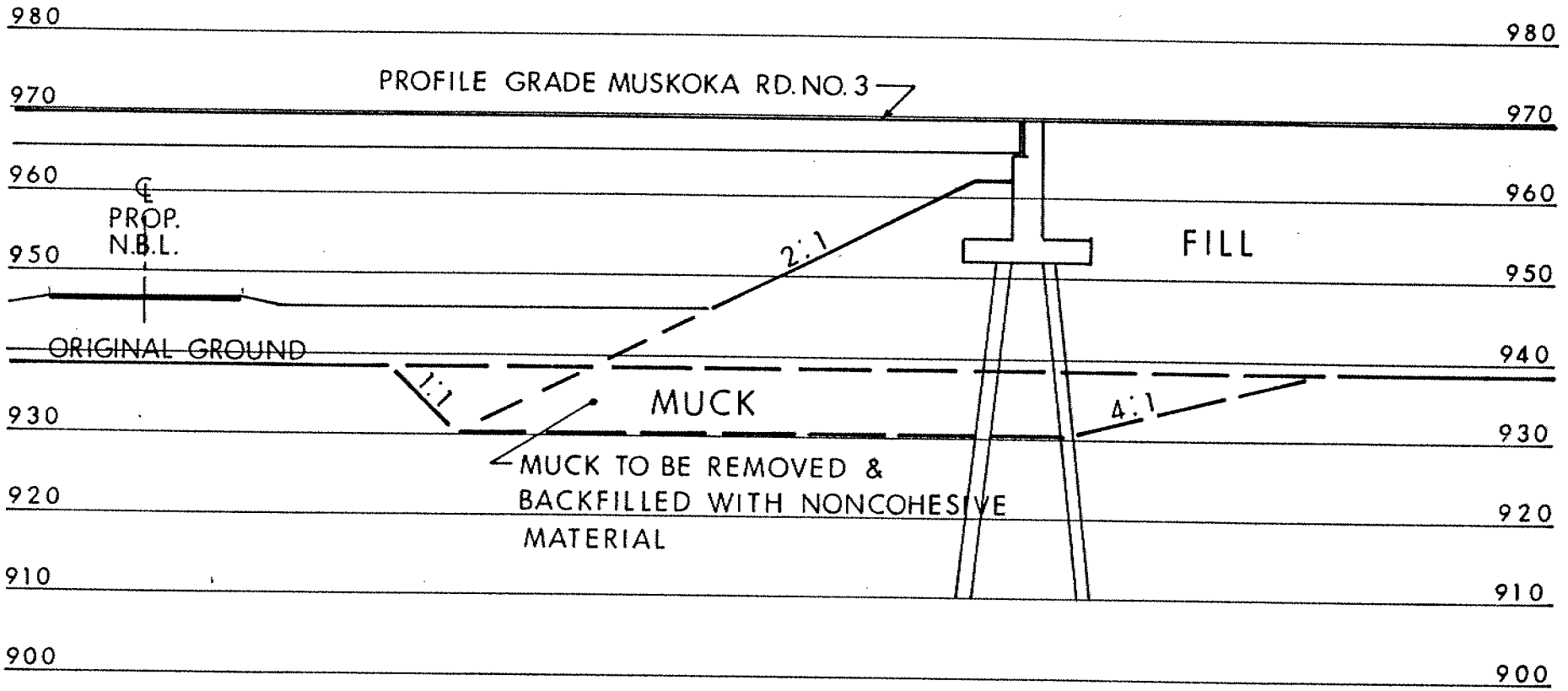


FIG. 5



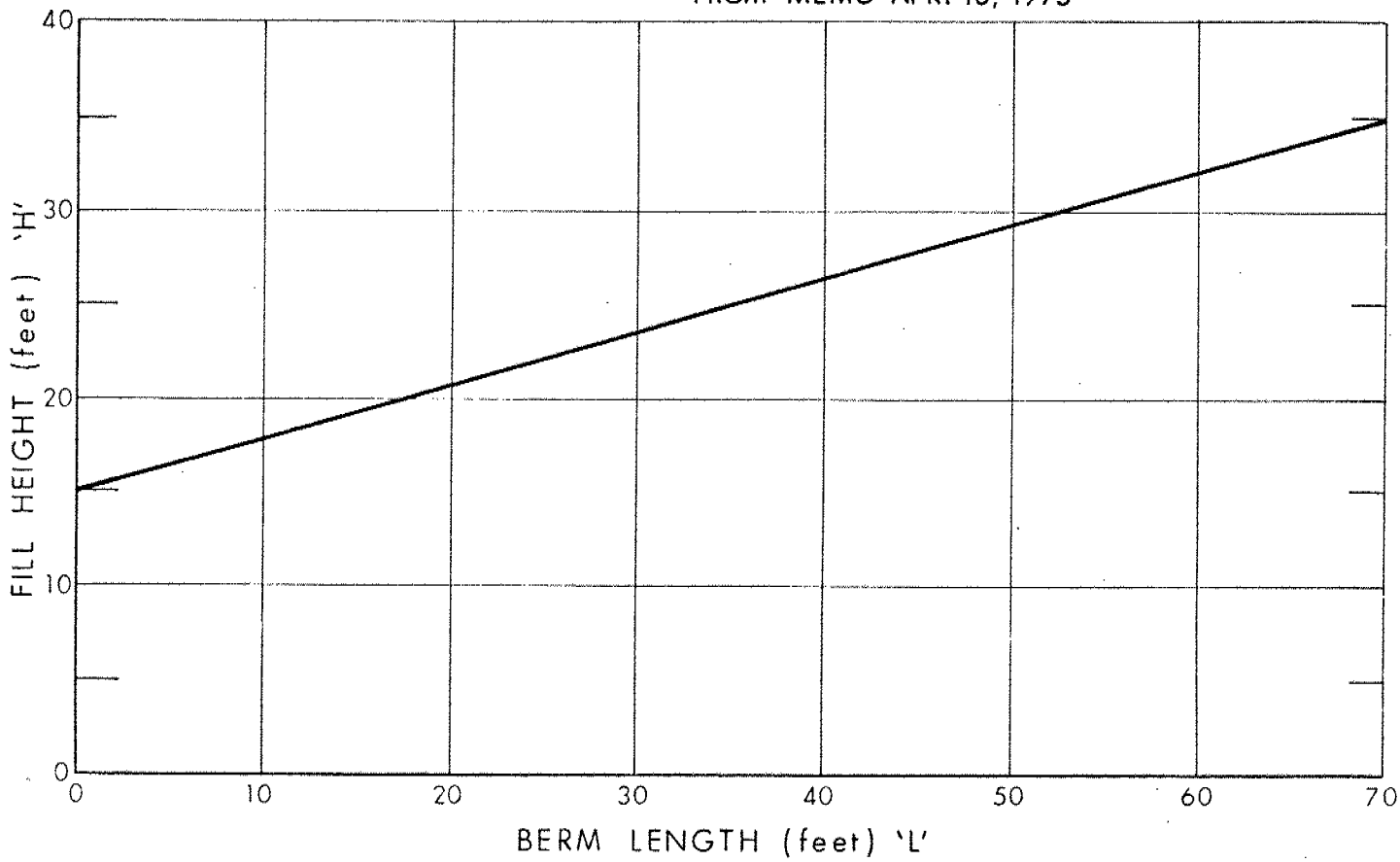
MUCK EXCAVATION
AT EAST ABUTMENT

TYPICAL SECTION

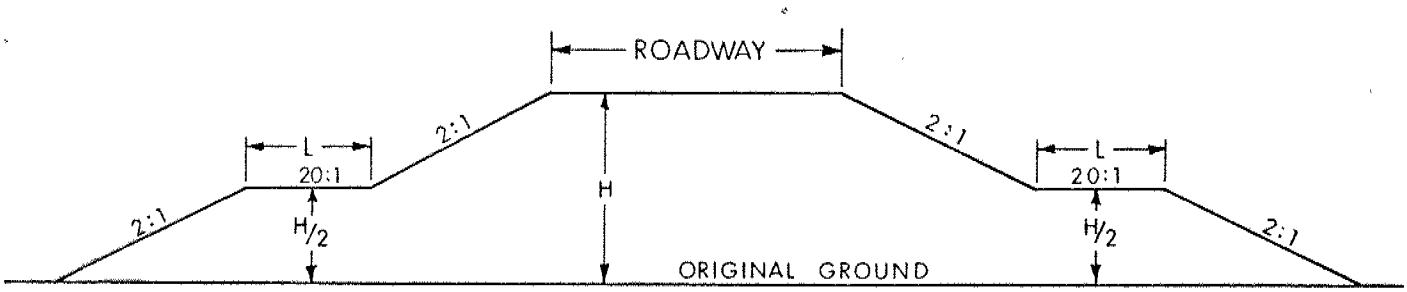
FIG. 6

W. P. 74-74-06

FROM MEMO APR. 10, 1975



BERM DESIGN FOR N-E RAMP



TYPICAL SECTION
(N.T.S.)

FIG. 7

W. P. 74-74-06

FF-A-24(a) (Rev. Jan. 73)

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

'N' = STANDARD PENETRATION RESISTANCE : - 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 : -

CONSISTENCY	c LB./SQ.FT.
VERY SOFT	0 - 250
SOFT	250 - 500
FIRM	500 - 1000
STIFF	1000 - 2000
VERY STIFF	2000 - 4000
HARD	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10 % , SOME 10 - 25 % , WITH 25 - 40 % , > 40 % SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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
w_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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a 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
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

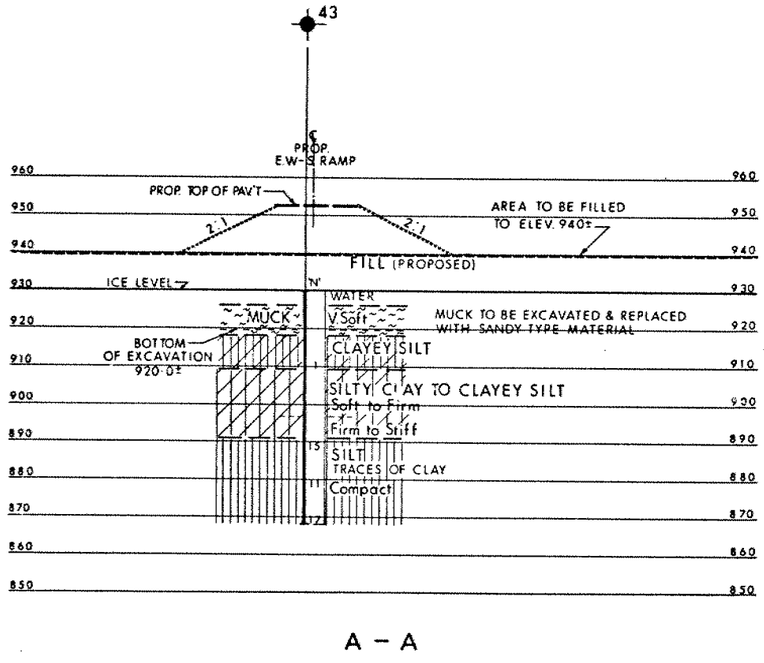
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

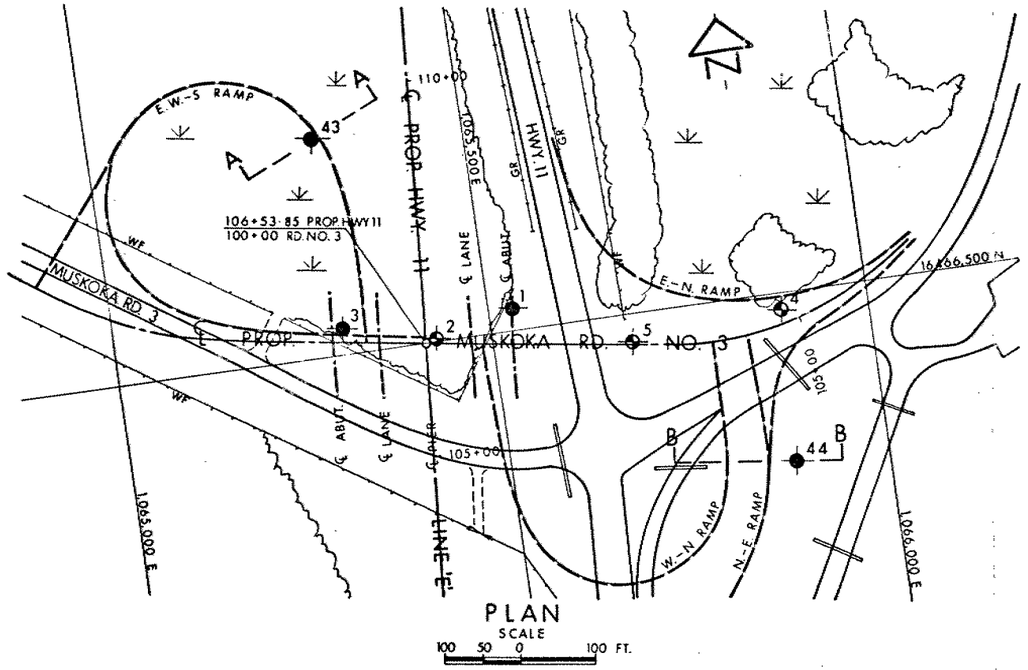
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

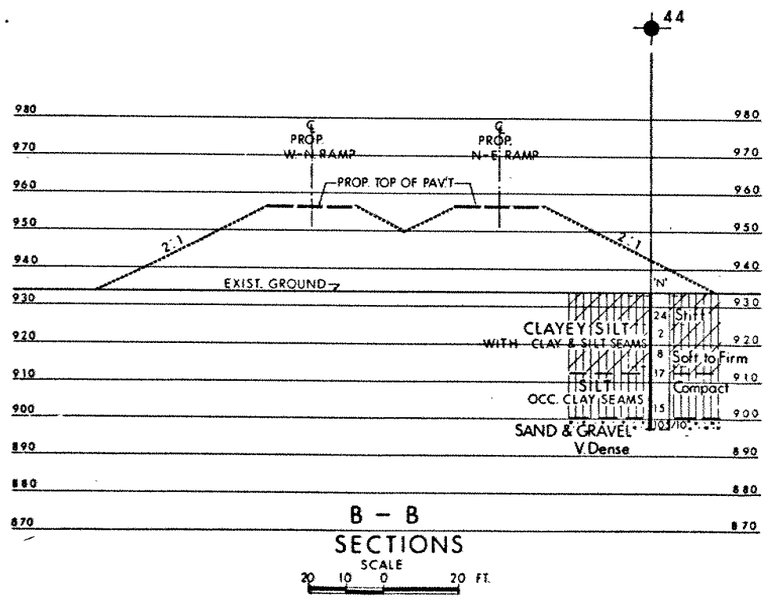


A – A



PLAN

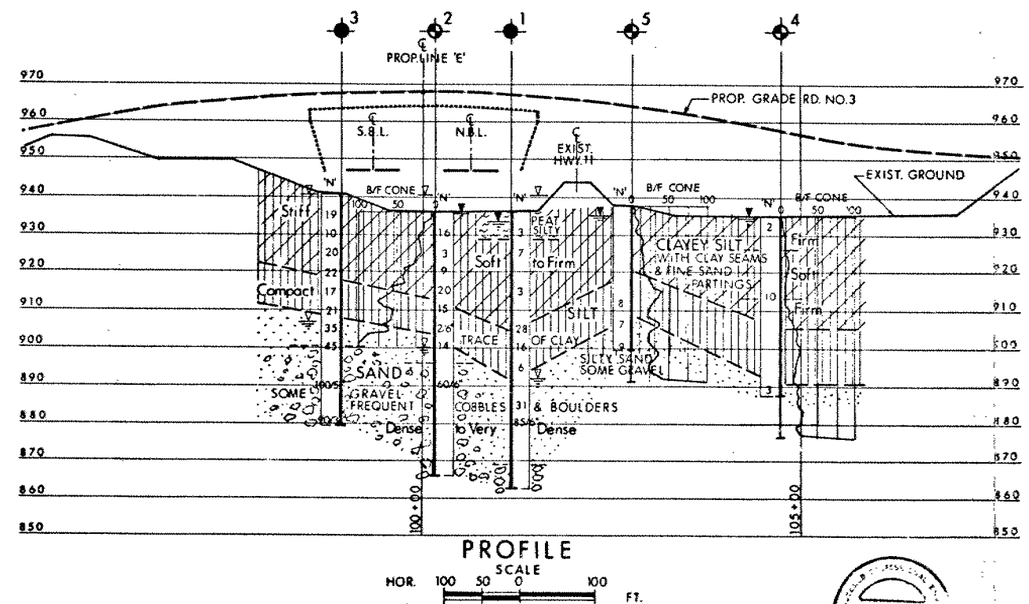
SCALE 100 50 0 100 FT.



B – B

SECTIONS

SCALE 20 10 0 20 FT.

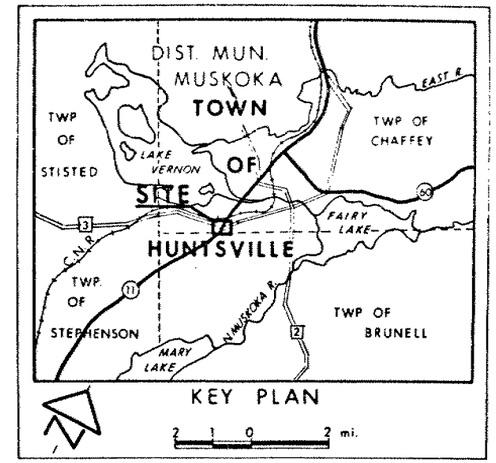


PROFILE

SCALE

HOR. 100 50 0 100 FT.

VERT. 20 10 0 20



LEGEND

- Bore Hole
- Dynamic Cone Penetration Resistance Test B/F CONE - Blows/Ft. Cone Test (350 ft.lbs. energy/blow)
- Bore Hole & Cone Test
- Water Levels established at time of field investigation.
  B.H. No. 1 & 2 SEPT. 1975
  4 & 5 OCT. 1974
  43 & 44 FEB. 1976
  NO W.L. established B.H. 3

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	936·7	16,466,528	1,065,533
2	936·5	16,466,504	1,065,423
3	941·0	16,466,533	1,065,302
4	935·5	16,466,478	1,065,885
5	937·9	16,466,462	1,065,682
43	930·0	16,466,790	1,065,300
44	934·0	16,466,275	1,065,875

▽ HEAD
▽ ENCOUNTERED
ARTESIAN CONDITION

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS			
	DATE	BY	DESCRIPTION

REF: 2-B-625

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

MUSKOKA ROAD NO.3

HIGHWAY NO 11 PROP LINE 'E' DIST NO 11
DIST. MUNICIPALITY MUSKOKA TOWN OF HUNTSVILLE
TWP CHAFFEY LOT 7 CON 1

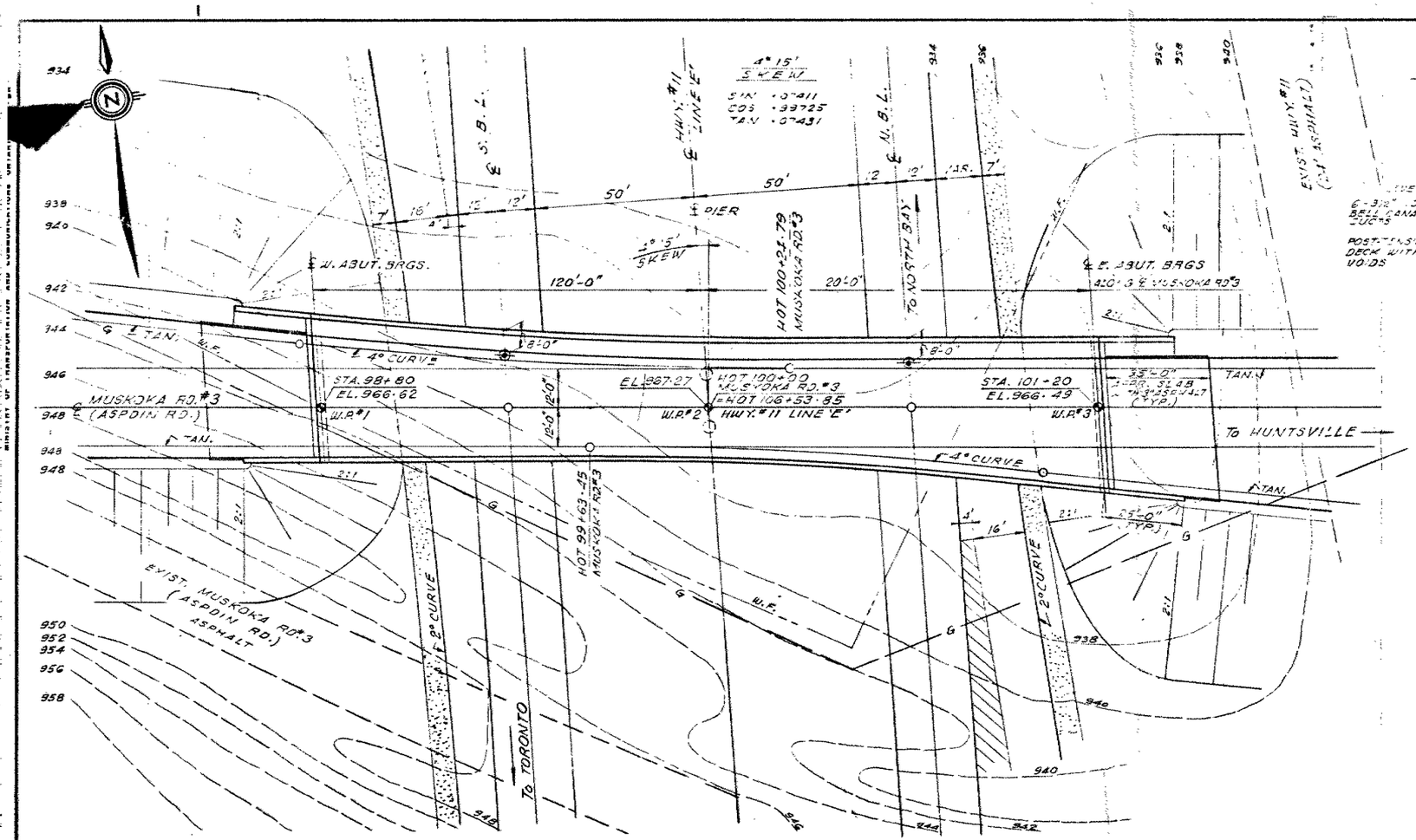
BORE HOLE LOCATIONS & SOIL STRATA

SUBMD B. L.	CHECKED	W.P. NO 74-74-06	DRAWING NO 747406-A
DRAWN O. L. J.	CHECKED	A.O. NO	
DATE 16 MAR. 1976		SITE NO	BRIDGE DRAWING NO
APPROVED		CONT NO	

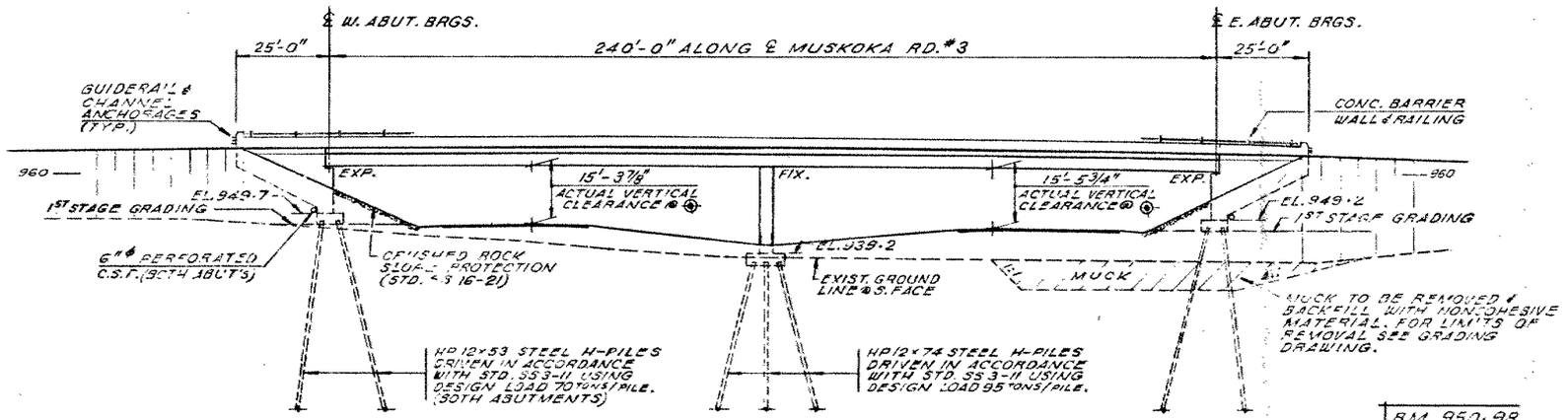
DIST. 11
CONT No
WP No 74-74-06

MUSKOKA RD.#3 (ASPDIN RD.) UNDERPASS
GENERAL LAYOUT

SHEET



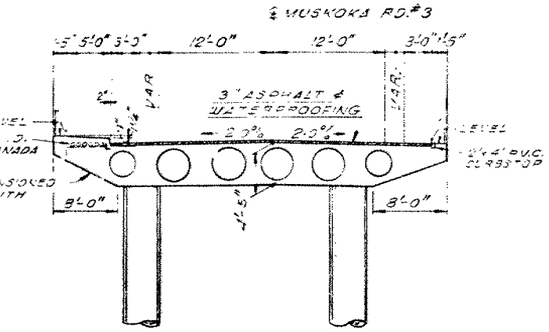
PLAN
1" = 20'-0"



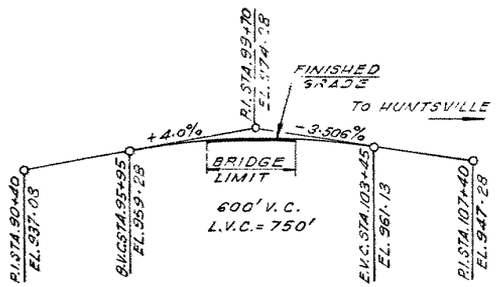
SOUTH ELEVATION
1" = 20'-0"

BM 950.98
GEODETIC DATUM
N.& W. IN ROOT
0.9' TRIPLE ELM
65.0' LT. 86+74

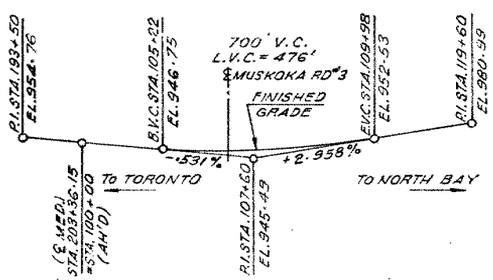
NORTH — SOUTH



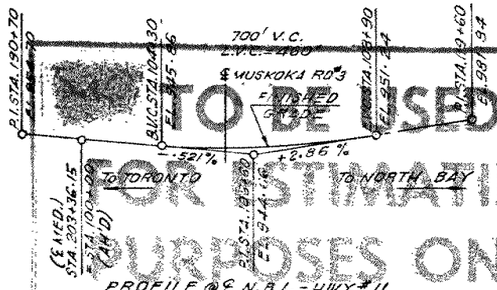
TYP. DECK SECTION
1/8" = 1'-0"



PROFILE @ ℄ MUSKOKA RD.#3
N.T.S.



PROFILE @ ℄ S.B.L. - HWY.#11
N.T.S.



PROFILE @ ℄ N.B.L. - HWY.#11
N.T.S.

NOTES:

REINFORCING STEEL GRADE
50 K.S.I.

CLASS OF CONCRETE

DECK, SIDEWALK OVER DECK & BARRIER WALL ____ 5000 PSI.
PIER COLUMNS ____ 4000 PSI.
REMAINDER ____ 3000 PSI.

CLEAR COVER ON REINF. STEEL

FOOTINGS & ABUTMENTS ____ 3"
PIER COLUMNS ____ 2½"
DECK TOP ____ 2"
DECK BOTTOM ____ 1½"
SIDEWALK ____ 2"
AND/OR AS NOTED ON DRAWINGS

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO A SMOOTH LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ±1/8". TO ACHIEVE THE MINIMUM CLEAR COVER OF 2" SPECIFIED, THE TOP LAYER OF DECK REINFORCING STEEL SHALL BE PLACED PRIOR TO CONCRETING, WITH A CLEAR COVER OF 2 1/2", ±1/2" TOLERANCE.

LIST OF DRAWINGS

42-169-1 GENERAL LAYOUT
-2 BORE HOLE LOCATIONS & SOIL STRATA
-3 FOOTING LAYOUT
-4 WEST ABUTMENT
-5 EAST ABUTMENT
-6 PIER
-7 DECK LAYOUT, ELEVATIONS & ABUT. BAGS.
-8 LONGITUDINAL CABLE DETAILS
-9 TRANSVERSE CABLE DETAILS
-10 DECK REINFORCEMENT
-11 BARRIER WALL
-12 BARRIER WALL WITH SIDEWALK
-13 STEEL RAILING (SINGLE TUBE)
-14 35 FT. APPROACH SLAB (BARRIER WALL)
-15 STANDARD DETAILS I
-16 STANDARD DETAILS II
-17 STANDARD DETAILS III
42-169-18 AS CONSTRUCTED ELEV'S & DIM.

CONCRETE QUANTITIES

CONCRETE IN PIER, ABUTMENTS & WINGWALLS { 241 C.Y. 3000 PSI / 22 C.Y. 4000 PSI }
PRESTRESSED CONCRETE BRIDGE DECK ____ 1100 C.Y.
CONCRETE IN BARRIER WALLS ____ 44 C.Y.
CONCRETE IN SIDEWALK ____ 13 C.Y.

RECEIVED
GEOTECHNICAL OFFICE
FEB 18 1977
SOIL MECHANICS
MINISTRY OF TRANSPORTATION & COMMUNICATIONS

TO BE USED FOR ESTIMATING PURPOSES ONLY

REGISTERED PROFESSIONAL ENGINEER
CIVIL
P. C. LAW
PROVINCE OF ONTARIO

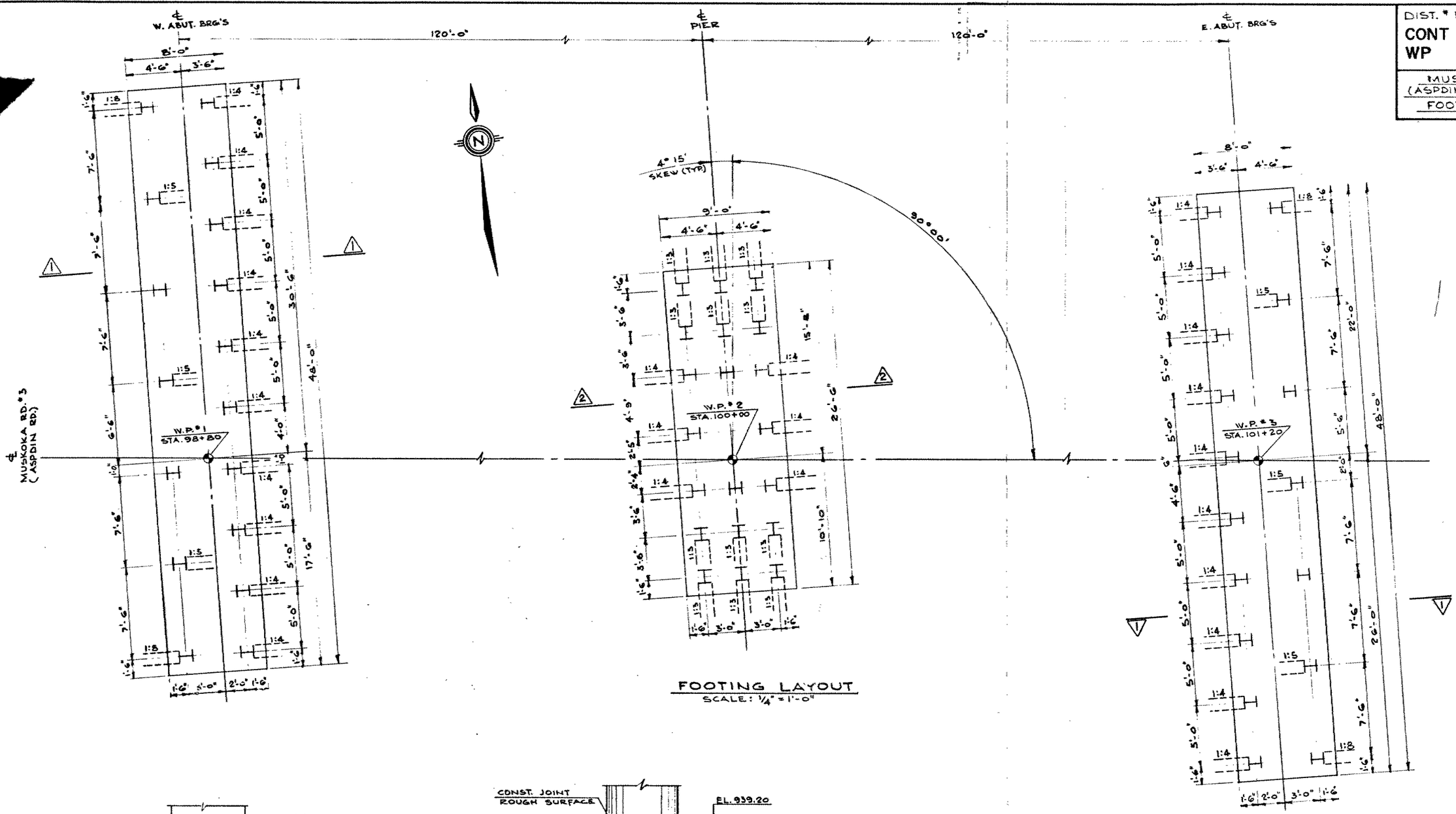
DATE FEB 1 1977

FOR REDUCED PLAN USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

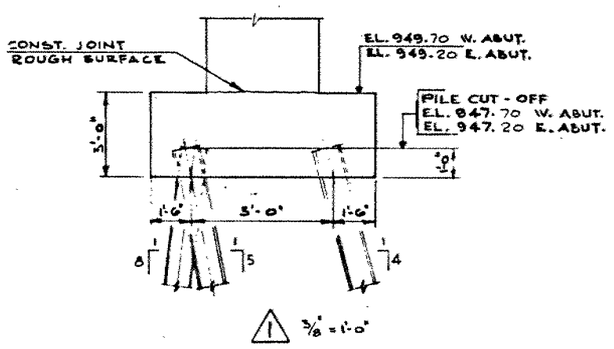
REVISIONS	DATE	BY	DESCRIPTION

DESIGN	CHECK	LOADING	DATE
DRAWING	CHECK	SITE No	DWG

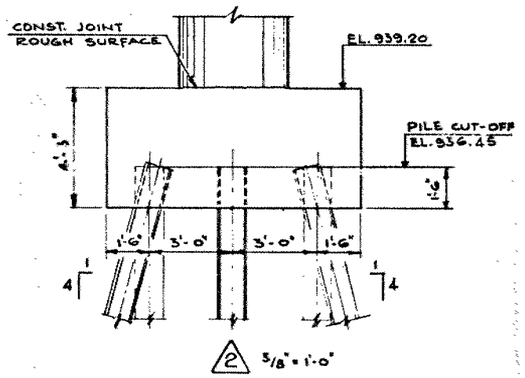
TRANSLAR 1164-R



FOOTING LAYOUT
SCALE: 1/4" = 1'-0"



1 3/8" = 1'-0"



2 3/8" = 1'-0"

LIST OF STEEL H-PILES

LOCATION	TYPE	No. REQ'D	LENGTH	REMARK
WEST ABUT.	HP 12 x 53	17	67'-0"	WITH DRIVING SHOE
PIER	HP 12 x 74	20	62'-0"	
EAST ABUT.	HP 12 x 53	17	82'-0"	

REGISTERED PROFESSIONAL ENGINEERS — CIVIL — P. O. LAW — PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

DIST. # 11
CONT No
WP No 74-74-06

MUSKOKA RD. #3 (ASPDIN RD.) UNDERPASS
FOOTING LAYOUT

SHEET

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	P.O.L.	CHECK	E.C.	LOADING HS 20-44	DATE FEB. 77
DRAWING	S.M.	CHECK	P.O.L.	SITE No 42-169	DWG 3

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO

TRANSLAN 1164-76

Mr. W. Van Beilen
Head, North and Northwestern Section
Structural Office
2nd Floor, West Building

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

Mr. A. Radkowski

78 06 20

Re: Lavase River and CPR Overhead
NBL, WP 71-74-06, Site 43-200B
SBL, WP 71-74-05, Site 43-200A
Highway 11, District 13, North Bay

We have reviewed the final bridge drawings for this project. Our comments are as follows:

1. To ensure the stability of the south approach fills of both structures, the 2 to 6 foot thick surficial organic material within the plan limits of the approach fills for a distance of 100 feet behind the abutments should be completely subexcavated to its full depth and back-filled with granular type of material to at least one foot above the prevailing water level.

2. To prevent erosion by runoff, the forward slopes of the south approaches should also be protected with a layer of crushed rock.

3. A dewatering scheme will be required for the construction of the center piers as the excavation will be carried out in granular subsoil below the prevailing ground water level.

4. The steel H piles in pile group A at the south abutment of the SBL structure should be 50 feet long. Please revise the pile length table in drawing 43-200A-3 accordingly.

B.Ly
Senior Engineer

For: H. Devata
Supervising Engineer
BL/HD/sr

cc: W. Peck
Files