

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 40I13-31

DIST. 1 REGION Southwestern

W.P. No. 42-66-11

CONT. No. 76-47

W. O. No. \_\_\_\_\_

STR. SITE No. 14-355

HWY. No. 402

LOCATION Hwy. 402 Line C,  
Hwy. 79 Interchange Underpass

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 3

REMARKS: documents to be unfolded  
before microfilming

## INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the following project:

W.P. 42-66-11 - Hwy. 79 Interchange Underpass  
Hwy. 402, Line 'C'  
District 1, Chatham

For purposes of the contract all other Foundation Investigation Reports prepared by or for the Ministry in connection with the above mentioned project are superceded by this report.

## SITE DESCRIPTION

The site is situated in Lots 18 and 19, Con. 2, Twp. of Warwick, County of Lambton.

The surrounding area is flat with cultivated farm land on the east side and scattered scrub and trees on the west side.

Physiographically, the site is located in the region referred to as the Horseshoe Moraines.

## SUBSURFACE CONDITIONS

### General

Generally, uniform subsoil conditions were found to prevail over the area investigated. The subsoil consists of a deep deposit of clayey silt with traces of sand, overlying limestone bedrock.

The boundaries between various soil types are shown on the Record of Borehole Sheets contained in the Appendix of this report. The locations and elevations of borings, together with the inferred subsoil stratigraphy is shown on Drawing D-7063-2 of the Contract Drawings.

From ground level downward, the various strata are described in some detail with regard to soil types and soil properties, as follows:

### Clayey Silt With Traces of Sand

This was the predominant soil deposit and was found in all boreholes. Boreholes 2, 3 and 6 were terminated at depths of 21.5 ft. into this stratum. Boreholes 1, 4 and 5 were carried down to the bedrock. The thickness of the deposit varies from 65.5 ft. in Borehole 1, to 70.5 ft. in Boreholes 4 and 5.

The material, in general, consists of clayey silt with traces of sand. However, below elevation 740 the percentage of sand and gravel

gradually increases with depth. In borehole 2, the material was found to possess slightly higher plasticity and is classified as clayey silt to silty clay. There were occasional partings of silt and/or fine sand, less than 1 inch in thickness. These partings were apparently randomly distributed and could possibly act as water bearing seams. In boreholes 3, 4 and 5, a 3-4 ft. thick layer of silt with traces of sand and clay was intersected between elevations 745 and 752.

The consistency of the material varies from very stiff to hard, as indicated by 'N' values ranging from 15 to 75 blows/ft. Field vane tests indicate the undrained shear strength everywhere is greater than 2,000 p.s.f. Only two laboratory tests were carried out to determine the undrained shear strength, and the results vary from 1,800 to 4,300 p.s.f.

Physical properties of the deposit, as determined from laboratory tests, are as follows: (see Fig. 1)

	<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Liquid Limit	22%	40%	30%
Plastic Limit	15%	21%	18%
Natural Moisture Content	12%	25%	19%

Grain-size analyses indicate the following distributions, and are plotted on Fig. 2.

Gravel	0 - 7%
Sand	0 - 20%
Silt	53 - 90%
Clay	8 - 41%

Colour of the material was gray, except for the upper 8 ft. where it was brown.

#### Bedrock

The bedrock was proven in borehole 4. In boreholes 1 and 5, the bedrock surface was assumed to be the level at which practical refusal to augering and to driving the split-spoon was reached. Small amounts of weathered shale were recovered from the split-spoon samples. The rock core obtained shows the bedrock to be shaley limestone. The bedrock surface varies from elevation 691.1 to 691.7.

Groundwater

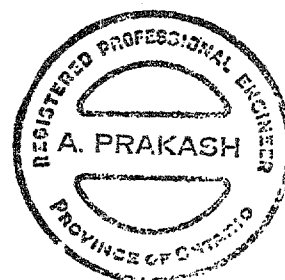
The following water levels were observed during the field work:

Borehole #1	Elevation 759.2
2	758.9
3	759.9
4	758.9
5	759.4
6	757.2

Because the clayey silt material itself is relatively impermeable, the seepage of water into the borehole indicates that the silt and/or fine sand partings act as water bearing seams.

*A. Prakash*

A. PRAKASH, P. Eng.  
Senior Engineer



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

April, 1976

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 1

WP 42-66-11 LOCATION Hwy. 79 Sta. 330 + 01 31' Rt. ORIGINATED BY AP  
 DIST 1 HWY 402 BORING DATE May 19, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE Bombardier Flight Auger and Cone CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
752.1	Ground Level															
0.0			1	SS	21	760										
	Brown		2	SS	42											0 10 74 16
	Grey		3	SS	17											
	Clayey silt, traces of sand		4	SS	19	750										0 1 67 32
			5	SS	26											0 3 73 24
	Occasional silt and/or fine sand partings.		6	SS	35	740										0 2 71 27
			7	SS	33											
	Very Stiff to hard		8	SS	30	730										
			9	SS	41											
			10	SS	55	720										0 3 67 30
			11	SS	59	710										
			12	SS	75	700										2 15 57 26
697.1																
65.0	Weathered Shale		13	SS	100/5"	690										
66.0	End of Borehole Probable Bedrock															

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE No 2

W.P. 42-66-11 LOCATION Hwy. 79 Sta. 330 + 04 31' Lt. ORIGINATED BY AP  
 DIST 1 HWY 402 BORING DATE May 25, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ $w$ $w_L$	UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE					
761.9	Ground Level								
0.0									
			1	SS	21				
			2	SS	45				
			3	SS	17				
			4	SS	31				
			5	SS	34				
740.4									
21.5	End of borehole								

20  
 15  $\phi$  5 % STRAIN AT FAILURE  
 10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 3

WP 42-66-11 LOCATION Hwy 79 Sta. 328 + 61 32' Rt ORIGINATED BY AP  
 DIST 1 HWY 402 BORING DATE May 20, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE Bombardier Flight Auger and Cone CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES		GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE		'N' VALUES	20	40	60	80	100	$w_p$	$w$		
762.5	Ground Level														
			1	SS	30	760									
			2	SS	42										
			3	SS	32										
			4	SS	31	750									
			5	SS	19										
741.0	Very Stiff to Hard														
21.5	End of borehole					740									

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 4

WP 42-66-11 LOCATION Hwy. 79 Sta. 328 + 66 34' Lt. ORIGINATED BY AP  
 DIST 1 HWY 402 BORING DATE May 26, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger, NX Casing, BX Core and Cone CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 20 40 60	UNIT WEIGHT Y	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE					
761.7	Ground Level								
			1	SS	34				
			2	SS	45				
	Brown Grey		3	SS	24				0 3 60 37
	Silt, traces of sand & clay		4	SS	26				0 2 90 8
			5	SS	26				0 2 63 35
			6	SS	23				
			7	TW	PH				2 13 65 20
	Clayey silt, traces to some sand (increasing with depth) traces of gravel in lower regions (below elev. 740). Occ. silt and/or sand partings.		8	SS	38				
			9	SS	41				
	Very Stiff to hard.		10	SS	31				3 18 53 26
			11	SS	35				
691.2									
70.5	Bedrock								
686.5	Shaley Limestone		12	BX	75%				
75.2	End of Borehole								

20  
15  $\diamond$  5 % STRAIN AT FAILURE  
10



## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 5

WP 42-66-11 LOCATION Hwy. 79 Sta. 327 + 30 32' Rt. ORIGINATED BY AP  
 DIST 1 HWY 402 BORING DATE May 21, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE Bombardier Flight Auger and Cone CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$W_p$	$W$	$W_L$		
762.2	Ground Level															
0.0			1	SS	39	760										
	Brown		2	SS	62											
	Grey		3	SS	56											
	Silt, some sand		4	SS	23	750										0 2 67 41
	traces of clay		5	SS	21											0 5 81 14
			6	TW	PH	740										0 1 64 35
	Clayey silt, traces		7	SS	15											
	to some sand		8	TW	PH	730										4 9 62 25
	(increasing with															
	depth) traces of		9	SS	25	720										
	gravel in lower															
	regions (below		10	SS	27	710										7 20 54 19
	elev. 740). Occ.															
	silt and/or sand		11	SS	-	700										
	partings.															
	Very stiff to hard															
691.7																
70.5	Weathered Shale		12	SS	10071"	690										
70.6	End of Borehole															
	Probable Bedrock															

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

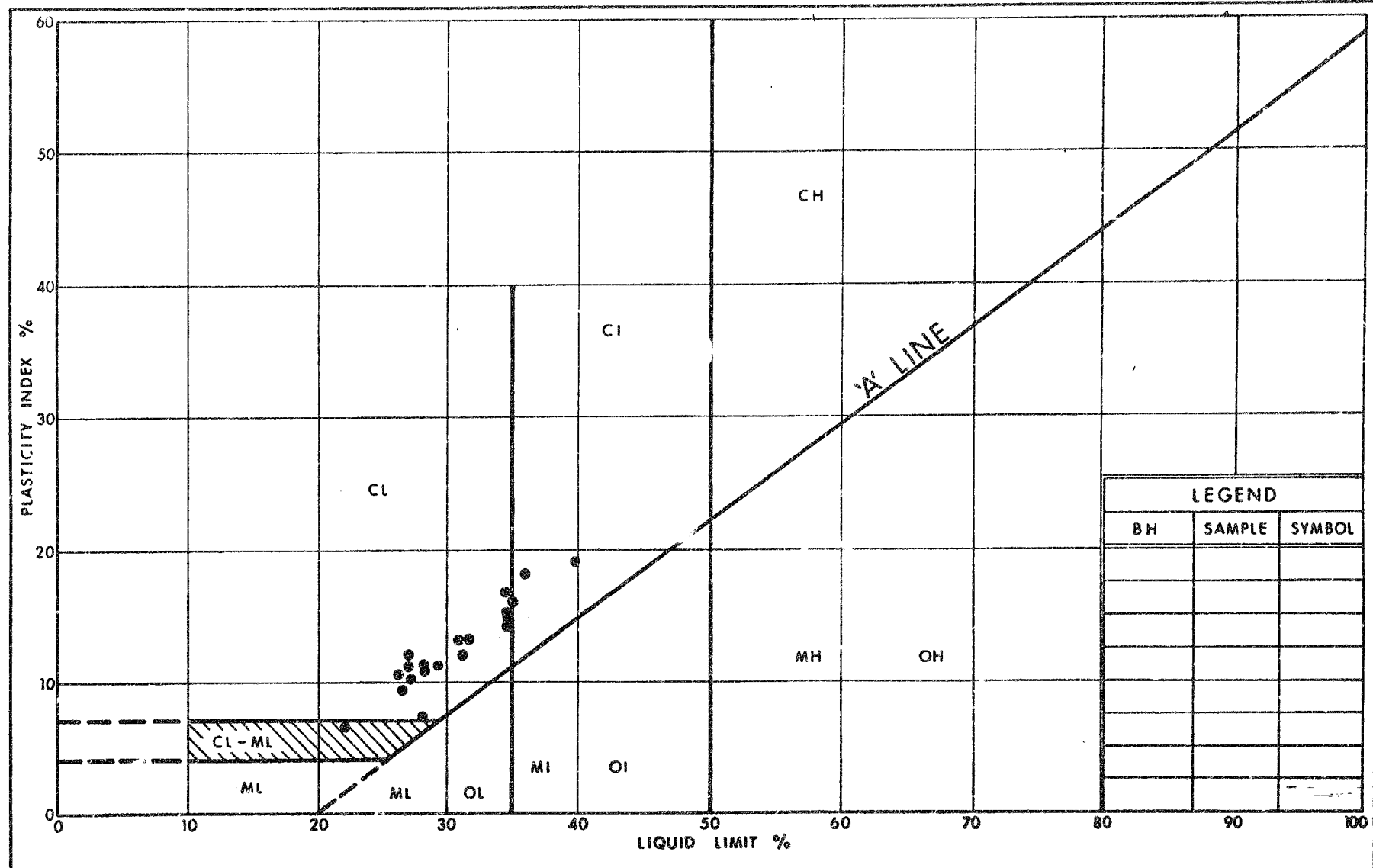
## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 6

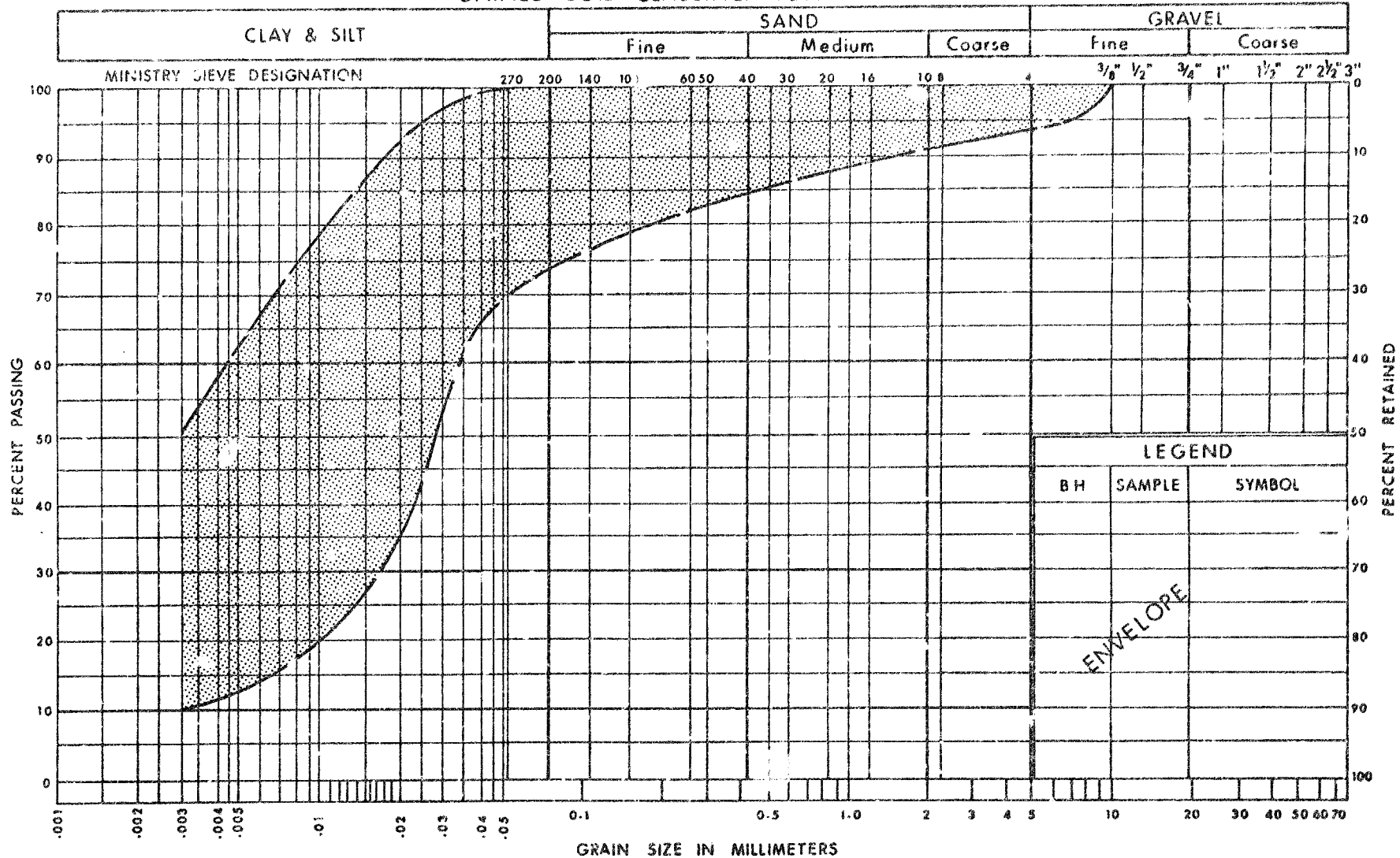
WP 42-66-11 LOCATION Hwy. 79 Sta. 327 + 27 32' Lt. ORIGINATED BY AP  
 DIST 1 HWY 402 BORING DATE May 25, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone CHECKED BY 10

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 20 40 60	UNIT WEIGHT $\gamma$	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE					
761.7	Ground Level								
0.0	Clayey silt, traces of sand. Occ. silt and/or partings.  Very stiff to hard		1	SS	25				0 2 58 40
			2	SS	29				
			3	SS	23				
			4	SS	17				0 2 70 28
740.2			5	SS	23				
21.5	End of borehole								

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10



# UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation and  
Communications

Ontario  
ENGINEERING SERVICES BRANCH

**GRAIN SIZE DISTRIBUTION**  
**CLAYEY SILT**  
TRACE OF SAND, OCC. SILT &/OR SAND PARTINGS

FIG No 2  
W P 42-66-11

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Crossing at  
Hwy. 79 and C.A.H. 402, Line 'C'  
Twp. of Warwick Co. of Lambton  
District #1 (Chatham)  
W.O. 71-11042 --- W.P. 42-66-11

---

1. INTRODUCTION:

A request for a foundation investigation at the crossing of the proposed C.A.H. 402, Line 'C' and Hwy. 79, was received from Mr. A.P. Watt, Regional Bridge Planning Engineer, in a memorandum dated April 13, 1971.

A field investigation was subsequently carried out by the Foundation Section to determine the subsoil conditions existing at the site. This report contains the results of this investigation and our recommendations pertaining to the design of the proposed structure foundations and approach embankments.

2. DESCRIPTION OF THE SITE:

The site of the proposed structure is situated about 4 miles north of Watford, approximately 1 mile south of Hwy. 7.

The surrounding area is flat with cultivated farm land on the east side and scattered scrub and trees on the west side.

Physiographically, the site is located in the region referred to as the Horseshoe Moraines.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

A total of six sampled boreholes and six dynamic cone penetration tests was carried out during the course of the field work. Boring was achieved by means of a continuous flight

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES: (cont'd) ... auger machine, for soil sampling and diamond drilling purposes. During the field work, disturbed samples were obtained by means of a standard split-spoon sampler: the energy used in driving it, conformed to the requirements of the Standard Penetration Test. Undisturbed samples were recovered using 2-inch I.D. Shelby tubes which were pushed into the soil hydraulically, or by hand. Where possible, field vane tests were carried out at elevations 12 inches below sample depths.

Dynamic cone penetration tests were carried out adjacent to each borehole. Driving energy used to advance the cone was 350 ft. - lbs. per blow.

The bedrock was proved at one borehole location using BX rock coring equipment.

All boreholes were surveyed in the field by personnel from London Region Engineering Survey Section. The locations and elevations of the borings are shown on Drawing No. 71-11042A, which accompanies this report.

All samples were visually examined and classified at the site as well as in the laboratory. Following this inspection, laboratory tests were carried out on selected samples to determine the following physical properties:

Atterberg Limits

Moisture Content

Grain-Size Distribution

Undrained Shear Strength

Bulk Density

Consolidation Characteristics

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES: (cont'd) ...

The test results are summarized on the Record of Borehole sheets contained in the Appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

Generally, uniform subsoil conditions were found to prevail over the area investigated. The subsoil consists of a deep deposit of clayey silt with traces of sand, overlying limestone bedrock.

The boundaries between various soil types are shown on the Record of Borehole sheets. The estimated stratigraphical profile shown on Drawing No. 71-11042A is based upon this information.

From ground level downward, the various strata are described in some detail with regard to soil types and soil properties, as follows:

4.2) Clayey Silt with Traces of Sand:

This was the predominant soil deposit and was found in all boreholes. Boreholes 2, 3 and 6 were terminated at depths of 21.5 ft. into this stratum. Boreholes 1, 4 and 5 were carried down to the bedrock. The thickness of the deposit varies from 65.5 ft. in Borehole 1, to 70.5 ft. in Boreholes 4 and 5.

The material, in general, consists of clayey silt with traces of sand. However, below elevation 740, the percentage of sand and gravel gradually increases with depth.

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

4.2) Clayey Silt with Traces of Sand: (cont'd) ...

In borehole 2, the material was found to possess slightly higher plasticity and is classified as clayey silt to silty clay. There were occasional partings of silt and/or fine sand, less than 1 inch in thickness. These partings were apparently randomly distributed and could possibly act as water bearing seams. In Boreholes 3, 4 and 5, a 3-4 ft. thick layer of silt with traces of sand and clay was intersected between elevations 745 and 752.

The consistency of the material varies from very stiff to hard, as indicated by 'N' values ranging from 15 to 75 blows/ft. Field vane tests indicate that undrained shear strength everywhere is greater than 2,000 p.s.f. Only two laboratory tests were carried out to determine the undrained shear strength, and the results vary from 1,800 to 4,300 p.s.f.

Physical properties of the deposit, as determined from laboratory tests, are as follows: (see Fig. 1)

	<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Liquid Limit	22%	40%	30%
Plastic Limit	15%	21%	18%
Natural Moisture Content	12%	25%	19%

Grain size analyses indicate the following distributions, and are plotted on Fig. #2.

Gravel	0 - 7 %
Sand	0 - 20 %
Silt	53 - 90 %
Clay	8 - 41 %



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

4.2) Clayey Silt with Traces of Sand: (cont'd) ...

Colour of the material was gray, except for the upper 8 ft. where it was brown.

4.3) Bedrock:

The bedrock was proven in Borehole 4. In Boreholes 1 and 5, the bedrock surface was assumed to be the level at which practical refusal to augering and to driving the split-spoon was reached. Small amounts of weathered shale were recovered from the split-spoon samples. The rock core obtained shows the bedrock to be shaley limestone. The bedrock surface varies from elevation 691.1 to 691.7.

5. GROUNDWATER CONDITIONS:

The following water levels were observed during the field work:

Borehole	1	Elevation	759.2
	2		758.9
	3		759.9
	4		758.9
	5		759.4
	6		757.2

Because the clayey silt material itself is relatively impermeable, therefore, the seepage of water into the borehole indicates that the silt and/or fine sand partings act as water bearing seams.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a two-span (137'-137') underpass structure at the crossing of new Hwy. 402, Line 'C' and Hwy. 79. The proposed grade of Hwy. 402 will be at approx. elevation 760.0, - i.e. about 4 ft. below the present grade of Hwy. 79. The future grade of Hwy. 79 will be at approximate elevation 782.0, resulting in a maximum approach height of about 22 ft.

In general, the subsoil at the site consists of about 70 ft. of very stiff to hard clayey silt with traces of sand, overlying shaley limestone bedrock.

6.2) Foundations:

a) Spread Footings in Original Ground

As described earlier, the shear strength of the subsoil is in general greater than 2000 p.s.f. Therefore, it is recommended that the entire structure be supported on spread footings. A safe net pressure of 2.0 tons/ sq. ft. may be assumed for design purposes.

The upper zone of the subsoil is slightly desiccated and is, therefore, susceptible to softening on contact with water. Therefore, it is recommended that the base of the footing excavations be protected by a concrete working slab, immediately on exposure. Any seepage into the excavations can be handled by pumping.

b) Spread Footings on Compacted Fill:

As an alternative, the abutments may be supported on spread footings placed on well compacted, suitable granular

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

6.2) Foundations: (cont'd) ...

b) Spread Footings on Compacted Fill: (cont'd) ...

material within the approach fills. A safe design load of 2.0 TSF may be assumed. The granular material should consist of G.B.C. Class 'A' and should be fully compacted according to the current D.H.O. Standards. A detailed construction scheme is outlined on Figure 3 of the Appendix.

c) Perched Abutments on Short Piles:

As a second alternative, the abutments may be constructed within the approach fills and supported on short piles driven through the fill and some 10.0 ft. into the original ground. In the case of 12-3/4" O.D. and 1/4" thick wall steel tube piles, a safe design load of 25 tons per pile may be used.

It is estimated that the following maximum settlements will occur in the subsoil at various locations over a long period of time following the end of construction.

Pier -	Spread footings in original ground	1.0 - 1.5 inches
Abutment -	Spread footings in original ground	} 3.0 - 4.0 inches
	Spread footings on compacted fill	
	Perched abutments on short piles	

Regardless of which of the above methods is adopted, the structure should be built to accommodate the 3.0 inches differential settlements between the abutments and the pier.

d) End - Bearing Piles:

As another alternative, the abutments and pier may be supported on steel H - piles driven to refusal into the bedrock. For design purposes the maximum allowable design load

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

6.2) Foundations: (cont'd) ...

d) End - Bearing Piles: (cont'd) ...

may be used for the particular steel section used.

All foundations and pile caps should be protected against frost action by at least 4 ft. of earth cover.

6.3) Approach Embankments:

The shear strength of the subsoil is such that it will be able to safely support the 22-ft. high approach embankments constructed with 2:1 side slopes. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 3 inches.

Based on the performance of structures and embankments built in the same general area and with somewhat similar subsoil conditions, it is estimated that maximum settlements of 3 to 4 inches will occur beneath the abutment locations. To minimize the effect of differential settlements between the abutments and pier footings, it is recommended that the approach embankments be built in advance of the structure for as long a period as possible. The topsoil and the soft organic material should be removed in accordance with the pertinent D.H.O. Standards within the construction area.

7. MISCELLANEOUS:

The field investigation was carried out during the period May 19 - 28, 1971, under the supervision of Mr. A. Prakash, Project Foundation Engineer, who also prepared this report.

Equipment was owned and operated by Dominion Soil Investigation Ltd.

This report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

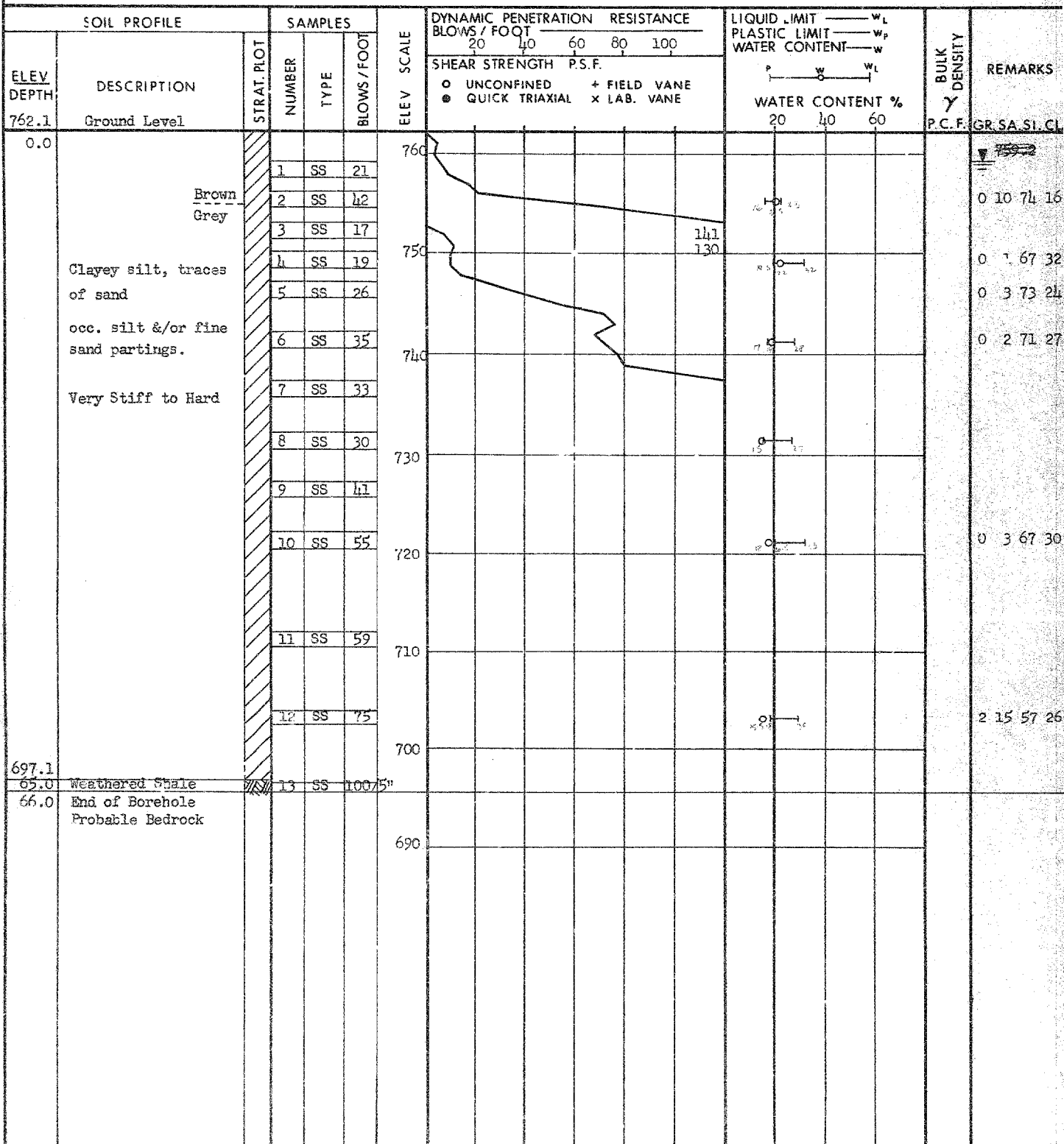
June, 1971

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11042 LOCATION Hwy. 402 Line 'C' Sta. <sup>3</sup>230 + 01 31' Rt. ORIGINATED BY AP  
 W.P. 42-66-11 BORING DATE May 19, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE Bombardier Flight Auger and Cone CHECKED BY [Signature]



DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11042      LOCATION Hwy. 402 Line 'C' Sta. 230 + 04 31' Lt.      ORIGINATED BY AP

W.P. 42-66-11      BORING DATE May 25, 1971      COMPILED BY KW

DATUM Geodetic      BOREHOLE TYPE GME Flight Auger & Cone      CHECKED BY *SK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	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		BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % 20 40 60
							20 40 60 80 100	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					
761.9	Ground Level												
0.0	Brown Grey Clayey silt to silty clay, traces of sand, occ. silt &/or fine sand partings. Very Stiff to Hard		1	SS	21	760							
			2	SS	45								0 1 62 37
			3	SS	17	750							0 0 60 40
			4	SS	31								0 5 69 29
740.4			5	SS	34	740							
21.5	End of Borehole												

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11047 LOCATION Hwy 2, Line 'C' Sta. 228 + 61 32' 2 Rt. ORIGINATED BY AP  
W.P. 42-66-11 BORING DATE May 20, 1971 COMPILED BY KW  
DATUM Geodetic BOREHOLE TYPE Bombardier Flight Auger and Cone CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			B. LK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	$w_p$	$w$	$w_L$		
762.5	Ground Level														
	Brown Grey silt, traces of sand & clay Clayey silt, traces of sand. occ. silt &/or sand partings.		1	SS	30										
			2	SS	42										0 2 64 34
			3	SS	32										0 5 85 10
			4	SS	31										1 1 58 40
741.0	Very Stiff to Hard		5	SS	19										
21.5	End of Borehole														



DEPARTMENT OF HIGHWAYS- ONTARIO

MATERIALS &amp; TESTING OFFICE

## RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 71-110h2

LOCATION Hwy. 402 Line 'C' Sta. 228 + 66 34' Lt.

ORIGINATED BY AP

W.P. 42-66-11

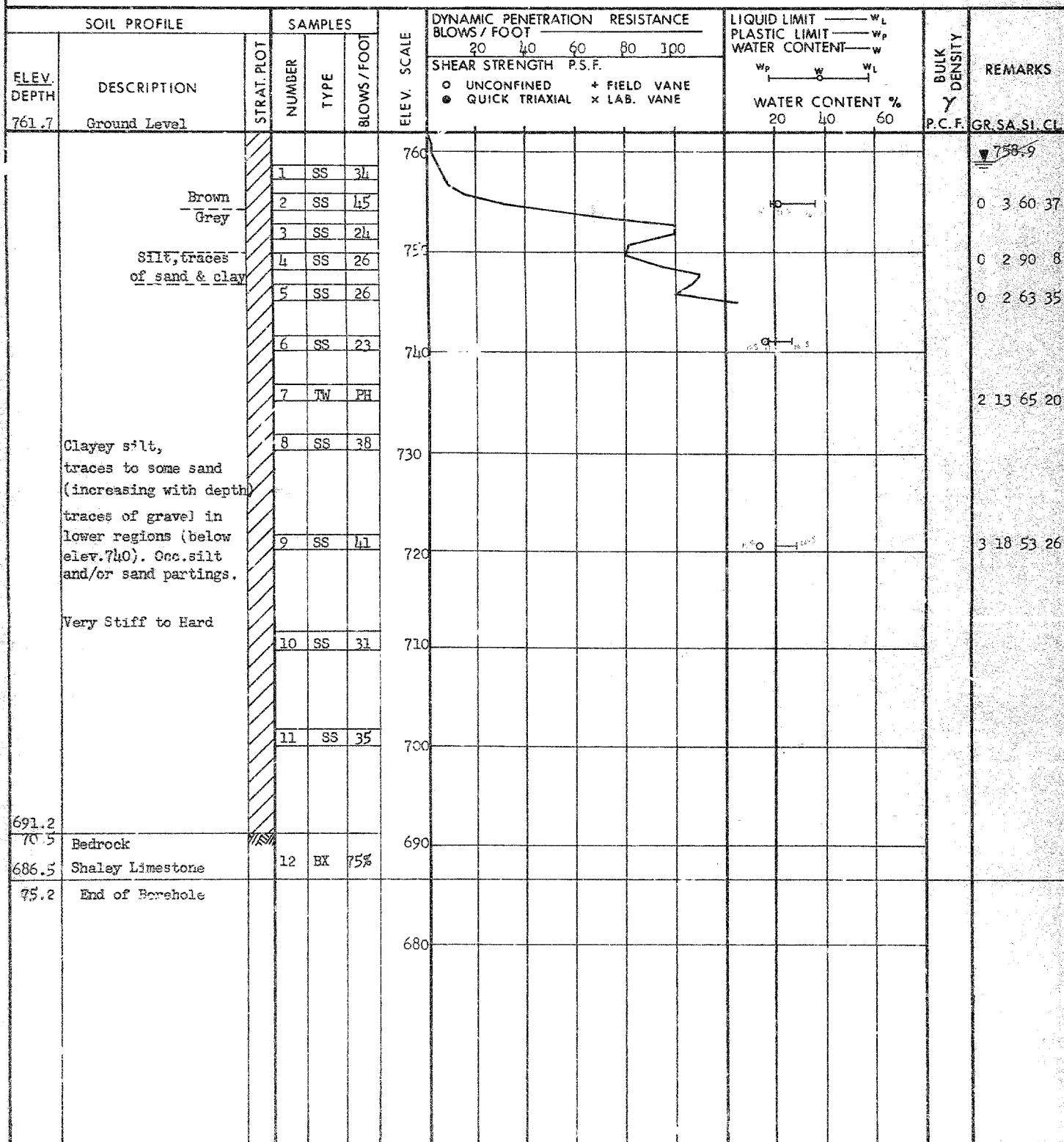
BORING DATE May 26, 1971

COMPILED BY KW

DATUM Geodetic

BOREHOLE TYPE CME Flight Auger, NX Casing, BX Core and Cone

CHECKED BY



DEPARTMENT OF HIGHWAYS- ONTARIO

MATERIALS &amp; TESTING OFFICE

## RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 71-11042

LOCATION

Hwy. 402 Line 'C' Sta. 227 + 30 32' Rt.

ORIGINATED BY

AP

W.P. 42-66-11

BORING DATE

May 21, 1971

COMPILED BY

KW

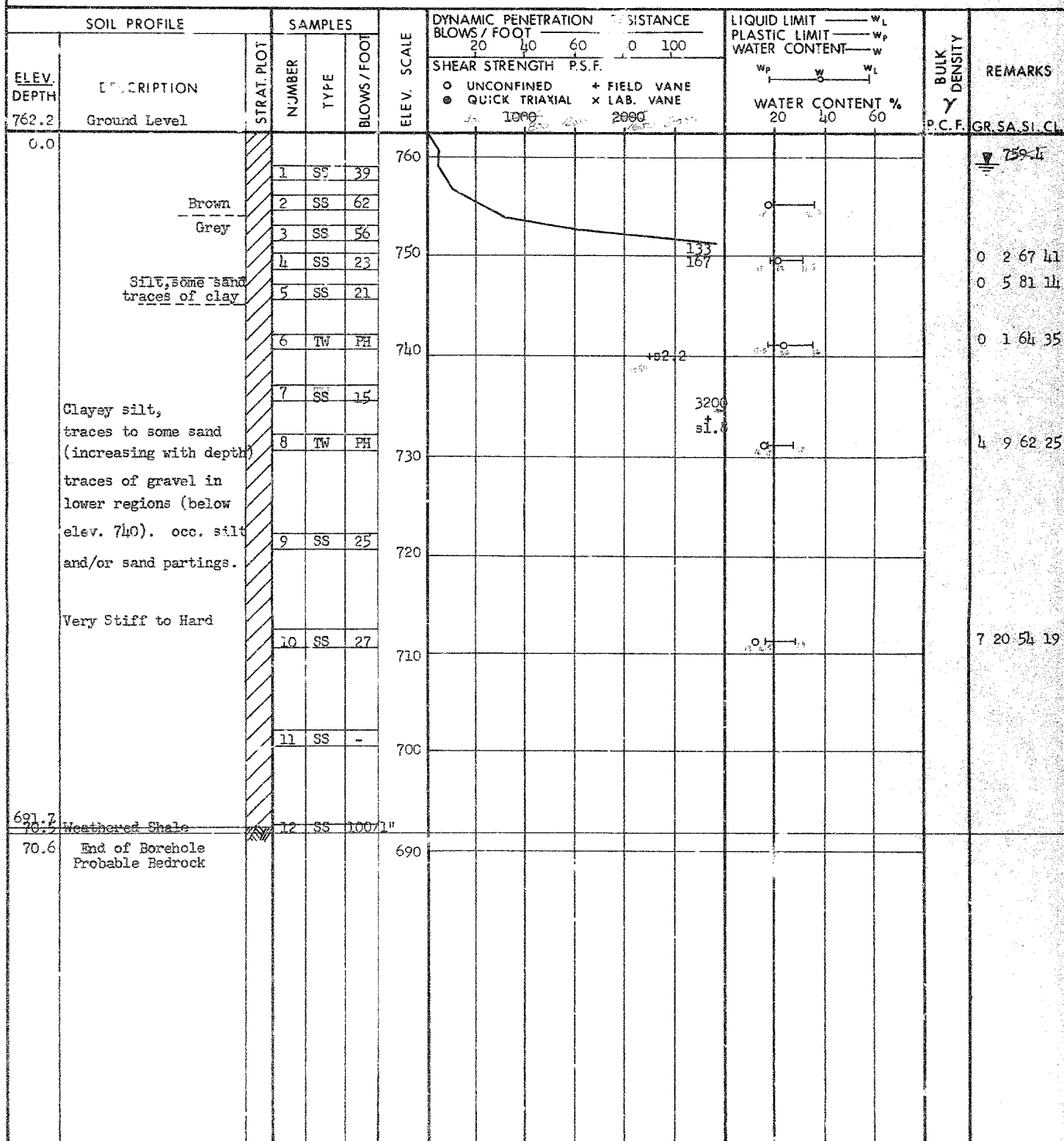
DATUM Geodetic

BOREHOLE TYPE

Bombardier Flight Auger &amp; Cone

CHECKED BY

JL



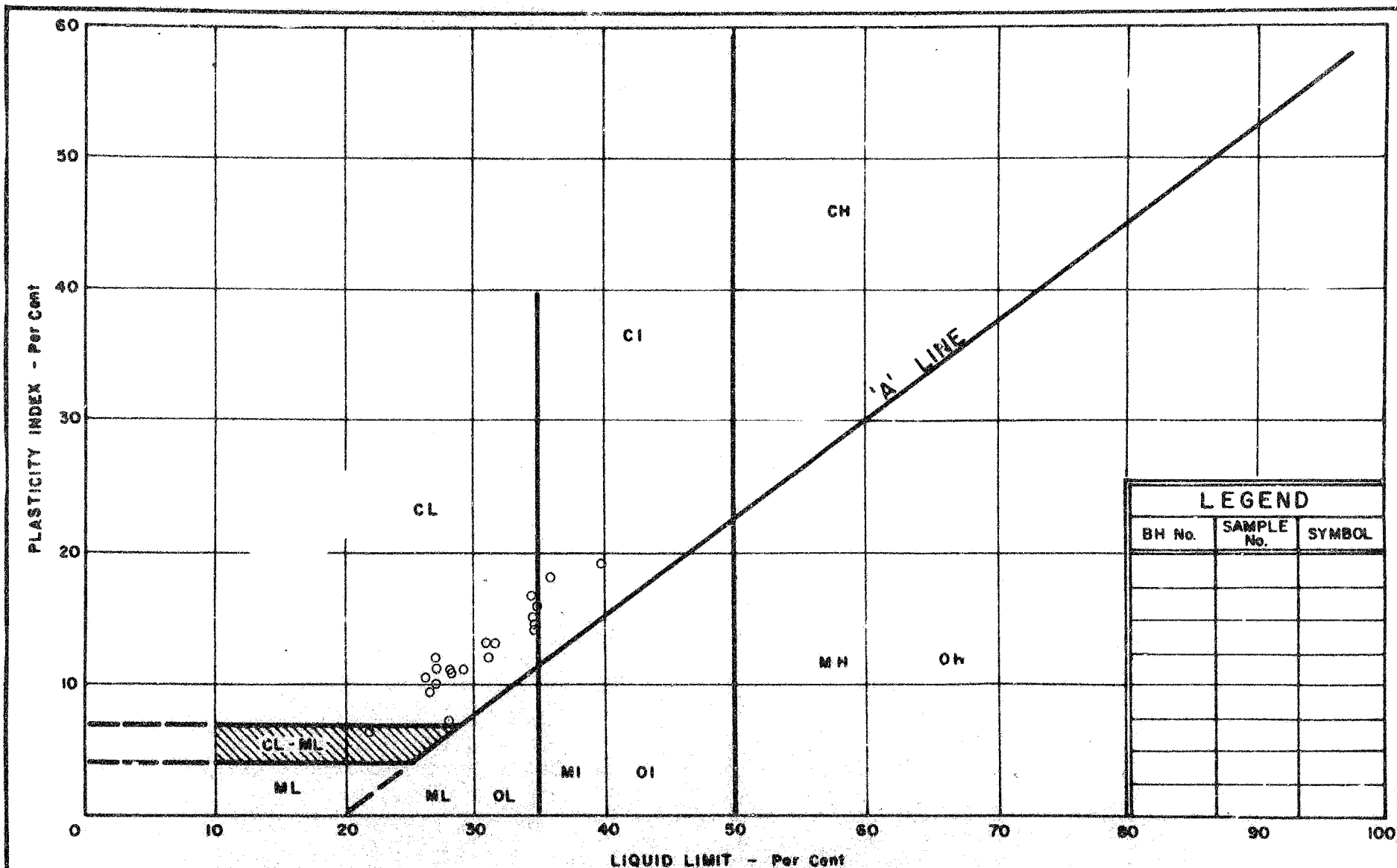
DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

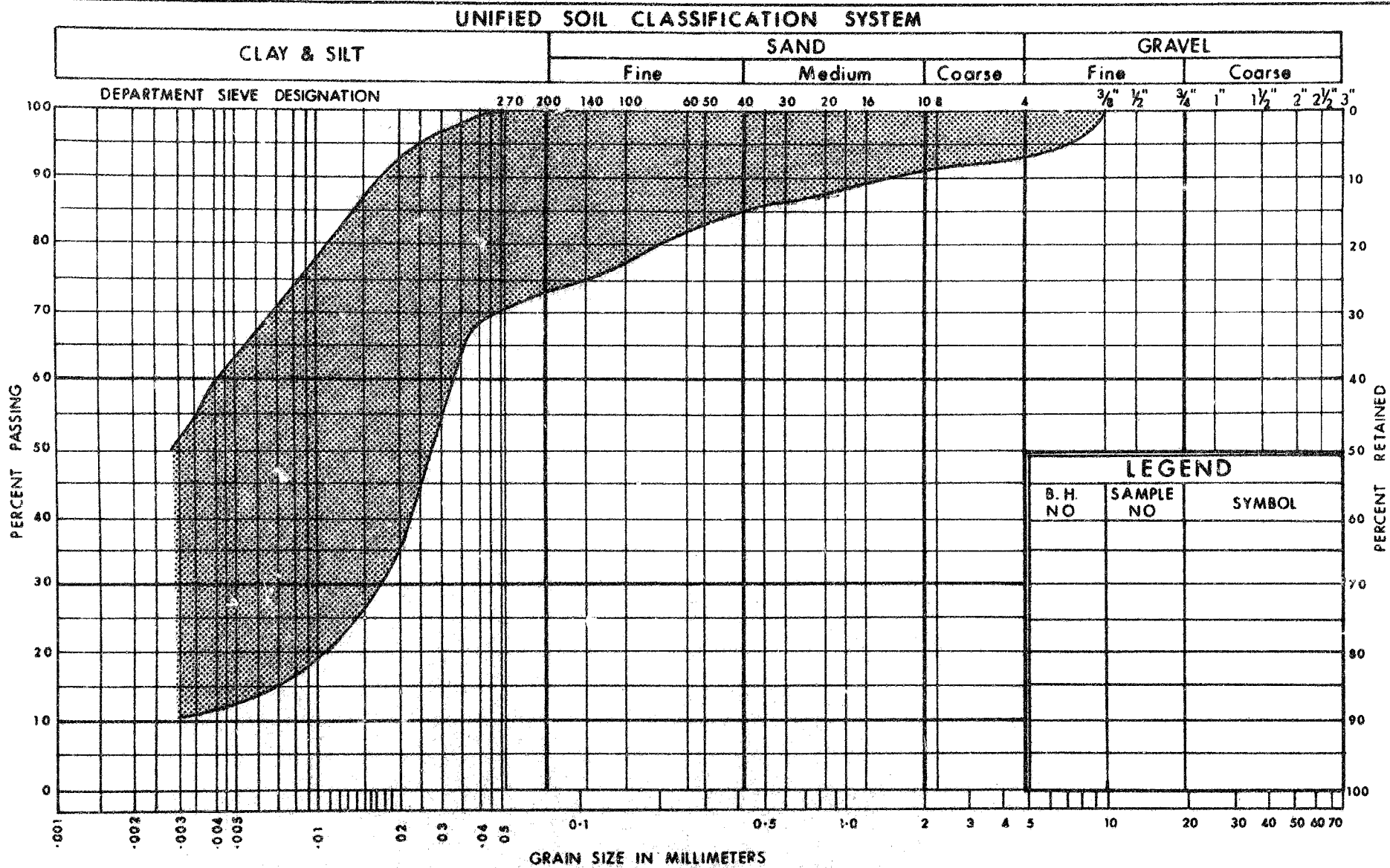
## RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 71-11042 LOCATION Hwy. 402 Line 'C' Sta. <sup>3</sup>227 + 27 32' Lt. ORIGINATED BY AP  
 W.P. 42-66-11 BORING DATE May 25, 1971 COMPILED BY KW  
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone CHECKED BY SR

SOIL PROFILE		SAMPLES			ELEV. SCALE	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. PLT	NUMBER	TYPE		BLOWS/FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %				
761.7	Ground Level											
0.0	Clayey silt, traces of sand. occ. silt &/or sand partings.  Very Stiff to hard		1	SS	25							
			2	SS	29							
			3	SS	23							
			4	SS	17							
			5	SS	23							
740.2												
21.5	End of Borehole											





DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# GRAIN SIZE DISTRIBUTION

## CLAYEY SILT

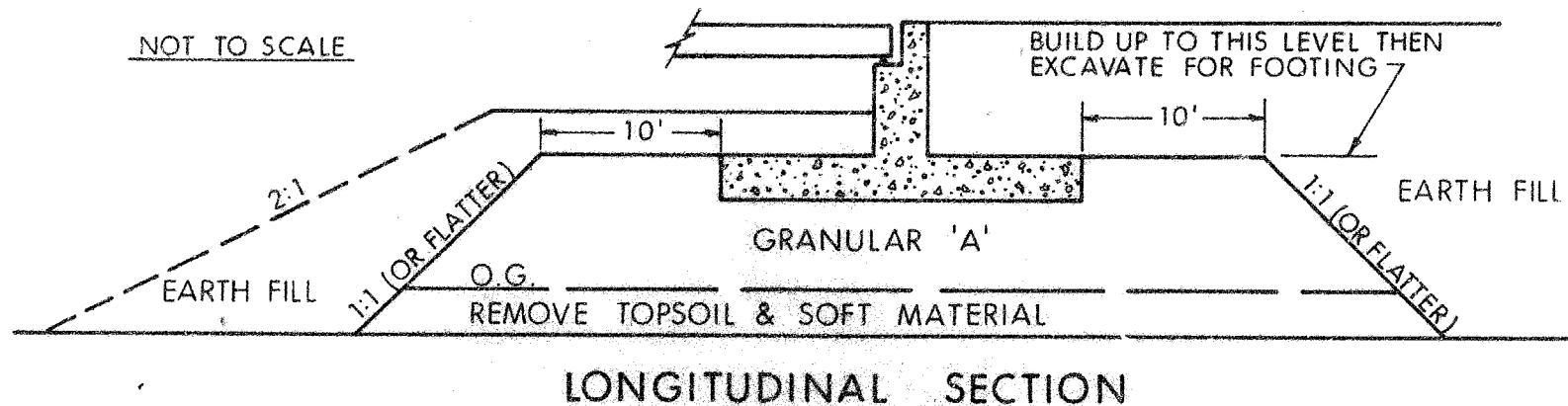
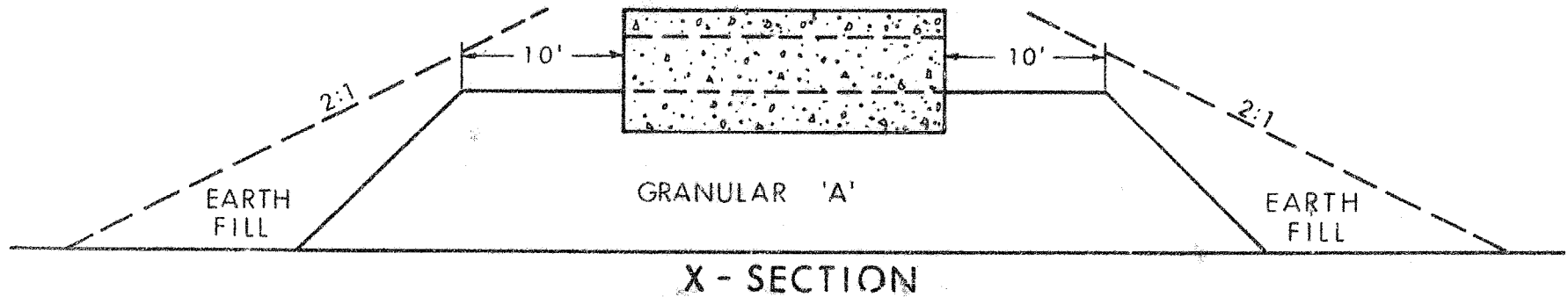
TRACE OF SAND, OCC. SILT &/OR SAND PARTINGS

W.P. No. 42-66-11

**JOB No:** 71-11042

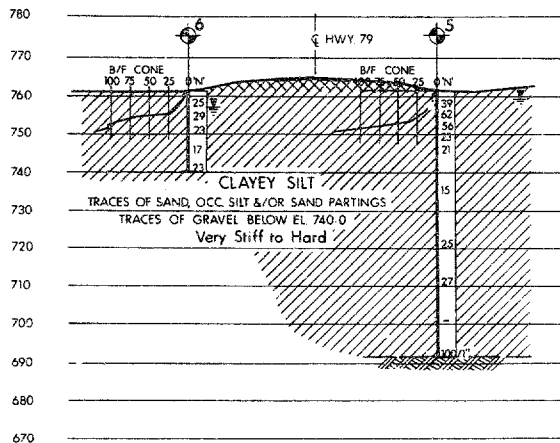
FIG. 2

## ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE

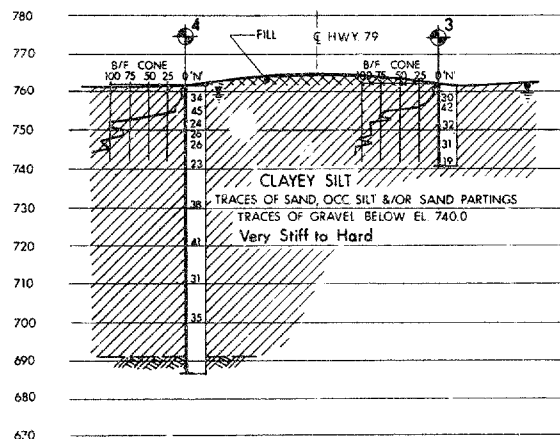


### NOTES

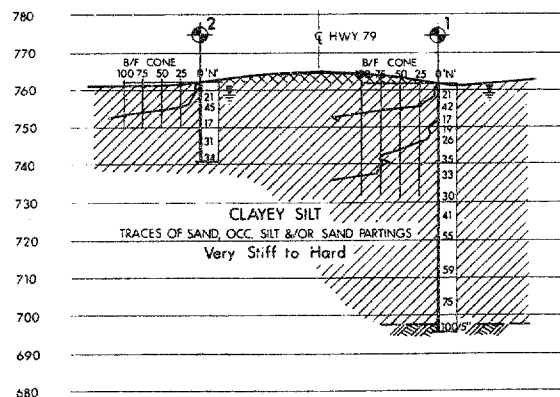
- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.
- 2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT D.H.O. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.



A-A



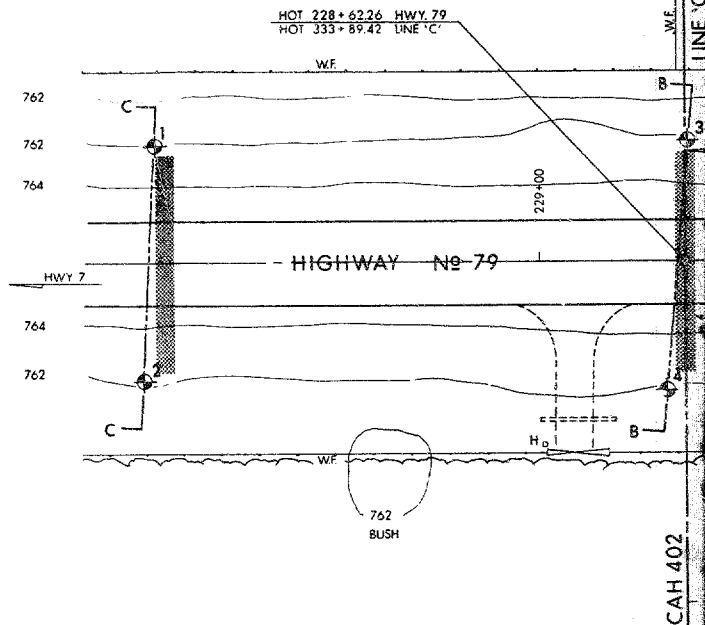
B-B



C-C

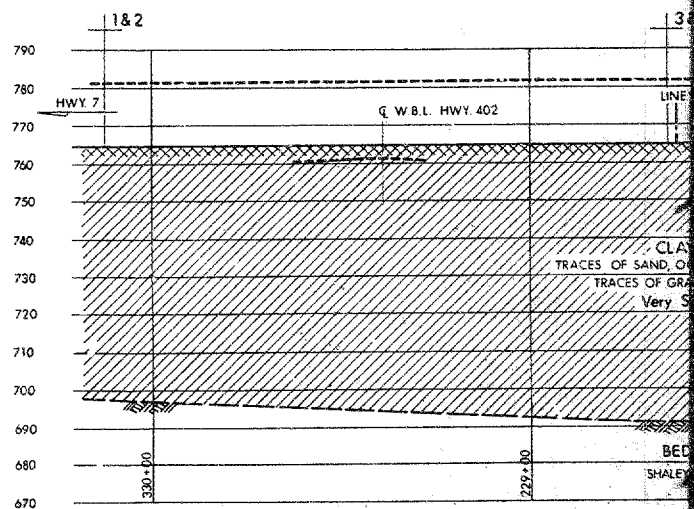
SECTIONS

20 10 0 SCALE 20 40 FT



PLAN

20 10 0 SCALE



PROF

20 10 0 SCALE





DOCUMENT CONTAINS NEITHER RECOMMENDATIONS  
NOR CONCLUSIONS OF THE FBI. IT IS THE PROPERTY OF THE FBI  
AND IS LOANED TO YOUR AGENCY; IT AND ITS CONTENTS ARE NOT TO BE  
DISTRIBUTED OUTSIDE YOUR AGENCY.

GEOCRES No. 40 113 - 31

DIST. 1 REGION SOUTHWESTERN

W.P. No. 42-66-11

CONT. No. 76-47

W. O. No. \_\_\_\_\_

STR. SITE No. 14-355

HWY. No. 402

LOCATION HWY 402 LINE 'C'

HWY 79 INTERCHANGE UNDERPASS.

Overall, 98.2% of the 100,000 total cases are covered 3

REMARKS:

\_\_\_\_\_

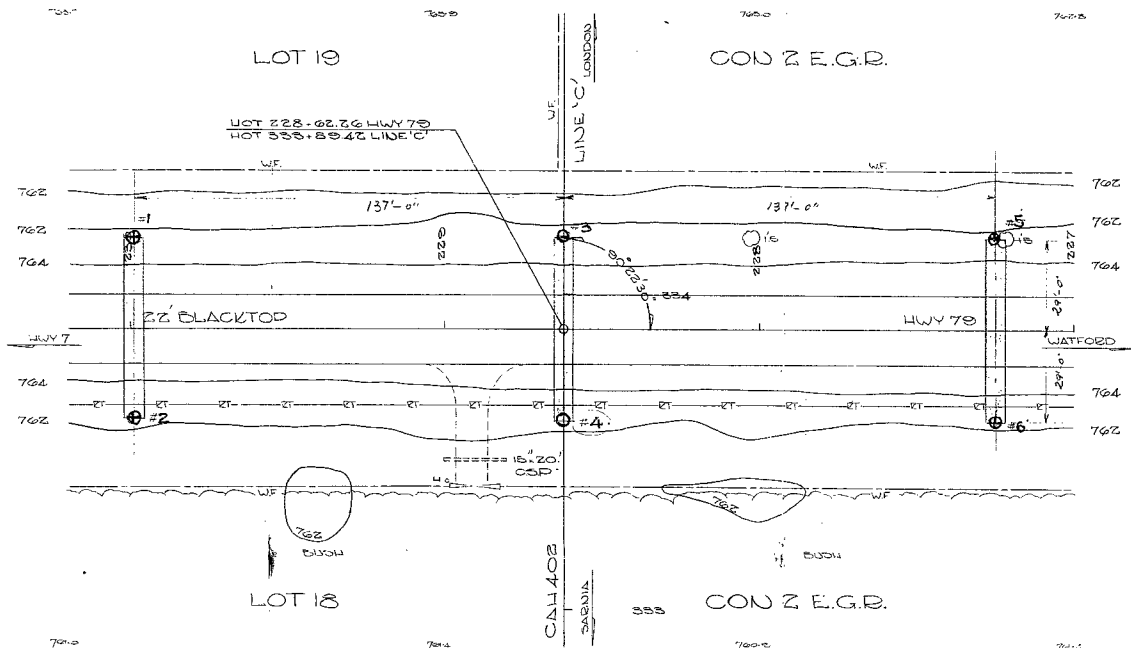
.....

1-6784-3

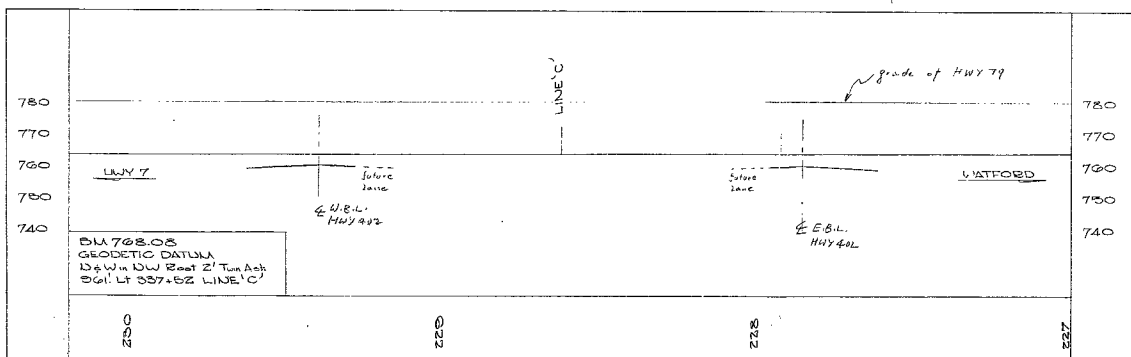
1-6784-3

CO LAMBTON  
TWP WARWICK

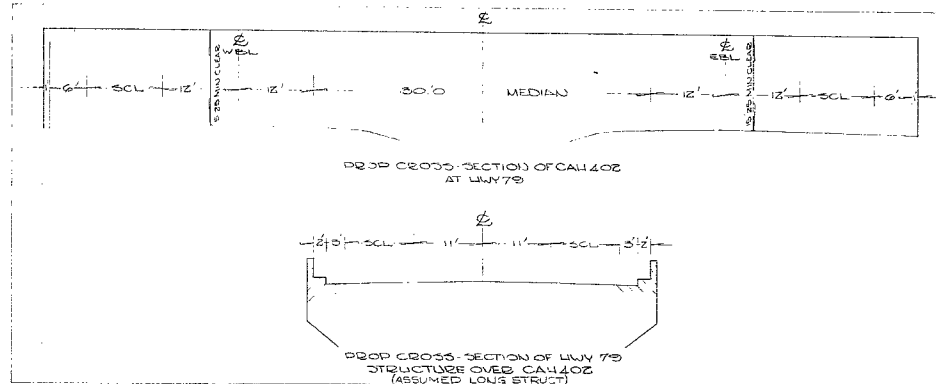
CON 2 E.G.R.



PLAN  
SCALE - 1/10" = 20' FT

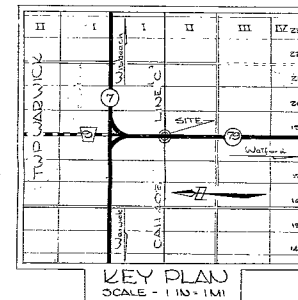


PROFILE  
SCALE - 1/10" = 20' FT



PROPOSED CROSS-SECTION OF CAL 402  
AT HWY 79

PROBABLE FOOTING LOCATIONS



KEY PLAN  
SCALE - 1/10" = 1/4 MI

71-11042

STR WP 42-66-11

DATE	REVISIONS & ADDITIONS	BY	CHKD

DEPARTMENT OF HIGHWAYS ONTARIO  
DESIGN BRANCH  
ENGINEERING SURVEYS OFFICE

BRIDGE SITE #2

PROPOSED CROSSING  
AT  
HWY 79  
AND  
CAL 402 LINE 'C'  
LOTS 18 & 19 CON 2 SOUTH OF EGBRANT RD  
TOWNSHIP WARWICK COUNTY LAMBTON

SCALE AS SHOWN	DISTRICT N-1 CHATHAM	REGION SOUTHWESTERN
WD 9582-12-66 Date of Survey NOV 68 Date of Plan DEC 68	SITE 19-355	
SURVEY BY Chief of Hwy G TELFORD Superintendent W SMITH	DRAWN BY DRAFTSMAN GUTHRIE Superintendent D BULE	
CHECKED BY Draftsman G HOBBS Superintendent	PLAN E-4873-1	

40113-31

1-6784-1

1-6784-1

