

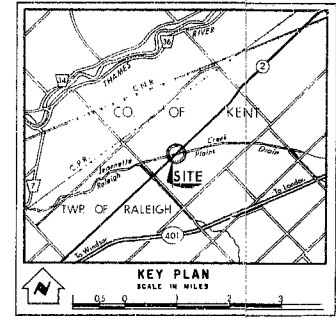
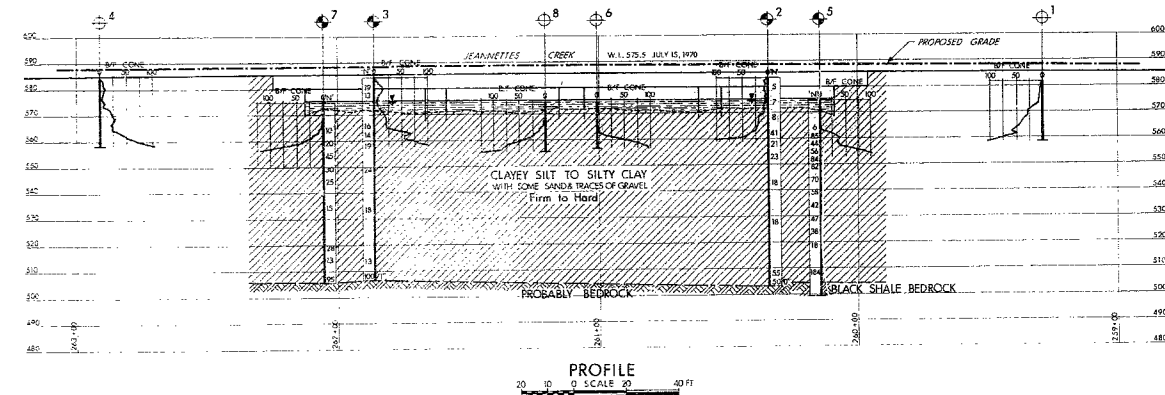
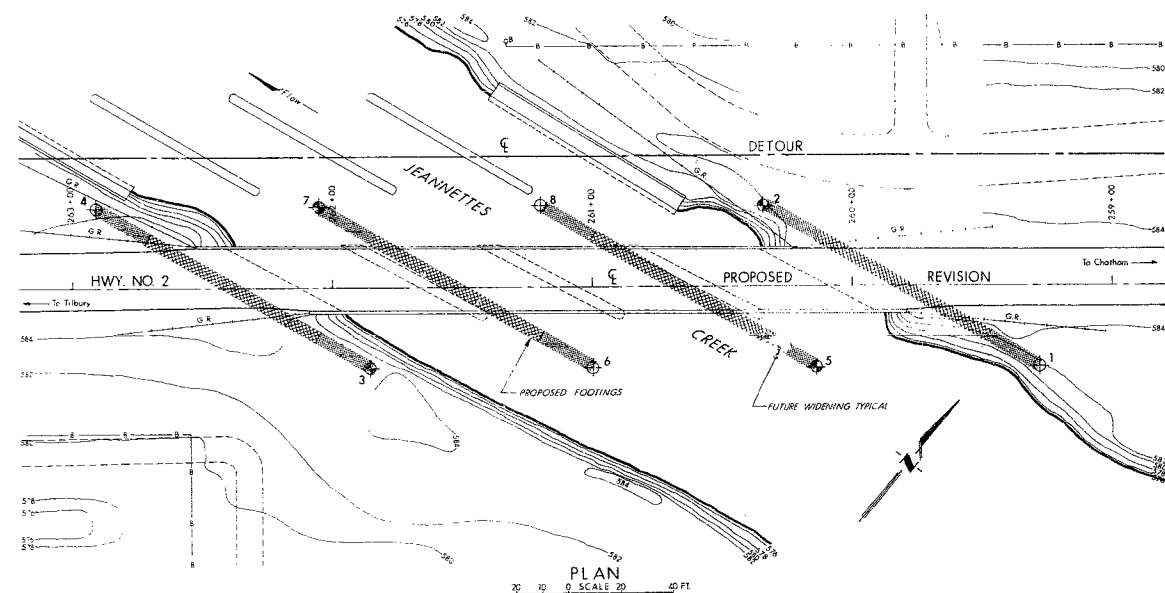
CONT. 72-2

W. OF CHATHAM

W. LTS - HWY. 2

RALEIGH PLAINS

40J8-34



LEGEND				
	Bore Hole			
	Cone Penetration Hole			
	Bore & Cone Penetration Hole			
	Water Levels established at time of field investigation, DECEMBER 1970.			
NO.	ELEVATION	STATION	OFFSET	
1	581.6	259+27	31' LT.	
2	583.7	260+33	31' RT.	
3	584.3	261+85	31' LT.	
4	584.1	262+91	31' RT.	
5	574.3	260+14	31' LT.	
6	574.3	261+00	31' LT.	
7	574.3	262+05	31' RT.	
8	574.3	261+20	31' RT.	

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

DATE	BY	DESCRIPTION

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

JEANNETTES CREEK

KING'S HIGHWAY NO. 2 PROP. REVISION DIST. NO. 1
CO. KENT
TWP. RALEIGH LOT 8 CON. 4 & 5

BORE HOLE LOCATIONS & SOIL STRATA

DRAWN BY S. B. CHECKED BY S. B. DATE JANUARY 26, 1971 SITE NO. 70-11121 A
APPROVED BY [Signature] CONTRACT NO. 40J8-34

GEORES. NO. 40J8-34

MEMORANDUM

20-002

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

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

ATTENTION: Mr. S. McCombie

DATE: January 27, 1971

40J-58

Our File Ref.

IN REPLY TO

FEB 1 1971

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Raleigh Plains Drain Bridge
4.4 Miles West of Chatham
West Limits - Highway #2
District No. 1 (Chatham)

W.O. 70-11121 - W.P. 88-67-00

Cont 72-002 site 13-150

40J8-34

GEOCRE No.

Attached, we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please feel free to contact our Office.

ACS/Wde7
Attach.

A. G. Sternac

PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. E. R. Davis
H. A. Treganier
D. W. Farren
W. Zonnenberg
P. C. Brown
A. P. Lott (2)
J. Roy
B. J. Giroux
B. A. Singh

Foundations Files
Gen. Files

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 - 4.3) Clayey Silt to Silty Clay with some Sand and traces of Gravel.
 - 4.4) Black Shale Bedrock.
 5. GROUNDWATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS.
 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Raleigh Plains Drain Bridge
4.4 Miles West of Chatham
West Limits - Highway #2
District No. 1 (Chatham)
N.O. 70-11121 - W.P. 98-67-00

1. INTRODUCTION:

A memo requesting a foundation investigation at the location of the above structure, was received from Mr. A. P. Watt, Regional Bridge Planning Engineer, Southwestern Region, on November 17, 1970.

A field investigation was subsequently carried out by the Foundation Section in order to determine the subsoil and groundwater conditions at the site.

This report contains the results of our field and laboratory investigations, together with our recommendations pertaining to the design of foundations for the proposed structure and the stability of the approach embankments.

2. DESCRIPTION OF THE SITE:

The proposed structure over Raleigh Plains Drain is located 4.4 miles west of Chatham West Limits on Hwy. #2. The drain has a width of some 100 ft. and a bed elevation 14 feet below existing Hwy. #2 grade. There was some 6 ft. of water during the time of the field operation.

Immediately north of the existing bridge and parallel to it, piers and abutments have been constructed. Apparently in the 1930's it was planned to make Hwy. #2 four-lane, and foundations were built for the structure to carry the westbound traffic - this never came to pass and the foundations have remained unused.

2. DESCRIPTION OF THE SITE: (cont'd.) ...

This can be utilized to carry the temporary Bailey bridge required as a detour during construction of the proposed bridge.

The surrounding area is flat, cultivated farmland.

Physiographically the region is known as the St. Clair Clay Plain.

3. FIELD AND LABORATORY INVESTIGATION:

During the course of the investigation, 4 sampled boreholes and 8 dynamic cone penetration tests were carried out. Boreholes #2 and 3 and dynamic cone penetration tests #1 and 4, were put down, using a continuous flight auger machine, while boreholes #5 and 7 and dynamic cone penetration tests #6 and 8 having been located on the water, were advanced from a portable raft using a diamond rig.

Borehole #5 was sampled down to bedrock and cored, using an API core barrel, while boreholes #2, 3 and 7 were terminated at depths ranging from 69 to 80 ft.

Disturbed samples were obtained using a 2" O.D. split-spoon sampler; the energy used for driving, conformed to the requirements of the Standard Penetration Test.

Undisturbed samples were obtained by means of 2" I.D. Shelby tubes pushed manually into the subsoil.

Vane tests were carried out, where possible, 1-1/2 ft. below the sample depths.

Samples were visually examined in the field and subsequently in the laboratory. Following this examination, laboratory tests were carried out on selected samples to determine the following engineering properties of the overburden:

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

1. Bulk Density.
2. Natural Moisture Content.
3. Atterberg Limits.
4. Grain-Size Distribution.
5. Unconfined Compressive Strength.

The results of field and laboratory tests are shown on the Record of Borelog sheets.

Plots of Plasticity Index vs. Liquid Limit and typical grain-size distribution curves are shown in Figs. 1 to 3 of the report Appendix.

The locations and elevations of all boreholes were surveyed by personnel from London Region, and are shown on Dwg. #70-11121A, which accompanies this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The subsoil at this site consists of 6 - 7 feet of fill that can be classified as clayey silt with sand and traces of gravel and some organics. Beneath the fill lies a deep deposit of clayey silt to silty clay with some sand and traces of gravel extending down to a depth of some 80 feet below the top of the fill and overlying black shale bedrock. Detailed descriptions of the various soil types encountered in each borehole are given on the Record of Borehole sheets. The estimated stratigraphical profile of Dwg. #70-11121A, is based upon this information.

From ground level downwards, the description of the deposits is as follows:

4.2) Fill Material:

This material, identified as clayey silt with sand, was found in boreholes #2 and 3 and extended to a depth of 6 - 7 ft.

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

4.2) Fill material: (cont'd.) ...

'N' values ranged from 5 blows/ft. to 19 blows/ft. and, hence, the consistency is estimated to be firm to very stiff.

4.3) Clayey Silt to Silty Clay with some Sand and traces of Gravel:

This deposit extends from beneath the fill down to the black shale bedrock.

Physical properties of the material in the deposit, as determined from field and laboratory tests, are summarized as follows:

	<u>Clayey Silt</u>	<u>Silty Clay</u>
Moisture Content %	9.7 to 27.6	16.6 to 40.5
Liquid Limit %	18.7 to 32.2	41.6 to 46.4
Plastic Limit %	13.9 to 21.3	20.3 to 24.1
Bulk Density p.c.f.	124 to 131	109 to 114

Vane tests throughout the whole deposit gave shear strengths ranging from 680 p.s.f. to over 2,000 p.s.f., and sensitivity values from 1.6 to 4.0. Unconfined compression tests performed in the laboratory resulted in shear strengths from 824 p.s.f. to 2,660 p.s.f.

The 'N' values throughout the whole deposit ranged from 6 to 184 blows/ft., indicating a firm to hard consistency.

4.4) Black Shale Bedrock:

Bedrock was proved in B.H. #5 only, as mentioned earlier in the report. It was found to lie at an elevation of 502.0.

The high percentage of recovery obtained, indicates sound bedrock.

5. GROUNDWATER CONDITIONS:

Groundwater elevations, observed in the open boreholes at the close of operations, were found to be as follows:

B.H. #2	--	574.74
B.H. #3	--	575.34

The water level in the creek at the time of the field investigation was at elev. 574.3. It should be assumed that the groundwater level will be at or slightly higher than the prevailing creek water level.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to replace the existing 4-span bridge carrying Hwy. #2 over Raleigh Plains Drain some 4.4 miles west of Chatham West Limits.

Present proposals call for a three-span (86'-36'-86') structure with a profile grade 3 feet above the existing grade and the new centre-line, some 2 - 3 ft. south of the existing centre-line.

Recommendations given below, are valid for the future widening of the bridge, by about 15 ft. on each side.

The drain has a width of some 100 ft. and a bed elevation 14 ft. below existing Hwy. #2 grade. There was some 6 ft. of water in the drain at the time of the field operation.

Subsoil at the site consists of a deep deposit of firm to hard clayey silt to silty clay, and this has adequate strength to provide spread footing support. Detailed recommendations are made as follows:

The piers and abutments may be supported on spread footings founded at or below the following elevations:

West Abutment	:	El. 562.0
West Pier	:	El. 562.0
East Abutment	:	El. 562.0
East Pier	:	El. 562.0

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

A safe net bearing pressure of 2 tons/sq.ft. can be assumed at these elevations.

Depth of footings must also conform with hydrological requirements.

A minimum cover of 4 ft. is required for the footings to give the necessary frost protection.

With regard to dewatering of the footing excavations, it should be noted that the subsoil in all boreholes other than B.H. #5 was found to be cohesive and, therefore, relatively impermeable soil. In B.H. #5, however, it was observed that the cohesive deposit contained sand and silt layers of high permeability. Excavation which intersects such sand layers may be subjected to considerable inflow of water with possible boiling of the bases, depending on the proximity of the sand or silt layers. In such cases, it would be necessary to lower the groundwater level by some means, or to carry out the excavation within a suitable cofferdam.

It is possible that these conditions may arise during the excavations of the East pier and abutment.

The approach fills will be heightened by 3 ft. and no stability problems are anticipated.

All slopes should be protected against erosion by means of rip-rap, according to hydrological requirements.

7. MISCELLANEOUS:

The field work, performed during the period from December 1 to 16, 1970, together with preparation of this report, was undertaken by Mr. E. Szymanski.

Equipment used was owned and operated by P.V.K. & Sons Drilling Co.

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

January, 1971.

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-11121 LOCATION Sta. 259 + 27 (31' Lt. of New Hwy. 2) ORIGINATED BY HS
 W.P. 88-67-00 BORING DATE Dec. 7, 1970 COMPILED BY HS
 DATUM Geodetic BOREHOLE TYPE Dynamic Cone Penetration Test CHECKED BY *HS*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
581.6	Ground Level										
558.6	End of Cone Test										
23.0											

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-11121

LOCATION

Sta. 260 + 33 (31' Rt. # New Hwy. 2)

ORIGINATED BY HS

W.P. 88-67-00

BORING DATE

December 1, 1970

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE

Pendrill

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		BLOWS/FOOT	20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE 500 1000 1500 2000 2500				WATER CONTENT % 15 30 45
583.7	Ground Level															
577.7	Fill - Clayey silt with traces of sand and gravel		1	SS	5											
6.0			2	TW	PM											
			3	SS	7											
			4	TW	PM											
	Clayey silt to silty clay with some sand and gravel		5	SS	8											
			6	TW	PM											
			7	SS	LI											
	Firm to Hard		8	SS	21											
			9	SS	23											
			10	TW	PM											
			11	SS	18											
			12	TW	PM											
			13	SS	18											
			14	TW	PM											
			15	SS	55											
503.2			16	SS	50/0"											
80.5	Probable Bedrock End of Borehole															

FOUNDATION SECTION

ORIGINATED BY HS

COMPILED BY HS

CHECKED BY

20
15 ϕ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-11121 LOCATION Sta. 262 + 91 (31' Rt. of Hwy. 2) ORIGINATED BY HS
 W.P. 88-67-00 BORING DATE Dec. 7, 1970 COMPILED BY HS
 DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test only CHECKED BY *HS*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				
584.1	Ground Level															
558.1	End of Cone Test															
26.0																

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 70-11121

LOCATION

Sta. 260 + 14 (31' Lt. of New Hwy. 2)

ORIGINATED BY HS

W.P. BP-67-00

BORING DATE

Dec. 7, 1970

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE

Washboring, NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 15 30 45
							20	40	60	80	100	UNCONFINED + FIELD VANE QUICK TRIAXIAL x LAB. VANE					
							500	1000	1500	2000	2500						
574.3	Water Level																
567.8	Water					570											
6.5			1	SS	6												
			2	SS	35												
	Sandy silt		3	SS	44										2 20 64 14		
			4	SS	56												
	Silty sand		5	SS	85										0 67 (33)		
			6	SS	82										1 52 38 9		
			7	SS	70												
	Silty sand		8	SS	58										21 55 28 15		
			9	SS	42												
	Clayey silt to silty clay, some sand and trace of gravel		10	SS	47												
	Very Stiff to Hard		11	SS	38												
			12	SS	18												
			13	SS	18 1/2										0 44 (56)		
504.3	Shale fragments																
70.0	Black Shale		14	RC	100%												
499.3	Bedrock																
75.0	End of Borehole																

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 70-11121 LOCATION Sta. 261 + 00 (31' Lt. of New Hwy. 2) ORIGINATED BY HS
 W.P. 88-67-00 BORING DATE Dec. 10, 1970 COMPILED BY HS
 DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test only CHECKED BY

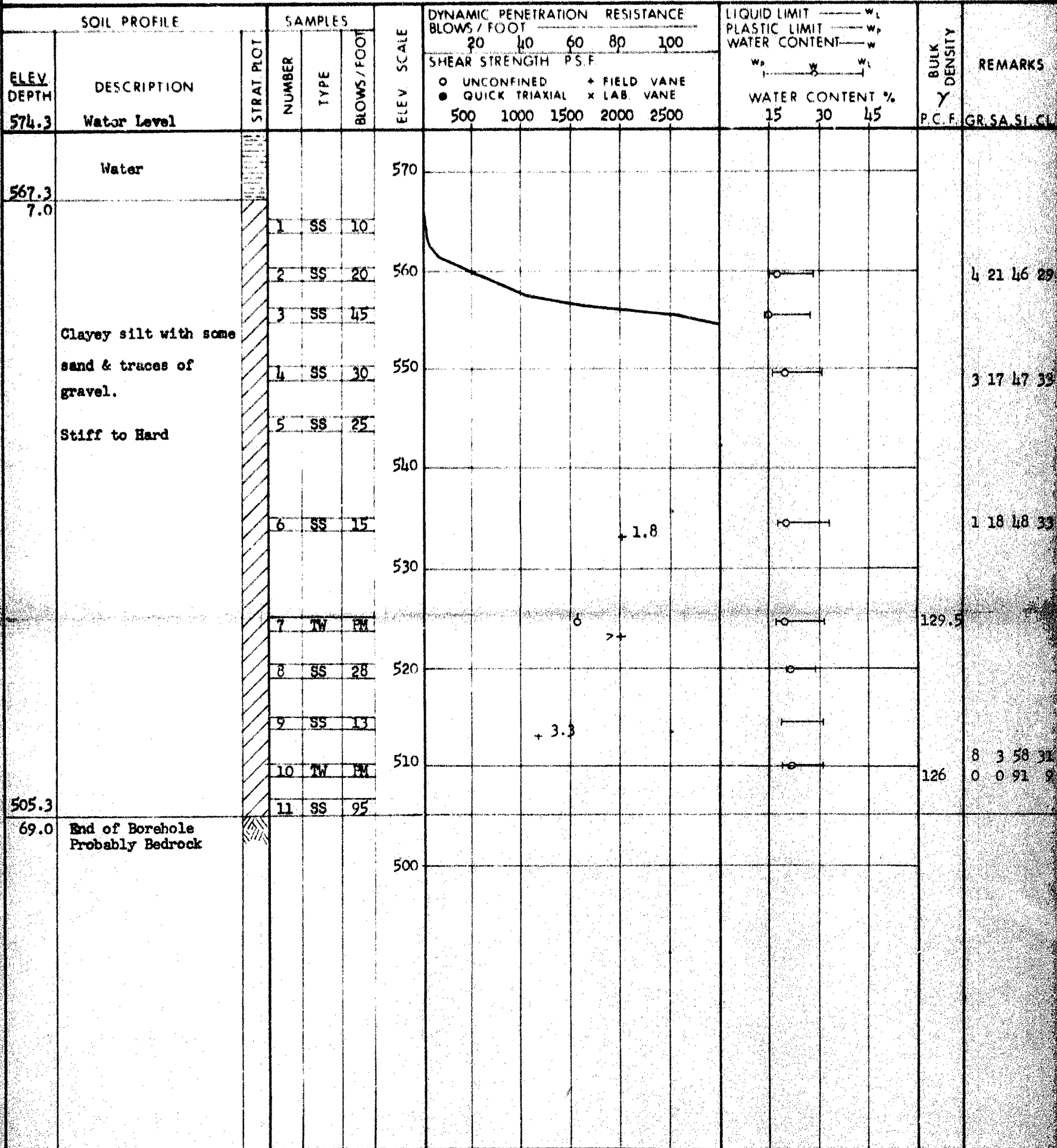
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %			
						20	40	60	80	100				
574.3	Water Level													
567.3	Water													
7.0														
556.3														
18.0	End of Cone Test													

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 70-11121 LOCATION Sta. 262 + 05 (31' Rt. of New Hwy. 2) ORIGINATED BY HS
W.P. 88-67-00 BORING DATE Dec. 10, 1970 COMPILED BY HS
DATUM Geodetic BOREHOLE TYPE Washboring, NX & BX Casing CHECKED BY



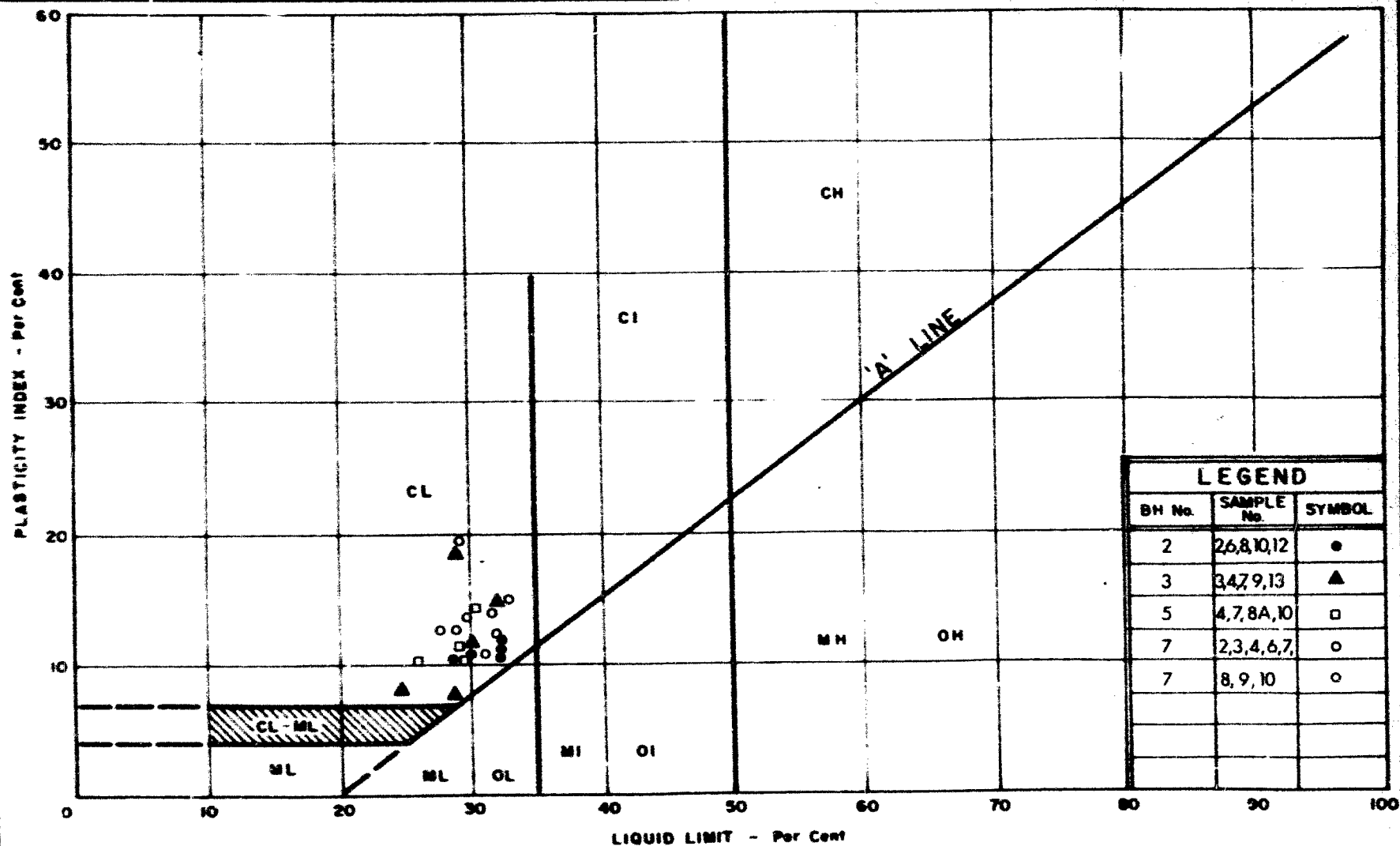
DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 70-11121 LOCATION Sta. 261 + 20 (31' Rt. of Hwy. 2) ORIGINATED BY HS
 W.P. 88-67-00 BORING DATE Dec. 16, 1970 COMPILED BY HS
 DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY

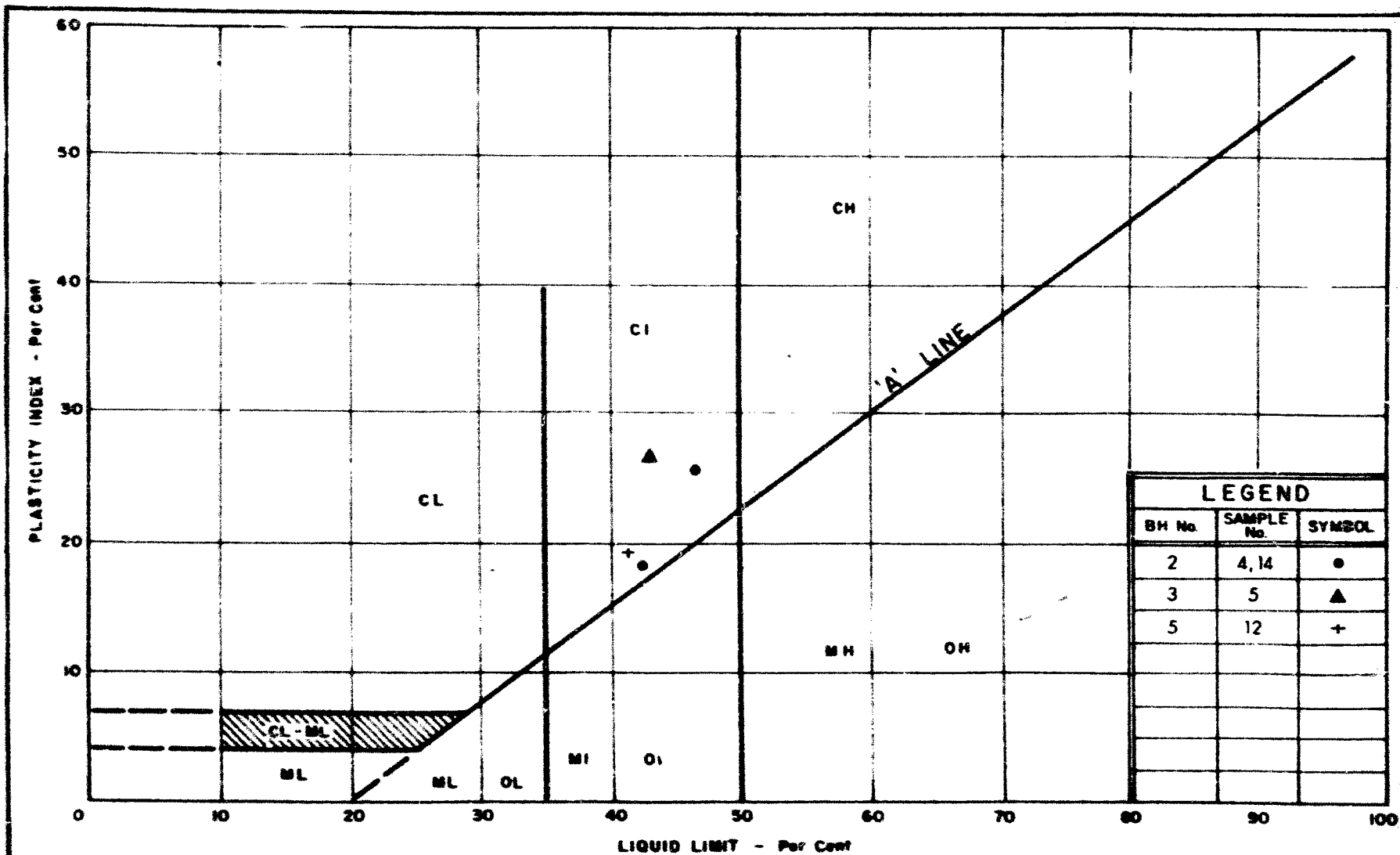
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	WATER CONTENT %			
574.3	Water Level														
568.3	Water														
6.0															
555.3															
19.0	End of Cone Test														



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART CLAYEY SILT

WP No. 88 - 67 - 00
JOB No. 70 - 11121
FIG. 1



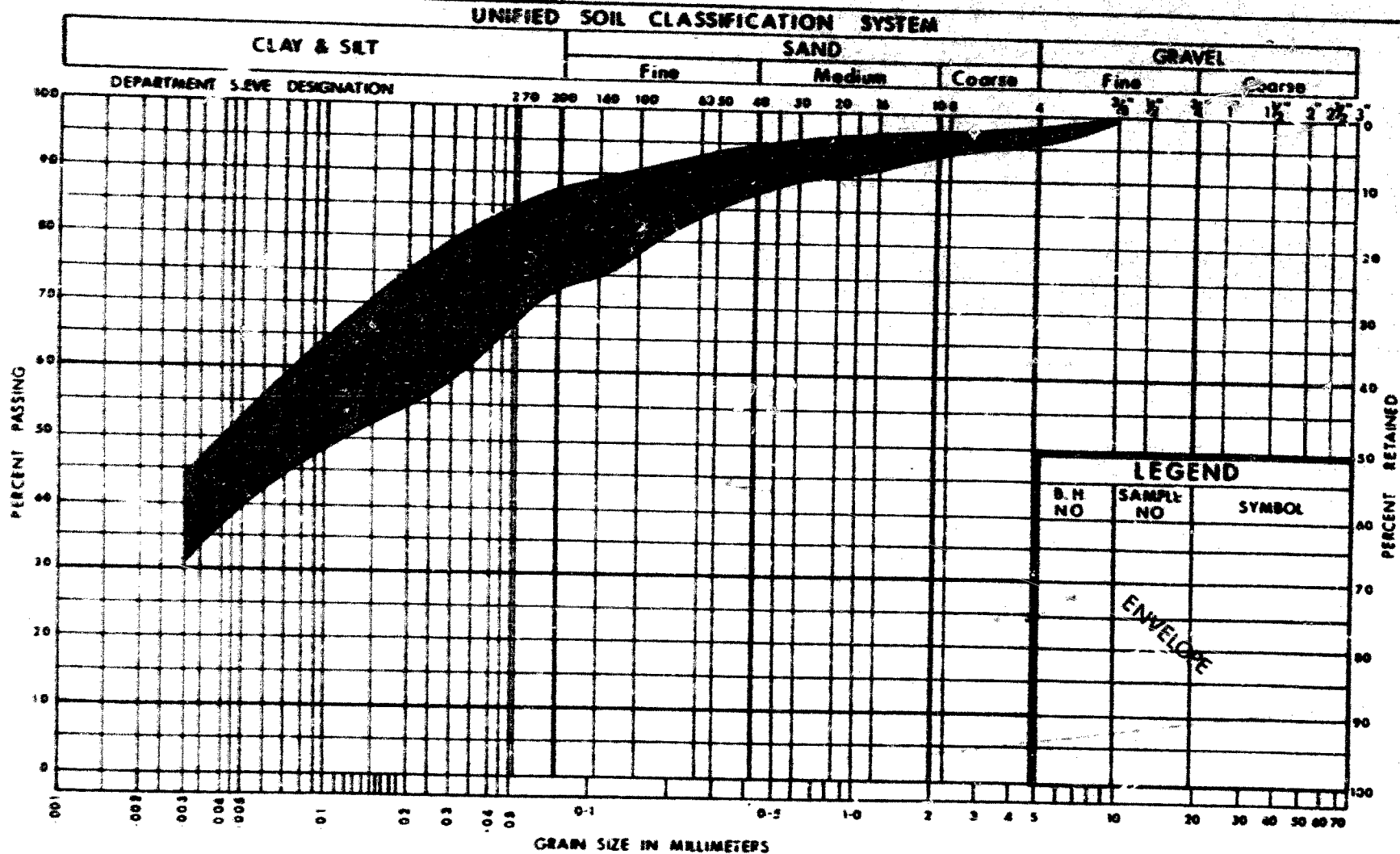
LEGEND		
BH No.	SAMPLE No.	SYMBOL
2	4, 14	•
3	5	▲
5	12	+



DEPARTMENT OF MINERALS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART SILTY CLAY

WP No. P8 - 67 - 00
JOB No. 70 - 11121
FIG. 2



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
CLAYEY SILT

W.P. No. 88 - 67 - 00

JOB No: 70 - 11121

FIG. 3

HAMMER TYPE B-12 WEIGHT 1.30 ENERGY 22,500 FT. LBS

REVENUE	TO	874	OVERSEEN
---------	----	-----	----------

MISCELLANEOUS DETAIL SHEET

(DO NOT USE FOR GRADING QUANTITIES, ETC)
(OR FOR SCRATCH PAD USE)

SHEET NO. _____ OF _____

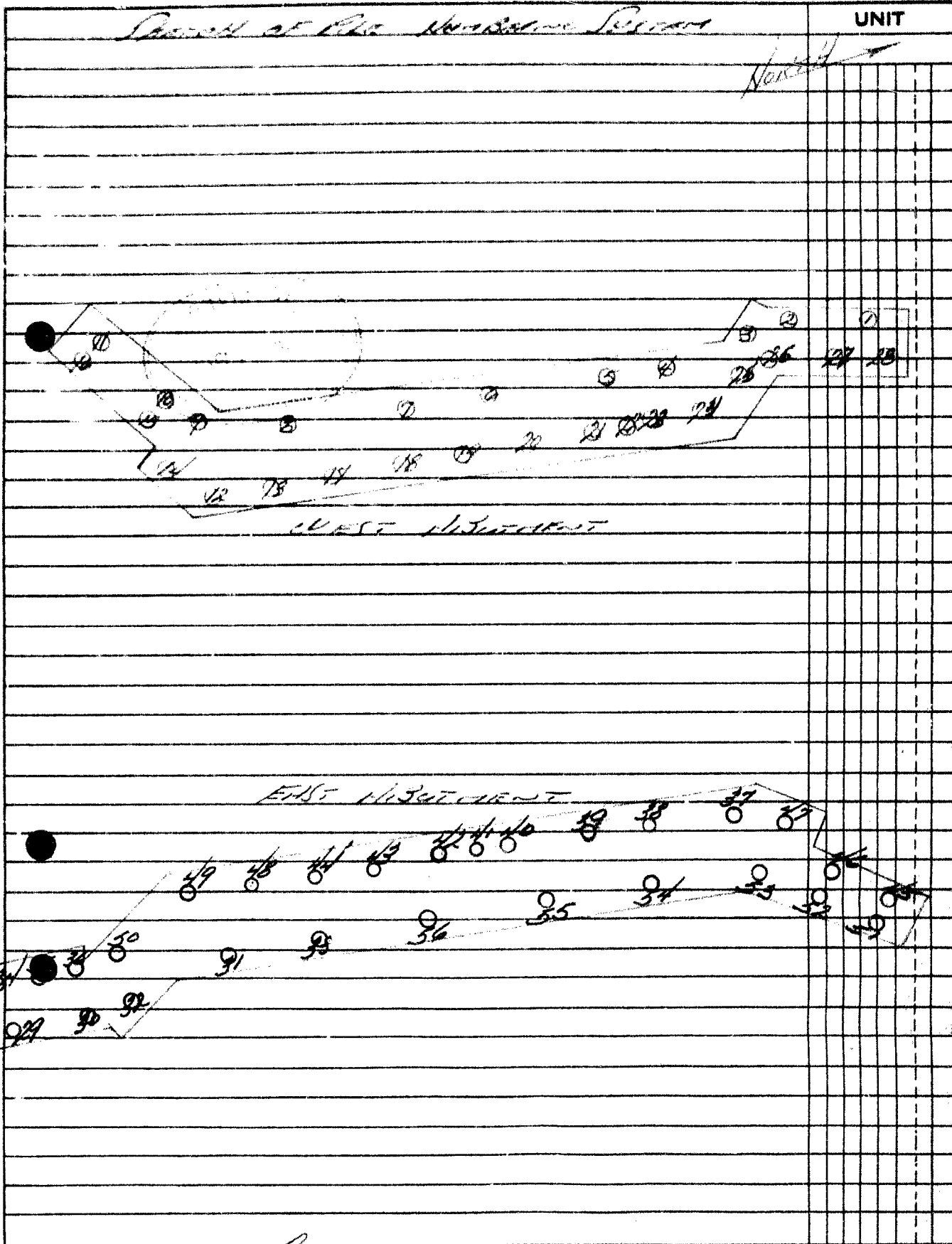
DATE Sept 11/82

WORK PROJECT NO. _____

CONTRACT NO. 12-82

ITEM NO. _____

LOCATION OF MATERIAL, ETC. near road 12th over 6550"



DETAILED BY B. Smith

CHECKED BY _____

Department of Highways Ontario

Copy for the information of
Foundation Office.

Mr. A. Stermac,

Principal Foundation Engineer,
Room 107, Lab. Bldg.

C. S. Grebski,
Structural Office.

August 26, 1971.

Raleigh Plains Drain Bridge,
W.P. 88-67-00, Site 13-150,
Highway #2, District #1.

70-11-121

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,
Structural Design Engineer.

CSG/mh
ENCL*

cc: Foundation Office.

10/10/71

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

~~Mr. A. P. Webb,~~
Regional Bridge Planning
Engineer,
London Regional Office.

Bridge Office,
Downsview.

June 7, 1971.

Saleigh Plains Drain Bridge,
W.P. 88-67-00, Site #13-150,
Highway #2, District #1.

70-11-121

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-7003-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$217,000 which includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

C. S. Grebski,
Bridge Design Engineer.

CSG/mh

ENCLOSURE

cc: B. R. Davis,
A. Stermac,
J. Anderson,
A. Crowley.

W. B. Sullivan

Mr. A. McConnell,
Regional Functional Planning
Engineer, LONDON.

Materials and Testing,
London.

September 17, 1969.

- C.F. 88-67-00, Highway #2,
Raleigh Plains Drain Bridge
4.4 Miles West of Chatham West
Limits, District No. 1.

The above project is located within the Chatham Plains
area of the St. Clair Clay Plain.

Hand auger borings indicate that the near surface sub-
soil consists of alluvial silty clay (light clay) such that
provision for 21" granular (6" G.B.C. Class "A" plus 15" sand
cushion) will probably be required for the proposed structure
approaches. At the ends of the project, provision for 3"
asphalt over 21" granular will likely be required on the
widening prior to resurfacing with a 1 1/2" surface course. Hot
mix pavement on the new granular grade will consist of two
1 1/2" binder courses and a 1 1/2" surface course. On the proposed
detour, provision for 6" G.B.C. "A" plus 14" sand cushion will
probably be required. Pavement may consist of a 2" single
course of G.B.C. 5.

A detour Bailey Bridge may be supported on the existing
concrete piers of the former bridge that was constructed for
four lanes. Abutment cribs may be placed on the top of the
embankments on either side of the drain. Such cribs should
be located at least 4' from the edges of the embankments.

A foundation investigation will be required to determine
proper structure support for the proposed new structure. The
near surface borings indicate that bearing piles will probably
be required.

The closest available G.B.C. Class "A" is located
approximately 6 miles east of Chatham at a 15 mile haul to the
project. The closest available sand cushion is located 2 to 3
miles west of Cedar Springs approximately 14 miles from the
project.

Am Batten

A. M. BATTEN,
FOR: J. R. RAY,
REGIONAL MATERIALS ENGINEER.

AMB:hp.

C.C. - G. A. Wong,
A. Sternac,
W. Zonnenberg,
A. M. Batten,
File.