

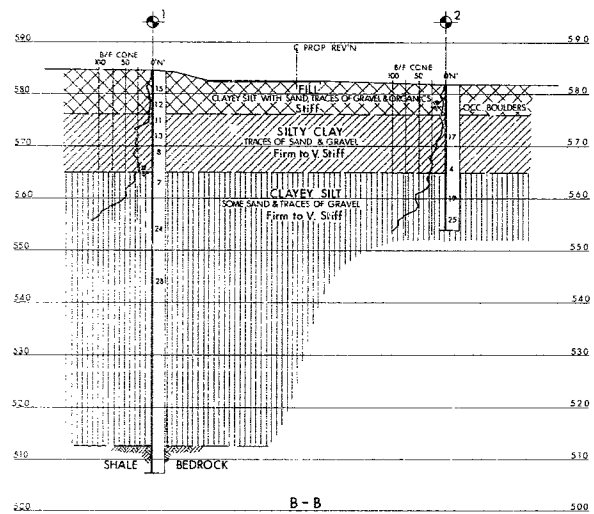
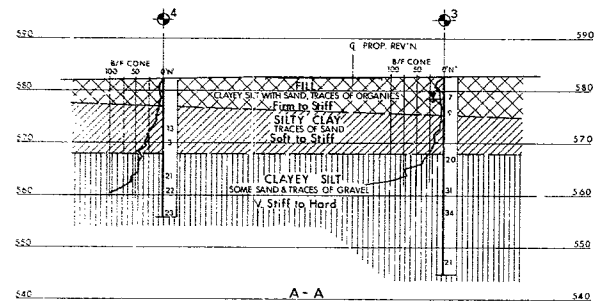
CONT. 71-98

GOVERNMENT

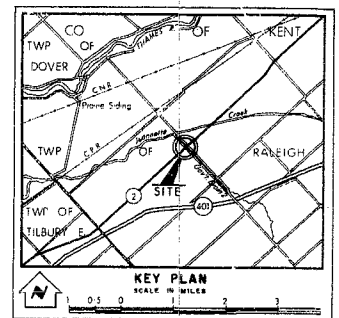
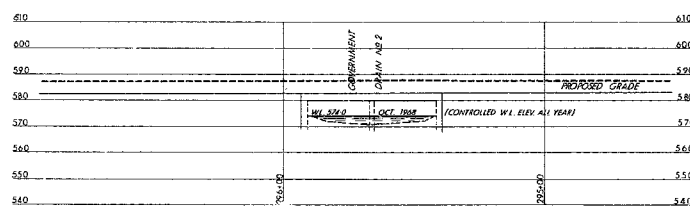
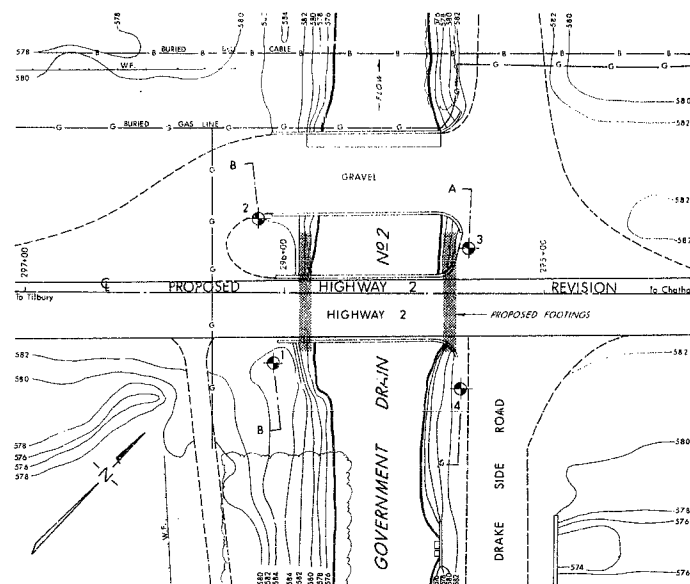
DRAIN #2 BR.

W. OF CHATHAM

40J8-33



SECTIONS  
10 5 0 SCALE 10 20 FT



**LEGEND**

- Bore Hole
- Cone Penetration Hole
- Bore A Cone Penetration Hole
- Water Levels established at time of field investigation, MAR. 1970

**NOTE:** Water Level in Bore Hole 4 not established at time of field investigation.

NO.	ELEVATION	STATION	OFFSET
1	584.6	296+04	27' LT.
2	582.0	296+10	28.5' RT.
3	582.8	295+29	17.5' RT.
4	582.2	295+32	36.5' LT.

**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.

DATE	BY	DESCRIPTION

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

**GOVERNMENT DRAIN NO. 2**

KING'S HIGHWAY NO. 2 PROP. REV. N. DIST. NO. 1  
CO. KENT  
TWP. RALEIGH LOT 6&7 CON. 4&5

**BORE HOLE LOCATIONS & SOIL STRATA**

DRAWN G.A. CHECKED S.Y. MAP NO. 90-67-00  
DRAWN S.O. CHECKED S.Y. JOB NO. 70-F-18  
DATE: 3 MAY 1970 SITE NO. 70-F-18A  
APPROVED: [Signature] DATE: [ ]

GEORES NO. 40JB-33

## MEMORANDUM

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

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

ATTENTION: Mr. S. McCombie

DATE: May 11, 1970

OUR FILE REF.

IN REPLY TO

MAY 21 1970

SUBJECT

FOUNDATION INVESTIGATION REPORT  
For  
Government Drain #2 Bridge  
5.0 Miles West of Chatham West Limits  
Highway #2  
District No. 1 (Chatham)  
W.J. 70-F-18 -- W.P. 90-67-00  
(ONT 71-098)

40 I - 72

GEOCRE No.

40J8-33

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.

AGS/KseF  
Attach.

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

cc. Messrs. B. R. Davis  
H. A. Tregaskes  
D. A. Parson  
M. Zonnenberg  
F. C. Brown  
A. P. Ratt (2)  
J. Roy  
B. A. Singh

Foundations Files  
Gen. Files

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  3. FIELD AND LABORATORY INVESTIGATION.
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    - 4.2) Fill Material.
    - 4.3) Clayey Silt - Silty Clay with traces of Sand and Gravel.
    - 4.4) Black Shale Bedrock.
  5. GROUNDWATER CONDITIONS.
  6. DISCUSSION AND RECOMMENDATIONS:
    - 6.1) General.
    - 6.2) Spread Footings.
    - 6.3) Steel H-Piles Driven to Bedrock.
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  7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT  
For  
Government Drain #2 Bridge  
5.0 Miles West of Chatham West Limits  
Highway #2  
District No. 1 (Chatham)  
W.J. 70-F-18      --      W.P. 90-67-00

---

1. INTRODUCTION:

In a memo dated March 4, 1970, a request was submitted by Mr. A. P. Watt, Regional Bridge Planning Engineer, Southwestern Region, for a foundation investigation at the location of the above structure.

The investigation was carried out by the Foundation Section. Presented in this report are the results of this investigation, together with the recommendations regarding the structure foundations.

2. DESCRIPTION OF THE SITE:

The site is located 5 miles west of Chatham West Limits on Highway #2. The existing bridge is in badly deteriorating condition, and is only some 23 feet wide. Immediately north of the existing bridge and parallel to it, lies a second bridge of similar size, in much better condition; this second structure has never been used.

The surrounding area is flat, cultivated farmland.

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

### 3. FIELD AND LABORATORY INVESTIGATION:

The field work consisted of four sampled boreholes and, adjacent to these, four dynamic cone penetration tests. Borehole #1 was sampled down to bedrock and cored using an AXT core barrel, while boreholes #2, 3 and 4 were terminated at depths ranging from 25 to 30 feet.

Equipment used consisted of a diamond drill adapted for soil sampling purposes.

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.

All samples were visually identified in the field and then returned to the laboratory where further tests were carried out to determine Atterberg Limits and moisture contents, density, particle size distribution and unconfined shear strength. Four consolidation tests were undertaken.

### 4. SUBSOIL CONDITIONS:

#### 4.1) General:

The subsoil at the site consists of a shallow fill of some 7 - 9 feet that can be classified as clayey silt with sand and traces of gravel and organics. Beneath the fill lies a deep deposit of clayey silt to silty clay with traces of sand and gravel extending down to a depth of some 72 feet below the top of the fill and overlies black shale bedrock.

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

4.2) Fill Material:

This material, identified as clayey silt with sand, traces of gravel and organics, was found in all boreholes and extended to a depth of 7 - 9 feet. 'N' values observed ranged from 7 blows/foot to 15 blows/ft. and hence the consistency is estimated to be firm to stiff.

Occasional boulders were observed in the region of B.H. #2.

Moisture Contents ranged from 17% to 33%  
 Plastic Limits - from 19% to 20%  
 Liquid Limits - from 35% to 36%

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

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

Atterberg limits indicate the material to be silty clay above elevation 565.0 on the west side - i.e., in boreholes #1 and #2, and above elevation 568.0 on the east side - i.e., boreholes #3 and #4. Below these elevations it is classed as clayey silt.

The properties of the deposit are summarized below:

Grain-Size Distribution -

<u>Silty Clay</u>				<u>Clayey Silt</u>			
Gravel	0 - 2%	Sand	1 - 9%	Gravel	2 - 4%	Sand	16 - 17%
Silt	29 - 75%	Clay	24 - 60%	Silt	47 - 48%	Clay	31 - 35%
Liquid Limit	35 - 52				27 - 35		
Plastic Limit	19 - 23				16 - 20		
Moisture Content	20 - 40				14 - 24		
Pulk Density PCF	111 - 124				124 - 135		
'N' Values -	3 - 17				7 - 34		
(blows/ft.)							

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

4.3) Clayey Silt - Silty Clay with traces of Sand and Gravel:-  
(cont'd.) ...

The 'N' values indicate that the consistency of the silty clay ranges from firm to stiff, and of the clayey silt from firm to hard, though the latter can be classed generally as very stiff.

Vane tests throughout the whole deposit gave shear strengths ranging from 960 PSF to over 2,000 PSF, and sensitivity values from 1.8 to 7.1. Unconfined compression tests performed in the laboratory resulted in shear strengths from 670 PSF to 3,390 PSF. Considering the east side, the deposit can be taken as having a shear strength greater than 2,000 PSF below elevation 568.0, whereas the west side has strengths as low as 670 PSF until elevation 561.0 is reached, below which the strength increases to over 2,000 PSF. A plot of the variation in shear strength with regard to depth, is shown in Fig. 1 in the Appendix.

Plots of Plasticity Index vs. Liquid Limit and typical grain-size distribution curves are also shown in the Appendix.

4.4) Black Shale Bedrock:

Bedrock was proved at one location only as mentioned earlier in the report. It was found to lie at an elevation of 512.3. (The low recovery obtained was probably due to loss of material on retrieving the sample.)

5. GROUNDWATER CONDITIONS:

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

- |          |                 |
|----------|-----------------|
| 1. 564.6 | 2. 577.5        |
| 3. 578.8 | 4. Not obtained |
- 606.2  
15  
601.7

It must be noted that the above water levels may not represent the true groundwater levels due to the relatively impermeable nature of the subsoil and the short duration of the field work.

## 6. DISCUSSION AND RECOMMENDATIONS:

### 6.1) General:

It is proposed to replace the existing bridge carrying Highway #2 over Government Drain #2 some 5 miles west of Chatham West Limits.

The new structure will have a single span of 57 feet and will have a profile grade 5 feet above the existing grade.

The drain has a width of some 50 ft. and a bed elevation 12 feet below existing Highway #2 grade. There was some 4 ft. of water in the drain at the time of the field operation, and apparently this level is maintained throughout the year.

As mentioned earlier in the report, the subsoil underneath the road fill consists of a deep deposit of clayey silt - silty clay overlying shale bedrock.

Recommendations concerning the foundations to the proposed structure are given below:

### 6.2) Spread Footings:

The structure can be founded on spread footings at or below elevations 565.0 (West) and 566.0 (East). A safe bearing capacity of 1.8 TSF can be assumed at these elevations.

Should a spread footing foundation be adopted, total settlements in the order of 5 inches are expected under the abutments due to the embankment and footing loads over a long-term period.

### 6.3) Steel H-Piles Driven to Bedrock:

Alternatively, the structure may be supported on end-bearing piles driven to bedrock. In the case of steel H-piles, the design load can be taken as the maximum allowable for the particular section adopted.

In this case, the settlement under the embankment is anticipated to be 3 inches over a long-term period.

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

6.4) General Recommendations:

The approach fills will have a height of 5 feet and no stability problems are anticipated. The fills should consist of well compacted acceptable material.

The topsoil and any soft organic material should be removed within the construction area.

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

7. MISCELLANEOUS:

The field investigation was carried out during the period March 19 to 26, 1970, under the supervision of Mr. G. Allen, Project Foundation Engineer.

Equipment used was owned and operated by Master Soil Investigations Ltd.

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

May, 1970

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-F-18      LOCATION Sta. 296 + 04 27' Lt.      ORIGINATED BY GA

W.P. 90-67-00      BORING DATE March 19, 20 & 23, 1970      COMPILED BY GA

DATUM Geodetic      BOREHOLE TYPE Washboring, NX, BX Casing      CHECKED BY *ML*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w <sub>L</sub> PLASTIC LIMIT — w <sub>p</sub> WATER CONTENT — w			BULK DENSITY γ	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT										
							20	40	60	80	100	SHEAR STRENGTH P.S.F.					
												○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      x LAB. VANE					
							1000      2000					WATER CONTENT % 15      30      45					
584.6	Ground Level																
0.0	Fill-Clayey silt with sand, traces of gravel and organics.		1	SS	15	580											
	Stiff		2	SS	12												
576.0			3	SS	11												
8.6	Silty clay with traces of sand.		4	SS	13												
	Firm to stiff		5	SS	8												
565.0			6	TW	PM												
19.6			7	SS	7												
			8	TW	PM												
	Clayey silt with some sand & traces of gravel		9	SS	24												
	Firm to very stiff		10	TW	PM												
			11	SS	28												
			12	TW	PM												
			13	TW	PM												
512.3																	
72.3	Black Shale Bedrock		14	RC	40%	510											
507.3																	
77.3	End of Borehole																

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-F-18 LOCATION Sta. 296 + 10 28.5' Rt.

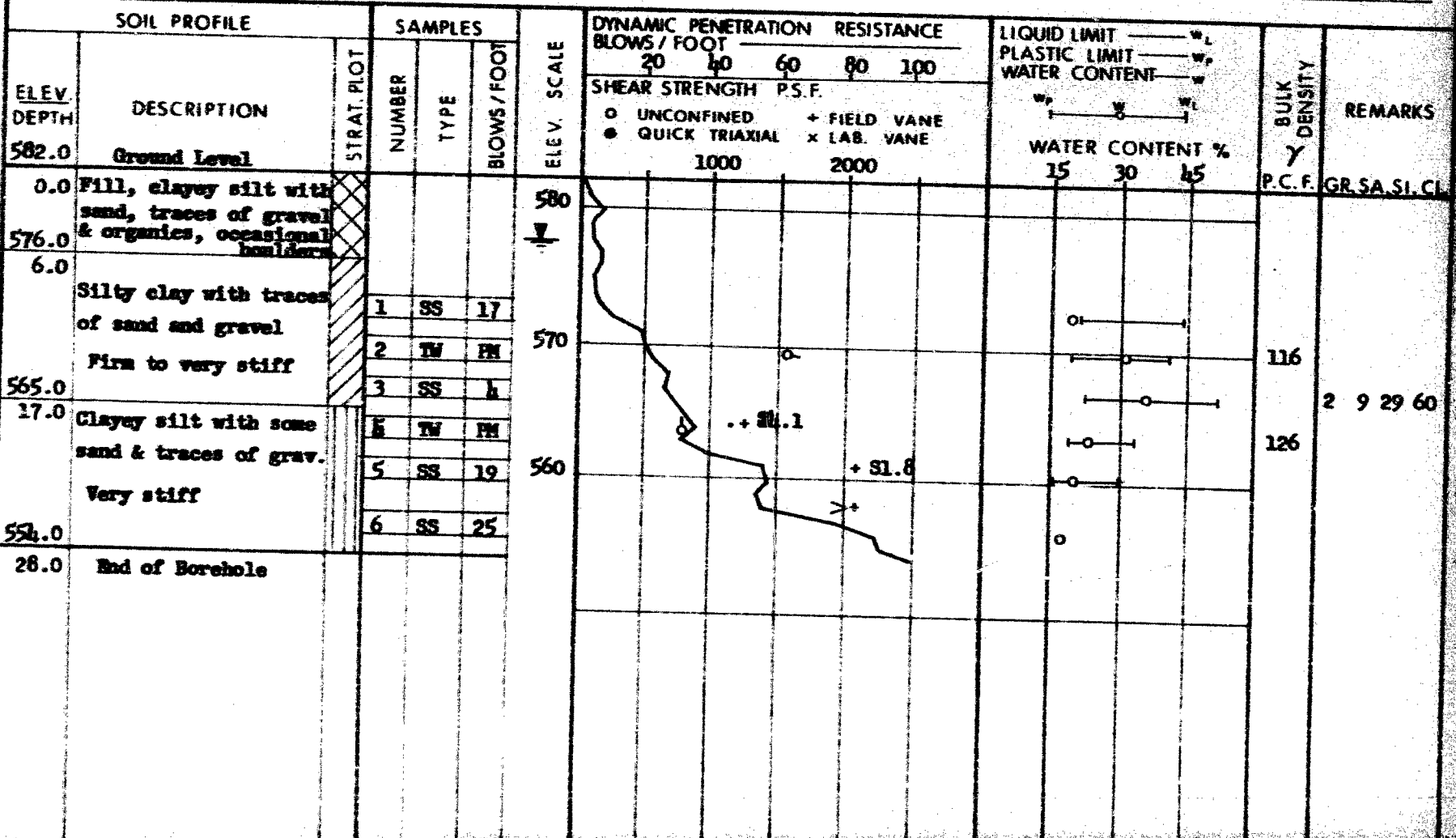
W.P. 90-67-00 BORING DATE March 24 & 25, 1970

DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing

ORIGINATED BY GA

COMPILED BY CA

CHECKED BY [Signature]

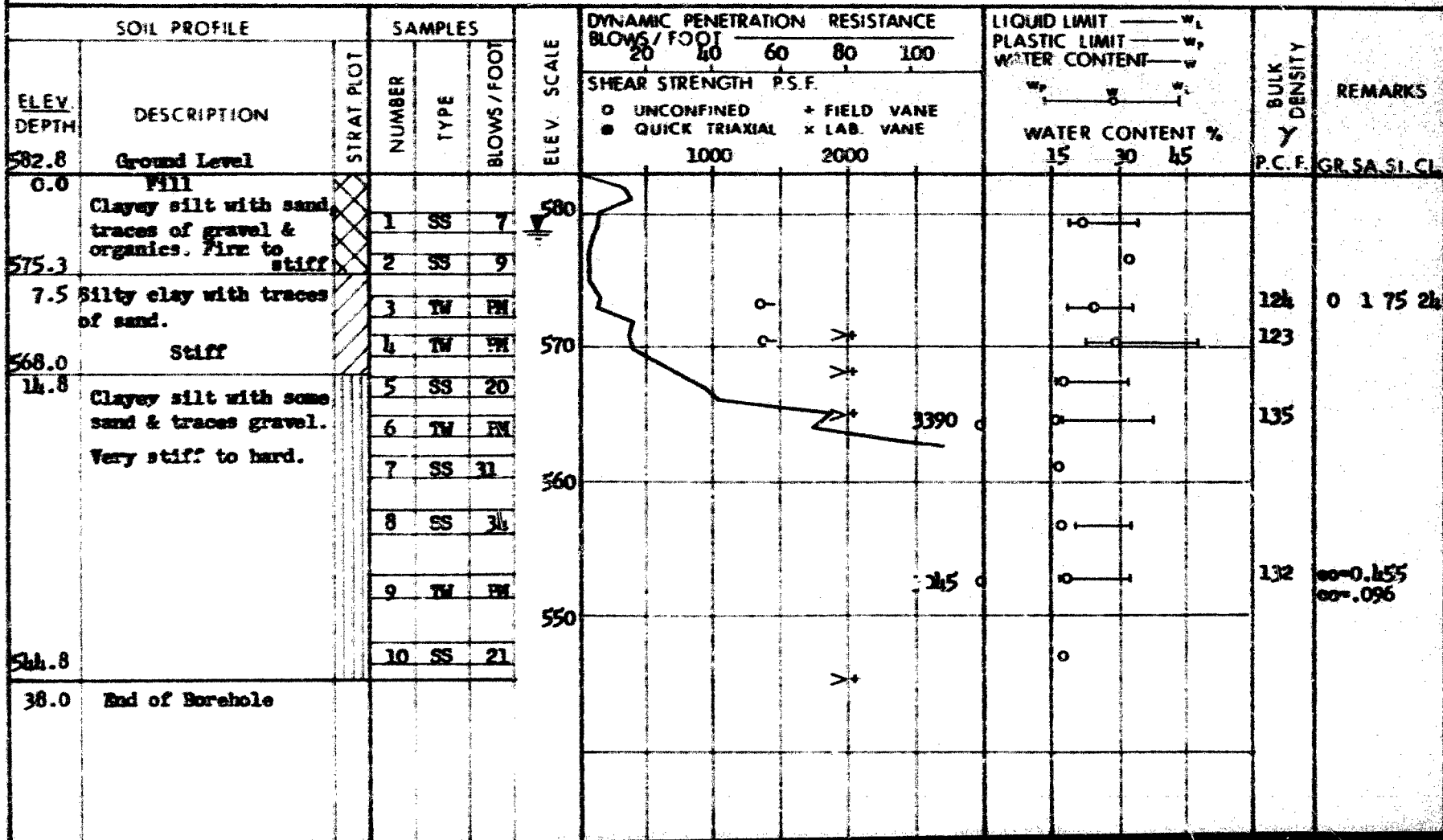


DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 70-F-18 LOCATION Sta. 295 + 29 17.3' Rt. ORIGINATED BY GA  
 W.P. 90-67-00 BORING DATE March 24, 1970 COMPILED BY GA  
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY [Signature]



DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-F-18

LOCATION Sta. 295 + 32 36.5' I.L.

ORIGINATED BY GA

W.P. 90-67-00

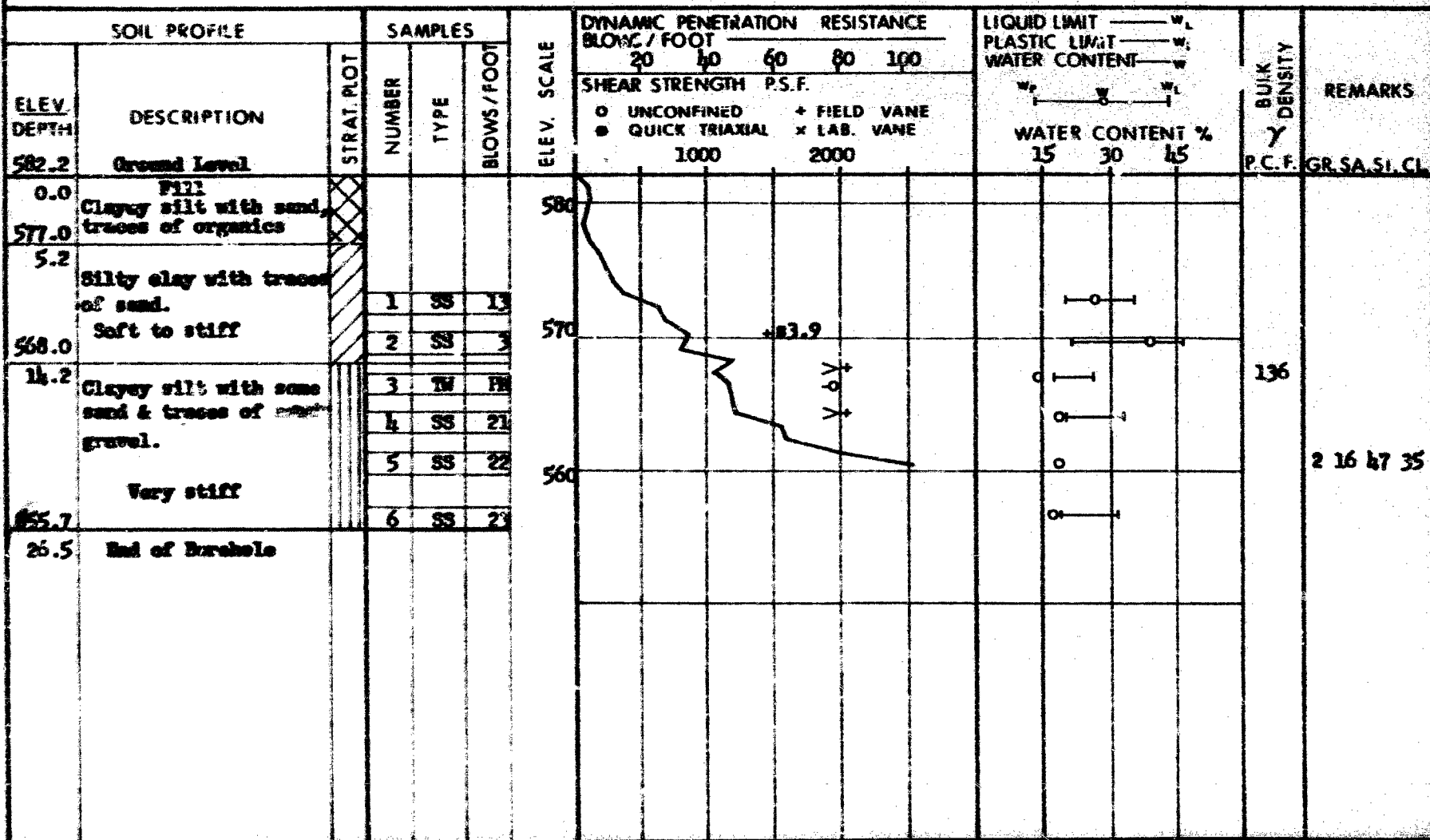
BORING DATE March 24 &amp; 26, 1970

COMPILED BY GA

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

CHECKED BY



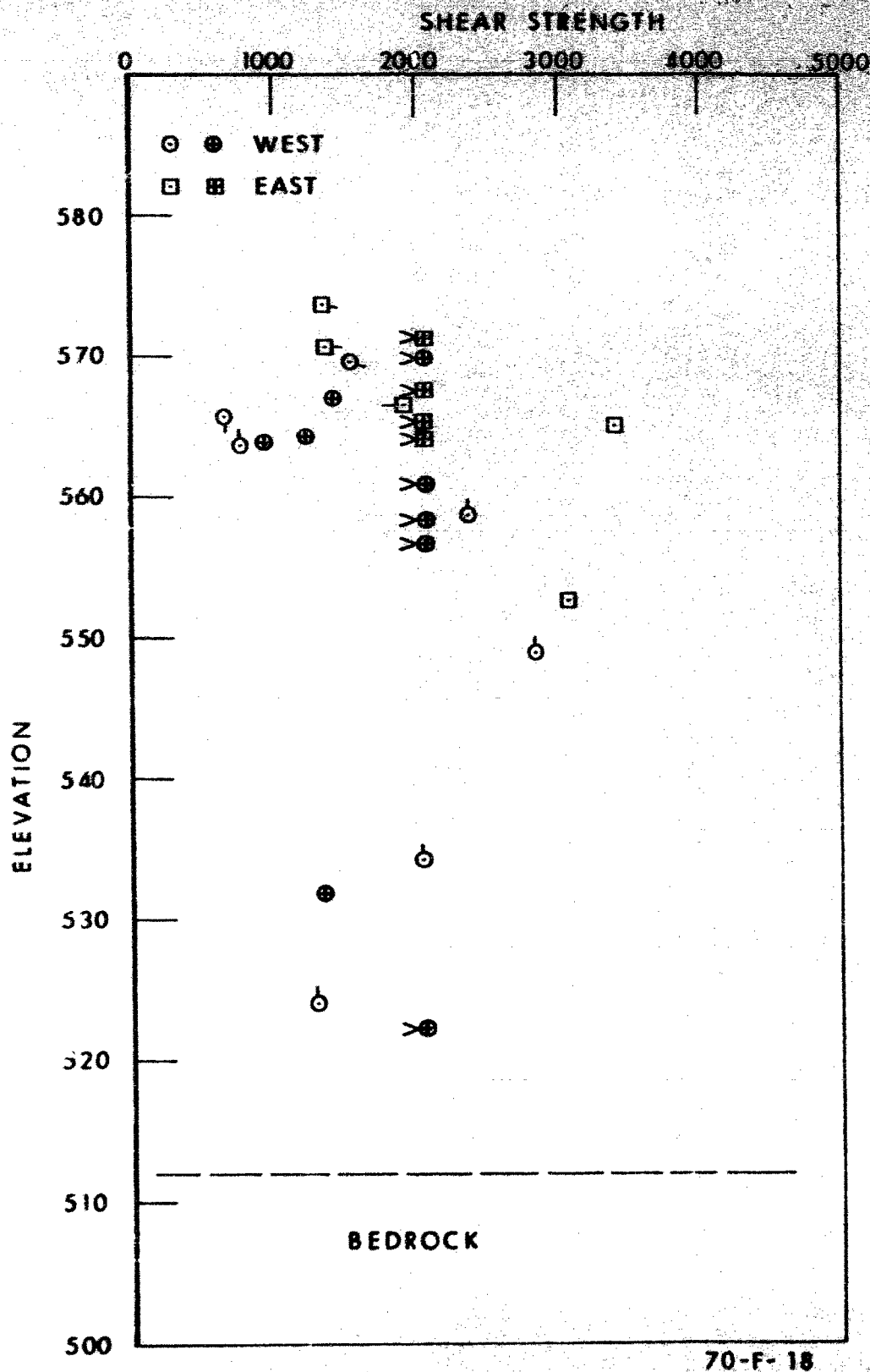
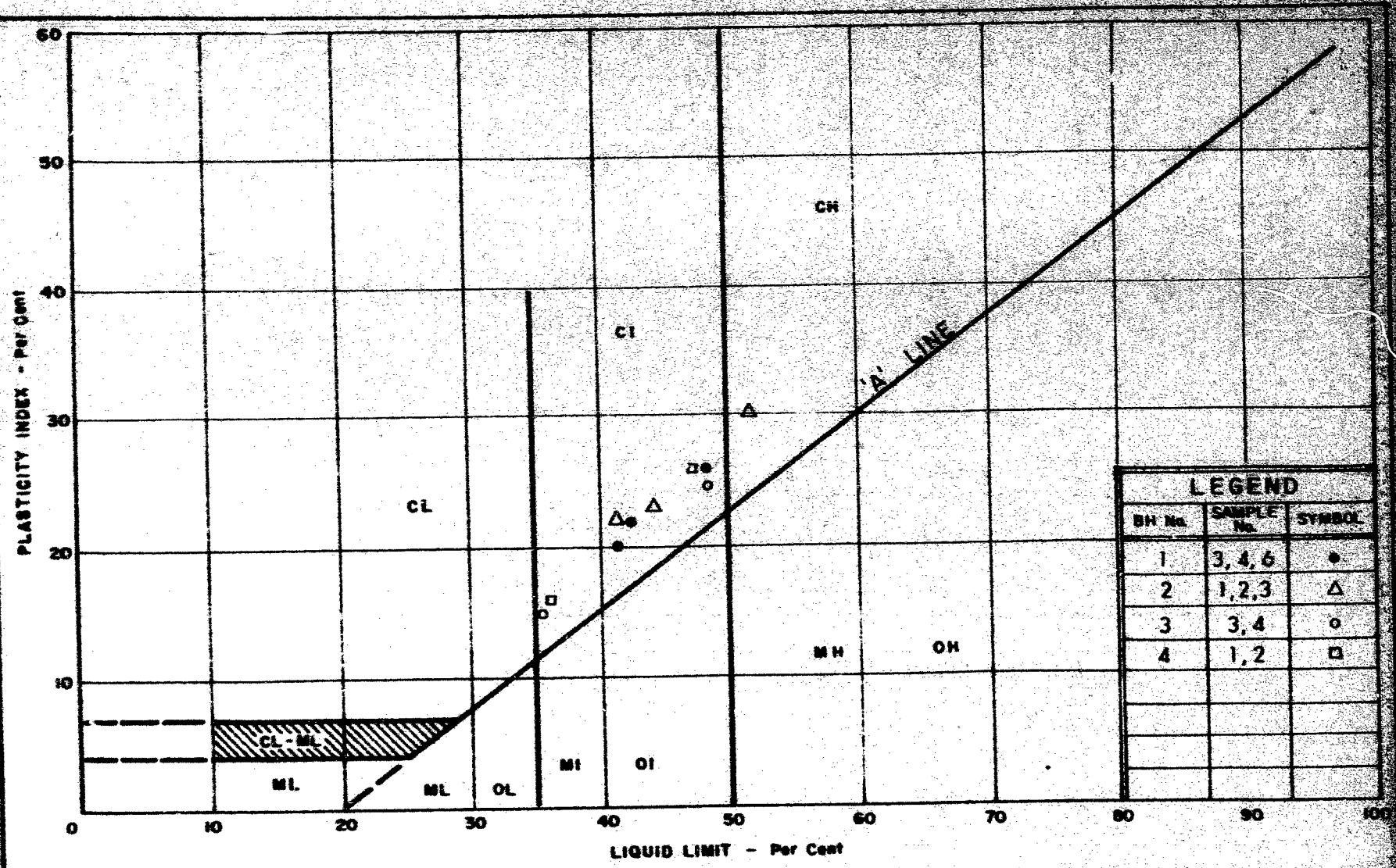


FIG. 1



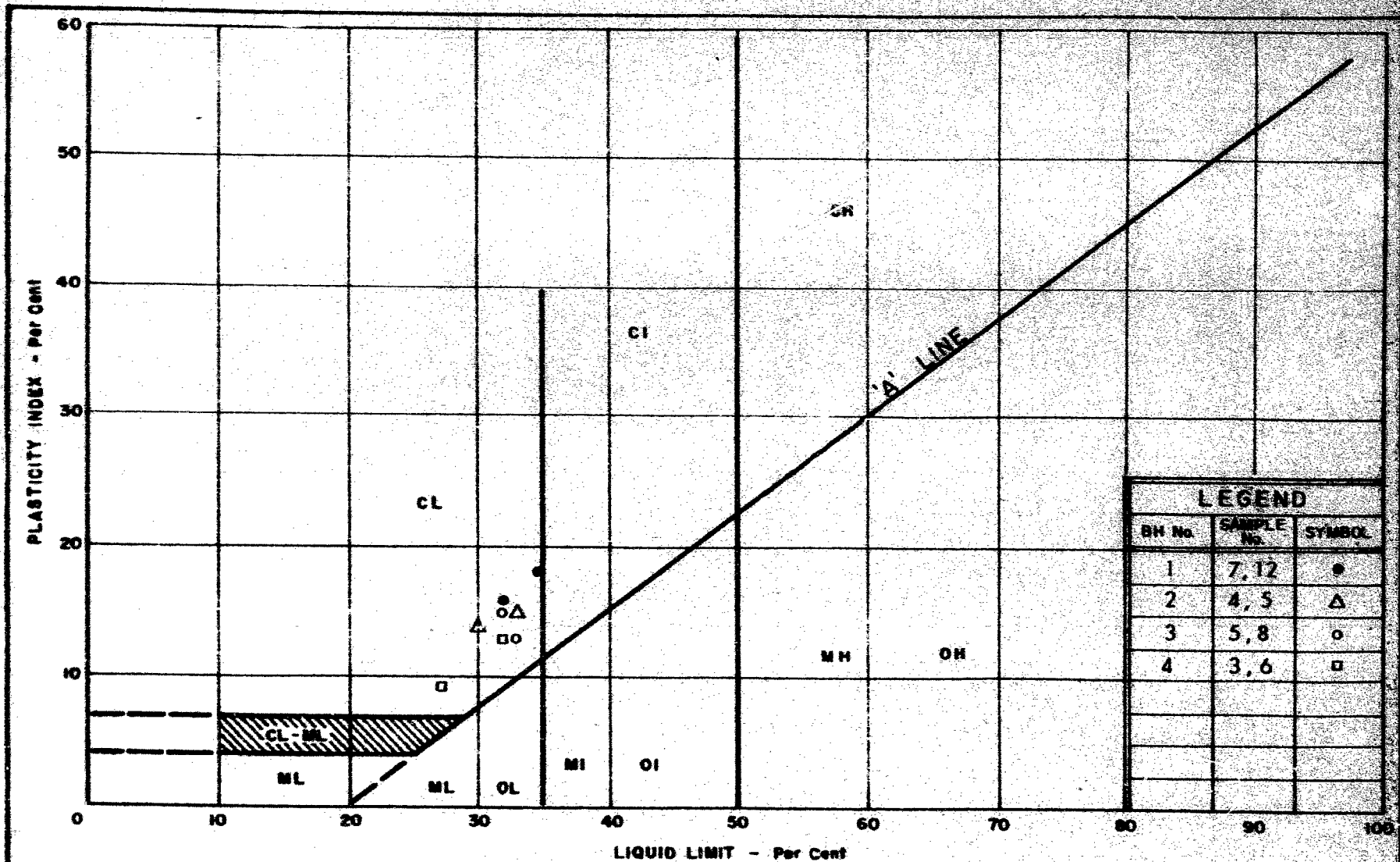
LEGEND		
BH No.	SAMPLE No.	SYMBOL
1	3, 4, 6	•
2	1, 2, 3	Δ
3	3, 4	○
4	1, 2	□



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# PLASTICITY CHART SILTY CLAY

WP. No. 0090-67-00  
JOB No. 70-F-18  
FIG. No. 2



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

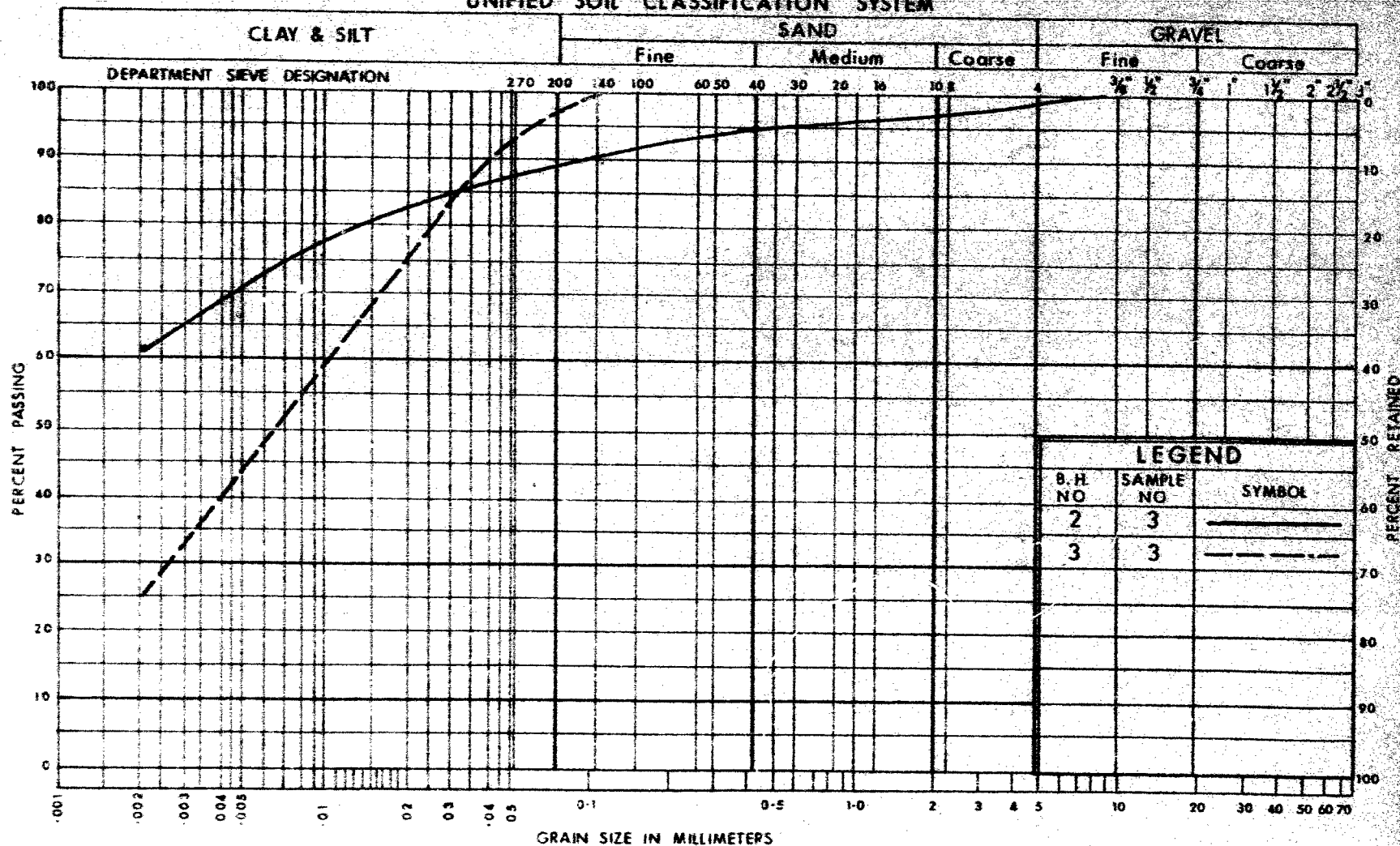
# PLASTICITY CHART CLAYEY SILT

WP No. 0090-67-00

JOB No. 70-F-18

FIG. No. 3

## UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

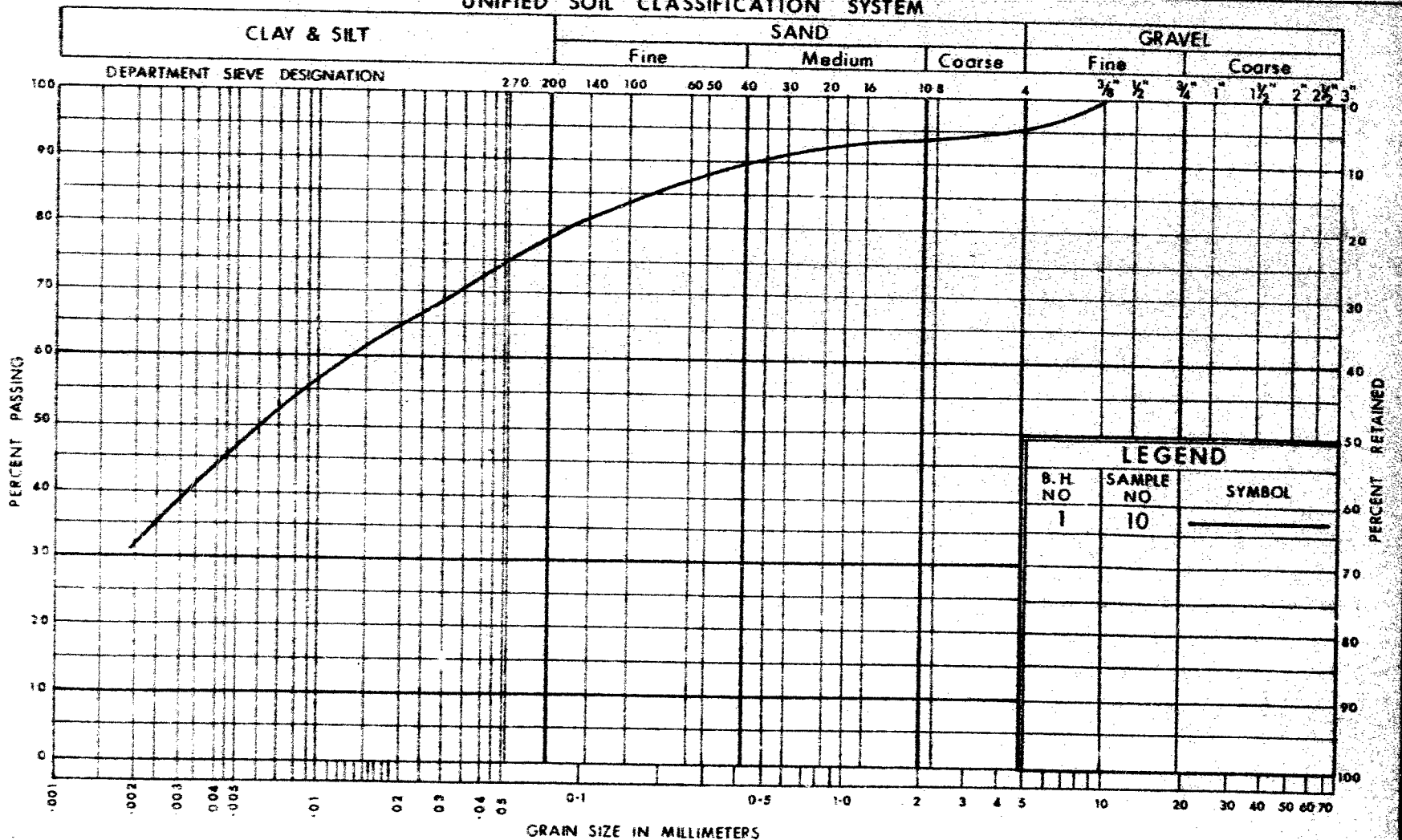
**GRAIN SIZE DISTRIBUTION**  
**SILTY CLAY**  
TRACES OF SAND & GRAVEL

W.P. No. 0090-67-00

JOB No. 70-F-18

FIG. No. 4

## UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# GRAIN SIZE DISTRIBUTION CLAYEY SILT

SOME SAND & TRACES OF GRAVEL

W.P. No. 0090-67-00

JOB No. 70-F-18

FIG. No. 5

Department of Highways Ontario

Copy for the information of

Mr. K. Selby.  
MEMO TO FILE

J. L. Keen,  
Bridge Office.

June 14, 1971.

N.P. 90-67-00 Site #13-149,  
Government Drain No. 2 Bridge,  
(Jeannette Creek Bridge #2),  
Highway #2, 5 Mi. West of  
Chatham, West Limits, Dist. #1.

70-F-18

The Head Office review for the above project was held on June 11, 1971. The D4 shows that payment for the item "supply and drive steel sheet piles" on a square foot basis, i.e. 4550 s.f. Messrs. J. Walter and F. Allen requested that the driving of the steel sheet piles and cut-off tops of steel sheet piles (310 L.F.) be combined into one lump sum item provided that we are reasonably sure that the final tip elevation shown on the drawings can be reached. As requested at the review meeting, I have had K. Selby, Foundation Section, review the installation shown on the bridge drawings in this regard. It is Mr. Selby's opinion that it is reasonable to assume that the piles can be driven to the specified tip elevation without undue difficulty. (June 14/71).

In view of the above, I will request that Mr. M. Stoyanoff look into making the necessary revisions to the D4 and Special Provisions and process accordingly.

J. L. Keen,  
Regional Bridge Design Engineer.

JLK/mh

cc: E. J. Willis,  
W. Sonnenberg,  
K. Selby.

MEMORANDUM

TO: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Bldg.

FROM: C.S. Grebski,  
Bridge Office

ATTENTION:

DATE: April 15, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT: Government Drain No. 2 Bridge  
5.0 Miles West of Chatham West Limits  
W.P. 90-67-00, Site No. 13-149  
Highway 2, District No. 1

70-11-018

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

Kindly give us your comments at your earliest convenience.



C.S. Grebski,  
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

19 APR 1971

NO COMMENTS

A L B

2 3 4

*Jan 4/71*

Department of Highways Ontario

Copy for the information of Mr. A. Stermac

Mr. A.P. Watt,  
~~Reg. Bridge Planning Engineer,~~  
London Regional Office,  
London, Ontario

Bridge Office,  
Downsview

March 3, 1971

Government Drain No. 2 Bridge  
5.0 Mi. West of Chatham W. Limits  
W.P. 90-67-00, Site No. 13-149  
Highway 2, District No. 1

70-9 78

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6859-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$120,000. This cost includes tender, materials, engineering and sundry construction but does not include the removal of the two existing structures.

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

C.S. Grebski,  
Bridge Design Engineer

CSG:rd

Attach.

c.c. B. Davis  
A. Stermac (2)  
J. Anderson  
A. Crowley

## MEMORANDUM

70-F-18

To: Mr. A.G. Stermac,  
Principal Foundation Engr.,  
Mat. and Testing Office,  
Lab. Bldg., DOWNSVIEW.

From: Bridge Planning,  
Southwestern Region.

ATTENTION

DATE: March 4th, 1970.

OUR FILE REF.

IN REPLY TO

---

SUBJECT:

E.P. 90-67-00, Bridge Site 13-149,  
Government Drain #2 Bridge,  
5.0 miles west of Chatham west limits,  
Highway 2,  
District 1 - Chatham.

---

Would you kindly arrange to have a foundation investigation conducted at the above location. I have enclosed two copies of the bridge site plan E-4876-1 with the probable footing locations marked in red.

I have also enclosed the field reconnaissance report for your use.

APW/er  
Incl.

A.P. WATT  
Reg. Bridge Planning Engineer,  
Southwestern Region.

c.c. S. McCombie.  
S. Crowley.  
S. Anderson.