

CONT. 71-104

GRAND MARAIS

DRAIN. E. C. ROWE

ELSMERE ST. EXT. BR.

40J6-6

(AM. 112 LAB. 6006) 71-134

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

DATE: June 10, 1970.

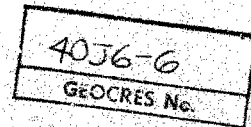
OUR FILE REF.

IN REPLY TO JUL - 7 1970

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Elsmere St. Extension Bridge
over Grand Marais Drain
E. C. Row Expressway
District #1 Chatham
W.J. 70-11041 -- W.P. 257-66-19

405-41



CONT. 71-104

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 do not hesitate to contact our Office.

AGS/hrd
Attach.

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

cc: Messrs. E. R. Davis
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
F. C. Brown
A. P. Watt
J. Roy
B. A. Singh

Foundation Files,
General Files.

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FOUNDATION INVESTIGATION REPORT
For
Proposed Elsmere St. Extension Bridge
over Grand Marais Drain
E.C. Row Expressway
District #1 Chatham
W.J. 70-11041 -- W.P. 257-66-19

1. INTRODUCTION:

In a memo dated April 30, 1970, Mr. A. P. Watt, Regional Bridge Planning Engineer, requested a Foundation investigation for the above structure.

The investigation was carried out by the Foundation Section. Presented in this report are the results of the completed field and laboratory studies as well as recommendations pertaining to the foundations of the proposed structure.

2. DESCRIPTION OF THE SITE:

The bridge site is located in the City of Windsor where the proposed Elsmere St. Extension will cross the Grand Marais Drain. The Elsmere St. Extension will connect Grand Marais Rd. East and North Service Road some $\frac{1}{2}$ mile East of Howard Avenue.

The topography is flat and the area is built up with residential dwellings.

Physiographically the region is referred to as the St. Clair Clay Plain.

3. FIELD AND LABORATORY WORK:

The field investigation consisted of two sampled boreholes and four cone penetration tests. One of the boreholes was continued until practical refusal was reached; the other was terminated at a depth of 50 feet.

Borings were carried out using a hollow stem auger machine. When it became impractical to auger further, washboring was adopted using AX casing. For the standard penetration tests a driving energy of 350 ft./lb. was used.

Undisturbed samples were recovered using 2" I.D. Shelby tubes pushed hydraulically into the soil. Field vane tests were performed where possible $1\frac{1}{2}$ feet below the sample depths.

Samples were visually examined in the field and subsequently in the laboratory.

The locations and elevations of the boreholes were surveyed in the field by London Region Engineering Surveys Section and are shown in Drawing 70-11041A which accompanies this report.

Laboratory tests were carried out in selected samples to determine Atterberg Limits, natural moisture contents, grain size distribution, bulk density and unconfined shear strength.

The results of tests carried out in the field and laboratory are plotted in the borehole logs which form part of this report.

4. SOIL TYPES AND SOIL CONDITIONS:

4.1) General:

The subsoil at the site consists of a deep deposit of Clayey Silt to Silty Clay with some Sand and traces of Gravel overlying bedrock. The boundaries of the deposits are shown in the Record of Borehole sheets attached to the Appendix. The estimated stratigraphical profile of drawing 70-11041A is based upon this information.

4.2) Clayey Silt - Silty Clay with some Sand and Traces of Gravel:

This deposit was found in all boreholes and extends from immediately below the topsoil down to the surface of the bedrock at a depth of 112 feet. Atterberg Limits and field observations indicate that from ground level (elev. 601.0) down to el. 540.0 and below elev. 520.0 down to bedrock the material can be classified as clayey silt; between the aforementioned elevations the material is classified as silty clay.

The top 4 to 6 feet of the deposit is weathered and has a consistency (based on Standard Penetration Tests) of stiff; below this the material is desiccated for a further 8 feet and in this region has a consistency of very stiff to hard. Beneath the desiccated portion the moisture content of the deposit increases accompanied by a rapid decrease in shear strength.

Within the desiccated region elev. 588.0 to elev. 596.0 the strength of the material is well over 2000 p.s.f. Below elev. 588.0 the strength decreases to a value of about 800 p.s.f.

at 533.0 and remains at this value down to elev. 547.0 beyond which point no further shear strength values were obtained.

Field and laboratory tests gave the following results:-

	Clayey Silt	Silty Clay
Moisture Content %	12 - 19	27 - 35
Liquid Limit %	22 - 23	36 - 40
Plastic Limit %	13 - 15	17 - 18
Grain Size Distribution %		
Unconfined Shear Strength p.s.f.	480 -	>5690
Field Vane p.s.f.	680 -	>2000
Density p.c.f.	133 -	144
'N Values	5 -	23

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

4.3) Bedrock:

From previous investigations in the immediate area the bedrock has been found to be limestone and the surface to lie between 110 and 120 feet below existing ground. In this investigation once practical refusal was reached at a depth of 112', i.e. elev. 493.8, this was taken as the probable bedrock surface.

5. GROUNDWATER CONDITIONS:

At the end of drilling operations the water levels in the boreholes were found to be as follows:-

B.H. #1 ... 580.8 B.H. #2 ... dry

These readings cannot be taken as representing the groundwater level due to the short duration of the field work and the impermeable nature of the subsoil.

6. DISCUSSION AND RECOMMENDATIONS:

The proposed connection between Grand Marais Rd. E. and North Service Rd., crosses the Grand Marais Drain and a structure is required at this location.

The drain is around 43 feet wide, top of bank to top of bank with side slopes approximately 3:1. The bed elevation is some 6 feet below general ground level.

The new structure will have a single span of 77 feet and the approach fill will have a height of 5 feet.

The subsoil at the site consists of a deep strata of Clayey Silt to Silty Clay with some Sand and traces of Gravel overlying limestone bedrock.

Recommendations regarding foundations for the proposed structure are given below:-

Spread Footings

The upper desiccated portion of the deposit is suitable for a spread footing type of foundations; these can be placed between elev. 591.0 and elev. 594.0 with a safe bearing capacity of 2 T.S.F.

The desiccated zone is 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.

Short Timber Piles

As an alternative the footings may be supported on short timber piles. It is estimated that number 14 class 'A' treated timber piles driven 40 feet into the deposit will have a safe capacity of 20T.

All foundations should be protected against frost action by a minimum of 4 feet of earth cover.

The shear strength of the subsoil is such that it will safely support the proposed 5 feet fill.

The topsoil and all organic material should be removed in accordance with the pertinent D.H.O. standards within the construction area.

Because of the compressible nature of the subsoil, it is inevitable that consolidation settlements will occur over a long term period due to the imposed loads of structure and embankment. Past experience however indicates that these will be of a minor nature.

If scour poses a problem then the footings can be permanently enclosed in a sheet pile liner driven down below the scour depth anticipated.

Slopes should be protected against scour up to H.W.L. in the vicinity of the structures.

7. MISCELLANEOUS:

The field investigation was carried out during the period May 19 - 21, 1970, under the supervision of Mr. G. Allen, Project Foundation Engineer, who also prepared this report.

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

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

June, 1970.

APPENDIX I

FOUNDATION SECTION

ORIGINATED BY GA

COMPILED BY GC

CHECKED BY

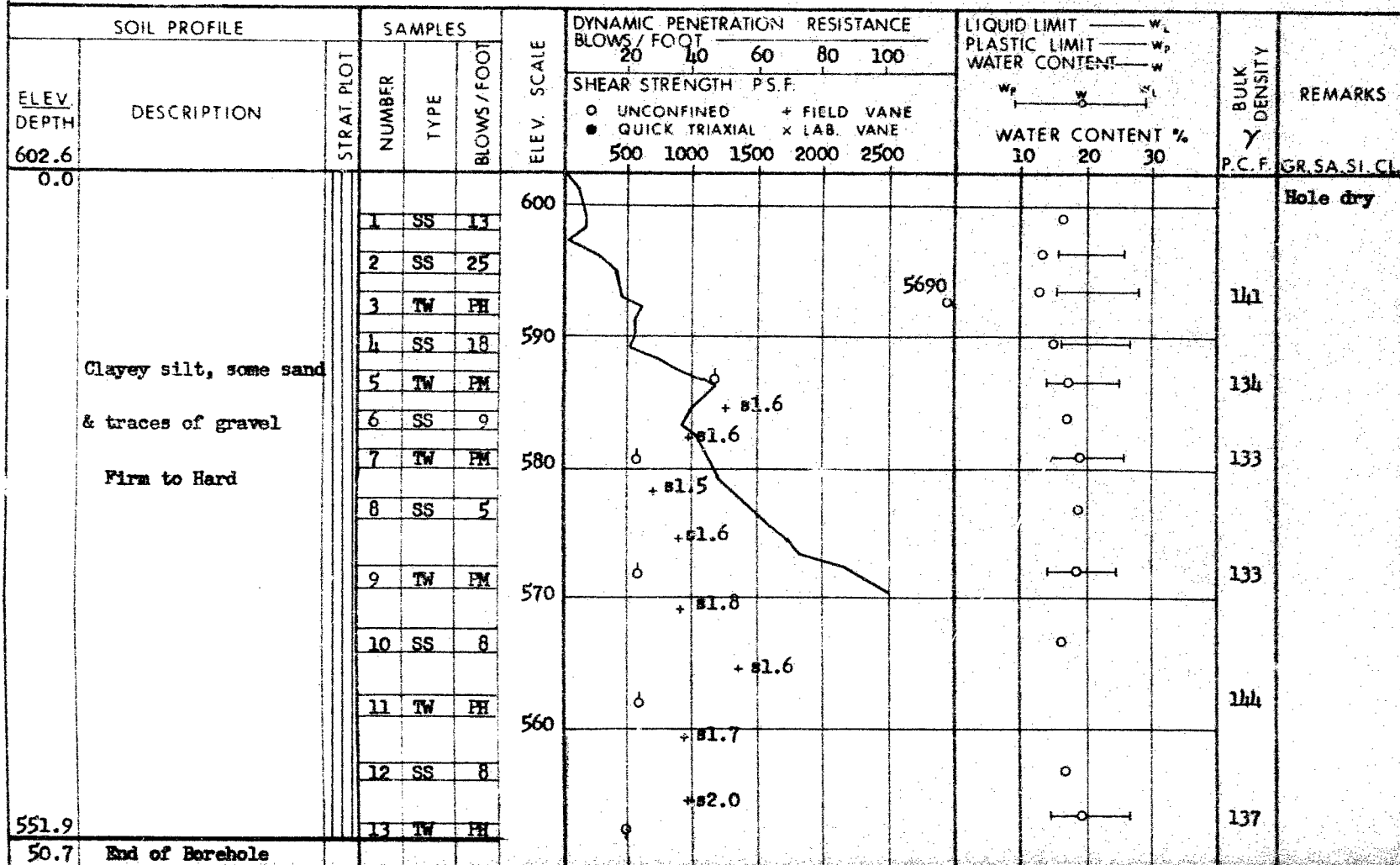
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE 500 1000 1500 2000 2500	LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
600.8	Ground Level									
0.0						600				
			1	SS		13				
			2	SS		23				
			3	TW	PH					
			4	TW	PH					
			5	SS		7				
			6	TW	PH					
			7	SS		10				
	Clayey silt, some sand and traces of gravel		8	TW	PH					
			9	SS		6				
	Firm to Hard		10	TW	PH					
			11	SS		6				
			12	TW	PH					

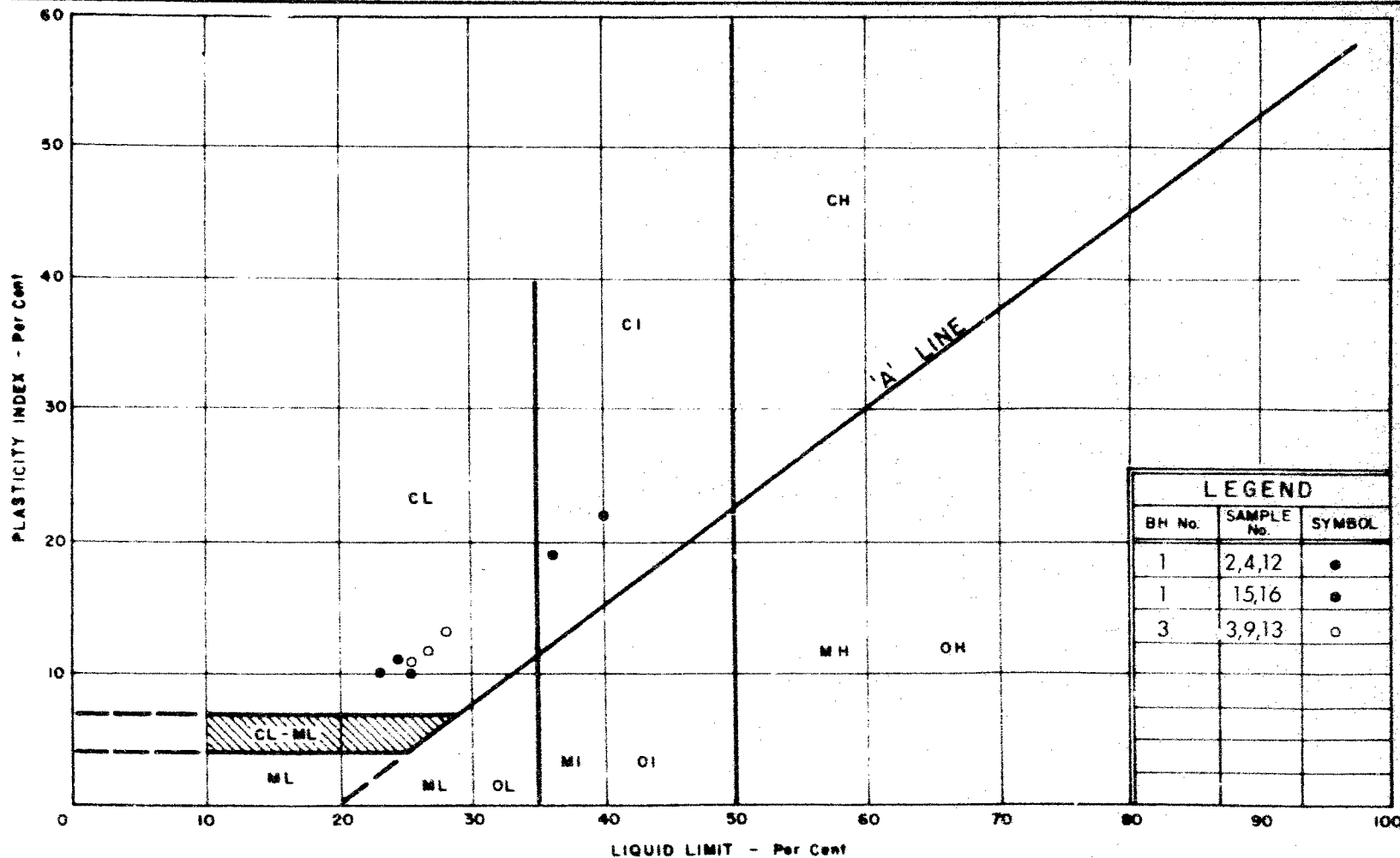
DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 70-11041 LOCATION Co-ords. 100,849 N; 71,526 E. ORIGINATED BY GA
W.P. 257-66-19 BORING DATE May 21, 1970 COMPILED BY GC
DATUM Geodetic BOREHOLE TYPE HS Auger CHECKED BY





LEGEND		
BH No.	SAMPLE No.	SYMBOL
1	2,4,12	●
1	15,16	●
3	3,9,13	○



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DIVISION

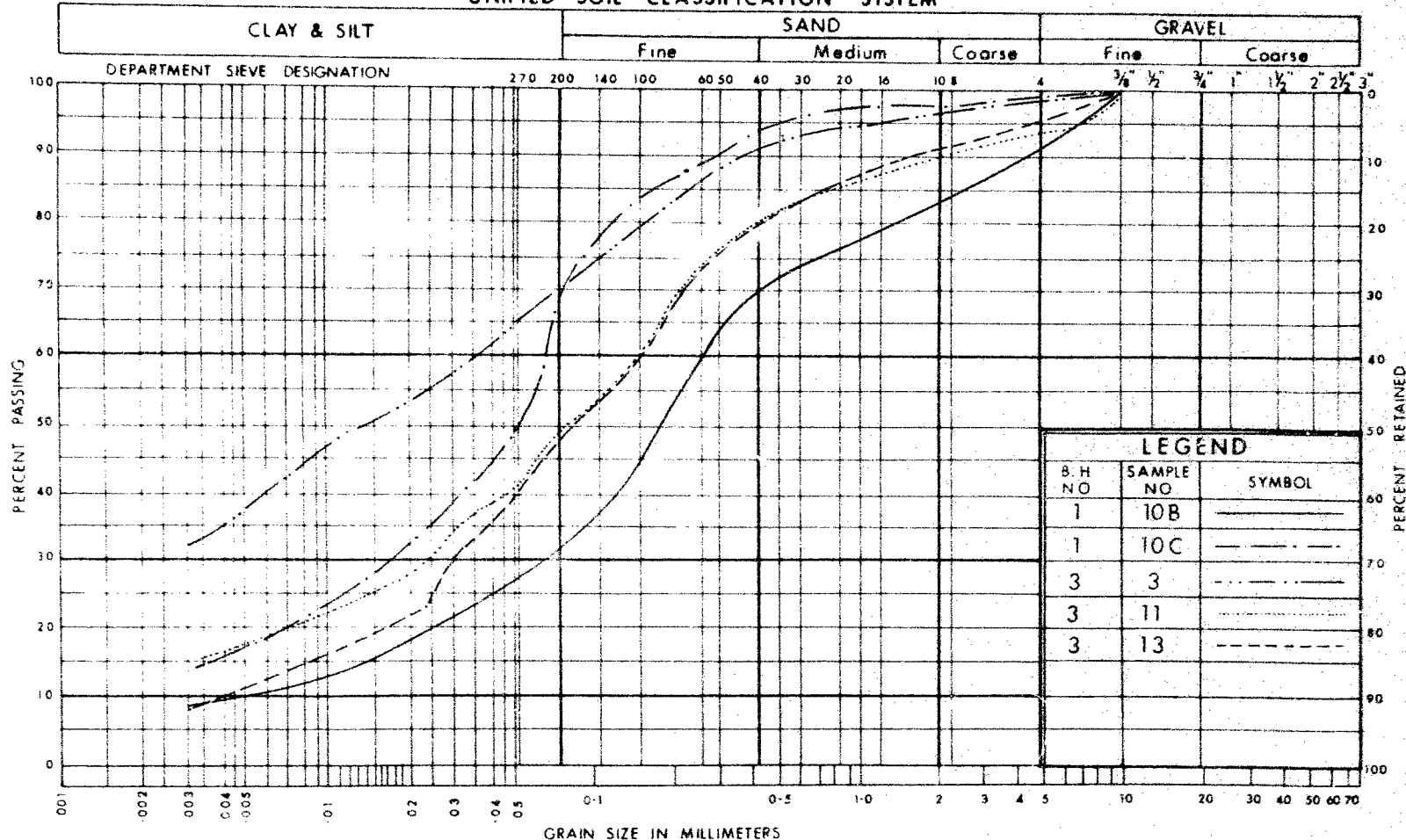
PLASTICITY CHART CLAYEY SILT & SILTY CLAY

WP No. 257-66-19

JOB No. 70-11041

FIG. No. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION
CLAYEY SILT
SOME SAND & TRACES OF GRAVEL

W.P. No. 257-66-19

JOB No. 70-11041

FIG. No. 2