

65-F-40

Hwy. # 400

JANE ST. TO

EGLINTON

Ave.

MEMORANDUM

TO: Mr. R. G. Burnfield,
Regional Functional
Planning Engr.,
Central Region,
Admin. Bldg.

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

DATE: April 1, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

PRELIMINARY
FOUNDATION INVESTIGATION REPORT
(In connection with Functional Study)
For
Future Extension of Hwy. 400 from
Jane Street to Eglinton Avenue
District No. 6, Toronto
W.J. 65-F-40 -- W.P. (N11)

In order to provide the necessary information for the functional study, we are forwarding to you, three (3) copies of our Preliminary Foundation Investigation Report on subsoil conditions existing at the above site.

We believe that the factual data and recommendations contained therein, although preliminary in nature only, will prove adequate for your present requirements.

Should there be any queries regarding this report, please do not hesitate to contact our Office.

AGS/MdeF
Attach.

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

cc: Messrs. R. G. Burnfield (3)
A. M. Teye
G. K. Hunter (2)
T. J. Kovich
J. C. Thatcher
Foundations Office (2)✓
Gen. Files

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PRELIMINARY
FOUNDATION INVESTIGATION REPORT
(In connection with Functional Study)
For
Future Extension of Hwy. 400 from
Jane Street to Eglinton Avenue
District No. 6, Toronto
W.J. 65-F-40 -- (Nil)

1. INTRODUCTION:

It is proposed to extend the existing Hwy. 400 in a southerly direction from Jane St. to Eglinton Ave., where it will intersect the future Richview Expressway (Hwy. 403) in Metropolitan Toronto. The proposed alignment requires the construction of a number of structures, together with embankments and cuts.

A request was received from Mr. T. J. Kovich, Regional Materials Engineer, in a memo dated December 10, 1964, to carry out a preliminary foundation investigation for the above-mentioned project in order to provide the necessary information for the functional study.

Subsequently, a foundation investigation consisting of approximately one borehole at each structure location, for preliminary information, was undertaken by this Section. Presented in this report are the results of our investigation pertaining to the preliminary foundation design of the proposed structures, embankments and cuts.

Since this investigation is preliminary in nature, detailed investigation of the subsoil should be carried out at

1. INTRODUCTION: (cont'd.) ...

each structure location prior to the final design of structure foundations.

2. DESCRIPTION OF SITE AND GEOLOGY:

The alignment of the proposed extension of Hwy. 400 generally follows the Black Creek valley between Jane St. and Eglinton Ave. At this location the Black Creek valley is generally flat to undulating. The surrounding area is generally used for industrial and residential purposes.

The proposed site is within the upper reaches of glacial Lake Iroquois. Black Creek runs in a relatively recent valley, cut into the Lake Iroquois deposits. Below the Lake Iroquois or recent floodplain deposits of Black Creek, the general soil stratigraphy consists of a succession of glacial till and interglacial deposits of the Pleistocene period, extending to bedrock.

3. FIELD AND LABORATORY WORK:

The field work consisted of 14 boreholes and 14 cone penetration tests. The boring was carried out by means of conventional diamond drilling equipment adapted for soil sampling purposes.

Samples were recovered at the required depths by means of a 2-in. O.D. split-spoon sampler and by a 2-in. I.D. Shelby tube sampler. The dimensions of the split-spoon sampler and the energy used in driving it, conform to the requirements of the

cont'd. /3 ...

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

Standard Penetration Test. In-situ vane tests were carried out wherever possible, in order to determine the undrained shear strength of the cohesive deposits. Rock core samples were obtained by means of an AXT core barrel. Driving energy used in the dynamic cone penetration tests was 350 ft.-lbs. per blow.

The locations and elevations of all boreholes are shown on the accompanying log sheets, included in the Appendix of this report.

Samples were visually examined and identified in the laboratory as well as in the field. Tests were carried out in the laboratory on a selection of samples to determine:

- 1) Natural Moisture Contents
- 2) Bulk Densities
- 3) Grain Size Distributions
- 4) Atterberg Limits
- 5) Undrained Shear Strengths

Laboratory test results have been summarized and are included under Appendix I of this report.

4. SUMMARIZED SOIL CONDITIONS:

In general, a surface layer of silty sand to sandy silt, ranging from 3 to 31 ft. in thickness, was found over the entire site of the proposed line. Traces of organics, mainly twigs and roots and also occasional shells, were encountered in the upper portion of this deposit. Based on the Standard Penetration test

cont'd. /4 ...

4. SUMMARIZED SOIL CONDITIONS: (cont'd.) ...

results, the relative density of the stratum may be described as very loose to very dense.

Underlying the granular deposit or extending from ground level, is an extensive stratum of clayey silt with sand and occasional gravel, ranging in thickness from 63 ft. to 110 ft. The undrained shear strength of this material varies considerably over the entire site. However, the consistency of the deposit may be described essentially as firm to hard. Within this deposit occasional distinct layers of silty sand to sandy silt, approximately 4 ft. to 15 ft. thick were encountered.

A stratum of silty sand to sandy silt with occasional gravel was encountered immediately below the clayey silt deposit. This granular deposit, as indicated by the results of the Penetration tests, ranges between compact to very dense in general.

Bedrock was proved in a limited number of boreholes, and was observed immediately below the silty sand to sandy silt stratum. The bedrock was identified as "Shaley Dolomite".

The water levels observed during the course of the investigation generally corresponded to prevailing Black Creek water levels. In certain boreholes artesian conditions were observed, when the borehole penetrated to the lower silty sand to sandy silt stratum.

Borehole logs, showing the stratigraphy of the subsoil, together with inferred physical properties and water level observations, are included in the Appendix of this report.

cont'd. /5 ...

5. DISCUSSION AND RECOMMENDATIONS:

5.1) Structures at Crossing of Hwy. 400 and the Richview Expressway, Sta. 45+80, Structures 10R & 11R:

Two high-level structures are proposed at the above intersection to carry Richview Expressway traffic to and from Hwy. 400. Approach fills to these structures reach a maximum height of 55 ft.

Two boreholes (B.H. #1 and B.H. #2) were drilled at this site. A surface layer of silty Sand to Sandy Silt with occasional gravel was found in both boreholes. On the high ground at the west side of the Black Creek valley (B.H. #2), the depth of the stratum was observed to be 29 ft., while on the valley floor (B.H. #1), the observed depth was 8 ft. The relative density of the stratum varies considerably between the boreholes. It is generally dense to very dense, with 'N' values ranging from 39 to 135 blows/ft., in B.H. #2, while in B.H. #1, it is loose to compact with 'N' values ranging from 5 to 22 blows/ft.

Underlying the silty sand to sandy silt stratum is an extensive deposit of Clayey Silt with Sand and occasional gravel. The thickness of the stratum is 95 ft. in B.H. #1, while in B.H. #2, it was proved to a maximum depth of 132 ft. below the ground surface. The undrained shear strength of this deposit ranges from 1,095 p.s.f. to 2,325 p.s.f. Based on the above values, together with the Standard Penetration test results, which gave values ranging from 20 to 75 blows/ft., the consistency of the stratum is estimated as stiff to hard.

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

5.1) (cont'd.) ...

Immediately following the clayey silt with sand stratum a further deposit of Silty Sand with occasional gravel was encountered in B.H. #1 and drilled to a depth of 132 ft. This deposit is generally very dense with 'N' values ranging from 36 to 200 blows/ft.

At this location the proposed grade of Hwy. 400 will be approximately at the ground surface. Two high-level structures are proposed at the intersection of Hwy. 400 and the Richview Expressway. The maximum height of approach embankments will be in the order of 55 ft. The subsoil conditions are generally favourable for spread footing type of support. At the time of writing of this report, the details, such as the number of spans, footing locations, etc., are not determined. However, spread footings located some 5 ft. below the natural ground in the sand stratum may provide a safe bearing pressure of 2½ t.s.f. It appears that some of the footings may be located within the present course of Black Creek. In such a case, care should be taken to remove any organic materials at the footing locations prior to construction.

No approach fill stability problems are anticipated, provided standard 2:1 side slopes are used.

5.2) Structure at Crossing of Hwy. 400 and Eglinton Avenue, Sta. 51+80, Structure 12R:

It is proposed to construct an underpass structure at the crossing of Hwy. 400 and Eglinton Avenue. The maximum depth of the proposed cut for the future Hwy. 400 at this location will

cont'd. /7 ...

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

5.2) (cont'd.) ...

be in the order of 5 ft. The approach fills for the revised Eglinton Ave. will be some 15 ft. in height.

B.H. #3, which was drilled at this site, revealed a surface layer of 31 ft. of loose to compact Silty Sand with occasional gravel, containing traces of organics to 10 ft. The 'N' values in the stratum ranged from 4 to 22 blows/ft. Beneath this layer a deposit of firm to hard Clayey Silt with Sand extends to some 116 ft. below the ground surface. Within this deposit, distinct layers of compact to very dense silty sand were encountered between elevations 295-286 and 282 - 278. The undrained shear strength measurements range from 650 p.s.f. to 1,900 p.s.f., while the 'N' values range from 18 to 42. Following the clayey silt with sand is a deposit of Silty Sand with occasional gravel. This deposit was investigated to a depth of 137 ft. below the ground surface, where the borehole was terminated. The material is in a compact to very dense state, with 'N' values being in the order of 24 blows/ft. to 150 blows/5 in.

The structure may be supported on spread footings. A safe design load of $1\frac{1}{2}$ t.s.f. may be used for footings placed at elev. 348 or lower. However, if larger loads are required, as an alternative, the structure may be supported on large displacement friction piles. A safe design load of 20 tons/pile may be used for #14 timber piles embedded at least 45 ft. into the original ground. No approach fill or cut stability problems are anticipated, provided standard 2:1 side slopes are used.

cont'd. /8 ...

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

5.3) Structure at Crossing of Eglinton Ave. and Relocated Black Creek, Structure 13R:

A bridge structure is proposed at the crossing of Eglinton Ave. and relocated Black Creek. At the structure, approach fills will be in the order of 18 ft. above ground level.

Borehole #5, which is located near the north-east corner of the proposed structure, reveals the following subsoil conditions. A surface layer of loose Silty Sand with occasional gravel extends from ground level to 10 ft. This layer is followed by a deposit of Clayey Silt with Sand and occasional gravel extending to 99 ft. Shear strength measurements in the stratum ranged from 990 p.s.f. to more than 2,240 p.s.f., while 'N' values varied between 16 and 97. From these values the consistency of the stratum is estimated to be firm to hard. Within this stratum a layer of loose to compact silty sand to sandy silt was encountered between 36 ft. and 50 ft. Immediately following the clayey silt with sand is a deposit of Silty Sand to Sandy Silt with gravel. The borehole was terminated within this stratum at 122 ft. Standard Penetration test values ranged from 78 to 155/9 in., indicating a very dense relative density. An artesian pressure was observed within this stratum at elev. 246.

At this location a new channel will be constructed for the relocated Black Creek. The estimated invert of the creek is at approximate elev. \pm 338. In such a case, the footings should be situated at elev. \pm 333 or lower, in the clayey silt stratum. The proposed structure may be supported on spread footings. A safe design load of 2 t.s.f. may be used. No approach fill stability problems are anticipated, provided standard 2:1 side slopes are used.

cont'd. /9 ...

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

5.4) Structure at the Crossing of Hwy. 400 and Relocated Trethewey Dr., Sta. 70+50, Structure 14R:

An overpass structure is proposed at the relocated crossing of Hwy. 400 and Trethewey Dr. The proposed grade is such that high approach embankments are required. The maximum height of fill will be in the order of 32 ft.

Two boreholes (B.H. #6 and B.H. #7) were drilled in this area. The results show the subsoil to consist of about 10 ft. of Silty Sand with occasional gravel, containing traces of organics. Standard Penetration or 'N' values in the stratum range from 2 to 22, indicating a relative density of very loose to compact.

Underlying this deposit is an extensive stratum of Clayey Silt with Sand and occasional gravel. The thickness of the layer was 110 ft. in B.H. #7 and 85 ft. in B.H. #6.

The shear strength values for the stratum are as follows:

Field Vane ----- in excess of 2,000 p.s.f.

Unconfined Compression - 1,580 p.s.f. - 5,060 p.s.f.

Based upon the above values, the consistency of the deposit may be described as stiff to hard.

Within this stratum, a 7-ft. layer of dense to very dense silty sand to sandy silt was encountered at 86 ft. in B.H. #7.

Immediately below the above stratum, a deposit of Silty Sand to Sandy Silt, containing occasional gravel, was found. This deposit was contacted at 120 ft. in B.H. #7 and drilled to 135 ft., while in B.H. #6, it was found at 94 ft. and drilled to 115 ft.

cont'd.. /10 ...

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

5.4) (cont'd.) ...

'N' values in the stratum ranged from 32 ft. to 68 ft., indicating a relative density of dense to very dense. Within this stratum an artesian pressure was noted in both boreholes. In B.H. #6, it was found at elev. 259 with a total measured head of 96 ft., while in B.H. #7, it was found at elev. 236 with a total measured head of 117 ft.

The subsoil at the structure site is suitable for the placing of spread footings. A safe bearing load of 2 t.s.f. may be used, provided the footings are placed at elev. 347.0 or lower in the clayey silt stratum.

At present, the Black Creek meanders through the proposed structure site. Care should be taken to remove all organic materials from underneath the footings or pile caps.

Because of the high shear strength of the subsoil, no approach fill stability problems are anticipated, provided 2:1 side slopes are used.

5.5) Structure at the Crossing of Hwy. 400 and Black Creek, Station 104+50, Structure 15R:

A bridge structure is proposed to span the Black Creek at Station 104+50. The proposed grade in this area necessitates approach fills up to about 8 feet in height above the existing ground level.

Borehole #8, located at the proposed crossing, indicated about 12 feet of Silty Sand (relative density loose to compact) containing traces of organics and occasional gravel, followed by

cont'd. /11 ...

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

5.5) (cont'd.) ...

about 63 feet of Clayey Silt with Sand and occasional gravel (consistency firm to hard). This deposit is underlain by a 47-ft. stratum of compact to very dense Silty Sand to Sandy Silt, with occasional gravel. The granular stratum is followed by Shaley Dolomite and Limestone bedrock, which was contacted at 122 ft.

Subsoil at the site is not suitable for the placing of spread footings, if a safe bearing load of more than one t.s.f. is required for design purposes. Since footings with such low bearing pressures are generally considered uneconomical, the alternate method of founding the structure on piles is recommended. #14 timber piles driven some 45 ft. into the original ground should provide a design capacity of 20 tons/pile. As a precaution, all organic materials should be removed from underneath the footings of pile caps. No approach fill stability problems are anticipated, provided standard 2:1 side slopes are used.

5.6) Structure at Crossing of Hwy. 400 and Lawrence Ave., Sta. 120+00, Structure 16R:

An overpass structure is proposed at the above crossing. The proposed grades at this intersection are such that approach fills of up to 20 ft. are required for Hwy. 400, while cuts of the order of 5 ft. are required for Lawrence Ave. From B.H. #9, located near the north abutment of the proposed structure, the following subsoil information was obtained. From ground level downward, a stratum of Clayey Silt with Sand and occasional gravel extends to 86 ft. The shear strength measurements (1,140 p.s.f. to more than

cont'd. /12 ...

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

5.6) (cont'd.) ...

2,000 p.s.f.) and 'N' values (11 to 35) show the consistency of the stratum to range from firm to hard. Underlying the above stratum and extending to bedrock at 122 ft., is a deposit of Silty Sand to Sandy Silt, containing occasional gravel. Standard Penetration test or 'N' values in the stratum ranged from 6 to 183 for 9 in., indicating a relative density of loose to very dense. The bedrock encountered immediately below the above granular deposit was identified as Shaley Dolomite. It was proved by drilling 5 ft. of AXT core.

Subsoil at this site is not favourable for spread footings. Therefore, large displacement friction piles are recommended. For #14 timber piles, driven at least 45 ft. into the original ground, a safe design load of 20 tons/pile may be used. No approach fill or cut stability problems are anticipated, provided standard 2:1 side slopes are used.

5.7) Structure at Crossing of Ramp N-W (Hwy. 400 and Lawrence Ave. Interchange) and Black Creek, Structure 18R:

A bridge structure is proposed at the crossing of the N-E ramp of the future Hwy. 400 and the Black Creek at the proposed Lawrence Ave. Interchange. At the structure location the proposed grade is approximately 11 ft. above the existing ground level.

Borehole #10, drilled at this site, reveals that the subsoil consists of three distinct strata. There is a 6-ft. thick surface layer of very loose Silty Sand with traces of organics. This is followed by a 70-ft. thick deposit of Clayey Silt with Sand

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

5.7) (cont'd.) ...

and occasional gravel. The consistency of the stratum as determined from shear strength measurements (850 p.s.f. to 3,060 p.s.f.) and 'N' values (14 to 29 blows/ft.) ranged from firm to very stiff. This stratum, in turn, is underlain by 74 ft. of very loose to very dense ('N' values 2 to 133/9 in.) Silty Sand to Sandy Silt. At 150 ft. below ground level, Shaley Dolomite bedrock was encountered and proved by drilling 5 ft. of AXT core.

The creek bottom at this location will be at approximate elev. 385. In such a case, the footings for the proposed structure should be at elev. 380 or lower, for adequate frost protection. At this depth the subsoil mainly consists of very stiff, clayey silt with sand and occasional gravel, which is favourable for spread footing type foundations. A safe design load of 2 t.s.f. may be used. Care should be taken to remove all organic materials from under the footings prior to construction. No approach fill stability problems are anticipated if standard 2:1 side slopes are used.

5.8) Structure at Crossing of Hwy. 400 and Queen's Ave., Sta. 141+00, Structure 19R:

An underpass structure is proposed at the crossing of Hwy. 400 and Queen's Ave. To accommodate the proposed grades, cuts in the order of 20 ft. are required for Hwy. 400, while the Queen's Ave. approach fills will be in the order of 10 ft.

Borehole #11 was drilled near the east abutment location of the structure. A 3-ft. surface deposit of Silty Sand is followed

cont'd. /14 ...

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

5.8) (cont'd.) ...

by a stratum of Clayey Silt with Sand and occasional gravel extending to 91 ft. Shear strength measurements ranged from 1,265 p.s.f. to 1,760 p.s.f., while 'N' values ranged from 8 to 55 blows/ft. From these results, the consistency of the stratum is estimated as stiff to hard. Embedded within this stratum, two distinct layers of silt were encountered. One seam extended from 45 ft. to 59 ft., while the other extended from 62 ft. to 68 ft. The relative density of these seams varied from dense to very dense. Following the clayey silt with sand is a deposit of Silty Sand to Sandy Silt. The bore-hole was terminated within this stratum, at a depth of 134 ft. Standard Penetration test ('N') values in the deposit range from 14 blows/ft. to 130 blows/ft. for 7 inches, indicating a relative density of compact to very dense.

The structure may be supported either on spread footings or large displacement friction piles. For spread footings placed at elev. 390 or lower, a safe design load of $1\frac{1}{2}$ t.s.f. may be used. For #14 timber piles, driven at least 45 ft. into the subsoil, a safe design load of 20 tons/pile may be used. No approach fill or cut stability problems are anticipated, if standard 2:1 side slopes are used.

5.9) Structure at Crossing of Hwy. 400 and Maple Leaf Drive, Sta. 148+00, Structure 20R:

An underpass structure is proposed at the crossing of Hwy. 400 and Maple Leaf Drive. The proposed grades require cuts in the order of 10 ft. for Hwy. 400, and approach fills of the order

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

5.9) (cont'd.) ...

of 20 ft. for Maple Leaf Drive.

One borehole (B.H. #12) was drilled at this site. The subsoil consists of two main deposits. Extending from ground level down to 93 ft. is a stratum of Clayey Silt with Sand and occasional gravel. Shear strength measurements ranged from 770 p.s.f. to more than 2,000 p.s.f., while 'N' values ranged from 17 to 69 blows/ft. Based on these values, the consistency of the stratum is estimated to be firm to hard. A thin layer of dense silty sand was found between 63 ft. and 67 ft. within this deposit. Immediately below the stratum of clayey silt with sand, a deposit of Silty Sand to Sandy Silt was encountered. This stratum was drilled to 167 ft. from ground level. Standard Penetration test ('N') values in the deposit varied from 15 to 146 blows/ft., indicating a relative density of compact to very dense.

The subsoil is suitable for the placing of spread footings. A safe load of 2 t.s.f. may be assumed for design purposes if normal frost protection is provided. No approach fill or cut stability problems are anticipated provided standard 2:1 side slopes are used.

5.10) Widening of Existing Structure at Crossing of Maple Leaf Drive and Black Creek, Structure 21R:

It is proposed to widen the existing structure at the crossing of Maple Leaf Drive and Black Creek. Approach fills for the proposed structure will be in the order of 10 ft.

The subsoil conditions revealed by B.H. #13, indicate a deep deposit, approximately 77 ft. in thickness of Clayey Silt with Sand. Within this deposit a thin layer of loose to compact silty

cont'd. /16 ...

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

5.10) (cont'd.) ...

sand was observed between 5 ft. to 10 ft. The deposit is essentially soft to hard with undrained shear strength measurements ranging erratically from 440 p.s.f. to over 2,000 p.s.f., and 'N' values ranging from 16 to 80 blows/ft.

Underlying this cohesive deposit is a stratum of dense to very dense ('N' values 34 to 67 blows/ft.) Silty Sand with occasional gravel. This deposit was proved to a maximum depth of 127 ft. below the ground surface.

At the proposed structure location the Black Creek invert is at approx. elevation 388. The footings for the widening may be placed at elev. 383 or lower, providing a 5-ft. frost cover. The subsoil at or below this elevation consists of clayey silt with sand having an average shear strength of 1,500 p.s.f.

The subsoil conditions are such that a maximum safe design load of only $1\frac{1}{2}$ t.s.f. may be used for spread footing support. If this is uneconomical, as an alternative, the structure may be supported on large displacement friction piles. For example, #14 timber piles driven some 45 ft. into the original ground, can provide a safe design of 20 tons/pile. No approach fill stability problems are anticipated for standard 2:1 side slopes.

5.11) Structure at Crossing of Hwy. 400 and Relocated Black Creek, Sta. 155+35, Structure 22R:

A bridge structure is proposed for the crossing of Hwy. 400 and relocated Black Creek. Cuts of up to 30 ft. are required over the southern half of the structure. However, for this preliminary

cont'd. /17 ...

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

5.11) (cont'd.) ...

report, one borehole only, was drilled. This borehole (B.H. #14) is located in the flat part of the valley, near the north end of the structure. As a result, recommendations in this report will be made only with regard to structure foundations.

Immediately below the ground level is a deposit of Clayey Silt with Sand and occasional gravel extending to 85 ft. From the shear strength measurements (1,320 p.s.f. to more than 2,000 p.s.f.) and 'N' values (6 to 10 blows/ft.), the consistency of the stratum is estimated to be stiff to hard. Following, a deposit of compact to very dense ('N' values 21 to 103 blows/ft.) Silty Sand with occasional gravel was encountered and drilled to a depth of 105 ft. where the borehole was terminated.

The structure may be supported on spread footings. A safe load of $1\frac{1}{2}$ t.s.f. may be used for design, provided the footings are located at elev. 383 or lower. As an alternative, large displacement friction piles may be used. For design, a safe load of 25 tons/pile may be used for #14 timber piles driven at least 45 ft. into the subsoil.

6. SUMMARY:

The results of a number of ~~a number of~~ preliminary investigations at the sites of the proposed structures on future Hwy. 400 extension between Jane St. and Eglinton Ave. are reported.

Subsoil at the various sites generally consist of deposits of loose to compact silty sand followed by firm to hard clayey silt,

cont'd. /18 ...

6. SUMMARY: (cont'd.) ...

sand and gravel, followed by compact to very dense silty sand to sandy silt overlying the shaley Dolomite bedrock.

Generally speaking, conditions at the various sites are similar with some differences in the strengths of the upper layers. Spread footings are recommended at some sites, and piled foundations at others. Details are given in the main body of the report.

Where piles are recommended, it is suggested that pile loading tests be initiated and carried out in order to more accurately assess the most suitable design loads.

It should be noted that this report is of a preliminary nature and is intended for Functional Planning purposes only. A complete foundation investigation will be necessary when definite proposals are finalized.

7. MISCELLANEOUS:

The field investigation, supervised by Mr. R. Magi and Mr. H. Szymanski, was carried out in January and February 1965. This report was prepared by Mr. R. Magi, Project Foundation Engineer, under the supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

The equipment was owned and operated by Johnston Drilling Co. of Ottawa and Master Soil Investigations of Toronto.

April 1965

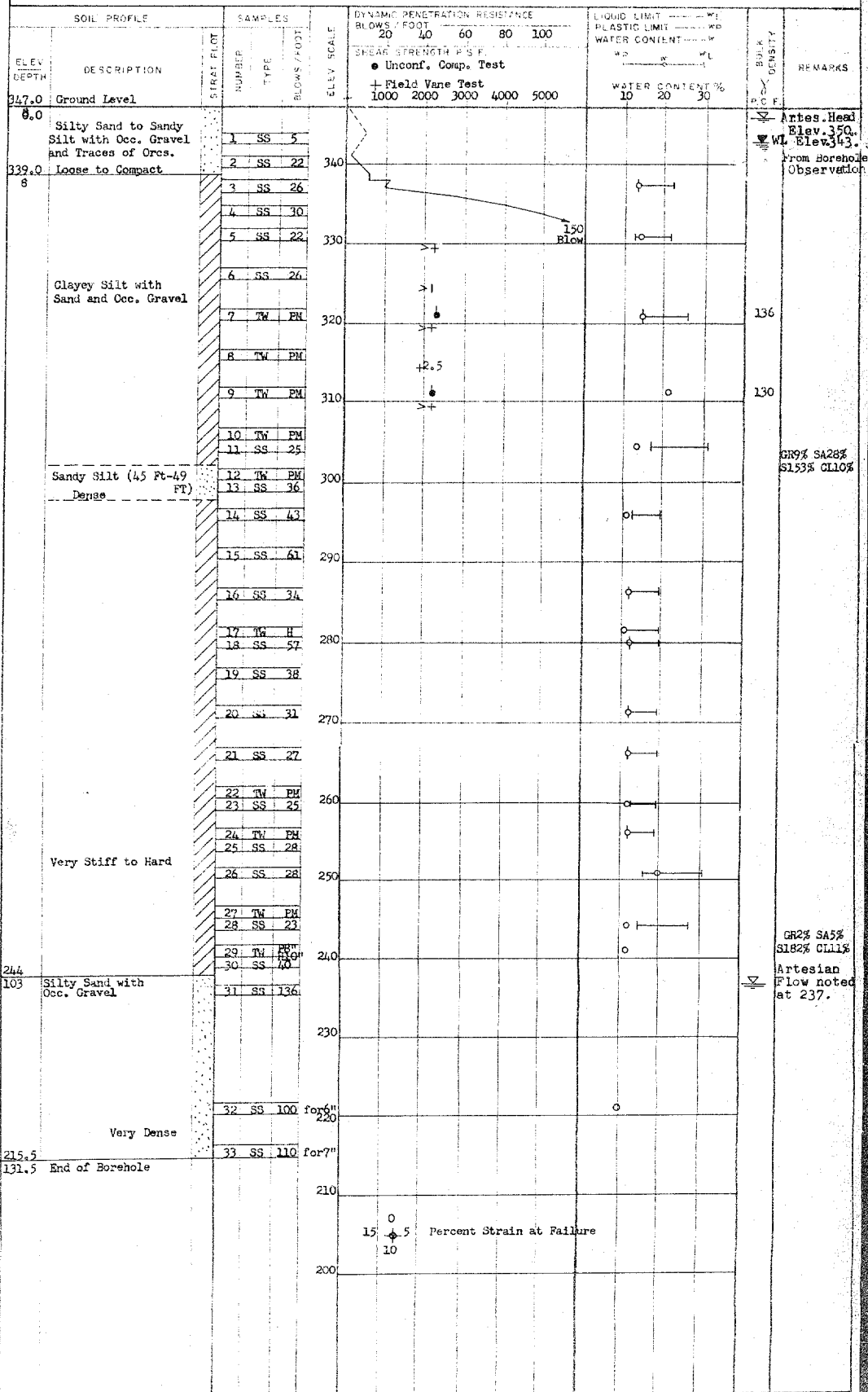
APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

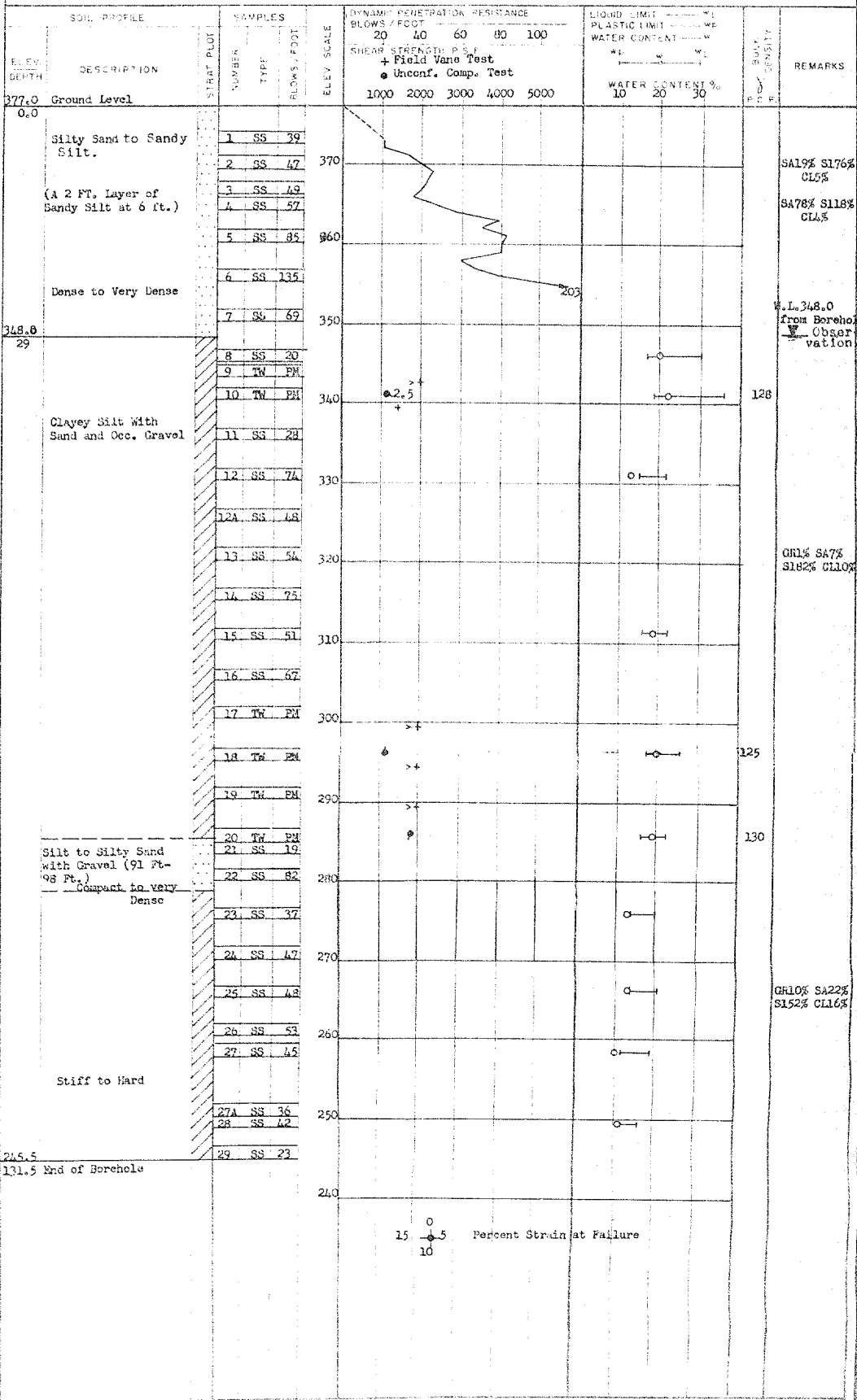
RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

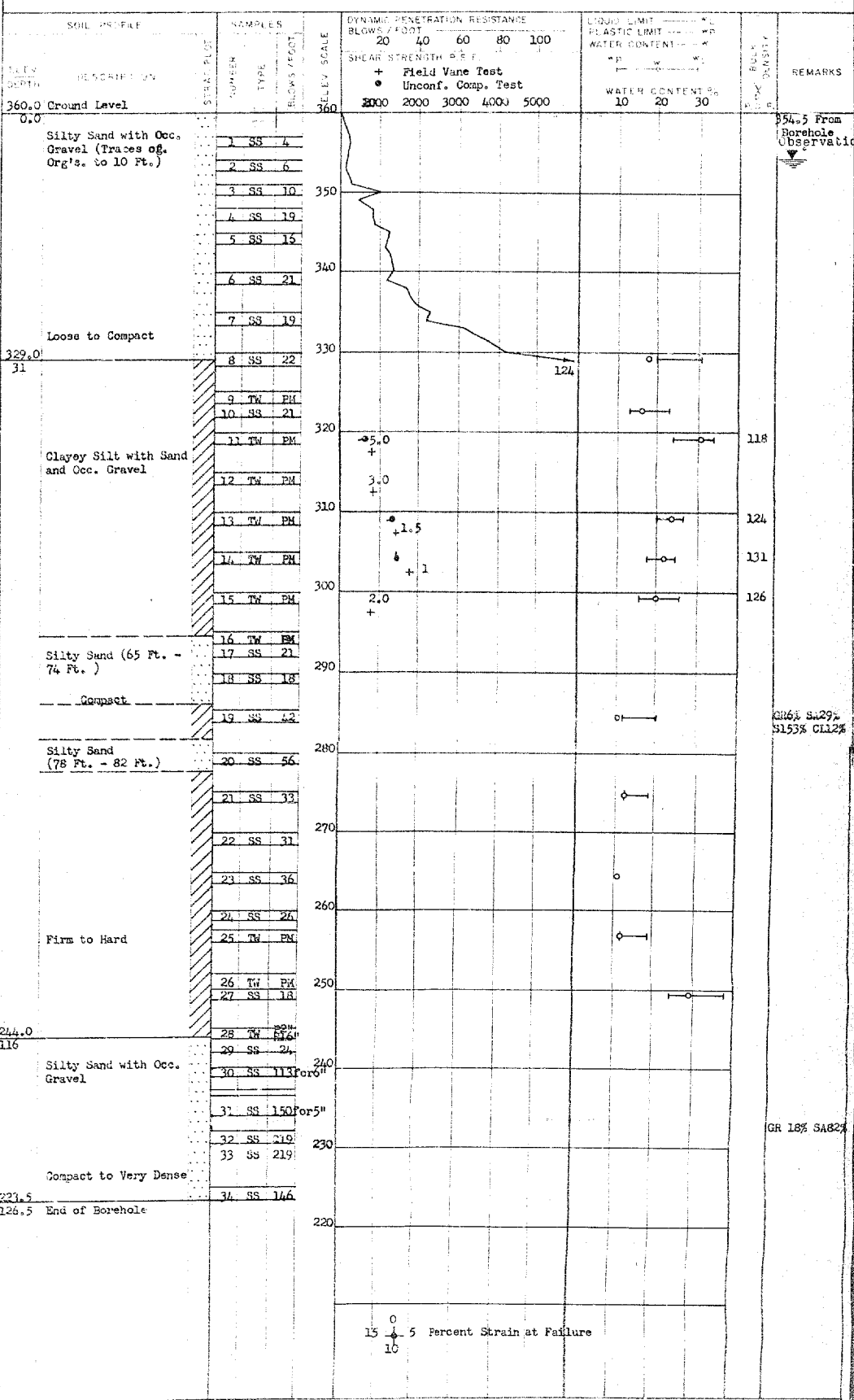
JOB 65-F-10 LOCATION STA. 44 + 30 (180' LT.) (Struct's 10R & 11R) ORIGINATED BY R.M.
 W.P. NIL BORING DATE 24 Feb. 1965 COMPILED BY H.S.
 DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY M.D.



DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO.2		FOUNDATION SECTION	
MATERIALS & TESTING DIVISION		LOCATION STA. 47 + 15 (265' LT.) (Struct's 10R & 11R)		ORIGINATED BY H.S.	
JOB 65-P-40		BORING DATE 2 Feb. 1965		COMPILED BY M.S.	
W.P. NIL		BOREHOLE TYPE Wash Boring		CHECKED BY M.D.	
DATUM Geodetic					



DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 3		FOUNDATION SECTION	
MATERIALS & TESTING DIVISION		LOCATION <u>STA. 51 + 10 (53' RT.) (Struct. 12R)</u>		ORIGINATED BY <u>R.M.</u>	
JOB <u>65-P-40</u>		BORING DATE <u>8 Feb. 1965</u>		COMPILED BY <u>H.S.</u>	
W.P. <u>NIL</u>		BOREHOLE TYPE <u>Washboring</u>		CHECKED BY <u>M.D.</u>	
DATUM <u>Geodetic</u>					

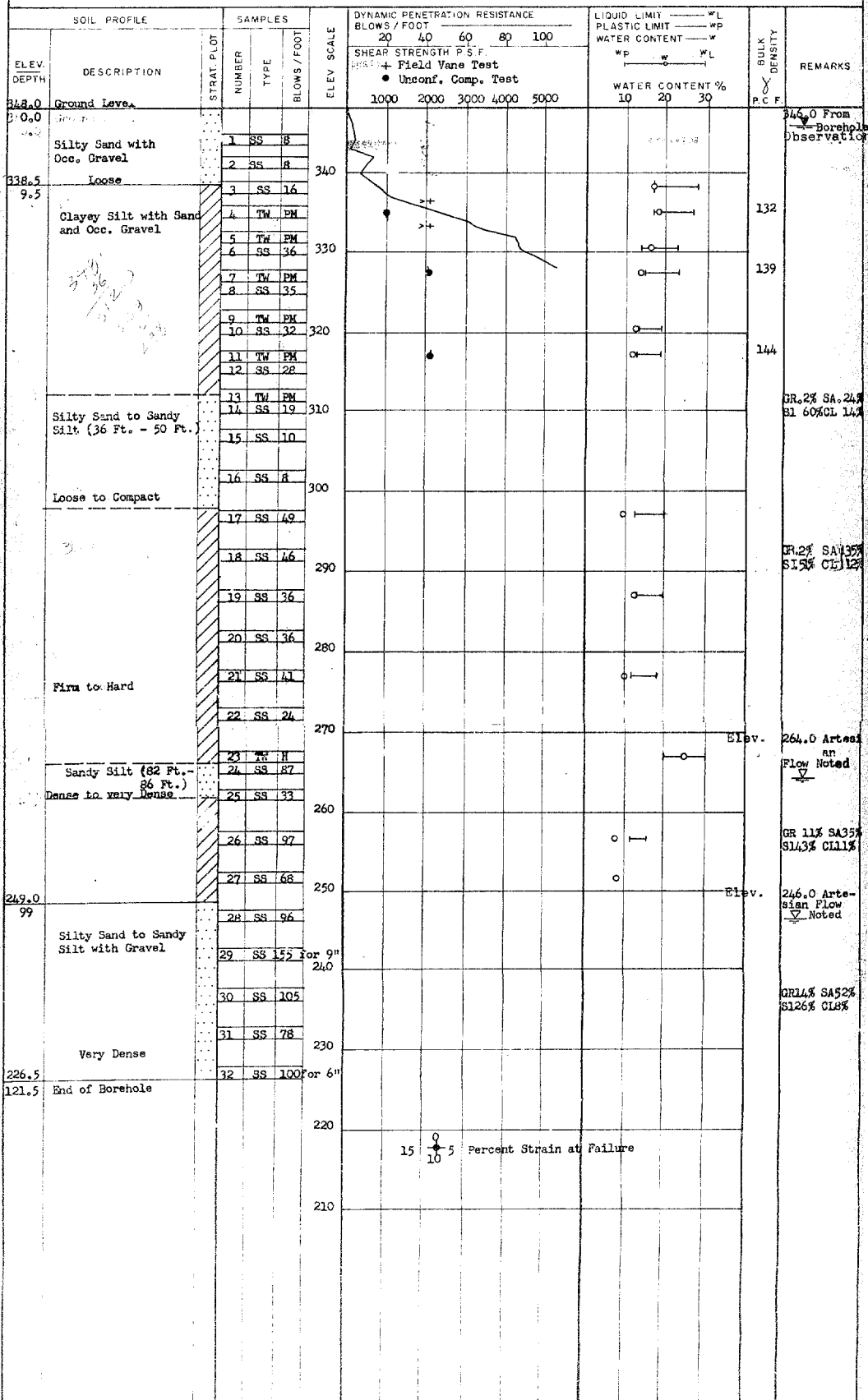


DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 65-F-40 LOCATION STA. 52 + 75 (525' RT.) (Struct. 13P) ORIGINATED BY R.M.
 W.P. NIL BORING DATE 15 Feb. 1965 COMPILED BY H.S.
 DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY M.D.

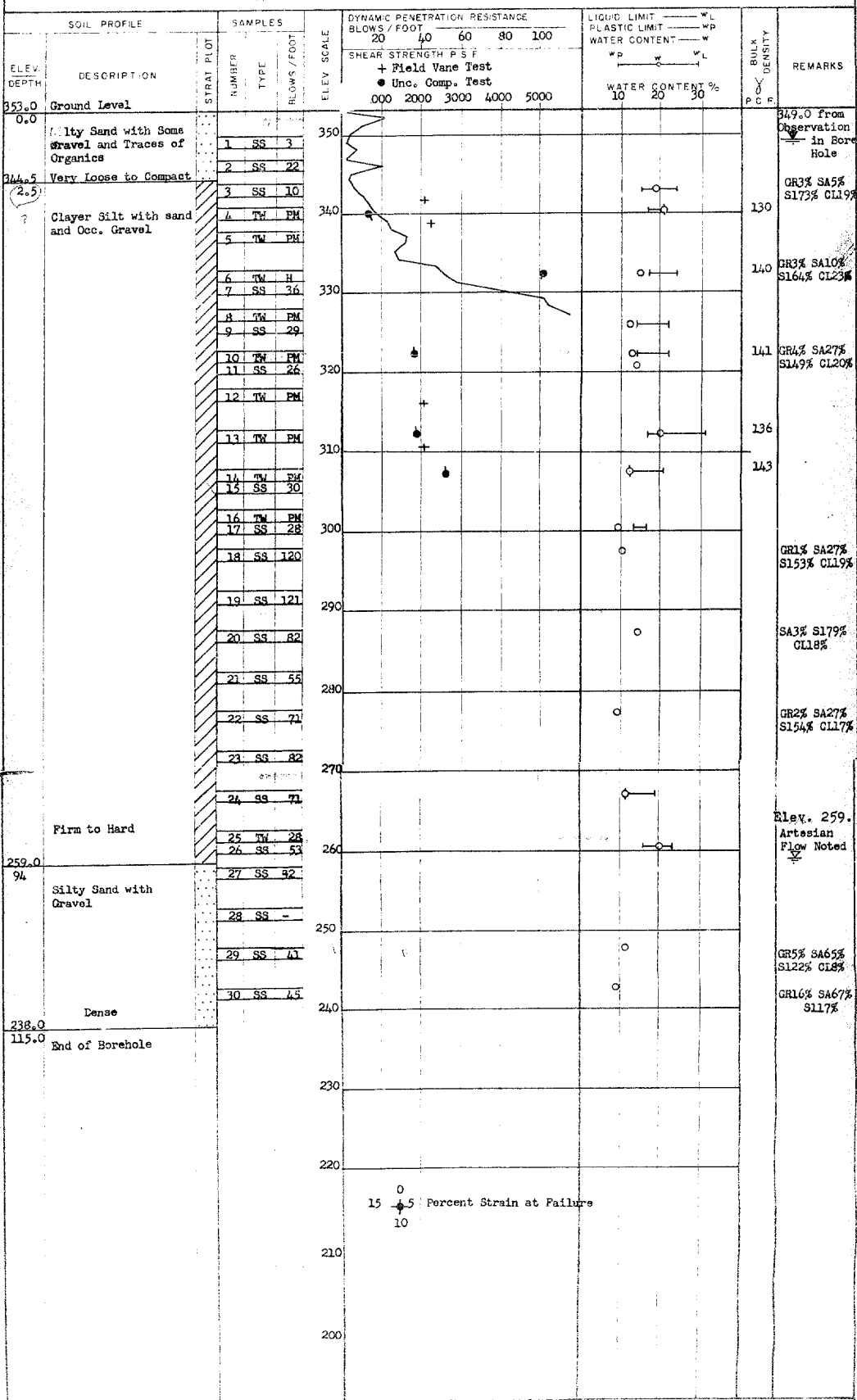


DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 65-R-40 LOCATION STA. 65 + 28.21'R ORIGINATED BY R.M.
W.P. NIL BORING DATE 26 Jan. 1965 COMPILED BY H.S.
DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY M.D.



FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY H.S.

CHECKED BY _____ M.D.

[illegible]

MATERIALS & TESTING DIVISION

JOB 65-P-40

LOCATION STA. 104 A 50 (60' LT.) (Struct. 15R)

ORIGINATED BY R.M.

W.P. NIL

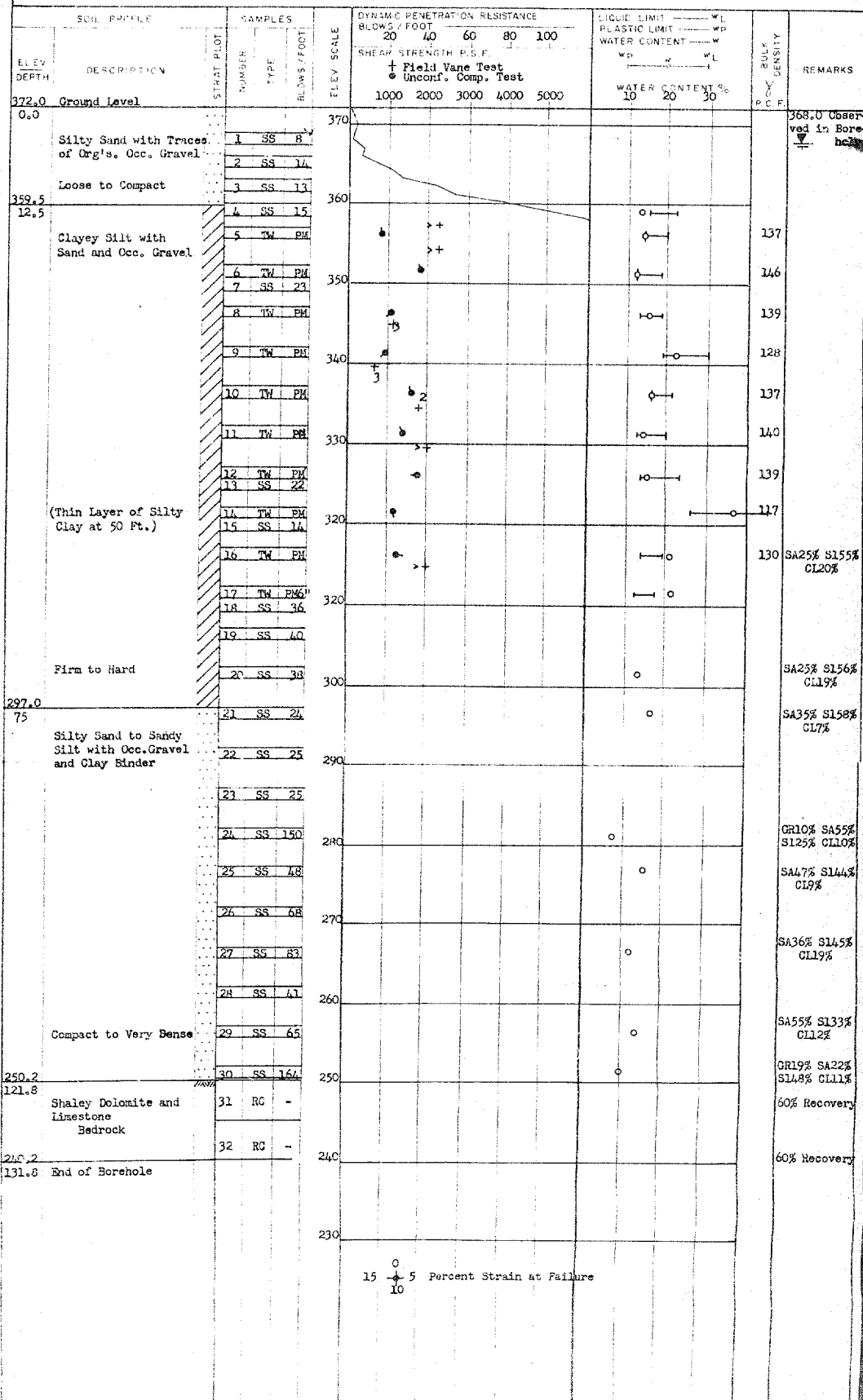
BORING DATE 18 Feb. 1965

COMPILED BY M.S.

DATAUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY M.D.



FIELD NO. & TESTING DIVISION

R 65-F-40

LOCATION Sta. 120+32 (95' Rt.) (Struct. 10R)

ORIGINATED BY H.S.

P H11

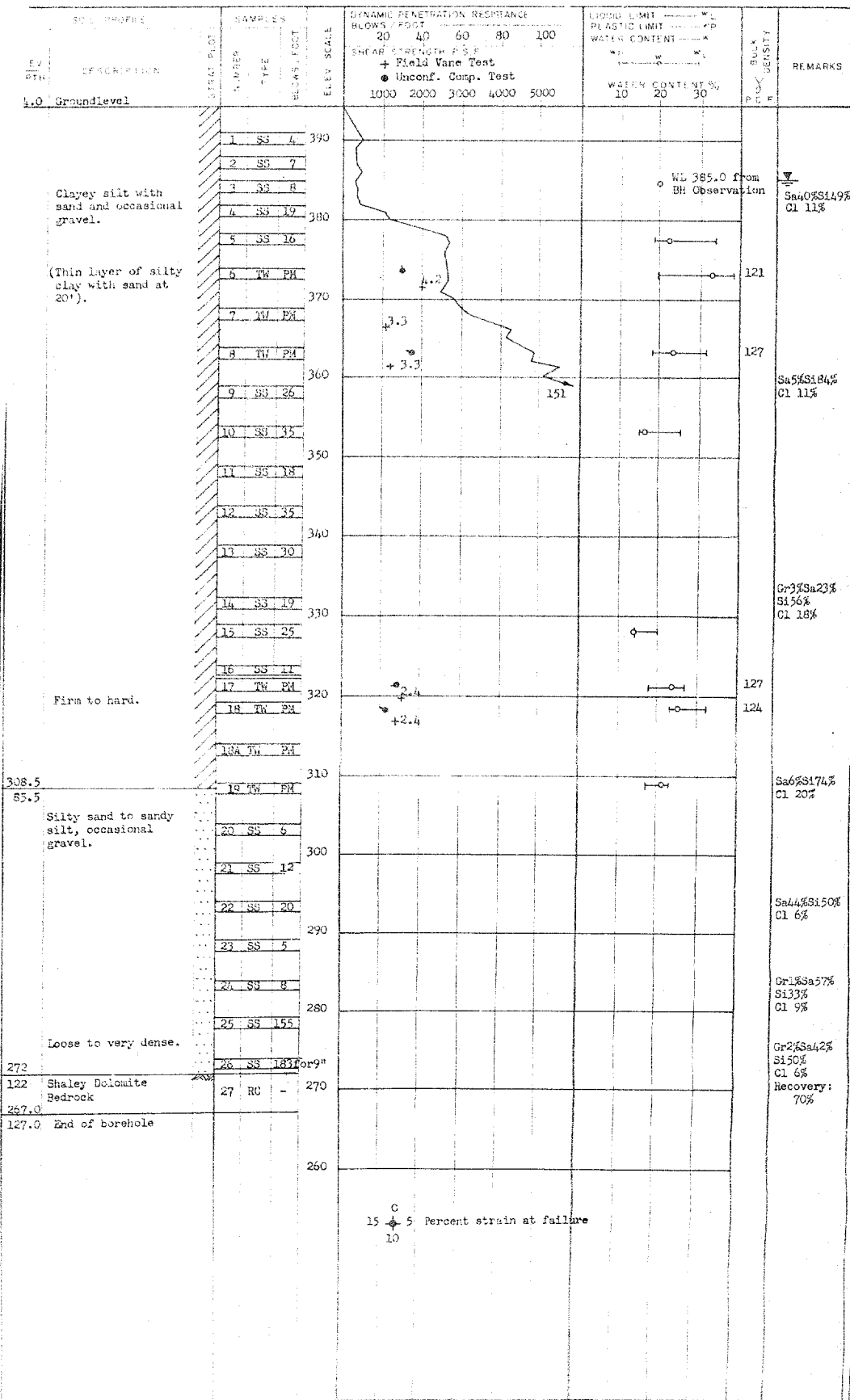
DRIVING DATE Feb. 15, 1965

COMPILED BY H.S.

TUM Genetic

BOREHOLE TYPE Washboring

CHECKED BY M.D.



DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-40

LOCATION Sta. 127/15 (475' Lt.) (Struct. 18R)

ORIGINATED BY H.S.

W.P. M1

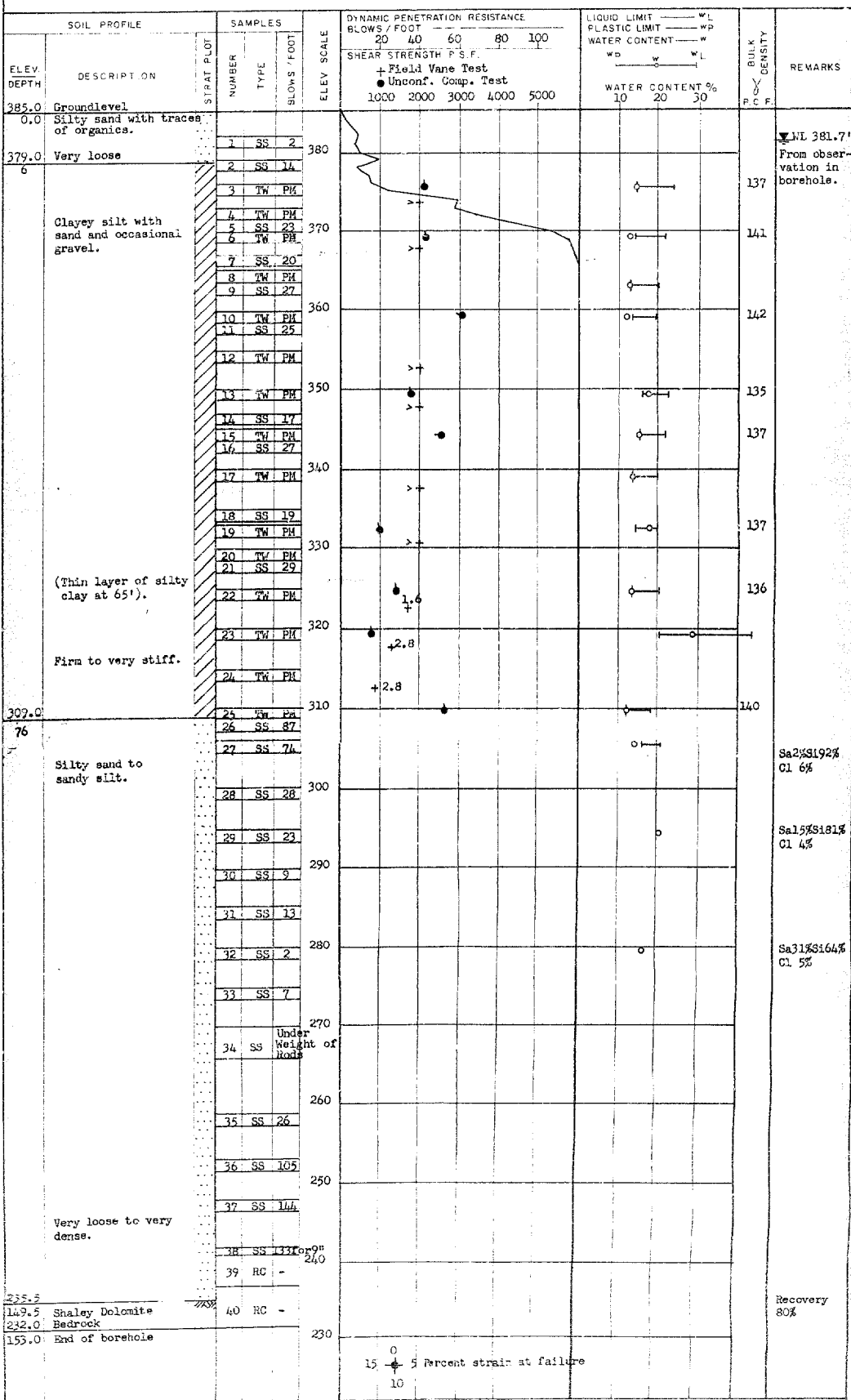
BORING DATE Feb. 17, 1965.

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY M.D.



DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-P-40

LOCATION STA. 138 + 80 (95' RT.) (Struct. 19H)

ORIGINATED BY H.S.

W.P. NIL

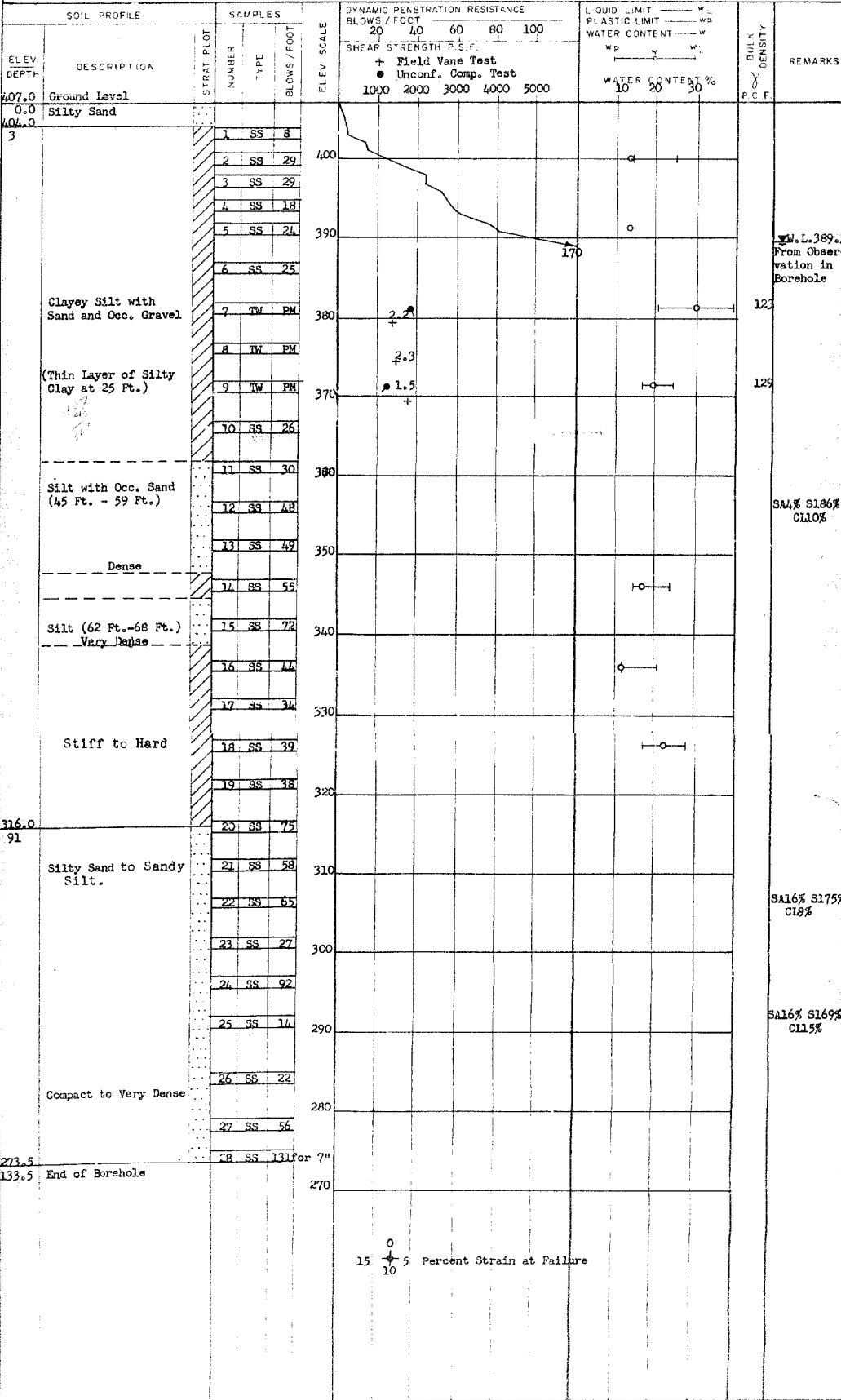
BORING DATE 9 Feb. 1965

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY M.D.



DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 12		FOUNDATION SECTION	
MATERIALS & TESTING DIVISION		LOCATION <u>STA. 148 + 43 (95' LT.) (Struct. 20R)</u>		ORIGINATED BY <u>H.S.</u>	
JOB <u>65-P-40</u>		BORING DATE <u>18 Jan. 1965</u>		COMPILED BY <u>H.S.</u>	
W.P. <u>NIL</u>		BOREHOLE TYPE <u>Washboring</u>		CHECKED BY <u>M.D.</u>	
DATUM <u>Geodetic</u>					

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT		
404.0	Ground Level								
0.0			1	SS	30	400			
	Clayey Silt with Sand and Occ. Gravel		2	SS	47				
			3	SS	47				
			4	SS	38				
			5	SS	24				
			6	SS	25				
			7	SS	29				
			8	SS	17				
			9	TV	PM				
			10	TV	PM				
			11	SS	23				
			12	TV	30				
			13	SS	39				
			14	SS	43				
			15	SS	38				
	Silty Sand (63 Ft.-67 Ft.)		16	SS	46				
	Dense		17	SS	46				
			18	SS	69				
			19	SS	59				
			20	SS	69				
			21	SS	55				
	Firm to Hard		22	SS	60				
311.0			23	SS	47				
93			24	SS	54				
	Silty Sand to Sandy Silt		25	SS	64				
			26	SS	81				
			27	SS	25				
			28	SS	1				
			29	SS	15				
			30	SS	23				
			31	SS	26				
			32	SS	146				
			33	SS	132				
	Compact to Very Dense		Lost	SS	63				
237.5			34	SS	76				
166.5	End of Borehole								

DYNAMIC PENETRATION RESISTANCE

BLOWS / FOOT

20 40 60 80 100

SHEAR STRENGTH P.S.F.

+ Field Vane Test

• Unconf. Comp. Test

1000 2000 3000 4000 5000

LIQUID LIMIT

PLASTIC LIMIT

WATER CONTENT

WP WL

WATER CONTENT %

10 20 30

BULK DENSITY

Y

P.C.F.

REMARKS

W.L. 384.4

From Observation in Borehole

138

134

SA42% SI54% CL4%

GR10% SA76% SI14%

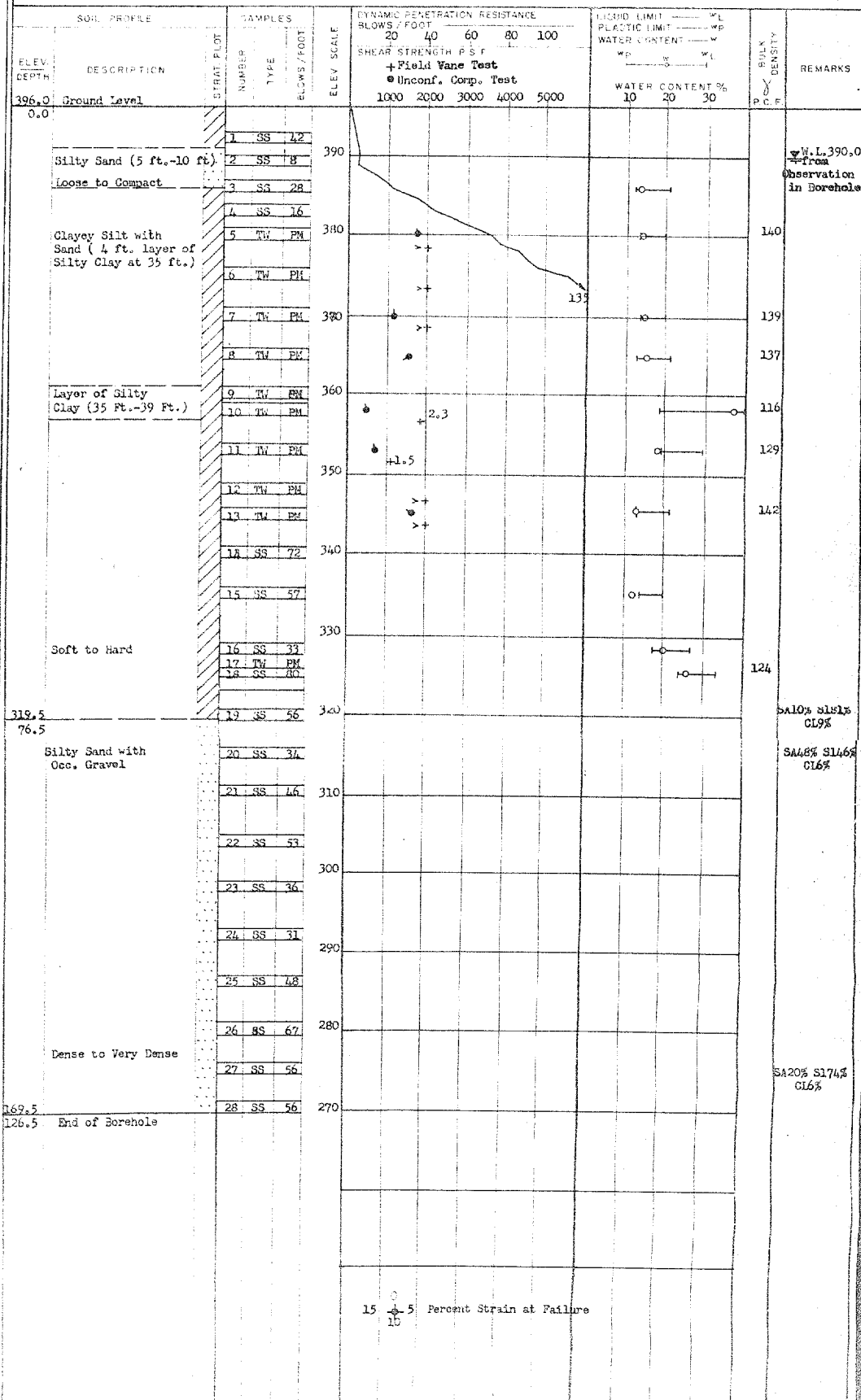
SA38% SI55% CL7%

SA66% SI29% CL5%

Percent Strain at Failure

0 15 10

MATERIALS & TESTING DIVISION

JOB 55-F-40LOCATION STA. 151+45 (380' LT.) (Struct. 20R)ORIGINATED BY H.B.W.P. NILBORING DATE 1 Feb. 1965COMPILED BY H.B.DATUM GeodeticBOREHOLE TYPE WashboringCHECKED BY M.D.

MATERIALS & TESTING DIVISION

JOB 65-P-40

LOCATION Sta. 155+60 (60' R.L.) (Struct. 22R)

ORIGINATED BY H.S.

W P M11

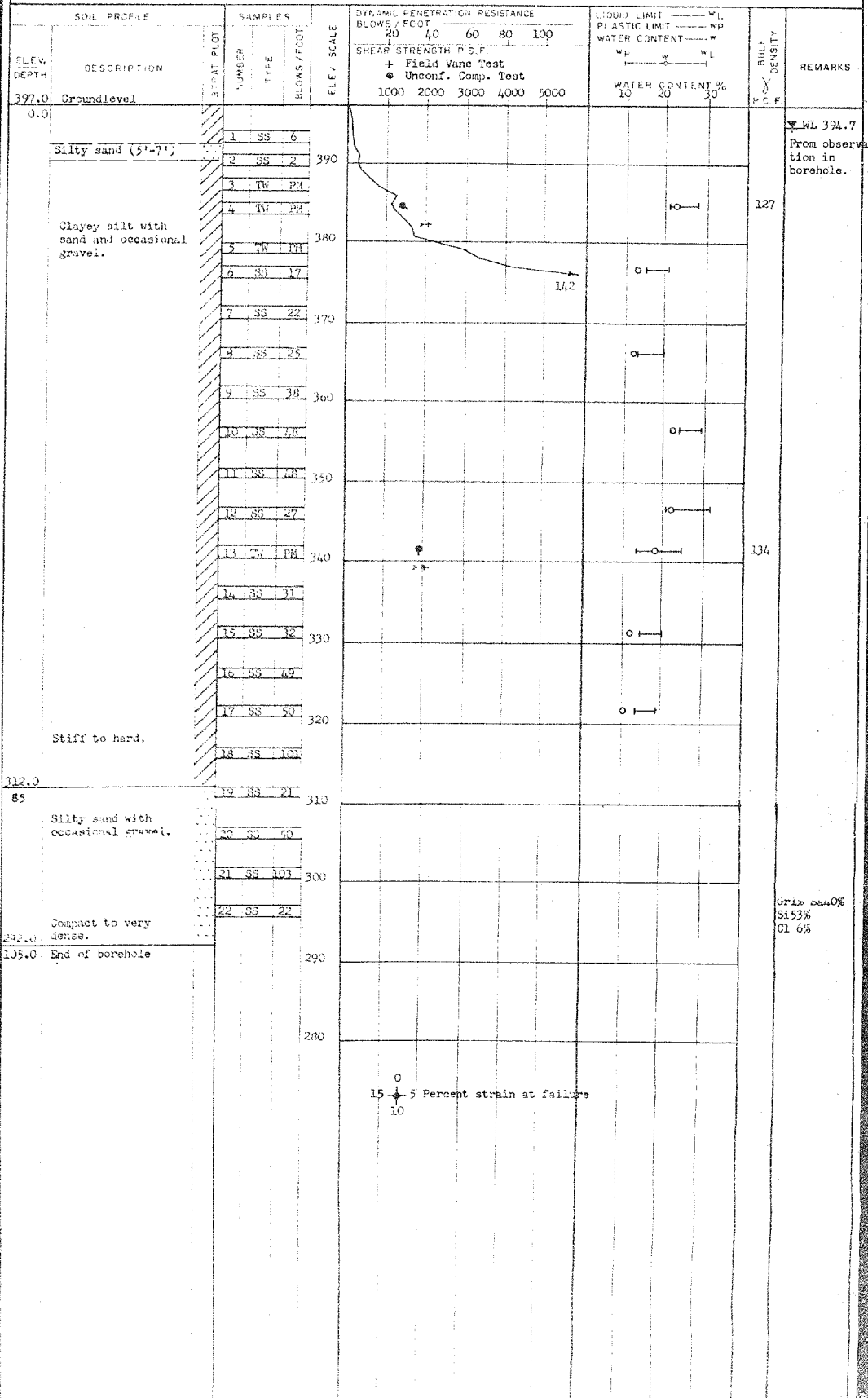
BORING DATE Feb. 2, 1965

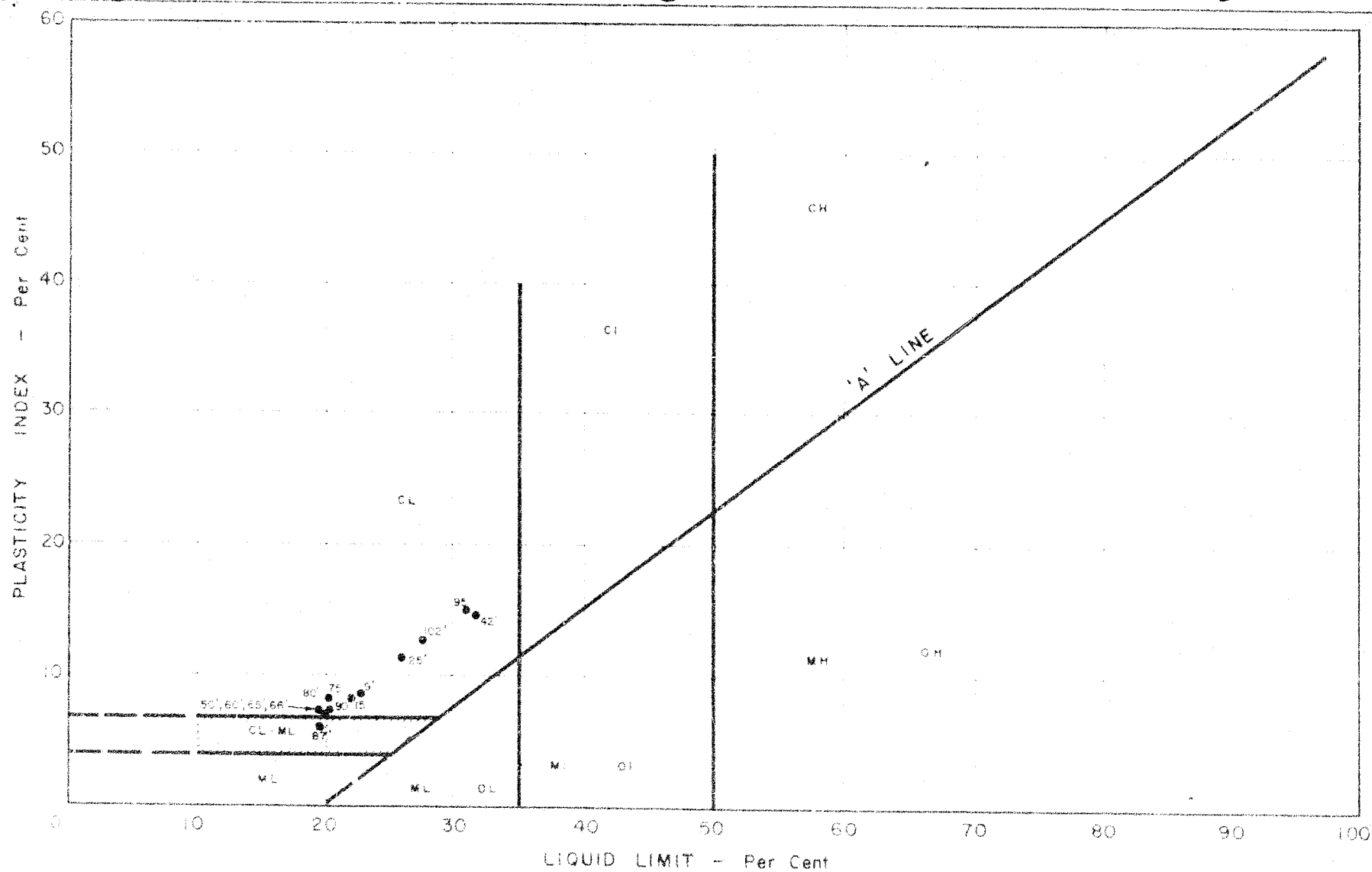
COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY M.D.





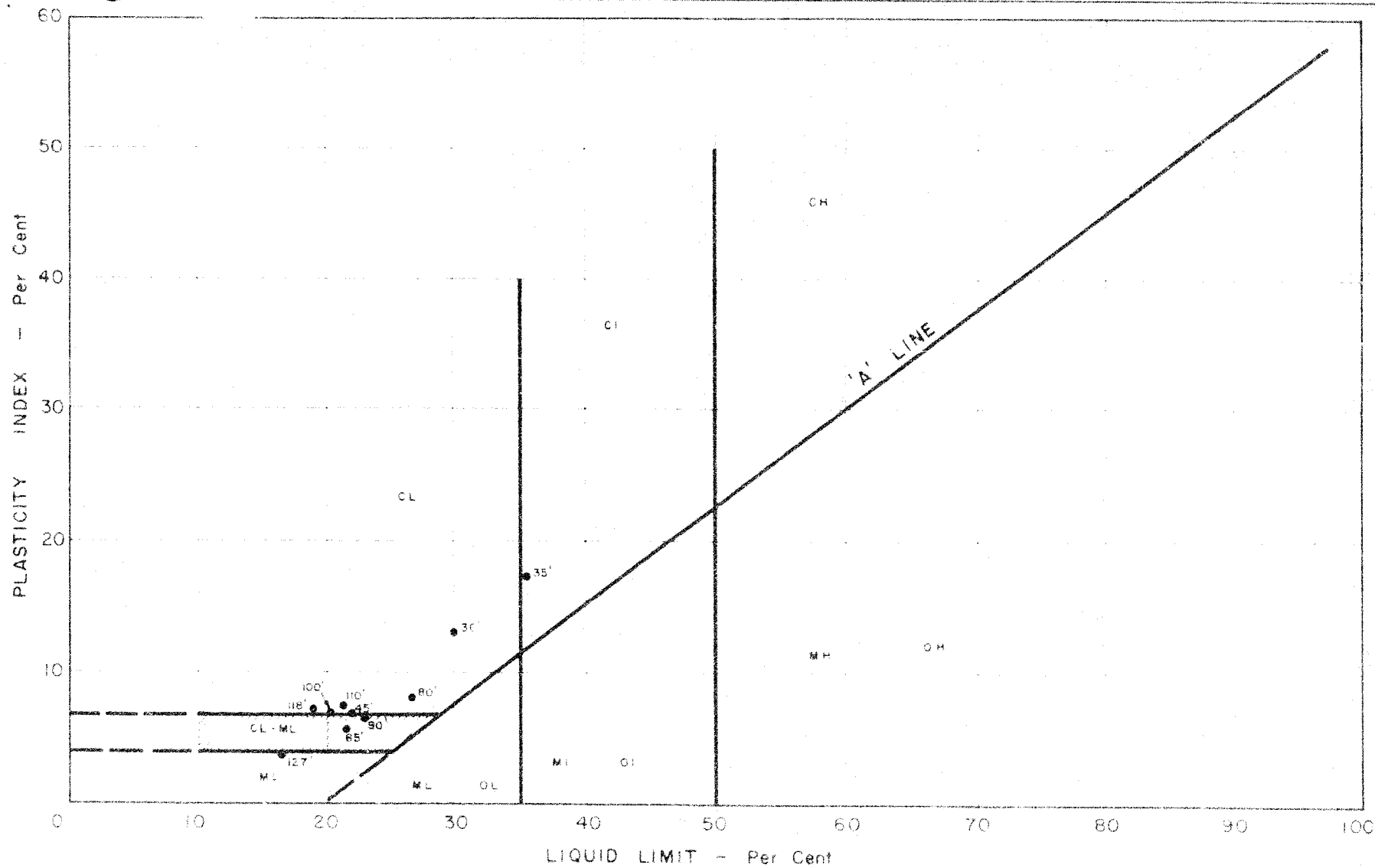
NOTES • BORE HOLE NO. 1

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY 400 EXT. to EGLINTON AVE



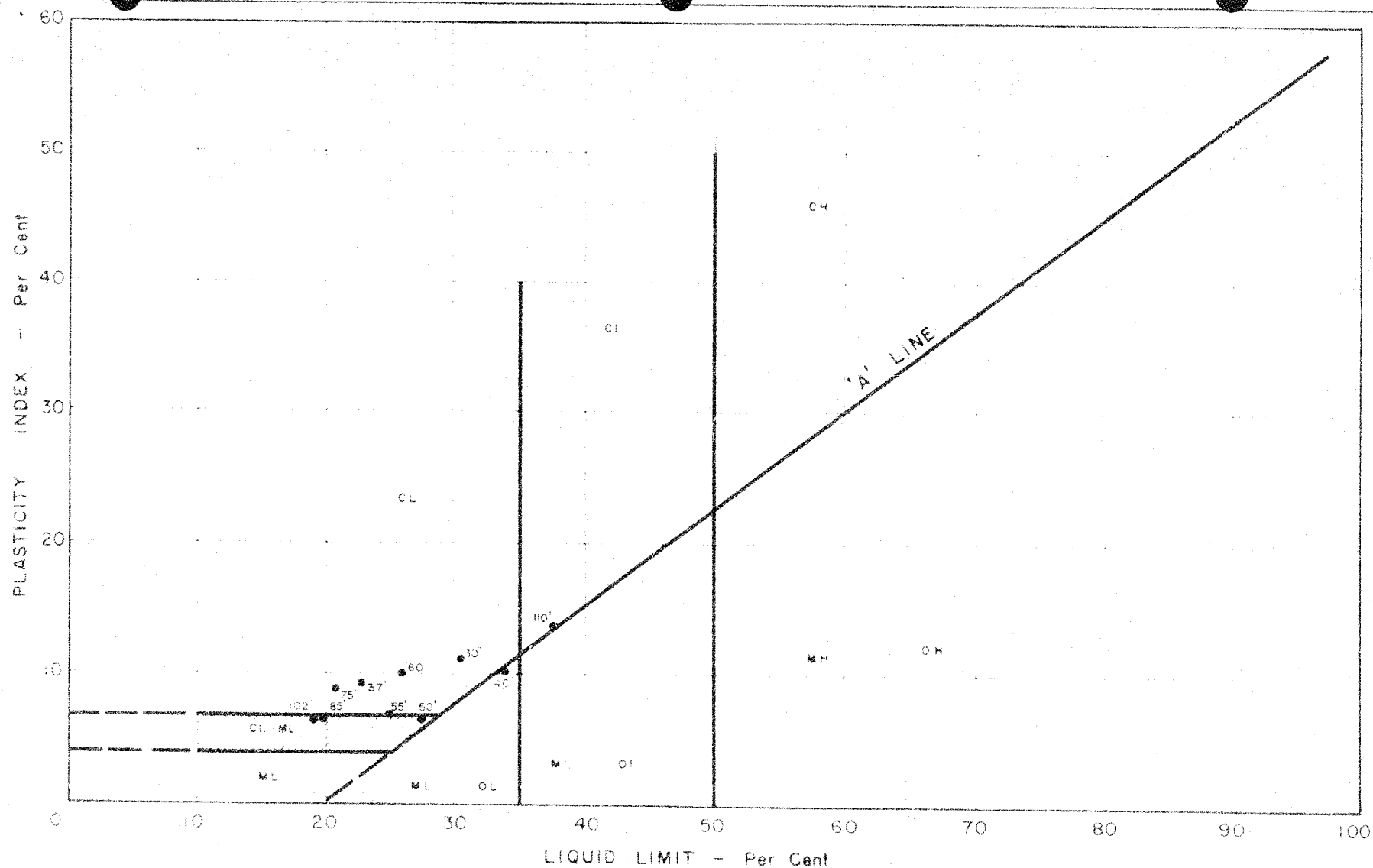
NOTES • - BORE HOLE NO. 2

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

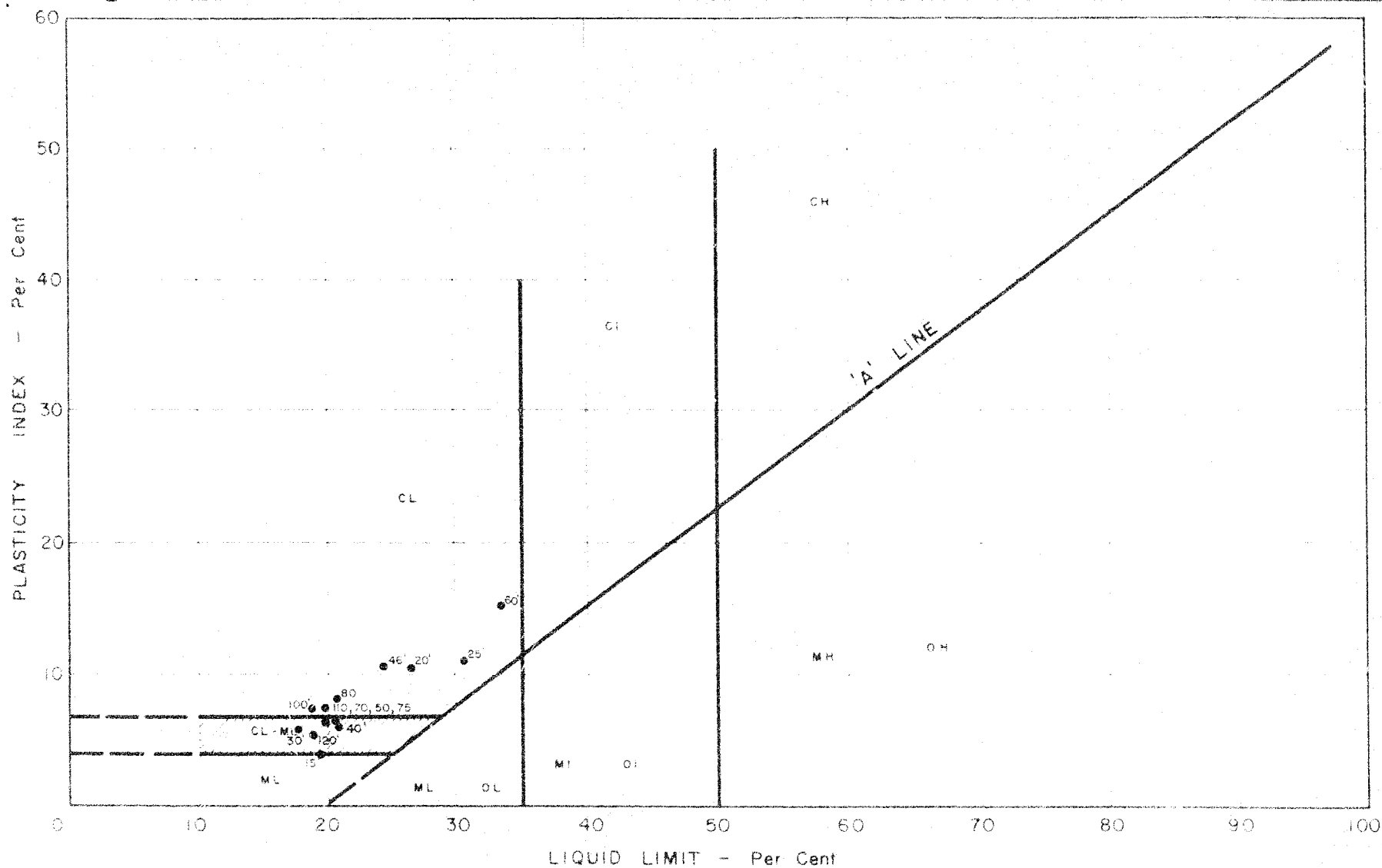
Location HWY 400 EXT. to EGLINTON AVE.



NOTES • FORE HOLE No. 3

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65 F. 40 W.P. No.
Location HWY 400 EXT. to EGLINTON AVE



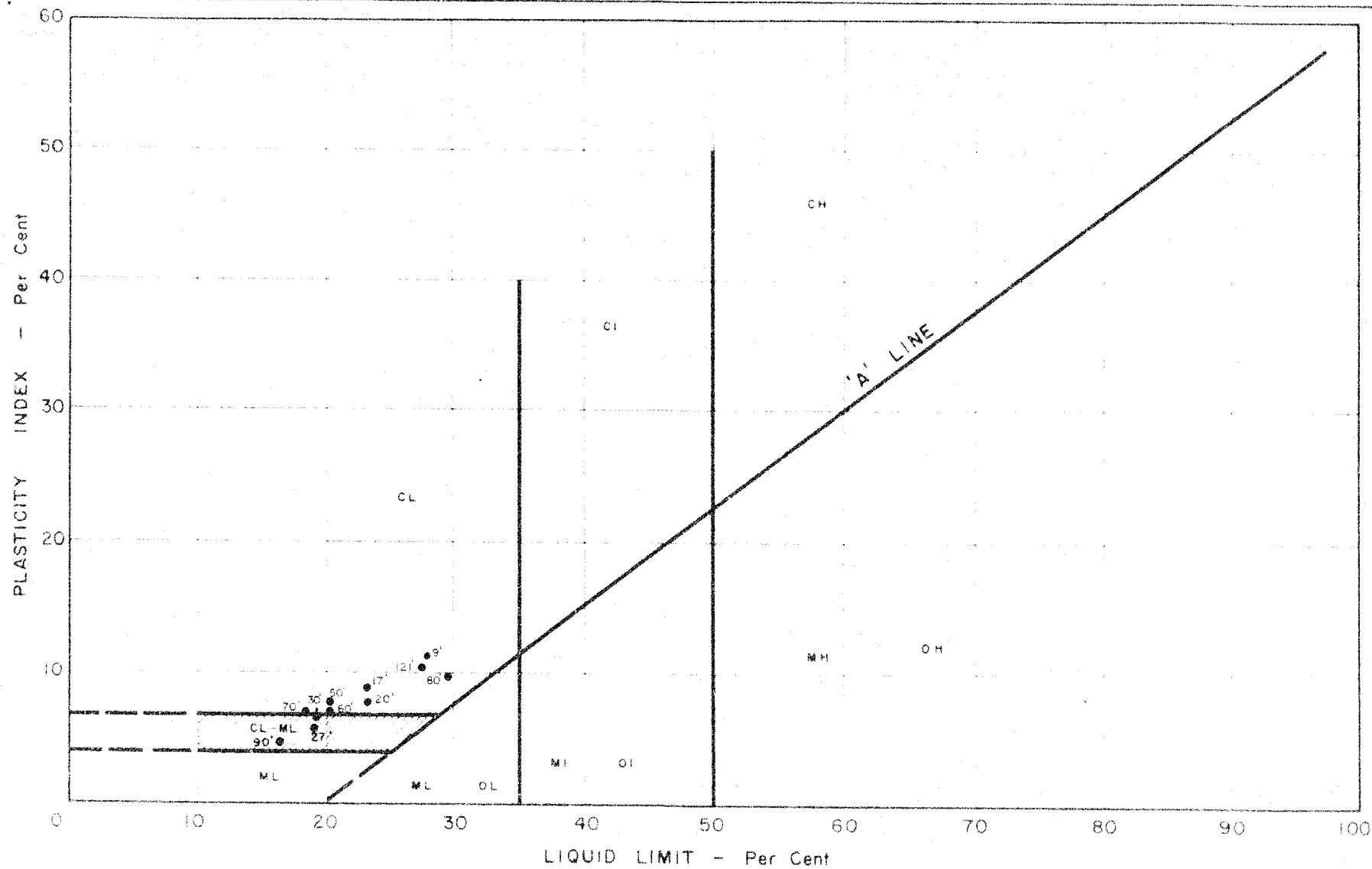
NOTES • BORE HOLE NO. 4

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65 F-40

W.P. No.

Location HWY 13 400 EXT to EGLINTON AVE.



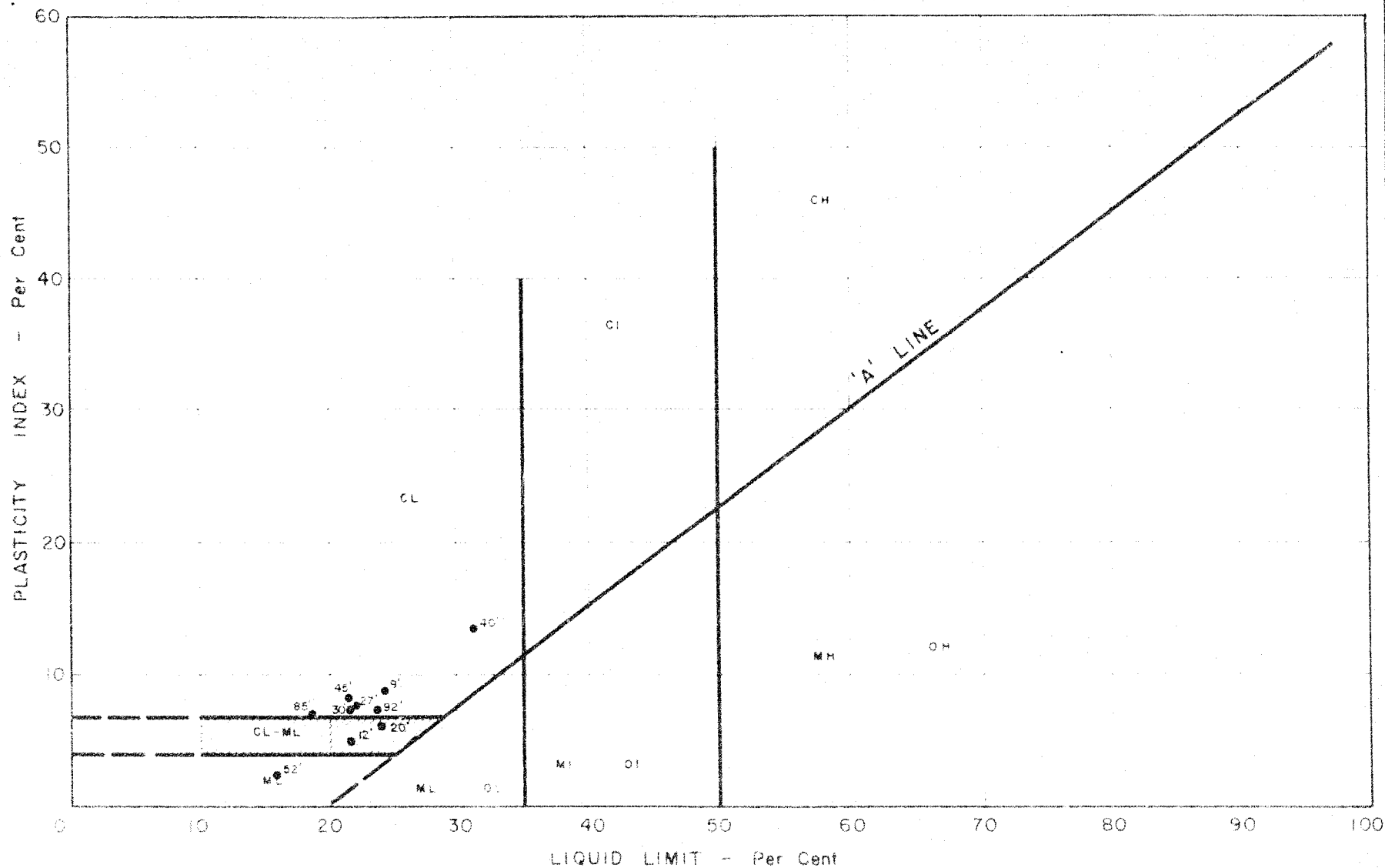
NOTES • - BORE HOLE NO. 5

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY 400 EXT. to EGLINTON AVE



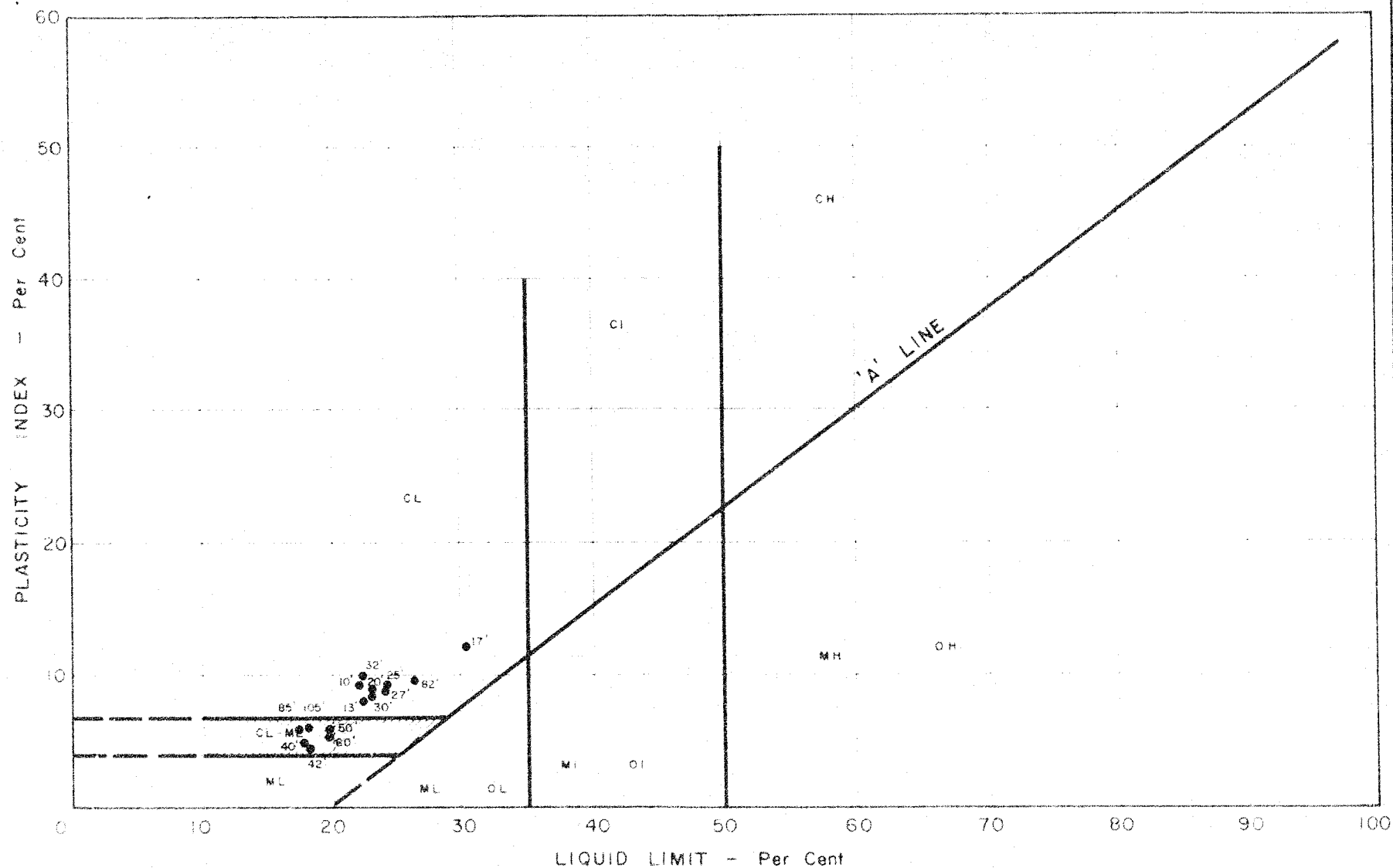
NOTES • BORE HOLE NO. 6

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W. No.

Location HWY. 400 EXT. to EGLINTON AVE



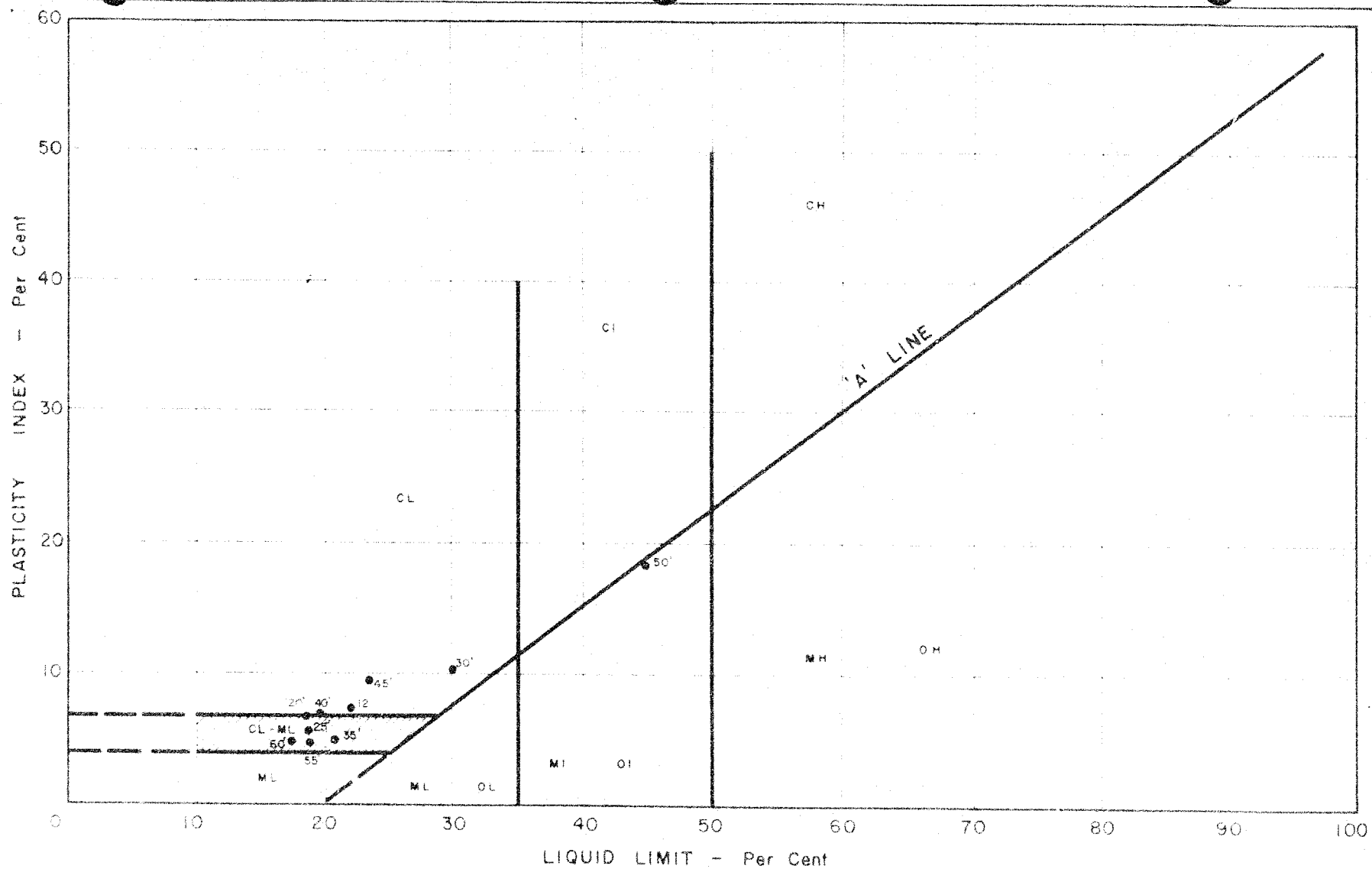
NOTES • - BORE HOLE NO 7

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location: HWY 400 EXT to EGLINTON AVE



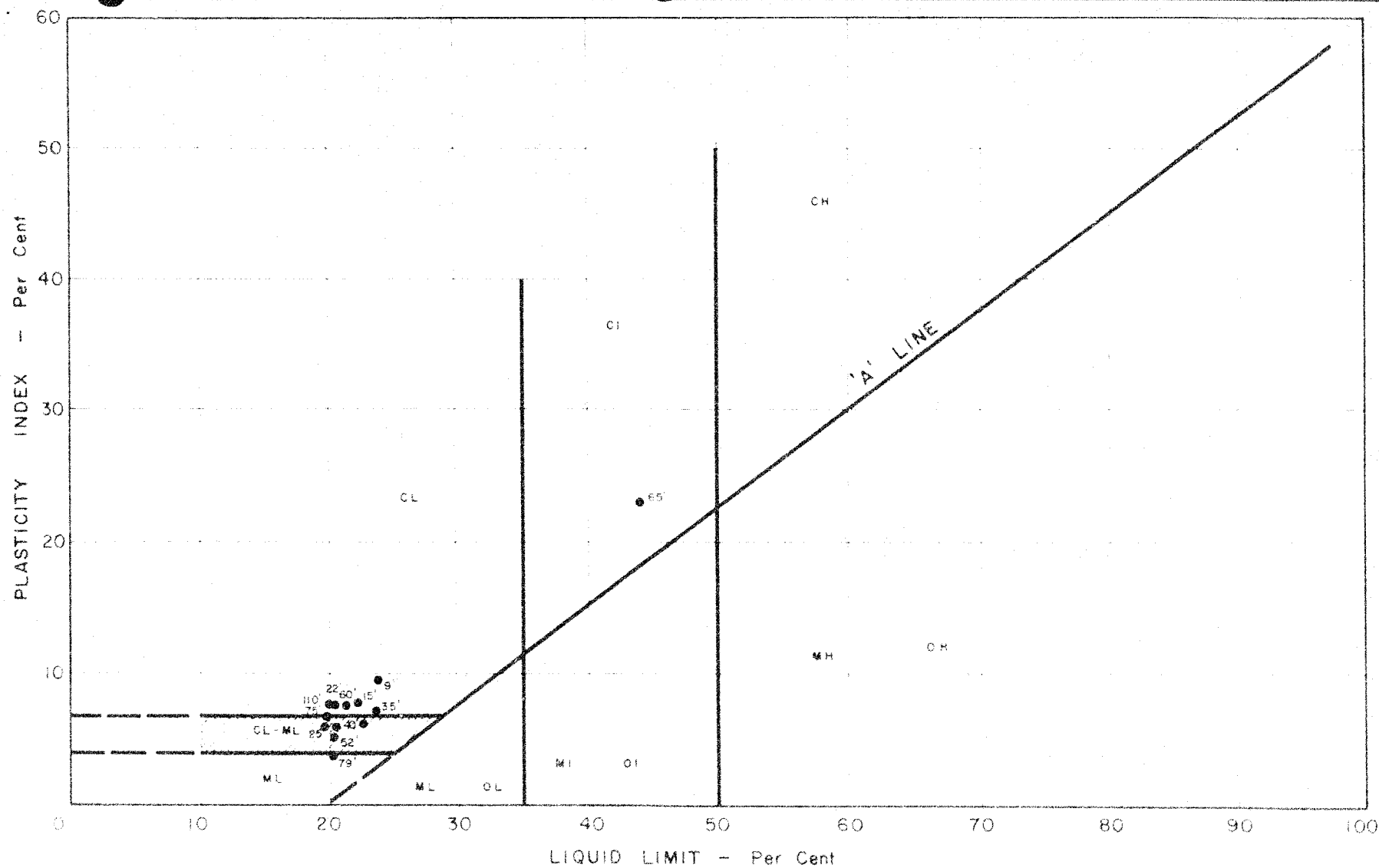
NOTES • BORE HOLE NO 8

 DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & RESEARCH DIVISION
 PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY. 400 EXT. to EGLINTON AVE.



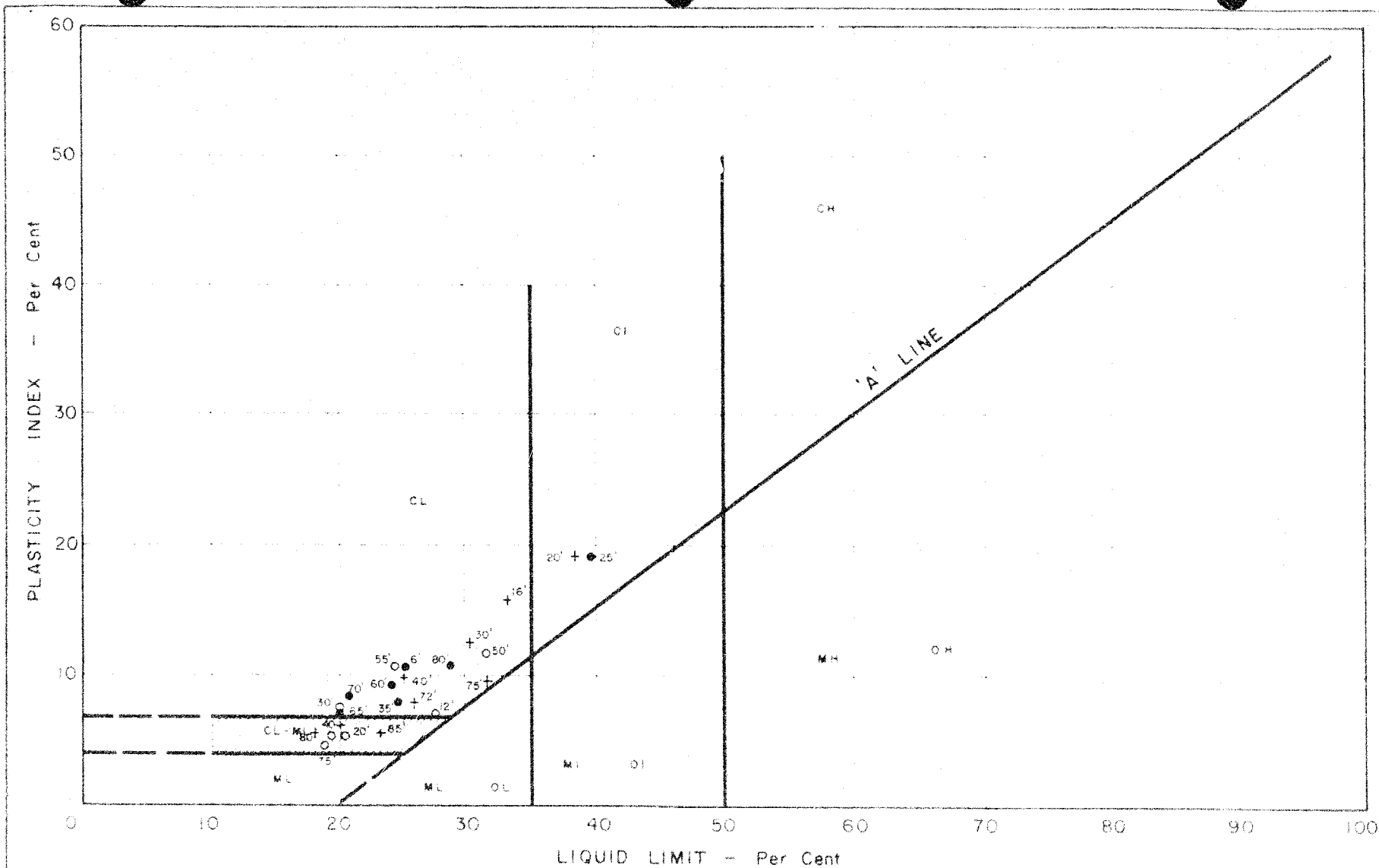
NOTES • BORE HOLE NO. 10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY 400 EXT. to EGLINTON AVE.



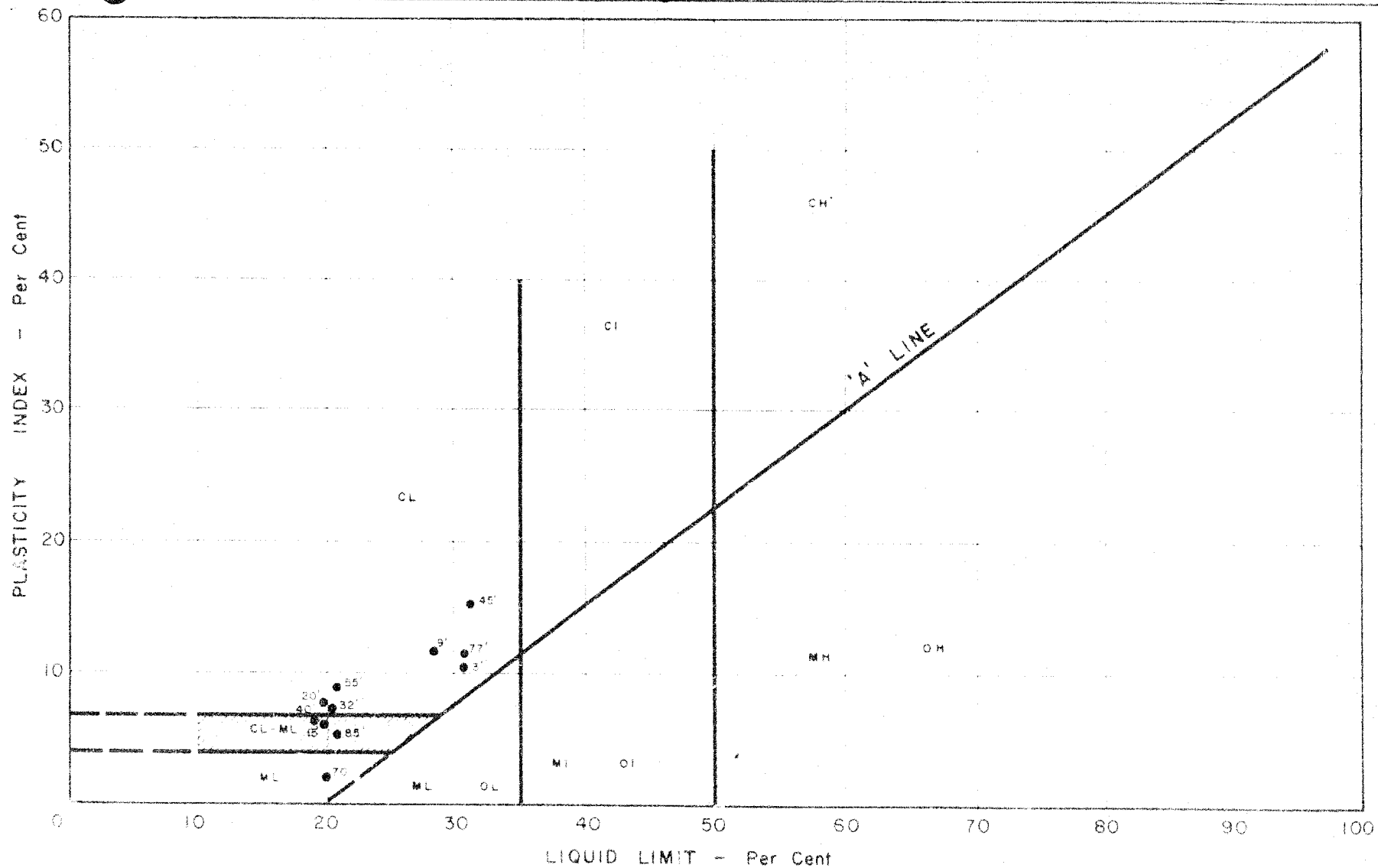
NOTES • - BORE HOLE NO 11
 + - BORE HOLE NO 9
 o - BORE HOLE NO 14

DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & RESEARCH DIVISION
 PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY 400 EXT to EGLINTON AVE.



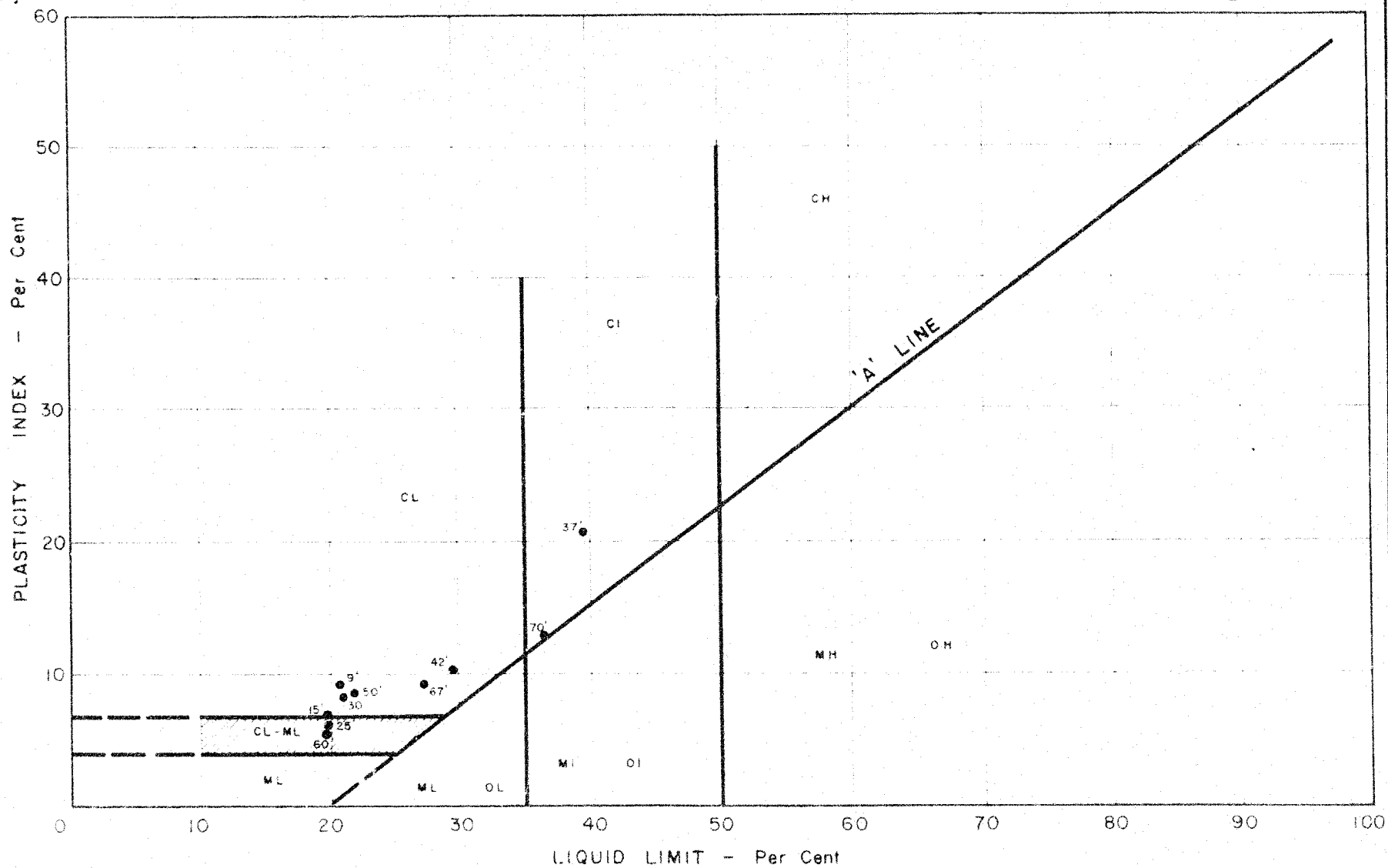
NOTES • BORE HOLE NO. 12

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY 400 EXT to EGLINTON AVE



NOTES • - BORE HOLE NO 13

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 65-F-40

W.P. No.

Location HWY 400 EXT. to EGLINTON AVE

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt

Sand

Gravel

Fine

Medium

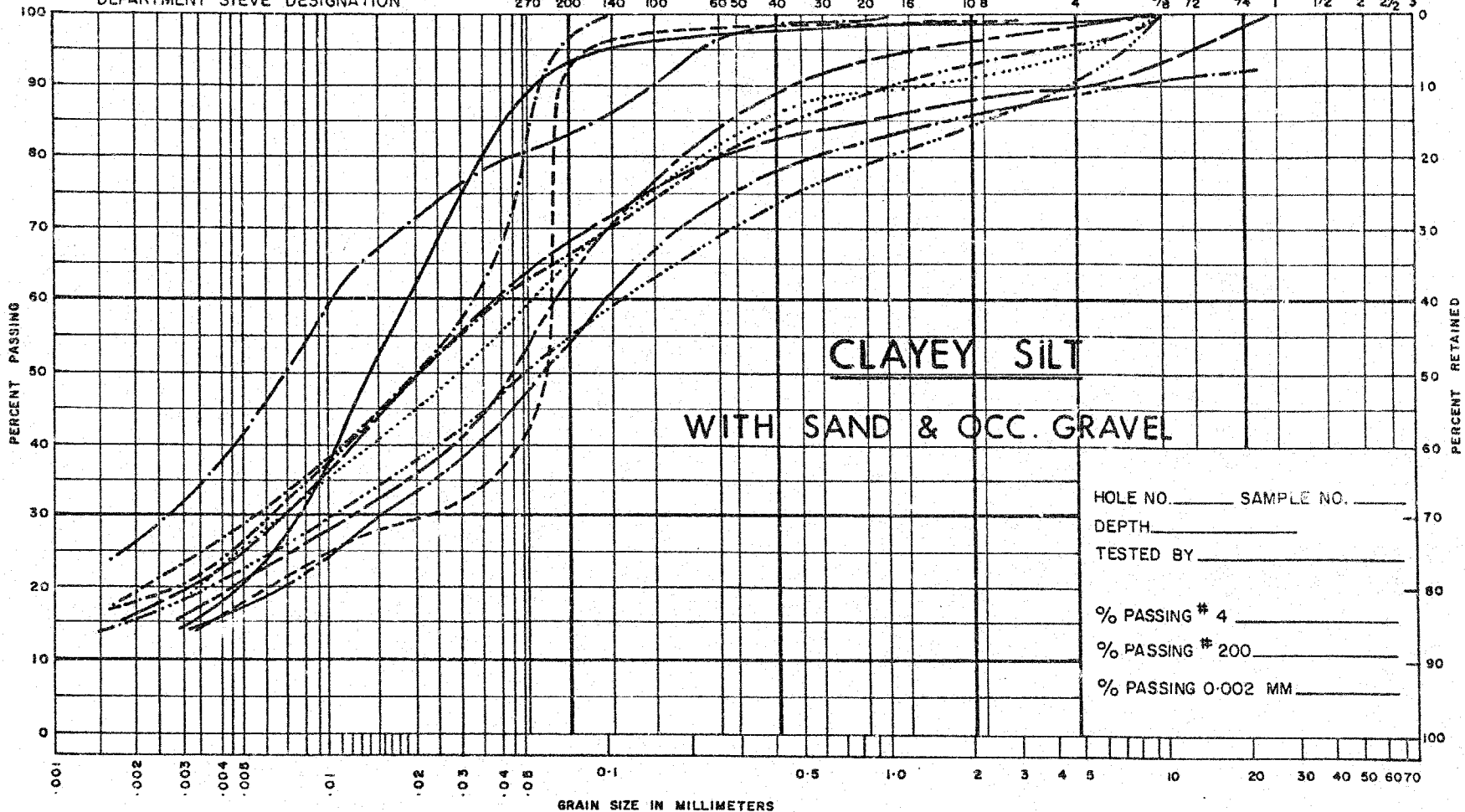
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 16 10 8 4 3/8" 1/2" 3/4" 1" 1 1/2" 2" 2 1/2" 3"



HOLE NO. _____ SAMPLE NO. _____

DEPTH _____

TESTED BY _____

% PASSING # 4 _____

% PASSING # 200 _____

% PASSING 0-002 MM _____

NOTES	B.H. 1, SA. 29	B.H. 4, SA. 13,
	B.H. 2, SA. 13	B.H. 4, SA. 19,
	B.H. 2, SA. 25	B.H. 4, SA. 26,
	B.H. 3, SA. 10	B.H. 5, SA. 18,
	B.H. 4, SA. 5	B.H. 5, SA. 26,

DEPARTMENT OF HIGHWAYS — ONTARIO MATERIALS & TESTING DIVISION GRAIN SIZE DISTRIBUTION

JOB NO. 65-F-40 W.P. NO. _____
LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt

Sand

Gravel

Fine

Medium

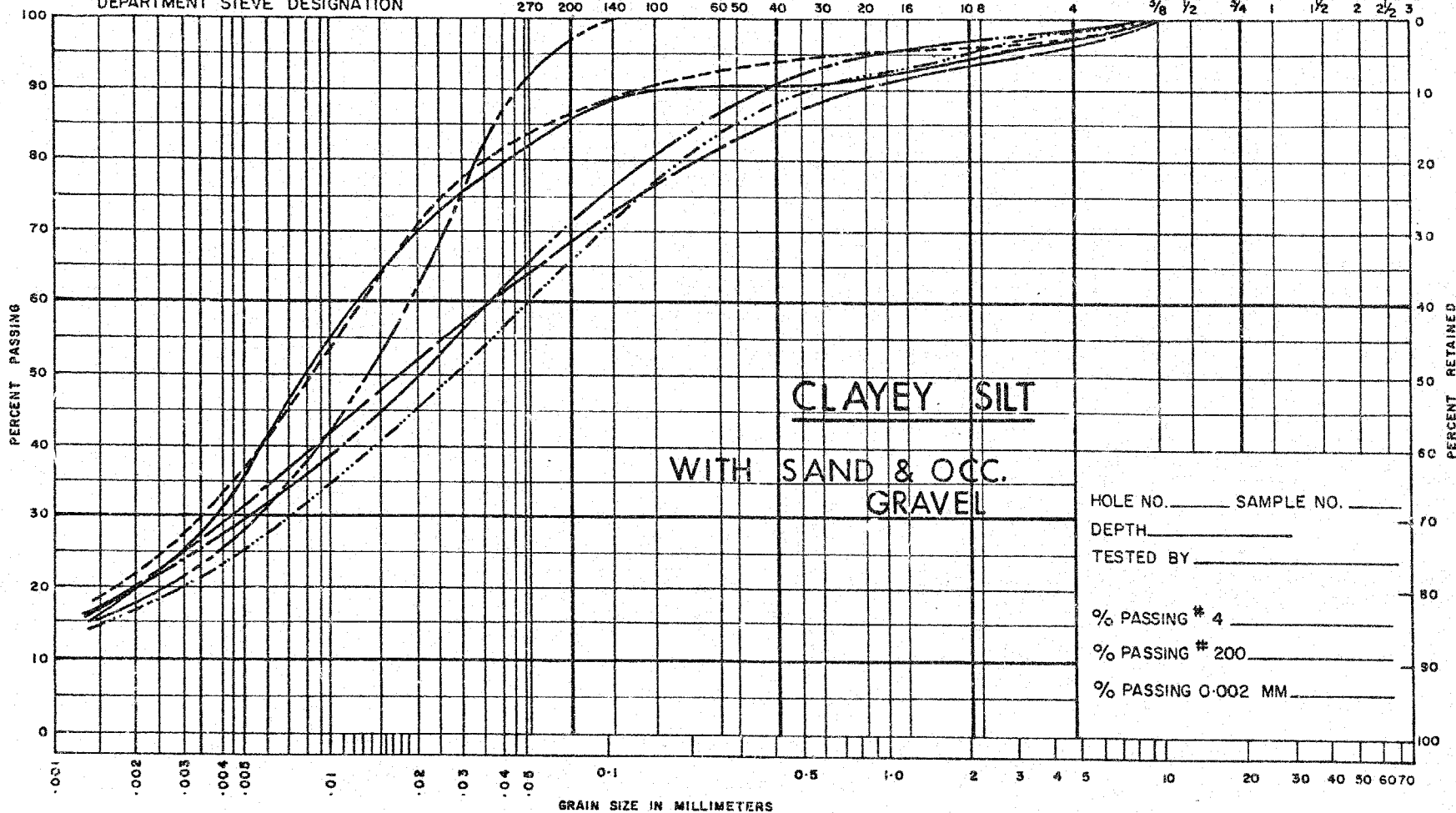
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 16 10 8 4 3/8 1/2 3/4 1 1 1/2 2 2 1/2 3"



BOREHOLE 6

NOTES	SAMPLE 3	SAMPLE 20
	" 6	" 22
	" 11	
	" 18	

DEPARTMENT OF HIGHWAYS — ONTARIO
 MATERIALS & TESTING DIVISION
GRAIN SIZE DISTRIBUTION

JOB NO. 65-F-40 W.P. NO. _____
 LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt

Sand

Gravel

Fine

Medium

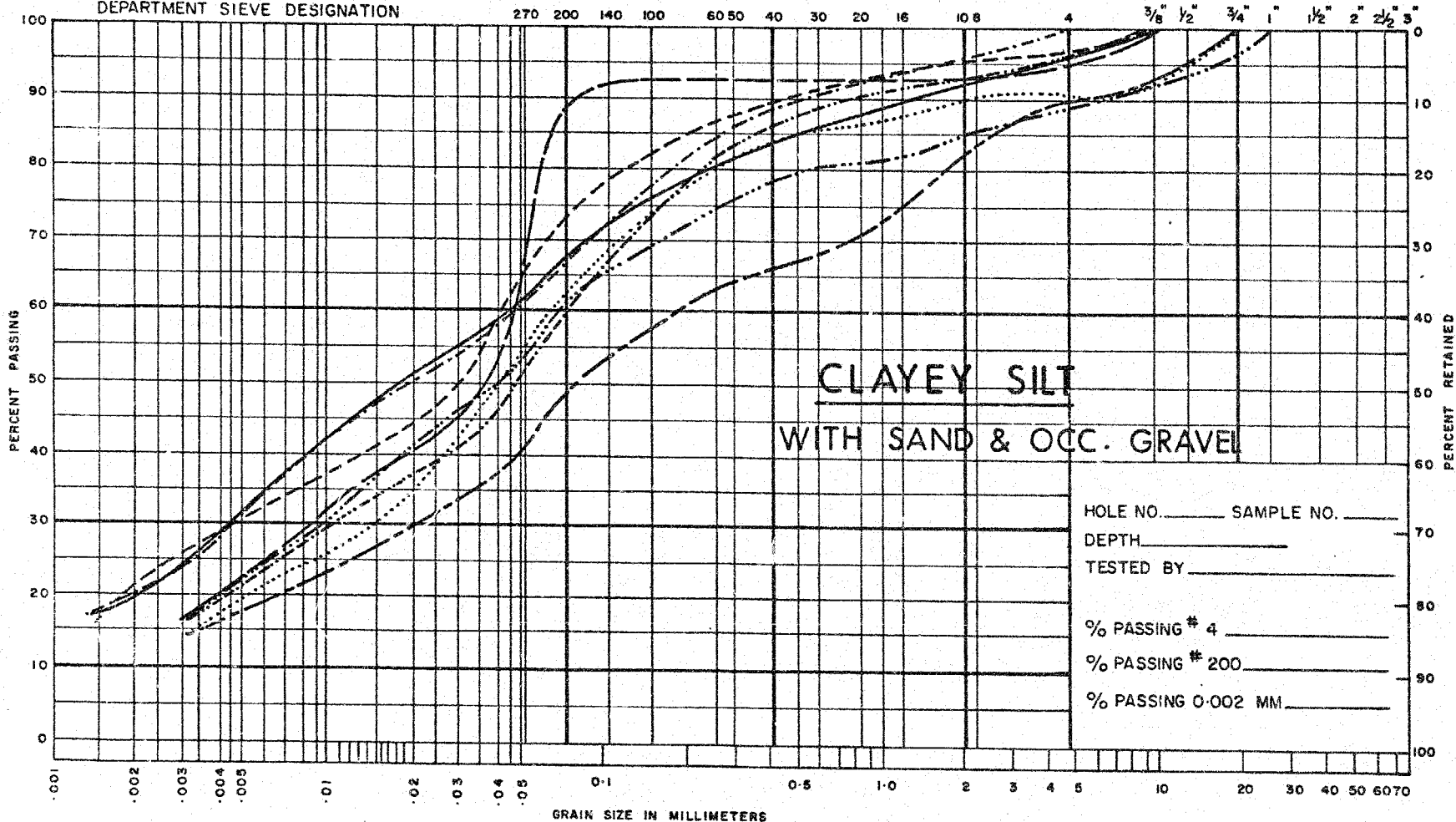
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 16 10 8 4 3/8" 1/2" 3/4" 1" 1 1/2" 2" 2 1/2" 3"



BORE HOLE 7

NOTES SAMPLE 3	SAMPLE 14
" 9	" 18
" 12	" 27
" 13	" 29

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS & TESTING DIVISION
GRAIN SIZE DISTRIBUTION

JOB NO. 65-F-40 W.P. NO. _____
LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt

Sand

Gravel

Fine

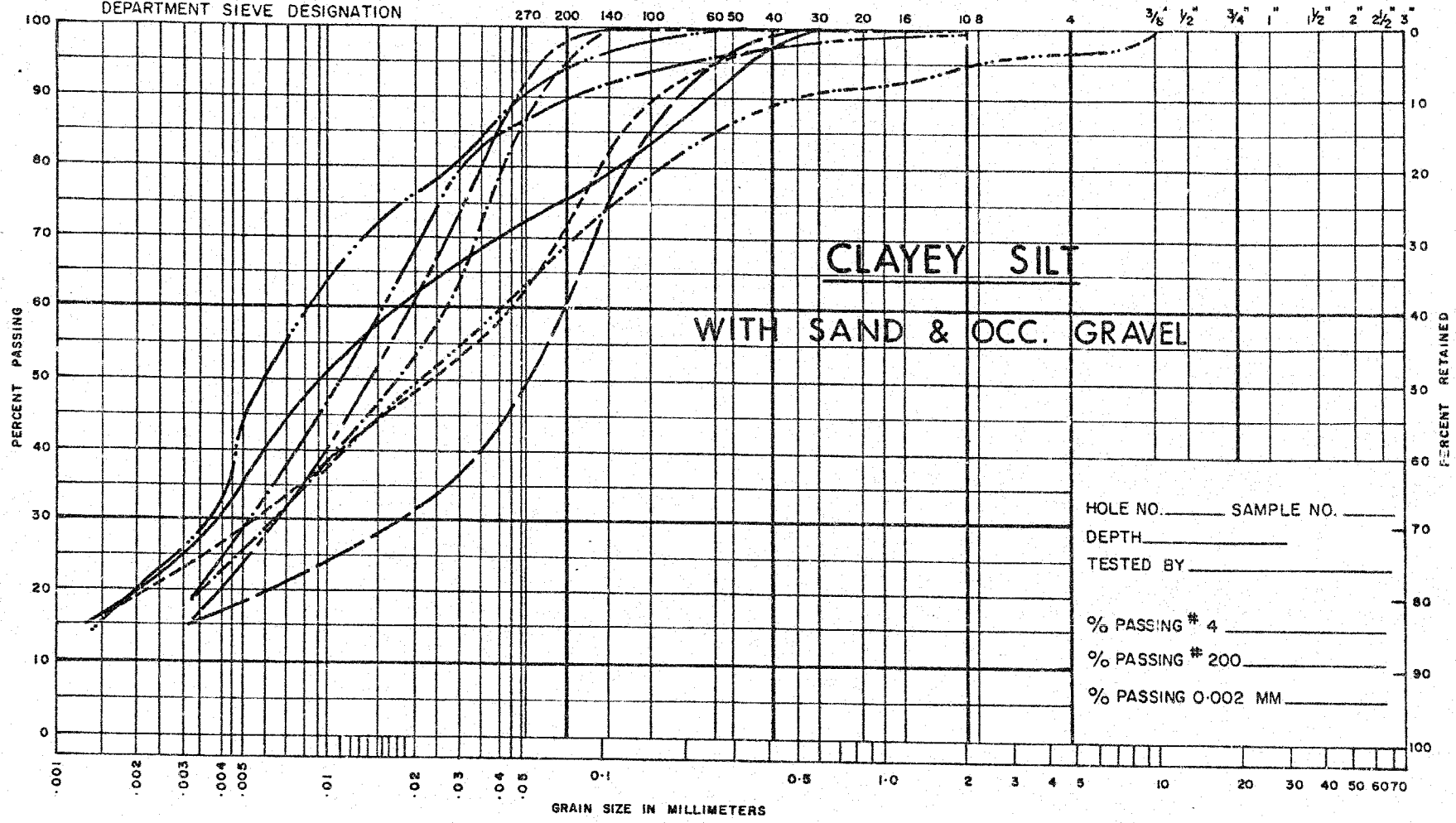
Medium

Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION



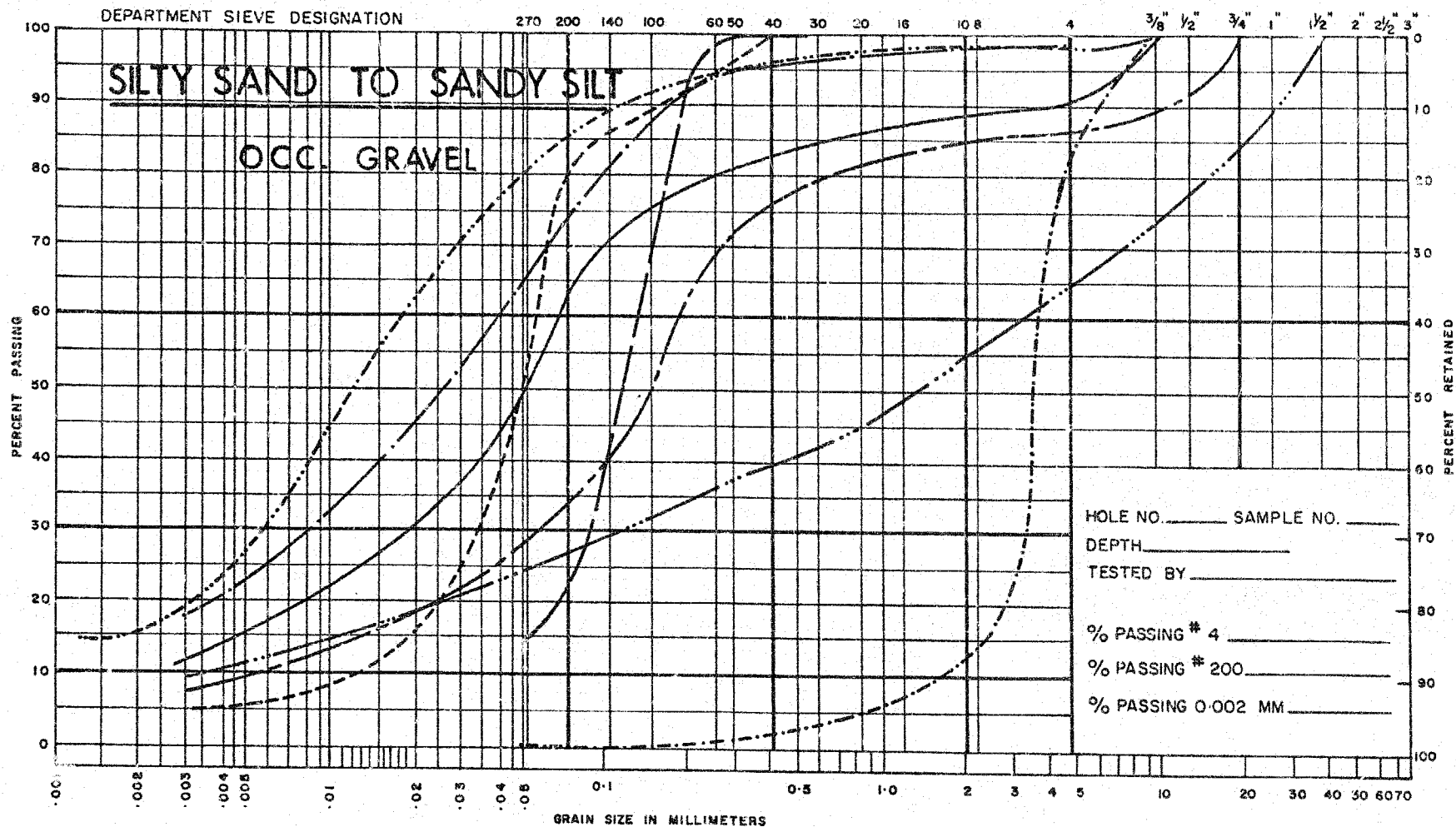
HOLE NO. _____ SAMPLE NO. _____
 DEPTH _____
 TESTED BY _____
 % PASSING # 4 _____
 % PASSING # 200 _____
 % PASSING 0.002 MM _____

NOTES	B.H. 8, SA. 16	B.H. 9, SA. 14
	" 8 " 20	" 9 " 19
	" 9 " 3	" 10 " 27
	" 9 " 9	" 14 " 19

DEPARTMENT OF HIGHWAYS — ONTARIO
 MATERIALS & TESTING DIVISION
GRAIN SIZE DISTRIBUTION
 JOB NO. 65-F-40 W.P. NO. _____
 LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse



NOTES B.H. 1, SA. 12	B.H. 4, SA. 22
" 2 " 2	" 5 " 14
" 2 " 3	" 5 " 30
" 3 " 32	" 5 " 22

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS & TESTING DIVISION

GRAIN SIZE DISTRIBUTION

JOB NO. 65-F-40 W.P. NO. _____

LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt

Sand

Gravel

Fine

Medium

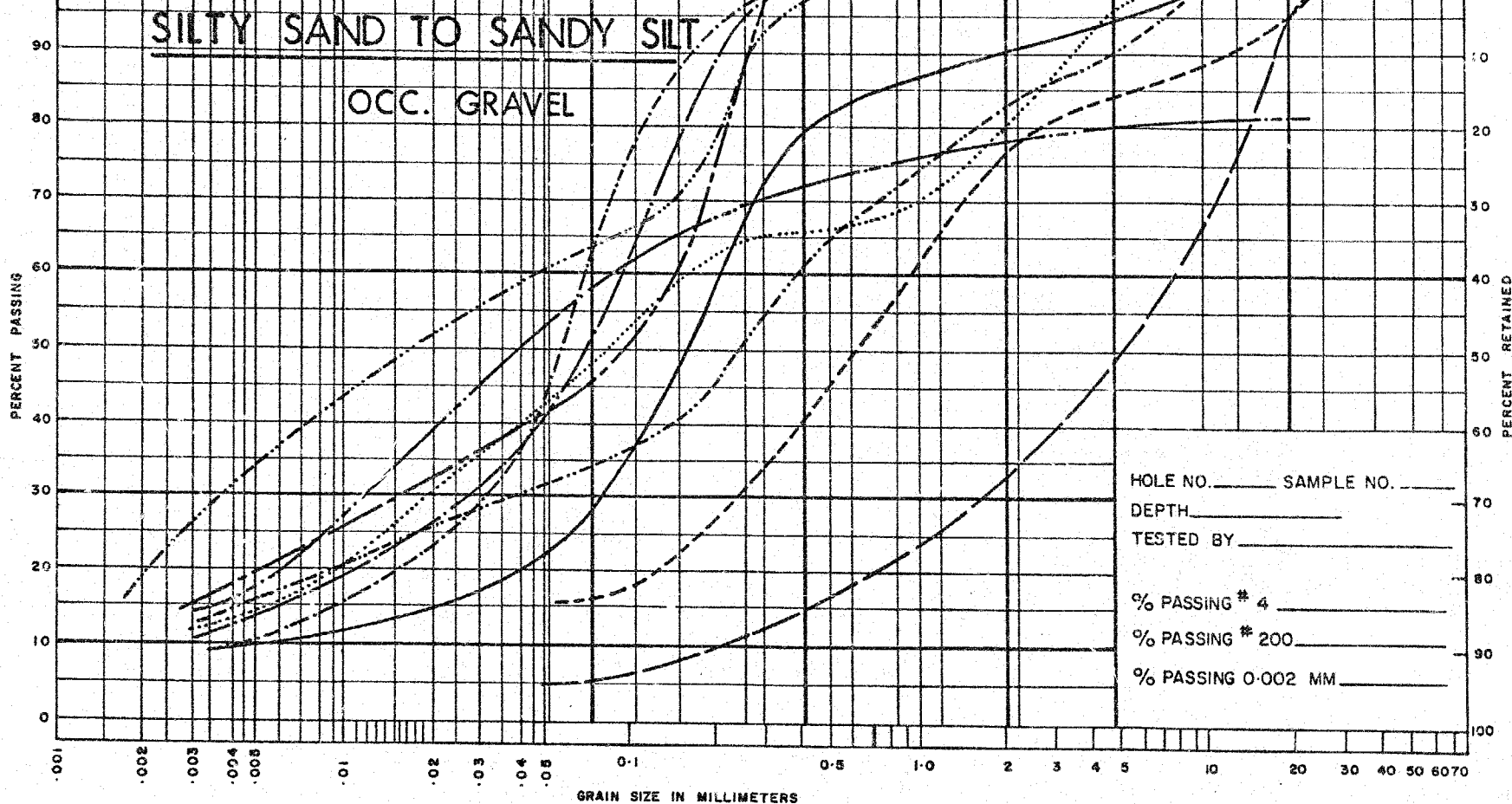
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 16 10 8 4 3/8 1/2 3/4 1 1 1/2 2 2 1/2 3 0



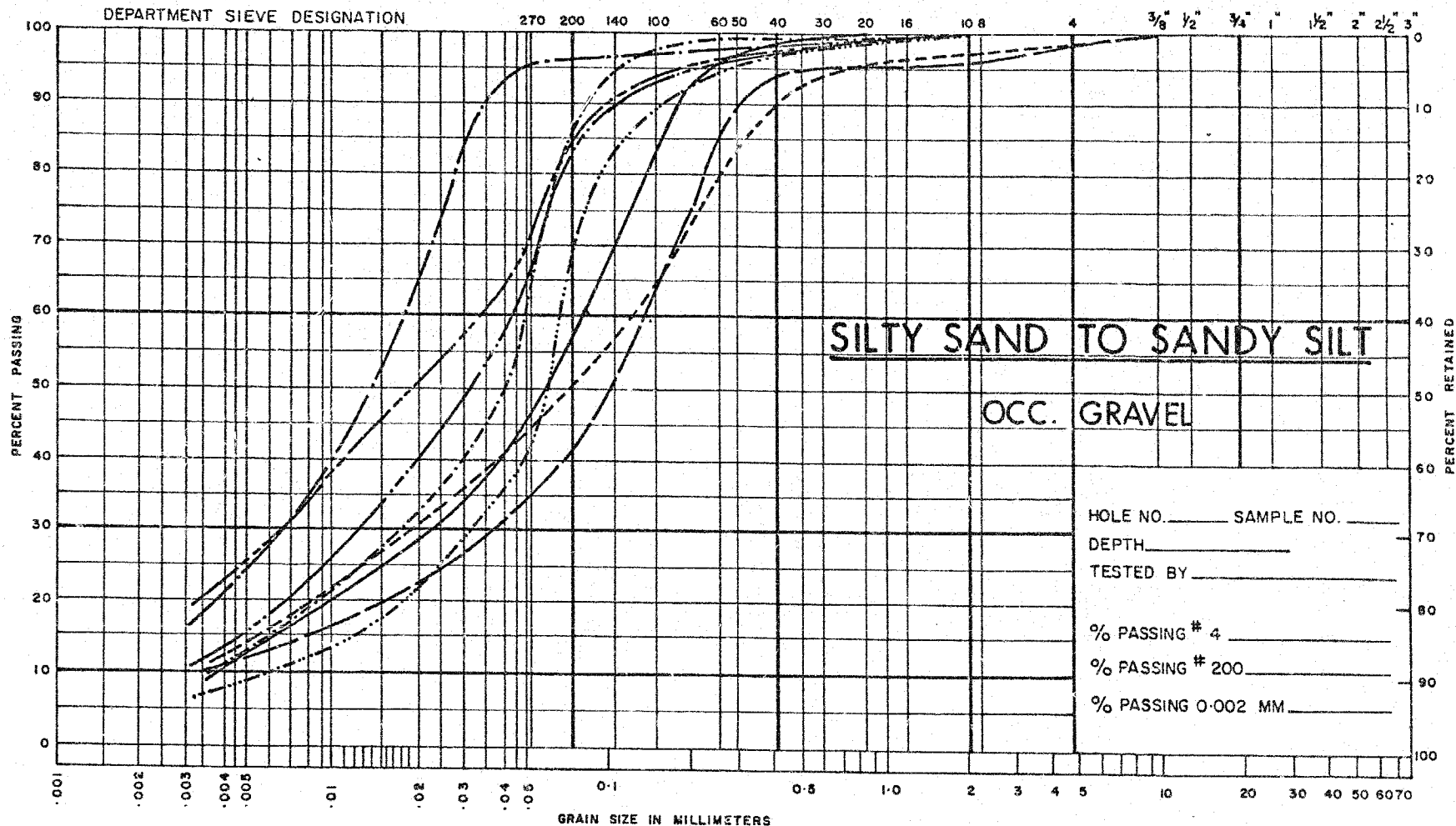
HOLE NO. _____ SAMPLE NO. _____
 DEPTH _____
 TESTED BY _____
 % PASSING # 4 _____
 % PASSING # 200 _____
 % PASSING 0-002 MM _____

NOTES	B.H. 6, SA. 29	B.H. 8, SA. 24
"	6, " 30	" 8, " 25
"	7, " 2	" 8, " 27
"	7, " 32	" 8, " 29
"	8, " 21	" 8, " 30

DEPARTMENT OF HIGHWAYS — ONTARIO
 MATERIALS & TESTING DIVISION
GRAIN SIZE DISTRIBUTION
 JOB NO. 65-F-40 W.P. NO. _____
 LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse



NOTES B.H. 9, SA. 22	BH. 10, SA. 32
" 9, " 24	" 11, " 12
" 9, " 26	" 11, " 22
" 10, " 29	" 11, " 25

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS & TESTING DIVISION
GRAIN SIZE DISTRIBUTION

JOB NO. 65-F-40 W.P. NO. _____

LOCATION HWY. 400 EXT. to EGLINTON AVE.

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt

Sand

Gravel

Fine

Medium

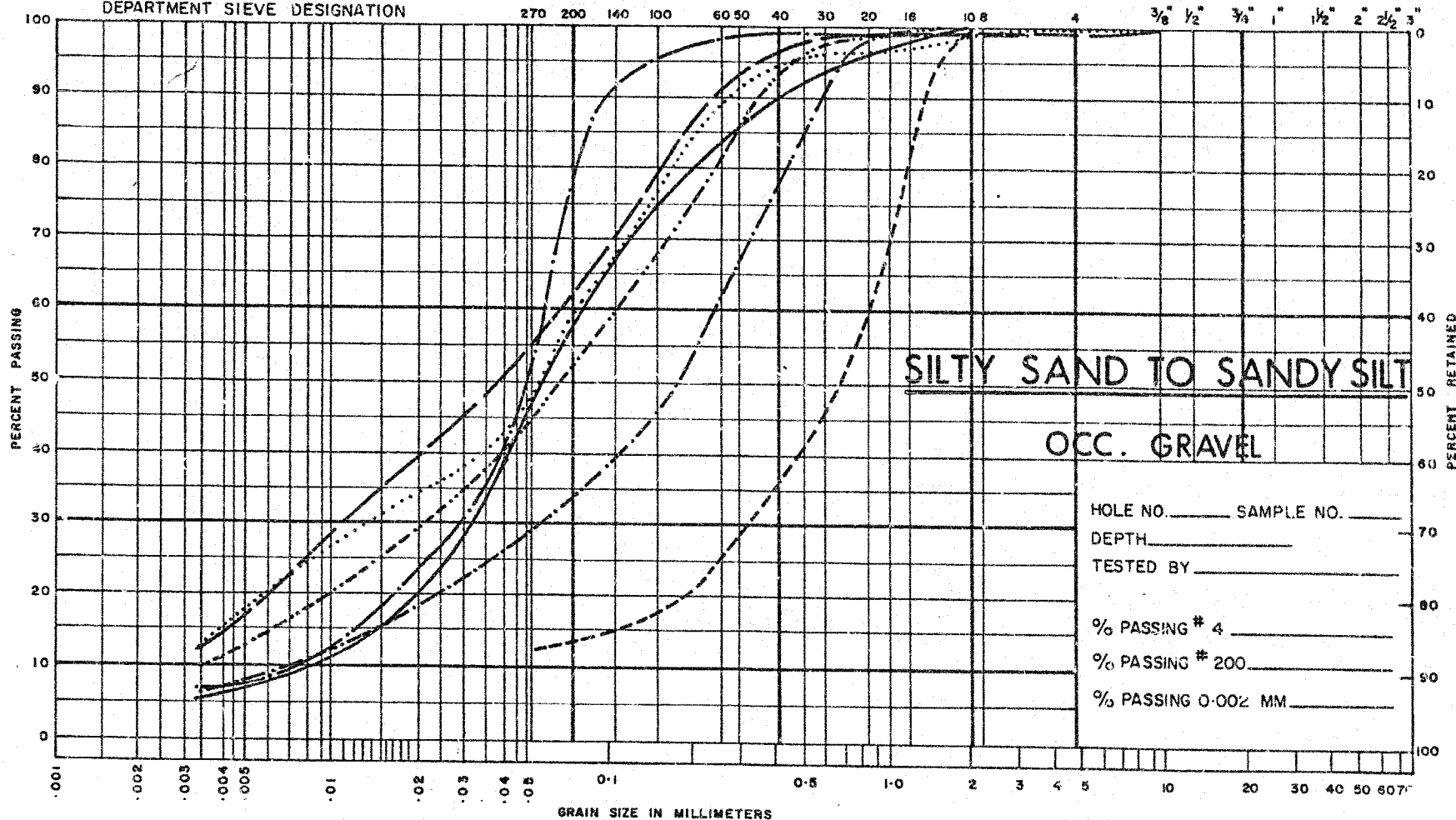
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

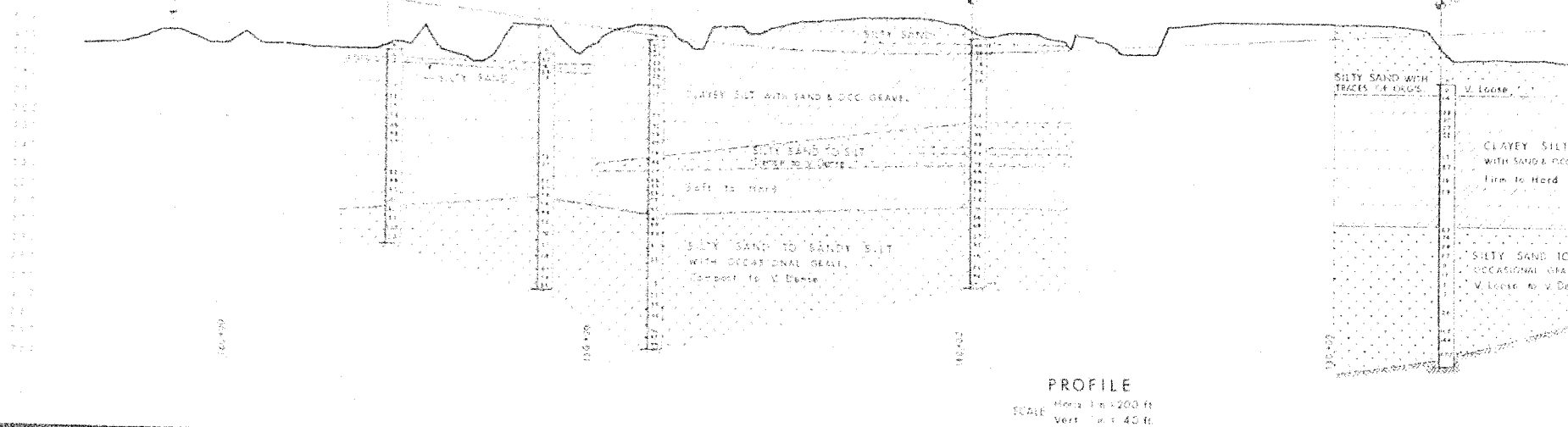
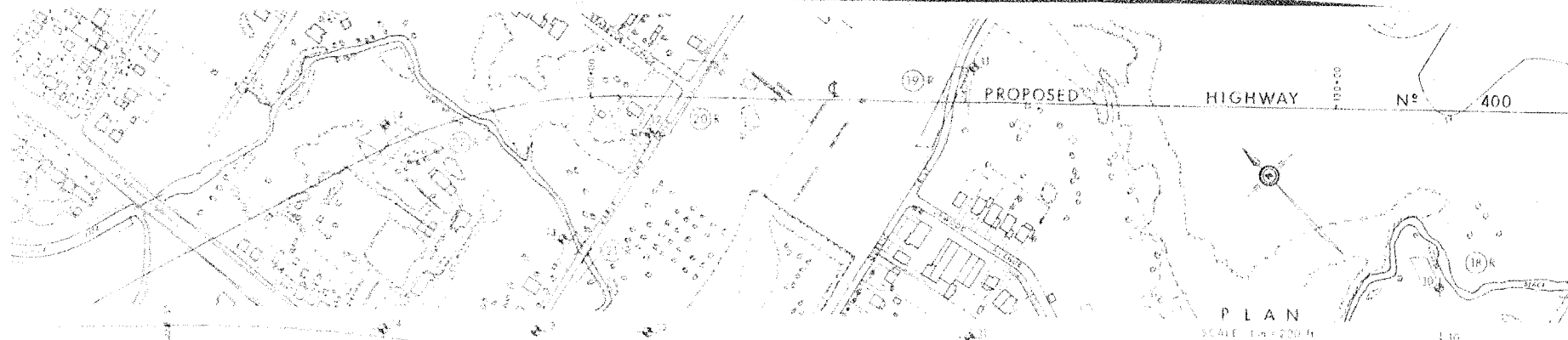
270 200 140 100 60 50 40 30 20 16 10 8 4 3/8" 1/2" 3/4" 1" 1 1/2" 2" 2 1/2" 3"

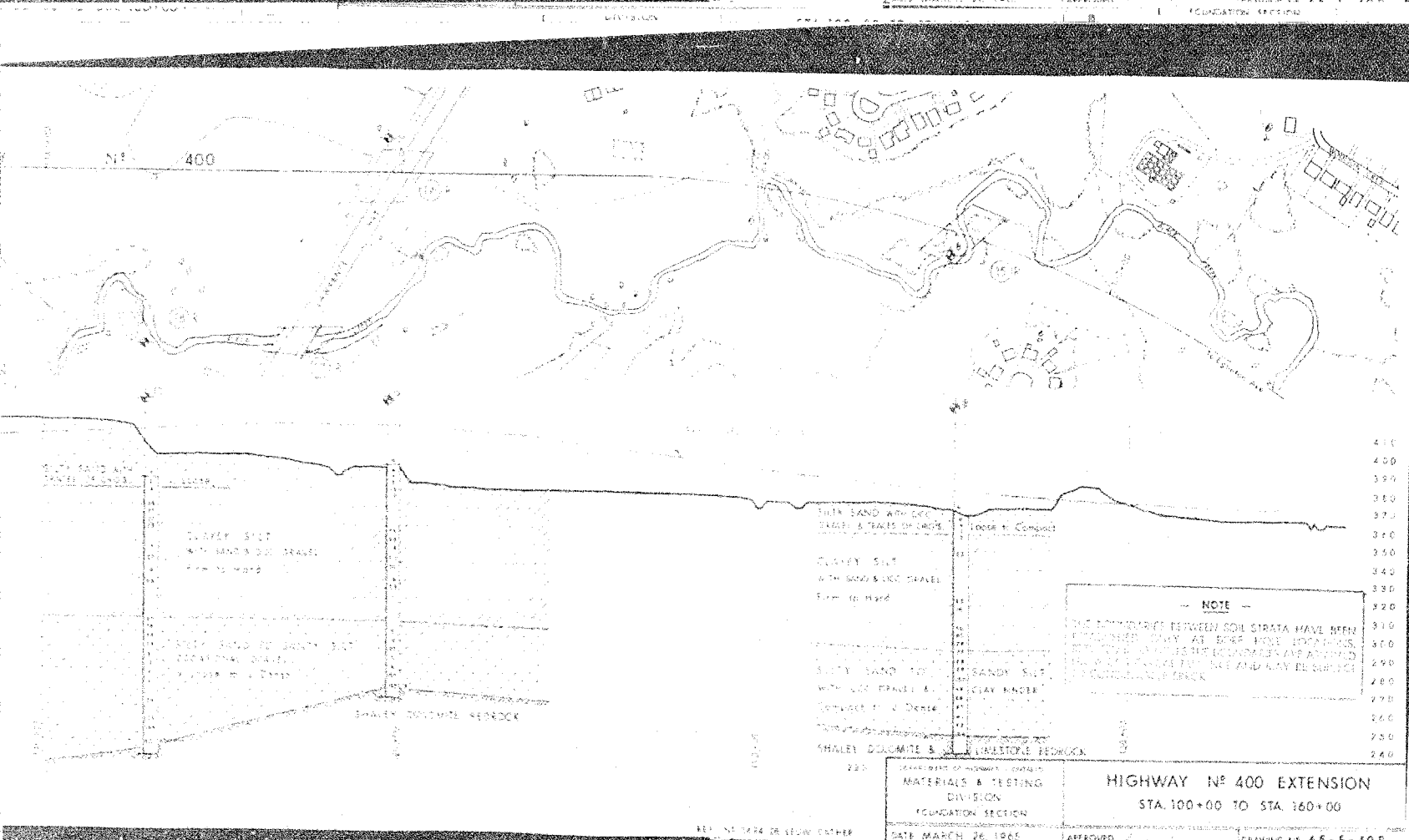


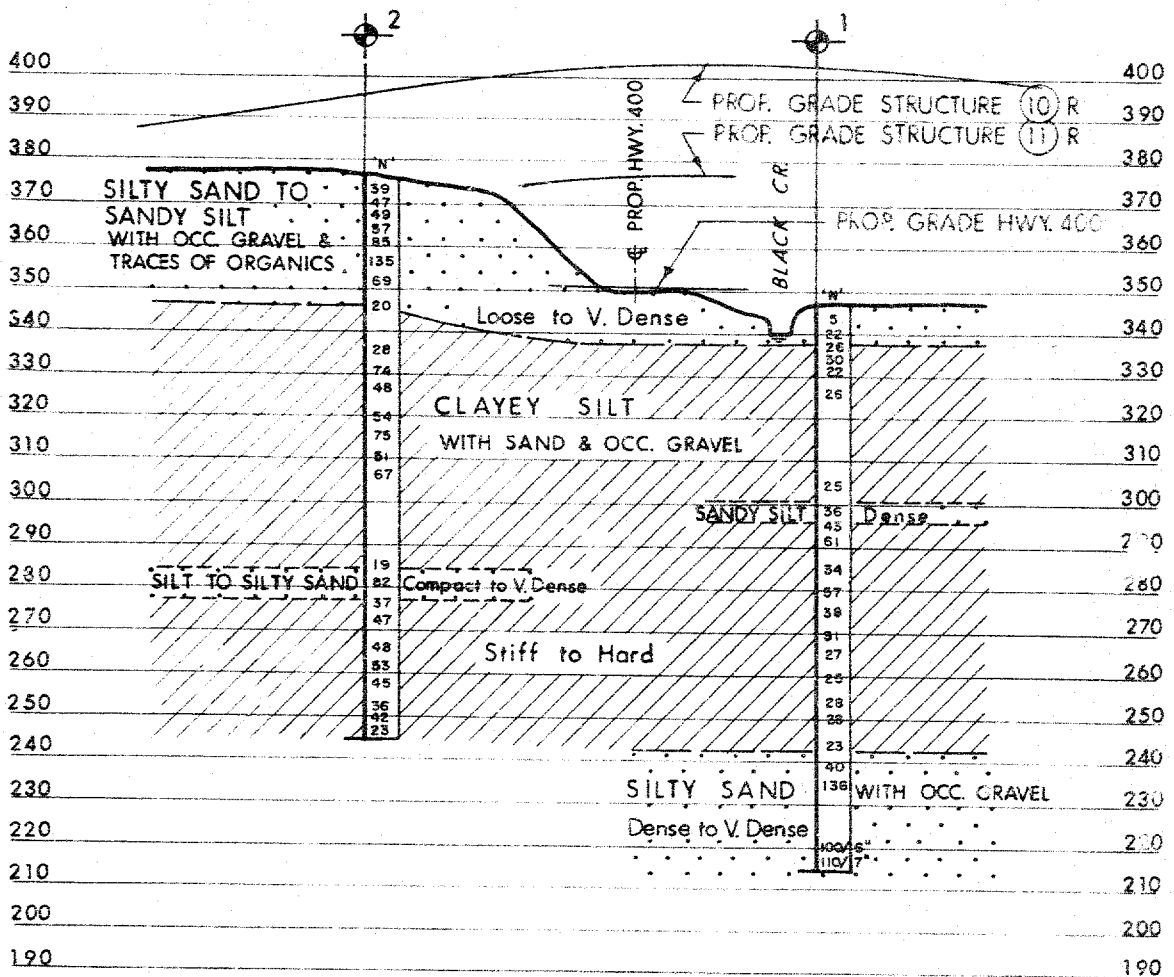
NOTES	B.H. 12, SA. 23	B.H. 13, SA. 20
" 12 " 24	-----	" 13 " 27
" 12 " 28	-----	" 14 " 22
" 12 " 29	-----	

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS & TESTING DIVISION
GRAIN SIZE DISTRIBUTION

JOB NO. 65-F-40 W.P. NO. _____
LOCATION HWY. 400 EXT. to EGLINTON AVE.







SECTION AT RICHVIEW EXPRESSWAY

SCALE: 1 in. = 200 ft.

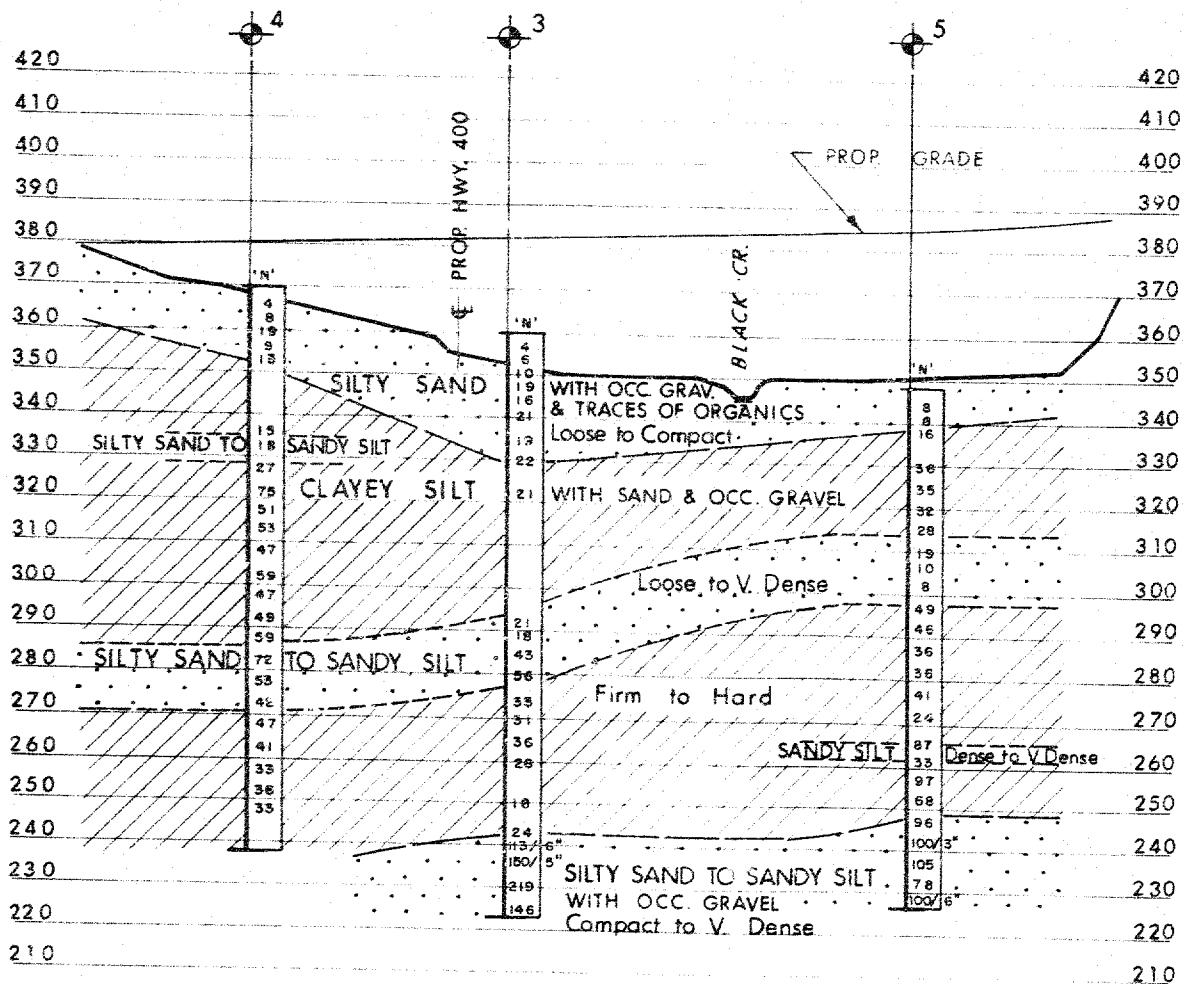
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING
DIVISION
FOUNDATION SECTION

HIGHWAY NO. 400 EXTENSION RICHVIEW EXPRESSWAY

DATE MARCH 25, 1965

APPROVED

DRAWING NO. 65-F-40 C



SECTION AT EGLINTON AVENUE

SCALE 1 in. = 200 ft.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING
DIVISION
FOUNDATION SECTION

HIGHWAY N° 400 EXTENSION
EGLINTON AVENUE

DATE MARCH 25, 1965

APPROVED

DRAWING N° 65 - F - 40 D

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- 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 :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Q _u	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS 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
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
C_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
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 (YOUNG'S 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_0	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

HIGHWAY 401 IMPROVEMENT - JANE STREET WESTERLY
HIGHWAY 400 EXTENSION
HIGHWAY 27 - Q.E.W. IMPROVEMENT

MINUTES OF THE SIXTY-FOURTH MEETING OF THE
DEPARTMENT OF HIGHWAYS OF ONTARIO AND
DE LEUW, CATHER & COMPANY OF CANADA LIMITED

Held at the Offices of:

De Leuw, Cather & Company of Canada Limited
1127 Leslie Street, Don Mills, Ontario, on
Wednesday, June 2, 1965, at 9:30 a.m.

PRESENT:

Department of Highways of Ontario

R. Strain	W. Friedmann
M. Gvildys	R. Oddson
J. Curtis	B. Giroux
K. Jorns	

De Leuw, Cather & Company of Canada Limited

R. Barr	S. Cumming
N. Rethy	M. Bishop
D. Woods	

The Minutes of the Meeting held on May 19th, 1965 were reviewed.

ITEM NO. 9 OF JUNE 2, 1965 MEETING

Mr. Friedmann will check on obtaining copies of the as constructed prints on Highway 27 north of Evans as well as on the Q.E.W. The sections east of Highway 27 and south of Evans were done previously by De Leuw Cather and will be obtained from their own files.

The following new points were covered:

HIGHWAY 401 IMPROVEMENT:

1. The method of issuing plans covering the revision of ramp W-S, Highway 400-401 was discussed. It was decided that 3 sets of prints will be sent to the district with a copy of the D-4 and quantity calculations. One set of plans with a copy of the D-4 and quantity calculations will be sent to the Region. Revised roadway mylars will be sent to the Region for issuing in the normal manner.

Tracings and D-4 Estimate of Toe Wall 8 and retaining wall 10 will be forwarded to Mr. Gvildys for checking.

2. The new locations for the Lighting Substation and the Hydro Transformer station were discussed. It was noted that North York prefer the location at Pelmo and Gary Drive as it is closer to their load centre. Soils data has been requested for this location and should be available shortly. De Leuw Cather will confirm with North York that they will relocate to this location.

It was decided to locate the Lighting Substation at Pellatt and Pelmo. This would save the cost of extending the lighting plan to the Gary Drive location and would cut down on Hydro loss. These combined savings would offset the cost of acquiring property at Pellatt.

3. At Ramp W-E-401 Bridge No. 2 falsework will be erected over the westbound collector at the time of its construction (Stage II).

When traffic has been shifted to the Collector, the balance of the falsework over the existing lanes of Highway 401 W.B. will be erected. Stage IV.

4. Mr. Giroux was given a coloured key plan showing utilities in the Islington Interchange so that locations can be field checked prior to construction.
5. It was noted that as the Islington Avenue Highway 401 job is nearly complete, the contract plans will be issued with base details on the back of the mylar. Mr. Farren's memo re Use of Mylars for Contract Plans was reviewed. It was pointed out that using mylar with base detail on the front would make the drafting more difficult where erasures are made. Mr. Friedmann asked that De Leuw Cather send him a letter listing our comments on the proposed system.

Q.E.W. - HIGHWAY 27:

6. De Leuw Cather will arrange a preliminary meeting with Consumers Gas and Department of Highways to discuss the location of gas mains in the Q.E.W. - Highway 27 area.

The next meeting will be held on June 16th, 1965 at 9:30 a.m.

Russell Barr

R.J.A. Barr,
Assistant Highway Engineer.

cc: W. Friedmann (16)
B. Davis (3)
J. Thatcher (1)
R. Strain (1)
K. Jorns

G.G. Stewart
W.E. Carroll
C.M. Bishop
S. Cumming
R.J.A. Barr

M.R. Rethy
R.J. Walker

DISTRICT 6

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

65-1-40

To: Mr. A.C. Stermac,
Principal Foundation Engineer.

From: T.J. Kovich.

DATE: December 10th, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT:

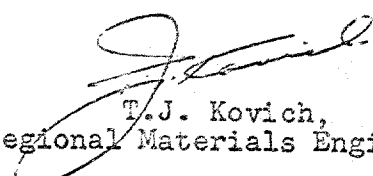
Hwy. #400, Jane Street to Eglinton Avenue,
(No Work Projects Numbers Assigned Yet).

The firm of DeLeuw Cather & Co. of Canada has been engaged by the Department to prepare a feasibility study and functional report for the above-noted section of proposed highway. In this regard, I had a call from John Hurst of the Consultants asking that we provide preliminary information at the proposed structure sites. The data required would have to be sufficient to permit them to get a rough idea of the type of foundations needed and also whether the sites chosen are the most practical from a foundation standpoint. Since all of this will require a good deal of work, I contacted Roy Burnfield to ensure that this was the scale of information required. He assured me that it was and that it was also a departure from the usual general information required by Functional Planning.

Mr. Hurst has indicated to me that necessary plans and field layout will be provided by his office. If you have any further queries, please feel free to contact Mr. R. Burnfield at 3581, Mr. John Hurst of DeLeuw, Cather at HU-1-5661 or myself.

TJK/hd

c.c. A. Rutka,
N.D. Smith,
T.J. Kovich,
Files.


T.J. Kovich,
Regional Materials Engineer.

WORK IN PROGRESS

BY D.H.C.

FEB. 1965.

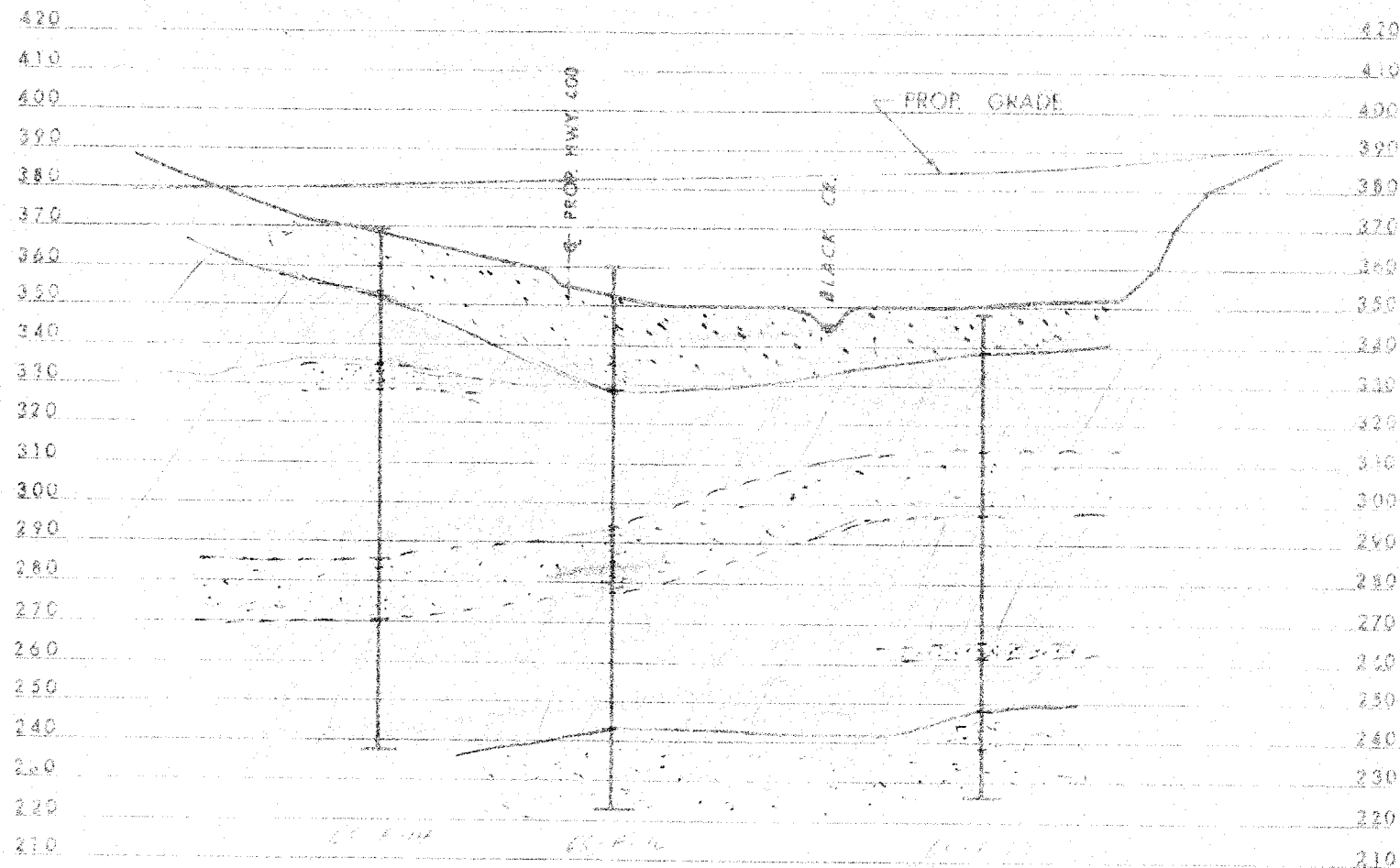
AGS

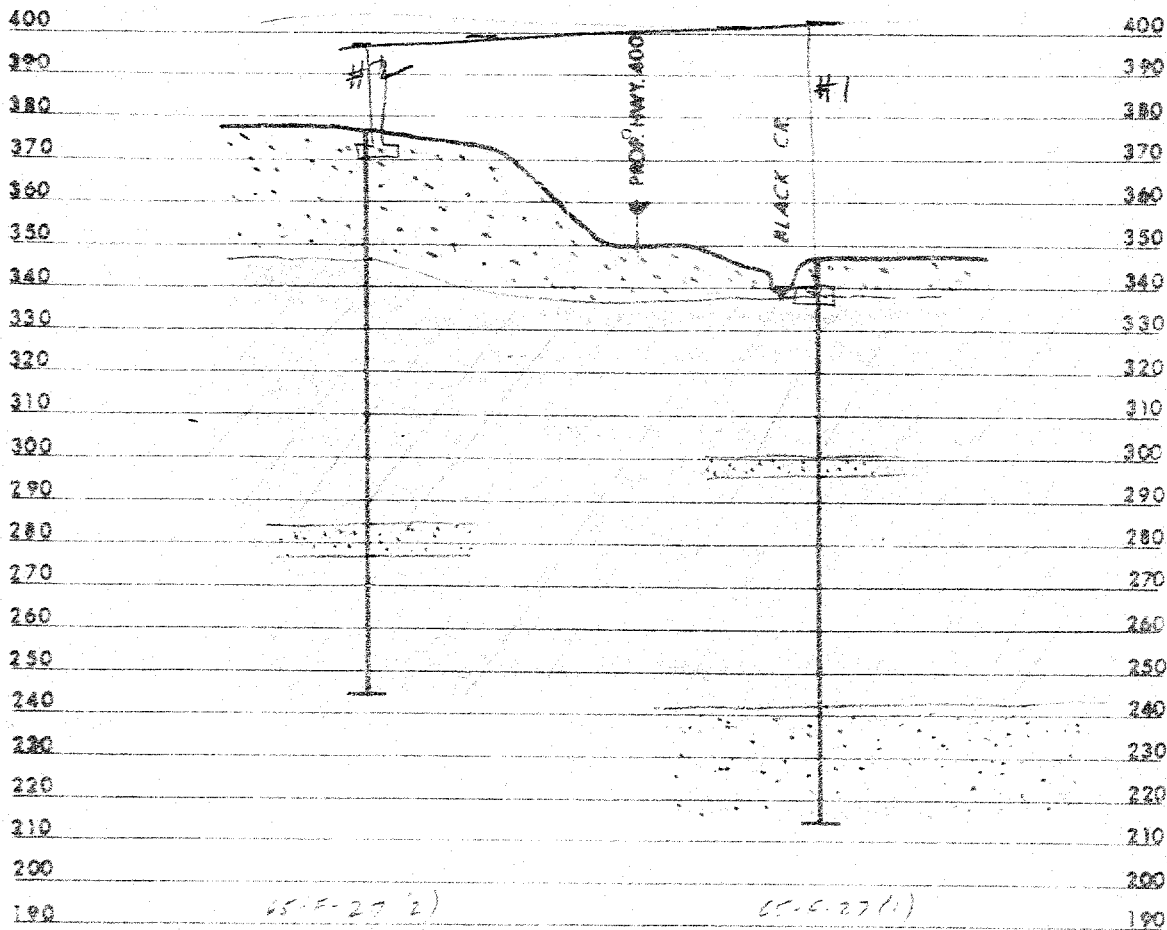
HIGHWAY 400 EXTENSION TO EGLINTON AVE.
(STRUCTURES)

W.J.	Bridge No.	Location -- Description
65-F-10	14R	Trethewey Dr. Overpass.
65-F-11	20R	Maple Leaf Dr. Underpass.
65-F-12	21R	Black Ck. Bridge at Maple Leaf Dr.
65-F-13	14R-a	Side Street Overpass.
65-F-14	9B	Ramp (N-W) Underpass at Eglinton Ave.
65-F-15	22R	Black Ck. Bridge between Jane St. and Maple Leaf Dr.
65-F-16	10B, 12R	Ramp (N-W) & #400 Underpass at Eglinton Ave.
65-F-17	19R	Queen's Ave. Underpass.
65-F-18	16R	Lawrence Ave. Overpass.
65-F-19	13R	Black Ck. Bridge near Eglinton Ave.
65-F-20	18R	Black Ck. Bridge N. of Lawrence Ave.
65-F-26	15R	Black Ck. Bridge S. of Lawrence Ave.
65-F-27	10R, 11R	Hwy. 400 & Richview Expressway Interchange.

Highway 400 Extension to EGLINTON (BOREHOLE DATA)

W.J.	BH	STA	OFFSET	GROUND ELEV.	DEPTH	
65-F-10	1	70+57	65'L	357.0	135.0	✓
65-F-11	1	148+43	75'L	404.0	166.5	✓
65-F-12	1	151+45	380'L	396.0	126.5	✓
65-F-13	1	65+28	21'R	353.0	115.0	✓
65-F-14	1	52+10 51+85	240'L 220'L	369.0	131.5	✓
65-F-15	1	155+60	60'R	397.0	105.0	✓
65-F-16	1	51+10	53'R	360.0	136.5	✓
65-F-17	1	139+80	95'R	407.0	133.5	✓
65-F-18	1	120+32	95'R	394.0	127.0	✓
65-F-19	1	52+75	525'R	348.0	121.5	✓
65-F-20	1	127+15	475'L	385.0	153.0	✓
65-F-26	1	104+50	60 70'L	372.0	131.8	✓
65-F-27	1	44+30 43+95	180'L 165'R	347.0	131.5	✓
	2	47+15	265'L	377.0	131.5	✓





HIGHWAY 400 EXTENSION TO EGLINTON AVE.
(STRUCTURES)

65-F-40
B.H. No.

	W.J.	Bridge No.	Location -- Description
7	65-F-10	14R	✓ Trethewey Dr. Overpass.
12	65-F-11	20R	✓ Maple Leaf Dr. Underpass.
13	65-F-12	21R	✓ Black Ck. Bridge at Maple Leaf Dr.
6	65-F-13	14R-a	Side Street Overpass.
4	65-F-14	9B	Ramp (N-W) Underpass at Eglinton Ave.
14	65-F-15	22R	✓ Black Ck. Bridge between Jane St. and Maple Leaf Dr.
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10	65-F-20	18R	✓ Black Ck. Bridge N. of Lawrence Ave.
8	65-F-26	15R	✓ Black Ck. Bridge S. of Lawrence Ave.
1, 2	65-F-27	10R, 11R	✓ Hwy. 400 & Richview Expressway Interchange.

DISTRICT 6

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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Principal Foundation Engineer.

FROM: T.J. Kovich.

DATE: December 10th, 1964.

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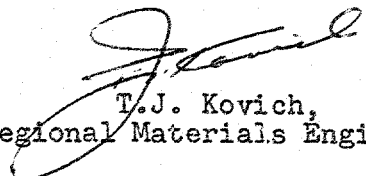
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