

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: January 30, 1970

OUR FILE REF.

IN REPLY TO

FEB - 6 1970

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
STRUCTURE #7, 8 and 9
Proposed Overpasses at the Crossing
Of the Realigned Q.E.W. and
Proposed Lakeshore Blvd. Ramps
Twp. of Etobicoke - County of York
District No. 6 (Toronto)
W.J. 69-F-77 - W.P. 314-65-8, 9 & 10

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/KSeF
Attach.

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

cc: Messrs. D. R. Davis
A. A. Fragasakes
D. W. Farren
C. K. Hunter (2)
F. C. Allen
W. S. Melnyshyn (2)
T. J. Kovich
B. A. Singh

Foundations Office
Gen. Files

COPY ALSO SENT TO
FENCO

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE AND GEOLOGY.
 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL AND BEDROCK CONDITIONS:
 - 4.1) General.
 - 4.2) Fill Material.
 - 4.3) Clayey Silt Stratum.
 - 4.4) Clayey Silt with Sand and Gravel - (Glacial Till).
 - 4.5) Shale Bedrock.
 5. GROUNDWATER CONDITIONS.
 6. EXISTING STRUCTURES AND APPROACH FILLS.
 7. DISCUSSION AND RECOMMENDATIONS:
 - 7.1) General.
 - 7.2) Abutment Foundations.
 - 7.3) Approaches.
 8. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
STRUCTURES #7, 8 and 9
Proposed Overpasses at the Crossing
Of the Realigned Q.E.W. and
Proposed Lakeshore Blvd. Ramps
Twp. of Etobicoke - County of York
District No. 6 (Toronto)
W.J. 69-F-77 - W.P. 314-65-8, 9 & 10

1. INTRODUCTION:

Major reconstruction is proposed for the Q.E.W. complex, about 1/4 mile east of Mimico Creek, in the south-eastern portion of the Township of Etobicoke, Metropolitan Toronto. This complex will involve the construction of 5 structures and related retaining walls. In conjunction with this project, the Foundation Section was requested, in a memo from Mr. W. S. Melinyshyn, Regional Bridge Planning Engineer, Central Region, dated September 10, 1969, to carry out subsurface investigations at the proposed sites of all the structures and their ancillary elements. An investigation was subsequently carried out by this Section to determine the subsoil, bedrock and groundwater conditions at the respective structure sites.

This report deals with the proposed overpass structures at the crossing of realigned Q.E.W. and the proposed ramps leading to and from Lakeshore Blvd. One structure is the Q.E.W. crossing of the Lakeshore Blvd. Ramps 'E-L.S.B.' and 'L.S.B.-E' (designated as No. 7 - W.B.L. and No. 8 - E.B.L.), and the other is the Lakeshore Blvd. Ramp 'W-L.S.B.' crossing of the aforementioned ramps (designated as No. 9). All the factual data obtained at this site, together with recommendations pertaining to the foundations of the structures, as well as the stability and settlement of the approach embankments are contained in this report.

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

Foundation reports will be submitted for other structures, as well as for the retaining walls, all located within this interchange complex.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is situated immediately south of the C.N.R. tracks and west of the existing twin overpass structures carrying the Q.E.W. over the Lakeshore Blvd. ramp, in the Twp. of Etobicoke. The surrounding terrain is flat to gently undulating in relief between elevations 272 and 278; the gentle topography was often obtained by placing fill.

The C.N.R. has five main lines, as well as siding lines leading to the food terminal. The tracks are generally super-elevated on an embankment which is between 2 and 14 feet above the surrounding terrain.

The existing 180 and 220-foot long twin (E.B.L. and W.B.L.) Q.E.W. overpass structures have three lanes each. The profile grades of the Q.E.W. and the Lakeshore Blvd. ramp vary between elevations 304 to 307 and elevations 272 and 284, respectively. The associated east and west approach embankments have a maximum height of about 24 and 30 feet, respectively. The embankment slopes vary from 2:1 to 2.5:1.

Physiographically the site is situated in the "Iroquois Plain", specifically in the "Toronto" sub-section of this region. In this sub-section the predominant overburden deposit is composed of a clayey silt stratum some 20 to 30 feet thick; this deposit is of pre-Iroquoian age. The cohesive stratum is underlain by a thin basal glacial till sheet which, in turn, is followed by grey shale bedrock of the Meaford-Dundas formation, Ordovician Period.

3. FIELD AND LABORATORY WORK:

During the progress of the field investigation the Regional Bridge Planning Section advised us that major revisions for the proposed complex had been initiated by the design consultant. The borings, put down prior to this notification, have been included, as well as the strategically located borings for the modified complex. In all, a total of twenty-five boreholes, all of which were accompanied by a dynamic cone penetration test, were put down at the proposed site. The majority of the borings were advanced by a diamond drill rig adapted for soil sampling purposes. At a few boring locations the holes were put down by a Penndrill employing power auger techniques, at the majority of these locations bedrock was proven using the diamond drill rig .

Samples of the fill and parent overburden were recovered, at required depths, in a 2" O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for carrying out the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Wherever possible, these samples were supplemented by manually or hydraulically pushing 2" I.D. Shelby tube samples into the cohesive portion of the overburden. In addition, in situ field vane tests were carried out within the softer, more compressible portions of this stratum. Bedrock was proven in 16 of the borings, by obtaining BXL size rock core samples.

The groundwater level conditions across the site, at the time of the investigation, were determined by recording the water levels in all the open boreholes.

The location and elevation of all the borings were surveyed by personnel from the Central Region-Engineering Surveys Section. The borings are shown in plan on Drawing No. 69-F-77A. Estimated stratigraphical sections are shown on the aforementioned drawing. All elevations given in this report are referenced to a Geodetic datum.

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

All samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this examination, laboratory testing was carried out on selected representative samples to determine the following engineering properties of the overburden:

Bulk Densities
Natural Moisture Contents
Grain-size Distributions
Atterberg Limits
Undrained Shear Strengths
Consolidation Characteristics

The results of this testing are plotted on the Record of Borelog sheets and summarized on Figures 1 to 5, inclusive, all contained in Appendix I of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant parent stratum across the site is composed of a stiff to hard clayey silt with occasional silt layers throughout; the thickness of this deposit ranges from 4 to 24.5 feet. The cohesive stratum is generally overlain by fill whose composition ranges from loose to dense silty sand to sandy silt to stiff to hard clayey silt. The fill is anywhere from 1 foot (near the C.N.R. tracks) to 35.5 feet (existing west approach) in depth. The clayey silt is underlain by a thin basal glacial till sheet, which, in turn, is followed by fractured to sound shale bedrock.

The boundaries of the various deposits, are shown on the accompanying borelog sheets. The stratigraphical sections, plotted on Drawing No. 69-F-77A, have been inferred from this data.

From ground surface downwards, the various soil types encountered are as follows:

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

4.1) Fill Material:

Fill was placed over the majority of the site as part of the grading and levelling operations carried out for the C.N.R. and the Q.E.W. - Lakeshore Blvd. complex. The total thickness of this fill varies from about 1 foot (B.H.'s #21 and 112) to 15 feet (B.H. #22). However, along the existing approaches the thickness of the fill was found to be as much as 35.5 feet (refer to B.H. #115). The majority of the fill is composed of a stiff to hard ('N' values between 6 and 96 blows/ft.) grey-brown clayey silt, with pockets of silt and sand throughout. In certain areas the fill contains distinct zones of compact to dense ('N' values between 8 and 69 blows/ft.) silty sand to sandy silt with cinders, bricks and other extraneous material. These zones are up to 17 feet in total thickness (refer to B.H. #111). Grain-size curves, obtained on representative samples of the fill, are plotted on Figure #1, in Appendix I.

A thin layer of organic topsoil (less than 1.5 feet in thickness) was often encountered between the fill and the parent subsoil.

4.3) Clayey Silt Stratum:

Directly underlying the fill is the predominant stratum across the site, composed of a brown to grey clayey silt with a trace of sand. Numerous layers of silt up to 4" thick are randomly located throughout the stratum. The thickness of the clayey silt varies from 4 to 24.5 feet, being on the average about 14 feet thick. Grain-size distribution curves for samples of the clayey silt, as well as from the granular layers, are plotted on Figure #2.

The engineering properties of the stratum, as determined by field and laboratory testing, are presented in tabular form:

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

4.3) Clayey Silt Stratum: (cont'd.) ...

Identity Tests:

| | | <u>Range</u> | <u>Average</u> |
|---------------------------------|--------------|--------------|----------------|
| Bulk Densities (p.c.f.) | (γ) | 124.5 - 137 | (128) |
| Liquid Limit (%) | (W_L) | 20 - 41 | (28) |
| Plastic Limit (%) | (W_p) | 14 - 26 | (18) |
| Natural Moisture Content (%) | (w) | 13 - 30 | (20) |
| Liquidity Index | (I_L) | neg. - 0.7 | (0.3) |

Consolidation Characteristics:

| | | |
|---|------------------|-----------------------|
| Initial Void Ratio | (e_0) | (0.65 |
| Recompression Index | (C_R) | 1 (0.04 |
| Est. Degree of Precon- solidation (p.s.f.) | ($P_c - P_0'$) | Test (6000 to 10,000 |

Undrained Shear Strength (C_u)
(p.s.f.)

| | |
|----------------|-----------------|
| 1) Field Vanes | 1,100 to >2,000 |
| 2) Lab. Tests | 1,000 to >2,000 |

Standard Penetration Tests 'N'
(Blows/ft.)

6 - 112 (30)

The Atterberg limit tests, summarized above, are also plotted on the Plasticity Chart, Figure #4. These results indicate that the cohesive stratum is inorganic with a plasticity in the low to intermediate range. In the deposit the natural moisture content ranges randomly from a few percent below the plastic

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

4.3) Clayey Silt Stratum: (cont'd.) ...

limit to values between the liquid and plastic limits (liquidity indices up to 0.7).

Based on the undrained shear strength testing carried out, it is estimated that the consistency of the cohesive stratum varies from stiff to hard, being typically in the hard range. The aforementioned pattern was corroborated by the standard penetration testing carried out within the deposit.

The consolidation characteristics of the stratum were determined by carrying out one laboratory oedometer test, the results of which are shown as a Void Ratio vs. Pressure plot, on Figure #5. Based on the results of this test, as well as the testing carried out in conjunction with the other investigations in this area, it is estimated that the stratum is preconsolidated by between 6,000 and 10,000 p.s.f. in excess of the existing overburden pressure. The values of the initial void ratio (e_0) and the recompression index (C_p) are within the normal range for cohesive deposits encountered in this area.

4.4) Clayey Silt with Sand and Gravel - (Glacial Till):

The cohesive stratum is underlain by a very stiff to hard ('N' values 21 to greater than 100 blows/ft.) glacial till deposit composed of clayey silt with sand and gravel. The thickness of this deposit varies from 2.5 to 11 feet. Occasional random granular zones are present throughout the glacial till; in these areas the subsoil is composed of silt and sand binding gravel. At a few of the boring locations, particularly where the deposit was found to be most extensive, fragments of shale were encountered in the lower 2 to 4 feet zone. It was often necessary to use diamond drilling techniques to advance the borings through this lower zone. Grain-size distribution curves, for samples of the glacial till, obtained with 2" O.D. sampling equipment, are shown on Figure #3.

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

4.4) Clayey Silt with Sand and Gravel - (Glacial Till):
(cont'd.) ...

The Atterberg limit tests, carried out on samples of this deposit, are plotted on Figure #4. This testing indicates that the cohesive matrix has a plasticity in the low to intermediate range. The corresponding natural moisture content is consistently below the plastic limit.

4.5) Shale Bedrock:

The glacial till deposit is underlain by bedrock which was proven in 16 of the borings, by obtaining from 3 to 10 feet of BXL size rock core. Over the area under investigation the surface of the bedrock was found to vary between elevations 248 and 264. In general, it slopes in an easterly direction.

The bedrock is composed of a grey horizontally bedded shale, with occasional limestone interbeds. The upper 1 to 4 feet of the bedrock is generally in a fractured and jointed condition. Below this upper zone the bedrock is relatively sound.

5. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out, during the period of the investigation, in the open holes. The observations are recorded on the borelog sheets and summarized on Drawing 69-F-77A.

The recorded observations indicate that the groundwater level in the overburden deposits, at the time of the investigation, generally varies between elevations 270 and 281, which correspond to depths ranging from 6 to 15 feet below existing ground surface. In the vicinity of the existing approach fills, however, this range in groundwater levels corresponds to depths up to 32 feet below the profile grade of the Q.E.W.

5. GROUNDWATER CONDITIONS: (cont'd.) ...

At a few boring locations, put down in the vicinity of the C.N.R. tracks (B.H.'s #18, 101, 102 and 103), the groundwater level varies between elevations 283 and 288 - i.e., is considerably higher than elsewhere across the site.

6. EXISTING STRUCTURES AND APPROACH FILLS:

The bridge drawings for the existing multi-span overpass structures indicate that the foundations are supported on end-bearing piles, driven to practical refusal into the lower portion of the basal glacial till sheet or, alternatively, to bedrock. As discussed in Section 2), the height of the existing spill-through type embankments (with 2:1 to 2-1/2:1 slopes) vary from 24 to 30 feet.

Visual examination, carried out at the time of the investigation, indicates that:

i) the approach embankments are inherently stable. Further, no cracking or dishing was noticed along the Q.E.W. paved lanes. This would infer that no appreciable total or differential settlements have occurred, due to the surcharge loading of the subsoil; and

ii) the existing structures appear to be in a satisfactory condition.

7. DISCUSSION AND RECOMMENDATIONS:

7.1) General:

It is proposed to construct two overpass structures at the following crossings:

i) the realigned Q.E.W. (W.B. 4 lanes and E.B. 3 lanes) and the ramp to Lakeshore Blvd. ('E-L.S.B.'), designated as Structure No. 7 and 8. This will be a single-span (approx. 36 feet) structure with a total width of 200 feet.

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

7.1) General: (cont'd.) ...

11) The revised ramp from the eastbound lanes of the Q.E.W. to Lakeshore Blvd. ('W-L.S.B.') and the ramps to and from Lakeshore Blvd. ('E-L.S.B.' and 'L.S.B.-E') designated as Structure No. 9. This will be a single-span (approx. 115 feet) structure with a total width of 60 feet.

The proposed profile grade of the Q.E.W., over the centre-line of the Lakeshore Blvd. ramp ('E-L.S.B.') varies from elevation 306, at the north end of the structure (No. 7 and 8), to 315, at the south end. The corresponding profile grade of the ramp varies from elevation 283 (north end) to elevation 277 (south end). To reach the proposed profile grade of the Lakeshore Blvd. ramps it will be necessary to cut through the existing approaches; the depth of the cut will vary from a few feet (north end) to up to 30 feet (south end). The finalized height of the approaches, in the immediate vicinity of the structure, will vary from 23 feet (north end) to 38 feet (south end). The depth of cut and height of the approaches for overpass structure No. 9 will be similar.

The existing approach fills shall be heightened and widened and incorporated into the proposed east and west approaches, which shall be common to both structures. The approach embankments will have a maximum height of 34 feet.

Due to space restrictions between the proposed fills and existing adjacent elements, such as the C.N.R. tracks and the respective ramps, a number of retaining structures are proposed for this area (specifically, Retaining Walls R-6, 7, 8 and 9). Recommendations pertaining to the retaining walls will be given in detail in our Report W.J. No. 62-P-120.

The predominant deposit across the site, as far as foundation considerations are concerned, is a 4 to 24.5-foot thick stiff to hard clayey silt stratum, which is underlain by

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

7.1) General: (cont'd.) ...

a thin hard glacial till deposit, followed by shale bedrock. The overburden is generally overlain by fill, which varies anywhere from 1 to 35.5 feet in thickness. The maximum thickness was encountered where fill has been placed to form the approaches to the existing structures.

The presence of the clayey silt stratum is of primary importance as far as foundation design is concerned, since it will be necessary to ensure that it is not 'overstressed' by either the structure element or approach fill surcharge loadings. These aspects will be discussed in the sub-sections to follow:

7.2) Abutment Foundations:

The abutments of the respective structures could be founded on spread footings, using a safe bearing pressure of 2.5 t.s.f., provided they are located in the parent subsoil, the upper stratum of which is the stiff to hard clayey silt. In all cases 4 feet of earth cover should be provided to the underside of the footings for frost protection purposes. The profile grade of the Lakeshore Blvd. ramps increases in a northerly direction; as a result of this, the footings can be stepped in order to avoid deep foundation excavations. Taking the aforementioned aspects into consideration, it is estimated that the abutment footings, at the respective locations, could be founded at the elevations given in the following Table:

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

7.2) Abutment Foundations: (cont'd.) ...

REALIGNED Q.E.W. CROSSING OF THE LAKESHORE RAMPS
(Structure No. 7 and 8)

Estimated Footing Elevation

| | South End | → | Stepping up to | → | North End |
|---------------|-----------|---|----------------|---|-----------|
| West Abutment | 268 | → | | → | 274 |
| East Abutment | 273 | → | | → | 279 |

RAMP 'W-L.S.B.' CROSSING OF RAMP 'E-L.S.B.' and 'L.S.B.-E'
(Structure No. 9)

| | | | |
|---------------|-----|----|-----|
| West Abutment | 268 | to | 272 |
| East Abutment | 275 | to | 277 |

Adequate measures should be taken to ensure the overall stability of the temporary cuts, required to reach the profile grade of the Lakeshore Flvd. ramps.

The footing excavations will extend below the ground-water level recorded during the period of the investigation. No major dewatering problems are anticipated, however, in view of the relatively impervious nature of the subsoil. Any minor seepage or surface run-off occurring in the excavations could be handled by employing conventional techniques, such as pumping from sumps.

As an alternative, the abutment foundations could be founded on end-bearing piles driven to bedrock (for estimating pile tip elevations, refer to Drawing No. 69-2-77A). The piles can be designed for the maximum allowable load for the respective pile section selected (e.g., 12 IP 74 steel H-piles may be designed for 90 tons/pile).

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

7.2) Abutment Foundations: (cont'd.) ...

If the structure is designed as a rigid frame, then a coefficient of earth pressure at rest (K_0) of 0.5 should be assumed for the granular fill material behind the wall, when designing the abutments. However, if some movement of the top of the wall is permitted, then a coefficient of active earth pressure (K_a) of 0.33 can be used.

7.3) Approaches:

Immediately behind the west abutment, the approaches will have a maximum height of the order of 35 feet. Elsewhere, the embankments will have a maximum height of 34 feet above the existing ground surface. No stability problems are anticipated at the location of the closed-type abutments, or along the approach embankments.

The cohesive foundation subsoil will undergo settlement due to consolidation, over a period of time, under the weight of the approach embankments. The induced stresses will be less than the degree of preconsolidation of the cohesive subsoil. This being the case, the majority of the settlement will be of a recompression nature. Settlement computations were carried out, the results of which will be discussed herein.

The maximum amount of settlement will take place beneath the west approach, where the height of fill is up to 34 feet above existing ground surface. The computations indicate that the settlement at such locations could be of the order of 2-1/2 to 3 inches.

In certain areas the approach embankments will be formed by increasing the height of and widening the existing fills. Differential settlement, between the old and new fill sections, could be of the order of 1-1/2 to 2 inches. It is anticipated that the majority of the aforementioned settlement

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

7.3) Approaches: (cont'd.) ...

will take place during or immediately after construction of the fill sections.

In order to have a smooth transition from the existing fill to the new fill sections, it is recommended that:

i) all topsoil be stripped from the existing fill sections prior to placing future fill; and

ii) the future fill be "keyed" into the existing approaches in accordance with current D.H.O. methods.

8. MISCELLANEOUS:

The field work was performed during the period of October 17 to November 29, 1969. The equipment was owned and operated by Master Soil Investigation Limited, Toronto.

This report was written by Mr. B. T. Darrah, Senior Foundation Engineer; this project was under the general supervision of Mr. L. Devata, Supervising Foundation Engineer, who also reviewed this report.

January, 1970

APPENDIX I

FOUNDATION SECTION

BH 17 69-F-76

ORIGINATED BY BC

Oct. 16 & 17, 1969

COMPILED BY SO

Penndrill Washboring, BX Casing, BXL Rock Core

CHECKED BY *[Signature]*

| SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | | BULK DENSITY P.C.F. | REMARKS |
|----------------|--|-------------|---------|------|--------------|--|--|--|--|-----------------------------|--|-------------------------------|---|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | ELEV. SCALE | SHEAR STRENGTH PSF. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | WATER CONTENT % 10 20 30 | | | |
| 283.3 | Ground Level | | | | | | | | | | | | |
| 0.0 | Clayey silt to silt trace of sand (occ. pockets of silty sand) (Fill) Grey-Brown Stiff or compact | | 1 | SS | 18 | 280 | | | | | | | WL in open BH at G.L. on Nov. 6/69 0 4 86 10 |
| | | | 2 | SS | 22 | | | | | | | | |
| | | | 3 | SS | 13 | | | | | | | | |
| | | | 4 | TW | PM | | | | | | | | |
| 268.3 | | | | | | 270 | | | | | | | |
| 266.8 | Clay with organics | | 5 | SS | 7 | | | | | | | | |
| 16.5 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | | 6 | SS | 17 | 260 | | | | | | | |
| 257.8 | Very stiff | | | | | | | | | | | | |
| 25.5 | weathered & fractured Shale Bedrock | | 7 | BXL | 60% | | | | | | | | |
| | Interbeds of limestone | | 8 | BXL | 95% | | | | | | | | |
| 251.8 | Gray Sand | | | | | | | | | | | | |
| 31.5 | End of Borehole | | | | | 250 | | | | | | | |

FOUNDATION SECTION

CHECKED BY

Dynamic Cone Test

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION BLOWS / FOOT 20 40 60 80 100 | RESISTANCE | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L WATER CONTENT % 10 20 30 | BULK DENSITY γ P.C.F. G/CM ³ | REMARKS | |
|--------------|---|-------------|---------|------|--------------|-------------|--|------------|--|--|-----------------------|--|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | | | | | | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE |
| | | | | | | | | | | | | |
| 284.8 | Ground Level | | | | | | | | | | | |
| 0.0 | Clayey silt, trace of sand (occ. pockets of silty sand) Fill | | 1 | SS | 42 | 280 | | | | | WL in open BH at G.L. | |
| | Brown | | 2 | SS | 96 | | | | | | | |
| 273.8 | Hard | | 3 | SS | 77 | | | | | | | |
| 11.0 | Clayey silt, trace of sand (occ. layers of silt & sand up to 4" thick throughout) | | 4 | SS | 41 | 270 | | | | | 6 58 28 8 | |
| | | | 5 | SS | 112 | | | | | | | |
| 262.8 | Very stiff to hard. | | 6 | SS | 15 | | | | | | | |
| 260.3 | Glacial Till Hard | | | | | 260 | | | | | | |
| 24.5 | fractured | | | | | | | | | | | |
| 256.1 | Shale bedrock, interbeds of limestone, Grey. Sound | | 7 | BXL | 95% | | | | | | | |
| 38.7 | End of Borehole | | | | | 250 | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 19

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,864 N; 227,490 E.

ORIGINATED BY

BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 17 and 20, 1969

COMPILED BY

GP

DATUM Geodetic

BOREHOLE TYPE

Penndrill-Washborin-BX Casing-BXL Rock Core

CHECKED BY

SL

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W | | | BULK DENSITY Y | REMARKS |
|--------------|---|-------------|---------|------|--------------|-------------|--|----|----|----|-----|--|---|---|-------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | 20 | 40 | 60 | 80 | 100 | W _p | W | W | | |
| 285.4 | Ground Level | | | | | | | | | | | | | | | |
| 0.0 | Clayey silt, trace of sand (Occ. pockets of silt throughout) | | 1 | SS | 13 | | | | | | | | | | | |
| | Fill | | 2 | SS | 57 | | | | | | | | | | | |
| 274.4 | Brown and Grey Very stiff to hard | | 3 | SS | 57 | | | | | | | | | | | |
| 11.0 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout). | | 4 | SS | 40 | | | | | | | | | | | |
| 266.4 | Very stiff to hard | | 5 | SS | 19 | | | | | | | | | | | |
| 19.0 | Clayey silt, with sand & gravel (Glacial Till) | | 6 | SS | 22 | | | | | | | | | | | |
| 260.4 | Grey Hard | | | | | | | | | | | | | | | |
| 25.0 | Shale Bedrock Grey fractured | | 7 | BXL | 85% | | | | | | | | | | | |
| 256.3 | Sound | | | | | | | | | | | | | | | |
| 29.1 | End of Borehole | | | | | | | | | | | | | | | |

Cone

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x LAB. VANE

WATER CONTENT %
10 20 30

P.C.F. GR. SA. SI. CL.

▼ 277.8
WL in open
BH, Nov. 6/69

11 13 56 20

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 20

FOUNDATION SECTION

JOB 59-F-77

LOCATION

Co-ords. 183,937 N; 227,540 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 20, 1969

COMPILED BY GP

DATUM Geodetic

BOREHOLE TYPE

Penndrill-Power Auger; Cone Test

CHECKED BY

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT ——— w_L | | BULK DENSITY | REMARKS | | |
|--------------|--|-------------|--------|------|-------------|--------------------------------|----|-------------------------|----|-----------------|---------|----|-----|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLT. | NUMBER | TYPE | | BLOWS / FOOT | 20 | 40 | 60 | | | 80 | 100 |
| | | | | | | SHEAR STRENGTH P.S.F. | | w_p ——— w ——— w_L | | WATER CONTENT % | | | |
| | | | | | | ○ UNCONFINED + FIELD VANE | | | | 10 | | 20 | 30 |
| | | | | | | ● QUICK TRIAXIAL x LAB. VANE | | | | | | | |
| 285.3 | Ground Level | | | | | | | | | | | | |
| 0.0 | Clayey silt to silt, trace of sand | | | | | | | | | | | | |
| | Fill | | 1 | SS | 38 | | | | | | | | |
| 278.8 | Brown Hard | | 2 | SS | 50 | | | | | | | | |
| 6.5 | Clayey silt, trace of sand, occ. layers of silt up to 2" thick throughout) | | 3 | SS | 41 | | | | | | | | |
| | | | 4 | SS | 33 | | | | | | | | |
| | Grey | | 5 | SS | 38 | | | | | | | | |
| | Hard | | 6 | SS | 31 | | | | | | | | |
| 262.3 | | | | | | | | | | | | | |
| 260.3 | Glacial Till. Hard | | | | | | | | | | | | |
| 25.0 | End of Borehole Probably Bedrock | | | | | | | | | | | | |

120/8"

▼ 270.2

WL in open
BH, Nov. 6/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 21

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 184,008 N; 227,609 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 20 & 21, 1969

COMPILED BY GP

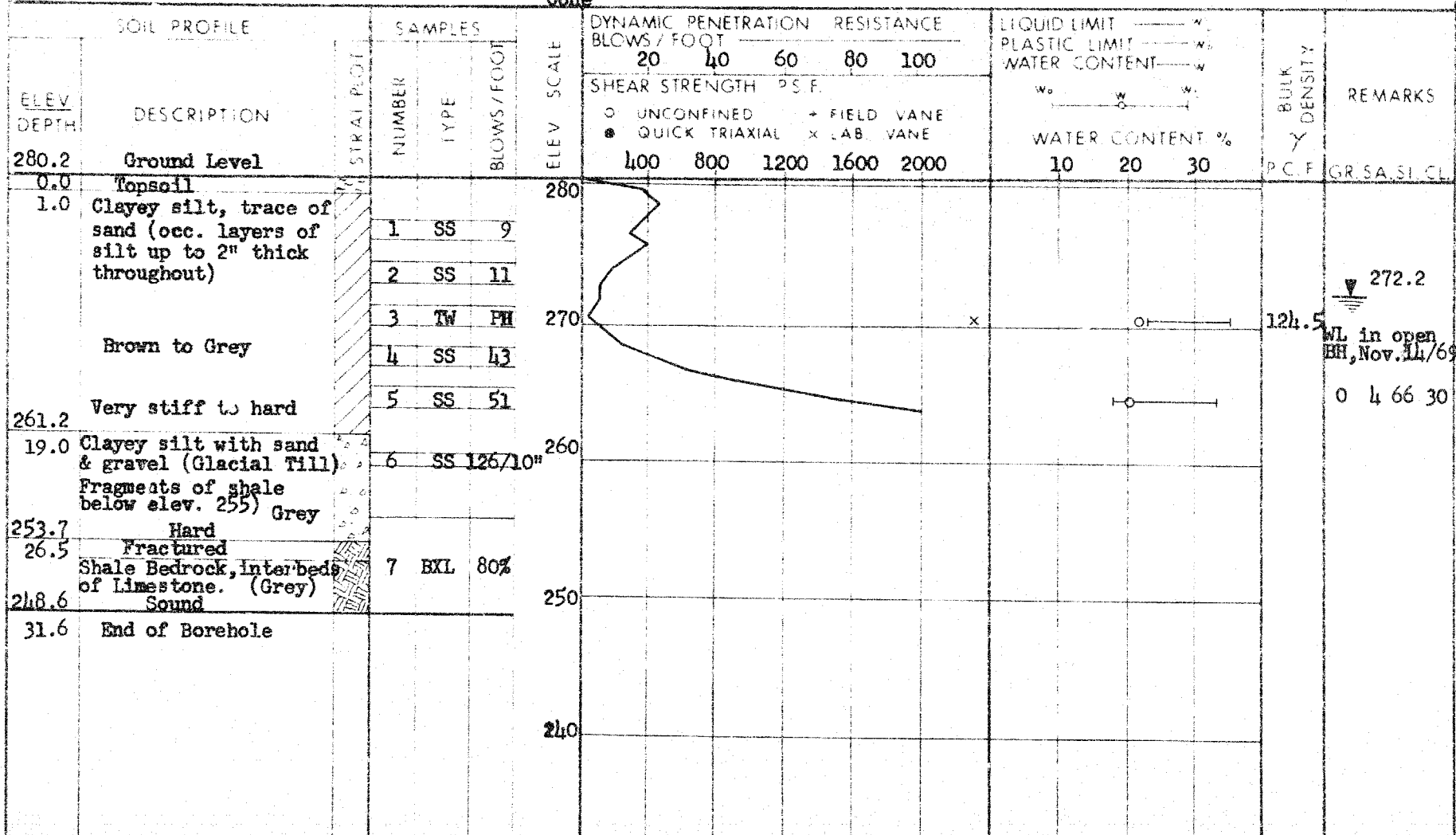
DATUM Geodetic

BOREHOLE TYPE

Pendrill-Washboring BX Casing - BXL Rock Core

CHECKED BY

Cone

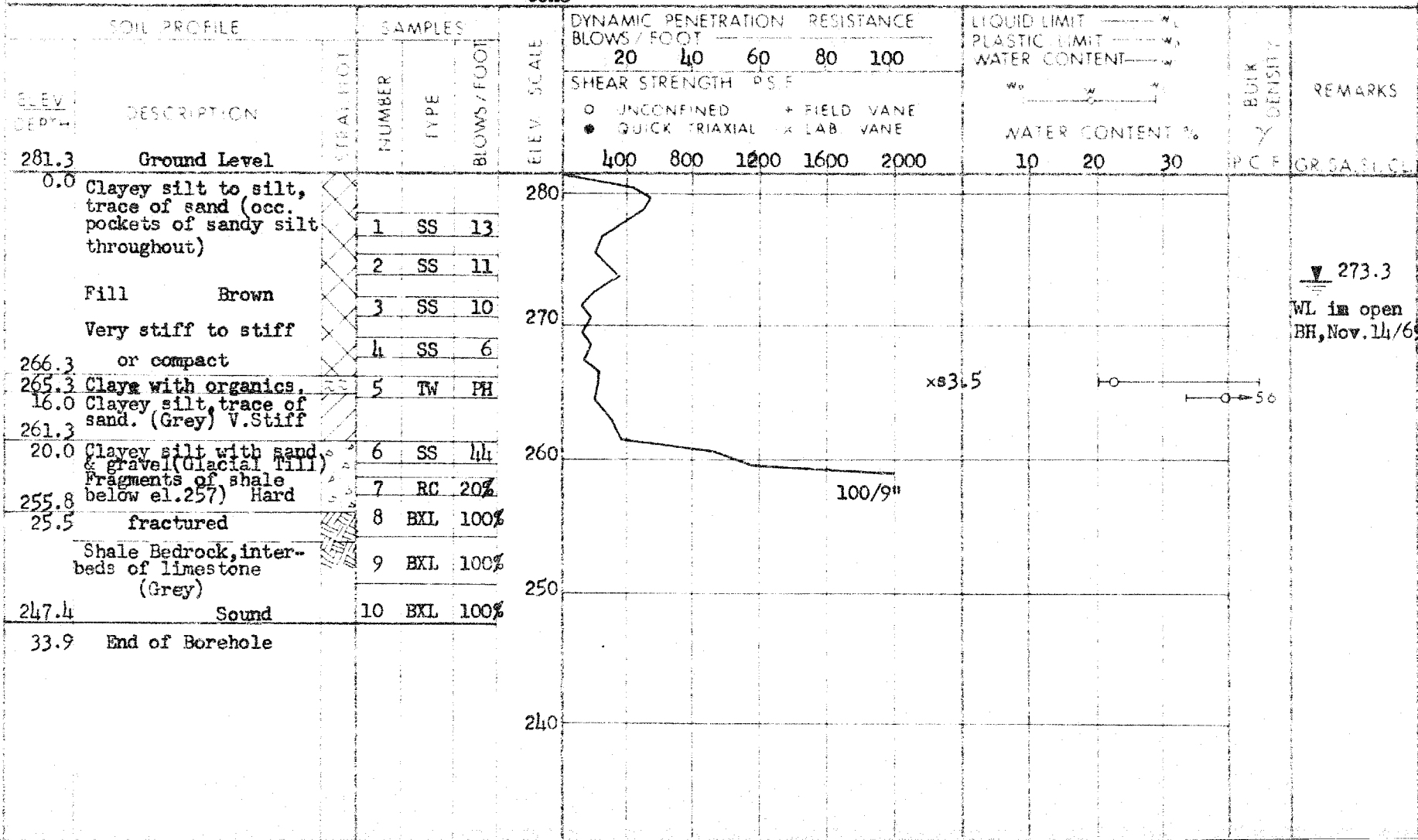


DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 22

FOUNDATION SECTION

JOB 69-F-77 LOCATION Co-ords. 184,080 N; 227,677 E. ORIGINATED BY BC
W P 314-65-8, 9 & 10 BORING DATE Oct. 20, 21 & 22, 1969 COMPILED BY GP
DATUM Geodetic BOREHOLE TYPE Penndrill-Washboring-BX Casing--BXL Rock Core CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 23

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 184,152N; 227,746 E.

ORIGINATED BY BC

W/P 314-65-8, 9 & 10

BORING DATE

Oct. 21, 22 & 23, 1969

COMPILED BY GP

DATUM Geodetic

BOREHOLE TYPE

Penndrill-Washboring-BX Casing-BXL Rock Core
Cone

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | | BULK DENSITY γ PCF | REMARKS | | | | | | | |
|--------------|-------------|-------------|---------|------|--------------|-------------|--------------------------------|----|----|----|----------------|--|-----------|------------|---------------------------------|---------|--|--|------|--|--|--|--|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | | | | | SHEAR STRENGTH PSF | | | | | w_0 ——— w ——— w_L WATER CONTENT % | | | | | | |
| | | | | | | | 20 | 40 | 60 | 80 | 100 | UNCONFINED | | FIELD VANE | | | | | | | | | |
| | | | | | | | | | | | QUICK TRIAXIAL | | LAB. VANE | | | | | | | | | | |
| | | | | | | | | | | | 400 | | 800 | | 1200 | | 1600 | | 2000 | | | | |

| | | | | | | | | | | | | | | | | |
|-------|---|--|---|-----|-----|--|--|--|--|--|--|--|--|--|--|--|
| 262.8 | Ground Level | | | | | | | | | | | | | | | |
| 0.0 | Sandy silt (Fill) | | | | | | | | | | | | | | | |
| 277.8 | Brown Compact | | 1 | SS | 20 | | | | | | | | | | | |
| 5.0 | Clayey silt to silt trace of sand (Fill) | | 2 | SS | 21 | | | | | | | | | | | |
| | Brown | | 3 | TW | PH | | | | | | | | | | | |
| 270.8 | Stiff to very stiff | | 4 | TW | PH | | | | | | | | | | | |
| 12.0 | Clayey silt, trace of sand (occ. layers of silt up to 2" thick throughout). | | 5 | SS | 11 | | | | | | | | | | | |
| | Brown to Grey | | 6 | TW | PM | | | | | | | | | | | |
| 258.8 | Stiff to very stiff | | 7 | BXL | 10% | | | | | | | | | | | |
| 24.0 | Clayey silt with sand & gravel (Glacial Till) shale fragments. Hard | | 8 | BXL | 50% | | | | | | | | | | | |
| 252.8 | Boulders up to 8" in size | | 9 | BXL | 95% | | | | | | | | | | | |
| 30.0 | fractured | | | | | | | | | | | | | | | |
| 250.3 | Shale Bedrock Sound | | | | | | | | | | | | | | | |
| 32.5 | End of Borehole | | | | | | | | | | | | | | | |

280

270

260

250

240

$s=5$

$\times s=3.5$

273.8

WL in open BH, Nov. 14/69

y 273.8

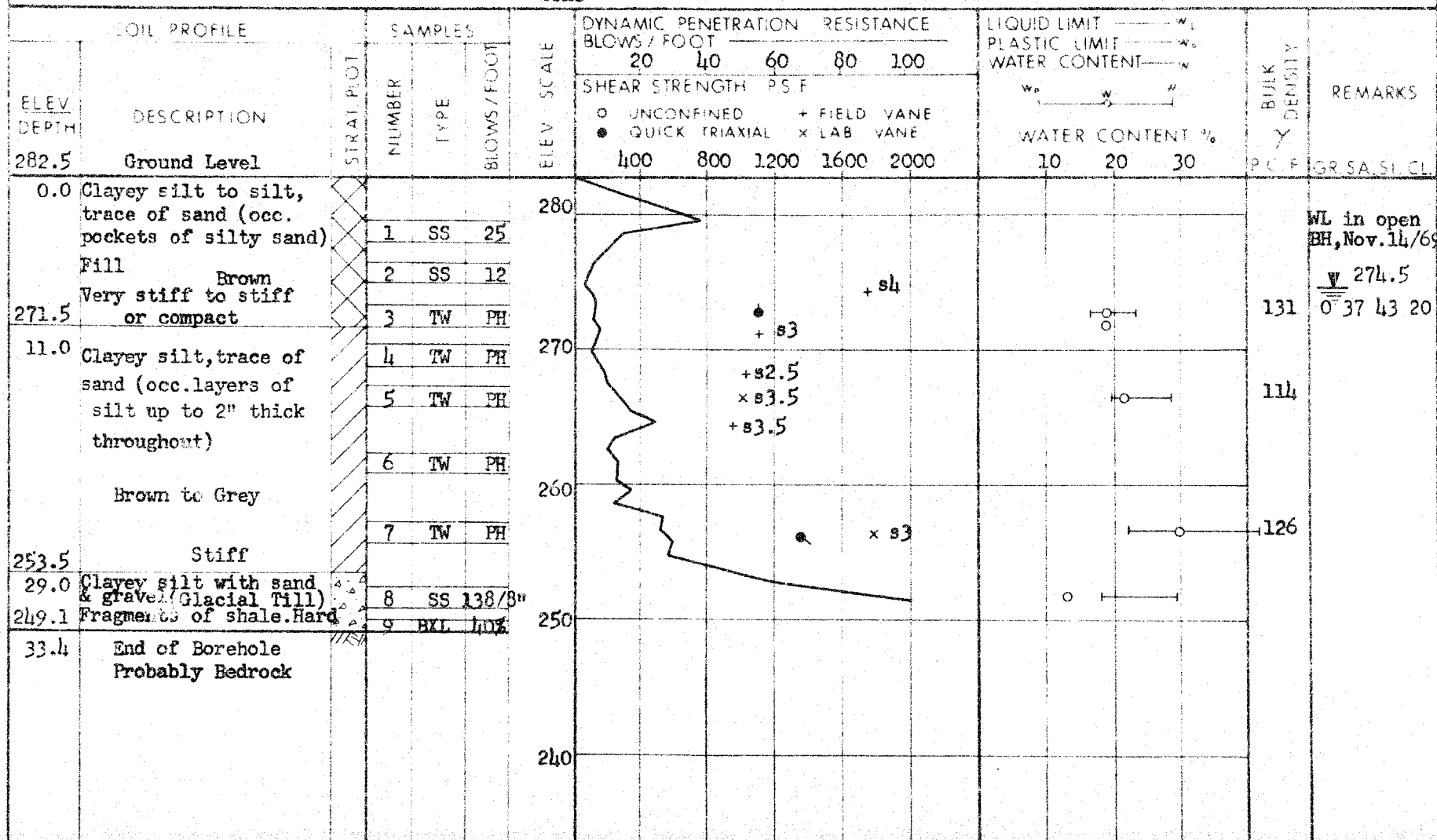
WL in open
BH, Nov. 14/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 24

FOUNDATION SECTION

JOB 69-F-77 LOCATION Co-ords 184,226 N; 227,816 E. ORIGINATED BY BC
W.P. 314-65-8, 9 & 10 BORING DATE Oct. 21 & 24, 1969 COMPILED BY GP
DATUM Geodetic BOREHOLE TYPE Penndrill-Washboring-BX Casing-BXL Rock Core CHECKED BY



DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 25

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 184,312 N; 227,899 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 22 & 24, 1969

COMPILED BY GP

DATUM Geodetic

BOREHOLE TYPE

Penndrill; Cone Test

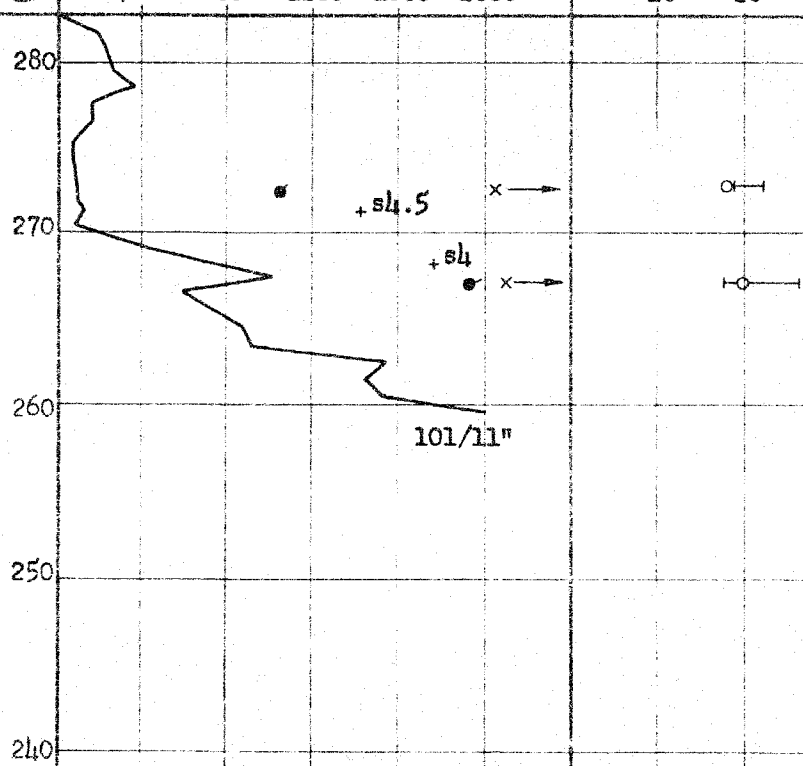
CHECKED BY

11/2

| 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 | | | | | w_p ——— w ——— w_L WATER CONTENT % 10 20 30 | | | | |
| | | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| | | | | | | | SHEAR STRENGTH P.S.F. | | | | | | | | | |
| | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | | | | | | | | |
| | | | | | | 400 | 800 | 1200 | 1600 | 2000 | | | | | | |
| 282.4 | Ground Level | | | | | | | | | | | | | | | |
| 0.0 | Clayey silt to silt, trace of sand & organic matter (occ. pockets of sand) Fill | | 1 | SS | 17 | | | | | | | | | | | |
| | Brown | | 2 | SS | 15 | | | | | | | | | | | |
| 271.4 | Very stiff or compact | | 3 | TW | PH | | | | | | | | | | | |
| 11.0 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | | 4 | TW | PM | | | | | | | | | | | |
| | Brown to Grey | | 5 | TW | PH | | | | | | | | | | | |
| 258.4 | Stiff to very stiff | | 6 | SS | 16 | | | | | | | | | | | |
| 24.0 | Clayey silt with sand & gravel (Glacial Till) | | 7 | SS | 46 | | | | | | | | | | | |
| | Grey | | 8 | SS | 22 | | | | | | | | | | | |
| 248.4 | Very stiff to hard | | | | | | | | | | | | | | | |
| 34.0 | fractured | | | | | | | | | | | | | | | |
| 242.8 | Shale bedrock, interbeds of limestone. Grey. Sound | | 9 | EXL | 100% | | | | | | | | | | | |
| 39.6 | End of Borehole | | | | | | | | | | | | | | | |

273.4

WL in open BH, Nov. 14/69



273.4
WL in open
BH, Nov. 14/69

FOUNDATION SECTION

ORIGINATED BY RD

COMPILED BY VK

CHECKED BY

| SOIL PROFILE | | SAMPLES | | | DYNAMIC PENETRATION BLOWS / FOOT | RESISTANCE | Liquid Limit — % Plastic Limit — % Water Content — % | BULK DENSITY | REMARKS |
|----------------|---|---------|------|--------------|-------------------------------------|-----------------------|--|--------------|---------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS / FOOT | | SHEAR STRENGTH P.S.F. | % | P.C.F. | |
| 283.3 | Ground Level | | | | | | | | |
| 0.0 | Clayey silt with frag-ments of rock & clinders | | | | | | | | |
| 280.3 | Fill. Very stiff | | | | | | | | |
| 3.0 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | 1 | SS | 31 | | | | | |
| | Brown to Grey | 2 | SS | 15 | | | | | |
| | | 3 | SS | 23 | | | | | |
| | | 4 | SS | 34 | | | | | |
| | | 5 | SS | 36 | | | | | |
| 263.3 | Very stiff to hard | | | | | | | | |
| 20.0 | Clayey silt with sand & gravel (Glacial Till) Fragments of shale below el. 257) | 6 | SS | 21 | | | | | |
| 256.3 | Very stiff to hard. | | | | | | | | |
| 27.5 | fractured Shale Bedrock, interbeds of limestone. Grey | 7 | BXL | 40% | | | | | |
| 247.8 | Sound | 8 | BXL | 100% | | | | | |
| 35.5 | End of Borehole | | | | | | | | |

The graph plots Dynamic Penetration (Blows/Foot) against Elevation Scale (Feet). The y-axis ranges from 240 to 280+ feet, and the x-axis represents Blows/Foot from 0 to 100+. A jagged line shows the penetration resistance profile, starting at ~31 blows/ft near the surface, decreasing to ~15 blows/ft at 280.3 ft, then rising to ~34 blows/ft at 263.3 ft, and finally dropping to ~21 blows/ft at 20.0 ft.

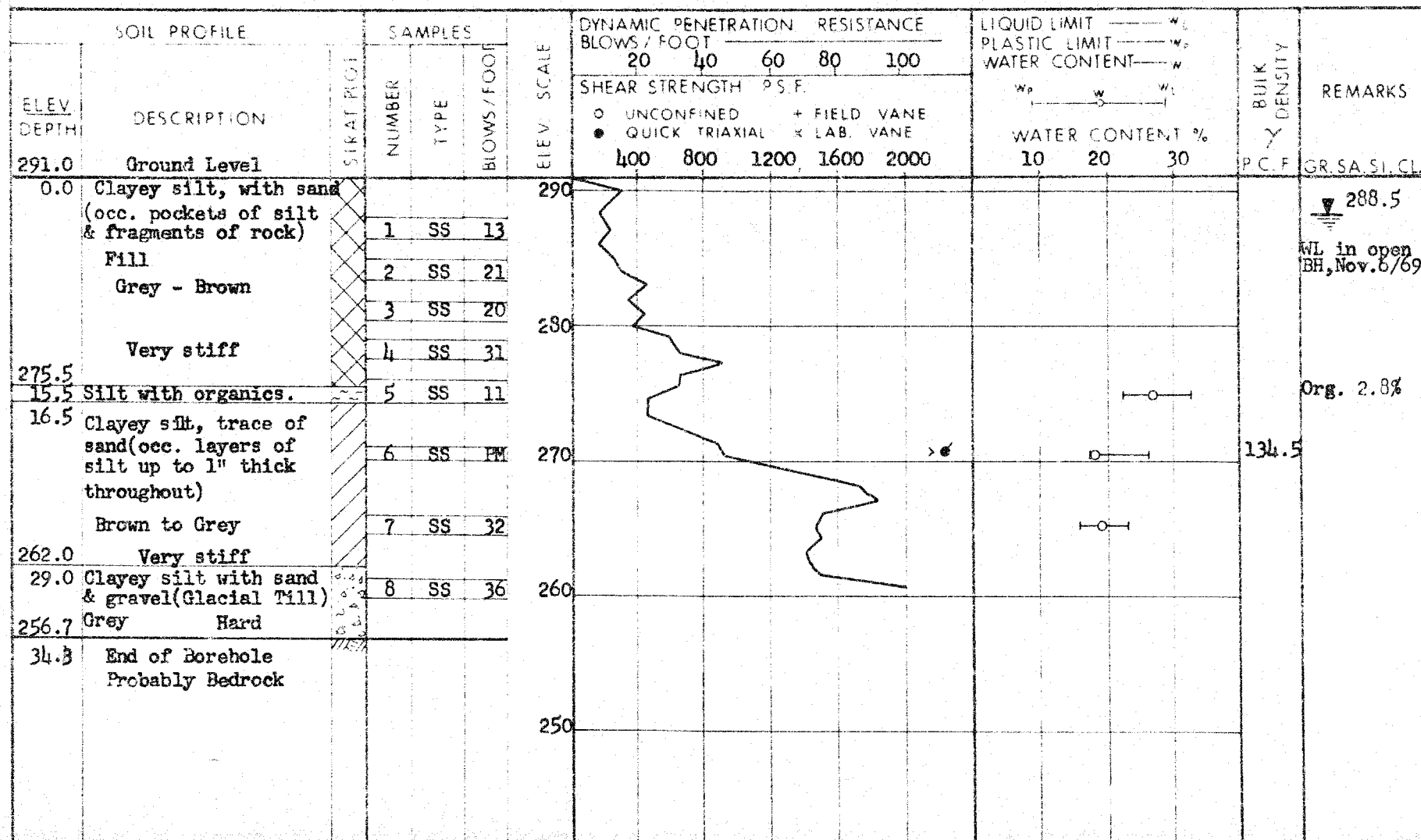
WL in open BH at G.L.
Nov. 6/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 102

FOUNDATION SECTION

JOB 69-F-77 LOCATION Co-ord. 183,866 N; 227,527 E. ORIGINATED BY BC
W.P. 314-65-8, 9 & 10 BORING DATE Oct. 28, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Penndrill, Cone Test CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 103

FOUNDATION SECTION

JOB 69-F-77 LOCATION Co-ords. 183,913 N; 227,575 E. ORIGINATED BY BC
W.P. 314-65-8, 9 & 10 BORING DATE Oct. 29 & 31 & Nov. 3, 1969 COMPILED BY VR
DATUM Geodetic BOREHOLE TYPE Penndrill-Washboring-BX Casing-BXL Rock Core CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT ——— W _L PLASTIC LIMIT ——— W _P WATER CONTENT ——— W | | | BULK DENSITY PCF | REMARKS |
|--------------|---|-------------|---------|------|------------|-------------|--|----|----|----|-----|--|--|--|---------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | | 20 | 40 | 60 | 80 | 100 | SHEAR STRENGTH PS F ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE | | | | |
| 287.1 | Ground Level | | | | | | | | | | | | | | | |
| 0.0 | Clayey silt with pockets of silt (Fill) | | | | | | | | | | | | | | | |
| 283.1 | Brown Very stiff | | 1 | SS | 67 | | | | | | | | | | | |
| 4.0 | Clayey silt, trace of sand (occ. pockets of silt up to 1/2" thick throughout) | | 2 | SS | 80 | 280 | | | | | | | | | | |
| | | | 3 | SS | 110 | | | | | | | | | | | |
| | | | 4 | SS | 58 | | | | | | | | | | | |
| | Brown to grey | | 5 | SS | 36 | 270 | | | | | | | | | | |
| | Hard | | 6 | SS | 43 | | | | | | | | | | | |
| 263.1 | | | | | | | | | | | | | | | | |
| 24.0 | Clayey silt, with sand & gravel (glacial Till) | | 7 | SS | 35/6" | 260 | | | | | | | | | | |
| | Fragments of shale below el. 255) | | | | | | | | | | | | | | | |
| 252.3 | Hard | | | | | | | | | | | | | | | |
| 34.8 | Shale Bedrock, interbeds of Limestone. | | 8 | BXL | 50% | 250 | | | | | | | | | | |
| | Grey. Fractured | | | | | | | | | | | | | | | |
| 242.3 | Sound | | 9 | BXL | 100% | | | | | | | | | | | |
| 44.8 | End of Borehole | | | | | 240 | | | | | | | | | | |

▼ 281.6
WL in open
BH Nov. 14/69

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 104

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,867 N; 227,614 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 30, 1969

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE

Penndrill - Dynamic Cone Test

CHECKED BY *AK*

| SOIL PROFILE | | STRAT. PLOT | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | | BULK DENSITY Y P.C.F. | REMARKS | |
|--------------|--|-------------|---------|------|--------------|-------------|--------------------------------|----|----|----|-----|--|--|--|-----------------------------|---------|-----------------|
| ELEV. DEPTH | DESCRIPTION | | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | | | | | SHEAR STRENGTH P.S.F. | | | | | WATER CONTENT % |
| | | | | | | | 20 | 40 | 60 | 80 | 100 | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | | | |
| 293.7 | Ground Level | | | | | | | | | | | | | | | | |
| 0.0 | Clayey silt, trace of sand (cinders, fragments of rock, etc.) Fill | | 1 | SS | 11 | 290 | | | | | | | | | | | |
| | | | 2 | SS | 11 | | | | | | | | | | | | |
| 284.7 | Very stiff | | | | | | | | | | | | | | | | |
| 9.0 | Clayey silt, trace of sand (occ. layers of silt up to 1/2" thick throughout) | | 3 | SS | 51 | | | | | | | | | | | | |
| | | | 4 | SS | 66 | 280 | | | | | | | | | | | |
| | | | 5 | SS | 46 | | | | | | | | | | | | |
| | Brown & Grey | | 6 | SS | 57 | 270 | | | | | | | | | | | |
| 267.3 | Hard | | 7 | SS | 41 | | | | | | | | | | | | |
| 26.5 | Clayey silt with sand & gravel (Glacial Till) | | 8 | SS | 41 | 260 | | | | | | | | | | | |
| | Grey | | | | | | | | | | | | | | | | |
| 259.7 | Shale Bedrock. | | 9 | SS | 100/2" | | | | | | | | | | | | |
| 34.0 | Fractured | | | | | | | | | | | | | | | | |
| 257.2 | | | | | | | | | | | | | | | | | |
| 36.5 | End of Borehole | | | | | | | | | | | | | | | | |

▼ 276.2

WL in open
BH, Nov. 14/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 105

FOUNDATION SECTION

JOB 67-F-77

LOCATION

Co-ords 183,646 N; 227,573 E.

ORIGINATED BY

RD

W.P. 314-65-8, 9 & 10

BORING DATE

Nov. 5 & 6, 1967

COMPILED BY

VK

DATUM Geodetic

BOREHOLE TYPE

Washboring-NX Casing-BXL Rock Core
Cone

CHECKED BY

R

| SOIL PROFILE | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | | BULK DENSITY γ P.C.F. | REMARKS | | |
|---------------|--|---------|------|------------|--------------------------------|----|----|----|----|--|--|--|---------------------------------------|---------|-----------------------------|--|
| ELEV DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS/FOOT | ELEV SCALE | 20 | 40 | 60 | 80 | 100 | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | | WATER CONTENT % 10 20 30 | |
| 302.0 | Ground Level | | | | | | | | | | | | | | | |
| 0.0 | Silty sand to silt, trace of gravel and cinders (Fill) | | | | | | | | | | | | | | | |
| | Grey to Brown | | | | | | | | | | | | | | | |
| 294.0 | Compact to Dense | | | | | | | | | | | | | | | |
| 8.0 | Clayey silt, trace of sand & organic matter (occ.pockets of silt throughout) (Fill) | | | | | | | | | | | | | | | |
| | Brown. Very stiff. | | | | | | | | | | | | | | | |
| 285.0 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | | | | | | | | | | | | | | | |
| 17.0 | | | | | | | | | | | | | | | | |
| | Brown | | | | | | | | | | | | | | | |
| | Hard | | | | | | | | | | | | | | | |
| 268.0 | | | | | | | | | | | | | | | | |
| 34.0 | Clayey silt with sand & gravel (Glacial Till) | | | | | | | | | | | | | | | |
| 264.7 | Hard | | | | | | | | | | | | | | | |
| 37.3 | fractured | | | | | | | | | | | | | | | |
| 259.7 | Shale Bedrock, interbeds of Limestone. Sound | | | | | | | | | | | | | | | |
| 42.3 | End of Borehole | | | | | | | | | | | | | | | |

275.2

WL in open
BH, Nov. 14/69

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 106

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,752 N; 227,633 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 31, 1969

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE

Penndrill - Cone Test

CHECKED BY

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|--|---------|------|--------------|-------------|--|----|----|----|-----|--|--|--|------------------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS / FOOT | | 20 | 40 | 60 | 80 | 100 | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | | |
| 305.3 | Ground Level | | | | | | | | | | | | | | |
| 0.0 | Clayey silt, trace of sand(occ. pockets of silt throughout) | 1 | SS | 8 | | | | | | | | | | | |
| | Fill | 2 | SS | 10 | | | | | | | | | | | |
| | Brown | 3 | SS | 24 | | | | | | | | | | | |
| | | 4 | SS | 17 | | | | | | | | | | | |
| | | 5 | SS | 19 | | | | | | | | | | | |
| 284.8 | Stiff to very stiff | | | | | | | | | | | | | | |
| 20.5 | Silt with organics | 6 | SS | 16 | | | | | | | | | | | |
| 21.5 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | 7 | TW | 30/8" | | | | | | | | | | | |
| | Brown | 8 | SS | 53 | | | | | | | | | | | |
| 268.3 | Hard | 9 | SS | 68 | | | | | | | | | | | |
| 37.0 | Clayey silt with sand & gravel (Glacial Till) Hard | 10 | SS | 100/2" | | | | | | | | | | | |
| 259.8 | Shale fragments throughout | | | | | | | | | | | | | | |
| 45.5 | End of Borehole Probably Bedrock | | | | | | | | | | | | | | |

268.6
WL in open
BH, Nov. 14/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 107

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,690 N; 227,610 E.

ORIGINATED BY

BC

W.P. 314-65-8, 9 & 10

BORING DATE

Oct. 30, 1969

COMPILED BY

VK

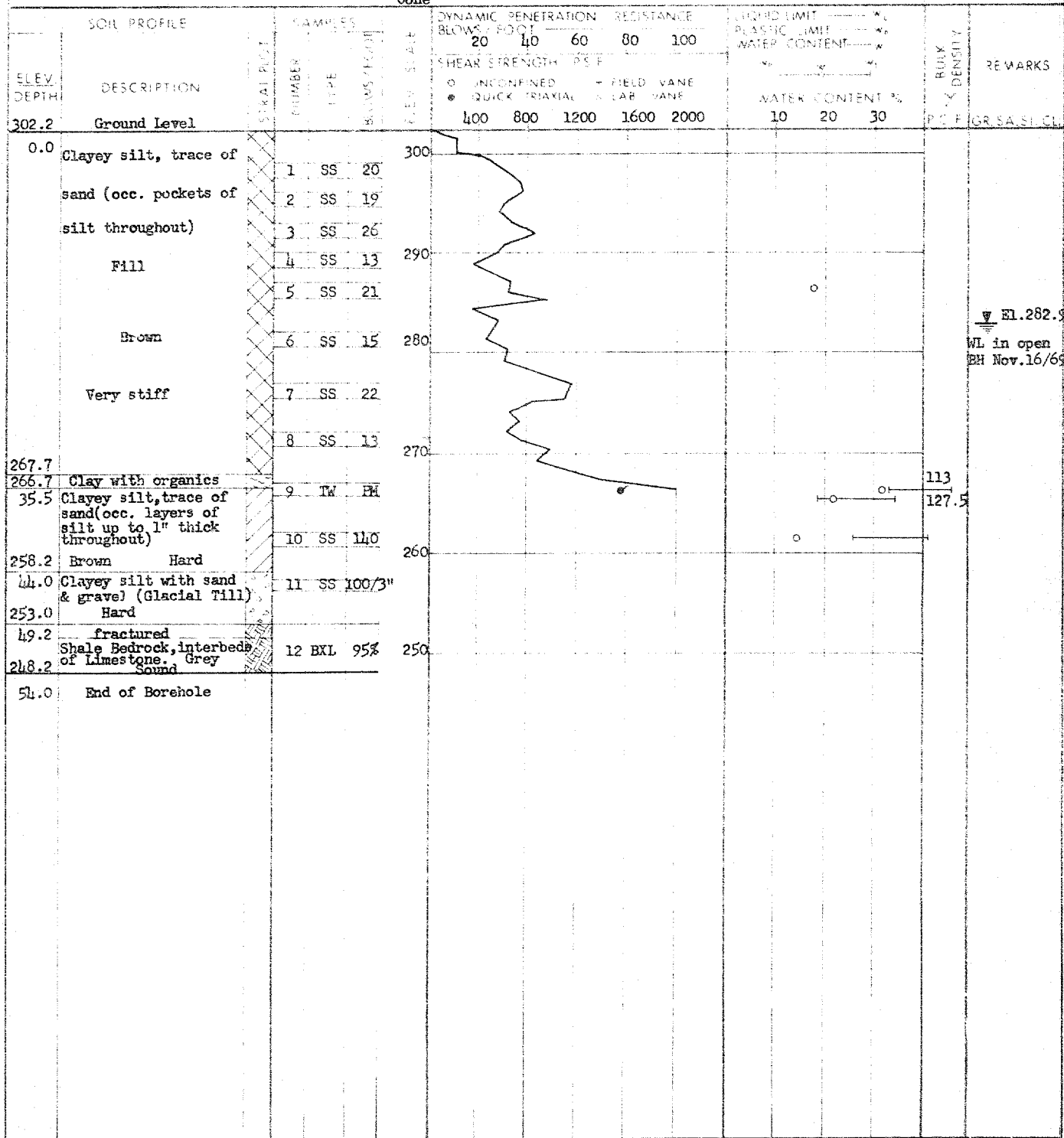
DATUM Geodetic

BOREHOLE TYPE

Penndrill-Washboring-BX Casing-BXL Rock Core

CHECKED BY

Cone



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 108

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,680 N; 227,703 E.

ORIGINATED BY

RD

W.P. 314-65-8, 9 & 10

BORING DATE

Nov. 7 & 10, 1969

COMPILED BY

GP

DATUM Geodetic

BOREHOLE TYPE

Washboring-NX Casing, BX, - BXL Rock Core; Cone

CHECKED BY

K

| SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — % | | | REMARKS | | |
|---------------|---|-------------|---------|------|--------------------------------|-------------|--|--|--|--|--|-----------------------------|---|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT. UNIT | NUMBER | TYPE | BLOWS/FOOT | ELEV. SCALE | BLOWS/FOOT 20 40 60 80 100 | | | | | WATER CONTENT % 10 20 30 | | | |
| | | | | | | | SHEAR STRENGTH — P.S.F. | | | | | | | | |
| | | | | | | | ○ UNCONFINED — FIELD VANE ● QUICK TRIAXIAL — LAB VANE | | | | | | | | |
| 290.2 | Ground Level | | | | | | | | | | | | | | |
| 0.0 | Silty sand (Fill) | | | | | 290 | | | | | | | WL in open BH, Nov. 14/65 ▼ 272.7 | | |
| 285.7 | Compact | | 1 | SS | 15 | | | | | | | | | | |
| 4.5 | Clayey silt, trace of sand (occ. layers of silt) Fill | | 2 | SS | 19 | | | | | | | | | | |
| 279.2 | Very stiff | | 3 | SS | 23 | 280 | | | | | | | | | |
| 11.0 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | | 4 | SS | 26 | | | | | | | | | | |
| | Brown to Grey | | 5 | SS | 16 | | | | | | | | | | |
| | Very stiff | | 6 | SS | 14 | 270 | | | | | | | | | |
| 266.2 | | | | | | | | | | | | | | | |
| 24.0 | Clayey silt with sand & gravel (Glacial Till) Occ. fragments of shale | | 7 | SS | 115/9" | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 257.2 | Hard | | 8 | SS | 60/3" | 260 | | | | | | | | | |
| 33.0 | Shale Bedrock | | | | | | | | | | | | | | |
| 253.2 | fractured sound | | 9 | BXL | 92% | | | | | | | | | | |
| 37.0 | End of Borehole | | | | | 250 | | | | | | | | | |

WL in open
BH, Nov. 14/69
▼ 272.7

2 13 57 28

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 109

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,583 N; 227,607 E.

ORIGINATED BY RD

M.P. 34-65-8, 9 & 10

BORING DATE

Nov. 11 and 12, 1969

COMPILED BY

QP

DATUM

Geodetic

BOREHOLE TYPE

Washboring-NX, BX Casing-BXL Rock Core, Cone

CHECKED BY

JK

| SOIL PROFILE | | SAMPLES | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— % | | | BULK DENSITY Y | REMARKS | | |
|--------------|---|---------|------|-------------|--------------------------------|----|----|----|-----|--|--|--|-------------------|---------|----|------------------------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | | BLOWS / FOOT | | | | | SHEAR STRENGTH ——— P.S.F. | | | | | | |
| | | | | | 20 | 40 | 60 | 80 | 100 | O UNCONFINED — FIELD VANE ● QUICK TRIAXIAL — LAB VANE | | | WATER CONTENT % | | | |
| 297.0 | Ground Level | | | | | | | | | | | | 10 | 20 | 30 | P.C.F. OR S.A. SI. CL. |
| 0.0 | Clayey silt, trace of sand & cinders (occ. pockets of silt throughout) Fill | 1 | SS | 16 | | | | | | | | | | | | |
| | Brown | 2 | SS | 18 | 290 | | | | | | | | | | | |
| | | 3 | SS | 27 | | | | | | | | | | | | |
| | | 4 | SS | 49 | | | | | | | | | | | | |
| | Very stiff to hard. | 5 | SS | 50 | 280 | | | | | | | | | | | |
| 276.5 | | | | | | | | | | | | | | | | |
| 20.5 | Silt with organics | 6 | SS | 16 | | | | | | | | | | | | |
| 21.5 | Clayey silt, trace of sand (occ. layers of silt up to 1" thick throughout) | 7 | SS | 29 | 270 | | | | | | | | | | | |
| | Brown | 8 | SS | 117/9" | | | | | | | | | | | | |
| 264.0 | Very stiff to hard | | | | | | | | | | | | | | | |
| 33.0 | Clayey silt with sand & gravel (Glacial Till) | | | | | | | | | | | | | | | |
| 260.0 | Hard | 9 | SS | - | 260 | | | | | | | | | | | |
| 37.0 | fractured | | | | | | | | | | | | | | | |
| 255.2 | Shale Bedrock, limestone interbeds. Sound | 10 | HXL | 95% | | | | | | | | | | | | |
| 41.8 | End of Borehole | | | | 250 | | | | | | | | | | | |

120/7"

WL on open BH, Nov. 14/69

275.0

▼ 275.0

WL on open
BH, Nov. 14/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 110

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,847 N; 227,821 E.

ORIGINATED BY RD

W.P. 314-65-8, 9 & 10

BORING DATE

Nov. 13, 14 and 17, 1969

COMPILED BY GP

DATUM Geodetic

BOREHOLE TYPE

Washboring-NX, BX Casing-BXL Rock Core, Cone

CHECKED BY

| ELEV. DEPTH | SOIL PROFILE DESCRIPTION | SAMPLES NUMBER TYPE | DYNAMIC PENETRATION BLOWS / FEET | RESISTANCE 20 40 60 80 100 | SHEAR STRENGTH - PSI | LIQUID LIMIT PLASTIC LIMIT WATER CONTENT % | REMARKS |
|----------------|---|------------------------|-------------------------------------|-------------------------------|----------------------|--|---------|
| | | | | | | | |
| 296.4 | Ground Level | | | | | | |
| 0.0 | Clayey silt, trace of sand (occ. pockets of silt throughout) Fill | 1 SS 35 | | | | | |
| | Brown | 2 SS 43 | | | | | |
| | | 3 SS 54 | | | | | |
| 281.4 | Hard | 4 SS 37 | | | | | |
| 15.0 | Clayey silt, trace of sand (occ. layers of silt up to 1/2" thick throughout) Brown to Grey | 5 SS 89 | | | | | |
| | | 6 SS 109 | | | | | |
| | | 7 SS 65 | | | | | |
| | Hard | 8 SS 87 | | | | | |
| 263.4 | | | | | | | |
| 33.0 | Clayey silt with sand & gravel (Glacial Till) | 9 SS 45 | | | | | |
| 258.9 | Hard | | | | | | |
| 37.5 | fractured | | | | | | |
| | Shale Bedrock, interbed of Limestone. Grey | 10 BXL 100% | | | | | |
| 252.2 | Sound | 11 BXL 100% | | | | | |
| 44.2 | End of Borehole | | | | | | |

250

120/8"

276.4

WL in open
BH, Nov. 14/69

0 6 55 38

RECEIVED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 113

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 183,911 N; 227,773 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

Nov. 17 and 18, 1969

COMPILED BY GP

DATUM Geodetic

BOREHOLE TYPE

Penndrill-Washboring-BX Casing-BXL Rock Core;

CHECKED BY

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— % | | | BULK DENSITY Y P.C.F. | REMARKS |
|--------------|---|---------|------|--------------|-------------|--|-----|------|------|------|--|----------------|----|-----------------------------|-----------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS / FOOT | | 20 | 40 | 60 | 80 | 100 | W _p | W _L | W | | |
| 293.8 | Ground Level | | | | | 400 | 800 | 1200 | 1600 | 2000 | 10 | 20 | 30 | | |
| 0.0 | Silty sand, trace of organic matter (Fill) | | | | | | | | | | | | | | |
| 288.8 | Brown. Loose. | 1 | SS | 8 | 290 | | | | | | | | | | |
| 5.0 | Clayey silt, with pockets of sand (Brown) (Fill) | 2 | SS | 7 | | | | | | | | | | | 1 7 79 12 |
| 285.3 | Stiff | | | | | | | | | | | | | | |
| 8.5 | Clayey silt, trace of sand(occ. layers of silt up to 2" thick throughout) | 3 | SS | 49 | | | | | | | | | | | |
| | | 4 | SS | 55 | 280 | | | | | | | | | | |
| | | 5 | SS | 54 | | | | | | | | | | | |
| | | 6 | SS | 19 | | | | | | | | | | | |
| | Brown to grey | 7 | TM | BM | 270 | | | | | | | | | | |
| | Hard to very stiff | | | | | | | | | | | | | | |
| 260.8 | | 8 | SS | 17 | | | | | | | | | | | |
| 33.0 | Clayey silt with sand & gravel(Glacial Till) | 9 | SS | 118/8" | 260 | | | | | | | | | | |
| 255.9 | Hard | | | | | | | | | | | | | | |
| 37.9 | Shale Bedrock, interbeds of limestone (grey) fractured | 10 | RC | 90% | | | | | | | | | | | |
| 250.9 | Sound | | BXL | | | | | | | | | | | | |
| 42.9 | End of Borehole | | | | 250 | | | | | | | | | | |

276.0

WL in open
BH, Nov. 14/69

137

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 114

FOUNDATION SECTION

JOB 69-F-77 LOCATION Co-ords. 184,640 N; 227,892 E. ORIGINATED BY RD
W.P. 314-65-8, 9 & 10 BORING DATE Nov. 20 and 21 1969 COMPILED BY GP
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing-BXL Rock Core: Cone CHECKED BY

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT | | | BULK DENSITY | REMARKS | | | | |
|--------------------|---|---------|------|------------|-------------|--------------------------------|-----|------|------|------|---------------|--|--|--------------|---------|------------------|-----------------|--|--|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS/FOOT | | BLOWS / FOOT | | | | | PLASTIC LIMIT | | | | | | | | |
| | | | | | | 20 | 40 | 60 | 80 | 100 | WATER CONTENT | | | | | | | | |
| SHEAR STRENGTH PSF | | | | | | UNCONFINED | | | | | FIELD VANE | | | LAB VANE | | | WATER CONTENT % | | |
| | | | | | | 400 | 800 | 1200 | 1600 | 2000 | 10 | | | 20 | 30 | P.C. GR SA SI CL | | | |
| 288.0 | Ground Level | | | | | | | | | | | | | | | | | | |
| 0.0 | Clayey silt, pockets of silt (Fill) | | | | | | | | | | | | | | | | | | |
| 283.0 | Stiff | 1 | SS | 6 | | | | | | | | | | | | | | | |
| 5.0 | Sandy silt, trace of clay (Fill) | 2 | SS | 21 | | | | | | | | | | | | | | | |
| | | 3 | SS | 25 | | | | | | | | | | | | | | | |
| | | 4 | SS | 46 | | | | | | | | | | | | | | | |
| | Compact to dense | 5 | SS | 36 | | | | | | | | | | | | | | | |
| 270.0 | 18.0 Clayey silt, trace of sand (occ. layers of silt up to 2" thick throughout) | 6 | TW | PM | | | | | | | | | | | | | | | |
| | Grey | 7 | TW | PM | | | | | | | | | | | | | | | |
| 257.0 | Stiff to hard | 8 | SS | 78 | | | | | | | | | | | | | | | |
| 31.0 | Clayey silt with sand & gravel (Glacial Till) | 9 | SS | 60/6" | | | | | | | | | | | | | | | |
| | Hard | | | | | | | | | | | | | | | | | | |
| 248.0 | Bouldery Zone | | | | | | | | | | | | | | | | | | |
| 40.0 | Boulders up to 6" size fractured | 10 | BXL | 26% | | | | | | | | | | | | | | | |
| 243.8 | Shale Bedrock, interbeds of Limestone. Sound | 11 | BXL | 100% | | | | | | | | | | | | | | | |
| 44.2 | End of Borehole | | | | | | | | | | | | | | | | | | |

280

270

260

250

240

120/9"

0 13 83 4

274.5

WL in open BH, Nov. 14/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 115

FOUNDATION SECTION

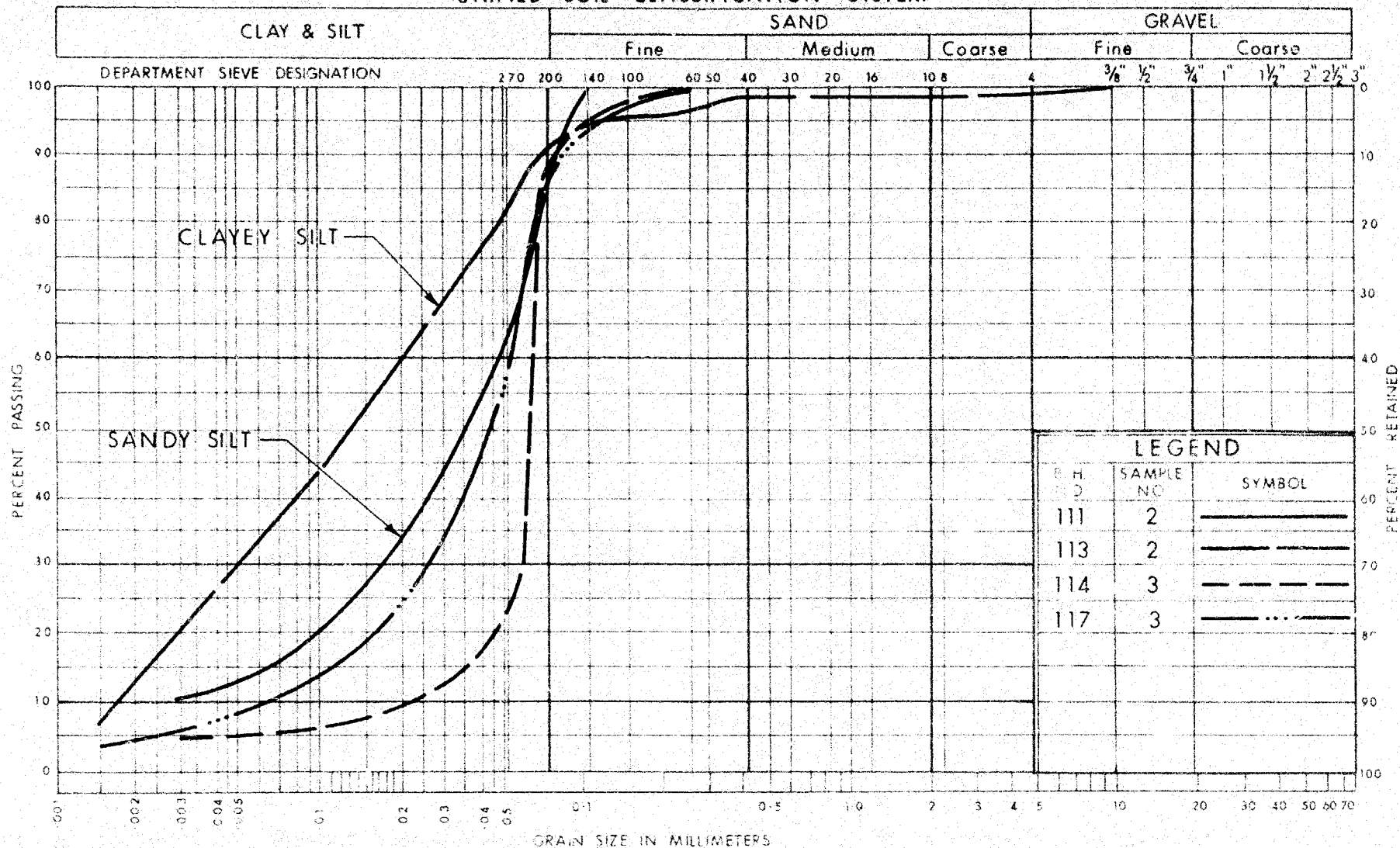
JOB 69-F-77 LOCATION Co-ord. 183,646 N; 227,558 E. ORIGINATED BY BC
W.P. 314-65-8, 9 & 10 BORING DATE Nov. 18, 1969 COMPILED BY GP
DATUM Geodetic BOREHOLE TYPE Penndrill-Power Auger; Cone CHECKED BY

| SOIL PROFILE | | SAMPLES | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — % | | | BULK DENSITY Y P.C.F. | REMARKS |
|--------------|--|---------|------|-------------|--|----|----|----|-----|--|----------------|---|-----------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | | 20 | 40 | 60 | 80 | 100 | W _p | W _L | W | | |
| 303.8 | Ground Level | | | | | | | | | | | | | |
| 0.0 | | | | | | | | | | | | | | |
| | Sandy silt to silty sand(Fill) Compact | 1 | SS | 10 | | | | | | | | | | |
| | | 2 | SS | 14 | | | | | | | | | | |
| | Clayey silt, trace of sand(occ. pockets of silt and sand) (Fill) | 3 | SS | 17 | | | | | | | | | | |
| | | 4 | SS | 6 | | | | | | | | | | |
| | Brown | 5 | TW | PH | | | | | | | | | | |
| | | 6 | SS | 6 | | | | | | | | | | |
| | Stiff to very stiff | 7 | TW | PH | | | | | | | | | | |
| | | 8 | TW | PH | | | | | | | | | | |
| 268.3 | | | | | | | | | | | | | | |
| 267.3 | Clay with organics | 9 | TW | PH | | | | | | | | | | |
| 36.5 | Clayey silt, trace of sand | | | | | | | | | | | | | |
| 262.8 | Very stiff | | | | | | | | | | | | | |
| 41.0 | Clayey silt with sand & gravel(Glacial Till) | 10 | TW | 45 | | | | | | | | | | |
| 256.5 | Grey Hard | 11 | SS | 100/5" | | | | | | | | | | |
| 47.3 | End of Borehole Probably Bedrock | | | | | | | | | | | | | |

▼ 281.
WL in open
BH, Nov. 14/69

129

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

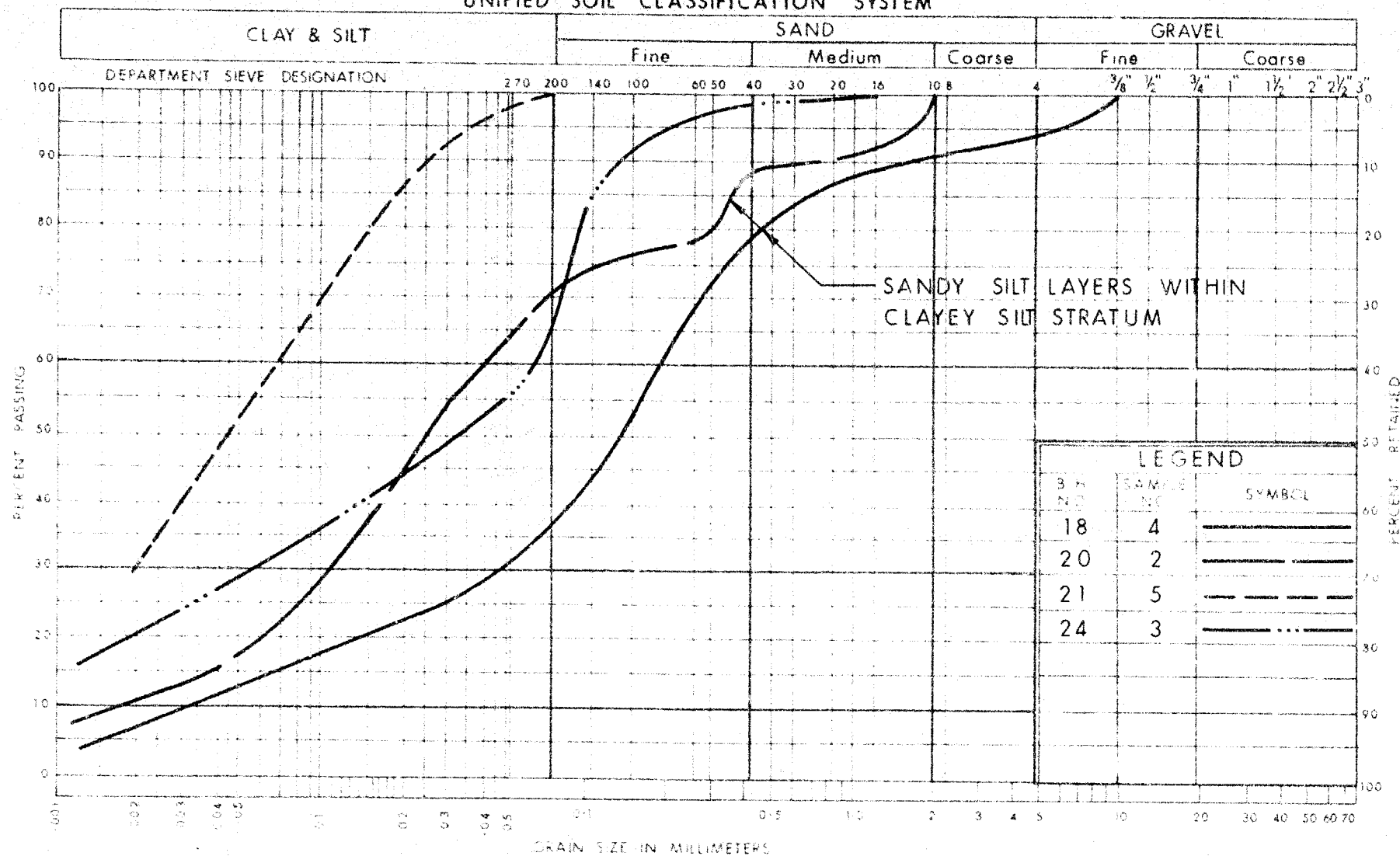
GRAIN SIZE DISTRIBUTION FILL MATERIAL

W.P. No. 314-65-8, 9 & 10

JOB No. 69-F-77

FIG. NO. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

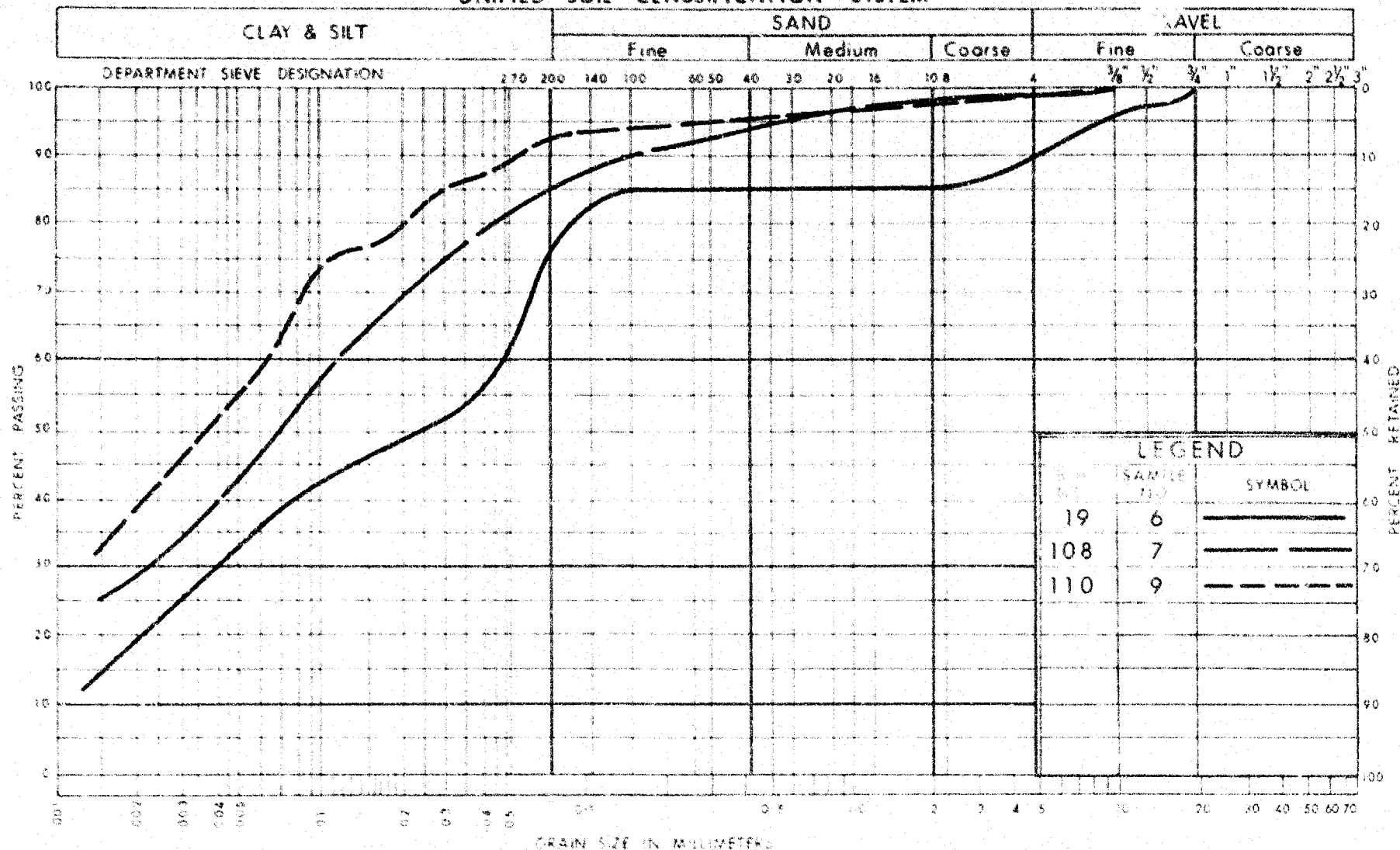
GRAIN SIZE DISTRIBUTION CLAYEY SILT STRATUM

WP No. 314-65-8,9 & 10

JOB No. 69-F-77

FIG. NO. 2

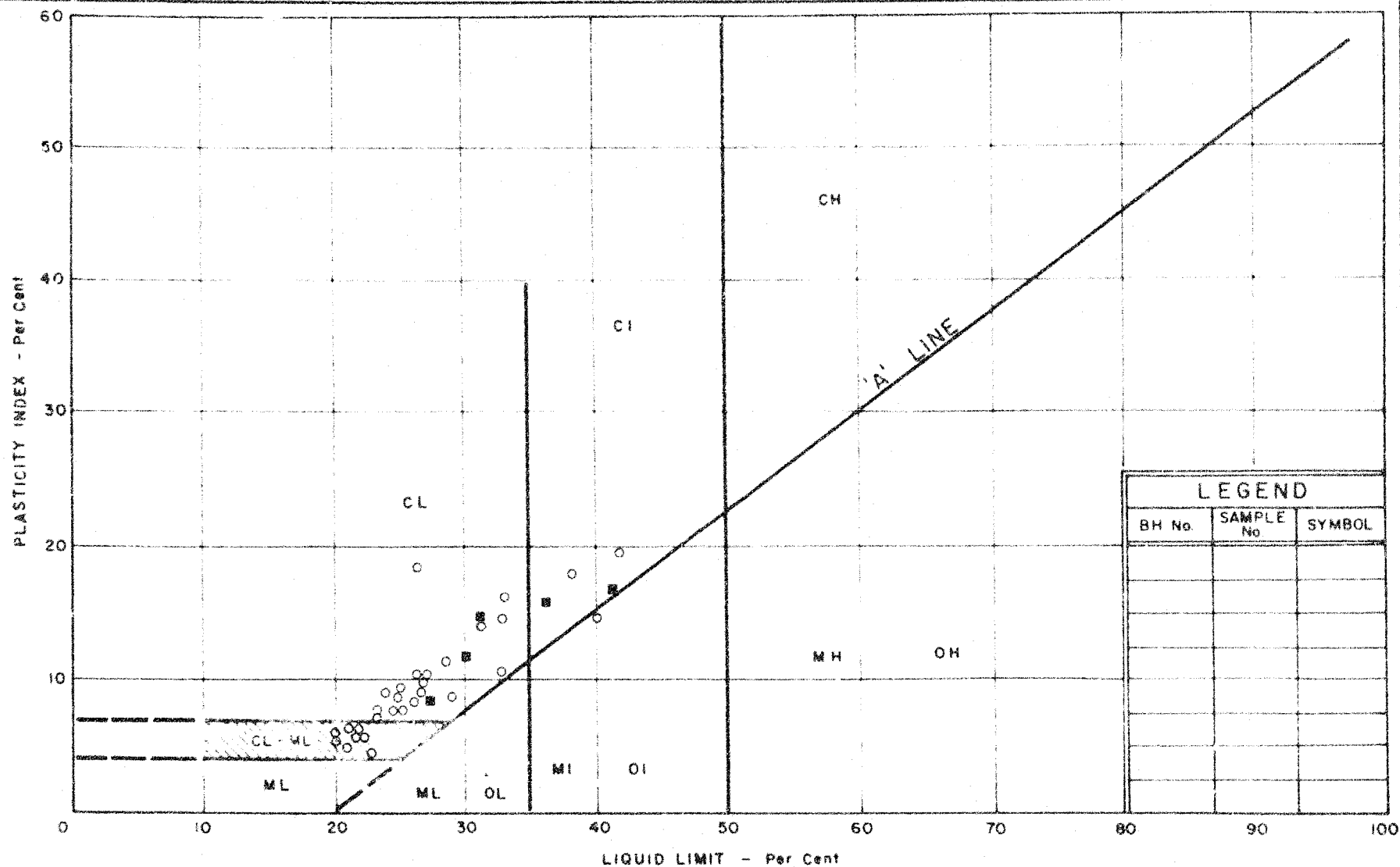
UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS AND
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
CLAYEY SILT WITH SOME SAND AND GRAVEL

WP No. 314-65-8, 9 & 10
JOB No. 69-F-77
FIG. NO. 3



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

- CLAYEY SILT
- GLACIAL TILL

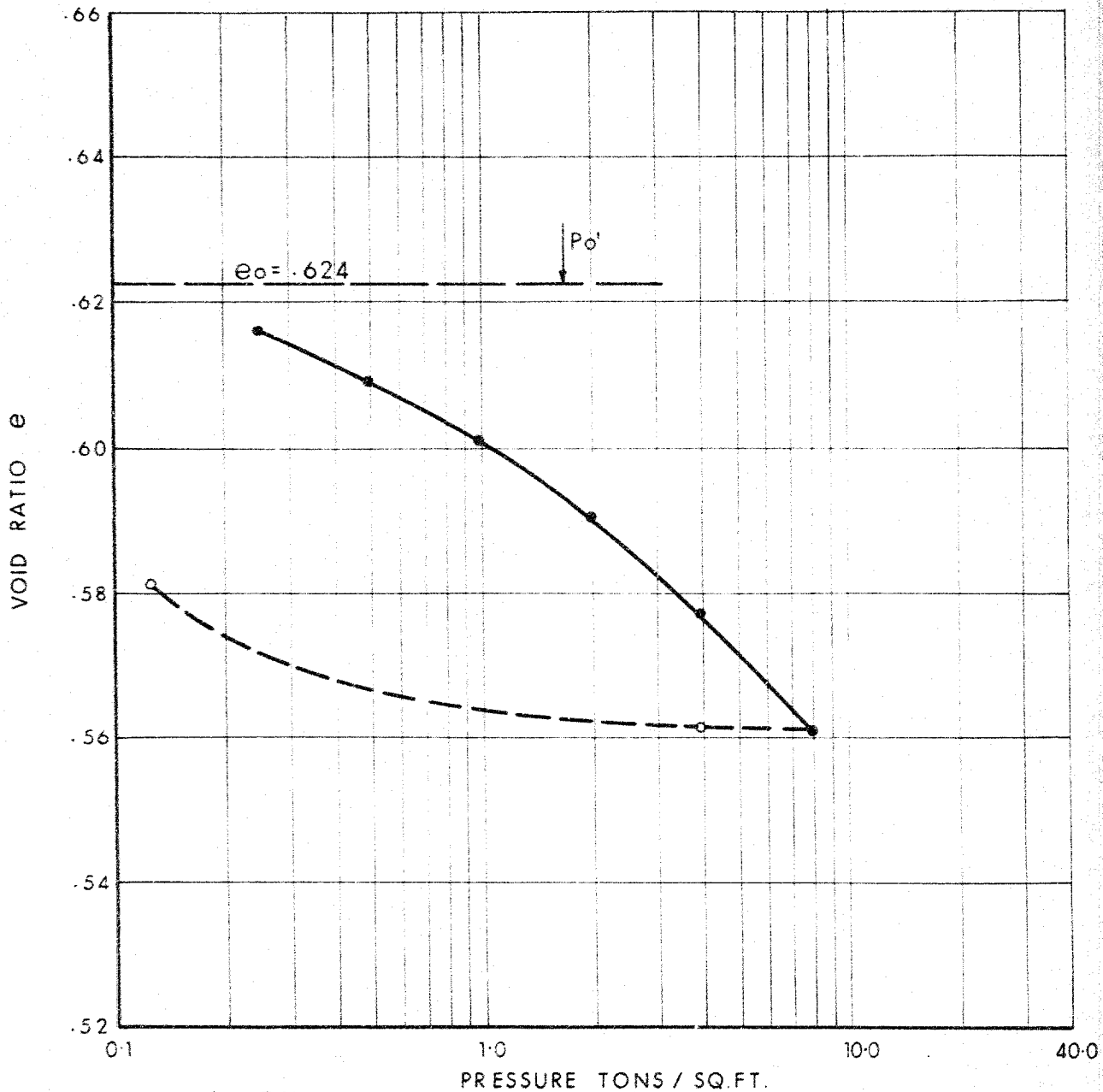
W.P. No. 314-65- 8, 9 & 10

JOB No. 69-F-77

FIG. NO. 4

VOID RATIO
VS
PRESSURE

BORE HOLE 115
SAMPLE 8
DEPTH 31'-5"
ELEV. 272.4



$W_L = 24.7\%$
 $W_P = 17.1\%$
 $W = 19.6\%$
 $C_{CR} = 0.04$

FIG. 5

JOB NO. 69-F-77

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 116

FOUNDATION SECTION

JOB 69-F-77

LOCATION

Co-ords. 184,084 N; 227,756 E.

ORIGINATED BY BC

W.P. 314-65-8, 9 & 10

BORING DATE

November 20, 1969

COMPILED BY GP

DATUM Geodetic

BOREHOLE TYPE

Penndrill Cone

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w _c | | | BULK DENSITY γ P.C.F. | REMARKS | | | |
|---------------|--|------------|---------|------|------------|--------------------------------|----|-----|-----|------|---|-----------------------|--|-----------------------------|---------|-----------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | BLOWS/FOOT | ELEV SCALE | 20 | 40 | 60 | 80 | 100 | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | |
| | | | | | | | | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE | | | | | |
| 284.6 | Ground Level | | | | | | | 400 | 800 | 1200 | 1600 | 2000 | | | | 10 20 30 | | |
| 0.0 | Silty sand, pockets of clayey silt (Fill) | | 1 | SS | 23 | 280 | | | | | | | | | | | | |
| 277.1 | Brown Compact | | 2 | SS | 48 | | | | | | | | | | | | | |
| 7.5 | Clayey silt, trace of sand (occ. layers of silt up to 2" thick throughout. | | 3 | SS | 24 | | | | | | | | | | | | | |
| | Brown to Grey | | 4 | SS | 11 | 270 | | | | | | | | | | | | |
| | | | 5 | SS | 9 | | | | | | | | | | | | | |
| | Hard to stiff | | 6 | TW | PH | | | | | | | | | | | | | |
| 260.6 | | | | | | 260 | | | | | | | | | | | | |
| 24.0 | Clayey silt with sand & gravel (glacial till) Grey | | 7 | TW | PH | | | | | | | | | | | | | |
| 253.4 | Hard | | | | | | | | | | | | | | | | | |
| 31.2 | End of Borehole | | | | | 250 | | | | | | | | | | | | |

280

270

260

250

x s5.5

120/7"

132.5

131

276.

in
WL open BH
Nov. 14/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 117

FOUNDATION SECTION

JOB 69-F-77 LOCATION Co-ords. 184,212 N; 227,876 E.
 W.P. 314-65-8, 9 & 10 BORING DATE November 20, 1969
 DATUM Geodetic BOREHOLE TYPE Penndrill - Power Auger; Cone

ORIGINATED BY BC
 COMPILED BY BP
 CHECKED BY

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— % | | | BULK DENSITY Y | REMARKS |
|--------------|--|---------|------|--------------|-------------|--|-----|------|------|------|--|----------------|----|-------------------|---------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS / FOOT | | 20 | 40 | 60 | 80 | 100 | W _L | W _P | W | | |
| 291.7 | Ground Level | | | | | 400 | 800 | 1200 | 1600 | 2000 | 10 | 20 | 30 | | |
| 0.0 | Silty sand to sandy silt, trace of clay (Fill) Brown | 1 | SS | 9 | 290 | | | | | | | | | | |
| | | 2 | SS | 22 | | | | | | | | | | | |
| | | 3 | SS | 69 | | | | | | | | | | | |
| 277.7 | Loose to very dense. | 4 | SS | 48 | 280 | | | | | | | | | | |
| 14.0 | Clayey silt, trace of sand (occ. layers of silt up to 2" thick throughout) Brown to grey Hard to stiff | 5 | SS | 50 | | | | | | | | | | | |
| | | 6 | SS | 17 | 270 | | | | | | | | | | |
| | | 7 | SS | 12 | | | | | | | | | | | |
| | | 8 | SS | 6 | 260 | | | | | | | | | | |
| 254.7 | | 9 | TW | PH | | | | | | | | | | | |
| 37.6 | Clayey silt with sand & gravel (glacial till) Hard | | | | | | | | | | | | | | |
| 251.7 | | | | | | | | | | | | | | | |
| 250.7 | Shale Bedrock fractured | 10 | SS | 135 1/6" | 250 | | | | | | | | | | |
| 41.0 | End of Borehole | | | | | | | | | | | | | | |

0 13 83 4

278

WL in open
 BH, Nov. 14/69

Org. 1%

124.5

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 - 6 | 500 - 1000 | COMPACT | 10 - 30 |
| STIFF | 6 - 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_s | 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 |
| $\bar{\sigma}$ | 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

| | |
|----------|---|
| z | 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 |

MEMORANDUM

TO: Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Office,
Admin. Bldg.

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

ATTENTION:

DATE: December 3, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT:

Q.E.W. Ramp 'W-L' Overpass
At Ramp 'I-L' & 'L-E', Bridge #9
W.P. 314-65-10, Site No. 37-899,
N.J. 69-F-77, --
Q.E.W., District No. 6 --

We have reviewed the final bridge drawing E-6766-1 & 2 for the above mentioned structure and submit the following comments:

1) The total pile lengths for this bridge should be changed to 550 Lin. ft. from 528 Lin. ft., as shown on the drawing.

11) The East abutment footing base can be raised to elev. 277 from elev. 274.0.

MD/YdeF

M. Devata
M. Devata,
SUPERVISING FOUNDATION ENGR.
For :
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. S. McCombie
G. C. E. Burkhardt
Foundations Files
Gen. Files

MEMORANDUM

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

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: November 12, 1970

OUR FILE REF.

IN REPLY TO

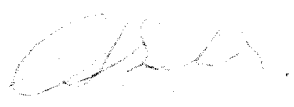
SUBJECT:

Q.E.W. Ramp 'W-L' Overpass
at Ramp 'E-L' & 'L-E', Bridge #9
W.P. 314-65-10, Site No. 37-899
Q.E.W., District No. 6

J-69-A-77

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

MEMORANDUM

To: Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Office,
Admin. Bldg.

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

Attention:

Date: December 3, 1970

Our File Ref.

In Reply To

SUBJECT:

Q.B.W. Overpass at Ramp 'B-L'
Bridge No. 7, W.P. 314-65-08, Site 37-246,
W.J. 69-P-77 - Q.E.W., District No. 6

We have reviewed the final bridge drawing D-6764-1 & 2 for the above mentioned structure and submit the following comments:

At some locations a layer of organic material was observed. It is not known whether this material is continuous over a large area. In any event, if observed during excavation, it should be removed for its full depth and replaced with granular material prior to the construction of the footings.

MD/MdeP

M. Devata,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. S. McCombie
G. J. E. Burkhardt
Foundations Files
Gen. Files

M. MORANDUM

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

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: November 12, 1970

OUR FILE REF.


IN REPLY TO

SUBJECT: Q.E.W. Overpass at Ramp 'E-L'
Bridge No. 7, W.P. 314-65-08, Site 37-246
Q.E.W., District No. 6

69-E-77

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.

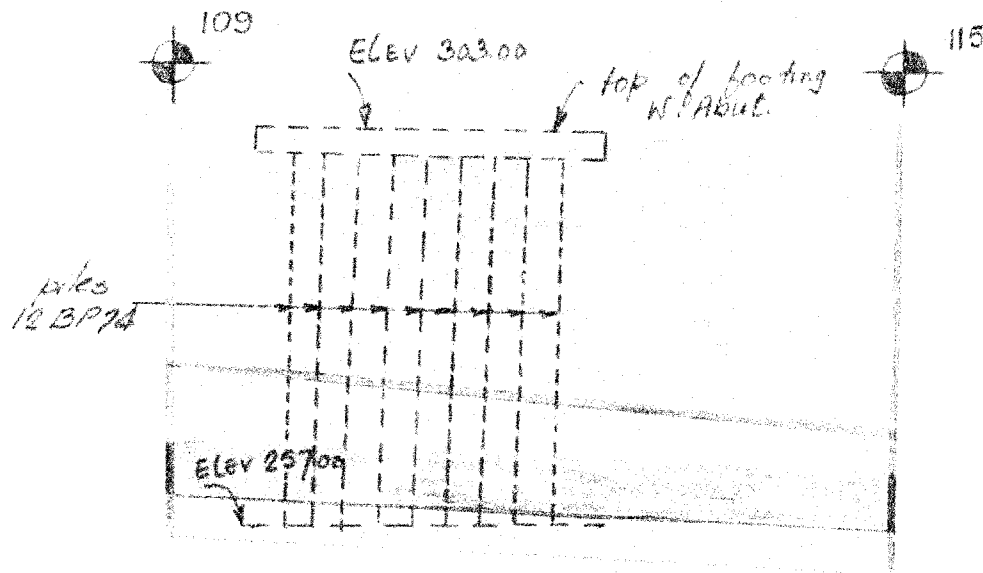

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

cc. Foundation Office

CHECKING DESIGN ON 69-F-77

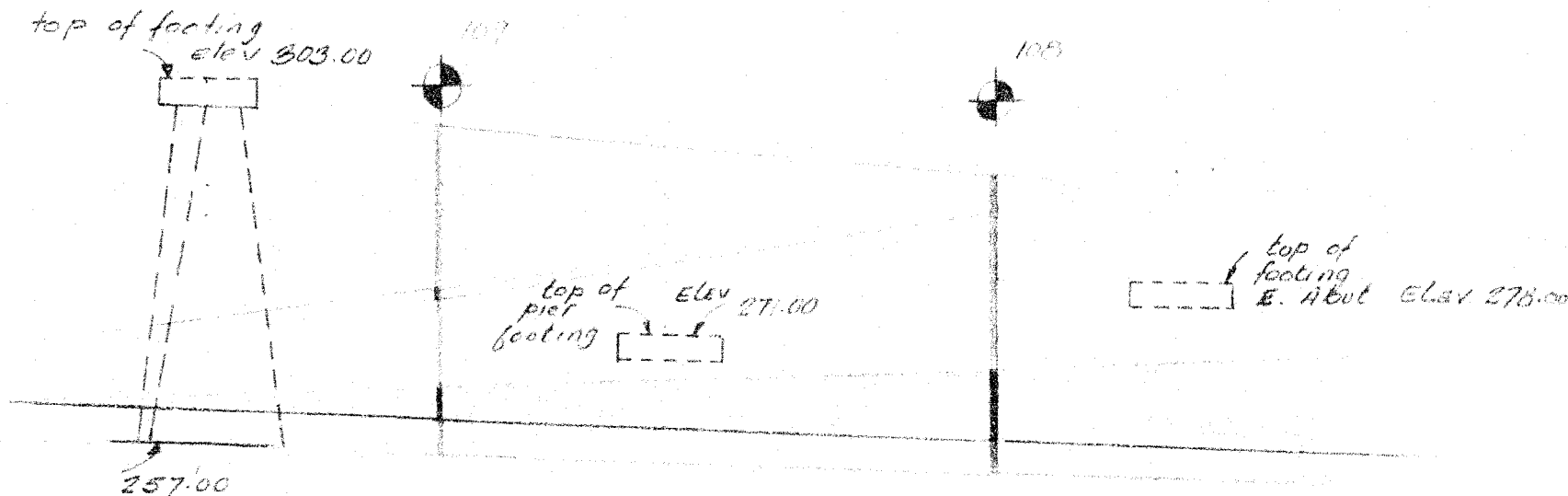


May 28, 1970.

CHECKING DESIGN

CN 69-F-77

Q.E.W. RAMP 'E-L' & 'L-E' (BRIDGE #9)

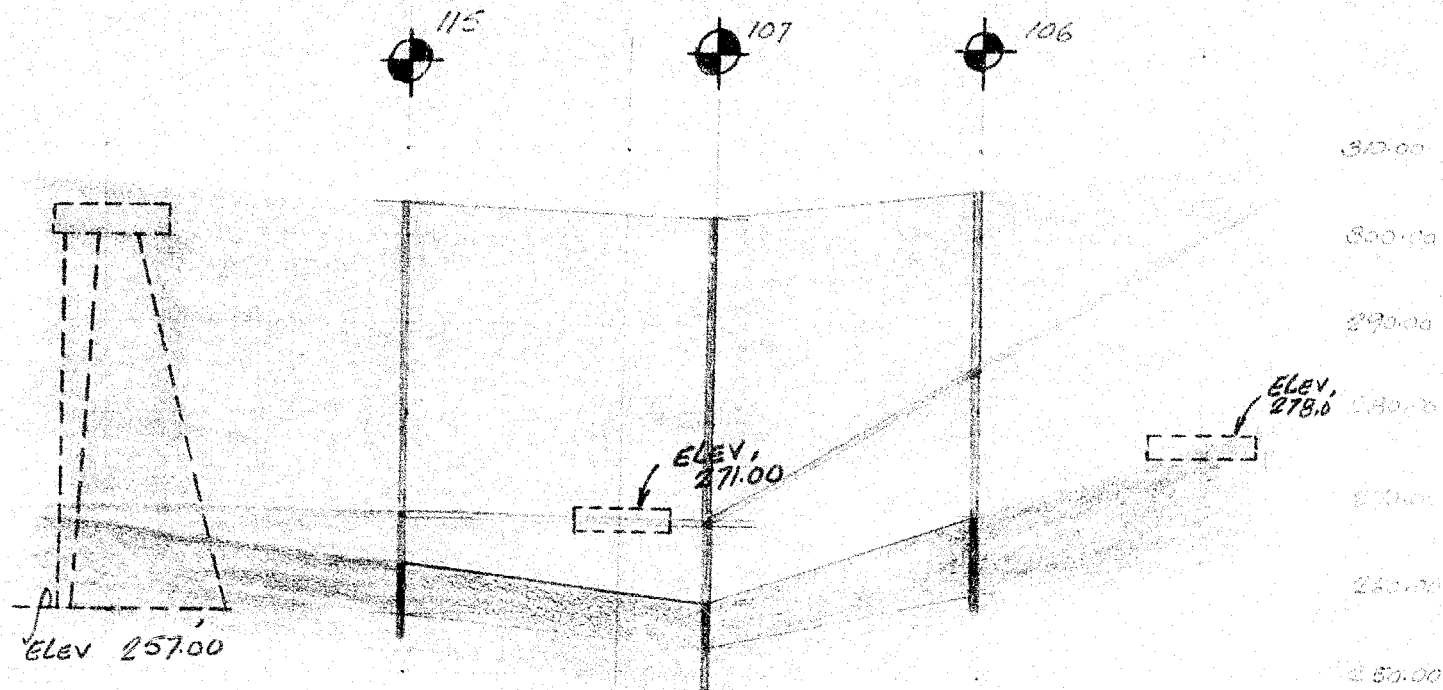


SCALE: HORIZ 1" = 40'-0"
VERT 1" = 20'-0"

- | | |
|--|---|
| | FILL (CLAYEY SILTS) |
| | SILTS WITH ORGANICS |
| | CLAYEY SILTS, TRACES OF SAND (SEE LAYERS OF SILT UP TO 1" THICK THROUGHOUT) |
| | GLACIAL TILL |
| | BED ROCK |

10/1/87, 19/10

CHECKING DESIGN
 ON 69-F-77
 Q.E.W. RAMP 'E-L' & 'L-E' (BRIDGE #9)



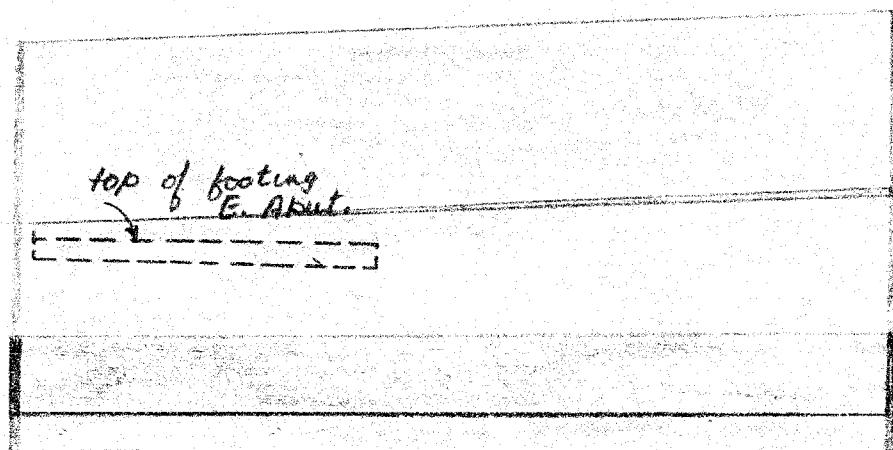
SCALE : Horiz 1" = 40'-0"
 VERT. 1" = 20'-0"

MAY 27, 1970

CHECKING DESIGN

ON 69-F-77

Q.E.W. RAMP 'E-L' & 'L-E'
BRIDGE #9



Scale: 1" = 20'-0"

May 28, 1970

300.00

299.00

298.10

297.00

296.00

295.00

294.00

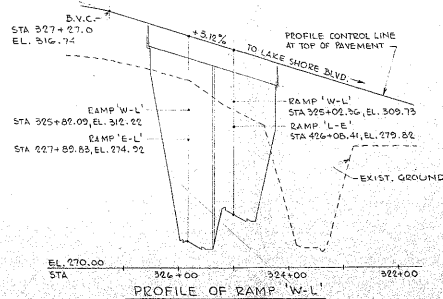
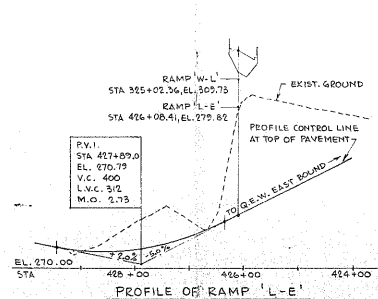
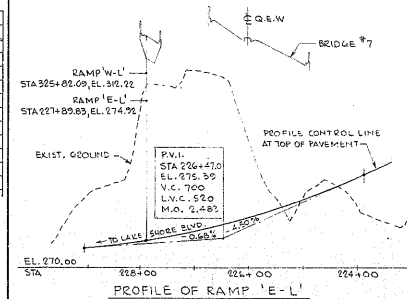
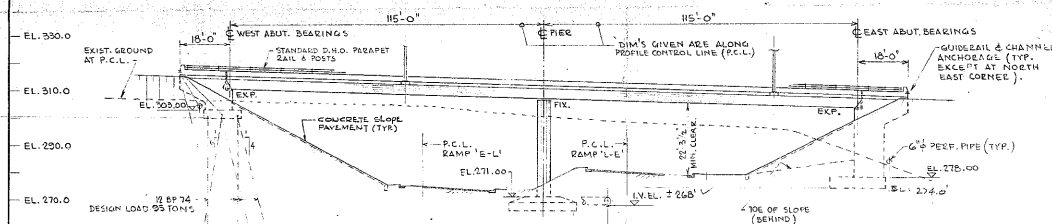
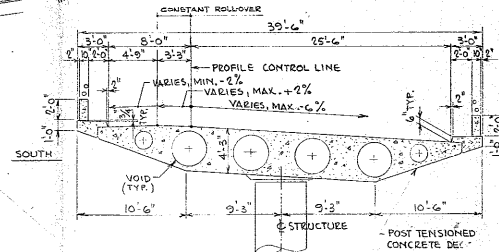
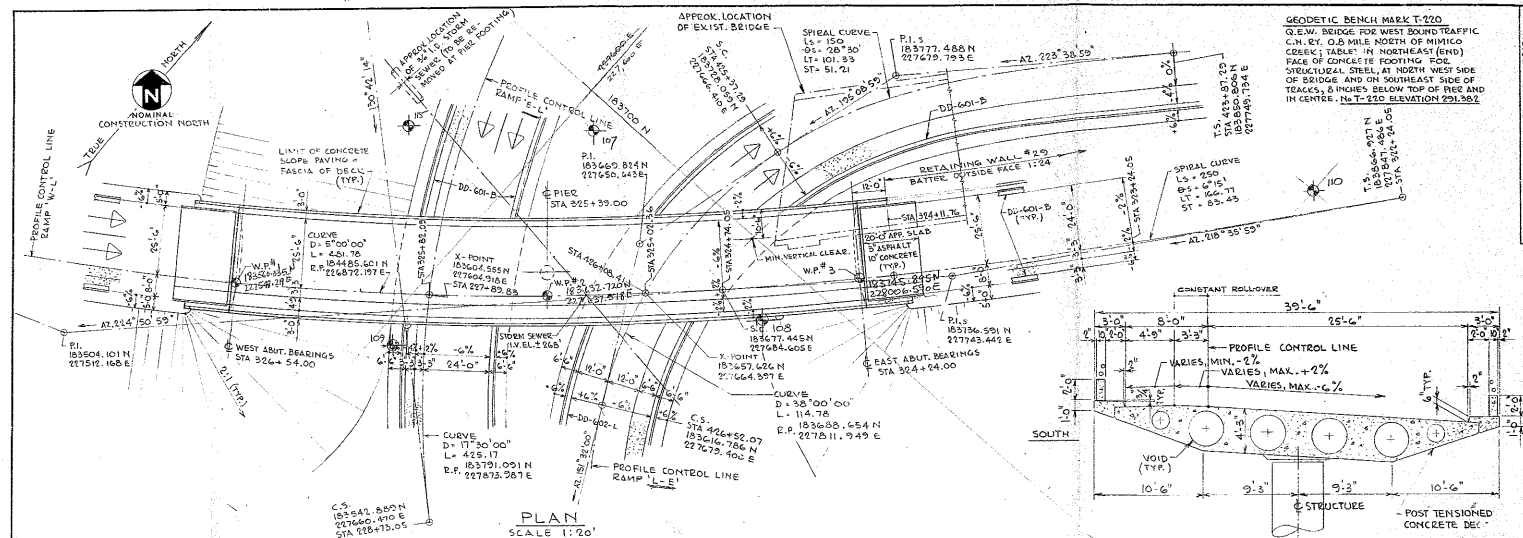
#69-F-77

W.P. 314-65-8, 9, AND 10.

Q.E.W. AND

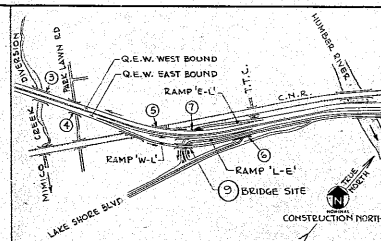
LAKESHORE BLVD. RAMPS.

STRUCTURES 7, 8, AND 9



- LIST OF DRAWINGS**
- D-676-1 GENERAL ARRANGEMENT
 - D-676-2 FOUNDATION LAYOUT
 - D-676-3 WEST ABUTMENT
 - D-676-4 EAST ABUTMENT
 - D-676-5 DECK DETAILS
 - D-676-6 DECK-REINFORCEMENT
 - D-676-7 DECK ELEVATIONS
 - D-676-8 PARAPET WALL DETAILS
 - D-676-9 STANDARD STEEL PARAPET RAIL
 - D-676-10 MISCELLANEOUS DETAILS
 - D-676-11 APPROACH SLABS
 - D-676-12 DETAILS OF CONCRETE SLOPE PAVING

FOR REDUCED PLAN



GENERAL NOTES

CLASS OF CONCRETE

DECK SLAB & DECK CURBS: SEE POSTSTRESSING NOTES DWG. D-676-6.
COLUMNS: 3000 P.S.I.
ABUTMENT CURBS, PARAPET WALLS & END ROSTS: 4000 P.S.I.
ALL OTHERS INCL. APPROACH SLABS: 3000 P.S.I.
CLEAR COVER TO REINFORCING STEEL
FOUNDATIONS & SURFACES: CONTACT WITH EARTH 3"
POINT FACE OF WALLS & TOP OF DECK SLAB 2"
ALL OTHERS 1 1/2"

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS
TO THE SPECIFIED ELEVATIONS WITH TOLERANCE OF 3/8" INCH
NO CONCRETE SHALL BE PLACED ABOVE THE BEARING SEATS UNTIL THE
DECK CONSTRUCTION HAS BEEN COMPLETED.

POSTSTRESSING NOTES

FOR POSTSTRESSING NOTES SEE DWG. D-676-6.



Seal of the Province of Ontario

| REVISION | DATE | BY | DESCRIPTION |
|----------|------|----|-------------|
| | | | |
| | | | |

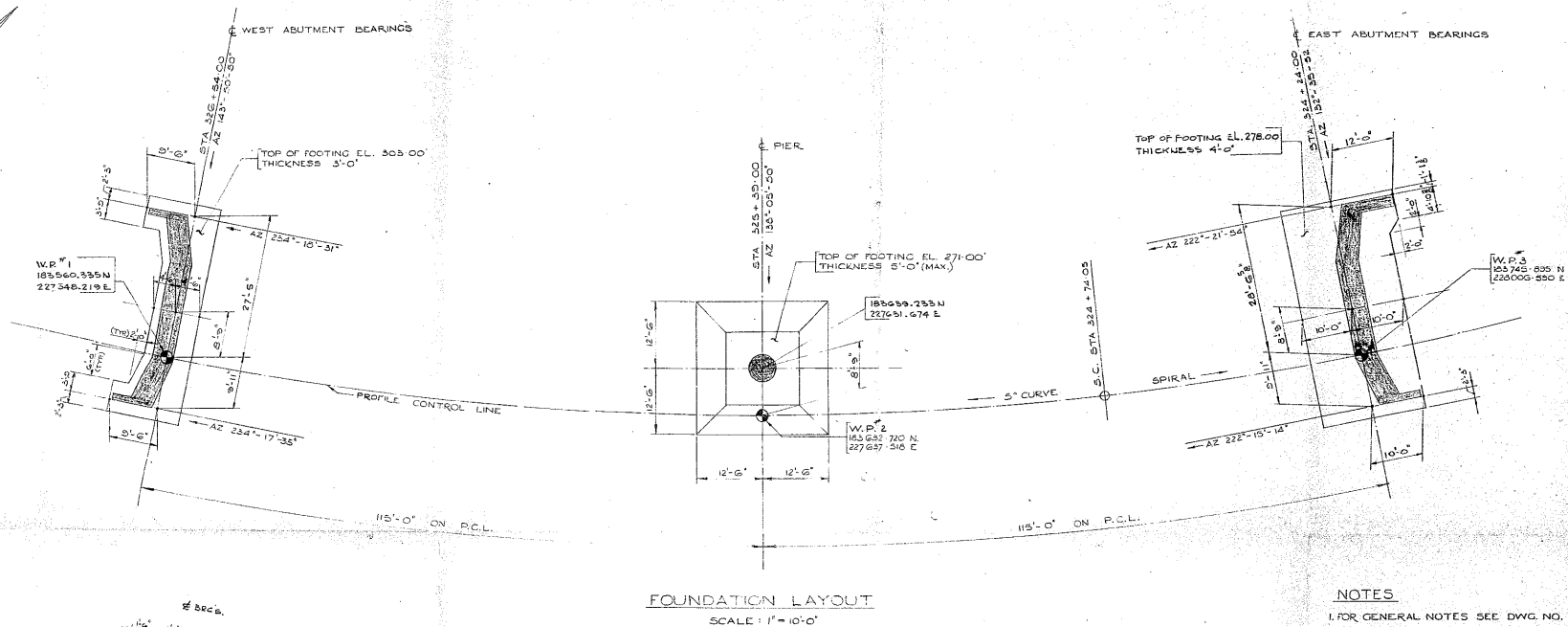
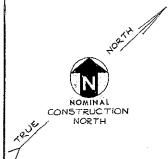
DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION
FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED

Q.E.W. RAMP 'W-L' OVERPASS AT RAMP 'E-L' & 'L-E' (BRIDGE #7)

KING'S HIGHWAY No. 7 Q.E.W. DIST. No. 6
CO. YORK BRIDGEOF STOBICOLE
TWP. 101 CON.

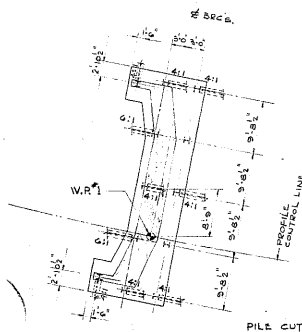
| GENERAL ARRANGEMENT | | | |
|---------------------|-------|---------|------|
| APPROVED | DRAWN | CHECKED | DATE |
| | | | |
| | | | |

FENC0 N° 3371 = 9K = 1



FOUNDATION LAYOUT

SCALE : 1" = 10'-0"



PILE LAYOUT
SCALE 1"=10'-0"

- STEEL H PILES - 12 BP 74 ✓
- DESIGN LOAD - 95 TONS
- 12 RIGID 8 BATTERED @ 4:1
2 BATTERED @ 6:1
2 VERT. } AS INDICATED
- FOR PILE SPICE DETAIL SEE DWG. D-6746-11
- TOTAL LENGTH OF PILES: $12 @ 44'-0" = 528'-0"$ (550')

PILE CUT-OFF ELEVATION = 301.00'

NOTES

1. FOR GENERAL NOTES SEE DWG. NO. D6766-1



| REVISIONS | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
| | | | |
| | | | |
| | | | |
| | | | |

69F-77

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

FOUNDATION OF CANADA ENGINEERING
CORPORATION LIMITED

Q.E.W. RAMP 'W-L' OVERPASS AT RAMP 'E-L' & 'L-E'
- BRIDGE #9 -

KING'S HIGHWAY No. Q.E.W. DIST. No. 6
CO. YORK BOROUGH OF ETOBICOKE
TWP. LOT CON.

FOUNDATION LAYOUT

| | | | | | | | |
|-----------------|----------|---------|----------|-----------------|--|--------------------|--|
| APPROVED | | | | SITE No. 37-699 | | W.P. No. 314-65-10 | |
| BRIDGE ENGINEER | | | | CONTRACT No. | | | |
| DESIGN | J. C. H. | CHECK | ES | No. | | | |
| DRAWING | A. H. P. | CHECK | ES | No. | | D-6766-2 | |
| DATE | SEP 30 | LOADING | HS 20-44 | No. | | | |

FENCE NO. 3671-5K-2

FOR REDUCED PLAN

USE SCALE BELOW

