

G.I.-30 SEPT. 1976

GEOCRES No. 3IF-60DIST. 9 REGION W.P. No. 3-67-01CONT. No. W. O. No. 71-11056STR. SITE No. HWY. No. 17LOCATION PETAWAWA By PASSNo of PAGES -OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. T. C. Kingsland, (2) FROM: Foundations Office,
Reg. Structural Planning Eng., Design Services Branch,
Eastern Region, West Bldg., Downsview.
Kingston, Ontario.

ATTENTION:

DATE: January 17, 1973.

OUR FILE REF.

IN REPLY TO FEB - 5 1973

SUBJECT:

31F-60

PRELIMINARY
FOUNDATION INVESTIGATION REPORT
For
Structure and Related Crossings Along
Hwy. 17 'New'
From the Existing Hwy. 17 at Brindle Road
(Twp. of Petawawa), South-easterly 14
Miles to Hwy. 62 (Twp. of Alice)
Alternate Alignments A, B and C
County of Renfrew, District 9 (Ottawa)
W.O. 71-11056 -- W.P. 3-67

Attached, we are forwarding to you our Preliminary Foundation Investigation Report pertaining to the above sites. Presented in this report are the results of the investigation, together with our general comments pertaining to the stability of the approaches and recommendations regarding structure foundations at various crossings.

We believe that the information contained therein, will prove adequate for your immediate use. Should you require further data, or clarification of the report, please do not hesitate to contact this Office.

A. G. Stermac

A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

AGS/ao

Attch.

cc: E. J. Orr
B. R. Davis
A. Rutka
A. J. Percy
J. E. Callaghan
B. J. Giroux
E. R. Saint
G. A. Wrong
B. A. Singh

Foundations Files
Documents ✓

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE AREA AND GEOLOGY.
 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL AND BEDROCK CONDITIONS.
 - 4.1) General.
 - 4.2) Fill Material.
 - 4.3) Organic Deposits.
 - 4.4) Upper Granular Deposits.
 - 4.4.1) Sand and Gravel.
 - 4.4.2) Silty Sand to Sandy Silt.
 - 4.5) Cohesive Deposits.
 - 4.6) Glacial Till.
 - 4.7) Irregularly Layered Deposits.
 - 4.8) Lower Granular Material.
 - 4.9) Bedrock Conditions.
 5. GROUNDWATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS.
 - 6.1) General.
 - 6.2) Hwy. 17 'N' Crossings - Proposed Alignment C.
 7. MISCELLANEOUS.
-

PRELIMINARY FOUNDATION INVESTIGATION REPORT
For
Structures and Related Crossings Along
Hwy. 17 'New'
From the Existing Hwy. 17 at Brindle Road
(Twp. of Petawawa), South-easterly 14
Miles to Hwy. 62 (Twp. of Alice)
Alternate alignments A, B and C
County of Renfrew, District 9 (Ottawa)
W.O. 71-11056 W.P. 3-67

1. INTRODUCTION:

The Foundations Office was requested to carry out a preliminary investigation for the possible structures and related crossings within the aforementioned 14 mile stretch of Hwy. 17N. Three alternate alignments were investigated (designated Lines A, B and C). The purpose of the investigation is to provide information pertaining to foundation design to aid in the planning studies for Hwy. 17N in this area.

The request for this foundation investigation was contained in a memo from Mr. T. C. Kingsland, Regional Planning Engineer, Eastern Region, dated June 7, 1971. An investigation was subsequently carried out by this Office to determine the subsoil, bedrock and groundwater conditions across the area.

The engineering aspects related to foundation design have been verbally discussed as well as presented at meetings held between personnel from the Eastern Region and this Office. This report is a follow-up to these discussions. It presents the factual information obtained from this investigation. Included are recommendations pertaining to foundation design at the various possible crossings, as well as the stability and settlement considerations associated with the required fills.

2. DESCRIPTION OF THE AREA AND GEOLOGY:

The area under investigation extends from the existing Hwy. 17 at Brindle Road to Hwy. 62 at a point 1.8 miles south-west

of Pembroke, a distance of approximately 14 miles. The whole area lies parallel to the Ottawa River and is located within the Townships of Petawawa and Alice.

Numerous creeks and the Petawawa River cross the area in the south-west to north-east direction. The area is flat with some small hills. The ground surface ranges from elevation 453 to elevation 530.

It is a mixed agricultural and natural woodland area with the insertion of the Camp Petawawa Military Reserve at the north-western end.

Geologically the western and central parts of the area belong to the physiographic region known as the Petawawa Sand Plain. In origin, it is a delta built in the Champlain Sea by the Petawawa, Barron, Indian and Ottawa Rivers during the Fossmill stage of Lake Algonquin. The predominant deposit in this area consists of a 13 to more than 100 feet deep stratum of granular material.

The eastern part enters the physiographic region known as the Ottawa Valley Clay Plains. Here extensive 5 to 30 feet deep clay deposits are interrupted by ridges of sand and/or bedrock. The sensitive marine clay was deposited in the geologic past in the Champlain Sea. The clay is generally underlain by glacial till followed in turn by granitic gneiss bedrock of Precambrian Age.

3. FIELD AND LABORATORY WORK:

A total of thirty-three boreholes were put down by means of conventional diamond drill rigs adapted for soil sampling purposes. The sites were located at the possible structure and creek crossings.

Samples of the overburden were obtained, at specific intervals, in a 2-inch O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. Where cohesive deposits were encountered, the split-spoon sampling was supplemented by taking 2-inch O.D. Shelby tubes, which were pushed manually or hydraulically into the soil. In addition, field vane tests were carried out, where possible to obtain the undrained shear

strength of the clay strata. Bedrock was proven in thirteen of the borings by obtaining either AXT or BX size rock core samples. Groundwater level observations were carried out, during the period of the investigation, in the open boreholes.

The soil, bedrock and groundwater conditions encountered at the boring locations are presented on the Record of Borelog sheets, appended to this report. The location and elevation of the various boreholes were provided by personnel from the Eastern Region Engineering Surveys Office. The elevations in this report are referenced to a Geodetic Datum. Boring locations and elevations are shown on Drawing No. W.O. 71-11056A. Estimated stratigraphical profiles, along proposed alignments A and C are plotted on Drawing No. 71-11056B.

All samples were subjected to 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:

- Natural Moisture Content
- Atterberg Limits
- Bulk Density
- Grain Size Distribution
- Undrained Shear Strength
- Lab Vane Test
- Consolidation Characteristics

The results of this testing are plotted on the Record of Borelog Sheets and summarized on Figures No. 1 to 8, inclusive, all contained in Appendix I of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The extent and composition of the overburden, within the area under investigation, varies markedly. West of the Petawawa River, the predominant stratum is composed of a dense

to very dense sand and gravel. This stratum varies in thickness from 13 feet near the river to 100 feet at Hwy. 17 (site #1). In the most westerly part of the stratum of sand and gravel is underlain by a layer of sandy silt or silty sand which, in turn, is followed by very dense gravel, which in turn is probably followed by gneiss bedrock. Closer to the river the sand and gravel stratum is directly underlain by gneiss bedrock.

East of the Petawawa River and West of the Boundary Road between the Townships of Petawawa and Alice, four of the eight investigated sites have the stratigraphical sequence of a 12 to 25 feet thick surficial granular deposit followed by a 5 to 28 feet thick cohesive deposit, which in turn, is followed by a 1 to 7 feet thick layer of glacial till then bedrock. In two of the sites the granular material is directly underlain by bedrock, the cohesive layer was not encountered in another two. In three of the abovementioned 8 sites, there is a 6 to 8 feet thick layer of sand overlying the bedrock and underlying the glacial till or cohesive deposits.

East of the Boundary Road between the Townships of Alice and Petawawa to Hwy. 62, in three of the seven investigated sites, a 16 to 30 feet thick surficial cohesive layer is underlain by a 8 to 12 feet thick glacial till layer, which in turn, is underlain by bedrock. In another site the cohesive material is overlain by a 7 feet thick granular deposit. In two sites the glacial till was found directly under a thin layer of topsoil and underlain by bedrock or a 27 feet thick granular deposit. In one site a 8 feet thick surficial cohesive layer is directly underlain by bedrock.

4.2) Fill Material:

Fill material was encountered at sites #23 and #24. At site #23, the depth of the fill varies from 7 to 16.5 feet and its composition is quite random, varying from sand and gravel

to clayey silt with ash, nails and organic material. Standard penetration testing carried out within the fill gave 'N' values ranging from 8 to 115 blows/foot. These values would indicate that the fill has been subjected to a considerable degree of compaction.

At site #24, 8 feet of compact granular road fill was encountered.

4.3) Organic Deposits:

Approximately 1,500 feet east of Petawawa River, at a point about 1-1/2 miles south-east of the existing Hwy. #17, there is a 500 feet wide swamp filled with organic material. In this area the surficial deposit is composed of a dark brown, very soft, fibrous peat. The thickness of the peat deposit ranges from 2 feet, along the edges of the swamp, to as much as 23.5 feet at the centre. In the central part of the swamp, the organic material is directly underlain by bedrock. Elsewhere, however, the organic material is underlain by the dense to very dense sand and gravel deposit common to this area. (Refer also to the Final Foundation Report No. 72-11021).

Organic material was not encountered at any other boring locations, except in some topsoil and the fill material discussed above. It is inferred, however, that surficial organic material may be present in isolated localized areas, as well as in the vicinity of the numerous creeks which cross this area.

4.4) Upper Granular Deposits:

4.4.1) Sand and Gravel:

From the existing Hwy. #17 to Airport Road (Site #14) a surficial sand and gravel deposit is present. This deposit is interrupted by the organic deposit located east of the Petawawa River, and at the upper 7 feet by the fill material of site #23. The thickness of this sand and gravel deposit varies

randomly from 100 feet at site #1 to 11 feet at site #4. Close to the Petawawa River and at site #12, this granular deposit contains numerous 6" to 12" boulders.

Grain-size distribution tests were carried out on samples from this deposit; the resulting curves are plotted in envelope form on Fig. 1 of the Appendix. Standard penetration testing was carried out within this deposit; the results are plotted on the Record of Borelog sheets. This testing gave 'N' values which range from 9 to more than 100 blows/foot, being generally in the 35 to 55 blows/foot range. Based on these results, it is estimated that the relative density of the granular material varies from loose to very dense, being generally in the dense to very dense range.

4.4.2) Silty Sand to Sandy Silt:

At some locations east of Petawawa River 27 to 25 feet surficial silty sand to sandy silt deposit is present. This deposit is interrupted by sand and gravel or clay surficial deposits.

Grain-size distribution tests were carried out on this deposit; the resulting curves are plotted in envelope form on Fig. 2 of the Appendix. The results from the Standard Penetration Tests carried out within this deposit are plotted on the Record of Borelog sheets. This testing gave 'N' values which range from 18 to 136 blows/foot. Based on these results, it is estimated that the relative density of this granular deposit varies from compact to very dense.

4.5) Cohesive Deposits:

At numerous sites east of the Petawawa River, there is a 5 to 28 feet thick cohesive layer of clay to silty clay. This layer is overlain by a 9 to 25 feet thick granular deposit at ten sites and by a thin topsoil layer at four other sites, and underlain by a 1 to 16 feet thick deposit of glacial till

(at eight sites) or bedrock (at three sites).

The engineering properties of the cohesive layer are summarized in the following table:

<u>Silty Clay to Clayey Silt</u>	<u>Range</u>	<u>Average</u>
Bulk Density (γ) (p.c.f.)	102 - 129	111.5
Liquid Limit (W_L) (%)	20 - 65	38
Plastic Limit (W_P)	15 - 26	22.5
Natural Water Content (W)	13.5 - 75	39
Liquidity Index (I_c)	0.4 - 7.6	1.3
Field Vane Test (p.s.f.)	850 - 2000+	
Lab Vane Test (p.s.f.)	615 - 7100	1900
Quick Triaxial Test (p.s.f.)	495 - 3190	1470

Consolidation Properties

<u>Borehole-Site/Sample</u>		<u>e_o</u>	<u>C_c</u>	<u>P_c (t.s.f.)</u>	<u>$P_c - P_o$ (t.s.f.)</u>
5	3	1.19	0.20	5.90	5.48
1 - 8	6	2.12	1.30	2.12	1.40
2 - 8	5	1.82	1.91	2.30	1.34
11	5	1.29	0.69	0.90	0.15
13	4	1.24	0.66	2.00	1.40
16	10	1.43	0.69	3.00	1.32
16	12	1.37	0.79	3.25	0.91

The Atterberg limit test results, given in the table, are also summarized on the Plasticity Chart, Figure #3. The testing indicates that the clay is inorganic with the plasticity being generally in the intermediate range. The natural moisture content is at or above the liquid limit as indicated by the high liquidity indices quoted (average 1.3). This means that the clay is sensitive marine Leda clay.

The results of field and laboratory vane tests and quick triaxial tests are plotted on the Record of Borelog sheets. The results indicate that the consistency of the cohesive material varies from firm to hard.

The grain size distribution of the cohesive deposit is presented on the Record of Borelog sheets and summarized on Fig. 3. Consolidation tests were carried out on seven samples; the void ratio vs. pressure graphs are shown in Fig. Nos. 5 and 7.

4.6) Glacial Till:

Glacial till is present at 16 sites out of the total 24. It is at the surface at sites 9 and 12, between the cohesive soil and the bedrock at sites 5, 11, 14, 16, 18 and 22, and under the granular deposit at the other eight sites. The thickness of the deposit varies from 2 to 51 feet.

As shown in the Record of Borelog sheets, the matrix of the till varies randomly. At some locations, it is cohesive (clayey silt binding sand and gravel) while at others it is granular in nature (silt and sand binding gravel); at some locations the till contains cobbles and small sized boulders. Grain-size distribution testing was carried out on samples from this deposit; the resulting curves are plotted in envelope form on Fig. 4.

Standard Penetration testing was carried out within this deposit. This testing gave 'N' values which vary from 3 to 92 blows/ft. in the cohesive till and 14 to more than 100 blows/ft. in the granular till. Based on these results, it is estimated that the cohesive till has a consistency which varies from soft to hard, being very stiff or hard in most areas. The granular till has a relative density in the compact to very dense range, being dense to very dense in most areas.

4.7) Irregularly Layered Deposits:

West of the Petawawa River, at sites 2 and 20, an irregularly layered deposit of sand, silt and clayey silt is present. The thickness of this deposit is 42 feet at site 2 and 72 feet at site 20. The relative density of the granular part of this deposit varies from loose to compact and the consistency of the cohesive part varies from firm to very stiff.

4.8) Lower Granular Material:

At four of the sites, west of the Petawawa River there is a 6 to 27 foot thick layer of sand to silty sand with boulders under the glacial till or the cohesive deposit.

Standard Penetration testing carried out within this deposit, gave 'N' values which range from 23 to 84 blows/foot. Based on these results, it is estimated that the relative density of the deposit varies from compact to very dense. Grain-size distribution testing was carried out on samples from this deposit; the resulting curves are plotted on Fig.5 of the Appendix.

4.9) Bedrock Conditions:

Bedrock was proven at 19 sites and refusal was reached in three more sites. Boreholes at sites 1 and 6 were ended when more than 110 feet had been augered without reaching bedrock.

The bedrock surface was found to vary randomly from lower than elevation 368 (at site 6) to elevation 506 (at site 7). The bedrock core samples were examined by Mr. K. W. Ingham, Geologist, Ministry of Transportation and Communications. The dominant type of bedrock encountered in the drilling is pink to dark grey gneiss of granitic or/and biotitic origin. This gneiss bedrock is interrupted at sites 10 and 18 where granite with biotitic inclusions was found.

In general the bedrock was found to be in a sound condition as evidenced by the high percentage of core recovery. At a few of the borings the upper 2 to 5 feet were in a fractured condition, and at Borehole #1 at site 3 the upper 16 feet was badly fractured.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during the period of the investigation in the open boreholes. The observations are presented on the individual borelog sheets

as well as on Drawing No. 71-11056B. The results indicate that the groundwater level varies between elevation 441 (site 2) to elevation 518 (at site 15). The depth of the water level ranges from 2 feet below ground level at site 12 to 33 feet below ground level at site 3 (Borehole #1).

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Three alternative alignments (A, B and C) were investigated for the proposed Hwy. #17 'New' Petawawa By-pass extending from the existing Hwy. 17 easterly to Hwy. 62. It is understood that the latest proposed alignment C will be adopted. Therefore, although the factual information given in the sections above covers the whole area (all the sites investigated on the three alignments) this section will provide the foundation engineering aspects associated with alignment C only.

The proposed highway will be a two lane highway. Later when Hwy. 17 'N' becomes a portion of Hwy. 417, the roadway will consist of two lanes in each direction, separated by a median.

The subsoil, bedrock and groundwater conditions, encountered in the area under investigation, have been discussed previously in this report in Sections No. 4 and 5. An inferred stratigraphical profile, along the proposed alignment C, is shown on Drawing No. W.O. 71-11056 B.

The following will be discussed in Subsection 6.2) of this report.

- i) Highway and roadway structure crossings of Hwy. 17 'N' (a total of six in all);
- ii) C.N. and C.P. Railway overhead structure crossings (two)
- iii) River crossing (one)
- iv) Treatment of deep organic fill (one)
- v) Fill on garbage dump area
- vi) Creek crossing (one)

These crossings are shown in plan on Drawing No. W.O. 71-11056A.

At this stage, the profile grades at the crossings,

as well as other pertinent data, have not been finalized.

Preliminary design data, recommendations pertaining to foundation design of the various structures, as well as the stability and settlement considerations for the approach fills, will be presented in the subsection previously mentioned.

6.2) Hwy. 17 'N' Crossings - Proposed Alignment C:

<u>Site No.</u>	<u>Crossing</u>	<u>Type</u>	<u>Page No.</u>
1	C.P.R.	Overhead Structure	
6	Baelstadt Road	Underpass Structure	
24	Paquette Road	Underpass Structure	
18	Petawawa River Swamp Treatment	Overpass Structure (Site 424+00 to 429+00)	
19	Murphy Road	Underpass Structure	
20	County Road 26	Underpass Structure	
21	Creek	Culvert, Fill	
22	County Road 17	Underpass Structure	
11	C.N.R.	Overhead Structure	
10	Hwy. 62	Underpass Structure	

It should be stressed that the recommendations given in this report are of a preliminary nature. A complete foundation investigation will be required at all the sites, once the design details for the proposed alignment 'C' become available.

7. MISCELLANEOUS:

The field work was carried out from June 11, 1971, to July 8, 1971 and September 15, 1971 to October 7, 1971 and it was supervised by A. E. Dyer, Student Technician (Field).

The equipment used was owned and operated by Johnston Drilling Co. Limited and Dominion Soils Investigation Limited.

This report was prepared by Mr. J. Cortabarría, Student Technician, and reviewed by Mr. M. Devata, Supervising Foundations Engineer.

James Bangs
for

J. Cortabarría,

M. Devata

M. Devata, P. Eng.

JC/ao

Jan. 16, 1973.



FOUNDATION RECOMMENDATIONS - SITE #1
Overhead Structure - Hwy. 17N & C.P.R.

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (ft.)	Recommendations		Remarks
		Structure	Approaches	

FINAL FOUNDATION REPORT SUBMITTED
Refer to W.O. 72-11021, dated April 10, 1972.

FOUNDATION RECOMMENDATIONS - SITE #6
Underpass Structure - Hwy. #17N & Baefstadt Rd.

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Fill Heights 21' to 25'	
484+	Sand, trace of silt and gravel Loose to dense (65') Sandy silt with some clay & gravel Compact to very dense (51'+)	<u>Pier(s)</u> Spread footings founded at elevations 478 within the granular deposit (6 feet below the final ground level) Allowable bearing pressure up to 3.0 t.s.f. <u>Abutments</u> 'Perched' on spread footings in the approach fills,, within a zone composed of well compacted granular material, using an allowable bearing value of 2.5 t.s.f. Alternatively, friction piles extending a minimum of 40' into parent subsoil, e.g. #14 timber piles with 25 tons/ pile allowable load. <u>Note:</u> Differential settlements between the abutments and adjacent piers will not exceed 1/2".	<u>Stability</u> Fills up to 25' (with 2:1 slopes) will be stable Probable Elastic <u>Settlement</u> 25' Fill (2:1 slope) 1" (max.)	

FOUNDATION RECOMMENDATIONS - SITE #24
Underpass Structure - Hwy. #17N & Paquette Rd.

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Heights 20' to 25'	
465.5	Fill (sand & gravel and some silt) Compact (8') Very bouldery sand and gravel with trace of silt and clay (Glacial till) Very dense (26')	<u>Pier(s)</u> Spread footings founded at or below elevation 457.5 within the granular deposit (6 feet below the final ground level) Allowable bearing pressure up to 4.5 t.s.f. <u>Abutments</u> 'Perched' on spread footings in the approach fills, within a zone composed of well compacted granular material, using an allowable bearing value of 2.5 t.s.f. Alternatively, end-bearing piles driven into Glacial till stratum. Estimated pile tip elevation 450 designed for the max. capacity for the pile section chosen. <u>Note:</u> Differential settlements between the abutments and adjacent piers will not exceed 1/2".	<u>Approaches</u> Heights 20' to 25' <u>Stability:</u> Fills up to 25' (with 2:1 slopes) will be stable. Probable Elastic Settlement - 25' Fill (2:1 slope) 1/2" (max.)	

FOUNDATION RECOMMENDATIONS - SITE #18
Bridge Structure - Hwy. 17N and Petawawa River

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches	

FINAL FOUNDATION REPORT SUBMITTED

Refer to W.O. 72-11010, dated Feb. 29, 1972.

FOUNDATION RECOMMENDATIONS
Treatment of Deep Organic Deposits

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations	Remarks
--	--	-----------------	---------

FINAL FOUNDATION REPORT SUBMITTED

Refer to W.O. 72-11012, dated Sept. 14, 1972.

FOUNDATION RECOMMENDATIONS - SITE #20

Hwy. 17N Fill on Garbage Dump Area

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Approx. Height of Fill (2:1 Slopes)	Stability and Settlement Considerations	Remarks
	Sand, Gravel, clayey silt, ash, nails, etc. (Garbage Dump) Compact to very dense (16.5) Sand and gravel Very dense (3')	6' to 10'	<u>Stability</u> No stability problems anticipated <u>Probable Settlement</u> 1" (max.)	

FOUNDATION RECOMMENDATIONS - SITE#19
Underpass Structure - Hwy. #17N & Murphy Rd.

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Heights 20' to 25'	
505+	Sand with trace of silt Compact (24') Sand, silt gravel (Glacial till) Very dense (6') Bedrock	<u>Pier(s)</u> Spread footings founded at or below elevation 500 within the granular deposit (6 feet below the final ground level) Allowable bearing pressure up to 2.5 t.s.f. Alternatively, end-bearing piles driven to practical refusal within the glacial till stratum. Estimated pile tip elevation 475 - designed for the max. allow- able capacity for the pile section chosen. <u>Abutments:</u> 'Perched' on spread footings in the approach fills, within a zone composed of well compacted granular material, using an allowable bearing value of 25 t.s.f. Alternatively, end-bearing piles driven to practical refusal in the glacial till stratum.- Estimated pile tip elevation 475 designed for the max. allowable capacity for the pile section chosen. <u>Note:</u> Differential settlements between the abutments and adjacent piers will not exceed 1".	<u>Stability:</u> Fills up to 25' (with 2:1 slopes) will be stable Probable Elastic Settlement: 25' fill (2:1 slope) 1" (max.)	

FOUNDATION RECOMMENDATIONS - SITE #20
Underpass Structure - Hwy. #17 N & County Rd. 26

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Heights 20' to 25'	
515+ 27	Silty Sand Dense to very dense (15') Silty Clay Firm to stiff (10') Irregularly layered SiH ₄ clayey silt and silty clay Loose to compact or firm to very stiff (72') Sand Dense (2') Glacial Till Very dense (5.5'+)	<u>Pier(s)</u> Spread footings founded at or below elevation 509 within the granular deposit (6 ft. below the final ground level). Allowable bearing pressure up to 3.0 t.s.f. <u>Abutments:</u> 'Perched' on spread footings in the approach fills within a zone composed of well compacted granular material using an allowable bearing value of 2.0 t.s.f. Alternatively, friction piles extending a minimum of 40' into parent subsoil, e.g. #14 timber piles with 25 tons/pile allowable load. <u>Note:</u> Differential settlements between the abutments and adjacent piers will not exceed 1.	<u>Stability:</u> Fills up to 25' (with 2:1 slopes will be stable) Probable elastic settlement: 25' Fill (2:1 slope) 1" (max.)	

FOUNDATION RECOMMENDATIONS - SITE #21
Culvert at Hwy. 17 N & Creek Crossing

Approx. Creek Water Level.	Predominant Overburden Strata Approx. Thickness (Ft.)	Approx. Height of Fill (2:1 Slopes)	Stability and Settlement Considerations	Remarks
464+ Approx. ground level 465.5+	Clayey silt to silty clay Firm (9') Silty sand (seams of clay through- out) Compact (6') Glacial Till Dense to very dense (10') Granite-gneiss bedrock Fractured	14' to 16'	<u>Stability:</u> No stability problems anticipated <u>Probable Settlement:</u> 1" (Max.)	A corrugated steel culvert pipe could be used at this location.

FOUNDATION RECOMMENDATIONS - SITE #22
Underpass Structure - Hwy. 17 N & Co. Rd. #17

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Heights 20' to 25'	
481+	Silty sand Dense (7.5') Clayey silt to silty clay Firm (21') Sand, Gravel, Silt Clay and boulders (Glacial Till) Very dense (21')	<u>Pier(s)</u> End-bearing piles driven to refusal within the glacial till stratum. Estimated pile tip elevation 447, designed for the max. capacity of the pile section chosen <u>Abutments:</u> Same as above	<u>Stability:</u> Fills up to 25' (with 2:1 slopes) will be stable. Probable settlement 25' Fill (2:1 slopes) 7" (max.)	

FOUNDATION RECOMMENDATIONS - SITE #11
Overhead Structure - Hwy. 17 N & C.N.R. Rail

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Heights 28' to 32'	
468.5+	Topsoil (2') Clayey silt to silty clay, trace of sand Firm to very stiff (28') Sand, gravel, silt, clay and boulders (Glacial till) Dense (13') Solid Bedrock	<u>Pier(s)</u> End-bearing piles driven into the glacial till stratum. Estimated pile tip elevation 428, designed for the max. capacity of the pile section chosen. <u>Abutments;</u>	<u>Stability:</u> Fills up to 32' (with 2:1 slopes) will be stable Probable settlement 32' fill (2:1 slopes) 3" - 5" (max.)	

FOUNDATION RECOMMENDATIONS - SITE #10
Underpass Structure - Hwy. 17 N & Hwy. 62

Approx. Existing Ground Level	Predominant Overburden Strata Approx. Thickness (Ft.)	Recommendations		Remarks
		Structure	Approaches Heights 20' to 25'	
469.5+	Sand, trace of gravel and clay (fill) (3') Clayey silt to silty clay Very stiff (16.5') Silt, sand and gravel, occasional boulders (Glacial Till) Very dense Granite Bedrock (sound)	<u>Pier(s)</u> Spread footings founded at or below elevation 464 within the cohesive deposit. Allowable bearing pressure up to 2.5 t.s.f. <u>Abutments</u> 'Perched' on spread footings in the approach fills, within a zone composed of well compacted granular material, using an allowable bearing value of 2.0 t.s.f. Alternatively, end-bearing piles driven to practical refusal in the glacial till stratum. Estimated pile tip elevation 440, designed for the max. allowable capacity for the pile section chosen. <u>Note:</u> Differential settlements between the abutments and adjacent spread footing supported piers will not exceed 1-1/2".	<u>Stability:</u> Fills up to 25' (with 2:1 slopes) will be stable. Probable settlement 25' Fill (2:1 slope) (1-1/2" (max.))	

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 1

JOB 71-11056

LOCATION Hwy. 17 - Petawawa Airport Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 18, 21, 22, 23, 1971

COMPILED BY BTB

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			W_P W W_L WATER CONTENT % 20 40 60				
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
500.7	Ground Level		1	SS	8	500								
1.0	Sand (medium to fine) trace of gravel.		2	SS	19									
			3	SS	28									
			4	SS	26									
			5	SS	35									
			6	SS	51									
			7	SS	42									
			8	SS	32									
			9	SS	43									
			10	SS	96									
			11	SS	43									
			12	SS	69									
			13	SS	81									
			14	SS	109									
			15	SS	61									
			16	SS	44									
			17	SS	38									
			18	Wash	-									
			19	SS	48									
			20	SS	65									
400.7						400								
100.0	Silty sand		21	SS	54									
	Very Dense													

Continued

20
15-0-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 1 Cont.

JOB 71-11056

LOCATION Hwy. 17 - Petawawa Airport Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 18, 21, 22, 23, 1971

COMPILED BY BTD

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT _____w _L				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT _____				PLASTIC LIMIT _____w _p					
							SHEAR STRENGTH P.S.F.				WATER CONTENT _____w					

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 2

JOB 71-11056

LOCATION Paquette Rd. @ Camp Petawawa Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 12 & 14, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing, BX, AXT 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 γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					w_p w w_L				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 20 40 60				
464.2	Ground Level															
0.0	Sand (medium to fine).	1	SS	11	460									1 96 (3)	
			2	SS	13											
			3	SS	17											
	Compact to Dense		4	SS	35											
451.6			5	SS	11	450									129	
12.6	Irregularly layered silt, sand and clayey silt.	6	TW	108												
		7	SS	15												
		8	TW	PM												
	Loose to Compact or Stiff to Very Stiff		9	SS	7	440									440.6 June 15/71	
		10	SS	26												
		11	SS	9												
		12	SS	24												
			13	SS	9	420									0 37 58 5	
			14	TW	PM											
			15	BX	90%											
409.7	Gneiss Bedrock		16	RC AXT	87%	410										
54.5			17	RC AXT	99%											
398.7	Sound					400										
65.5	End of Borehole					390										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 3

JOB 71-11056

LOCATION Petawawa River - West Bank Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 23 - 25, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX, AXT Casing, AXT, BX 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 γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		w_p ——— w ——— w_L WATER CONTENT % 20 40 60			
480.5	Ground Level											GR.SA.SI.CL.
0.0	Sand and gravel (numerous 6" to 10" boulders throughout)		1	SS	18	480						
			1A	BX	52%							
			2	SS	10							
			3	SS	13	470						82 17 (1)
			4	SS	28							
			5	SS	12h	460						
			6	SS	19							
			7	SS	97%	450						447.6 June 28/71
			7A	RC BX	14%							44 48 (8)
			8	SS	99	440						
			8A	BX	30%							
			9	SS	65%							
	Compact to Very Dense		10	SS	80%							
			10A	BX	40%							
429.0			11	SS	60%	430						
51.5	Fractured		12	AXT	83%							
	Sound											
	Biotite Gneiss		13	AXT	80%	420						
415.5	Bedrock		14	AXT	99%							
65.0	End of Borehole					410						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2- SITE NO 3

JOB 71-11056

LOCATION Portage Road River Crossing Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 21, 22, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % 20 40 60					
180.2	Ground Level															
0.0	Sand and gravel, Trace of silt, clay with numerous boulders		1	SS	51	480									477.3 June 22/71 27 60 (13)	
			2	SS	79											
			3	SS	65	470										
468.7	Very Dense		4	BX	75%											
11.5	Fractured		5	BX	85%	460										
	Biotite Gneiss Bedrock		6	BX	80%											
456.1	Sound															
24.1	End of Borehole					450										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3 - SITE NO 3

JOB 71-11056

LOCATION Top W. Bank Petawawa River at Portage Rd. Line 'A'

ORIGINATED BY AED

W.P. 3-67-01



BORING DATE June 16 & 17, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE AX, BX Casing; BX 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 $w_p \quad w \quad w_L$				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % 20 40 60					
464.5	Ground Level															
0.0	Sand and gravel (numerous 6" to 8" boulders throughout)		1	SS	52	460									56 h1 (3) ▼ 450.1 June 17/71	
			2	SS	14											
			3	SS	54											
			3A	BX	33%	450										
			4	SS	21											
			5	SS	30											
	Compact to Very Dense															
440.5			6	SS	103	440										
24.0	Biotite Gneiss Bedrock		7	AXT	79%	430										
			8	AXT	38%											
424.5	Fractured		9	AXT	28%											
40.0	End of Borehole					420										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1- SITE NO 4

JOB 71-11056

LOCATION Top W. Bank Petawawa River at Portage Rd. Line 'B'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 15, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing, BX Rock Core

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		BLOWS / FOOT				PLASTIC LIMIT w_p					
							SHEAR STRENGTH P.S.F.				WATER CONTENT w					

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2- SITE NO 4

JOB 71-11056

LOCATION Portage Rd. Line 'B'

ORIGINATED BY AED

W.P. 3-67-01

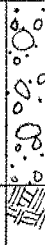
BORING DATE June 17, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casin

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	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				W_p — W — W_L					
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % 20 40 60					
478.8	Ground Level															
0.0	Sand and gravel (numerous 6" to 8" boulders throughout)		1	SS	72	470									26 56 (18) ▽ 468.3 June 21/71	
			2	SS	103											
			3	SS	88											
			4	SS	63											
465.8	Very Dense					460										
13.0	Biotite Gneiss Bedrock		5	EX	97%											
454.8	Sound		6	EX	96%	450										
24.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 5

JOB 71-11056

LOCATION County Rd. 17 Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 11, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000				WATER CONTENT % 20 40 60				
460.7	Ground Level														
1.0	Topsoil		1	SS	5	460									
	Clay to silty clay		2	TW	FM										
	Grey		3	TW	FM										
	Very Stiff		4	TW	FM	450									
443.7			5	TW	FM										
17.0	Het. mix. of sand, silt & gravel, trace of clay (Glacial Till)		6	TW	FM										
	Dense		7	SS	32	440									
435.7	Bouldery Zone (boulders up to 6" in size)		8	BX	40%										
25.0	Granite Gneiss Bedrock		9	BX	95%										
428.7	Sound		10	BX	100%	430									
32.0	End of Borehole					420									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 6

JOB 71-11056

LOCATION Baelstadt Rd. Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 24, 25 & 26, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing

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	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		W_P — W — W_L				
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE	WATER CONTENT % 20 40 60				
484.0	Ground Level						400 800 1200 1600 2000					GR 5A, SI, CL	
0.0	Sand, trace of silt and gravel	.	1	SS	9	480							June 26/71 172.0 5-93 (2)
			2	SS	30								
			3	SS	30								
			4	SS	23								
			5	SS	19								
			6	SS	15								
			7	SS	24								
			8	SS	20								
			9	SS	33								
			10	SS	20								
			11	SS	14								
			12	SS	12								
			13	SS	16								
			14	SS	27								
419.0	Loose to Dense	.	15	SS	40	420							0 92 (8)
65.0			16	SS	66								
			17	SS	18								
			18	SS	31								
			19	SS	31								
			20	SS	31								
	Sandy silt with some clay(thin seams) and some gravel	.				410							0 26 72 2
	Glacial Till	.				400							3 25 53 19
	Compact to Very Dense	.				390							
						380							

Continued

 20
 15 ϕ 5 % STRAIN AT FAILURE
 10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE - SITE N^o 6 Cont.

JOB 71-11056

LOCATION Baelstadt Rd. Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 24, 25 & 26, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					w_p w w_L				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 20 40 60				
368.0	Glacial Till Compact to Very Dense					370										
116.0	End of Borehole					360										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 7

JOB 71-11056

LOCATION County Rd. 26 Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 16 & 17, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE AX, BX, NX Casing; AXT 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 γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					WATER CONTENT % w_p w w_L 20 40 60				
523.2	Ground Level															
0.0	Sand, trace of clay, silt and gravel.		1	SS	21	520									520.9 June 18/71 8 81 (11)	
			2	SS	72											
			3	SS	59											
			4	SS	31											
	Loose to Very Dense		5	SS	8											
511.2						510									4 19 55 22	
12.0	Silty clay, some sand, trace of gravel.		6	SS	3											
506.2	Firm to Stiff															
17.0	Granite Gneiss Bedrock (Biotite Layers)		7	AXT	100%	500										
			8	AXT	100%											
			9	AXT	100%											
495.2	Sound					490										
28.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1 - SITE NO 8

JOB 71-11056 LOCATION North Side Alice-Petawawa Twp. Boundary Rd., Line 'A' ORIGINATED BY VK
 W.P. 3-67-01 BORING DATE June 29, 1971 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Wash & bore with NX & BX Casing CHECKED BY OF

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			w_p — w — w_L					
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE			WATER CONTENT % 20 40 60					
487.4	Ground Level														
1.5	Silt with sand and trace of clay.		1	SS	11	480								103	481.9 481.8/71 0 37 (63)
			2	SS	27										
			3	SS	34										
			4	SS	34										
478.4	Compact to Dense		5	TW	PM	470								103.5	eo=2.12 Pc=1.45tsf Cc=1.30
9.0	Clay to silty clay.		6	TW	PM										
			7	TW	PM										
			8	SS	-										
			9	TW	PM										
	Grey		10	SS	-	460								103.5	
450.4	Firm to Stiff					450								103.5	
37.0	Granite Gneiss Bedrock		11	BX RC	100%										
			12	BX RC	100%										
437.4	Sound					440									
50.0	End of Borehole					430									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2- SITE NO 8

JOB 71-11056

LOCATION South Side Alice-Petawawa Twp. Boundary Rd. Line 'A'

ORIGINATED BY VE

W.P. 3-67-01

BORING DATE June 28, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash and bore with NX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		W_P W W_L			
							\circ UNCONFINED + FIELD VANE \bullet QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000	WATER CONTENT % 20 40 60				
487.4	Ground Level											
0.0	Sandy silt with trace of clay.		1	SS	42	480					103	0 27 49 24 Pc=2.3tsf Cc=1.91 eo=1.822
			2	SS	26							
			3	SS	26							
			4	SS	5							
471.4	Loose to Dense											
16.0	Clay to silty clay. Grey		5	TW	PM	470						
465.6	Firm to Stiff											
21.8	Bot. mix. sand, gravel, silt, clay (Glac. Till), Dense		6	SS	38							
462.7												
24.7	Granite Gneiss											
457.9	Bedrock Sound		7	AXT	100%	460						
29.5	End of Borehole					450						

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 9

JOB 71-11056

LOCATION Hwy. 62 Pembroke

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 5, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash and Bore with BX & NX Casing

CHECKED BY (20)

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	PLASTIC LIMIT — w_p	WATER CONTENT — w	WATER CONTENT %		
453.6	Ground Level											
0.0	Topsoil		1	SS	4							
1.5	Het. mix. of sand, gravel, silt, clay (Glacial Till) (6" to 15" boulders below 8' depth)		2	TW	PM	450						
			3	SS	54							41 34 19 6
			4	SS	65							441.6 July 9/71
			5	SS	73 1/2	440						30 53 (17)
			6	AXT	50%							
			7	AXT	16%							
			8	SS	52	430						
			9	SS	38 1/2							
			10	AXT RC	15%							
418.6	Very Dense		11	AXT	7%	420						
35.0			12	SS	63							
			13	SS	85							1 85 (13)
	Silty sand, trace of gravel.					410						
	Very Dense											
	Blocky Zone (boulders up to 5" in size)					400						
390.9												
62.7	Granite Gneiss		14	AXT	88%	390						
387.6	Bedrock Fractured											
66.0	End of Borehole					380						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 10

JOB 71-11056

LOCATION Hwy. 62 Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 2, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % w_p w w_L				
							\circ UNCONFINED + FIELD VANE \bullet QUICK TRIAXIAL x LAB VANE				20 40 60				
469.5	Ground Level														
0.0	Sand, trace of gravel														
466.5	(Roadway Fill)														
3.0	Clayey silt to silty clay.		1	SS	19										
			2	SS	17										
	Grey		3	TW	PM	460									
			4	TW	PM										
			5	SS	8										
450.0	Very Stiff					450									
19.5	Het. mix. of silt, sand & gravel, some clay (Glacial Till) (boulders up to 12" in size throughout)		6	SS	57										
			7	SS	63/6"										
439.0	Very Dense		8	SS	92	440									
30.5	Granite		9	RC AXT	100%										
	Bedrock					430									
426.6	Sound		10	RC AXT	100%										
42.9	End of Borehole					420									

July 8/71
 462.5
 0 12 63 25

0 9 70 21

19 59 20 2

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 11

JOB 71-11056

LOCATION C.N.R. - East of Co. Rd. #15 Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 8, 1971

COMPILED BY BCB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT — w w_p — w — w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 100 800 1200 1600 2000				WATER CONTENT % 20 40 60				
468.4	Ground Level														
466.4	Topsoil		1	SS	17										
2.0	some sand		2	SS	11										
	Clayey silt to silty clay, trace of sand.		3	TW	PM	460			x3						0 39 36 25
			4	TW	PM										0 11 54 35
			5	TW	PM				+7						Gc=.6860
			6	TW	PM	450			+5					111.5	Pc=.9tfs
	Grey		7	TW	PM				+6						
			8	TW	PM				+3						0 2 68 30
438.4	Firm to Very Stiff		8	TW	PM	440			+8					112	0 21 49 30
30.0	Het. mix. sand & gravel with silt & clay (boulders up to 2.5' in size throughout) (Glacial Till)		8A	BX	84%				+2000						
425.6	Dense to Very Dense		9	SS	37	430									
42.8	Granite Gneiss Bedrock		10	SS	100%										
			11	BX	100%	420									
414.2	Sound		12	BX	70%										
54.2	End of Borehole					410									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 12

JOB 71-11056

LOCATION Co. Rd. #15 Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE June 30, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % 20 40 60				
488.7	Ground Level														
0.0	Topsoil		1	SS	11	480									GR. SA. SI. CL. 487.7 July 1/71 31 60 (9)
1.5	Sand, gravel, silt, clay (with boulders up to 10" throughout) (Glacial Till)		2	SS	21										
			3	SS	32										
477.5	Compact to Dense		4	AXT	38%	470									
11.2	fractured														
	Granite Gneiss Bedrock		5	AXT	94%										
467.2	Sound		6	AXT	100%	460									
21.5	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 13

JOB 71-11056 LOCATION Biesenthal Rd. Line 'A' ORIGINATED BY VK
 W.P. 3-67-01 BORING DATE June 29, 1971 COMPILED BY ECB
 DATUM Geodetic BOREHOLE TYPE Wash & Bore with NX & BX Casing CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000										
473.3	Ground Level		1	SS	6	470										GR, SA, SI, CL hole caved June 29/71 0 22 58 20	
0.0	Topsoil		2	SS	14												
469.3	Clayey silt with some sand, ——— Stiff ———		3	TW	PM												
4.0	Clay to silty clay																
462.7	Grey Firm to Very Stiff		4	TW	PM	460										Cc=0.660 Pc=2.0 TFS	
10.6	Granite Gneiss																
457.5	Bedrock Sound		5	AXT	100%												
15.8	End of Borehole					450											

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 14

JOB 71-11056

LOCATION Airport Rd. Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 6, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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		BLOWS / FOOT					PLASTIC LIMIT ——— w_p					P.C.F.
							SHEAR STRENGTH P.S.F.					WATER CONTENT ——— w					
525.7	Ground Level						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					w_p ——— w ——— w_L 20 40 60					
0.0	Sand, trace of silt to silt, trace of sand.		1	SS	15	520									521.8 July 7/71 0 91 (9)		
			2	SS	10												
			3	SS	45												
			4	SS	28												
	Compact to Very Dense		5	SS	64	510									0 4 92 1		
507.2			6	SS	15												
18.5	Clayey silt, trace of sand.		7	TW	PM	500									0 28 62 10		
501.2	Very Stiff		8	TW	PM												
24.5	Sand with gravel, some silt, trace clay. (Glacial Till)					490									37 44 18 1		
494.1	Dense		9	SS	41												
31.6	Granite Gneiss Bedrock		10	BX	83%	480											
487.2	Sound		11	AXT	100%												
38.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 15

JOB 71-11056

LOCATION Black Bay Rd. Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 2, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P W W_L					BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT % 20 40 60						
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000											
531.5	Ground Level															GR. SA. SI. CL.		
0.0	Silty sand to sandy silt, with a trace to some gravel.		1	SS	25	530												
			2	SS	40													
	Compact to Very Dense		3	SS	85	520										0 47 52 1		
			4	SS	136											517.6 July 6/71		
			5	SS	52	510										27 20 50 3		
506.5			6	SS	133											5 17 72 6		
25.0	Het. mix. of sand, silt and some gravel		7	TW	PM	500												
	(Glacial Till)		8	SS	120													
			8A	AXT	30%													
			9	SS	43	490										8 58 33 1		
			10	SS	21													
			10A	EX	55%													
			11	SS	120 1/2"	480												
	(boulders up to 12" in size throughout)		12	SS	150 2/3"													
			13	EX	100%													
			13A	SS	120 2/3"	470										15 70 (15)		
	Compact to Very Dense		14	SS	171 1/6"													
161.3			15	SS	150 2/2"	460												
70.2	Diotite Gneiss		16	BX	72%													
156.2	Bedrock (some weathering.)																	
75.3	End of Borehole					450												

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 16

JOB 71-11056 LOCATION Murray Rd. - Petawawa Line 'A'
 W.P. 3-67-01 BORING DATE June 29, 1971
 DATUM Geodetic BOREHOLE TYPE Wash & Bore with IM & BX Casing

ORIGINATED BY VK
 COMPILED BY ECH
 CHECKED BY [Signature]

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					w_p — w — w_L 20 40 60				
512.0	Ground Level														GR. SA. SI. CL.	
0.0	Sand, some gravel, trace of silt.		1	SS	24	510									No W.L. on June 30/71	
			2	SS	28										8 85 (7)	
			3	SS	35											
			4	SS	48	500										
	Compact to Very Dense		5	SS	58										25 67 (8)	
492.0			6	TW	PM	490										
20.0	Silty clay with some sand.		7	TW	PM											
			8	TW	PM											
			9	TW	PM	480									108	
			10	TW	PM											
			11	TW	PM	470									109	
	Stiff to Very Stiff		12	TW	PM											
457.0						460										
55.0	Sand, silt, clay, gravel, (Glas. Till), V. Dense		13	SS	110										2 52 31 15	
57.0	Biotite Gneiss															
451.6	Bedrock. Sound		14	AXT	90											
60.4	End of Borehole					450										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 17

JOB 71-11056

LOCATION County Rd.#17 & Hales Cr.

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 7, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— W_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT ——— W_P				
390.8	Ground Level						SHEAR STRENGTH P.S.F.				WATER CONTENT — W				
							○ UNCONFINED + FIELD VANE				W_P — W — W_L				
							● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %				
0.0	Clayey silt with some sand. Stiff		1	SS	7	390									
387.8	Grav. with sand (boulders)		2	SS	11.7"										
3.3	Granite Gneiss Bedrock		3	BX	100%										
			4	BX	100%	380									
377.0	Sound														
13.8	End of Borehole					370									

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

 387.5
 July 8/71

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 18

JOB 71-11056

LOCATION Petawawa River - East Bank Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 15, 1971

COMPILED BY EOB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT _____w _L PLASTIC LIMIT _____w _P WATER CONTENT _____w w _P — w — w _L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000									
471.4	Ground Level															
0.0	Sand and Gravel	•••••	1	SS	100	3" 470										
			2	SS	199											
	Very Dense		3	SS	150	460										
458.4																
13.0	Silty clay with trace of sand & gravel.	▨▨▨▨▨	4	SS	4											
			5	TV	FM											
	Firm to Stiff		6	TV	FM	450										
446.4																
25.0	Glac. Till. Very Dense	▨▨▨▨▨	7	SS	80	440										
26.3	Sand (boulders up to 10" in size throughout)	•••••	8	AXT	23											
439.4	Very Dense	•••••	9	AXT	17	440										
32.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2 - SITE NO 18

JOB 71-11056

LOCATION Petawawa River - West Bank Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 21, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX Casing

CHECKED BY *ECB*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %					
156.2	Ground Level															
0.0	Sand and Gravel (boulders up to 10" in size throughout)		1	SS	100	1"										
			2	SS	100	1"										
	Very Dense		3	SS	100	1"										
141.7	Fine Sand Layers					450										
14.5	Granite Bedrock (biotite gneiss inclusions)		4	AXT	93%	440										
131.7	Sound		5	AXT	95%											
24.5	End of Borehole					430										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3-SITE NO 18

JOB 71-11056

LOCATION Petawawa River, West Approach Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

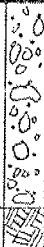
BORING DATE Sept. 22/71

COMPILED BY EGP

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BA Casing

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT % 20 40 60				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
460.1	Ground Level															
0.0	Sand and gravel (boulders up to 12" in size throughout)		1	SS	100	5"									29 65 (6)	
446.3	Very Dense		2	SS	100	1"	450									
13.8	Granite Bedrock (Biotite Gneiss inclusions)		3	AXT	97%		440									
437.1	Sound		4	AXT	92%											
23.0	End of Borehole															
						430										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4-SITE NO 18

JOB 71-11056

LOCATION Petawawa River Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 2, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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	STRAT. PLT.	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				w_p — w — w_L				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000	WATER CONTENT % 20 40 60							
467.2	Ground Level														
0.0	Sand & gravel to gravelly sand (occasional boulders throughout)		1	SS	125	460									▼463.7 Sept. 29/71
453.2	Compact to Very Dense		2	SS	20										33 61 (6)
44.0	Silty clay, trace of sand.		3	TW	PM	450								114	
			4	TW	PM										
	Firm to Stiff		5	TW	PM	440									
437.2															
30.0	Silty sand.		6	SS	23										
431.2	Compact		7	SS	6	430								A- 0 81 (19) B- 0 17 60 23	
36.0	Clayey silt with some sand & gravel (Glacial Till)		8	SS	45										
420.7	Firm to Hard					420									
416.5	Granite Bedrock														
415.7	Sound		9	AXT	100%										
51.5	End of Borehole					410									

DESIGN SERVICES BRANCH

FOUNDATIONS OFF

RECORD OF BOREHOLE - SITE No 19

JOB 71-11056

LOCATION Morphy Rd. Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 28, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NY & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			W_p W W_L				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 20 40 60				
505.2	Ground Level.													
0.0	Silty Sand													
			1	SS	25	500								
			2	SS	20									
			3	SS	20	490								
	Compact		4	SS	18									
481.2														
24.0	Het. mix. of sand, silt, gravel (Glacial Till)		5	SS	64	480								
	Very Dense													
	Bouldery Zone													
	(boulders up to 10" in size)		6	AXT	50%									
470.0						470								
35.2	End of Borehole													
						460								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 20

JOB 71-11056

LOCATION Co. Rd. #26 & Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 30, 1971

COMPILED BY ECE

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with M & BK Casing

CHECKED BY J.

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					w_p w w_L						
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 100 800 1200 1600 2000					WATER CONTENT % 20 40 60						
515.2	Ground Level																	
0.0	Silty Sand		1	SS	50	510												
	Dense to Very Dense		2	SS	32													
500.2						500												
15.0	Silty Clay		3	TW	PM											106		
	Gray		4	TW	PM													
490.2	Firm to Stiff					490												
25.0	Irregularly layered silt, clayey silt and silty clay, trace of sand throughout.		5	SS	19													
			6	TW	PM													
			7	TW	PM	480										120		
			8	TW	PM													
			9	SS	12	470										0 18 63 19		
			10	SS	12													
	Loose to Compact or Firm to Very Stiff		11	SS	10	460										0 17 59 24		
			12	SS	8													
			13	TW	PM	450												
			14	TW	PM													
			15	TW	PM	440										114		
			16	TW	PM													
			17	TW	PM	430												
			18	TW	PM													
			19	TW	PM	420										119(11)		
418.2																		
97.0	Sand		20	SS	10													
	Dense																	

Continued

20
15 ϕ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE N^o 20 Cont.

JOB 71-11056

LOCATION Co. Rd. #26 & Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 30, 1971

COMPILED BY ECR

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000			WATER CONTENT % 20 40 60				
105.0	Sand & gravel & silt (Glacial Till)	21	GS	87	410									
104.7	Very Dense Boulder													
110.5	End of Borehole					400								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 21

JOB 71-11056

LOCATION Hales Creek-West Branch Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Oct. 7/71

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLCT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					WATER CONTENT %					
479.2	Ground Level																
0.0	Topsoil																
1.0	Clayey silt to silty clay. Grey Very Stiff to Firm					470											
			1	SS	23												
			2	SS	20												
			3	TW	PM												
			4	TW	PM												
455.1			5	SS	100	460				15							
24.1	End of Borehole																
						450											

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2-SITE NO 21

JOB 71-11056

LOCATION Hales Creek-West Branch Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Oct. 6, 1971

COMPILED BY EOB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p w w_L WATER CONTENT %			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000									
465.4	Ground Level															
0.0	Sandy silt.															
462.4	Compact															
3.0	Clayey silt to silty clay.		1	TW	PM	460										
456.4	Firm															
9.0	Silty sand (seams of clay throughout)		2	SS	25											
450.4	Compact															
15.0	Het. mix. of sand, silt & gravel (Glacial Till)		3	SS	39	450										
			4	SS	63											
440.9	Dense to Very Dense															
24.5	Biotite Granite Gneiss Bedrock (fractured layers above el. 432.5)		5	AXT	80%	440										
			6	AXT	100%											
430.9	Sound															
34.5	End of Borehole					430										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 22

JOB 71-11056

LOCATION County Rd. #17 Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Oct. 4, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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. GR. SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000		w_p — w — w_L WATER CONTENT %			
481.0	Ground Level											
0.0	Silty Sand					480						
473.5	Dense		1	SS	32							
7.5	Clayey silt to silty clay.		2	TW	PM	470						
			3	TW	PM							
	Grey		4	TW	PM	460						
			5	TW	PM							
452.5	Firm		6	SS	100	450						
28.5	Het. mix. of sand, silt, and gravel, trace of clay (Glacial Till) (boulders up to 8" in size throughout)		7	SS	150/2"	440						
437.0	Very Dense											
44.0	End of Borehole					430						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 23

JOB 71-11056

LOCATION S-E Murphy Rd. Line 'C'

ORIGINATED BY WK

W.P. 2-67-01

BORING DATE Sept. 29/71

COMPILED BY EOB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT —w _L PLASTIC LIMIT —w _p WATER CONTENT —w w _p — w — w _L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
502.8	Ground Level															
0.0	Sand, gravel, ash, trash (Garbage Dump)	X	1	SS	4	500									498.6 Sept. 30/71	
		X	2	SS	17											
		X	3	SS	8											
195.8	Very Loose to Compact	X	4	SS	11											
7.0	Sand and gravel	0.0	5	SS	19											
		0.0	6	SS	21	490										
		0.0	7	SS	29											
		0.0	8	SS	59	480										
478.8	Compact to Very Dense	0.0	9	SS	100.5"											
24.0	End of Borehole					470										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2-SITE NO 23

JOB 71-11056

LOCATION S-E of Murphy Rd. Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 29/71

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O. UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				W_P W W_L WATER CONTENT %					
505.8	Ground Level															
0.0	Sand, gravel, clayey silt, ash, trash, nails etc. (Garbage Dump)		1	SS	22	500									502.0 Sept. 30/71	
			2	SS	14											
			3	SS	15											
			4	SS	47											
			5	SS	185											
			6	SS	23											
	Compact to Very Dense															
489.3			7	SS	115	490										
16.5	Sand and gravel.		8	SS	100	480										
186.8	Very Dense															
19.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 24

JOB 71-11056

LOCATION Paquette Rd.-Canadian Forces Base Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 24, 1971

COMPILED BY VK

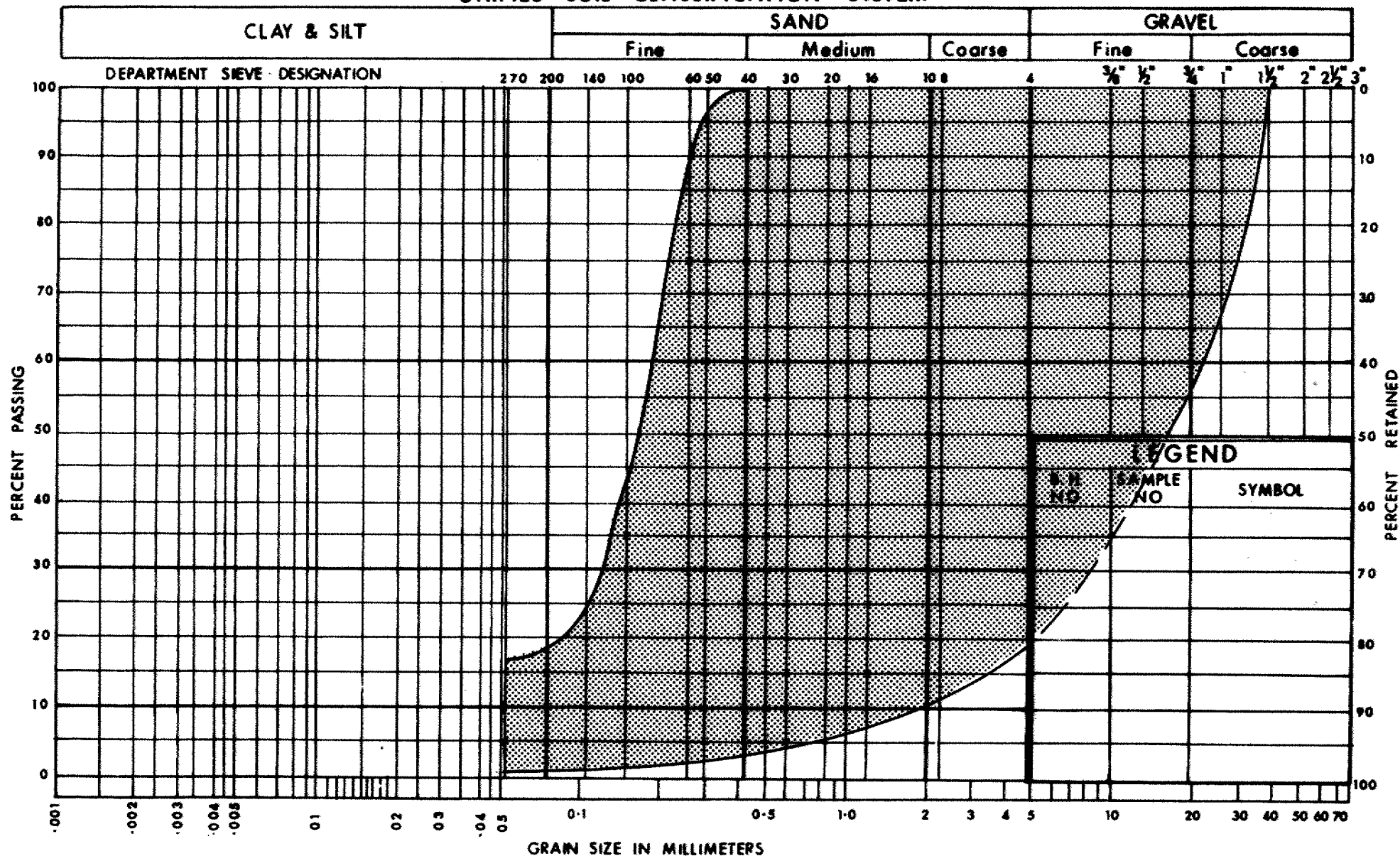
DATUM Geodetic

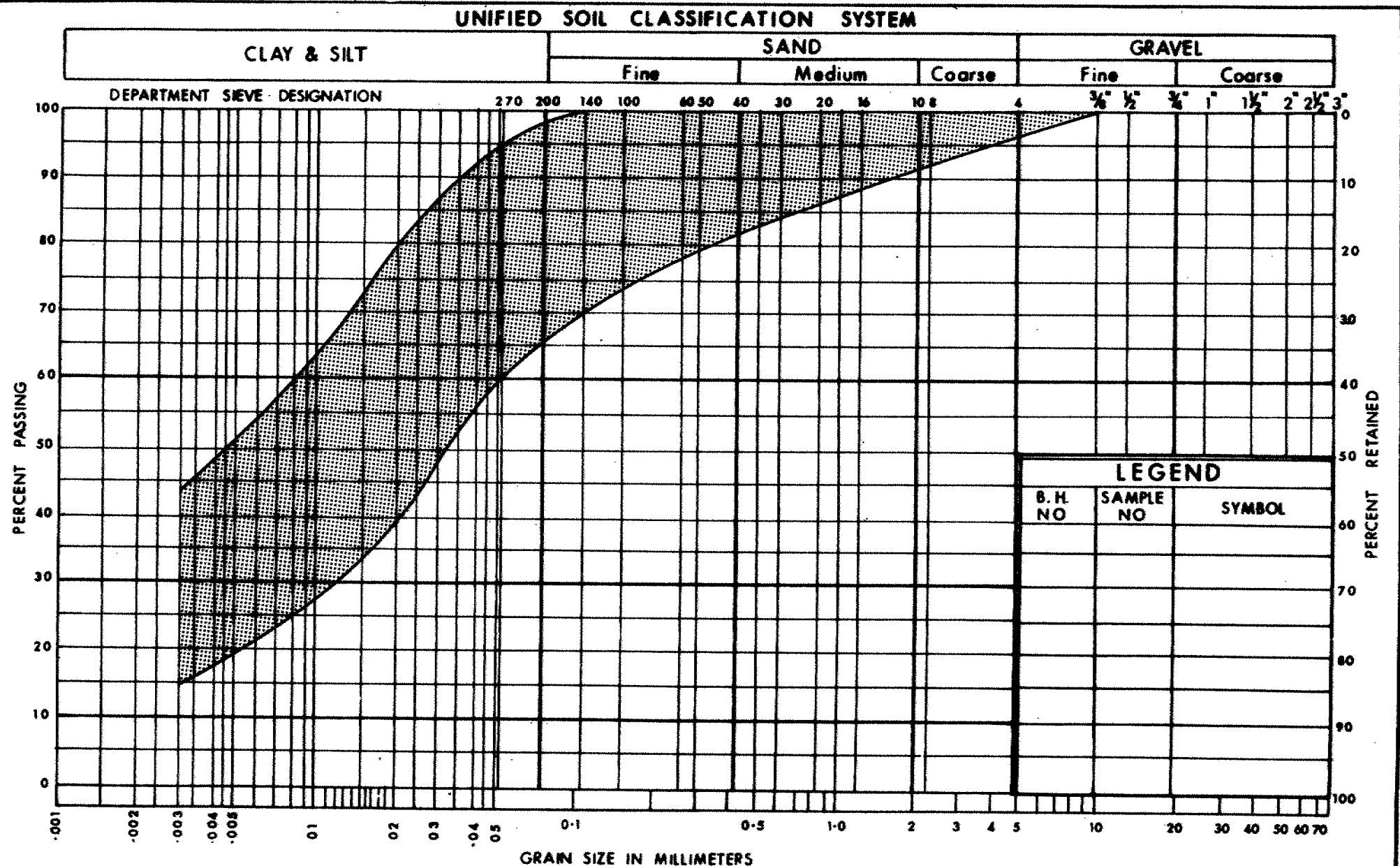
BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY C.C.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT %				
465.6	Ground Level.														
0.0	Sand and gravel and some silt (Fill)	⊗				460									0 82 (18)
457.6	Compact	⊗	1	SS	18										
8.0	Sand with gravel, trace silt, clay (boulders up to 10" in size throughout)	⊗	2	SS	94	450									
			3	SS	100 7/8"										
			4	SS	100 7/8"										
			5	SS	225		440								
			6	SS	100 7/8"										
431.4	(Glacial Till)	⊗	7	SS	100 7/8"									25 69 (6)	
34.2	End of Borehole					430									

UNIFIED SOIL CLASSIFICATION SYSTEM





**DESIGN SERVICES
BRANCH**

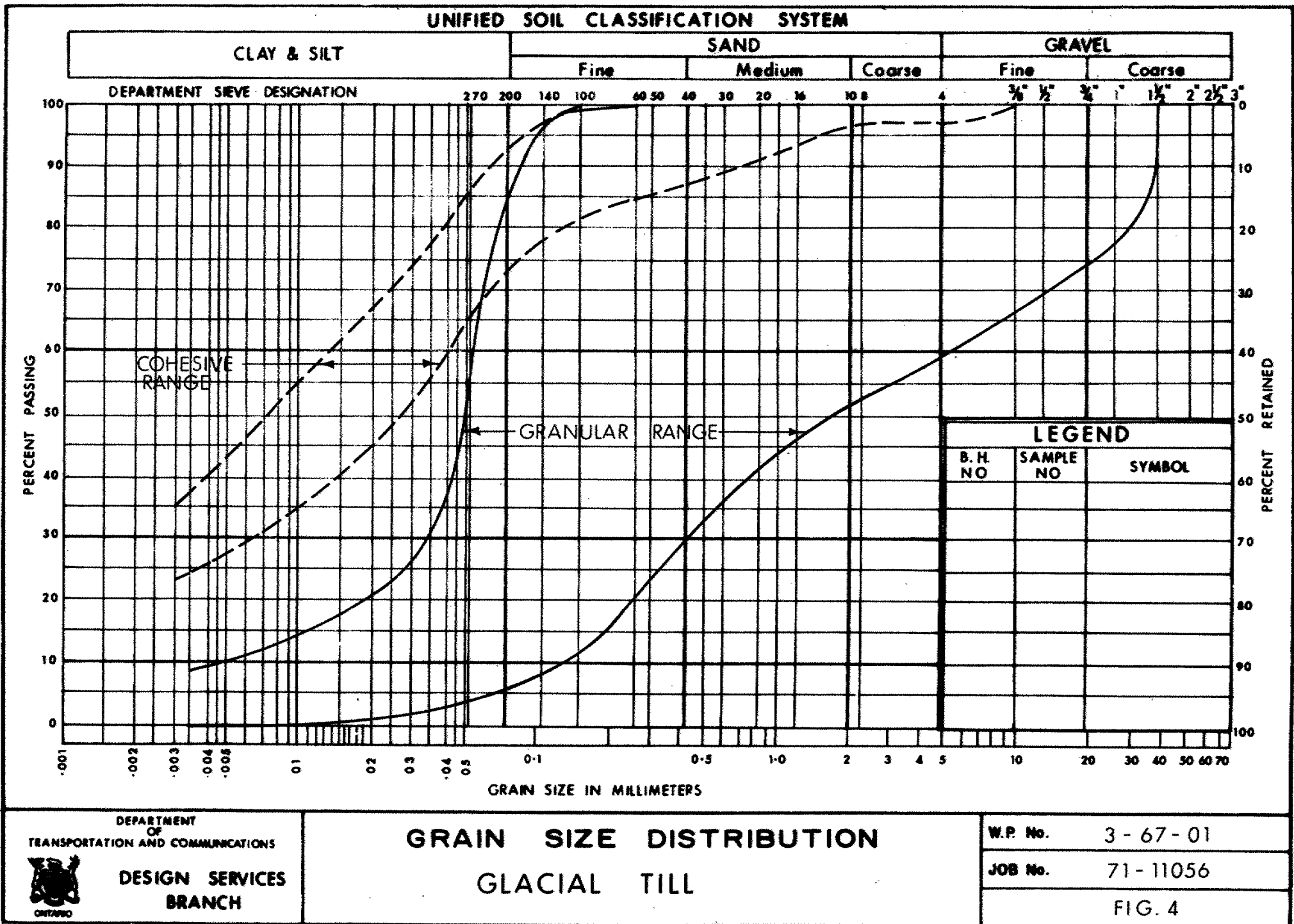
GRAIN SIZE DISTRIBUTION

CLAY TO CLAYEY SILT

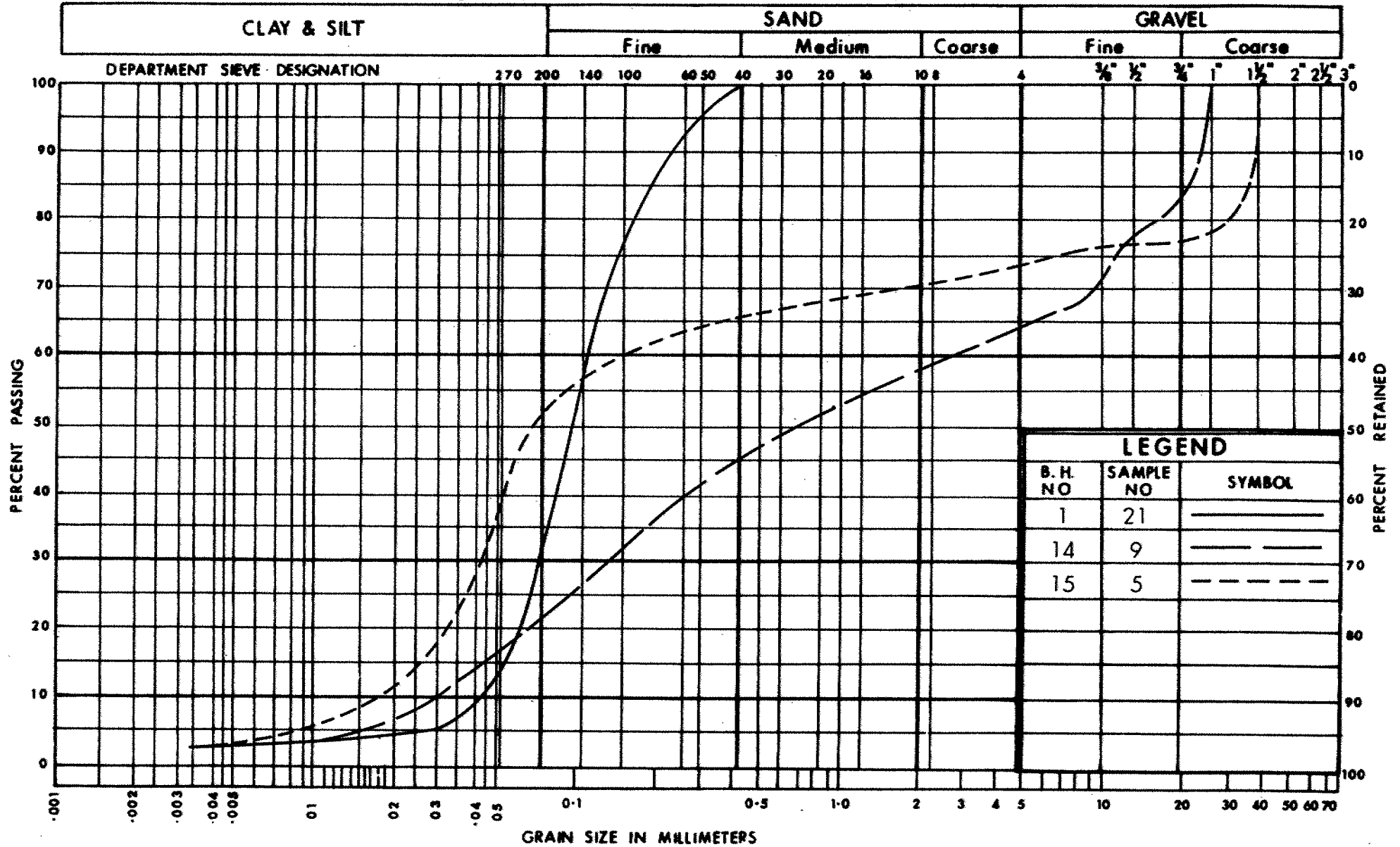
W.P. No. 3-67-01

JOB No. 71-11056

FIG. 3



UNIFIED SOIL CLASSIFICATION SYSTEM



VOID RATIO - PRESSURE CURVES

JOB NO. 71-11056

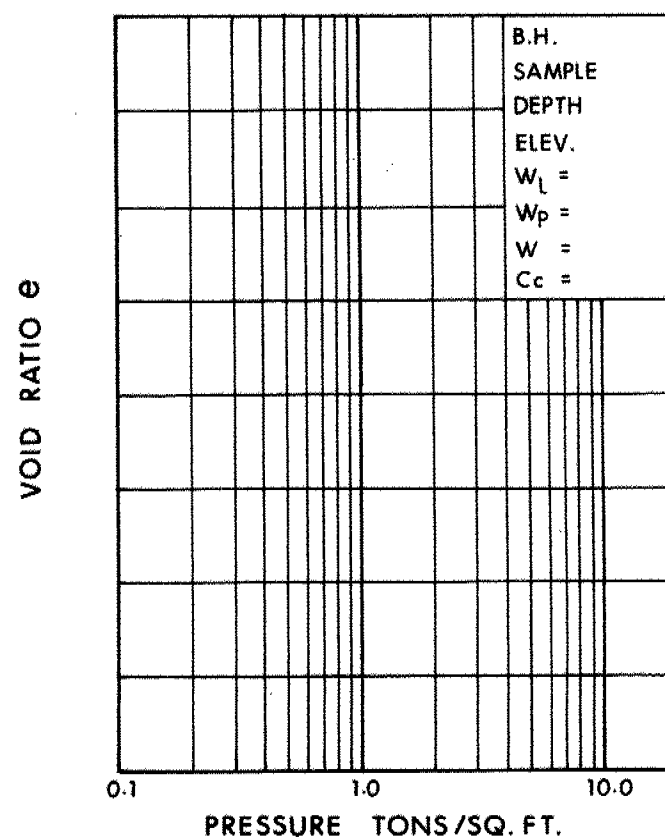
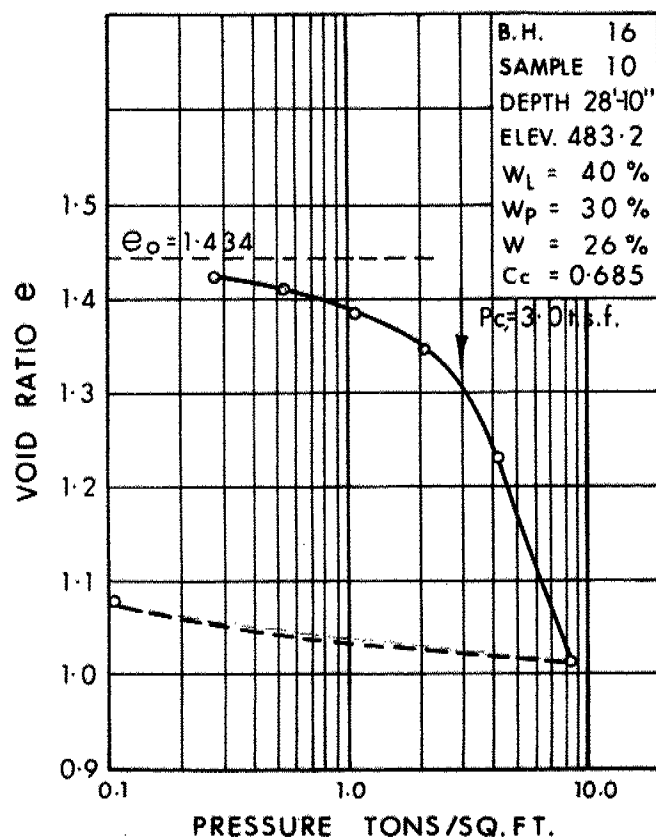
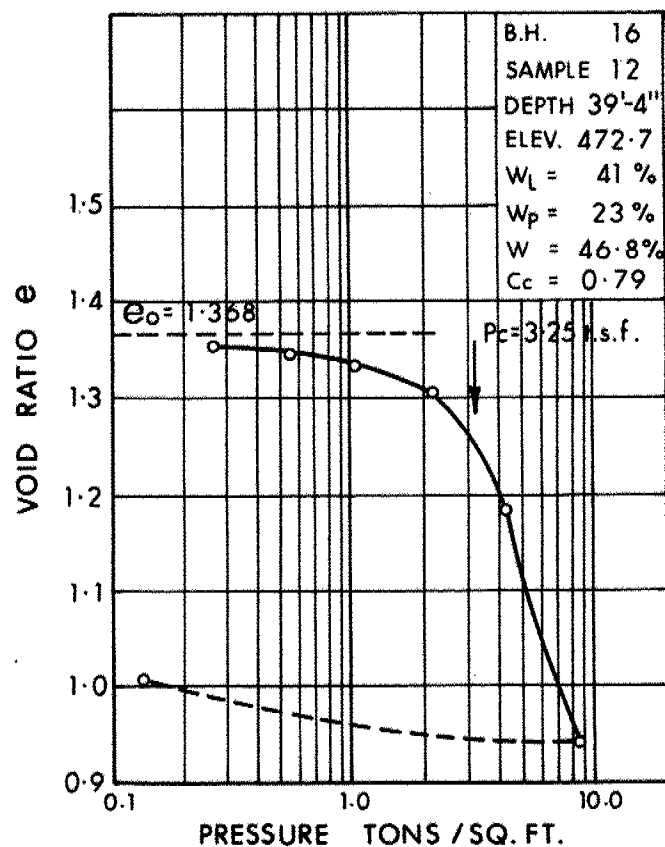
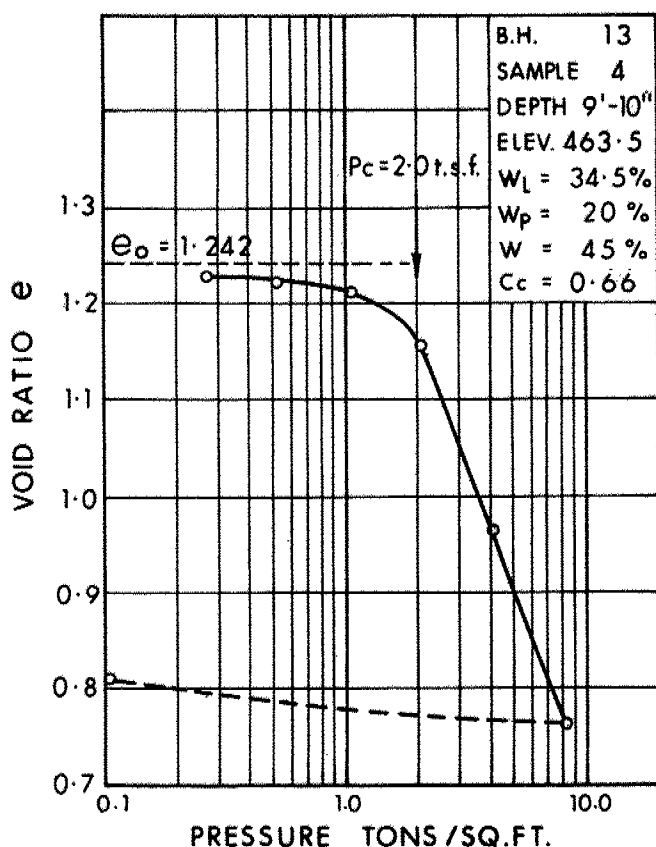


FIG. 6

VOID RATIO - PRESSURE CURVES

JOB NO. 71-11056

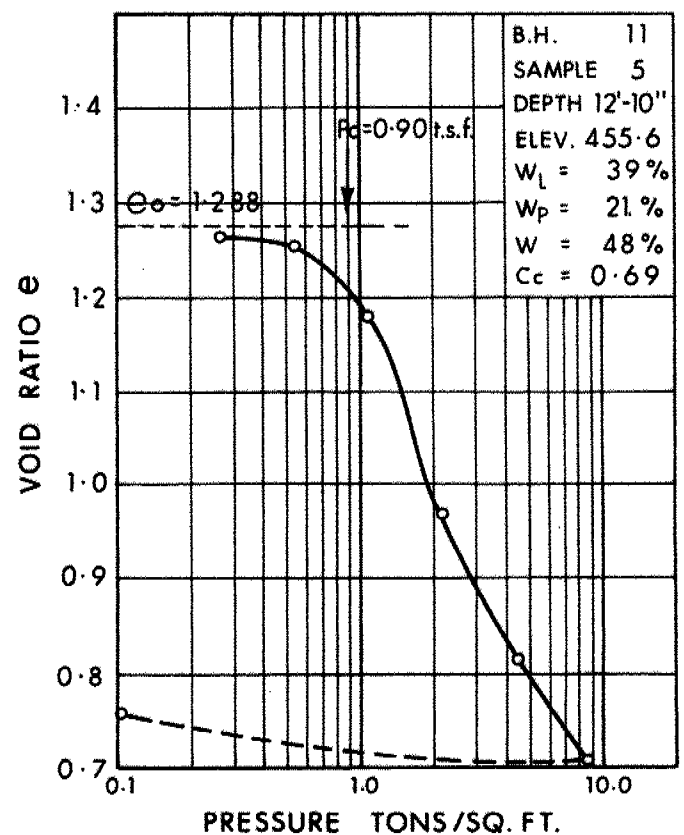
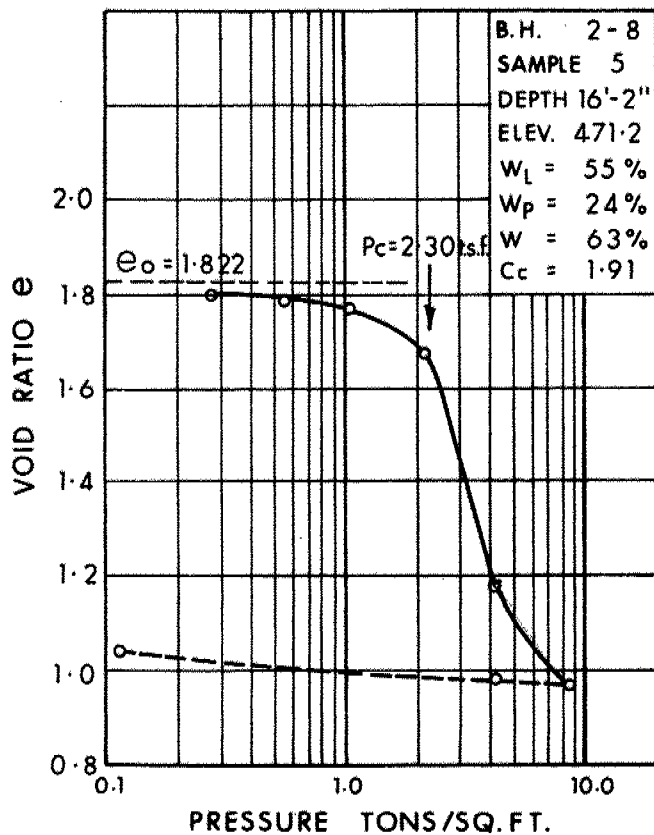
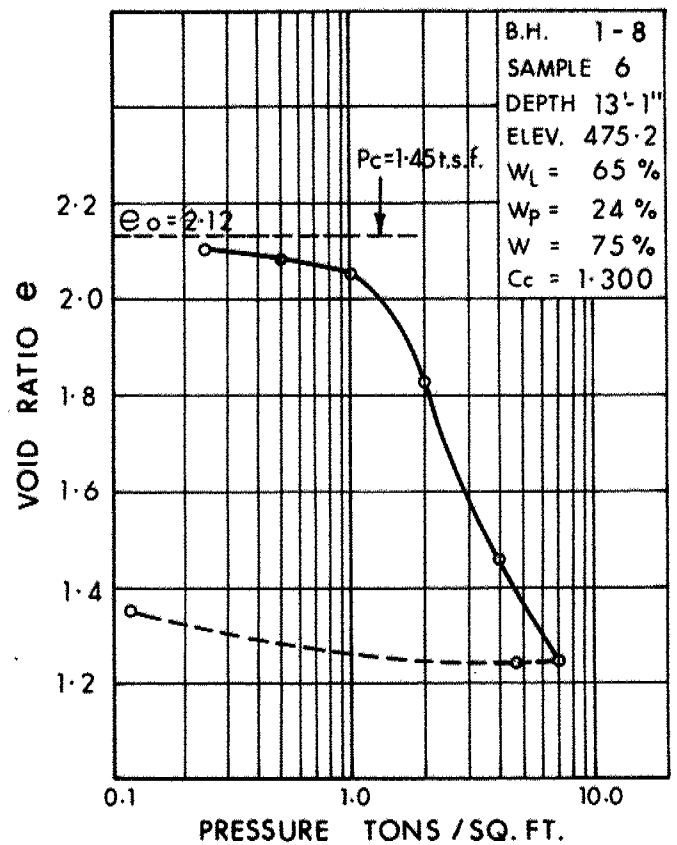
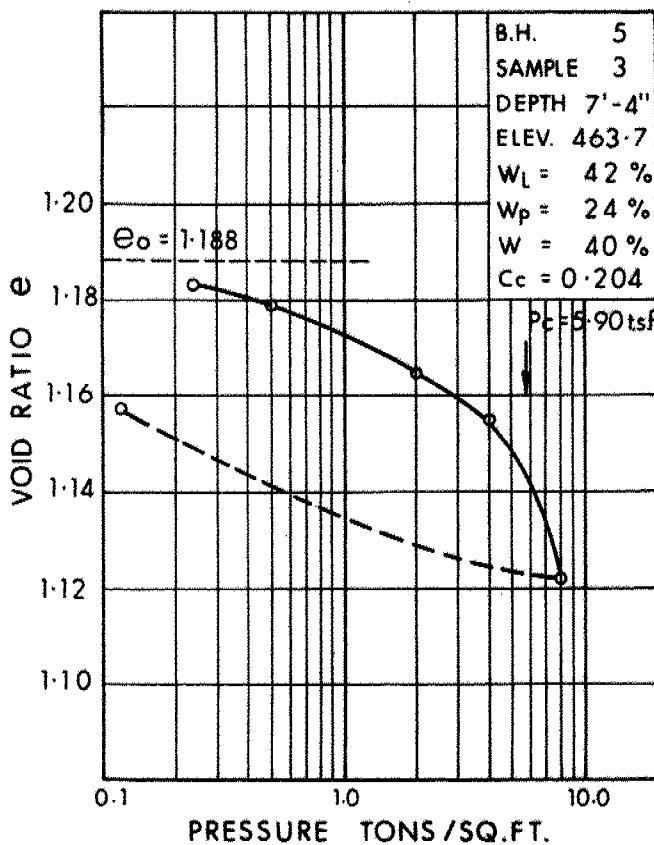
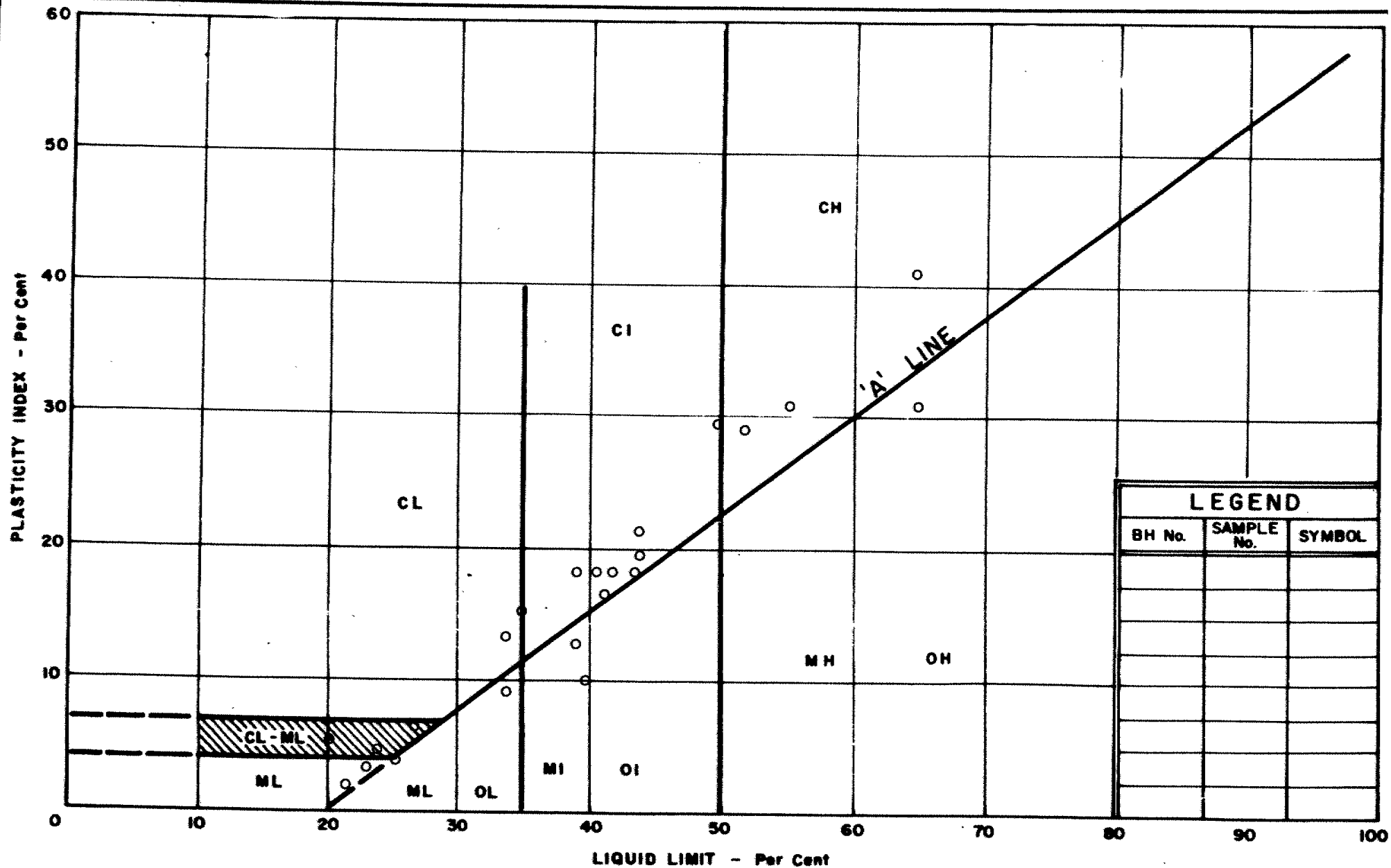


FIG. 7



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART CLAY TO CLAYEY SILT

W.P. No. 3-67-01

JOB No. 71-11056

FIG. 8

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION RESISTANCE

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

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTSOIL 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
w_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

OVERSIZE DRAWING

W.P. 3-67-01, Highway 17 'New'
Meeting on the Treatment of Organic Terrain
350 feet in Length Using a Blasting Technique

AGENDA

1. Introduction
2. Discussion on the removal of deep muskeg sections by:
 - a) Rolling surcharge method - brief discussion
 - b) Blasting method - main discussion
 - (i) "Underfill" method
 - (ii) The displacement of residual muskeg under the fill by blasting.

Section b) - (ii) is applicable to both methods
a) and b)

- (iii) Success of blasting methods
with approximate costs.
3. General Discussion.

NOTE

Discussion on alternate methods of muskeg treatment is most welcomed, but should be reserved for the general discussion period.

ATTENDANCE

Canadian Industries Limited
(C.I.L.)

Mr. H. Brennan - Explosives
Consultant

M. T. C.

Head Office Foundations

Mr. M. Devata - Supervising
Foundations Engineer

Mr. B. Darch - Senior Foundations
Engineer

M & T., Eastern Region

Mr. E. Saint - Regional Materials
Engineer

Mr. M. Batten - Regional Senior
Soils Supervisor

District #8

Mr. M. Bernhardt - Construction
Engineer

District #9

Mr. J. Cruikshank - Construction
Engineer

District #10

Mr. D. A. O. White - District
Engineer

Systems Design, Eastern Region

Mr. A. E. Irving - Project
Design Engineer

Mr. J. H. Tondeur - Design Group
Engineer

Mr. J. R. Bestvater - Design
Group Supervisor

Mr. M. Nanton - Junior Engineer

Queens University, Civil
Engineering Department

Dr. G. Raymond
Dr. G. Mitchell
Dr. P. Gaskin

Royal Military College,
Civil Engineering Department

Mr. G. Hollingshead

Resume of the M. T. C. Foundation Investigation Report/Soils Design
Report on Organic Terrain Treatment Highway 17 New.

Introduction

The excavation of organic materials to firm bottom or to a maximum of 12 feet has been recommended for all deposits within Highway 17 "New" (Soils Design Report - Kingston Region).

The Eastern Region has also proposed that a 13'0" surcharge above the profile grade be constructed from Station 424+50 - Station 428+00 using a rolling surcharge fill procedure.

The Foundation Office in Toronto in their report have suggested as an alternative to the above an "Underfill Blasting" technique described in L. Casagrande's paper entitled "Construction of Embankments Across Peaty Soils".

Outlined below are both methods of peat disposal and their respective estimates.

Methods of Removal of Muskeg Deposit

In order to check for residual muskeg trapped between the fill and firm bottom it will be necessary to use "jetting" to probe this backfill. This "jetting" procedure will be carried out at various locations and if substantial muskeg deposits are located, explosives will be used for spreading or distributing the trapped peat. This will reduce or eliminate localized settlement. The above procedure is common to both methods.

It is assumed that the organic silt and clay, sandwiched between the peat and firm bottom, has similar structural properties to that of the peat.

1. Surcharge Rolling Fill Method

See attached sheet for details. Systems Design- Kingston Region has come up with an estimate for the dragline time as follows:--

590 hours @ \$30.00/hour = \$17,700.00

Size of dragline using $1\frac{1}{2}$ yard bucket was recommended and this was to be obtained from Special Provision 8207 - Rental of swamp excavation equipment.

The Estimating Office assumed an excavation machine rate of 60 yds/hr.

2. Underfill Blasting Method

See attached sheet for details.

Surficial blasting = 590 lbs.

Charges placed on firm
bottom for 30'0" width
of excavation = 5840 lbs.

Total wt. of explosives

= 6430 lbs.

Total Cost = $\frac{6430}{50} \times \$60.00/\text{unit} = \$7,716.00$

The Estimating Office recommended an average unit price /50 lb. of explosives of \$60.00.

This appears to be a most conservative estimate. It is hoped that this meeting will shed further light on the subject so that a more realistic estimate can be compiled, and this information used for this, and, or, future projects.

Stations 424+00 and 429+00 the new highway will cross organic terrain. The depth of organic material ranges from 2 to 31.5 feet. The organic deposits are underlain by a competent sand and gravel deposit. In this area Hwy. #17 'New' will be carried on an embankment varying between 6 and 8 feet in height.

Since this is to be a Controlled Access Highway, special measures will have to be initiated in order to ensure proper performance of this localized section. Specifically, it is proposed to completely remove the organic deposits from beneath the embankment section. Two possible methods of displacing the peaty soils will be discussed in the subsections to follow; namely,

- i) displacement by blasting, and
- ii) displacement by the utilization of a rolling surcharge fill.

6.2) Displacement of Peaty Soil by Blasting:

Dr. L. Casagrande* has outlined the American and German experiences using blasting to displace deep deposits of peaty soils. Four methods were discussed; namely,

- i) toe shooting,
- ii) underfill blasting,
- iii) ditching,
- iv) relief method.

As far as this project is concerned the underfill blasting method, as refined by the Germans, is believed to be the most suitable under the conditions at this site. A proposed construction scheme is shown on Drawing No. W.O. 72-11012B; it will be discussed in the paragraphs to follow.

.....6

*Casagrande, L., "Construction of Embankments Across Peaty Soils." Contributions to Soil Mechanics - Boston Society of Civil Engineers, 1962 to 1964, Pp. 272 - 315.

Where the thickness of the organic material is less extensive (15 feet or less) it can be excavated completely using a conventional technique, such as with draglines. This operation can, therefore, be employed between the following:

Station 423+50 to 424+75

Station 428+00 to 429+50

Following the peat excavation in these areas acceptable granular fill should be placed and brought up to the profile grade of Hwy. #17 'New'. The treatment in these two areas should be completed prior to the operations to be adopted in the central area of the swamp.

Blasting will be required to displace the thick peaty material in the central area (between Stations 424+75 and 428+00). Since the highway embankment will be quite wide (75' to 100' crest to crest) best results will be realized if the blasting operations are carried out in stages. Using this technique a central core of fill, approximately 30 feet wide, should be sunk to firm bottom. Two additional stages then would be required to sink the outer portions of the embankment to firm bottom. During each of these stages the fill should be placed over the full length of the section. The first stage operational sequence is described in the following paragraphs:

- a) The integrity of the 4 to 6 feet thick surficial mat should be destroyed for a width of approximately 10 feet along the proposed centre line of Hwy. #17 'N'. This could be accomplished by pushing or jetting light charges to a depth of several feet below the original ground surface; these charges should be placed on 3 foot centres. This procedure will lessen the danger of cracks developing in the vegetative mat which might lead to sudden sliding during filling operations. Further, it will facilitate a uniform settlement of the fill and prevent the crust from being trapped beneath the fill.
- b) Fill can now be placed to form the central core; it should extend to a height well above the design grade. This is necessary so that the fill will realize a level which is close to the design grade following the blasting operation.

The fill should be composed of granular material with a minimum of coarse gravel sizes.

- c) The dynamite charges should be placed on firm bottom by using the jetting techniques outlined by Dr. Casagrande in his paper. The spacing of the charges, both in a longitudinal and traverse direction, as well as the quantity of dynamite in each charge, are outlined in Tables V and VI of this paper. These tables are presented in Appendix II of this report. A typical cross-sectional charge layout is shown on Drawing No. 72-11012B.
- d) All the charges should be set off simultaneously, thus sinking the central core through the displaced organic material down to hard bottom.

The core could be widened in either direction by placing fill then sinking these extensions down to hard bottom using blasting techniques similar to those discussed for the first stage operation.

In order to ensure the lateral stability of the finalized embankment section, it is recommended that berms be constructed; the berms can be formed of dumped organic soil obtained from the excavation. Recommended berm dimensions for various fill heights and organic depths have been specified by Dr. Casagrande. The berm requirements at a typical section are illustrated on Drawing No. W.O. 72-11012B.

Past experience has indicated that some subsidence and cracking often occur on the shoulder and along the slope of embankments placed in areas where peat has been displaced. This is due to the relative movement between the granular fill and adjacent organic material. Post-construction maintenance, due to these factors, can be minimized by constructing temporary surcharges over the crests of the embankment section in order to accelerate these movements. Typical surcharge details are shown on Drawing 72-11012B. The surcharges should be left in place for a period of at least two months; it then can be removed and used as a top dressing to the berms already in place.

6.3) Displacement of Peaty Soil Using Rolling
Surcharge Fill:

As an alternative to the underfill blasting method a rolling surcharge fill could be used.

As discussed in Subsection 6.2) the organic material, where it is less extensive (Stations 423+50 to 424+75 and 428+00 to 429+50) could be excavated using conventional techniques. Between Stations 424+75 and 428+00, however, the peat is too thick (20 to 32 feet) to be economically removed using direct methods. An attempt to displace the organic material in this area could be made by progressively advancing fill composed of coarse granular material. The surcharge should be advanced across the organic terrain by end-dumping granular material over the front face of the fill and by employing bulldozers to push the previously placed surcharge material forward. The forward portion of the fill should be built up to a height considerably above the proposed profile grade, say to a height of 25 to 30 feet. The organic material squeezed out in front of the advancing fill should be removed using draglines.

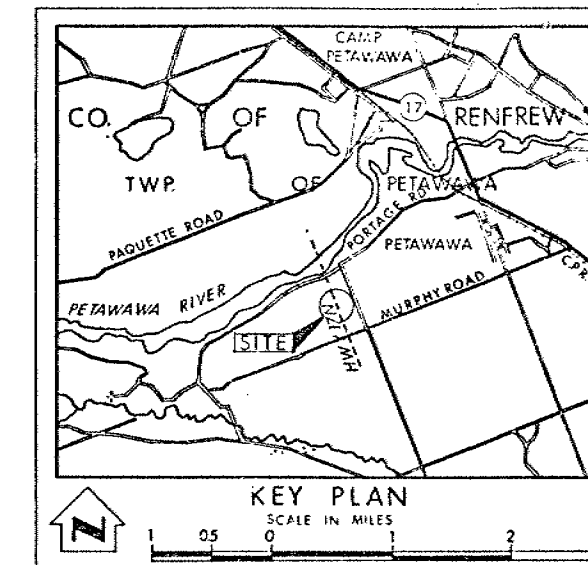
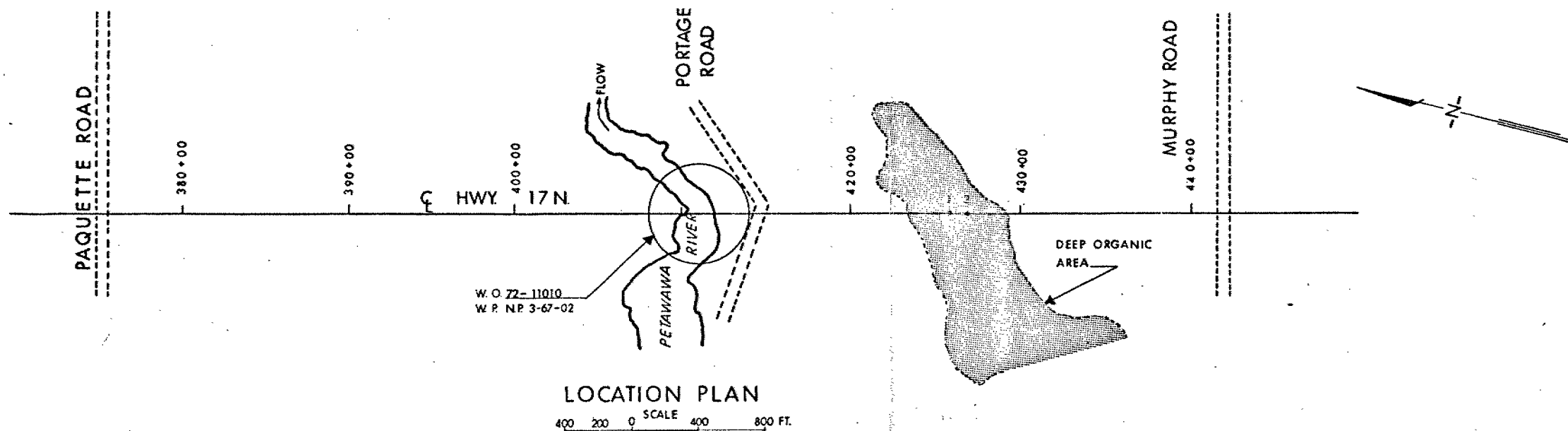
There is a possibility that the rolling surcharge may not be totally effective in displacing all the organic material. Organic soil, trapped beneath the granular fill, would adversely affect the performance of this section of the Hwy. #17 'N' embankment. Under these circumstances the embankment would settle differentially, and thus be a continuing maintenance problem. In this regard, it is recommended that, as soon as the surcharging operation is completed, probes be put down to determine if any organic soil has been trapped beneath the fill. If, in some localized areas a considerable thickness of organic soil is found to be present measures will have to be taken to displace it. The best method would be to employ the underfill blasting technique discussed in detail in Subsection 6.2).

Questions Pertinent to the Blasting Method

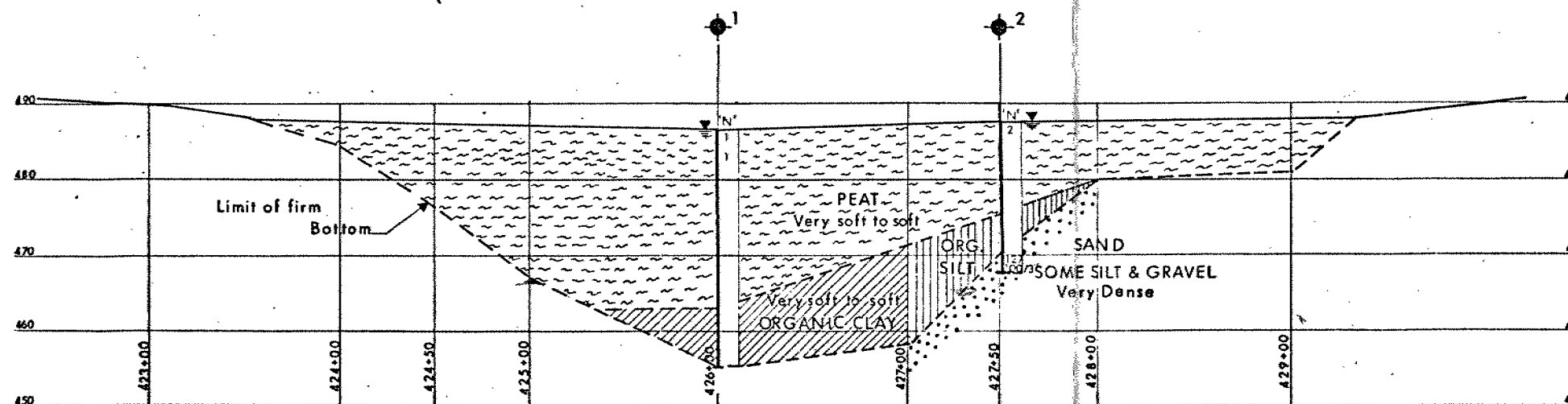
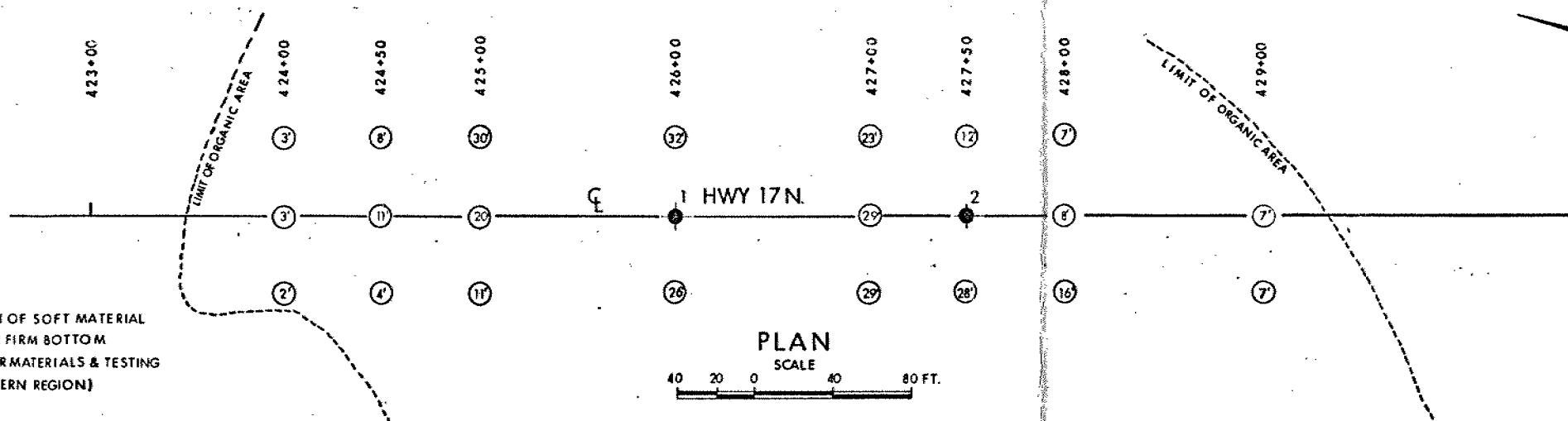
1. As per the Foundation Report "the integrity of 4' to 6' thick surficial mat should be destroyed for a width of approximately 10'0" along the proposed centreline of Highway 17 "New".

Requirement for the breakup of this surficial mat:

- a) Wt. and no of sticks
 - b) Requisite spacing of charges.
2. Charge layout on firm bottom - lateral and longitudinal spacing of charges to obtain a 30'0" width.
 3. Layout of charges for layer of trapped material. Type of explosives required.



NOTE: (20) DEPTH OF SOFT MATERIAL OVER FIRM BOTTOM AS PER MATERIALS & TESTING (EASTERN REGION)

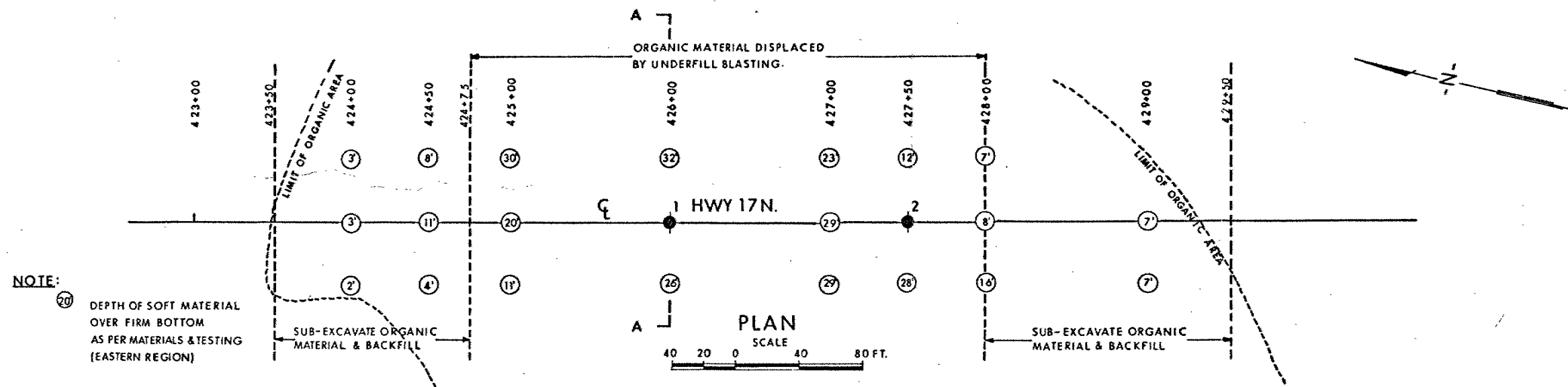


LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, Jan 1972		
NO.	ELEVATION	STATION	OFFSET
1	486.5	426+00	CL
2	487.6	427+50	CL

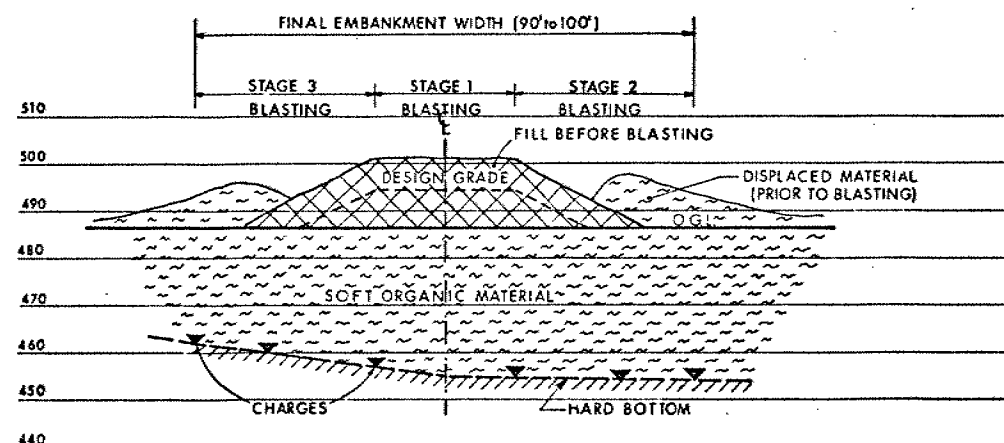
NOTE: The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE			
ORGANIC AREA STA. 424+00 TO STA. 429+00			
HIGHWAY NO. 17N		DIST. NO. 9	
CO. RENFREW		LOT _____ CON. _____	
TWP. PETAWAWA		LOT _____ CON. _____	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD B.T.D.	CHECKED <input checked="" type="checkbox"/>	WP NO. 3-67-01	DRAWING NO.
DRAWN F.L.	CHECKED <input checked="" type="checkbox"/>	JOB NO 72-11012	72-11012A
DATE JULY 12, 1972	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		



① UNDERFILL BLASTING PROCEDURE (FIRST STAGE)

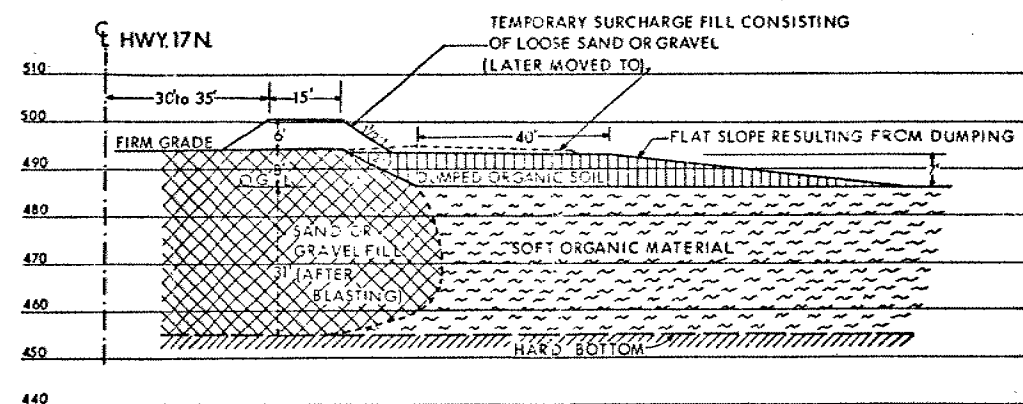


NOTE: RECOMMENDED SPACING BETWEEN THE CHARGES AS WELL AS THE QUANTITY OF DYNAMITE IN EACH CHARGE IS GIVEN IN TABLES V AND VI LOCATED IN APPENDIX II.

SECTION A-A



② RECOMMENDED BERM AND TEMPORARY SURCHARGE (TO BE PLACED FOLLOWING BLASTING OPERATION)



NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE			
TREATMENT OF ORGANIC AREA STA. 424+00 TO STA. 429+00			
HIGHWAY NO. 17 N.		DIST. NO. 9	
CO. RENFREW			
TWP. PETAWAWA		LOT CON.	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD. B.T.D.	CHECKED	WP NO. 3-67-01	DRAWING NO. 72-11012B
DRAWN F.L.	CHECKED	JOB NO. 72-11012	
DATE AUGUST 10, 1972	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No.1

FOUNDATION SECTION

JOB 72-11012

LOCATION Sta. 426 + 00

ORIGINATED BY B.U.

W.P. 3-67-01

BORING DATE January 25, 1972

COMPILED BY RRB

DATUM Geodetic

BOREHOLE TYPE Washboring NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % w_p ——— w ——— w_L 50 100 150				
486.5	Ground Level						O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE								
0.0	Surficial material	~	1	SS	1	485									WL in open
		~	2	SS	1								550 O→	Orgs 79.5%	BH Jan.25/72
	Soft	~				480		+4 +2							
	Peat (occasionally fibrous)	~	3	TW	PM			+3					808 O→		
	Dark Brown	~	4	TW	PM	475		+2					925 O→	Orgs 72%	
		~				470		+1							
		~	5	TW	PM			+2					936 O→		
	Very Soft to Soft	~				465									
463.0	Organic Clay		6	TW	PM			+6							
23.5	Grey					460		+4							
			7	TW	PM										
455.0	Very Soft to Soft					455		-10							
31.5	End of Borehole Hard Bottom														

20
15-5 % STRAIN AT FAILURE

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No.2

FOUNDATION SECTION

JOB72-11012LOCATIONSta. 427 + 50 Ø

W.P.3-67-01BORING DATEJanuary 27, 1972

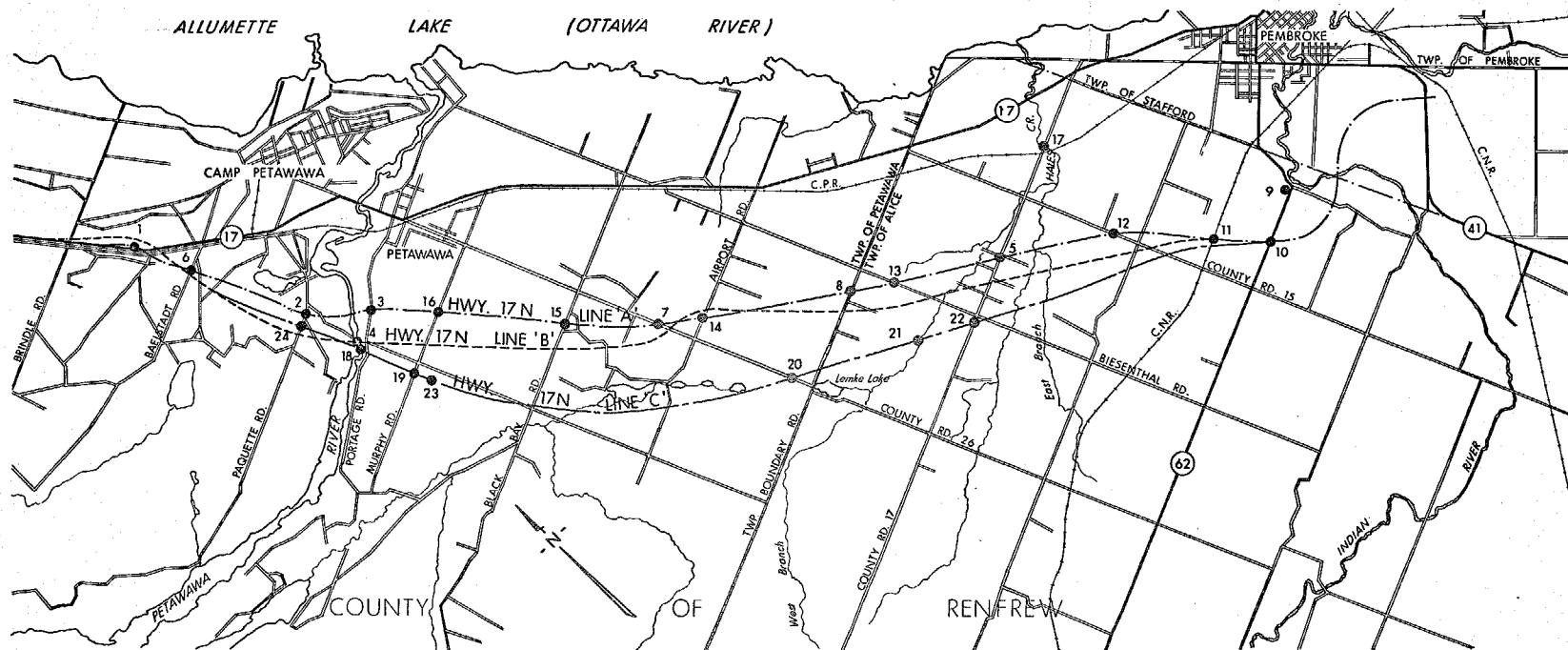
DATUMGeodeticBOREHOLE TYPEWashboring NX & BX

ORIGINATED BYB.U.

COMPILED BYRRB

CHECKED BY

SOIL PROFILE			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	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.						WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE						w _p ——— w ——— w _L				
487.6	Ground Level						200	400					50	100	150	GR. A, SI, CL.	
0.0	Surficial Material	~~~~~	1	SS	2	485										WL in open BH Jan.27/72	
	Soft		~~~~~	2	TW		PM										
	Peat (occasional fibrous)																
	Grey-Brown	~~~~~	3	TW	PM	480										8 78 (14)	
	Very Soft to Soft																
475.6		~~~~~															
12.0	Organic Silt		4	TW	PM	475									256 ○→	8 78 (14)	
	Grey-Brown																
470.6	Very Soft to Soft																
17.0	Sand with some silt and gravel.	•••••	5	SS	127	470									○	8 78 (14)	
467.5	Very Dense			6	SS		100/3"										
20.1	End of Borehole Hard Bottom					465											



● SITE LOCATION

PLAN
SCALE 1" = 400'

MINISTRY
OF
TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH
FOUNDATIONS OFFICE

DATE 19 JAN. 1973

PRELIMINARY INVESTIGATION
PROPOSED HWY. 17 N FROM BRINDLE RD.
TO HWY. 62 LINES A, B & C

W.P. NO.

3-67

DRAWING NO. 71-11056A

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31F-60

DIST. 9 REGION Eastern

W.P. No. 3-67-01

CONT. No. 76-18

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION Hwy 17 - Petawawa
Airport, Line 'A'

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. ☒

REMARKS: documents to be unfolded
before microfilming

72-11012

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A.E. Irving,
Project Design Engineer,
Systems Design Office,
Kingston, Ontario.

FROM: #9, Ottawa.

ATTENTION:

DATE: January 12, 1973.

OUR FILE REF.

IN REPLY TO

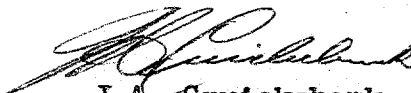
SUBJECT:

Re: W.P. 3-67-01, Hwy. 17N, Co. Rd. 17 W'ly
to W. of Petawawa

On page 3 of the Minutes of the Pre-Contract Review Meeting held December 18, 1972, it is noted in the second last paragraph that no further consideration is to be given to the use of explosives, in conjunction with excavation, for the purposes of pre-contract engineering.

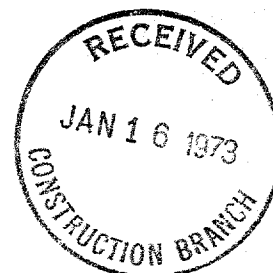
It was my understanding that a decision in this regard was to be reached only after a comparison had been made with "similar" situations previously encountered in Toronto District.

If the information resulting from this comparison is now available, the District would appreciate being advised of the relevant data.


J.A. Cruickshank,
District Construction Engineer.

JAC/ea

c.c. Mr. Devata, Downsview



FOUNDATION INVESTIGATION REPORT
For
Treatment of Organic Terrain
Proposed Hwy. #17 'New'
(Stations 424+00 to 429+00)
Township of Petawawa, County of Renfrew
District No. 9 (Ottawa)
W.O. 72-11012 -- W.P. 3-67-01

1. INTRODUCTION:

Proposed Hwy. #17 'New' is to bypass the Town of Petawawa at a point about 1-1/2 miles south of existing Hwy. #17. Approximately 1,500 feet east of the Petawawa River the new highway will cross an expanse of organic terrain which is about 500 feet in length. It is known that the thickness of the organic material is considerable. Since this is to be a Controlled Access Highway, special measures will have to be initiated in order to ensure proper performance of this localized section. In order to aid in assessing the measures required, the Foundations Office was requested to carry out a subsurface investigation in this area. The request was contained in a memo from Mr. A. M. Batten, Senior Soils Supervisor, Eastern Region, dated January 7, 1972. An investigation was subsequently carried out.

This report presents all the factual results obtained from this investigation, together with recommendations pertaining to the measures deemed necessary to ensure the suitable performance of this highway within this area.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The area under investigation is located approximately 1,500 feet east of the Petawawa River, at a point about 1-1/2 miles south of existing Hwy. #17. The area is rather flat and

low lying, with the ground surface ranging between elevations 485 and 490. The terrain is covered with light brush growth. The drainage is poor; this had led to the formation of a swamp. The plan limits of this swamp have been defined in a report presented to this Office by Mr. B. Sen Mathur, P. Eng., Airphoto Interpretation Engineer, Ministry of Transportation and Communications (dated January 13, 1972). A shallow (2 to 3 feet deep) creek meanders across this area. The water in the creek is generally not more than 1 foot deep.

Physiographically, the area under investigation is located in the region known as the "Petawawa Sand Plain." The granular overburden deposits encountered here were primarily laid down in a delta built in the Champlain Sea by the Petawawa, Barron, Indian and Ottawa Rivers during the Fossmill stage of Lake Algonquin. In the vicinity of the area under investigation the sand and gravel deposits range from about 5 to 30 feet in thickness. The surficial organic material has been superimposed on this deposit. The overburden is underlain by gneiss bedrock of Precambrian Age.

3. FIELD AND LABORATORY WORK:

Two sampled boreholes were put down during the course of the field investigation. The borings were advanced by means of a conventional diamond drill rig, adapted for soil sampling purposes. In addition, a series of soundings were put down by the Eastern Region Materials Section to define the vertical and lateral extent of the organic material.

Following the sampling and drilling operations a detailed log was made for each of the two borings, this log includes a record of the testing performed as well as the soil types encountered. The locations and elevations of the borings were surveyed by personnel from the Eastern Region Engineering Surveys Section, and are shown on Drawing No. 72-11012A, together with an estimated stratigraphical profile across the site. The

elevations in this report are referenced to a Geodetic datum.

All the samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this inspection, laboratory tests were carried out to determine the physical properties of the various soil types; namely,

Natural Moisture Content

Atterberg Limits

Organic Content

Grain-Size Distribution

The results of the laboratory testing are plotted on the Record of Borelog sheets.

4. SUBSOIL CONDITIONS:

4.1) General:

Between Stations 424+00 and 429+00, along the proposed Hwy. #17 'New' alignment, the terrain is swampy. The depth of organic material ranges from 2 feet to 31.5 feet. The organic deposits are underlain by the sand and gravel deposits common to this region.

The soil sequence, encountered at the boring locations, is shown on the borelog sheets, the stratigraphical profile plotted on Drawing No. 72-11012A has been inferred from this data. A brief resume of the stratigraphical sequence from ground surface downward is presented in the subsections to follow.

4.2) Organic Deposits:

In this area the surficial deposit is composed of a dark brown fibrous peat. The thickness of the peat ranges from 2 feet, along the edges of the swamp, to as much as 23.5 feet at B.H. #1, put down near the centre. The natural moisture content of the peat ranges from 550 to 936 percent, while the

organic content was found to vary from 72 to 80 percent by weight. The undrained shear strength of the peat was determined by performing in-situ vane tests; this testing gave values which ranged from 330 p.s.f., in the upper 5 to 7 feet, decreasing to as low as 95 p.s.f. with depth. Based on these results it is estimated that the consistency of the peat is soft, in the upper zone, decreasing to very soft, with depth.

Where the organic terrain is most extensive the peat is underlain by organic material of varying composition. At B.H. #1, for instance, the peat is followed by an 8 feet thick deposit of very soft organic clay, while at B.H. #2 it is underlain by 5 feet of very soft organic silt.

4.3) Lower Inorganic Deposit:

This investigation has indicated that, in the central portion of the swamp, where the organic material is most extensive, the organics are directly underlain by hard bottom (probably bedrock). Elsewhere, however, the organic material is underlain by the dense to very dense sand and gravel deposit common to this region.

5. GROUNDWATER LEVEL CONDITIONS:

Groundwater level observations were carried out during the period of the investigation in the open boreholes. The observations are presented on the individual borelog sheets as well as on Drawing No. 72-11012A. The results indicate that the groundwater level, across this poorly drained area, is at existing ground surface.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Hwy. #17 'New' is to bypass the Town of Petawawa at a point about 1-1/2 miles south of existing Hwy. #17. Approximately 1,500 feet east of the Petawawa River, namely, between

Stations 424+00 and 429+00 the new highway will cross organic terrain. The depth of organic material ranges from 2 to 31.5 feet. The organic deposits are underlain by a competent sand and gravel deposit. In this area Hwy. #17 'New' will be carried on an embankment varying between 6 and 8 feet in height.

Since this is to be a Controlled Access Highway, special measures will have to be initiated in order to ensure proper performance of this localized section. Specifically, it is proposed to completely remove the organic deposits from beneath the embankment section. Two possible methods of displacing the peaty soils will be discussed in the subsections to follow; namely,

- i) displacement by blasting, and
- ii) displacement by the utilization of a rolling surcharge fill.

6.2) Displacement of Peaty Soil by Blasting:

Dr. L. Casagrande* has outlined the American and German experiences using blasting to displace deep deposits of peaty soils. Four methods were discussed; namely,

- i) toe shooting,
- ii) underfill blasting,
- iii) ditching,
- iv) relief method.

As far as this project is concerned the underfill blasting method, as refined by the Germans, is believed to be the most suitable under the conditions at this site. A proposed construction scheme is shown on Drawing No. W.O. 72-11012B; it will be discussed in the paragraphs to follow.

.....6

*Casagrande, L., "Construction of Embankments Across Peaty Soils." Contributions to Soil Mechanics - Boston Society of Civil Engineers, 1962 to 1964, Pp. 272 - 315.

Where the thickness of the organic material is less extensive (15 feet or less) it can be excavated completely using a conventional technique, such as with draglines. This operation can, therefore, be employed between the following:

Station 423+50 to 424+75

Station 428+00 to 429+50

Following the peat excavation in these areas acceptable granular fill should be placed and brought up to the profile grade of Hwy. #17 'New'. The treatment in these two areas should be completed prior to the operations to be adopted in the central area of the swamp.

Blasting will be required to displace the thick peaty material in the central area (between Stations 424+75 and 428+00). Since the highway embankment will be quite wide (75' to 100' crest to crest) best results will be realized if the blasting operations are carried out in stages. Using this technique a central core of fill, approximately 30 feet wide, should be sunk to firm bottom. Two additional stages then would be required to sink the outer portions of the embankment to firm bottom. During each of these stages the fill should be placed over the full length of the section. The first stage operational sequence is described in the following paragraphs:

- a) The integrity of the 4 to 6 feet thick surficial mat should be destroyed for a width of approximately 10 feet along the proposed centre line of Hwy. #17 'N'. This could be accomplished by pushing or jetting light charges to a depth of several feet below the original ground surface; these charges should be placed on 3 foot centres. This procedure will lessen the danger of cracks developing in the vegetative mat which might lead to sudden sliding during filling operations. Further, it will facilitate a uniform settlement of the fill and prevent the crust from being trapped beneath the fill.
- b) Fill can now be placed to form the central core; it should extend to a height well above the design grade. This is necessary so that the fill will realize a level which is close to the design grade following the blasting operation.

The fill should be composed of granular material with a minimum of coarse gravel sizes.

- c) The dynamite charges should be placed on firm bottom by using the jetting techniques outlined by Dr. Casagrande in his paper. The spacing of the charges, both in a longitudinal and traverse direction, as well as the quantity of dynamite in each charge, are outlined in Tables V and VI of this paper. These tables are presented in Appendix II of this report. A typical cross-sectional charge layout is shown on Drawing No. 72-11012B.
- d) All the charges should be set off simultaneously, thus sinking the central core through the displaced organic material down to hard bottom.

The core could be widened in either direction by placing fill then sinking these extensions down to hard bottom using blasting techniques similar to those discussed for the first stage operation.

In order to ensure the lateral stability of the finalized embankment section, it is recommended that berms be constructed; the berms can be formed of dumped organic soil obtained from the excavation. Recommended berm dimensions for various fill heights and organic depths have been specified by Dr. Casagrande. The berm requirements at a typical section are illustrated on Drawing No. W.O. 72-11012B.

Past experience has indicated that some subsidence and cracking often occur on the shoulder and along the slope of embankments placed in areas where peat has been displaced. This is due to the relative movement between the granular fill and adjacent organic material. Post-construction maintenance, due to these factors, can be minimized by constructing temporary surcharges over the crests of the embankment section in order to accelerate these movements. Typical surcharge details are shown on Drawing 72-11012B. The surcharges should be left in place for a period of at least two months; it then can be removed and used as a top dressing to the berms already in place.

6.3) Displacement of Peaty Soil Using Rolling
Surcharge Fill:

As an alternative to the underfill blasting method a rolling surcharge fill could be used.

As discussed in Subsection 6.2) the organic material, where it is less extensive (Stations 423+50 to 424+75 and 428+00 to 429+50) could be excavated using conventional techniques. Between Stations 424+75 and 428+00, however, the peat is too thick (20 to 32 feet) to be economically removed using direct methods. An attempt to displace the organic material in this area could be made by progressively advancing fill composed of coarse granular material. The surcharge should be advanced across the organic terrain by end-dumping granular material over the front face of the fill and by employing bulldozers to push the previously placed surcharge material forward. The forward portion of the fill should be built up to a height considerably above the proposed profile grade, say to a height of 25 to 30 feet. The organic material squeezed out in front of the advancing fill should be removed using draglines.

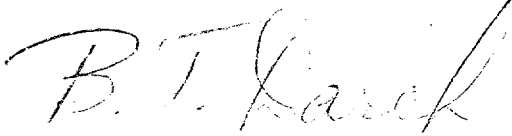
There is a possibility that the rolling surcharge may not be totally effective in displacing all the organic material. Organic soil, trapped beneath the granular fill, would adversely affect the performance of this section of the Hwy. #17 'N' embankment. Under these circumstances the embankment would settle differentially, and thus be a continuing maintenance problem. In this regard, it is recommended that, as soon as the surcharging operation is completed, probes be put down to determine if any organic soil has been trapped beneath the fill. If, in some localized areas a considerable thickness of organic soil is found to be present measures will have to be taken to displace it. The best method would be to employ the underfill blasting technique discussed in detail in Subsection 6.2).

7. MISCELLANEOUS:

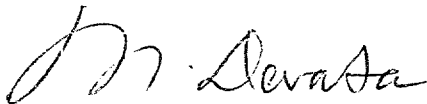
The field work was carried out between the period of January 25 to 27, 1972, under the immediate supervision of Mr. W. V. Urie, Field Technician.

The equipment used was owned and operated by the F.E. Johnston Drilling Co. Ltd., Ottawa.

This report was written by Mr. B. T. Darch, Senior Foundations Engineer, and reviewed by Mr. M. Devata, Supervising Foundations Engineer.



B. T. Darch, P. Eng.,



M. Devata, P. Eng.

BTD/ao

August 31, 1972.

RECOMMENDED
SPACING AND AMOUNT OF
EXPLOSIVES FOR
DYNAMITE CHARGES

*TABLE V

Thickness H of Peat Deposit	Distance D Between Rows of Charges	Spacing B Between Charges within a Row		
		Below Crest	Below Slopes	Outside Toes
<30 ft.	0.75H	H	0.75H	0.5H
30 to 60 ft.	0.75H	0.5H + 15 ft.	0.5H + 7.5 ft.	0.5H
>60 ft.	45 ft.	45 ft.	38 ft.	30 ft.

*TABLE VI

Thickness H of Peat Deposit - feet	Amount of Explosives W in lb/charge Along Center Line of Fill	
	For Width of Crest <30 feet	For Width of Crest >30 feet
10	50	60
20	80	100
30	120	150
40	160	200
50	200	250
60	250	300

*Casagrande, L., "Construction of Embankments Across Peaty Soils." Contributions to Soil Mechanics - Boston Society of Civil Engineers, 1962 to 1964. pp. 272-315.

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No.1

FOUNDATION SECTION

JOB 72-11012

LOCATION Sta. 426 + 00 Ø

ORIGINATED BY B.U.

W.P. 3-67-01

BORING DATE January 25, 1972

COMPILED BY RRB

DATUM Geodetic

BOREHOLE TYPE Washboring NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — w_p	WATER CONTENT — w	WATER CONTENT %		
486.5	Ground Level							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					
0.0	Surficial material	~	1	SS	1	485		200 400					
		~	2	SS	1							550	Orgs.
	Soft	~				480		+1 +2					
	Peat	~	3	TW	PM			+3				808	
	(occasionally fibrous)	~				475		+2					
	Dark Brown	~	4	TW	PM			+1				925	Orgs.
		~				470		+2					
	Very Soft to Soft	~	5	TW	PM			+2				936	
		~				465							
463.0	Organic Clay	~	6	TW	PM			+6					
23.5	Grey	~				460		+1					
		~	7	TW	PM								
455.0	Very Soft to Soft	~						-10					
31.5	End of Borehole	~				455							
	Hard Bottom	~											

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

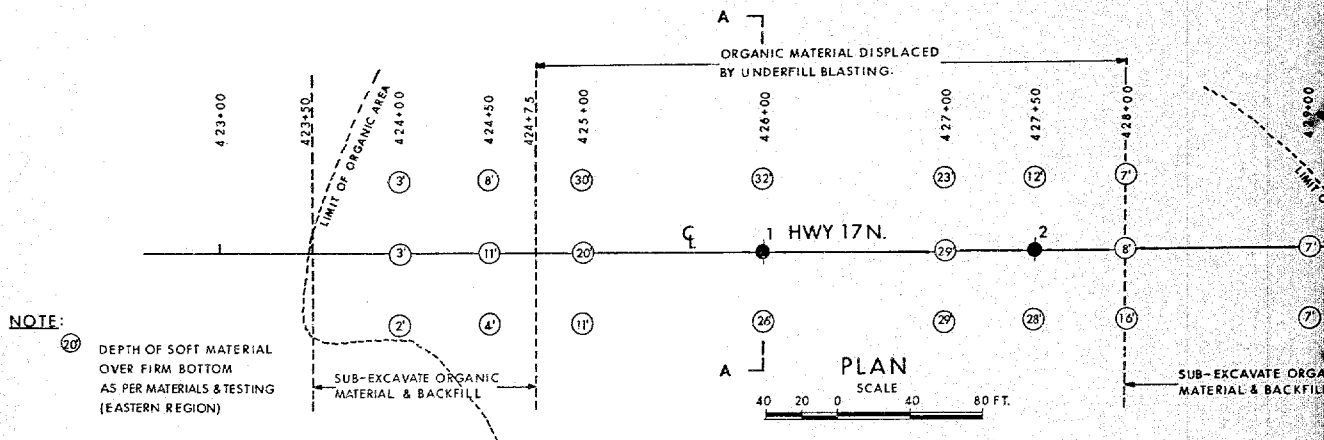
DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 2

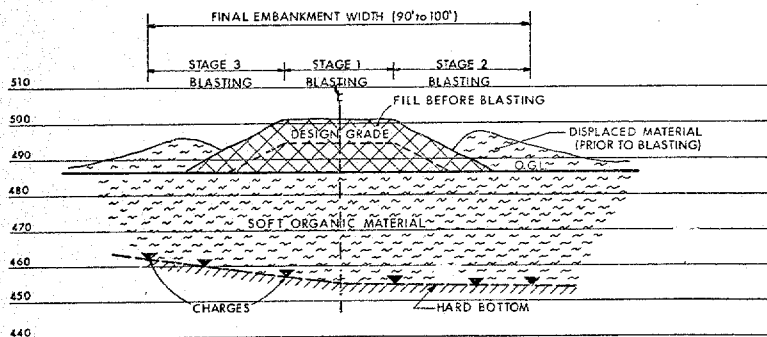
FOUNDATION SECTION

JOB 72-11012 LOCATION Sta. 427 + 50 Ø ORIGINATED BY B.U.
 W.P. 3-67-01 BORING DATE January 27, 1972 COMPILED BY RRB
 DATUM Geodetic BOREHOLE TYPE Washboring NX & BX CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT — w_p				
							SHEAR STRENGTH P.S.F.				WATER CONTENT — w				



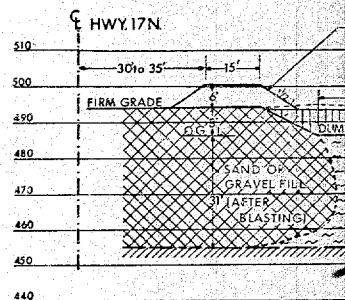
1 UNDERFILL BLASTING PROCEDURE (FIRST STAGE)



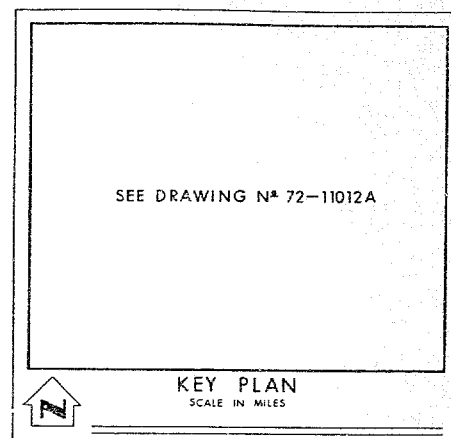
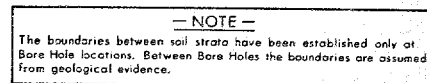
NOTE: RECOMMENDED SPACING BETWEEN THE CHARGES AS WELL AS THE QUANTITY OF DYNAMITE IN EACH CHARGE IS GIVEN IN TABLES V AND VI LOCATED IN APPENDIX II.

SECTION A-A

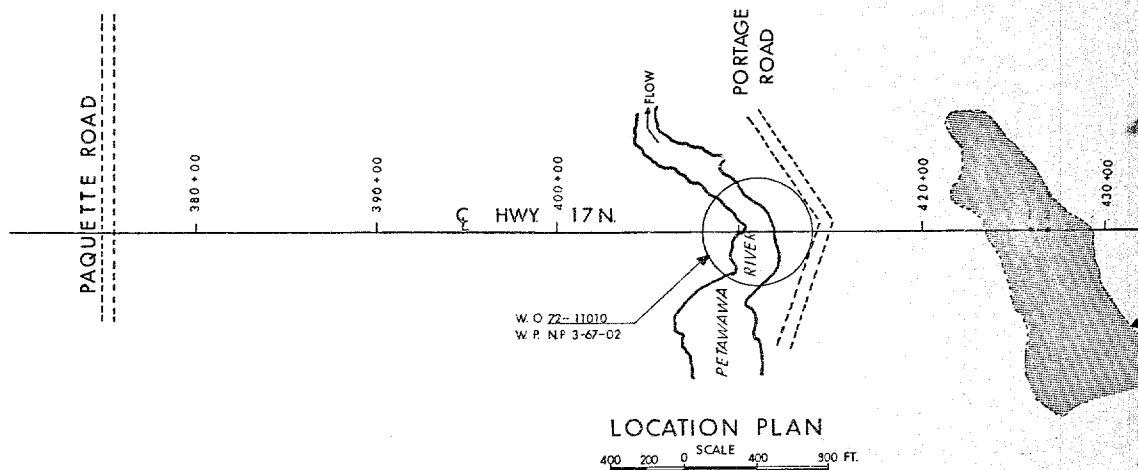
2 RECOMMENDED BERM TEMPORARY SURCHARGE (TO BE PLACED FOLLOWING B)



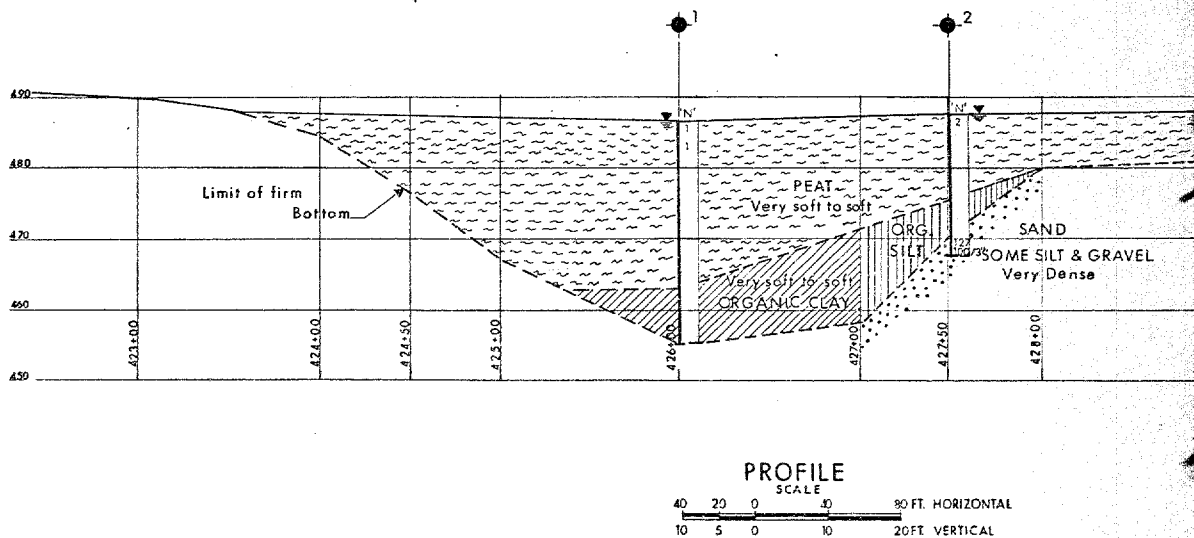
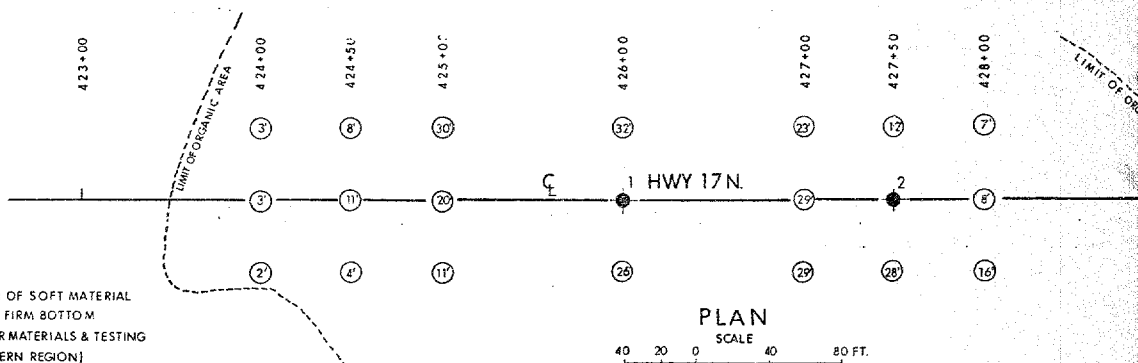
SECTION B-B

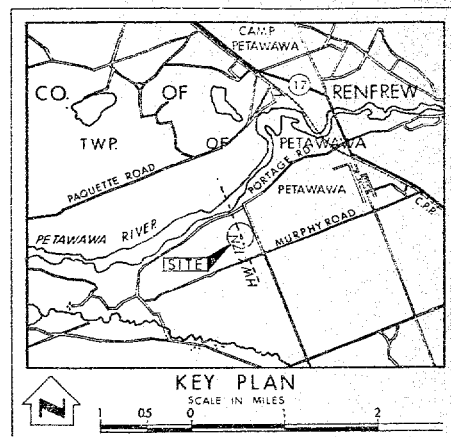
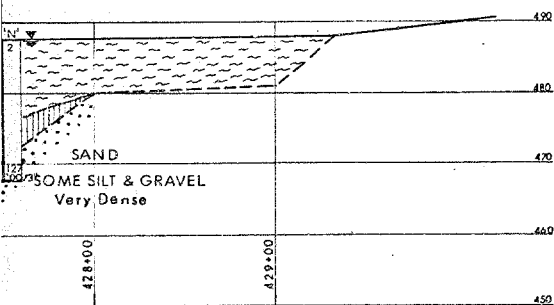
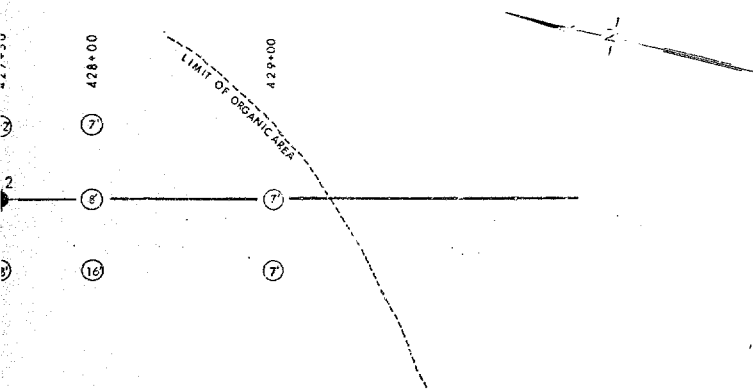
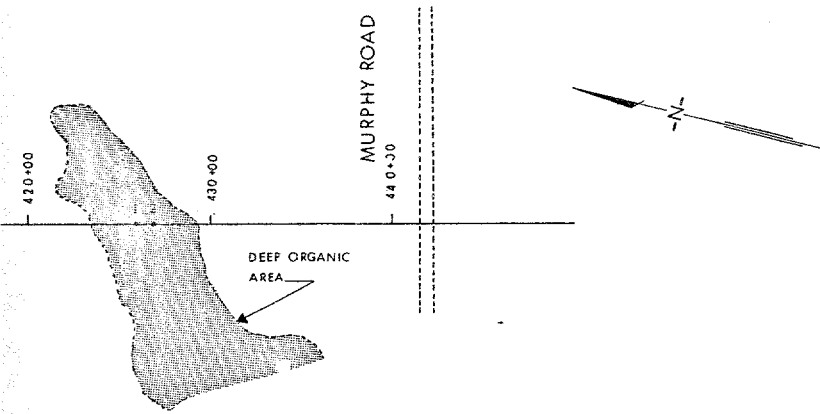
[illegible][illegible]

MINISTRY OF TRANSPORTATION & COMMUNICATIONS	
DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE	
TREATMENT OF ORGANIC AREA	
STA. 424+00 TO STA. 429+00	
HIGHWAY NO. 17 N.	DIST. NO. 9
CO. RENFREW	
TWP. PETAWAWA	LOT _____ CON. _____
BORE HOLE LOCATIONS & SOIL STRATA	
SUBMD. B.T.D. CHECKED _____	W.P. NO. 3-67-01
DRAWN F.L. CHECKED _____	72-11012B
DATE AUGUST 10, 1972	JOB NO. 72-11012
APPROVED <i>W. J. Macdonald</i> CHIEF ENG. NO.	BRIDGE DRAWING NO.
PERMITAL <i>W. J. Macdonald</i>	



NOTE:
② DEPTH OF SOFT MATERIAL
OVER FIRM BOTTOM
AS PER MATERIALS & TESTING
(EASTERN REGION)





LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, Jan 1972		
NO.	ELEVATION	STATION	OFFSET
1	486.5	426+00	4
2	487.6	427+50	4

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

ORGANIC AREA
STA. 424+00 TO STA. 429+00

HIGHWAY NO. 17 N. DIST. NO. 9
CO. RENFREW
TWP. PETAWAWA LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBSD BTD. CHECKED <input checked="" type="checkbox"/>	WP NO. <u>3-67-01</u>	DRAWING NO.
DRAWN F.L. CHECKED <input checked="" type="checkbox"/>	JOB NO <u>72-11012</u>	72-11012A
DATE <u>JULY 12, 1972</u>	SITE NO.	BRIDGE DRAWING NO.
APPROVED <u>[Signature]</u>	CONT. NO.	

FOUNDATION INVESTIGATION REPORT

For

Hwy. 17N, Organic Terrain, Sta. 424+00 to 429+00
W.P. 3-67-01

INTRODUCTION

This report contains results of a foundation investigation carried out at the following site:

W.P. 3-67-01

Organic terrain, Sta. 424+00 to 429+00

SITE DESCRIPTION AND GEOLOGY

The site is located approximately 1,500 ft. east of the Petawawa River, at a point about 1-1/2 miles south of existing Hwy. #17. The area is rather flat and low lying, with the ground surface ranging between elevations 485 and 490. The terrain is covered with light brush growth. The drainage is poor, this had led to the formation of a swamp. A shallow (2 to 3 feet deep) creek meanders across this area. The water in the creek is generally not more than 1 foot deep.

Physiographically, the area under investigation is located in the region known as the "Petawawa Sand Plain." The granular overburden deposits encountered here were primarily laid down in a delta built in the Champlain Sea by the Petawawa, Barron, Indian and Ottawa Rivers during the Fossmill stage of Lake Algonquin. In the vicinity of the area under investigation the sand and gravel deposits range from about 5 to 30 ft. in thickness. The surficial organic material has been superimposed on this deposit. The overburden is underlain by gneiss bedrock of Precambrian Age.

SUBSURFACE CONDITIONS

General

In this area the terrain is swampy. The depth of organic material ranges from 2 ft. to 32 ft. The organic deposits are underlain by the sand and

gravel deposits common to this region.

The boundaries of the various deposits, as determined in the boreholes, are shown on the Record of Borehole Sheets which are contained in the Appendix to this report. The locations and elevations are shown on Sheet No. 23A of the Contract Drawings. Estimated stratigraphical profiles and sections are shown also. A description of soil types encountered is as follows:

Organic Deposits

In this area the surficial deposit is composed of a dark brown fibrous peat. The thickness of the peat ranges from 2 ft., along the edges of the swamp, to as much as 24 ft. near the centre. The natural moisture content of the peat ranges from 550 to 936 percent, while the organic content varies from 72 to 80 percent by weight. The undrained shear strength of the peat as determined by in-situ vane tests ranges from 330 p.s.f., in the upper 5 to 7 ft., decreasing to as low as 95 p.s.f. with depth. Based on these results it is estimated that the consistency of the peat is soft, in the upper zone, decreasing to very soft, with depth.

Where the organic terrain is most extensive the peat is underlain by organic material of varying composition. In the middle for instance, the peat is followed by an 8 ft. thick deposit of very soft organic clay, half way between the edge and the centre while it is underlain by 5 ft. of very soft organic silt.

Lower Inorganic Deposit

In the central portion of the swamp, where the organic material is most extensive, the organics are directly underlain by firm bottom. Elsewhere, however, the organic material is underlain by the dense to very dense sand and gravel deposit common to this region.

Groundwater Level Conditions

Groundwater level observations were carried out during the period of the investigation in the open boreholes. The observations are presented on the Record of Borehole Sheets as well as on Contract Sheet No. 23A.

The results indicate that the groundwater level, across this poorly drained area, is at existing ground surface.

M. Devata

M. Devata, P. Eng.
Supervising Engineer



MD/bp
June, 1976

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 3-67-01

LOCATION Sta. 426 + 00 @ Hwy. 17N

ORIGINATED BY WU

DIST 9 HWY 17N

BORING DATE January 25, 1972

COMPILED BY RRB

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing

CHECKED BY

15 \pm 5 % STRAIN AT FAILURE

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 3-67-01 LOCATION Sta. 427 + 50 @ Hwy. 17N ORIGINATED BY WU
 DIST 9 HWY 17N BORING DATE January 27, 1972 COMPILED BY RRB
 DATUM Geodetic BOREHOLE TYPE Washboring NX & BX CHECKED BY Lo

SOIL PROFILE			SAMPLES			ELEV DEPTH	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100		
487.6	Ground Level												
0.0	Surficial Material		1	SS	2								
	Soft		2	TW	PM								
	PEAT												
	(occasional fibrous)		3	TW	PM	480							
475.6	Grey-Brown												
	Very Soft to Soft												
12.0	Organic Silt		4	TW	PM								
	Grey-Brown												
470.6	Very Soft to Soft												
17.0	Sand with some silt & gravel		5	SS	127	470							
467.5	Very Dense		6	SS	100.3"								
20.1	End of Borehole												
	Hard Bottom												
						460							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 1

JOB 71-11056

LOCATION Hwy. 17 - Petawawa Airport Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 18, 21, 22, 23, 1971

COMPILED BY BTB

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT %			
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE	W_P — W — W_L			
500.7	Ground Level											
1.0	Topsoil		1	SS	8	500						
			2	SS	19							
	Sand (medium to fine)		3	SS	28							
	trace of gravel.		4	SS	26	490						6 92 (2)
			5	SS	35							
			6	SS	51							
			7	SS	42	480						3 90 (7)
			8	SS	32							
			9	SS	43	470						470.7 July 8/71
			10	SS	96							
			11	SS	43	460						
			12	SS	69							
			13	SS	81	450						1 99
			14	SS	109	440						
			15	SS	61							
			16	SS	44	430						
			17	SS	38							
			18	Wash	-	420						0 96 (4)
			19	SS	48							
						410						
	Compact to Very Dense		20	SS	65							
400.7						400						
100.0	Silty sand											0 71 27 2
	Very Dense		21	SS	54							

Continued

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 1 Cont.

JOB 71-11056

LOCATION Hwy. 17 - Petawawa Airport Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 18, 21, 22, 23, 1971

COMPILED BY BTB

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — w_L				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT — w_p					
							SHEAR STRENGTH P.S.F.				WATER CONTENT — w					

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 2

JOB 71-1056

LOCATION Paquette Rd. @ Camp Petawawa Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 12 & 14, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing, BX, AXT 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 W_P ——— W ——— W_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000									
464.2	Ground Level															
0.0	Sand (medium to fine).		1	SS	11	460										
			2	SS	13											
			3	SS	17											
	Compact to Dense		4	SS	35										1 96 (3)	
451.6			5	SS	11	450										
12.6	Irregularly layered silt, sand and clayey silt.		6	TW	105											
			7	SS	15											
			8	TW	PM											
			9	SS	7	440									129 0 23 58 19	
	Loose to Compact or Stiff to Very Stiff		10	SS	26										440.6 June 15/71	
			11	SS	9	430										
			12	SS	24										0 37 58 5	
			13	SS	9	420										
			14	TW	PM											
409.7			15	BX	90%	410										
54.5	Gneiss Bedrock		16	RC AXT	87%											
	Sound		17	RC AXT	99%	400										
398.7																
65.5	End of Borehole															
						390										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 3

JOB 71-11056

LOCATION Petawawa River - West Bank Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 23 - 25, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX, AXT Casing, AXT, BX 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 γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			WATER CONTENT %				
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
480.5	Ground Level													
0.0	Sand and gravel (numerous 6" to 10" boulders throughout)		1	SS	48	480								82 17 (1)
			1A	BX	59%									
			2	SS	10									
			3	SS	13	470								
			4	SS	28									
			5	SS	124	460								
			6	SS	19									
			7	SS	97 7/8"	450								
			7A	RC BX	14%									
			8	SS	99	440								
			8A	BX	30%									
	Compact to Very Dense		9	SS	65 7/8"								447.6 June 28/71	
			10	SS	80 1/4"									
			10A	BX	40%									
			11	SS	60 1/2"	430								
429.0													44 48 (8)	
51.5	Fractured		12	AXT	83%									
	Sound													
	Biotite Gneiss		13	AXT	80%	420								
415.5	Bedrock		14	AXT	99%									
65.0	End of Borehole					410								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2 - SITE NO 3

JOB 71-11056

LOCATION Portage Road River Crossing Line 'A'

ORIGINATED BY AED

W.P. 3-67-01


BORING DATE June 21, 22, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, EX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — W_L PLASTIC LIMIT — W_P WATER CONTENT — W W_P — W — W_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
180.2	Ground Level													
0.0	Sand and gravel, Trace of silt, clay with numerous boulders		1	SS	51	480								477.3 June 22/71 27 60 (13)
			2	SS	79									
			3	SS	65	470								
468.7	Very Dense		4	EX	75%									
11.5	Fractured		5	EX	85%	460								
	Biotite Gneiss Bedrock		6	EX	80%									
456.1	Sound													
24.1	End of Borehole					450								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3 - SITE NO 3

JOB 71-11056

LOCATION Top W. Bank Petawawa River at Portage Rd. Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

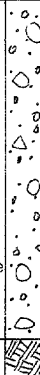

BORING DATE June 16 & 17, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE AX, BX Casing; BX Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT —w _L				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT —w _p					
464.5	Ground Level						SHEAR STRENGTH P.S.F.				WATER CONTENT —w					
							○ UNCONFINED + FIELD VANE				w _p — w — w _L					
							● QUICK TRIAXIAL × LAB VANE				WATER CONTENT %					
											20 40 60					
0.0	Sand and gravel (numerous 6" to 8" boulders throughout)		1	SS	52	460									56 h1 (3) 450.1 June 17/71	
			2	SS	14											
			3	SS	54											
			3A	BX	33%	450										
			4	SS	21											
			5	SS	30											
440.5	Compact to Very Dense		6	SS	103	440										
24.0	Biotite Gneiss Bedrock		7	AXT	79%	430										
			8	AXT	38%											
			9	AXT	28%											
424.5	Fractured															
40.0	End of Borehole					420										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1- SITE NO 4

JOB 71-11056

LOCATION Top W. Bank Petawawa River at Portage Rd. Line 'B'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 15, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing, RX 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 w_p — w — w_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT			SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
458.8	Ground Level					450						GR.SA.SI.CL Hole caved June 16/71 55 32 (13)	
0.0	Sand and gravel trace of clay (numerous 7" to 10" boulders)		1	SS	16								
			2	SS	11 1/2								
			3	BX	29 1/2								
448.3	Compact to Very Dense		4	SS	80 1/2								
10.5	Biotite Gneiss Bedrock		5	BX	88%	440							
			6	BX	87%								
			7	BX	81%								
			8	BX	99%								
438.0	Sound	9	BX	99%									
20.8	End of Borehole					430							

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2- SITE NO 4

JOB 71-11056

LOCATION Portage Rd. Line 'B'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 17, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT	WATER CONTENT		
478.8	Ground Level											
0.0	Sand and gravel (numerous 6" to 8" boulders throughout)		1	SS	72							
			2	SS	103							
			3	SS	88							
465.8	Very Dense		4	SS	63	470						
13.0	Biotite Gneiss Bedrock		5	BX	97%	460						
454.8	Sound		6	BX	96%							
24.0	End of Borehole					450						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE N^o 5

JOB 71-11056

LOCATION County Rd. 17 Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 11, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT — w_p				
							SHEAR STRENGTH P.S.F.				WATER CONTENT — w				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %				
460.7	Ground Level					400	800	1200	1600	2000	20	40	60	P.C.F.	GR.SA.SI.CL.
1.0	Topsoil		1	SS	5	460									
	Clay to silty clay		2	TW	PM										
	Grey		3	TW	PM										
	Very Stiff		4	TW	PM	450									
443.7			5	TW	PM										
17.0	Het. mix. of sand, silt & gravel, trace of clay (Glacial Till)		6	TW	PM										
	Dense		7	SS	32	440									
435.7	Bouldery Zone (boulders up to 6" in size)		8	BX	40%										
25.0	Granite Gneiss Bedrock		9	BX	95%										
428.7	Sound		10	BX	100%	430									
32.0	End of Borehole														
						420									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 6

JOB 71-11056

LOCATION Baelstadt Rd. Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 24, 25 & 26, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					W_p W W_L				
							\circ UNCONFINED + FIELD VANE \bullet QUICK TRIAXIAL \times LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 20 40 60				
484.0	Ground Level		1	SS	9	480										
0.0	Sand, trace of silt and gravel		2	SS	30											
			3	SS	30											
			4	SS	23	470										
			5	SS	19											
			6	SS	15											
			7	SS	24	460										
			8	SS	20											
			9	SS	33	450										
			10	SS	20											
			11	SS	14	440										
			12	SS	12											
			13	SS	16	430										
	Loose to Dense		14	SS	27											
419.0	Sandy silt with some clay(thin seams) and some gravel		15	SS	40	420										
65.0			16	SS	66											
			17	SS	18	410										
			18	SS	31	400										
	Glacial Till		19	SS	31	390										
	Compact to Very Dense		20	SS	31	380										

Continued

20
15-5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE - SITE N^o 6 Cont.

JOB 71-11056

LOCATION Baelstadt Rd. Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 24, 25 & 26, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE NX, BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
						400	800	1200	1600	2000	w_p	w	w_L			
368.0	Glacial Till Compact to Very Dense					370										
116.0	End of Borehole					360										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE-SITE NO 7

JOB 71-11056

LOCATION County Rd. 26 Line 'A'

ORIGINATED BY AED

W.P. 3-67-01

BORING DATE June 16 & 17, 1971

COMPILED BY HT

DATUM Geodetic

BOREHOLE TYPE AX, BX, NX Casing: AXT 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 γ	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					W_P W W_L WATER CONTENT %						
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					20 40 60						
523.2	Ground Level														P.C.F.	GR.SA.SI.CL		
0.0	Sand, trace of clay, silt and gravel.		1	SS	21	520										520.9		
			2	SS	72													June 18/71
			3	SS	59													8 81 (11)
			4	SS	31													
	Loose to Very Dense		5	SS	8													
511.2			6	SS	3	510										4 19 55 22		
12.0	Silty clay, some sand, trace of gravel.																	
506.2	Firm to Stiff																	
17.0	Granite Gneiss Bedrock (Biotite Layers)		7	AXT	100%	500												
			8	AXT	100%													
			9	AXT	100%													
495.2	Sound																	
28.0	End of Borehole					490												

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1 - SITE NO 8

JOB 71-11056

LOCATION North Side Alice-Petawawa Twp. Boundary Rd., Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE June 29, 1971

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & bore with NX & BX Casing

CHECKED BY JF

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT —w _L PLASTIC LIMIT —w _p WATER CONTENT —w w _p — w — w _L WATER CONTENT % 20 40 60	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
487.4	Ground Level		1	SS	11					
1.5	Silt with sand and trace of clay.		2	SS	27					
			3	SS	34					
478.4	Compact to Dense		4	SS	34					
9.0			5	TW	PM					
			6	TW	PM					
	Clay to silty clay.		7	TW	PM					
			8	SS	-					
	Grey		9	TW	PM					
			10	SS	-					
450.4	Firm to Stiff									
37.0	Granite Gneiss Bedrock		11	BX RC	100%					
			12	BX RC	100%					
437.4	Sound									
50.0	End of Borehole									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2-SITE NO 8

JOB 71-11056

LOCATION South Side Alice-Petawawa Twp. Boundary Rd. Line 'A'

ORIGINATED BY VE

W.P. 3-67-01

BORING DATE June 28, 1971

COMPILED BY ECP

DATUM Geodetic

BOREHOLE TYPE Wash and bore with NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_p — W — W_L	WATER CONTENT % 20 40 60	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT						
487.4	Ground Level										
0.0	Sandy silt with trace of clay.		1	SS	42						
			2	SS	26						
			3	SS	26						
			4	SS	5						
471.4	Loose to Dense										
16.0	Clay to silty clay. Grey		5	TW	PM						
465.6	Firm to Stiff										
21.8	Het. mix. sand, gravel, silt, clay (Glec. fill)		6	SS	38						
462.7	Dense										
24.7	Granite Gneiss										
457.9	Bedrock Sound		7	AXT	100%						
29.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 9

JOB 71-11056

LOCATION Hwy. 62 Pembroke

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 5, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash and Bore with BX & NX Casing

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 P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 20 40 60				
453.6	Ground Level													
0.0	Topsoil	~	1	SS	4	450								41 34 19 6 441.6 July 9/71 30 53 (17)
1.5	Het. mix. of sand, gravel, silt, clay (Glacial Till) (6" to 15" boulders below 8' depth)	4	2	TW	PM									
		4	3	SS	54									
		4	4	SS	65									
		4	5	SS	73 1/2		440							
		4	6	AXT	50%									
		4	7	AXT	16%									
		4	8	SS	52		430							
		4	9	SS	38 1/2									
		4	10	AXT RC	15%									
418.6	Very Dense	4	11	AXT	7%	420								
35.0		4	12	SS	63	410							1 85 (13)	
	Silty sand, trace of gravel.	4	13	SS	85									
		4												
	Very Dense	4				400								
	Bouldery Zone (boulders up to 5" in size)	4												
		4												
390.9		4				390								
62.7	Granite Gneiss	SE	14	AXT	88%									
387.6	Bedrock Fractured	SE												
66.0	End of Borehole					380								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 10

JOB 71-11056

LOCATION Hwy. 62 Line 'A'

ORIGINATED BY VK


W.P. 3-67-01

BORING DATE July 2, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				W_P W W_L WATER CONTENT % 20 40 60					
469.5	Ground Level															
0.0	Sand, trace of gravel					460									July 8/71 462.5 0 12 63 25	
466.5	(Roadway Fill)															
3.0	Clayey silt to silty clay.		1	SS	19											
			2	SS	17											
			3	TW	PM											
	Grey		4	TW	PM											
			5	SS	8											
450.0	Very Stiff					450										
19.5	Het. mix. of silt, sand & gravel, some clay (Glacial Till) (boulders up to 12" in size throughout)		6	SS	57	440									0 9 70 21	
			7	SS	63 1/4"											
439.0	Very Dense		8	SS	92										19 59 20 2	
30.5	Granite		9A	AXT	103%	430										
	Bedrock		9	RC AXT	71%											
				RC AXT	100%											
426.6	Sound		10	RC AXT	100%											
42.9	End of Borehole					420										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 11

JOB 71-11056

LOCATION C.N.R. - East of Co. Rd. #15 Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 8, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY *[Signature]*

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	STRAT. LOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % w_p — w — w_L				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000				20 40 60				
468.4	Ground Level														
466.4	Topsoil		1	SS	17										
2.0	some sand		2	SS	11										
	Clayey silt to silty clay, trace of sand.		3	TW	PM	460	○		x3			○			0 39 36 25
			4	TW	PM										0 11 54 35
			5	TW	PM		●	x5	+7				○		0 11 54 35
			6	TW	PM	450		+5	+5						0 4 67 29
	Grey		7	TW	PM				+6						
			8	TW	PM	440			+3	+6					0 2 68 30
438.4	Firm to Very Stiff		8A	BX	84%		●		x8				○		0 21 49 30
30.0	Het. mix. sand & gravel with silt & clay (boulders up to 2.5' in size throughout) (Glacial Till)		9	SS	37	430									
425.6	Dense to Very Dense		10	SS	100%										
42.8	Granite Gneiss Bedrock		11	BX	100%	420									
414.2	Sound		12	BX	70%										
54.2	End of Borehole					410									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 12

JOB 71-11056

LOCATION Co. Rd. #15 Line 'A'

ORIGINATED BY VK


W.P. 3-67-01





BORING DATE June 30, 1971

COMPILED BY ECF

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY 

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
488.7	Ground Level													
0.0	Topsoil		1	SS	11	480								487.7 July 1/71 31 60 (9)
1.5	Sand, gravel, silt, clay (with boulders up to 10" throughout) (Glacial Till)		2	SS	24									
			3	SS	32									
477.5	Compact to Dense		4	AXT	38%	470								
11.2	fractured													
	Granite Gneiss Bedrock		5	AXT	94%									
467.2	Sound		6	AXT	100%	460								
21.5	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 13

JOB 71-11056

LOCATION Biesenthal Rd. - Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE June 29, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					W_P W W_L					
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					20 40 60			P.C.F.	GR SA SI CL	
473.3	Ground Level																
0.0	Topsoil		1	SS	6	470										Hole caved June 29/71 0 22 58 20	
469.3	Clayey silt with some sand		2	SS	14												
4.0	Clay to silty clay		3	TW	PM												
462.7	Grey Firm to Very Stiff		4	TW	PM	460										Cc=0.660 Pc=2.0 TFS	
10.6	Granite Gneiss																
457.5	Bedrock Sound		5	AXT	100%												
15.8	End of Borehole					450											

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 14

JOB 71-11056

LOCATION Airport Rd. Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 6, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY *[Signature]*

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					W_P W W_L 20 40 60				
525.7	Ground Level															
0.0	Sand, trace of silt to silt, trace of sand.		1	SS	15	520									521.8 July 7/71 0 91 (9)	
			2	SS	10											
			3	SS	45											
			4	SS	28											
	Compact to Very Dense		5	SS	64	510									0 4 92 1	
507.2			6	SS	15											
18.5	Clayey silt, trace of sand.		7	TW	PM	500									0 28 62 10	
501.2	Very Stiff		8	TW	PM											
24.5	Sand with gravel, some silt, trace clay. (Glacial Till)					500									37 44 18 1	
494.1	Dense		9	SS	41											
31.6	Granite Gneiss Bedrock		10	BX	83%	490										
487.2	Sound		11	AXT	100%											
38.5	End of Borehole					480										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 15

JOB 71-11056

LOCATION Black Bay Rd. Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE July 2, 1971

COMPILED BY EOB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — w_L PLASTIC LIMIT — w_P WATER CONTENT — w w_P — w — w_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000							
531.5	Ground Level													
0.0	Silty sand to sandy silt, with a trace to some gravel.		1	SS	25	530								
			2	SS	40									
	Compact to Very Dense		3	SS	85									0 47 52 1
			4	SS	136	520								517.6 July 6/71
			5	SS	52	510								27 20 50 3
506.5			6	SS	133									5 17 72 6
25.0	Het. mix. of sand, silt and some gravel		7	TW	PM	500								
	(Glacial Till)		8	SS	120									
			8A	AXT	30%									
			9	SS	43	490								8 58 33 1
			10	SS	21									
			10A	EX	552									
			11	SS	120.4"	480								
	(boulders up to 12" in size throughout)		12	SS	150.3"									
			13	EX	100%									
			13A	SS	120.8"	470								15 70 (15)
	Compact to Very Dense		14	SS	174.6"									
461.3			15	SS	150.2"	460								
70.2	Biotite Gneiss													
456.2	Bedrock (some weathering.)		16	EX	72%									
75.3	End of Borehole					450								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE N^o 16

JOB 71-11056

LOCATION Murray Rd. - Petawawa Line 'A'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE June 29, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L WATER CONTENT % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000									
512.0	Ground Level														GR. SA. SI. CL.	
0.0	Sand, some gravel, trace of silt. Compact to Very Dense		1	SS	24	510									No W.L. on June 30/71 8 85 (7)	
			2	SS	28											
			3	SS	35											
			4	SS	48											
			5	SS	58											
492.0			6	TW	PM	490									108 0 19 52 29 Cc=0.685 Pc=3.0tsf	
20.0	Silty clay with some sand.		7	TW	PM											
			8	TW	PM											
			9	TW	PM											
			10	TW	PM											
			11	TW	PM											
	Stiff to Very Stiff		12	TW	PM										109	
457.0						460										
55.0	Sand, silt, clay, gravel		13	SS	110										2 52 31 15	
455.0	(Giac. Till). V. Dense															
57.0	Biotite Gneiss		14	AXT	90%											
451.6	Bedrock. Sound															
60.4	End of Borehole					450										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 17

JOB 71-11056

LOCATION County Rd.#17 & Hales Cre.

ORIGINATED BY VK


W.P. 3-67-01

BORING DATE July 7, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % W_P — W — W_L			
390.8	Ground Level											
0.0	Clayey silt with some sand. Stiff		1	SS	7	390						
387.8	Grav. with sand (boulder)		2	SS	11.75"							
3.3	Granite Gneiss Bedrock		3	BX	100%							
			4	BX	100%	380						
377.0	Sound											
13.8	End of Borehole					370						

387.5
July 8/71

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 18

JOB 71-11056

LOCATION Petawawa River - East Bank Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 15, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY *SP.*

SOIL PROFILE			SAMPLES			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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000		WATER CONTENT % 20 40 60		
471.4	Ground Level										
0.0	Sand and Gravel		1	SS	100	470					
			2	SS	199						
	Very Dense		3	SS	150	460					
458.4											
13.0	Silty clay with trace of sand & gravel.		4	SS	4		8			105	
			5	TW	PM						
	Firm to Stiff		6	TW	PM	450	5.5			102	
446.4											
25.0	Glac. Till. Very Dense		7	SS	90						
26.3	Sand (boulders up to 10" in size throughout)		8	AXT	23						
439.4	Very Dense		9	AXT	17	440					
32.0	End of Borehole										
						430					

461.9
Sept. 30/71

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2- SITE NO 18

JOB 71-11056

LOCATION Petawawa River - West Bank Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

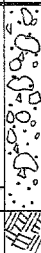
BORING DATE Sept. 21, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX Casing

CHECKED BY *[Signature]*

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	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		W _P W W _L WATER CONTENT %		
456.2	Ground Level		1	SS	100	1"	450				
0.0	Sand and Gravel (boulders up to 10" in size throughout)		2	SS	100	1"					
	Very Dense		3	SS	100	1"					
441.7	Fine Sand Layers										
44.5	Granite Bedrock (biotite gneiss inclusions)		4	AXT	93%						
431.7	Sound		5	AXT	95%		440				
24.5	End of Borehole						430				

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3-SITE NO 18

JOB 71-11056

LOCATION Petawawa River, West Approach Line 'C'

ORIGINATED BY VK


W.P. 3-67-01

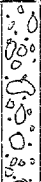

BORING DATE Sept. 22/71

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX Casing

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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 20 40 60				
460.1	Ground Level													
0.0	Sand and gravel (boulders up to 12" in size throughout)		1	SS	100	5"								29 65 (6)
446.3	Very Dense		2	SS	100	1"	450							
13.8	Granite Bedrock (Biotite Gneiss inclusions)		3	AXT	97%									
437.1	Sound		4	AXT	92%		440							
23.0	End of Borehole													
												</		

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4-SITE NO 18

JOB 71-11056

LOCATION Petawawa River Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 2, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

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 Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					W _p — W — W _L				
							○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE	400	800	1200	1600		
467.2	Ground Level															
0.0	Sand & gravel to gravelly sand (occasional boulders throughout)	0.0	1	SS	125	460									463.7 Sept. 29/71	
	Compact to Very Dense	0.0	2	SS	20										33 61 (6)	
453.2		0.0														
14.0	Silty clay, trace of sand.	0.0	3	TW	PM	450								114		
		0.0	4	TW	PM											
		0.0	5	TW	PM	440										
437.2	Firm to Stiff	0.0														
30.0	Silty sand.	0.0	6	SS	23											
431.2	Compact	0.0	7	SS	6	430										
36.0	Clayey silt with some sand & gravel (Glacial Till)	0.0	8	SS	45											
420.7	Firm to Hard	0.0				420										
46.5	Granite Bedrock	0.0														
415.7	Sound	0.0	9	AXT	100%											
51.5	End of Borehole	0.0				410										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 19

JOB 71-11056

LOCATION Murphy Rd. Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 28, 1971

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY *[Signature]*

SO. PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT ——— W_L PLASTIC LIMIT ——— W_P WATER CONTENT ——— W W_P ——— W ——— W_L			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 20 40 60					
505.2	Ground Level														GR.SA.SI.CL
0.0	Silty Sand														503.2 Sept.30/71
			1	SS	25	500									
			2	SS	20										1 84 (15
			3	SS	20	490									
	Compact		4	SS	18										
481.2															
24.0	Het.mix.of sand,silt, gravel (Glacial Till)		5	SS	64	480									34 53 (13)
	Very Dense														
	Bouldery Zone														
	(boulders up to 10" in size)		6	AXT	50%										
470.0						470									
35.2	End of Borehole														
						460									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE No 20

JOB 71-11056

LOCATION Co. Rd. #26 & Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 30, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY J.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — W_L PLASTIC LIMIT — W_P WATER CONTENT — W			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				W_P	W	W_L		
515.2	Ground Level						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000				WATER CONTENT % 20 40 60			P.C.F.	GR.SA.SI.CL.
0.0	Silty Sand		1	SS	50	510									
	Dense to Very Dense		2	SS	32										
500.2						500									
15.0	Silty Clay		3	TW	PM									106	
	Grey		4	TW	PM										
490.2	Firm to Stiff		5	SS	19	490									
25.0	Irregularly layered silt, clayey silt and silty clay, trace of sand throughout.		6	TW	PM										
			7	TW	PM	480								120	
			8	TW	PM										
			9	SS	12	470									0 18 63 19
			10	SS	12										
	Loose to Compact or Firm to Very Stiff		11	SS	10	460									0 17 59 24
			12	SS	8										
			13	TW	PM	450									
			14	TW	PM										
			15	TW	PM	440								114	
			16	TW	PM										
			17	TW	PM	430									
			18	TW	PM										
			19	TW	PM	420								119(1)	
418.2															
97.0	Sand		20	SS	40										
	Dense														

Continued

20
15-5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE N^o 20 Cont.

JOB 71-11056

LOCATION Co. Rd. #26 & Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 30, 1971

COMPILED BY BGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 20 40 60				
110.0						410										
105.0	Sand & gravel & silt (Glacial Till)	21	SS	84												
104.7	Very Dense Boulder															
110.5	End of Borehole					400										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1-SITE NO 21

JOB 71-11056

LOCATION Hales Creek-West Branch Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Oct. 7/71

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000									
179.2	Ground Level															
0.0	Topsoil															
1.0	Clayey silt to silty clay. Grey Very Stiff to Firm		1	SS	23	470										
			2	SS	20											
			3	TW	PM	460										
			4	TW	PM											
155.1				5	SS	100/112"										
24.1	End of Borehole					450										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2-SITE NO 21

JOB 71-11056

LOCATION Hales Creek-West Branch Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Oct. 6, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT %			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.									
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000									
465.4	Ground Level															
0.0	Sandy silt.															
462.4	Compact															
3.0	Clayey silt to silty clay.		1	TW	PM	460										
456.4	Firm															
9.0	Silty sand (seams of clay throughout)		2	SS	25											
450.4	Compact															
15.0	Het. mix. of sand, silt & gravel (Glacial Till)		3	SS	39	450										
			4	SS	63											
440.9	Dense to Very Dense															
24.5	Biotite Granite Gneiss Bedrock (fractured layers above el. 452.5)		5	AXT	80%	440										
430.9	Sound		6	AXT	100%											
34.5	End of Borehole					430										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 22

JOB 71-11056

LOCATION County Rd. #17 Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Oct. 4, 1971

COMPILED BY EGB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	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		SHEAR STRENGTH P.S.F.			W _P _____ W _____ W _L WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000							
481.0	Ground Level					480								
0.0	Silty Sand													
473.5	Dense		1	SS	32									
7.5	Clayey silt to silty clay.		2	TW	PM	470								
			3	TW	PM									
	Grey		4	TW	PM	460								
452.5	Firm		5	TW	PM									
28.5	Het. mix. of sand, silt, and gravel, trace of clay (Glacial Till) (boulders up to 8" in size throughout)		6	SS	100	450								
			7	SS	150/2"									
437.0	Very Dense					440								
44.0	End of Borehole					430								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1- SITE NO 23

JOB 71-11056

LOCATION S-E Murphy Rd. Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 29/71

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore NX & BX Casing

CHECKED BY *ECB*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT %			
502.8	Ground Level											
0.0	Sand, gravel, ash, trash (Garbage Dump)		1	SS	4	500						498.6 Sept. 30/71
			2	SS	17							
			3	SS	8							
495.8	Very Loose to Compact		4	SS	14							
7.0	Sand and gravel		5	SS	19							
			6	SS	24	490						
			7	SS	29							
	Compact to Very Dense		8	SS	59	480						
478.8			9	SS	100/20"							
24.0	End of Borehole					470						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2-SITE NO 23

JOB 71-11056

LOCATION S-E of Murphy Rd. Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 29/71

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY *OP*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT — w w_p ——— w ——— w_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
505.8	Ground Level															
0.0	Sand, gravel, clayey silt, ash, trash, nails etc. (Garbage Dump)	X	1	SS	22	500										502.0 Sept. 30/71
		X	2	SS	14											
		X	3	SS	15											
		X	4	SS	47											
		X	5	SS	185											
		X	6	SS	23	48"										
	Compact to Very Dense															
489.3			7	SS	115	490										
16.5	Sand and gravel.															
486.8	Very Dense		8	SS	100	0"										
19.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE - SITE NO 24

JOB 71-11056

LOCATION Paquette Rd.-Canadian Forces Base Line 'C'

ORIGINATED BY VK

W.P. 3-67-01

BORING DATE Sept. 24, 1971

COMPILED BY VK

DATUM Geodetic

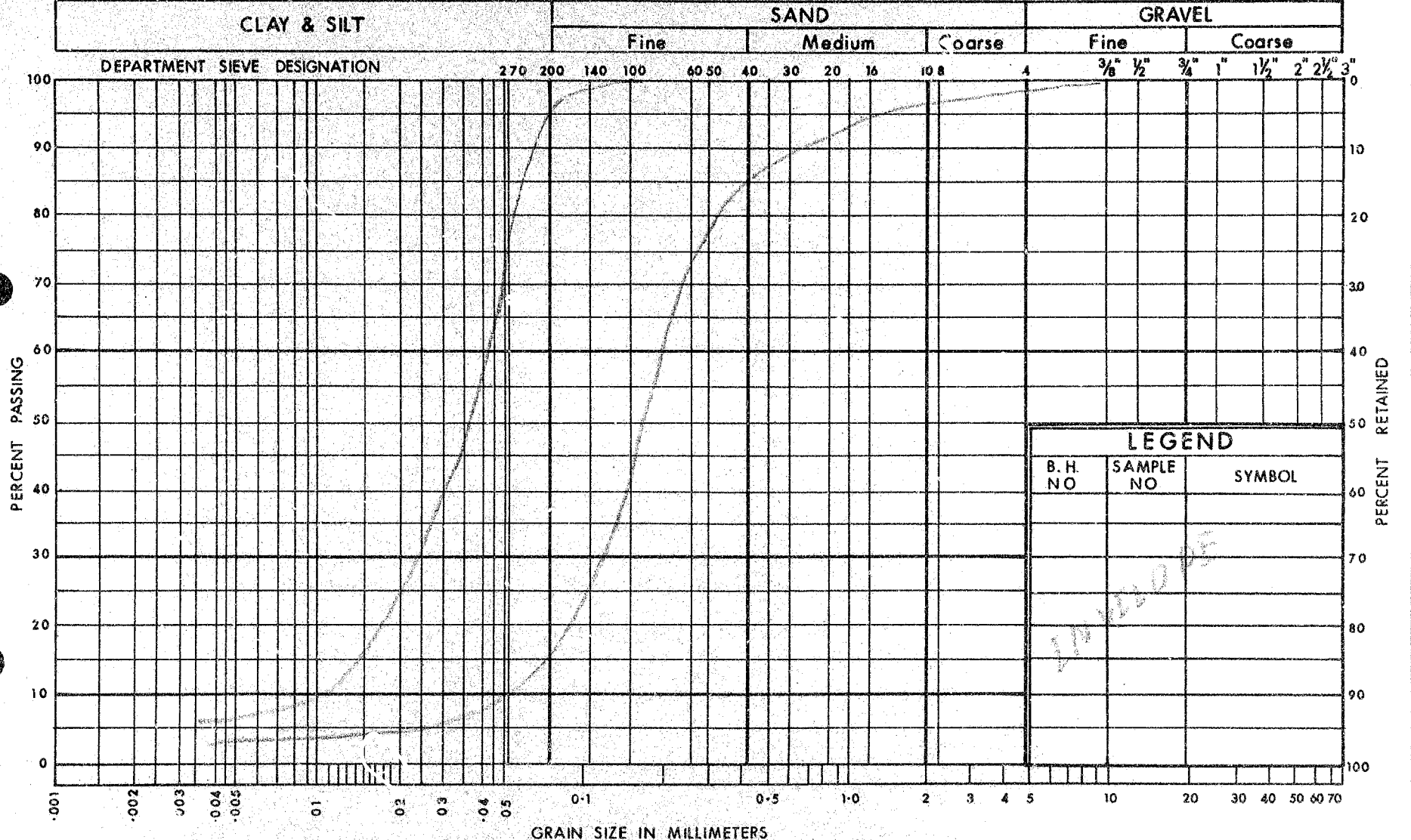
BOREHOLE TYPE Wash & Bore with NX & BX Casing

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WP — WL 20 40 60		
465.6	Ground Level										
0.0	Sand and gravel and some silt (Fill)		1	SS	18	460					0 82 (18)
457.6	Compact		2	SS	94						
8.0	Sand with gravel, trace silt, clay (boulders up to 10" in size throughout)		3	SS	100/6"	450					
	(Glacial Till)		4	SS	100/6"						
	Very Dense		5	SS	225	440					25 69 (6)
			6	SS	100/3"						
431.4			7	SS	100/3"						
34.2	End of Borehole					430					

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM

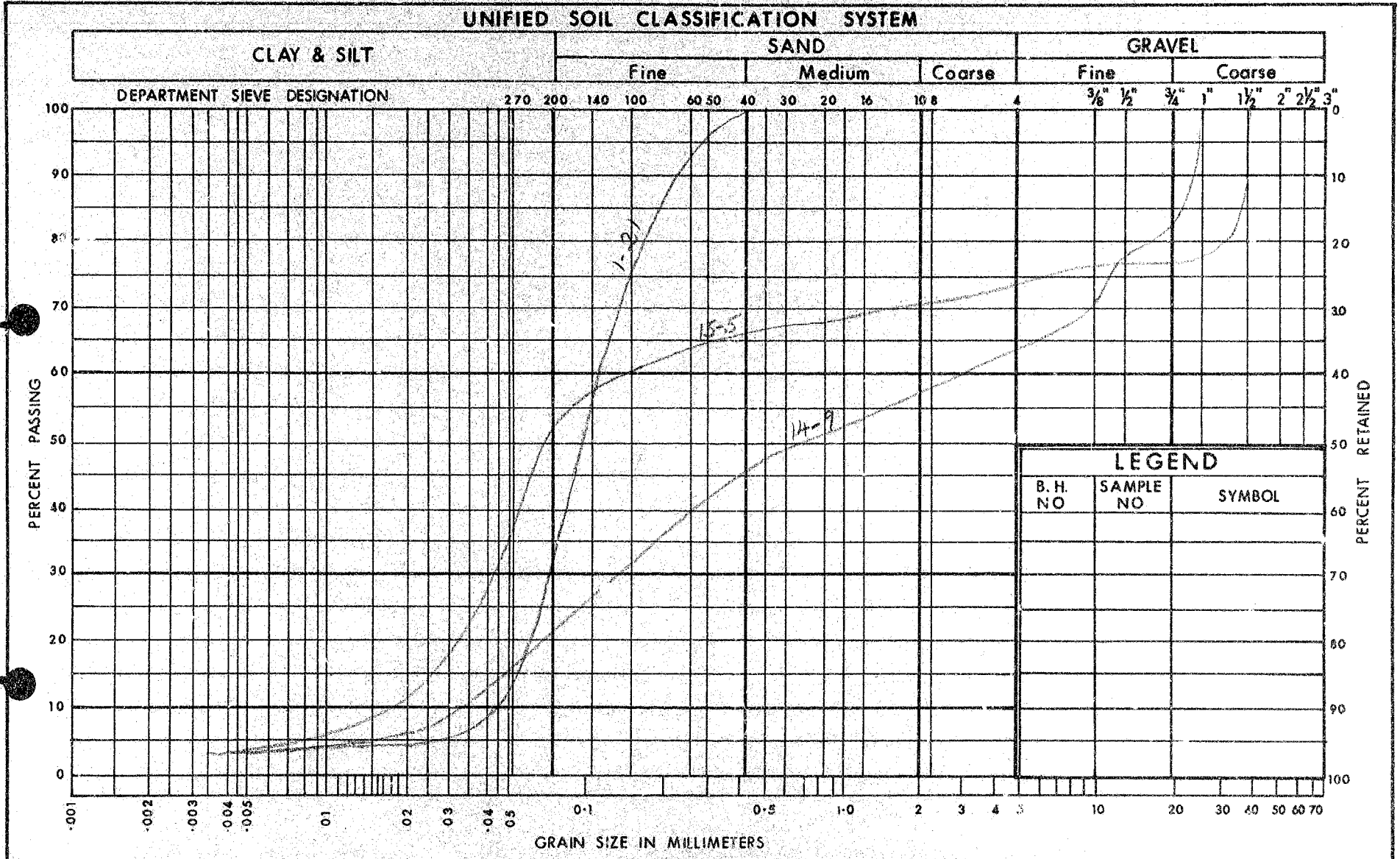


LEGEND		
B. H. NO	SAMPLE NO	SYMBOL

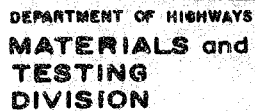
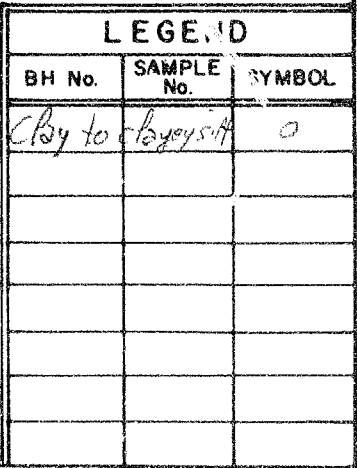
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
Silty sand (upper deposit)

W.P. No.
JOB No. 71-11056
Fig. 2



<p>DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS</p> <p>DESIGN SERVICES BRANCH</p>	<p>GRAIN SIZE DISTRIBUTION</p> <p><i>Sand and Gravel to Silty Sand (Lower deposit)</i></p>	<p>W.P. No. _____</p> <p>JOB No. <i>71-1105</i></p> <p style="text-align: center;"><i>Fig. 5</i></p>



W.P. No.
JOB No. 71-11056
FIG. 8