(RM. 110 LAB. BLDG.)

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

Attention: Mr. S. McCombie

Date: May 14, 1970

Our File Ref.

In reply to MAY 22 1970

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed Structures at the Crossings
Of
Hwy.#417, Eastbound & Westbound Lanes
And South Nation River
Twp. of Cambridge - County of Russell
District No. 9 (Ottawa)
W.J. 69-F-118 -- W.P. 35-66-15

Attached, we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MleF
Attach.
cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
S. J. Markiewicz
T. C. Kingsland (2)
J. E. Callaghan
J. E. Gruspier
M. R. Ernesaks (2)
B. A. Singh

Foundations Files
Gen. Files

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1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation to determine the subsoil conditions at the sites of the above mentioned proposed structures. The request was contained in a memo from the Bridge Planning Section - (Mr. T. C. Kingsland, Regional Bridge Planning Engineer, Eastern Region) dated December 3, 1969. Subsequently, a subsurface investigation was carried out by this Section in order to determine the subsoil, bedrock and groundwater conditions at the above site. This report contains the results of the investigation as well as our recommendations pertaining to the stability of the proposed approach embankments and the design of the structure foundations.

At the time that the field work was in progress, and prior to the preparation of this report, various alternative schemes for the proposed crossings were being considered. Consequently, the programme of field investigation was modified and/or expanded and tentative recommendations, from a foundation viewpoint, were made known verbally to personnel in Bridge Planning and Design Sections. This report has been prepared taking into account the latest information which has been provided by the Bridge Planning Section.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site of the proposed crossings is located along the South Nation River, some 0.8 miles upstream of the Town of Casselman. The South Nation River, at this site, is some

2. DESCRIPTION OF THE SITE AND GEOLOGY: (cont'd.) ...

300 ft. wide and flows in a northerly direction in a broad, relatively shallow, U-shaped channel. At the time of the investigation, the depth of water in the deepest portion of the channel was about 20 ft., and the ice thickness averaged about 18 inches (Jan. - Feb., 1970).

The western bank of the river consists of a relatively flat-lying floodplain, some 100 ft. wide, beyond which the ground surface rises at an average gradient of about 10 horizontal to 1 vertical to a maximum elevation of 206± - i.e., some 20 ft. above the river level (elev. 186). The west bank, in the area of the investigation, is cleared and used mainly as a pastureland.

The eastern bank of the river consists of steeply rising ground (average gradient about 2½:1) to a 20-ft. wide gravel road which is situated some 17 ft. above the river level. East of this gravel road, the ground surface rises very gently towards the east and is cleared for agricultural purposes. The east bank valley slopes are covered with a growth of poplar, elm and maple trees.

Two river control structures are located on the South Nation River about 1 mile downstream of the site. The first consists of an overflow dam having a crest elevation of about 186 (estimated). About 1000 ft. downstream of this structure is an old spillway structure having a control elevation of about 180 ± (estimated). The existing County Rd. #3 into Casselman is carried over the river by means of a low steel truss bridge with an estimated soffit elevation of about 202 ±. According to the available information, a high water level elevation of up to 199 has been recorded in the past during the peak flood flow of the South Nation River.

The area is situated within the "Winchester Clay Plains" physiographic region, in which marine clays ("Leda" clay), deposited during the inundation of the region by the Champlain Sea in post-glacial times, are underlain by fluvio-glacial deposits followed by shale and/or limestone bedrock.

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3. FIELD AND LABORATORY WORK:

A total of 19 boreholes, of which 11 were accompanied by dynamic cone penetration resistance tests, was carried out at the site. In addition, 9 shallow boreholes were put down along the west bank and edge of the river in order to delineate the vertical and horizontal extent of an isolated organic deposit (see Section 4.2). In order to supplement the information obtained from the boreholes, 5 additional dynamic cone penetration tests were carried out. The borings and cone tests were achieved by means of three standard diamond drill rigs adapted for soil sampling purposes.

Samples at the surface of and below the cohesive overburden at the site were obtained by hammering a 2-inch O.D. split-spoon sampler in accordance with the specifications for the Standard Penetration Resistance Test. The same procedure was used in carrying out the dynamic cone penetration resistance tests. Relatively undisturbed samples of the cohesive overburden were obtained at the required depths by manually pushing 2-inch I.D. Shelby tubes into the subsoil. Wherever possible, in-situ field vane tests were also carried out within the cohesive overburden in order to determine the undrained shear strength characteristics. Bedrock was proven across the site by core drilling a minimum of 5 ft. in AXT size at 12 of the borehole locations.

Surveying was carried out by personnel from the Kingston Region Engineering Surveys Section. The borehole locations and elevations are shown on Drawings 69-P-118A and 69-P-118B for the Eastbound and Westbound lane crossings, respectively, together with the corresponding estimated stratigraphical profiles. The elevations given in this report are referenced to a geodetic datum.

The soil samples and rock cores recovered from the investigations were carefully examined in the field and once more in the laboratory prior to testing. Selected samples of the overburden were then tested in the laboratory for the following physical properties:

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

Natural Moisture Contents
Bulk Densities
Atterberg Limits
Grain-Size Distributions
Undrained Shear Strengths
Consolidation Characteristics
Organic Matter Contents

The results of this testing are summarized on the individual Record of Borelog sheets as well as on Figures 1 to 6, all of which are contained in the Appendix to this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The predominant stratum at this site consists of a clay deposit which ranges in thickness from about 44 to 51 ft. at the approach locations and 14 to 18 ft. in the central portion of the river. The upper 8 to 14 ft. of the deposit beyond the river banks, is in a desiccated condition. Underlying the desiccated zone along the west bank of the river is a deposit of organic silt-clay having a maximum thickness of 8 ft., followed by the non-desiccated portion of the clay deposit.

The clay stratum across the site is underlain by a silty sand deposit which ranges in thickness randomly between 6 and 20 ft. The silty sand deposit is, in turn, underlain by a granular type of glacial till deposit, which ranges in thickness randomly between 2 and 8 ft. Sound limestone bedrock underlies the silty sand or glacial till strata at depths of 60 to 68 ft. at the approaches and 44 to 53 ft. below the river bed.

The various soil strata encountered at this site are described in greater detail in the sections to follow. A summary sheet of the laboratory and field tests is shown on Figure 1 of the Appendix.

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

4.2) Organic Silt-Clay:

Along the west bank of the South Nation River, a deposit of organic material was encountered at both the E.B.L. and W.B.L. crossing locations. Specifically, this organic deposit was found to extend from about Station 376+70 to Station 378+15 at the proposed W.B.L. crossing and Station 373+90 to Station 375+50 at the proposed E.B.L. crossing. The maximum thickness of this deposit was found to be about 8 ft. At both locations, this deposit is overlain by up to about 7 ft. of stiff to very stiff desiccated silty clay to clay with a trace of sand.

Examination of the recovered samples from the organic deposit shows that the material consists of an organic silt to organic clay containing traces of sand and occasional decayed wood fragments. The results of laboratory tests on typical samples from this deposit are tabulated below:

	Range	(Avg.)	Remarks
Natural Moisture Content - %	55 - 137	(104)	
Liquid Limit - %	58 - 133	(95)	
Plastic Limit - %	45 - 75	(55)	
Organic Matter - (dry wt. basis) - %	12 - 22	(17)	
Bulk Density (γ) - PCF		(86)	one determination
Undrained Shear Strength (C_u) - PSF		(550)	" "
Std. Penetration Resistance 'N' Values - Blows/ft.	1 - 5	(2)	N = 14 also recorded.

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

4.2) Organic Silt-Clay: (cont'd.) ...

The Atterberg limits are shown on the Plasticity Chart, Figure 2 in the Appendix. These indicate that the material is generally a highly compressible organic clay (OH). However, in certain locations, some samples from the deposit were found to consist of organic silt (OL). The 'N' values indicate that the overall deposit has a soft consistency. However, 'N' values as high as 14 blows/ft. were recorded, and it is believed that these are due to the presence of wood fragments within the deposit.

4.3) Clay:

Underlying a surficial cover of topsoil at the river banks and immediately below the river bed, is a clay deposit which extends to depths of 40 to 50 ft. below the ground surface at all the approach locations. The thickness of the clay deposit below the river bed varies between 14 and 18 ft. At the west bank of the river, a deposit of organic silt-clay was encountered some 7 ft. below the ground surface, extending to a maximum depth of about 15 ft.

The upper 10 to 14 ft. of the clay deposit at the approaches is desiccated and exhibits a mottled brown to grey-brown colour. The thickness of this desiccated zone decreases towards the river. Below the desiccated zone, the clay is generally grey in colour with some alternate grey-brown layers occurring at random. In the lower 20 $\pm$ ft. of the deposit the clay contains occasional shell fragments and small pockets of a black substance believed to be a form of sulphide which is associated with clays of marine origin. Examination of the Shelby tube samples from this deposit revealed the presence of thin silt partings and fine sand seams which occur throughout the stratum in a random manner.

The results of laboratory tests on representative samples are summarized on Figure 1 in the Appendix, and are tabulated on the following page, along with the field test results:

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

4.3) Clay: (cont'd.) ...

I. Index Properties		Desiccated Zone Range (Avg.)	Non-Desiccated Zone Range (Avg.)
Natural Moisture Content	(W) - % :	25 - 55 (36)	56 - 87 (70)
Liquid Limit	(W_L) - % :	31 - 64 (49)	51 - 82 (71)
Plastic Limit	(W_p) - % :	19 - 31 (24)	24 - 34 (29)
Liquidity Index	(L_I) - :	0.4 - 1.0 (0.6)	0.9 - 1.2 (1.0)
Bulk Density	(γ) - PCF :	112 - 116 (114)	95 - 102 (99)

II. Undrained Shear Strengths (C_u)		
Field Vanes - PSF	-	600-1120 (900)
Laboratory Vanes - PCF	2175 - 4025(3005)	490-1310 (930)
Unconfined Compression Tests - PSF	610 - 1620(1110)	470-1150 (665)
Sensitivity (S_t)	-	6 - 48

III. Consolidation Characteristics		Non-Desiccated Zone Range (Avg.)
Initial Void Ratio	(e_o) :	1.69 - 2.42 (2.0)
Compression Index	(C_c) :	0.7 - 2.1 (1.5)
Recompression Index	(C_R) :	0.03 - 0.07 (0.05)
Degree of Preconsolidation - (P'_c-P'_o) PSF	-	1500 - 1900 (West Appr.) 1800 - 2300 (East Appr.)

The Atterberg limits, which are plotted on the Plasticity Charts on Figures 3A and 3B in the Appendix, indicate that the soil is inorganic and of high plasticity (CH). However, there are random layers of a soil of lower plasticity (CI) which indicate that the clay deposit contains occasional silty clay layers.

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

4.3) Clay: (cont'd.) ...

The values of the undrained shear strength versus elevation for all the boreholes are shown on Figure 1. No significant increase in shear strength with depth is noticeable in the non-desiccated portion of the deposit.

The 'N' values within the desiccated zone ranged between 5 and 22 blows/ft. and averaged about 13 blows/ft. On the basis of the undrained shear strength measurements and the 'N' values, the desiccated zone is considered to have a consistency ranging from very stiff to stiff. The consistency of the non-desiccated clay is estimated to range between firm and stiff.

The results (e - log p curves) of four consolidation tests on representative samples, obtained in the clay deposit below the desiccated zone at the approach locations, are shown on Figure 4. These tests indicate that the clay has been preconsolidated in the past to an effective pressure some 1500 to 2000 PSF in excess of the existing effective overburden pressure. Typical effective pressure - elevation plots are shown on Figure 1, Appendix I.

4.4) Silty Sand:

Directly underlying the clay stratum across the site, a deposit of silty sand was encountered. The thickness of this stratum varied at random across the site and ranges between 6 and 12 ft. at the W.B.L. crossing location and 9 and 20 ft. at the E.B.L. crossing location. The deposit consists of fine sand with traces of silt, as well as silty sand. An envelope of grain-size distribution curves is shown on Figure 5 in the Appendix. The moisture content of typical samples ranged between 17 and 22 per cent and averaged about 20 per cent. The 'N' values ranged between 10 and 76 blows/ft., and were generally higher than 30 blows/ft. within the upper 5 ft. of the deposit. Based on

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

4.4) Silty Sand: (cont'd.) ...

these 'N' values, the overall relative density of the deposit is considered to be generally compact, being occasionally dense to very dense near the surface of the deposit.

4.5) Heterogeneous Mixture of Silt, Sand and Gravel - (Glacial Till):

A deposit consisting of a heterogeneous mixture of silt, sand and gravel (glacial till) was encountered below the silty sand stratum at most of the borehole locations. The glacial till was found to have an average thickness of about 5 ft., where encountered.

The glacial till is essentially non-cohesive - i.e., granular in nature. However, a few samples exhibited very slight plasticity indicating the presence of traces of clay at random locations. The grain-size distribution curves for typical samples are shown on Figure 6 in the Appendix. The average moisture content of the deposit was determined to be about 8 per cent. The 'N' values in this stratum ranged from 12 to 8[illegible] blows/ft., averaging about 44 blows/ft. These 'N' values tended to increase with depth, indicating that the glacial till is generally very dense with localized zones near the surface having a compact relative density.

4.6) Limestone Bedrock:

Bedrock was core-drilled at strategically located boreholes along the proposed alignments for the E.B.L. and W.B.L. crossings. These borings reveal a relatively uniform bedrock profile across the site. At the E.B.L. crossing location, the bedrock was encountered between elevations 133 at the West approach and elevation 138.5 at the East approach. At the W.B.L. crossing, the bedrock was encountered between elevations 136 at the West approach and 142 at the East approach. These elevations indicate that, in general, the rock surface slopes gently in a

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

4.6) Limestone Bedrock: (cont'd.) ...

westerly direction at each crossing location and tends to rise upwards in a northerly direction.

Examination of the recovered cores indicates that the bedrock is essentially composed of limestone; however, shale impurities are present throughout, together with isolated thin shale seams. The bedrock is therefore classified as a shaly limestone. Core recoveries of over 90 per cent, in general, indicate that the bedrock is basically sound throughout.

5. GROUNDWATER CONDITIONS:

Observations of the water levels in the boreholes were carried out during the period of the field investigation. These observations are shown on Drawings 69-F-118A and 69-F-118B, as well as on the individual Records of Borelog sheets.

At the time of this investigation, the river level was at about elevation 186 and the groundwater level, as inferred from boreholes put down adjacent to the river's edge along the west bank, corresponds to this elevation. Beyond the floodplain of the west bank, the groundwater level was observed to be located 3 to 5 ft. below the ground surface - i.e., at about elevations 197 to 201. The groundwater level at the higher ground on the east bank of the river was observed to be located some 8 to 10 ft. below the ground surface - i.e., at about elevations 192 to 196.

It is concluded from these observations that, in the general area of investigation, the internal drainage is towards the river.

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6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct two separate structures to carry the Eastbound and Westbound lanes of Hwy. #417 across the South Nation River at a site located about 0.8 miles upstream of the Town of Casselman.

As mentioned earlier in this report, various alternative schemes were being considered for the proposed crossings. It was originally proposed to construct multispan structures in order to accommodate a new Township Rd. (Side Rd.) along the west bank and the existing gravel road along the east bank beneath Hwy. #417. Preliminary recommendations were made by this Section with regards to the stability of the approach embankments for the aforementioned scheme. The berm requirements and other considerations by the Planning Section indicated that a low-level structure would be desirable at this location. At this stage it was considered that two additional separate structures would be constructed to carry the proposed Twp. Rd. over Hwy. #417. On the basis of economical as well as other requirements, it was concluded that such a scheme would not be satisfactory at this location. At a later stage, due to problems other than foundation considerations, it was decided by the Regional Functional and Bridge Planning Sections that a high-level bridge would be the only choice at this location.

As of this writing, it is now proposed to construct two separate 3-span (174'-218'-174') structures, one for the E.B.L. and one for the W.B.L. crossing. The centre-lines of the East- and Westbound lanes will be located about 350 ft. apart. The profile grade of Hwy. #417 at both the crossings will be at about elevation 224 $\pm$. The new Twp. Rd. (Side Rd.) will be carried below the proposed Hwy. #417 along the west bank of the river. This Side Rd. will be located at about elevation 202 $\pm$ on an embankment situated between the West approach fill and the West pier of the proposed structures.

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

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

As proposed, the new structures will span over the existing gravel road along the east bank of the river and, therefore, no changes are contemplated in the alignment or grade of the gravel road. The approach fills for the two structures will be some 20 to 24 ft. in height.

The investigation has revealed that the predominant deposit across the site is a clay stratum of some 44 to 51 ft. thickness at the approaches and 14 to 18 ft. in thickness in the central portion of the river. The upper 8 to 14 ft. of this deposit is desiccated at the approach locations and has a generally very stiff consistency. Below this desiccated zone, the clay is of firm to stiff consistency. Along the western bank of the river, the floodplain is underlain, at a depth of about 7 to 8 ft., by a deposit of organic clay having a maximum thickness of about 8 ft. Across the site, the clay deposit is underlain by a generally compact silty sand deposit of 6 to 20 ft. thickness, which in turn, is followed by a relatively thin deposit of granular glacial till. The glacial till is underlain by a sound shaly limestone bedrock which is encountered across the site between elevations 133 and 142.

6.2) Approach Embankments:

In view of the presence of the firm to stiff clay deposit across the site and the organic material along the west bank of the river, analyses have been carried out in order to assess the stability and settlement of the proposed approach fills as well as the embankment which will carry the proposed Side Rd. beneath the structures. These analyses are discussed in detail in the following sub-sections:

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

6.2) Approach Embankments: (cont'd.) ...

6.2.1) Stability Considerations -

Stability analyses have been carried out in terms of total stresses for circular arc type failure surfaces using an electronic computer. According to the available information, the area of the proposed crossings is located in a region of probable seismic activity. For this reason, earthquake forces have also been taken into consideration in these analyses by assuming horizontal components of acceleration equivalent to 0.1g and 0.2g. For such magnitudes of acceleration, minimum factors of safety of 1.05 (for 0.1g) and 1.0 (for 0.2g) have been chosen in the design of the approach embankments.

The subsoil conditions and properties used in the stability analyses are shown on Figure 7, together with the proposed fill geometry at both the crossings.

These analyses indicate that:

i) no stability problems are anticipated for the proposed geometry, the factors of safety ranging between about 1.6 and 1.9.

ii) the reductions in the factors of safety due to horizontal components of acceleration equivalent to 0.1g and 0.2g are respectively about 20 and 35 per cent. Even with these reductions, it is estimated that the approach fills will have the required minimum factors of safety - namely, 1.05 and 1.0.

iii) The location of the Side Rd. embankment is such that no subexcavation of the underlying organic material is necessary. Analyses using a minimum shear strength value of 250 PSF for the organic material, indicate that the Side Rd. will be stable for the geometry shown on Figure 7.

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

6.2) Approach Embankments: (cont'd.) ...

6.2.1) Stability Considerations - (cont'd.) ...

Care should be taken to ensure that the river banks are not trimmed any steeper than the existing slopes. The river banks should be protected to the high water level for any possible scour.

6.2.2) Settlement Considerations:

Settlement analyses have been carried out in order to estimate the anticipated long-term settlement due to the consolidation of the clay deposit beneath the approach embankments. It has been assumed in these analyses that the settlements within the desiccated zone will be mainly elastic in nature and will be realized immediately upon construction of the embankment fills.

For the proposed geometry, the maximum height of fill is in the order of 24 ft. The settlement analyses indicate that for such fills, the anticipated consolidation settlement will be about 18 inches and will be realized within a period of about 5 to 7 years. It is also anticipated that about 50 per cent, or 9 inches of the total settlement will be realized within a period of about 12 months. For this reason, we recommend that the approach embankments be constructed to grade at least 12 months prior to construction of the structure foundations, and that the final paving operations be delayed for as long a period as is practically fe sible.

The clay deposit is inferred to be preconsolidated by about 1500 to 2000 PSF. Therefore, for fills in the order of 14 ft. in height, the settlements will be due to recompression only and should be in the order of 2 to 4 inches. It is expected that such recompression or "elastic" settlements should be realized in a relatively short period of time - i.e., during or immediately after construction of the approach fills.

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

6.2) Approach Embankments: (cont'd.) ...

6.2.2) Settlement Considerations: (cont'd.) ...

The embankment which will carry the new Side Rd. along the west bank of the river, will also settle as a result of compression of the organic layer along the west bank. Due to the organic nature of the subsoil, both primary and secondary types of compression will take place due to the embankment loading. Computations were not carried out to determine the magnitude of the primary compression, since it will take place during and immediately after the construction of the embankment. The estimated settlement, due to secondary compression, will be in the order of 12 to 16 inches beneath the eastern-most portion of the embankment where the thickness of the organic deposit is a maximum. The aforementioned settlement can be minimized by subexcavating the organic layer and backfilling with any granular type of material. Settlements beneath the Side Rd. embankment, due to recompression of the clay deposit, will be relatively minor.

6.3) Structure Foundations:

In view of the presence of firm to stiff clay across the site, it is recommended that the piers and abutments be supported on end-bearing piles driven to the surface of the bedrock. The design load would depend on the pile section chosen. For example, 12 BP 74 steel H-piles, may be designed for 95 tons/pile. Due to the anticipated settlement at the approaches and the consequent negative skin frictional forces, it would be desirable to reduce the design loads to 70 tons/pile at the abutment locations. Consideration should also be given to supporting the extreme ends of the wing walls on piles in order to prevent any tilting of the abutments.

The proposed piers will be located within the existing river channel. Therefore, a temporary dewatering scheme will be required during the construction of the pile caps.

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

6.3) Structure Foundations: (cont'd.) ...

As an alternative to steel H-piles, the proposed piers can be supported on lined concrete caissons founded on the surface of the bedrock. A design load of 300 tons/caisson may be used for 48-inch diameter caissons. If caissons are considered more suitable at this location, the Foundation Section will obtain the necessary details with regard to caisson installations.

6.4) Alternate Grade - Low-Level Crossing:

As discussed in the earlier sections of this report, the choice of high-level bridges at this site has been finalized and the recommendations made in this report have referred to this choice. However, in the event that consideration may be given, at a later date, to a low-level crossing (profile grade at about elevations 210 - 212 for the two structures), this Section will provide recommendations with regard to the stability and settlement of the proposed fills. Our recommendations pertaining to the structure foundations for a low-level crossing, however, will be as those already given in Section 6.3) of this report.

7. MISCELLANEOUS:

The field work was carried out during the period December 9, 1969 - February 10, 1970, under the supervision of Messrs. C. Mirza, Project Foundation Engineer and H. Stankaitis, Technician.

This report was prepared by Mr. Mirza, and reviewed by Mr. M. Devata, Supervising Foundation Engineer, who was in general charge of the project.

Equipment used was owned and operated by F. E. Johnston Drilling Co. Ltd., Ottawa.

May, 1970.

APPENDIX I

FORM 08-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 E.B.L. ℄ Sta. 371 + 50 o/s 20' Lt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 9 - 10, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT
204.0	Ground Level				
0.0	Topsoil				
1.5	Desiccated Very stiff - Stiff mottled red-brown and grey		1	SS	18
			2	SS	14
			3	TW	PM
190.0			4	SS	5
14.0	Clay with occ. fine sand & silt partings. Firm - very stiff Sensitive Grey with occ. black mottling		5	TW	PM
			6	TW	PM
			7	TW	PM
			8	TW	PM
			9	TW	PM
160.0			10	TW	PM
44.0	Sand				
157.0					
47.0	End of Borehole				

ELEV. SCALE

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

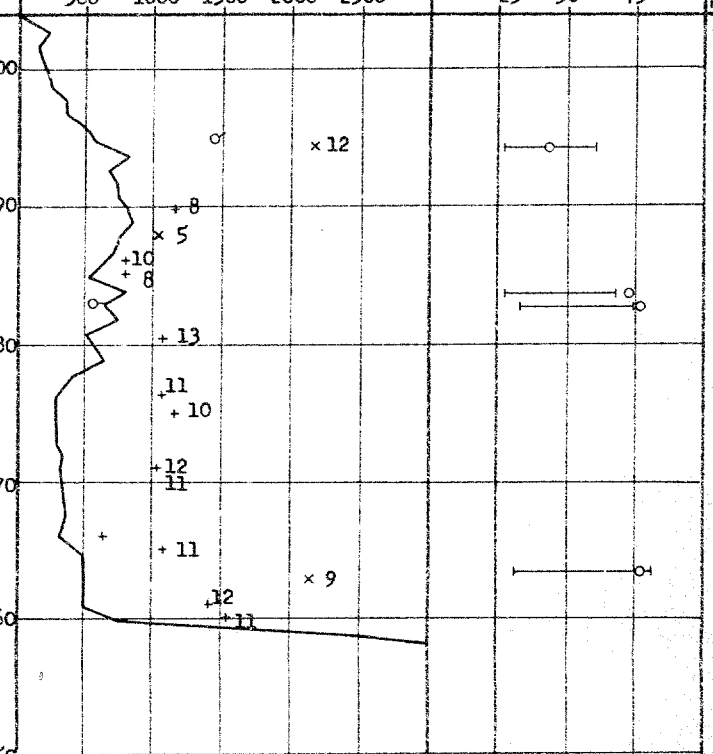
LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

201.5



20
15 ⊕ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 E.B.L. ℄ Sta. 372 + 43 o/s 25' Rt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 9-12, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
201.9	Ground Level				
0	Topsoil				
1.5	Desiccated Hard - Very stiff mottled Red-brown and grey		1	SS	22
			2	SS	18
			3	TW	PM
188.9			4	SS	7
13.0			5	TW	PM
	Clay with occ. silt seams		6	TW	PM
	Firm - stiff Sensitiv e Grey with occ. black mottling		7	TW	PM
			8	TW	PM
			9	TW	PM
			10	TW	PM
154.9					
47.0	Fine sand with trace of silt & gravel Very dense - compact Grey		11	SS	56
			12	SS	40
			13	SS	20
			14	SS	21
136.9					
65.0 / 133.4	Glacial Till				
68.5 / 128.4	Shaley Limestone Bedrock. Sound		15	AXT	100%
73.5	End of Borehole				

ELEV. SCALE: 200, 190, 180, 170, 160, 150, 140, 130, 120

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH PSF — 500 1000 1500 2000 2500
o UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % — 25 50 75

BULK DENSITY γ P.C.F.: 113, 102

REMARKS
GR. SA. SI. CL.
▼ 197.2
2 94 3 1
N. recovery

20
15 ⟡ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 E.B.L ℄ Sta. 372 + 89 o/s 261 Lt. ORIGINATED BY CM

W.P. 35-66-15 BORING DATE December 12, 1969 COMPILED BY CM

DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT
201.7	Ground Level	
0.0	Probably Desiccated	
189.0		
12.7	Probably Clay	
156.7		
45.0	Probably Sand	
136.2		
65.5	End of Cone Test Probably Glacial Till	

SAMPLES: NUMBER | TYPE | BLOWS/FOOT

ELEV. SCALE: 200, 190, 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

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

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

GR. SA. SI. CL.

Practical refusal

20
15 — 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-[illegible]8 LOCATION Hwy. 417 E.BL. ℄ Sta. 373 + 21 o/s 18' Rt. ORIGINATED BY CM

W.P. 35-66-15 BORING DATE December 12, 1969 COMPILED BY CM

DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY [illegible]

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FOOT
199.5	Ground Level				
0.0	Probably Desiccated				
188.0					
11.5	Probably Clay				
155.5					
44.0	Probably Sand				
137.5					
62.0	End of Cone Test Probably Glacial Till				

ELEV. SCALE: 190, 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

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: GR. SA. SI. CL.

Practical refusal

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 E.B.L. ℄ Sta. 373 + 80 o/s 5' Rt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 15-16, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX,BX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
191.8	Ground Level				
0.0	Topsoil				
1.5	Desiccated Very stiff - stiff mottled red-brown and grey		1	SS	14
			2	SS	9
181.8			3	SS	3
10.0	Clay with occ. silt seams & silty clay layers Firm - Stiff Sensitive Grey with occ. black mottling.		4	TW	PM
			5	TW	PM
			6	TW	PM
			7	TW	PM
			8	TW	PM
151.8			9	SS	37
40.0	Silty fine sand with a trace of gravel Dense				
141.8			10	SS	12
50.0	Het.mix.of silt,sand & gravel with trace clay (Glacial Till) Compact - very dense grey		11	SS	90/4"
133.5					
58.3	Shaley Limestone bedrock Sound		12	AXT	99%
128.1					
63.7	End of Borehole				

ELEV SCALE: 190, 180, 170, 160, 150, 140, 130, 120

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.: 100

REMARKS

▼187.8

GR. SA. SI. CL.
5 74 17 4
30 39 26 5
21 19 58 2

OH

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 E.B.L. ℄ Sta. 374 + 00 o/s 5' Lt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE February 3, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
191.0	Ground Level					190
0.0	Topsoil					
1.0	Clay with some silt & sand; desiccated		1	SS	16	
183.4	V.Stiff - mottled brown		2	SS	16	
7.6	org. clay - soft		3	SS	-	
8.7	Clay		4	SS	-	180
	Grey with occ. black mottling		5	SS	-	
			6	SS	-	
172.0			7	SS	-	
19.0	End of Borehole					170

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.

REMARKS GR.SA.SI.CL.

▼ 187.5

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 E.B.L. ℄ Sta. 374 + 25 o/s 30' Rt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE February 3, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-HX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
190.6	Ground Level					
0.0	Topsoil					190
	Clay with trace silt & sand. Desiccated. Firm-Stiff. Mottled Brown		1	SS	7	
183.0			2	SS	10	
7.6	Organic clay with dec. wood fragments. Soft. Black.		3	SS	4	
177.3			4	SS	-	180
			5	SS	-	
13.3	Clay with occ. silt seams. Grey with black mottling		6	SS	-	
			7	SS	-	
			8	SS	-	
169.6			9	SS	-	170
21.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

WATER CONTENT % 25 50 75

112%

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

▼187.1

13.6% orgs.

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 E.B.L. ℄ Sta. 374 + 50 o/s 30' Lt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE February 2, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
191.3	**Ground Level**				
0.0	Topsoil				
1.0	Clay with sand pockets Desiccated		1	SS	8
183.3	Mottled brown-grey		2	SS	9
8.0	Org. clay with occ. dec. wood fragments. Soft to firm		3	SS	3
			4	SS	-
			5	SS	-
175.3	Black		6	SS	-
16.0	Clay		7	SS	-
171.3	Grey		8	SS	-
20.0	End of Borehole				

ELEV. SCALE: 190, 180, 170

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 25 50 75

133%

BULK DENSITY γ P.C.F.

REMARKS GR.SA.SI.CL.

▼187.3

21.9% org.

16.7% org.

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 69-F-118 LOCATION HWY.417 E.B.L. ℄ Sta. 374 + 75 o/s 10' Lt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 17-18, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing CHECKED BY AK.

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
188.0	Ground Level				
0.0	Topsoil		1	SS	4
0.8	Silty clay-clay with trace sand. Desiccated Firm-stiff. Mottled brown		2	SS	6
			3	SS	12
180.5			4	SS	9
7.5	Org. clay with trace of dec. wood fragments Firm - soft		5	SS	5
			6	SS	3
173.0	Black		7	SS	2
15.0			8	SS	1
	Clay Grey				
146.5					
41.5	Silty fine sand. Compact		9	SS	15
43.0	End of Borehole				

ELEV. SCALE: 180, 170, 160, 150, 140

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

WATER CONTENT % 25 50 75

135%

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

▼ 186.5

17.4% org.

20% org.

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 69-F-118 LOCATION HWY.417 E.B.L. ℄ Sta. 37+75 o/s 30' Rt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE February 5, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

SOIL PROFILE ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
186.0	River Ice Level					
0.0	Ice water					
1.0	Silty clay with trace of sand. Mottled grey		1	SS	-	
181.0						
5.0	Org. clay - silt occ. dec. wood fragments. Soft Black		2	SS	-	180
			3	SS	-	
			4	SS	-	
			5	SS	-	
172.4						
13.6	Clay		6	SS	-	
			7	SS	-	170
167.0	Gray with black mottling		8	SS	-	
19.0	End of Borehole					160

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w

WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.

REMARKS GR.SA.SI.CL.

13.1% org.

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 11

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 E.B.L. ℄ Sta. 375 + 00 ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE January 29 - 30, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & BX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
186.0	River ice level				
184.5	Ice				
183.5	Water				
2.5	Org. clay with occ. dec. wood fragments. Very soft		1	SS	1
			2	SS	1
173.5			3	TW	PM
12.5	Clay with occ. silt partings. Firm - Stiff Sensitive Grey with occ. black mottling.		4	TW	PM
			5	TW	PM
			6	TW	PM
			7	TW	PM
			8	TW	PM
147.0					
39.0	Fine sand Loose - Compact Grey		9	SS	11
			10	SS	9
136.0					
50.0	Silt, sand & gravel (Glacial Till) Dense		11	SS	32
133.2					
52.8	Shaley limestone Bedrock Sound		12	AXT	97%
128.1					
57.9	End of Borehole				

ELEV SCALE: 180, 170, 160, 150, 140, 130, 120

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

× 9, + 13, + 20, + 24, + 21, + 41, + 40, × 26, + 22, + 15, + 31

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %
25 50 75

137%
133%

BULK DENSITY γ P.C.F.
102

REMARKS
GR. SA. SI. CL.

16.5% org.

0 98 2 0

40 32 (28)

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 EBL ℄ Sta. 375 + 50 ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE February 5, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
186.0	River Ice Level					
184.2	Ice					
1.8	Water					180
169.5						170
169.0	org. clay-silt		1	SS	-	
17.0	Clay		2	SS	-	
			3	SS	-	
			4	SS	-	
	Grey; occ. black mottling		5	SS	-	160
			6	SS	-	
155.5			7	SS	-	
30.5	End of Borehole					150

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.

REMARKS
GR. SA. SI. CL.

20
15 ⊕ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 13

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 EBL Ø Sta. 375 + 80 o/s 30' Lt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE January 29, 1970 COMPILED BY GM
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FOOT	ELEV. SCALE
186.0	River Ice Level					
0.0	Ice					
1.0	Water					180
170.0						170
16.0	Probably Clay					160
149.0						150
37.0	Probably Sand					140
136.0						
50.0	Probably Glacial Till					
132.7						130
53.3	End of Cone Test Probably Bedrock					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

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

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

GR. SA. SI. CL.

Practical refusal

20
15 S % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 14

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 EBL ℄ Sta. 376 + 50 o/s 18' Rt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE January 29 - 30, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
186.0	River Ice Level				
184.5	Ice				
1.5	Water				
168.7					
17.3	Clay Grey				
151.0					
35.0	Fine - Sand Very dense - compact Grey		1	SS	72
			2	WS	-
			3	SS	22
138.0					
48.0	Het.mix.of silt,sand & gravel (Glacial Till)		4	SS	50
132.6	Dense-Grey				
53.4	Shaley limestone Bedrock		5	AXT	99%
127.5	Sound				
58.5	End of Borehole				

ELEV. SCALE: 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

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
GR.SA.SI.CL

Borehole washed thro
clay to san
stratum.

no recovery

no recovery

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 15

FOUNDATION SECTIO

JOB 69-F-118 LOCATION HWY. 417 EBL ℄ Sta. 377 + 75 o/s 30' Lt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE January 27 - 28, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & BX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE
186.0	River Ice Level					
184.4	Ice					
1.6						
	Water					
175.5						
10.5	Clay with occ. silt partings & silty clay layers Firm - Stiff Sensitive Grey occ. black mottling		1	TW	PM	180
			2	TW	PM	
			3	TW	PM	170
			4	TW	PM	
			5	TW	PM	
			6	TW	PM	160
			7	TW	PM	
151.0			8	SS	-	
35.0	Fine sand Compact - very dense Grey		9	SS	21	150
			10	SS	64	
			11	SS	19	
141.0			12	WS	-	
45.0	Het.mix of silt,sand & gravel(Glac. Till) Compact - v. dense Grey		13	SS	27	140
			14	SS	75/9"	
134.7						
51.3	Shaley limestone Bedrock - Sound		15	AXT	95%	
130.1						130
55.9	End of Borehole					
						120

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE
500 1000 1500 2000 2500

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.

REMARKS GR. SA. SI. CL

no recovery
0 87 (13)
no recovery
41 33 24 2

20
15 ⊕ 5 % STRAIN AT FAILURE
10

FORM 08-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 16

FOUNDATION SECTION

JOB 69-F-118 LOCATION HWY. 417 EBL @ Sta. 378 + 44 o/s 20' Lt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 17-18, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
201.0	Ground Level				
0.0	Fill material				
1.5	Desiccated Very stiff - firm mottled red-brown & grey		1	SS	14
			2	SS	5
190.0			3	SS	4
11.0	Clay with occ. silt partings & clayey silt layers		4	SS	2
			5	TW	PM
			6	TW	PM
	Firm - stiff Sensitive Grey with black mottling		7	TW	PM
			8	TW	PM
			9	TW	PM
			10	TW	PM
154.5			11	TW	PM
46.5	Silty fine sand Compact-dense				
149.5	Grey		12	SS	32
51.5	End of Borehole				

ELEV. SCALE: 200, 190, 180, 170, 160, 150, 140

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

+ 6; + 7, 9; × 7; + 13, 11; + 12, 12; + 11, 21; + 36, 22; + 10; + > 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p w w_L
WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.: 100

REMARKS: ▼ 192.0

GR. SA. SI. CL.: 0 89 10 1

20
15 ◇ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 17

FOUNDATION SECTION

JOB 69-F118 LOCATION Hwy.417 EBL ℄ Sta. 379 + 40 o/s 20' Rt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE February 5-10, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & HX Casing; Cone CHECKED BY

ELEV. / DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
204.3	Ground Level				
0.0	Topsoil				
1.0	Desiccated Very stiff - stiff Mottled red-brown and grey		1	TW	PM
			2	SS	20
			3	TW	PM
			4	SS	20
			5	TW	PM
192.0			6	SS	10
12.0			7	TW	PM
	Clay with occ. silt partings Firm - stiff Sensitive Grey with occ.grey-brown layers and black mottling		8	TW	PM
			9	TW	PM
			10	TW	PM
			11	TW	PM
			12	TW	PM
			13	TW	PM
			14		
154.3					
50.0	Silty fine sand with trace gravel Very dense - dense Grey		15	SS	76
145.3			16	SS	42
59.0	Het.mix.of silt,sand & gravel (Glacial Till) Dense - very dense Grey		17	SS	43
138.8			18	SS	116/6"
65.5	Shaley limestone Bedrock Sound		19	AXT	90%
133.8					
70.5	End of Borehole				

ELEV. SCALE: 200, 190, 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE
500 1000 1500 2000 2500

3320 ×sU

+5 +14 +13 ×7 +18 +17 +16 +15 +14 +15 +15 +15 ×7 +15 +15

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.: 114

REMARKS GR.SA.SI.CL.

194.2

3 76 (21)

41 38 (21)

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 18

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL ℄ Sta. 375 + 47 O/S 18' Lt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 15-17, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing CHECKED BY MK.

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
201.8	Ground Level					
0.0	Topsoil					200
1.5	Desiccated Very stiff - stiff mottled red-brown and grey		1 2 3 4	SS SS SS TW	21 17 9 PM	
185.8			5	TW	PM	190
16.0	Clay with occ. silt partings & silty clay layers Firm - stiff Sensitive Grey with occ. black mottling		6 7 8 9 10 11	TW TW TW TW TW TW	PM PM PM PM PM PM	180 170 160
153.3						
48.5	Silty fine sand Dense - compact Grey		12 13	SS SS	49 13	150
141.8						
60.0	Het.mix.of silt, sand & gravel (Glacial Till) Very dense		14	SS	53	140
136.3						
65.5	Shaley limestone Bedrock Sound		15	BX	97%	130
131.0						
70.8	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p w w_L
WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.

REMARKS
GR.SA.SI.CL.

▼197.4

112

no recovery

0 76 (24

no recovery

20
15 5 % STRAIN AT FAILURE
10

FORM 08-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 19

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL ℄ Sta. 376 + 60 o/s 20' Lt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 18-19, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS / FOOT	ELEV. SCALE
190.9	Ground Level					190
0.0	Topsoil					
1.5	Desiccated Stiff mottled brown-grey		1	SS	9	
183.0			2	SS	1	180
7.9	Clay with trace silt		3	TW	PM	170
	Firm - stiff Sensitive Grey with black mottling		4	TW	PM	160
146.9						150
44.0	Silty fine sand with trace of clay Compact Grey		5	SS	25	140
136.9						130
54.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

+8 +9 +9 +8 +8
+16 +13 +13 +8 +8
×8 ×15 ×18 +13 +21 +17 +15

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.
99

REMARKS
▼ 187.9
0 74 (26)

GR. SA. SI. CL.

20
15 ✧ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 20

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 WBL ℄ Sta. 376 + 80 ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE January 21, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
190.5	Ground Level				
188.5	Topsoil		1	SS	4
2.0	Silty clay-clay with trace sand.		2	SS	22
183.6	Desiccated. V.Stiff		3	SS	18
6.9			4	SS	16
181.7	Org.clay. Soft. Black		5	SS	2
8.8	Clay		6	SS	-
	Grey with black mottling		7	SS	-
			8	SS	-
			9	SS	-
170.5			10	SS	-
20.0	End of Borehole				

ELEV. SCALE: 190, 180, 170

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P — w — w_L
WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.

REMARKS
GR. SA. SI. CL.
▼ 188.0

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 21

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 WBL ℄ Sta. 377 + 00 o/s 30' Rt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE January 20-22, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & BX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT
190.3	Ground Level				
188.8	Topsoil				
1.5	Silty clay with trace sand. Desiccated. Very stiff mottled Red-brown-Grey		1	SS	17
			2	SS	18
182.0			2A	SS	3
8.3	Org.silt-clay,with tr. of dec. wood frags.		3	TW	PM
	Firm. Black		3A	SS	4
176.3			3B	SS	5
14.0			4	TW	PM
	Clay with occ. silt partings & silty clay layers		5	TW	PM
	Firm - stiff Sensitive Grey with some black mottling		6	TW	PM
			7	TW	PM
			8	TW	PM
148.3			9	TW	PM
42.0	Silty fine sand with trace of gravel		10	SS	30
			11	SS	29
	Compact		12	SS	~~100/3"~~
136.8					
53.5	Shaley limestone		13	AXT	90%
132.8	Bedrock Sound				
57.5	End of Borehole				

ELEV. SCALE: 190, 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE — 500 1000 1500 2000 2500

+44 +46 ×8 +48 +15 +11 +36 +4 +10 +9 +13

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % — 25 50 75

111%

BULK DENSITY γ P.C.F.: 83, 96

REMARKS: GR.SA.SI.CL.

187.6

1 79 (20)

no recovery

20
15 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 22

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL ℄ Sta. 377 + 25 o/s 30' Lt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE January 22, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

SOIL PROFILE ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
190.2	Ground Level					190
0.0	Topsoil					
1.5	Silty clay with trace sand. Desiccated. Very stiff - stiff mottled red-brown		1	SS	8	
			2	SS	15	
182.5						
7.7	Organic clay with occ. dec. wood fragments		3	SS	14	180
			4	SS	3	
	Soft - Black		5	SS	4	
175.0			6	SS	2	
15.2	Clay		7	SS	1	
170.2	Grey		8	SS	1	170
20.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.

REMARKS GR.SA.SI.CL.

186.9

15.8% org.

108%

16.4% org.

20
15 — 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 23

FOUNDATION SECTION

JOB 69-F-118-2 LOCATION Hwy. 417 WBL ℄ Sta. 377 + 50 o/s 25' Rt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 17-18, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
189.0	Ground Level				
0.0	Topsoil		1	SS	4
1.2	Silty clay with trace sand & org. material. Firm. Desiccated		2	SS	2
			3	SS	8
181.5	mottled brown-grey		4	SS	3
7.5	Org. clay with occ. dec. wood fragments.		5	SS	2
			6	SS	2
175.5	Soft. Black		7	SS	3
13.5	Clay Firm to stiff Grey				
145.5					
144.0	Silty fine sand. Compact		8	SS	25
45.0	End of Borehole				

ELEV. SCALE: 180, 170, 160, 150, 140

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE
500 1000 1500 2000 2500

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

▼ 186.5
17.1
19.8 } org.
19.1
3 73 20 4

20
13 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 24

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 WBL Ø Sta. 377 + 75 ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE January 23, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAY PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE
186.3	River Ice Level					
185.3	Ice water					
1.0	Silty clay with trace sand; desiccated					
181.3			1	SS	2	
5.0	Org. silt-clay; occ. dec. wood pieces.		2	SS	-	180
			3	SS	-	
176.4	soft black		4	SS	-	
9.9	Clay		5	SS	-	
			6	SS	-	
	Grey with some black mottling		7	SS	-	170
166.3			8	SS	-	
20.0	End of Borehole					160

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

12.2% org.

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT- [illegible] (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 25

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 WBL ℄ Sta. 378 + 00 o/s 10' Rt. ORIGINATED BY HRS
W.P. 35-66-15 BORING DATE February 6, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w — WATER CONTENT % 25 50 75	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
186.0	River Ice Level									
183.7	Ice									
2.3										
179.2	Water					180				
6.8	Org. clay		1	SS	2					
	Soft Black		2	SS	-			118%		13.6% org.
174.7			3	SS	-					
11.3	Clay		4	SS	-					
	Grey		5	SS	-	170				
	occ. black mottling		6	SS	-					
165.2			7	SS	-					
20.8	End of Borehole					160				

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 26

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 WBL ℄ Sta. 378 + 25 o/s 10' Lt. ORIGINATED BY HRS

W.P. 35-66-15 BORING DATE February 6, 1970 COMPILED BY CM

DATUM Geodetic BOREHOLE TYPE Washboring-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	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 %		GR. SA. SI. CL.
186.0	River Ice Level									
183.9	Ice									
2.1	Water					180				
174.0										
12.0	Org. silt-clay. Soft		1	SS	-					
13.0	Clay		2	SS	-	170				
			3	SS	-					
	Grey with black mottling		4	SS	-					
			5	SS	-	160				
154.0			6	SS	-					
32.0	End of Borehole					150				

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 27

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy. 417 WBL ℄ Sta. 378 + 30 30' Rt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE January 23 -27, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT
186.0	River Ice Level				
184.8	Ice				
1.2	Water				
168.5					
17.5	Clay with occ. silty clay layers & silt seams. Firm to stiff Sensitive Grey with some black mottling		1	SS	1
			2	TW	PM
			3	TW	PM
			4	TW	PM
			5	TW	PM
			6	TW	PM
150.5			7	SS	17
35.5	Fine sand with trace silt. Compact Grey		8	SS	22
			9	SS	14
138.0			10	SS	26
48.0	Shaley limestone Bedrock Sound		11	AXT	99%
132.8					
53.2	End of Borehole				

ELEV. SCALE: 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE — 500 1000 1500 2000 2500

wt. of rods
+16
+32
+40
×4
+35
+28
+7

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
WATER CONTENT % — 25 50 75

BULK DENSITY γ P.C.F.

REMARKS — GR. SA. SI. CL.

0 94 (6)

20
15 ⊕ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 28

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL ℄ Sta. 379 + 00 ORIGINATED BY HRS

W.P. 35-66-15 BORING DATE February 9, 1970 COMPILED BY CM

DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
185.0	River Ice Level					
184.0	Ice					
2.0	Water					180
166.0						170
20.0	Probably Clay					160
152.0						150
34.0	Probably Sand					
140.3						140
45.7	End of Cone Test Probably Bedrock					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT
20 40 60 80 100

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

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
GR.SA.SI.CL.

Practical refusal

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 29

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL ℄ Sta. 379 + 60 o/s 18' Lt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE January 26 - 27, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & BX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
186.0	River Ice Level					
0.0	Ice					
1.2	Water					180
167.7						170
18.3	Clay with occ.silt partings Firm - Stiff Sensitive Grey with some black mottling		1	TW	PM	
			2	TW	PM	
			3	TW	PM	160
			3A	SS	-	
			4	TW	PM	
			5	TW	PM	
151.0						
35.0	Silty fine sand Compact Grey		6	SS	12	150
145.2			7	SS	50	
40.8	Het.mix of silt,sand & gravel (Glacial Till) Grey		8	WS	-	
141.7						
44.3	Shaley Limestone Bedrock Sound		9	AXT	86%	140
134.0			10	AXT	98%	
52.0	End of Borehole					130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — 500 1000 1500 2000 2500
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % — 25 50 75

BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
97	lost sample
	0 87 (13)

20
15 S % STRAIN AT FAILURE
10

FORM CS-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 30

FOUNDATION SECTION

JOB 69-F-118 LOCATION HWY.417 WBL ℄ Sta. 380 + 00 ORIGINATED BY HRS

W.P. 35-66-15 BORING DATE February 9, 1970 COMPILED BY CM

DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
186.0	River Ice Level					
184.5	Ice					
1.5	Water					180
170.0						170
16.0	Probably Clay					160
153.0						
33.0	Probably Sand					150
142.7						
44.3	End of Cone Test					140

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

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

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
GR.SA.SI.CL.

practical refusal

20
15 ⊕ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 31

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL Ø Sta. 380 + 60 o/s 30' Rt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE January 27 - 28, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & BX Casing; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS / FOOT	ELEV SCALE
186.4	River Ice Level					
0.0	Ice & water					
0.7	Clay with trace sand & occ. silt partings & silty clay layers Firm - stiff Sensitive Grey with some black mottling		1	TW	PM	180
			2	TW	PM	
			3	TW	PM	
			4	TW	PM	
			5	TW	PM	170
			6	TW	PM	
			7	TW	PM	160
157.0						
29.4	Silty fine sand Compact Grey		8	SS	23	
147.4			9	SS	10	150
39.0	Het.mix.of silt,sand & gravel(Glacial Till) Very dense. Grey		10	SS	88	
143.4						
43.0	Shaley limestone bedrock Sound		11	AXT	98%	140
138.1						
48.3	End of Borehole					130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F. 500 1000 1500 2000 2500
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

+26 +25 ×22 ×5 +44 +44 ×20 +84 +90 +29 +29

LIQUID LIMIT w_L
PLASTIC LIMIT w_p
WATER CONTENT w

WATER CONTENT % 25 50 75

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

0 80 (20)

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 32

FOUNDATION SECTION

JOB 69-F-118-2 LOCATION HWY. 417 WBL ℄ Sta. 381 + 46 o/s 91' Rt. ORIGINATED BY CM
W.P. 35-66-15 BORING DATE December 18-19, 1969 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing CHECKED BY MC

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE
201.5	Ground Level					
0.0	Topsoil					200
1.0	Desiccated Very stiff mottled red-brown & grey		1	SS	20	
190.0			2	SS	4	190
11.5	Clay with silt partings & occ. silty clay layers		3	TW	PM	180
	Firm - Stiff Sensitive Grey with some black mottling		4	TW	PM	170
153.2						160
48.3	Silty fine sand Dense Grey		5	SS	46	150
141.0						
60.5	End of Borehole Probably Bedrock					140

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

+11 +6 +5 +7 +6 +6
×6 +7 +10 +12 +9
+13 +20 +21 +7 +6 +7

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %
25 50 75

BULK DENSITY γ P.C.F.

95
103

REMARKS

▼ 196.

GR. SA. SI. CL.
0 74 25 1

Practical refusal to further washing

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 33

FOUNDATION SECTION

JOB 69-F-118 LOCATION Hwy.417 WBL ℄ Sta. 382 + 00 o/s 18' Lt. ORIGINATED BY HS
W.P. 35-66-15 BORING DATE February 3 - 5, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-NX & HX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
204.6	Ground Level				
0.0	Topsoil				
1.3	Desi ated Very stiff - stiff mottled red-brown and grey		1	TW	PM
			1A	SS	16
			2	TW	PM
			3	SS	13
			4	TW	PM
192.6			5	SS	10
12.0	Clay with occ. silt seams & silty clay layers Firm - Stiff Sensitive Grey with some black mottling		6	TW	PM
			7	TW	PM
			8	TW	PM
			9	TW	PM
			10	TW	PM
			11	TW	PM
			12	TW	PM
			13	TW	PM
153.6			14	TW	PM
51.0	Silty fine sand compact grey		15	SS	29
			16	SS	14
144.0					
142.3	Si.,Sa.,& Gr.(Glac.Till)		17	SS	1
62.3	Shaley limestone Bedrock Sound		18	AXT	95%
136.9					
67.7	End of Borehole				

ELEV SCALE: 200, 190, 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 20 40 60 80 100

SHEAR STRENGTH P.S.F.: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE
500 1000 1500 2000 2500

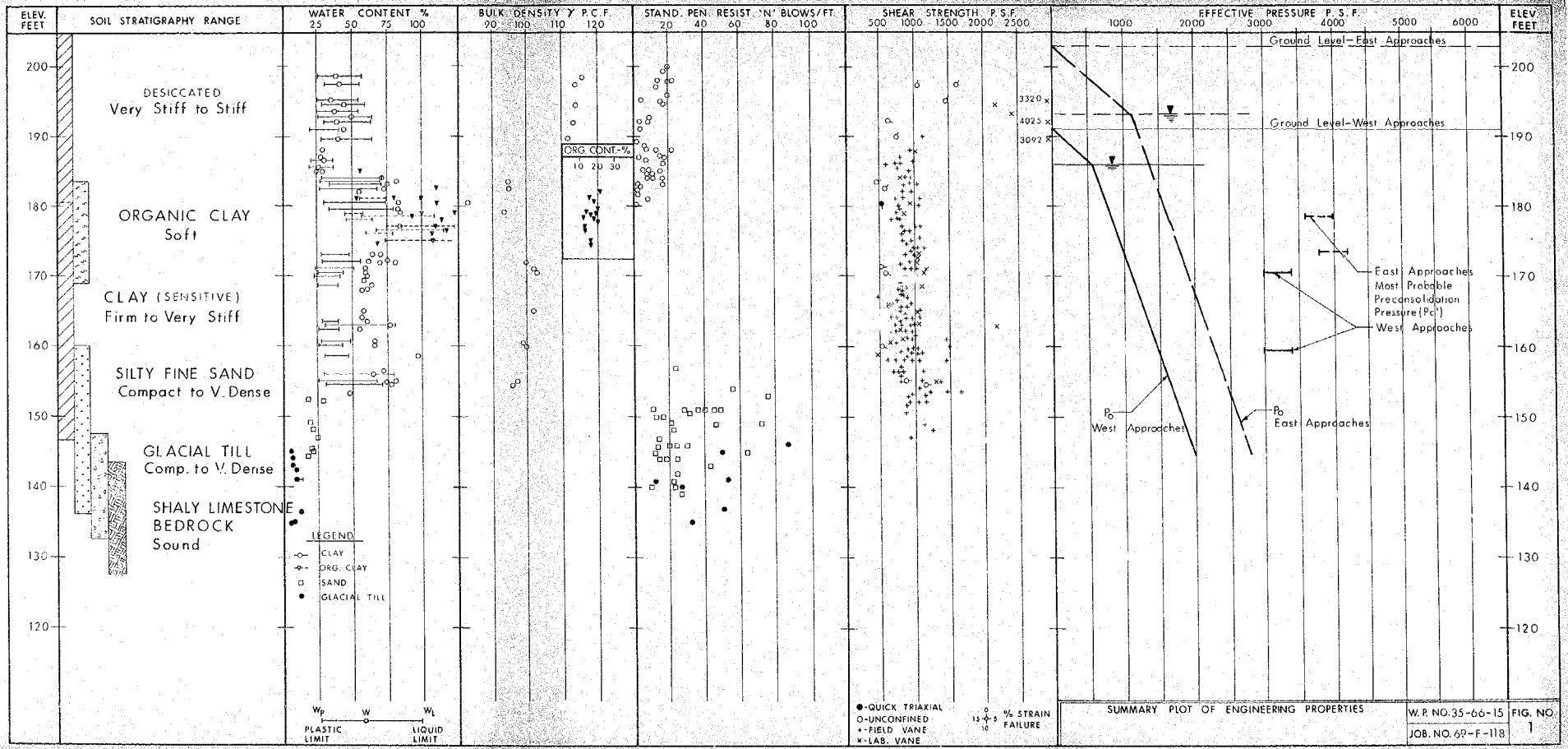
LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p w w_L
WATER CONTENT %: 25 50 75

BULK DENSITY γ P.C.F.: 116, 95

REMARKS: ▼196.6

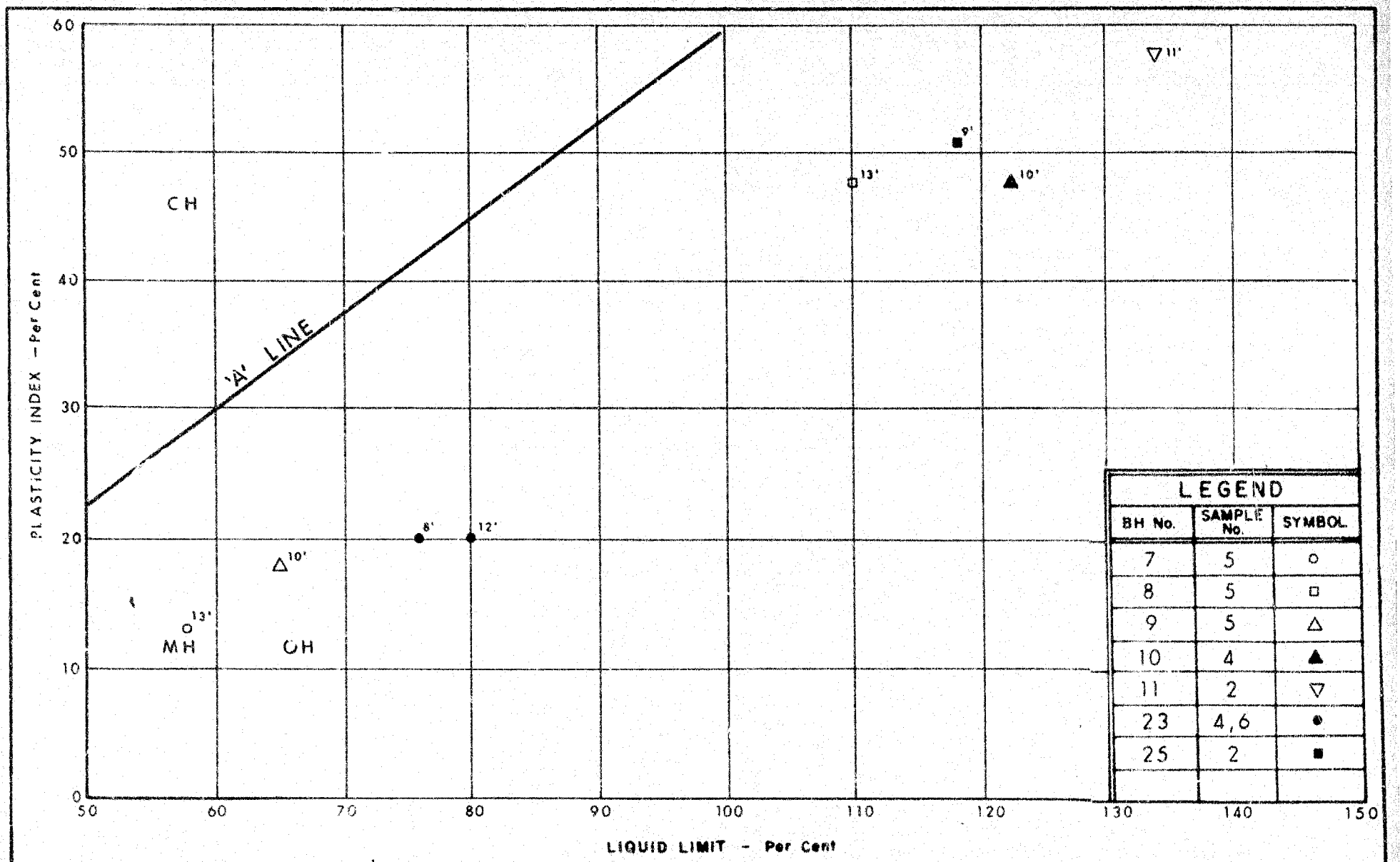
GR SA SI CL

20
15 5 % STRAIN AT FAILURE
10



SUMMARY PLOT OF ENGINEERING PROPERTIES

FORM OB-MT-252
REVISED JULY 1966



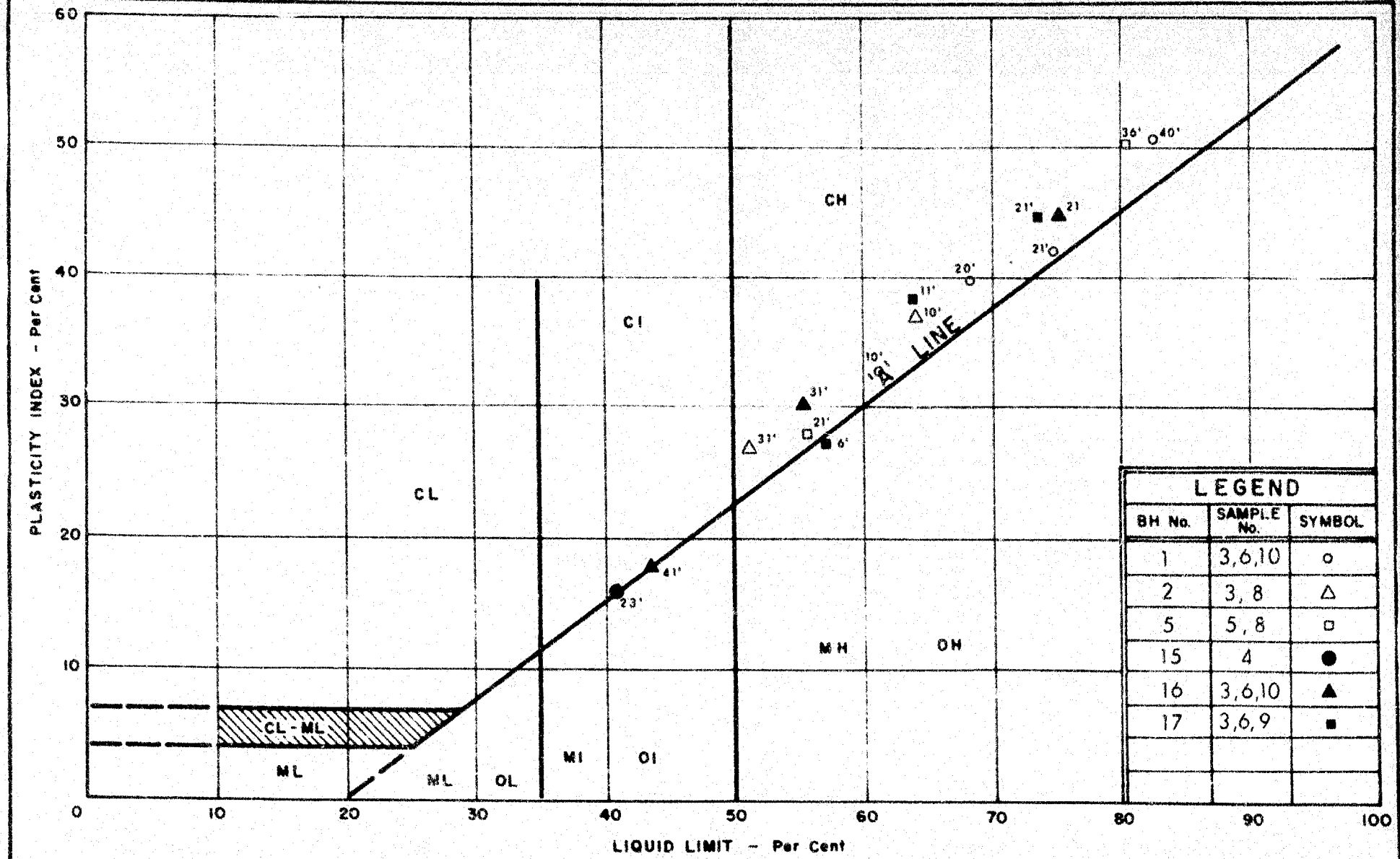
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

ORGANIC CLAY

W.P. No. 35-66-15
JOB No. 69-F-118
Fig. Nº 2

FORM OB-MT-252
REVISED JUL[illegible]966



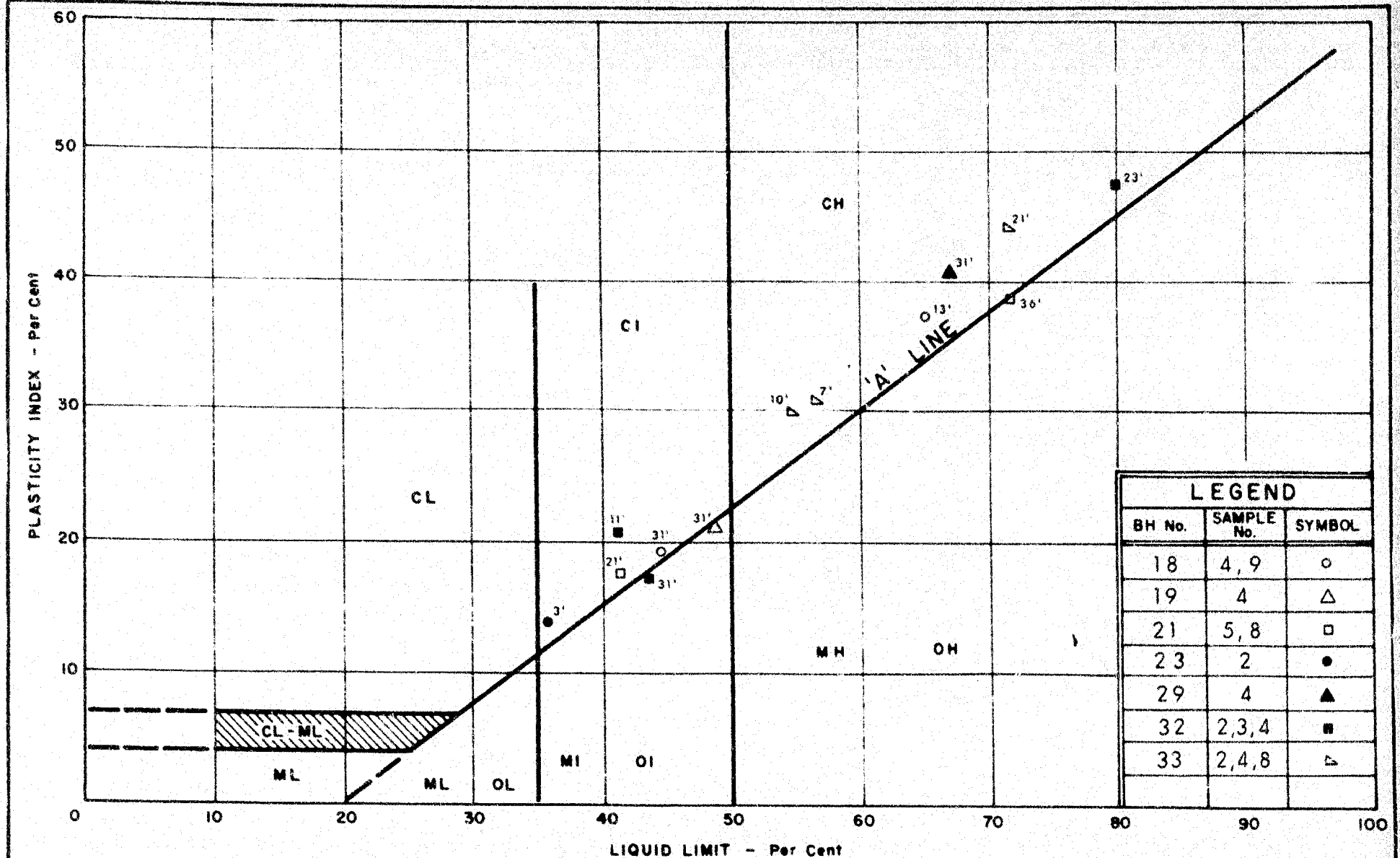
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

CLAY

W.P. No. 35-66-15
JOB No. 69-F-118
Fig. No. 3A

FORM OB-MT-252
REVISED JUL[illegible] 1966



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

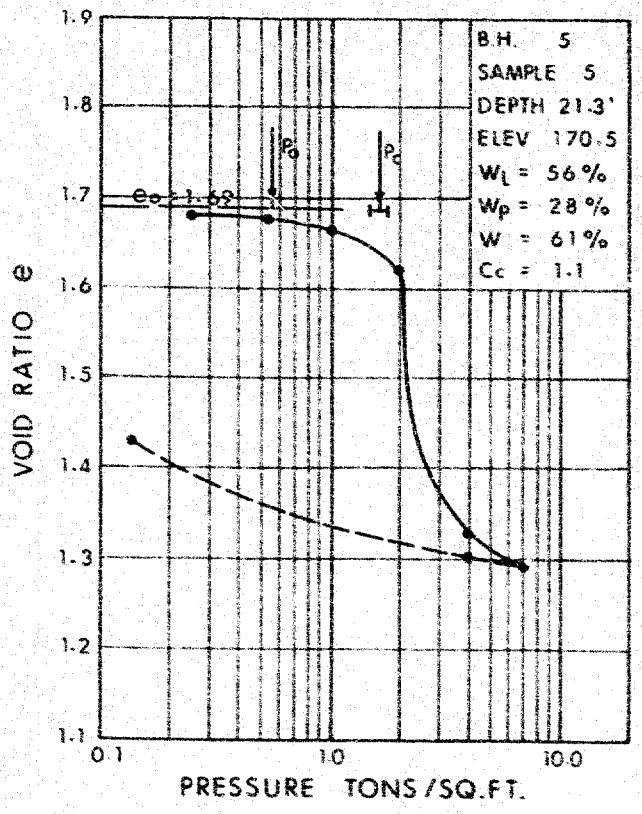
PLASTICITY CHART

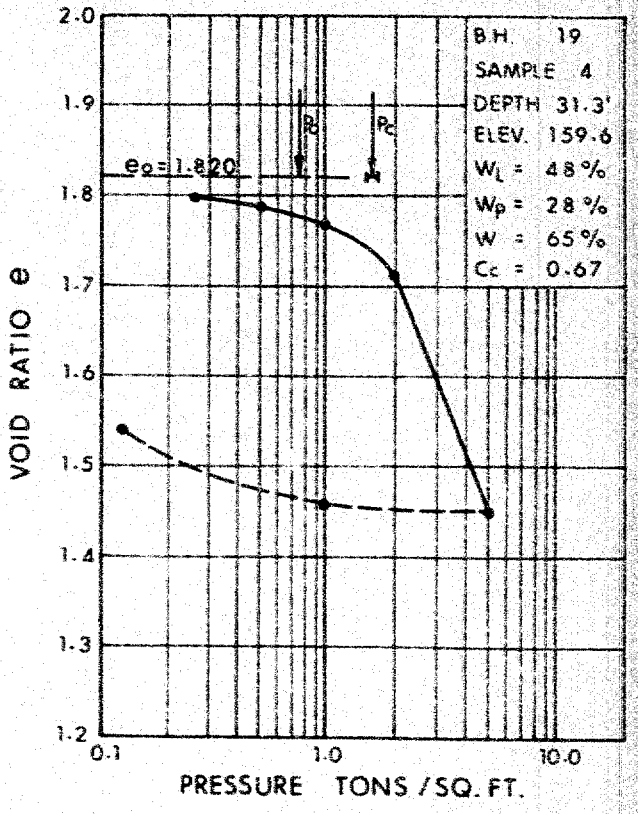
CLAY

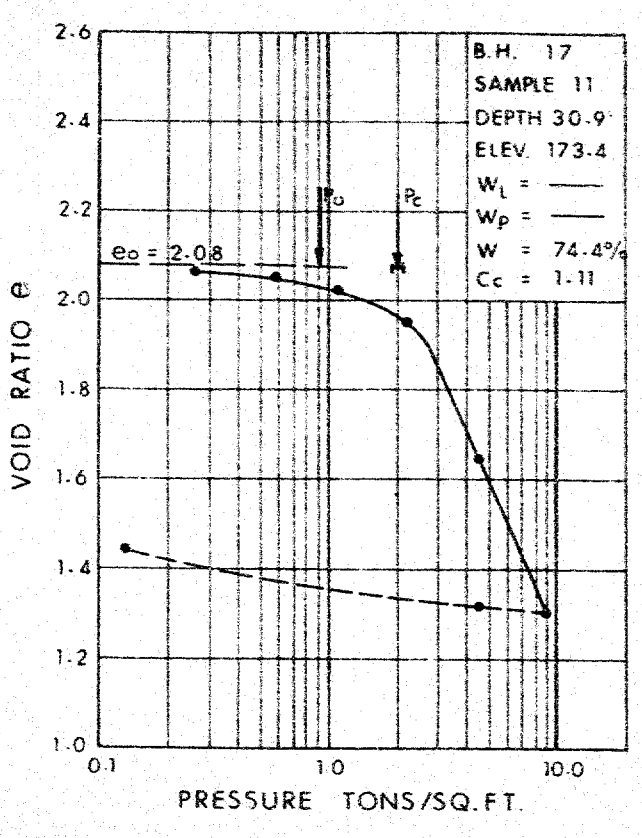
W.P. No. 35-66-15
JOB No. 69-F-118
Fig. No. 3B

VOID RATIO – PRESSURE CURVES

JOB NO. 69 – F – 118







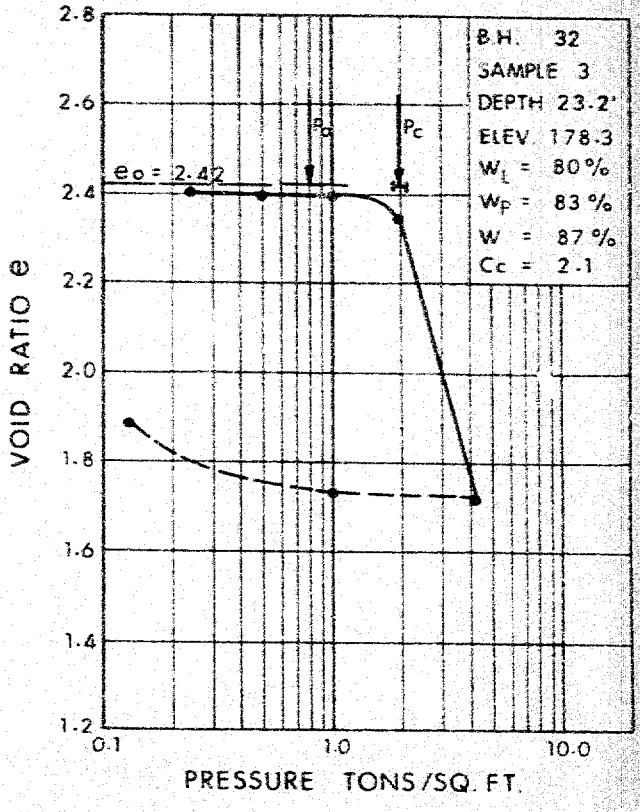
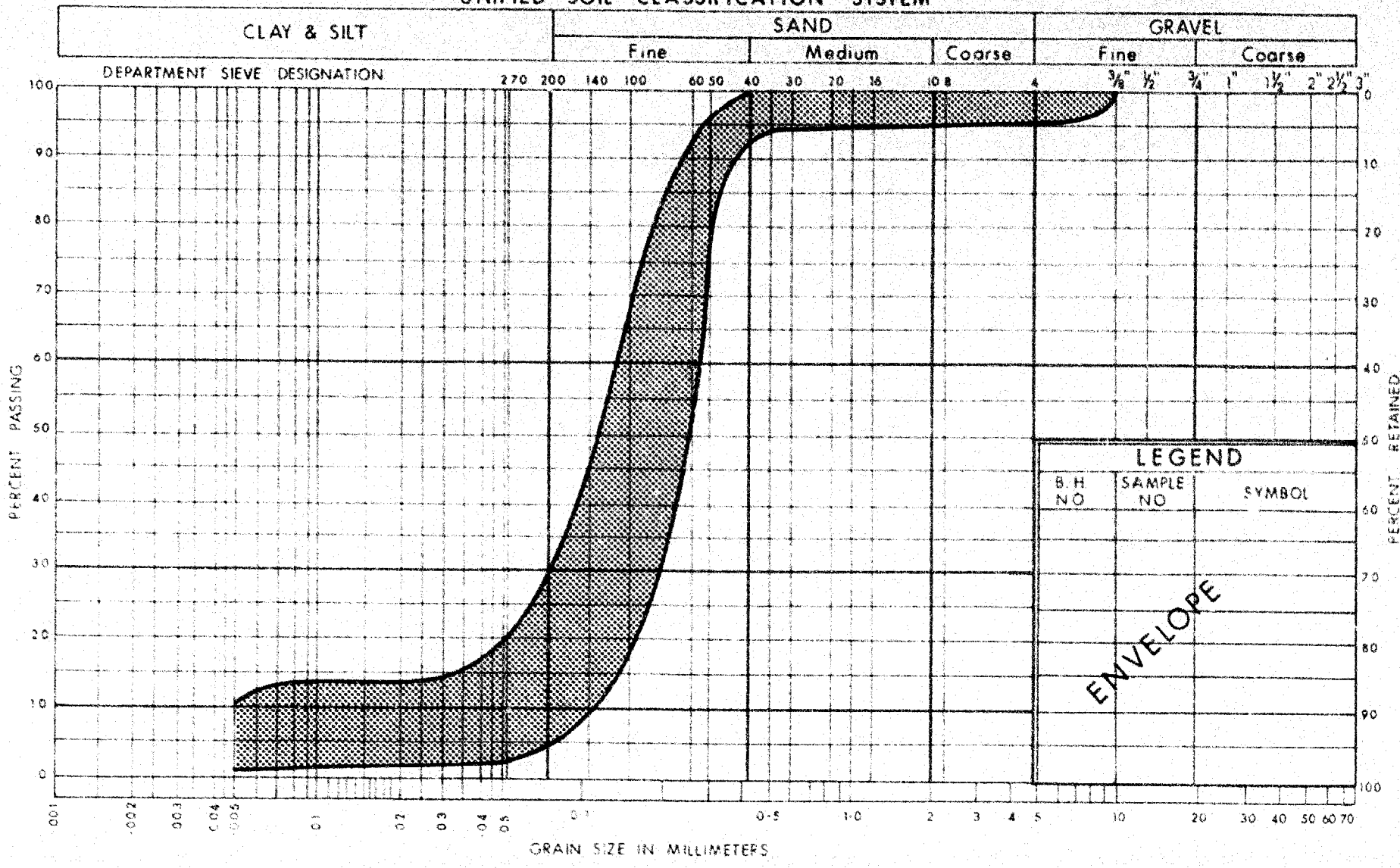


FIG. 4

FORM OB MT-17
REV. APR 1965

UNIFIED SOIL CLASSIFICATION SYSTEM

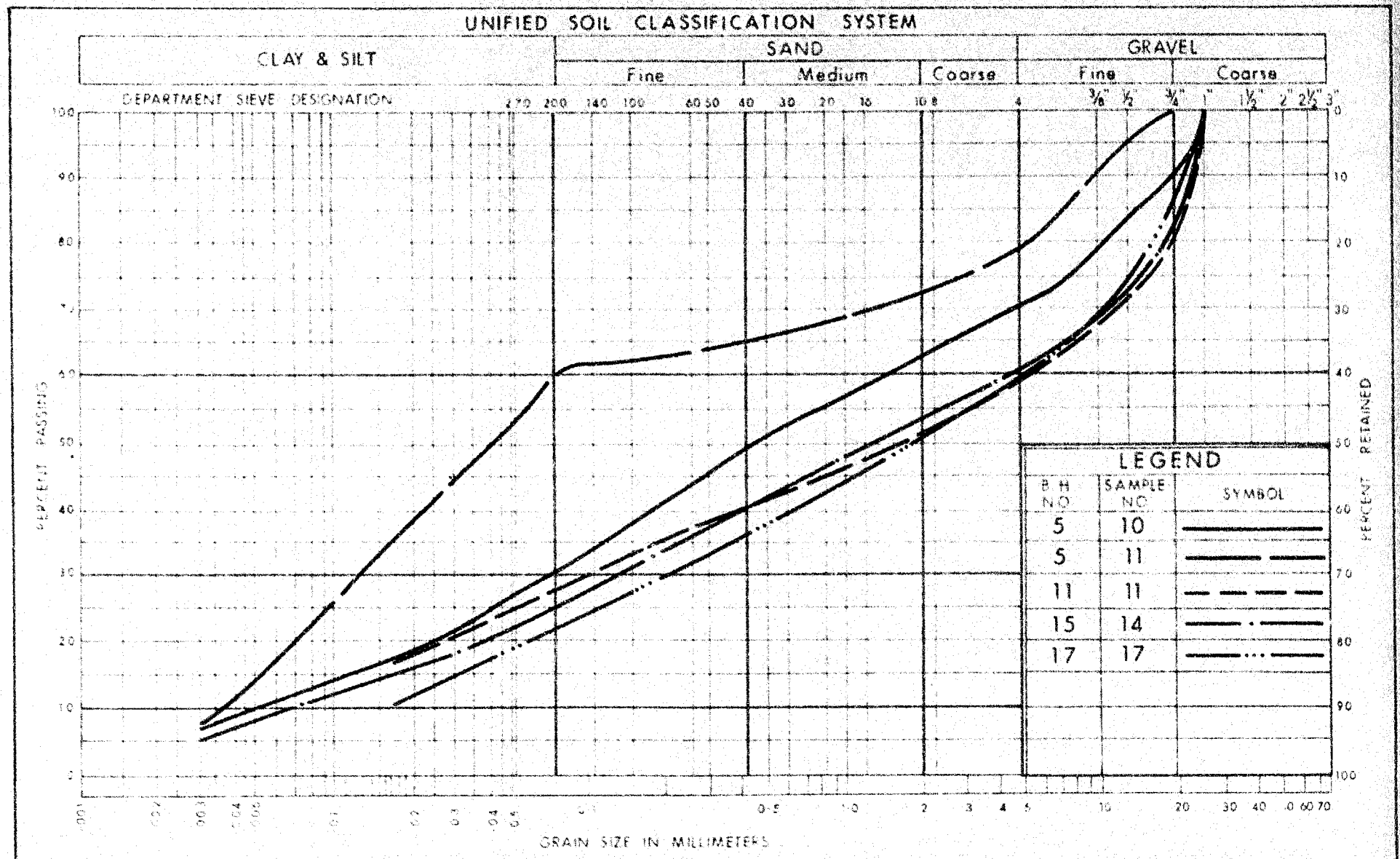


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION
FINE SAND

W.P. No. 35 – 66 – 15
JOB No. 69 – F – 118
Fig. No. 5

REV. APR 1965



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

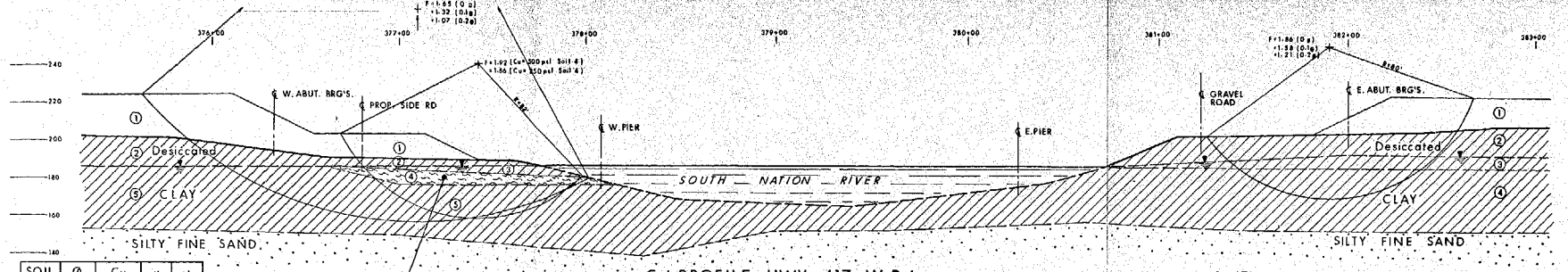
GRAIN SIZE DISTRIBUTION

GLACIAL TILL

W.P No. 35 – 66 – 15

JOB No. 69 – F – 118

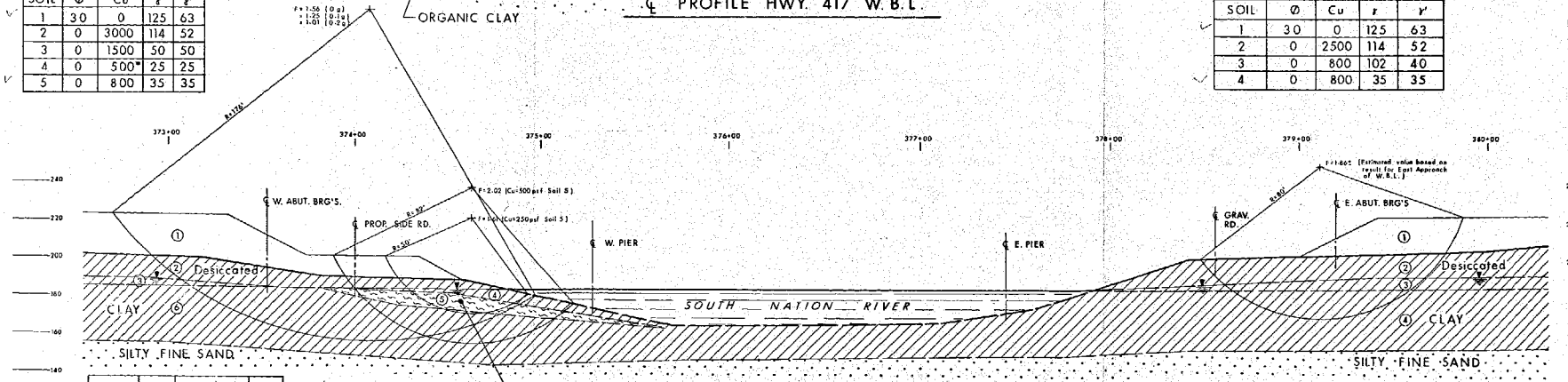
Fig. Nº 6



℄ PROFILE HWY. 417 W.B.L.

SOIL	Ø	Cu	γ	γ'
1	30	0	125	63
2	0	3000	114	52
3	0	1500	50	50
4	0	500*	25	25
5	0	800	35	35

SOIL	Ø	Cu	γ	γ'
1	30	0	125	63
2	0	2500	114	52
3	0	800	102	40
4	0	800	35	35



℄ PROFILE HWY. 417 E.B.L.

SOIL PROPERTIES SAME AS ABOVE

SOIL	Ø	Cu	γ	γ'
1	30	0	125	63
2	0	3000	114	52
3	0	1000	102	40
4	0	900	40	40
5	0	500*	25	25
6	0	800	35	35

* Cu=250 also used in Stability Analyses

SCALE
20 10 0 20 40 60 80 FT.

HIGHWAY 417 AND SOUTH NATION RIVER
STABILITY ANALYSES

W.P. 314-65-15 JOB NO. 69-F-118 FIG. NO. 7

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 90 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 :-

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

TYPE OF SAMPLE

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

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX $= \frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta \sigma'}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma'}$
T_v	TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
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 (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

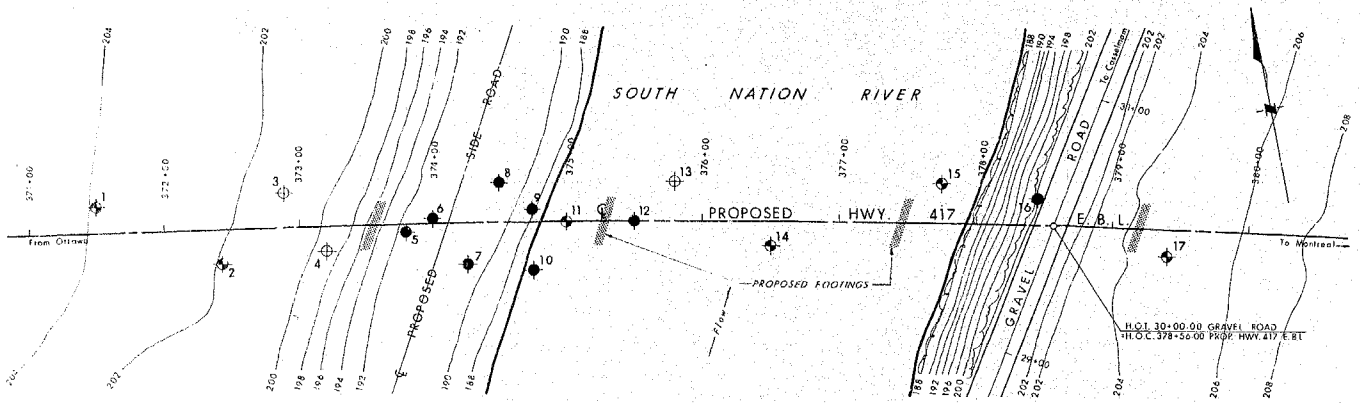
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

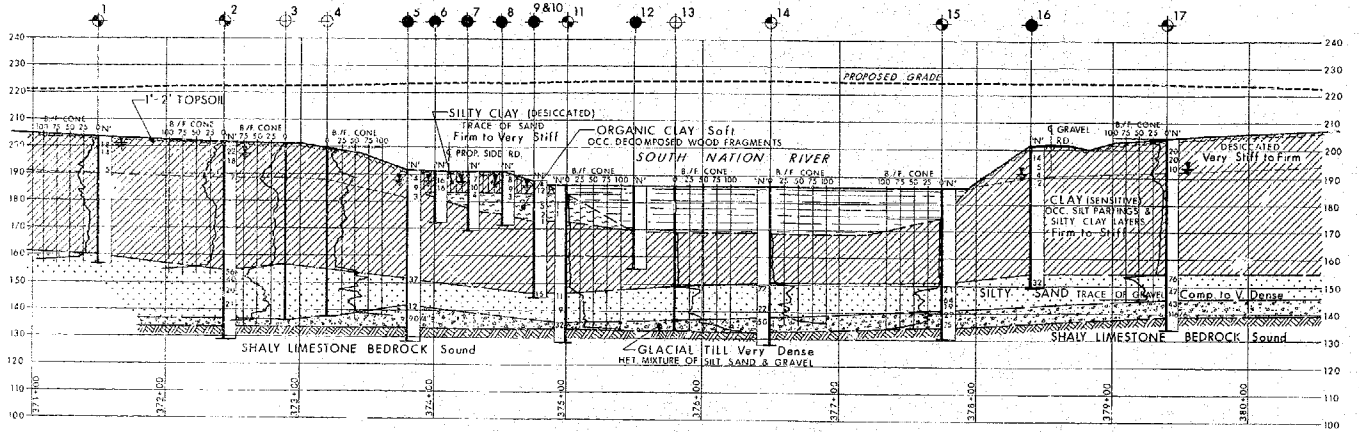
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

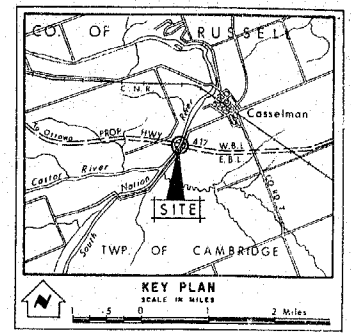
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN
SCALE
40 20 0 40 80 FT.



℄ PROFILE
SCALE
VERT 20 10 0 20 40 FT.
HORIZ. 40 20 0 40 80 FT.



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, Dec. 1969 to Feb. 1970

NO.	ELEVATION	STATION	OFFSET
1	204.0	371+50	20' LT.
2	201.9	372+43	25' RT.
3	201.7	372+89	26' LT.
4	199.5	373+21	18' RT.
5	191.8	373+60	5' RT.
6	191.0	373+00	5' LT.
7	190.6	374+25	30' RT.
8	191.3	374+50	30' LT.
9	188.0	374+75	10' LT.
10	185.9	374+75	30' RT.
11	186.0	375+00	℄
12	186.0	375+50	℄
13	196.0	375+80	30' LT.
14	186.0	376+50	18' RT.
15	186.0	377+75	30' LT.
16	201.0	378+44	20' LT.
17	204.3	379+40	20' RT.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS		
DATE	BY	DESCRIPTION

PRINT RECORD

NO	FOR	DATE

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

SOUTH NATION RIVER

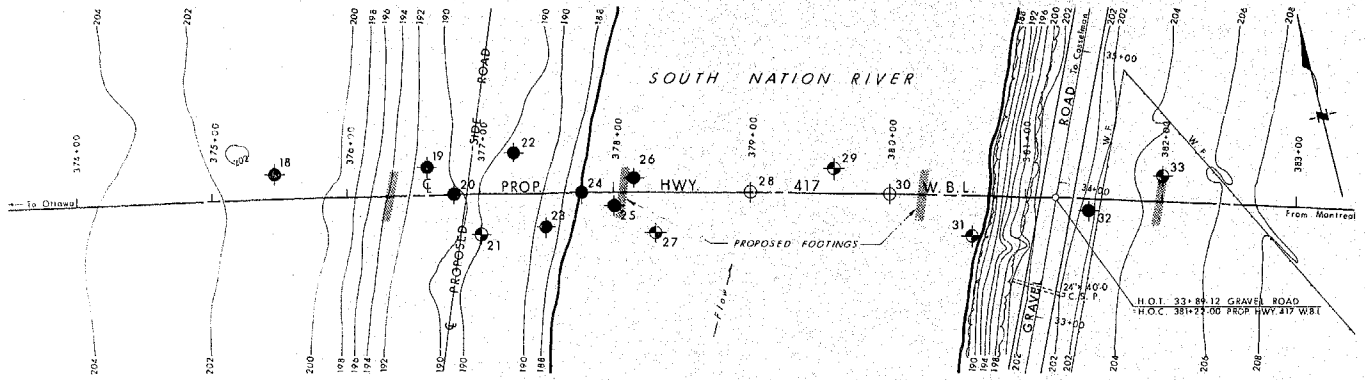
KING'S HIGHWAY NO. PROP. HWY. 417 E.B.L. DIST. NO. 9
CO. RUSSELL
TWP. CAMBRIDGE LOT 12 CON. VII

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D C.M.	CHECKED ...	W.P. NO. 35-66-15
DRAWN G.P.	CHECKED //	JOB NO. 69-F-118
DATE April 29, 1970		SITE NO.
APPROVED R.F. Legget		CONT. NO.

M.&T. DRAWING NO. 69-F-118A
ZENDRE DRAWING NO.

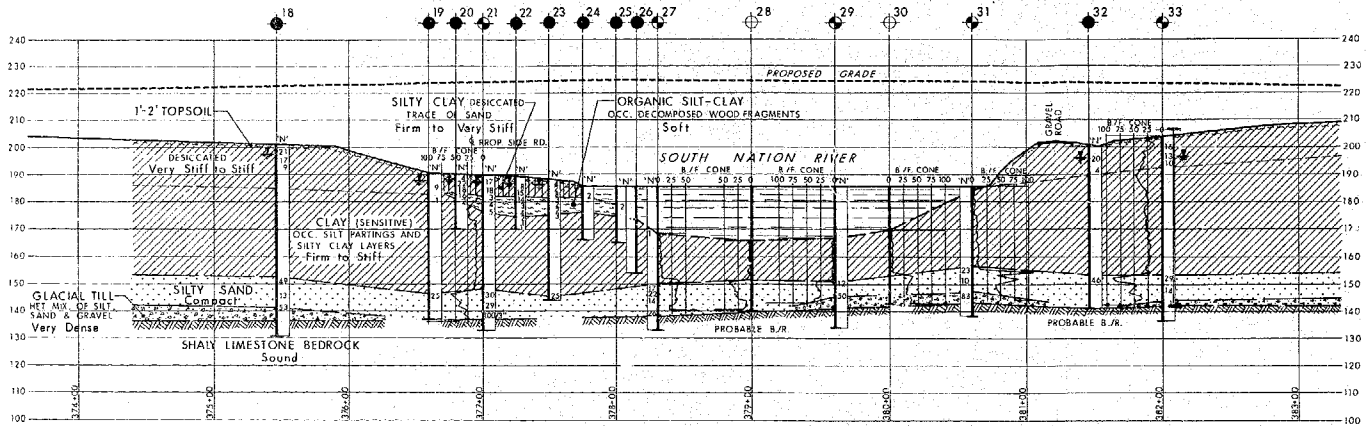
REF. NO. E-4644-1



PLAN

SCALE

40 20 0 40 80 FT.



℄ PROFILE

SCALE

VERT. 20 10 0 20 40 FT.

HORIZ. 40 20 0 40 80 FT.

SEE DWG. 69-F-118A

KEY PLAN

SCALE IN MILES

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. Dec 1969 to Feb. 1970

NO.	ELEVATION	STATION	OFFSET
18	201-8	375+47	18' LT.
19	190-9	376+60	20' LT.
20	190-5	376+80	℄
21	190-3	377+00	30' RT.
22	190-2	377+25	30' LT.
23	189-0	377+50	25' RT.
24	186-3	377+75	℄
25	186-0	378+00	10' RT.
26	186-0	378+15	10' LT.
27	186-0	378+30	10' RT.
28	186-0	379+00	℄
29	186-0	379+60	16' LT.
30	186-0	380+00	℄
31	186-4	380+60	30' RT.
32	201-5	381+46	9' RT.
33	204-6	382+00	18' LT.

- NOTE -

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS		
DATE	BY	DESCRIPTION

PRINT RECORD		
NO.	FOR	DATE

REF. NO. E-4685-1

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE - FOUNDATION SECTION

SOUTH NATION RIVER

KING'S HIGHWAY NO. PROP. HWY. 417 W.B.L. DIST. NO. 9

CO. RUSSELL

TWP. CAMBRIDGE LOT 12 CON. VII

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. C. M.	CHECKED	W.P. NO. 35-66-15	M.B.T. DRAWING NO.
DRAWN G. P.	CHECKED	JOB NO. 69-F-118	69-F-118B
DATE April 28, 1970		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

69-E-118

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Laboratory Building,
Downsview, Ontario.

From: Bridge Section,
Kingston, Ontario.

Attention:

Date: December 3, 1969.

(Received by Foundation Section On Dec 8th 1969

Our File Ref.

In reply to

Subject: W.P. 35-66-15, Site 27-210,
South Nation River Bridge, W. B. L.
(1.0 Mile West of Casselman).
Highway 417, District 9 - Ottawa

We are sending to you herewith two prints of Bridge Site Plan E-4685-1 (W. B. L.) on which we have marked the proposed location of the above structure. Also enclosed are two copies of your Field Reconnaissance Report.

We would be pleased if you will make arrangements for the necessary foundation investigation and to have your report, the scheduled date for which is January 14, 1970.

T. C. Kingsland

T. C. Kingsland
Regional Bridge Planning Engineer

TCK/hl
Encls.
c.c. (with encl.)
Bridge Office Files Section
c.c. Mr. R. Forrest

NOTE:
The enclosed Plans are for the westbound lane structure only. The site plans for the eastbound lane structure will follow as soon as available.

TCK

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Laboratory Building,
Downsview, Ontario.

From: Bridge Section,
Kingston, Ontario.

Attention:

Date: December 4, 1969.

Our File Ref.

In reply to

Subject: W.P. 35-66-15, Site 27-210,
South Nation River Bridge,
(1.0 Mile West of Casselman),
Highway 417, District 9-Ottawa

Further to my letter of December 3, 1969, we now enclose Bridge Site Plan E-4684-1 (2 copies) for the eastbound lane structure.

T. C. Kingsland
Regional Bridge Planning Engineer

TCK/bl
Encls.

c.c. (with encl.)
Bridge Office Files Section (Mr. S. McCombie)

Department of Highways Ontario
Copy for the information of

Mr. M. Devada ✓

Mr. H. Forsyth,
Regional Property Supervisor,
KINGSTON, Ontario.

Functional Planning Section,
KINGSTON, Ontario.

December 16, 1969

H.I. 33-66-03, Dwy. 417, District 3, Ottawa

With reference to our recent conversation, and the photo mosaic which I gave to you on December 12, 1969, it would be appreciated if we could have a windshield estimate of the cost of the property in lots 12, 13, and 14, concession 7, Township of Cambridge assuming the following conditions:

A. The Township road on the west bank of the South Nation River is relocated under the South Nation River structure, thereby providing access to the properties in question.

B. The Township road on the west bank being closed at the freeway thereby providing no access to the properties in question.

C. The Township road on the west bank is closed at the freeway and a service road constructed more or less paralleling the freeway on the south side from the westerly end of the existing township road to County Road # 3, west of Casselman, thereby providing access to the properties in question.

An estimate of the recovery value of severed lands in lots 17 to 14 inclusive in concession 6 assuming access is available as per A and C above would also be appreciated.

Receipt of this information will allow us to make a comparative study of the merit of raising the South Nation River structure in order to accommodate the road on the west bank.

Your early attention to this matter will be appreciated.

A. J. Percy
PROJECT PLANNER DEC.

AJP/sgp

c. c. - R. Forrest
- T. C. Kingsland
- M. Devada ✓
- S. J. Markiewicz

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: MEMO TO FILE

From: Functional Planning Section, Kingston, Ontario.

Attention:

Date: December 18, 1969.

Our File Ref.

In reply to

Subject: W.P. 35-66-03, Hwy. 417, District 9-Ottawa
South Nation River

A meeting was held in Boardroom #3 of the Regional Office on December 16th, 1969. Those present were as follows:

M. Devata	-	Foundation Section-Downsview
K. Bassi	-	Bridge Office-Downsview
T.C. Kingsland	-	Reg. Bridge Planning Engineer
A.J. Percy	-	Project Planning Engineer
J. Desrocher	-	Functional Planning
I. Williams	-	Functional Planning

The meeting was called to discuss the various alternatives which could be used for the crossing of the South Nation River. Three basic alternatives were considered which are as follows:

1. That the grade of the South Nation River structure be set sufficiently high to accommodate under the structure both the roads on the east and west banks of the river, to give the normal 15' - 3" of clearance. An alternative to this scheme would be to provide a restricted clearance for the road on the west bank since it serves only 3 farms. The restricted clearance would be in the order of 13' - 6".

2. Set the grade of the South Nation River bridge low so that both of the roads would have to be closed at the freeway. This scheme would involve the complete buy-out of the property to the south of the freeway on the west side of the river and also would require a relocation of the township road on the east bank of the river to bring it out to County Road #7 south of the interchange south of Casselman.

3. Set the grade of South Nation River bridge such that it will accommodate the road on the east side of the river only. This again would involve complete buy-out of the 3 farms south of the freeway and west of the river but will provide continuity of the existing township road on the east bank. After considerable discussion it was decided to proceed on the following basis:

1) The Bridge Office would provide estimates for the cost of the structures on the various grade lines considering the following conditions:

a) Maximum height of fill for settlement considerations 20'.

b) Vertical distance from profile grade of freeway to profile grade of gravel road 21' for normal conditions, that is, 15' - 3" clearance.

c) The minimum gradient on South Nation River structure to be 0.5% .

d) Forward slope of fill to be 3:1.

2) The Regional Functional Planning Section will prepare an estimate of the various schemes using the Bridge Office estimates, property estimates and the cost of any township road relocations.

3) On the basis of the above estimates the Regional Functional Planning Office will make a recommendation as to which grade line to use.

4) Mr. M. Devata will investigate the possibility of using 25 ft. fills with berms and determine the predicted settlement for such a fill. The Bridge Office will then consider if a saving would result in the use of these 25 ft. fills provided settlements seem tolerable.

The meeting then adjourned.

A. J. Percy
Project Planning Engineer

AJP/hl
c. c. M. Devata
K. Bassi
T. C. Kingsland

DEPARTMENT OF HIGHWAYS ONTARIO

09-F-118

MEMORANDUM

To: Mr. C. S. Grebski,
Bridge Design Engineer,
Downsview, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: January 2, 1970.

Our File Ref.

In reply to

Subject: W. P. 35-66-03, Limoges to Casselman,
W. P. 35-66-15, Site 27-210, South Nation River Bridge,
Highway 417, District 9 - Ottawa

With reference to your memo of December 24th, 1969 to Mr. S. McCombie, we would make the following comments:

1) No doubt the alignment of the freeway could be revised to put the structure on tangent. This will involve a revision of the order of two to three miles in length.

2) In view of our present work load and other priorities, it will take at least two weeks before a study could be made of this revision and a survey request issued for the revision.

3) It will also take three to four weeks for Engineering Surveys to obtain the necessary field information, such as running the new alignment, taking the profile, and gathering information for the E-plans.

4) An additional two to three weeks will be required to obtain the necessary cross sections.

5) After the revision is run in the field, new soils information will likely be required, and in view of the heavy snowfall in the area this will take about two weeks after which the information will have to be plotted for Road Design.

6) It is possible that additional foundation information will be required which could further delay the structure design.

7) From the above, it can be seen that a considerable delay could result in the requested revision, and Road Design have advised that their schedule will be seriously jeopardized if they do not receive the complete information by the end of January 1970.

8) In view of the present tight schedule of the Highway 417 projects, we do not feel a revision to the alignment is warranted, since the saving is relatively minor in comparison to the cost of the total freeway.

. 2

9) We would point out that we hold field meetings to review the projects prior to the issuance of the survey request. All sections involved have an opportunity to express their views at the meeting and/or in their written comments following the meeting. Possibly the Bridge Design Section should be represented at future meetings to avoid any delay or unnecessary expenditure in both field and office staff.

10) After the issuance of a Functional Report, any changes in alignment should be of a minor nature.

The above is submitted for your consideration.

A. J. Percy,
for: M. R. Ernesaks,
Regional Functional Planning Engineer.

AJP/mjh

c.c. S. McCombie
T.C. Kingsland
B.R. Davis
W.G. Wigle
J.E. Gruspier
H.A. Aron
S.J. Markiewicz
A.G. Stermac
C.R. Robertson

Department of Highways Ontario
Copy for the information of
Mr. M. Devata,
Foundation Office, Lab. Building

MEMO TO FILE

K.G. Bassi,
Bridge Office

January 2, 1970

South Nation River Bridge
W.P. 35-66-15, Site 27-210
Highway 417, District #9 - Ottawa

A meeting was held this afternoon at the Foundation Office, Downsview. Those present were as follows:

M. Devata - Foundation Office, Downsview
C. Mirza - " " "
K. Bassi - Bridge Office, Downsview

The meeting was requested by the Foundation Office as additional Borehole Data had become available since the meeting in Kingston on December 16, 1969.

The Foundation Office proposed that for preliminary estimating purposes the following criteria be used instead of the criteria suggested at the Kingston meeting:

1. E.B. Lanes Structure

West Bank

(a) Forward slope of fill 2:1.

(b) For Grades #1, #1A and #2 forward toe of fill Sta. 374 + 00 without a berm or Sta. 374 + 60 with approx. 60 ft. berm at El. 203.00.

(c) For Grade #3 forward toe of fill Sta. 374 + 50.

East Bank

(a) Forward slope of fill 2:1.

(b) For Grades #1, #1A and #2, forward toe of fill Sta. 379 + 00.

(c) For Grade #3 forward toe of fill Sta. to suit clearance to Twp. Road.

RE: South Nation River Bridge
W.P. 35-66-15, Site 27-210
Highway 417, District #9 - Ottawa

2. W.B. Lanes Structure

West Bank

(a) Forward slope of fill 2:1.

(b) For Grades #1, #1A and #2 forward toe of fill Sta. 376 + 80 without a berm or Sta. 377 + 40 with approx. 60 ft. berm at El. 203.00.

(c) For Grade #3 forward toe of fill Sta. 377 + 40.

East Bank

(a) Forward slope of fill 2:1.

(b) For Grades #1, #1A and #2 forward toe of fill Sta. 381 + 60.

(c) For Grade #3 forward toe of fill Sta. to suit clearance to Twp. Road.

The Bridge Office will provide preliminary costs of structures on the various grades based on the above conditions.

K.G. Bassi,
Regional Bridge Design Engineer

KGB:rd

c.c. M. Devata
T.C. Kingsland
A.J. Percy

Department of Highways Ontario
Copy for the information of

Mr. A.G. Stermac

69-F-118

Mr. M.R. Ernesaks,
Reg. Functional Planning Engineer,
Kingston Regional Office

Bridge Office,
Downsview

January 12, 1970

Mr. A.J. Percy

W.P. 35-66-03, Limoges to Casselman,
W.P. 35-66-15, Site 27-210, South Nation River Bridge
Highway 417, District 9 - Ottawa

Thank you for your memo of January 2 outlining reasons why the alignment of Highway 417 at this location should not be changed at this time.

We tend to agree with you, as the $50,000 structure saving would in all likelihood be used up on extra engineering services required to effect the change.

Your item nine suggesting the Bridge Design Section should be brought into the picture at the field meeting stage is a good one. I think this should be done at all locations where relatively large structures such as this one are involved. It is possible that if this is done on future projects large savings can be affected.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

c.c. S. McCombie
T.C. Kingsland
B.R. Davis
W.G. Wigle
J.E. Gruspier
H.A. Aron
S.J. Markiewicz
A.G. Stermac
C.R. Robertson
K.G. Bassi

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Downsview, Ontario.

From: Bridge Section,
Kingston, Ontario.

Attention: Mr. M. Devata

Date: February 25, 1970.

Our File Ref.

In reply to

Subject: W.P. 35-66-15, Site 27-210,
South Nation River Bridge,
(1.0 Mile West of Casselman),
Highway 417, District 9 - Ottawa

With reference to the foundation investigation which you have carried out at the above site, the recommended profile for the crossings is that denoted by Grade 3 on the enclosed partial prints of Functional Planning's drawing showing alternative profiles for the scheme.

However, in order to allow for the possibility of reverting to the higher grade (Grade 1), the Foundation Investigation Report should contain recommendations relating to both Grade 1 and Grade 3 profiles.

Approximate locations for the river piers in each case are as follows:

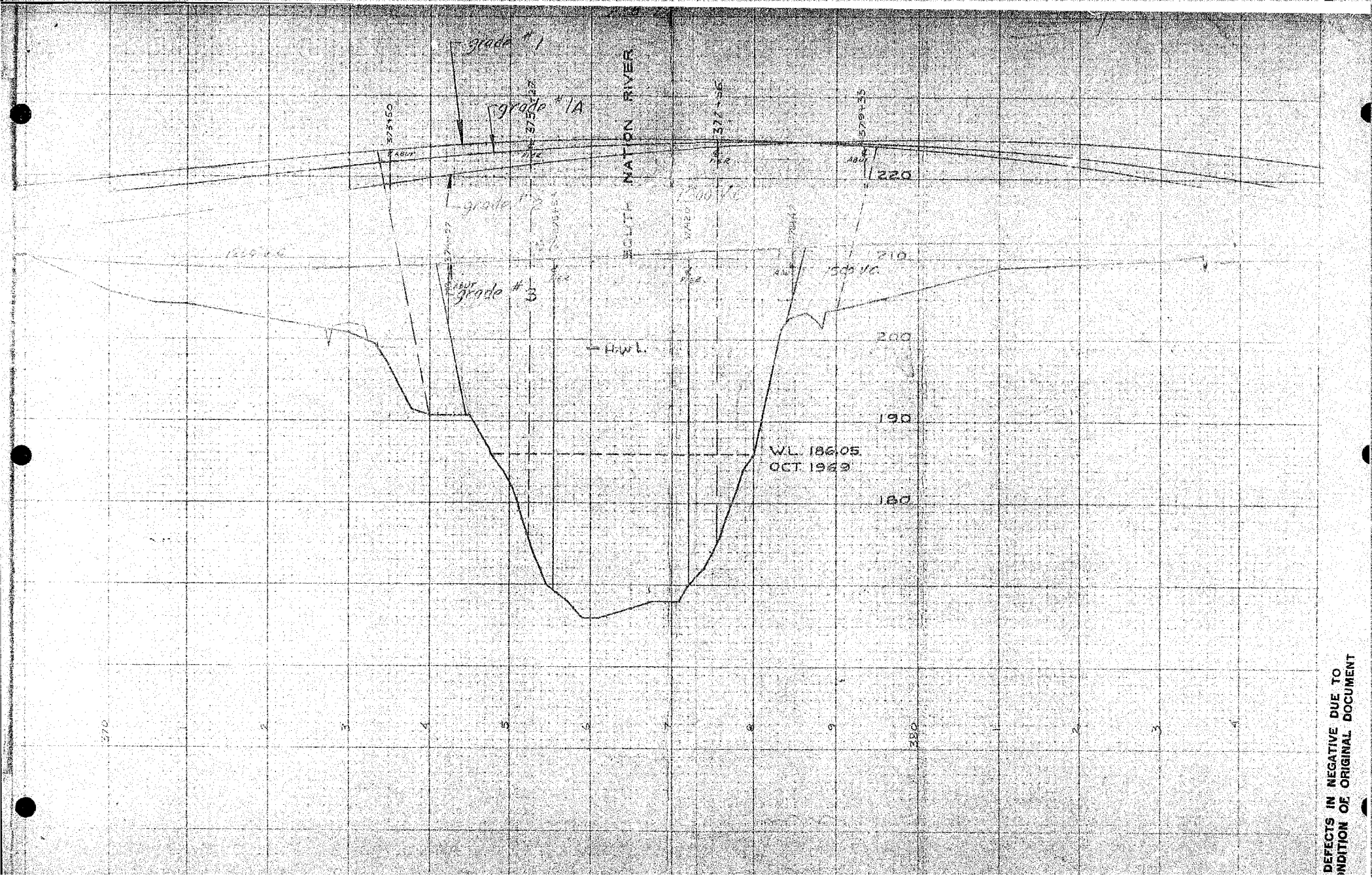
	E.B.L. Stations		W.B.L. Stations	
Grade 1	375+27	377+56	377+95	380+16
Grade 3	375+54	377+20	378+38	379+96

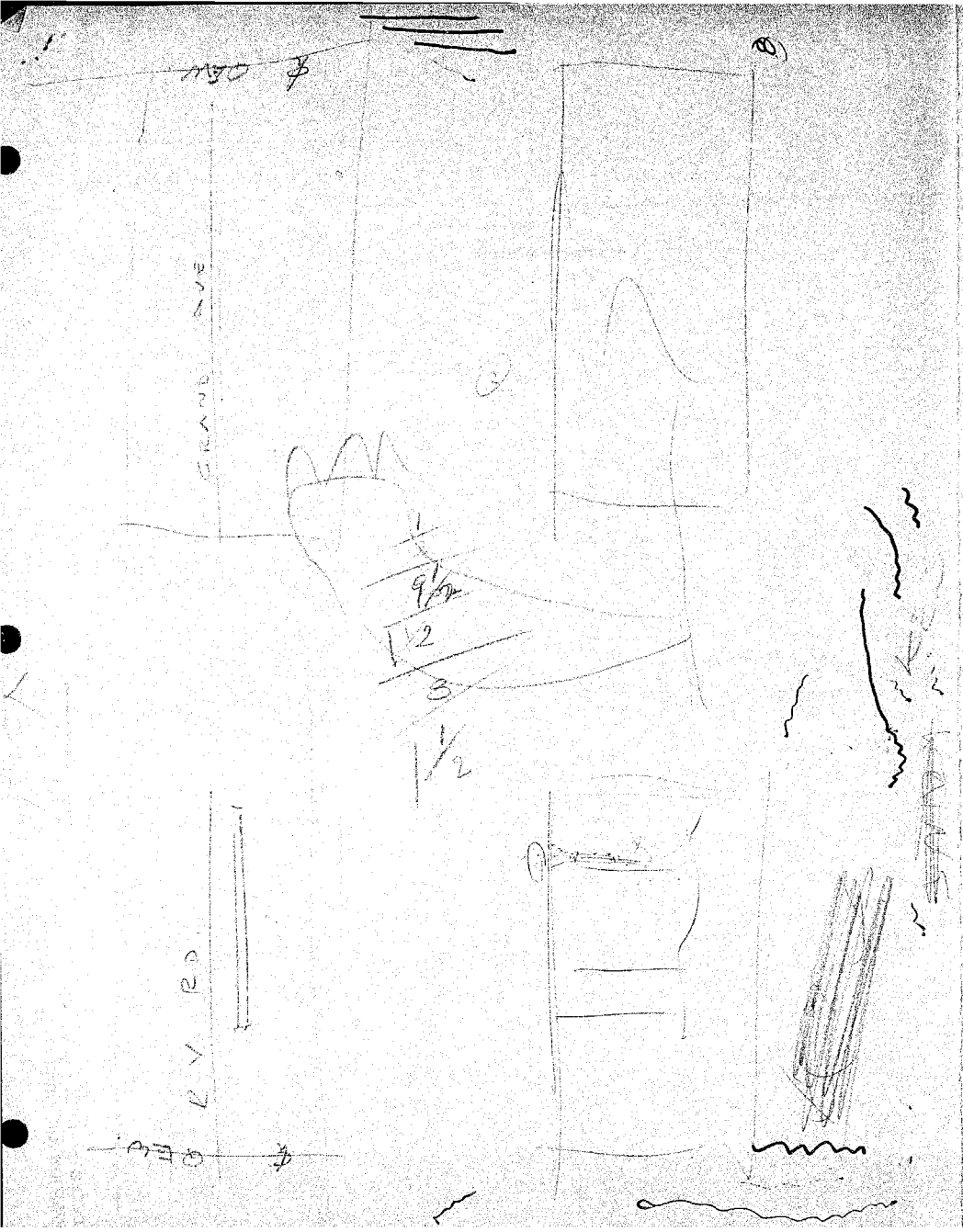
T. C. Kingsland
Regional Bridge Planning Engineer

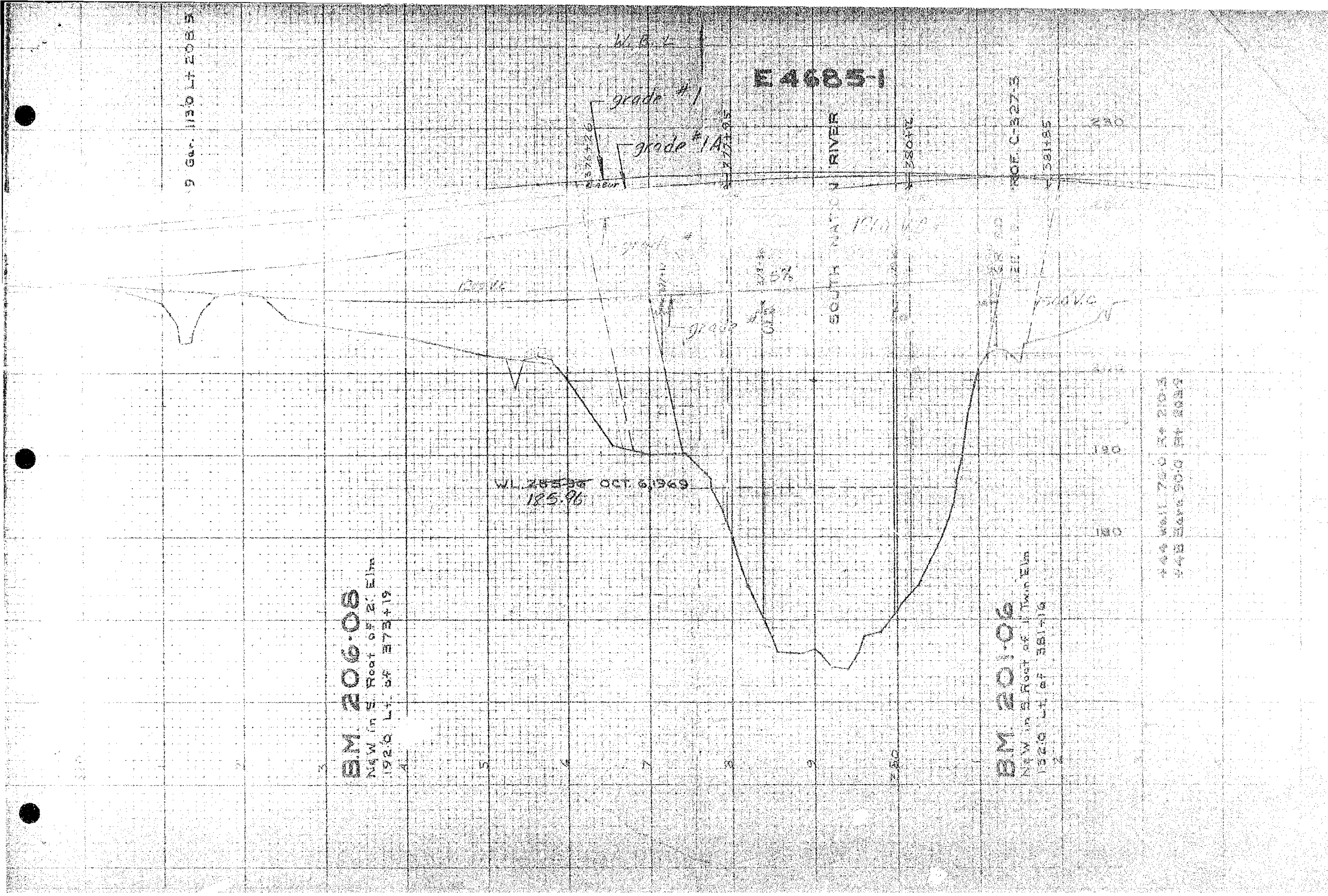
TCK/hl
Encl.
c.c.
Mr. M.R. Ernesaks - Att. Mr. A.J. Percy
Mr. K. Bassi
Bridge Office Files (Mr. S. McCombie)

May 6/70
4:45 PM

Confirmed w/ Tom Kingsland's office that grade 1 is the choice at this crossing and therefore no need to comment on grade 3 in the report. However, a short para will be written on our part to say that we will comment further if grade 3 is selected.
Cm.




GRAND AVE
1
9/16
2
3
1/2



DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

69-F-118

To: Mr. S. J. Markiewicz,
Regional Road Design Engineer,
Kingston, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: April 22, 1970.

Our File Ref.

In reply to

Subject: W. P. 35-66-03, Hwy. 417, Limoges to Casselman,
District 9 - Ottawa

Attached are two prints showing a revision to the above project in the vicinity of the South Nation River. This revision has been made on instructions from the Design Criteria Review Committee at Meeting No. 32, Item 5.

The necessary survey request has been issued.

A. J. Percy,
Project Planning Engineer.

JLD/AJP/mjh
Att.

c.c. I. C. Campbell
W. G. Wigle
L. Timson
J. E. Callaghan
J. E. Gruspier
T. C. Kingsland
A. Zembal
W. Whittle
K. Westerby
E. Barrie
H. A. Aron
A. G. Stermac ✓
A. G. Boucher
J. S. Trew
L. Kelenyi
R. Forrest

Department of Highways Ontario
Copy for the information of

Mr. A. Stermac

69-F-118

Mr. T.C. Kingsland,
Reg. Bridge Planning Engineer,
Kingston Regional Office,
Kingston, Ontario

C.S. Grebski,
Bridge Office

May 15, 1970

South Nation River Bridge - W.B.L.
1 Mile West of Casselman
W.P. 35-66-22, Site 27-217
Highway 417, District No. 9

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6826-P for the above-mentioned structure.

The estimated cost of the proposed structure is $605,000. This cost includes tender, materials, engineering and sundry construction.

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

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. S. McCombie
A. Stermac (2)
J. Anderson

No Comments
M. Devata
May 21/1970

Department of Highways Ontario
Copy for the information of

Mr. A. Stermac

Mr. T.C. Kingsland,
Reg. Bridge Planning Engineer,
Kingston Regional Office,
Kingston, Ontario

C.S. Grebski,
Bridge Office

May 15, 1970

South Nation River Bridge - E.B.L.
1 Mile West of Casselman
W.P. 35-66-15, Site 27-210
Highway 417, District No. 9

69-F-118

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6824-P for the above-mentioned structure.

The estimated cost of the proposed structure is $605,000. This cost includes tender, materials, engineering and sundry construction.

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

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. S. McCombie
A. Stermac (2)
J. Anderson

No comment.
M. Devata
May 21/1970

This copy for: Mr. A. G. Stermac
Att: Mr. M. Devata

A60

Mr. S. J. Markiewicz,
Regional Road Design Engineer,
Kingston, Ontario.

Bridge Section,
Kingston, Ontario.

Mr. R.H.B. Fenn

May 27, 1970.

69-F-118

W.P. 35-66-15 (E. B. L.), Site 27-210,
W.P. 35-66-22 (W. B. L.), Site 27-217,
South Nation River Bridge,
(1 Mile West of Casselman),
Highway 417, District 9 - Ottawa

With reference to the above mentioned structures I should like to draw your attention to Page 14, paragraph 6.2.2, of the Foundation Investigation Report for these bridges dated May 22, 1970.

This paragraph dealing with settlement considerations recommends that the approach embankments to the structures should be constructed to grade at least 12 months prior to construction of the bridge foundations and that the final paving operations should be delayed for as long a period as is practically feasible.

I shall be glad to know if you consider that this recommendation can be carried out.

T. C. Kingsland
Regional Bridge Planning Engineer

TCK/hl

c.c. M. R. Ernesaks - Att. A. J. Percy
A. G. Stermac - Att. M. Devata
C. S. Gretski - Att. K. Emami
Bridge Office Files Section (S. McCombie)

Department of Highways Ontario
Copy for the information of

69-F-118

Mr. S. J. Markiewicz,
Regional Road Design Engineer.
R.D.O., Kingston.

Materials & Testing Office,
Kingston, Ontario.

1 June 1970.

W.P. 35-66-03, Hwy. 417,
Limoges to Casselman,
District 9, Ottawa.

We are forwarding herewith a revised copy of soils profile 417K9-6 E.B.L. which now includes the soils profiles for the relocated Township Road on the west side of the South Nation River and the Township Road on the east side of the river.

Your attention is drawn to the Foundation Investigation Report for the structures at the South Nation River (W.P. 35-66-15). In Section 6.2.1 it is pointed out that care should be taken to ensure that the river banks are not trimmed any steeper than the existing slopes. It is also recommended that the river banks be protected to the high water level for any possible scour. It is felt that scour protection should also be provided for the fill slopes of the portion of the proposed relocated Township Road situated between the west approach fill and the west pier of the proposed structure.

H. A. Meyer

for J. E. Gruspier,
Regional Materials Engineer.

HAM/jtk

Enclosed

c.c. J. E. Callaghan
A. G. Stermac
G. A. Wrong

69-F-3118

South Nation River Bridge - E.B.L

		Allowance for Batter & Cut Off	Pile Length
W. Abut			
Pile Cut off Elev	- 206.5		
Rock Elev	- 133.5		
Vert. Length	73.0	4	77'
E. Abut			
Pile Cut Off Elev	- 207.0		
Rock Elev	- 138.0		
Vert. Length	- 69.0	4	73'
W. Pier			
Pile Cut Off Elev	175.5		
Rock Elev	133.0		
Vert Length	42.5	4	47
E Pier			
Pile Cut Off Elev	- 176.5		
Rock Elev	- 134.7		
Vert Length	- 41.8	4	46

69-F-118

South Nation River Bridge - W.B.L

		Allowance for Batter & Cut Off	Pile Length
W. Abut.			
Pile Cut Off Elev.	206.5		
Rock Elev.	136.8		
Vert. Length	69.7	4'	74
E Abut			
Pile Cut Off Elev.	206.5		
Rock Elev.	142.3		
Vert Length	64.2	4'	68
W. Pier			
Pile Cut Off Elev.	175.5		
Rock Elev.	138.0		
Vert. Length	37.5	4'	42
E. Pier			
Pile Cut Off Elev.	176.5		
Rock Elev.	142.0		
Vert Length	34.5	4	39

cc: FOUNDATIONS (RM 1110)

AGS

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

ATTENTION:

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

DATE: November 26, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: South Nation River Bridge - W.B.L.
W.P. 35-66-22, Site No. 27-217
Highway 417, District No. 9
W.O. 69-11118

We have reviewed the Final Bridge Drawings D-6826-1 & 4 for the above mentioned structure and submit the following comments:

It is recommended that the pile lengths for the West and East pier be increased from 40 ft. and 36 ft. to 42 ft. and 39 ft., respectively.

MD/MdeF

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

cc: Messrs. S. McCombie
T. C. Kingsland

Foundations Files
Gen. Files

cc: FOUNDATIONS - RM. 107 LAB. BLDG

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

ATTENTION:

DATE: November 26, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: South Nation River Bridge - E.B.L.
W.P. 35-66-15, Site No. 27-210
Highway 417, District No. 9
W.O. 69-1118

We have reviewed the Final Bridge Drawings D-6824-1, 3, & 4 for the above mentioned structure and submit the following comments:

In our opinion, the pile lengths for the structure should be as follows:

Location		Pile Length
West Abutment	.....	77 ft.
East Abutment	.....	73 ft.
West Pier	.....	47 ft.
East Pier	.....	46 ft.

MD/MdeF

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

cc: Messrs. S. McCombie
T. C. Kingsland

Foundations Files
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: November 19, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: South Nation River Bridge - W.B.L.
W.P. 35-66-22, Site No. 27-217
Highway 41, District No. 9

69-F-118

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

Kindly give us your comments at your earliest convenience.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

comments made
Nov 26/70
W.H.

Nov 30

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: November 23, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: South Nation River Bridge - E.B.L.
W.P. 35-66-15, Site No. 27-210
Highway 417, District No. 9

69-F-118

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

Kindly give us your comments at your earliest convenience.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

Comments made
NV 26/70
W.A.

AR
3 Dec. 70

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

W.O. 69-F-118

TO: Mr. S. J. Markiewicz
Regional Road Design Engineer
Road Design Office, Kingston

FROM: Materials and Testing Office
Kingston

ATTENTION: Mr. G. Ricker

DATE: December 21, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: Hwy. 417, W.P. 35-66-03,
Limoges to Casselman
District 9, Ottawa

Further to our discussion regarding scour protection at the Relocated Township Road on the west side of the South Nation River, we wish to emphasize the following:

A section of the Relocated Township Road (Sta. 44+ to Sta. 54+) will have one slope exposed to the water action of the South Nation River during periods of flooding. Since the fill material used on the west side of the river is expected to be fine sand, it is felt that the complete fill slope through this section should be rip-rapped for scour protection.

H. A. Meyer

for: A. M. Batten
Senior Soils Supervisor

HAM:mgm

cc: J. E. Callaghan
T. Kingsland
G. A. Wrong
A. G. Stermac

SUMMARY OF PILE DRIVING RECORDS

W.O. 69-F-118 W.P. 35-66-15 CONT. 72-173 DIST. 9

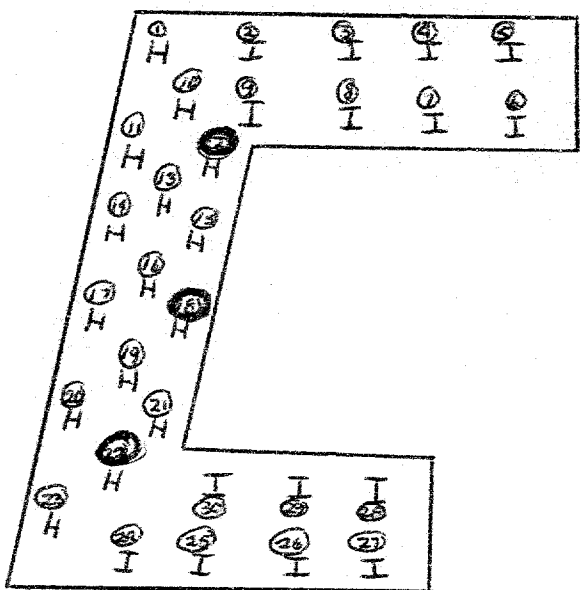
SITE HWY 417 E/ SOUTH NATION RIV. KING

DATE DRIVEN FEB. 26 - MAR - 6/73 WEIGHT OF ANVIL 0.25 T

HAMMER TYPE D-12. WEIGHT 1.38 T ENERGY 22,500 FT. LBS.

LOCATION OF PILES	PILE				ESTIMATED TIP EL. (ft.)	DIFFERENCE Longer(+) Shorter(-) Than Estimated (ft.)	REMARKS
	TYPE	NO.	LENGTH (ft.)	TIP EL. (ft.)			
WEST BOUND							
LANE	12 BP. 74	12	64.3	142.2	136 - 142	—	RE DRIVEN TO
EAST ABUTMENT							
—11—	—11—	18	64.2	142.3	—11—	—	
—11—	—11—	22	64.7	141.8	—11—	—	

Hwy #417 Cont. 72-173
South Nation River
W.B.L. - East Abutment



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

Form OB-MT-285 (REVISED NOV. 1971) OVER

DESIGN SERVICES BRANCH
FOUNDATION OFFICE

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 72-173 STRUCTURE SOUTH NATION RIVER (W.B.L.)

CONTRACTOR C.A. PITTS DESIGN LOAD OF PILE REFUSAL

HAMMER DETAILS: TYPE DELMAG D-12 WEIGHT 1.38T HEIGHT OF FALL OR ENERGY 22,500

TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP .25T

PILE DETAILS 12BP 74

PILE NO. 12 LOCATION EAST ABUTMENT DATE DRIVEN FEB 26-MAR 5

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETPATION BLOWS/FT.
4:35PM	1	7		26	5		51	13		76	
FEB 26	2	2		27	6		52	26		77	
50'	3	3		28	6		53	26		78	
	4	6		29	6		54	28		79	
	5	6		30	7		55	27		80	
	6	7		31	8		56	26		81	
	7	7		32	8		57	25		82	
	8	8		33	8	Hit	58	24		83	
	9	8		34	8	Bedrock	59	20		84	
	10	9		35	8	~~350'~~	60	19		85	
	11	9		36	8	63'	61	72		86	
	12	8		37	9	AT APPROX	62	42		87	
	13	7		38	8	3:00 PM	63	250(6")		88	
	14	7		39	9		64			89	
	15	7		40	8		65			90	
	16	7	STOPPED	41	7		66			91	
	17	6	AT 46'	42	7		67			92	
	18	5	AT 4:45PM	43	7		68			93	
	19	5	SPLICED	44	7		69			94	
	20	6	FEB 27	45	7		70			95	
	21	6	10:30	46	7		71			96	
	22	5	-11 AM	47	2+16		72			97	
	23	5	DRIVING	48	19		73			98	
	24	5	MAR. 5	49	14		74			99	
	25	5	2:35PM	50	9		75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						

FINAL LENGTH OF PILE 64'4" FINAL CUT OFF ELEVATION 206.50

REPORT TO BE SENT TO:- PRINCIPAL FOUNDATION ENGINEER
DESIGN SERVICES BRANCH
DEPARTMENT OF
TRANSPORTATION AND
COMMUNICATIONS
DOWNSVIEW, ONTARIO

206'5"
-43
Typ. of. 142'2

SIGNED D Turner
NAME (PRINT) D. TURNER
DATE MAR 12/73
ATTACH SKETCH OF PILE NUMBERING SYSTEM

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12¾" O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12¾" x ½" steel plate shoe.

Details for the final six inches of penetration must be completed for all piles except in the case of an end bearing pile driven to bedrock. Final length of pile, and final cut off elevation must always be given.

The total length being driven is the full length of the pile and remains unchanged until a length is cut off or spliced on.

The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

OVER

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

Form OB-MT-283
(REVISED NOV. 1971)

DESIGN SERVICES BRANCH
FOUNDATION OFFICE

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 72-173 STRUCTURE South Nation River W.B.L.

CONTRACTOR C.A. Pitts DESIGN LOAD OF PILE Refusal

HAMMER DETAILS: TYPE Delmag D-12 WEIGHT 1.38T HEIGHT OF FALL OR ENERGY 22,500

TYPE OF ANVIL OR CAP Steel WEIGHT OF ANVIL OR CAP .25T

PILE DETAILS 12 BP 74

PILE NO. 18 LOCATION East Abutment DATE DRIVEN Feb 27 & Mar 5

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.
3:15 PM	1	14		26	4		51	6		76	
Feb 27	2	4		27	5		52	7		77	
50'	3	6		28	5		53	8		78	
	4	6		29	5		54	15		79	
	5	6		30	4		55	17		80	
	6	6		31	5		56	15		81	
	7	7		32	5		57	14		82	
	8	7		33	4		58	18		83	
	9	8		34	5		59	10		84	
	10	7		35	5	Hit	60	9		85	
	11	7		36	4	Bedrock	61	12		86	
	12	6		37	4	1:45 PM	62	13		87	
	13	6		38	4	63'5"	63	32		88	
	14	6		39	4		64	31 (-1)		89	
	15	5	Stopped	40	4		65			90	
	16	5	At 45'0"	41	4		66			91	
	17	6	At 3:25 PM	42	4		67			92	
	18	5	Began	43	3	Spliced	68			93	
	19	5	Splicing	44	4	18'	69			94	
	20	5	3:35 -	45	4		70			95	
	21	4	4:15	46	10		71			96	
	22	5	PM	47	8		72			97	
	23	4	Driving	48	7		73			98	
	24	4	Mar 5	49	5		74			99	
	25	5	1:15 PM	50	5		75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						

FINAL LENGTH OF PILE 64' 2" FINAL CUT OFF ELEVATION 206.50

REPORT TO BE SENT TO:- PRINCIPAL FOUNDATION ENGINEER
DESIGN SERVICES BRANCH
DEPARTMENT OF
TRANSPORTATION AND
COMMUNICATIONS
DOWNSVIEW, ONTARIO

206.5
64.2
Typed 142.3

SIGNED D Turner

NAME (PRINT) D. TURNER

DATE Mar 12/73

ATTACH SKETCH OF PILE NUMBERING SYSTEM

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12¾" O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12¾" x ½" steel plate shoe.

Details for the final six inches of penetration must be completed for all piles except in the case of an end bearing pile driven to bedrock. Final length of pile, and final cut off elevation must always be given.

The total length being driven is the full length of the pile and remains unchanged until a length is cut off or spliced on.

The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

OVER

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

Form OB-MT-285
(REVISED NOV. 1971)

DESIGN SERVICES BRANCH
FOUNDATION OFFICE

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 72-173 STRUCTURE SOUTH NATION RIVER WBL

CONTRACTOR C.A. PITTS DESIGN LOAD OF PILE REFUSAL

HAMMER DETAILS: TYPE DELMAG D-12 WEIGHT 1.38 T. HEIGHT OF FALL OR ENERGY 22,500

TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP .25 T.

PILE DETAILS 12BP74

PILE NO. 22 LOCATION EAST ABUTMENT DATE DRIVEN FEB 26 + MAR 9

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.
3:45PM	1	10		26	6		51	11		76	
FEB.26	2	2		27	7		52	12		77	
50'	3	3		28	7		53	12		78	
	4	6		29	6		54	11		79	
	5	7		30	7		55	10		80	
	6	8		31	7		56	10		81	
	7	8		32	6		57	9		82	
	8	9		33	6		58	9		83	
	9	9		34	6		59	10		84	
	10	9		35	7		60	12		85	
	11	10		36	6	HIT	61	13		86	
	12	10		37	7	BEDROCK	62	22		87	
	13	9		38	6	63'5"	63	33		88	
	14	8		39	6	10:40AM	64	20(7")		89	
	15	9		40	6		65			90	
	16	8		41	7		66			91	
	17	6		42	6		67			92	
	18	7		43	7		68			93	
	19	6	STOPPED	44	6	BEGIN	69			94	
	20	6	AT 46'0"	45	7	DRIVING	70			95	
	21	6	4:00PM	46	6	10:15	71			96	
	22	6	SPLICED	47	13	MAR. 6	72			97	
	23	6	18' ON	48	7		73			98	
	24	7	UNTIL	49	6		74			99	
	25	6	4:45PM.	50	6		75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						

FINAL LENGTH OF PILE 64'8" FINAL CUT OFF ELEVATION 206.50

REPORT TO BE SENT TO:- PRINCIPAL FOUNDATION ENGINEER
DESIGN SERVICES BRANCH
DEPARTMENT OF
TRANSPORTATION AND
COMMUNICATIONS
DOWNSVIEW, ONTARIO

206.5
64.7
141.8
Typ of.

SIGNED D. Turner

NAME (PRINT) D. TURNER

DATE MAR 12/73

ATTACH SKETCH OF PILE NUMBERING SYSTEM

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12¾" O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12¾" x ½" steel plate shoe.

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The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

69-F-118

SOILS ● PILING ● CONCRETE & ASPHALT ● TESTING & INSPECTION

FONDEX LTD.
FOUNDATION ENGINEERS

April 27th, 1971.

Department of Highways of Ontario,
Materials & Testing Division,
Highway 401 and Keele Street,
Downsview, Ontario.

Attention: Mr. A. G. Stermac
Principal Foundation Engineer

Re: Report on Foundation Conditions for a Proposed Structure at the Crossing of the South Nation River to Join County Road 8 to County Road 16 Russell County.

Dear Sir:

Accompanying this letter is our preliminary report covering the soils investigation at the above mentioned site.

Several charts and a drawing referred to in the text of the report are not enclosed but will be ready for our meeting with you on the morning of Friday, April 30th. These include profiles of the earth slopes as analyzed, a summary of soil properties, and grain size analysis charts.

It is hoped that the report and drawings as enclosed will prove sufficient for your perusal before our meeting.

If you should have any queries prior to Friday morning, please do not hesitate to call us.

Yours very truly,

J. Lecompte

JL/tc

Jacques Lecompte, P.Eng.

376 CHURCHILL AVENUE ● SUITE 207 ● OTTAWA 3, ONTARIO ● TELEPHONE 728-5888

PRELIMINARY

REPORT ON FOUNDATION CONDITIONS

FOR

PROPOSED STRUCTURE AT THE CROSSING

OF THE

SOUTH NATION RIVER

TO JOIN

COUNTY ROAD NO. 8 TO COUNTY ROAD NO. 16

RUSSELL COUNTY

UNITED COUNTIES OF PRESCOTT AND RUSSELL

BY

FONDEX LIMITED

Ottawa, Ontario.

April 15th, 1971.

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TABLE OF CONTENTS

PRELIMINARY

REPORT ON FOUNDATION CONDITIONS

FOR

PROPOSED STRUCTURE AT THE CROSSING

OF THE

SOUTH NATION RIVER

TO JOIN

COUNTY ROAD NO. 8 TO COUNTY ROAD NO. 16

RUSSELL COUNTY

1. Introduction

This report presents an appraisal of the foundation conditions at the site of a proposed bridge over the South Nation River between Concessions II and III, Township of Cambridge, Russell County, Ontario. The appraisal and report were requested by Mr. A. J. Lynch, P.Eng., Counties Engineer, Counties of Prescott and Russell.

The site of the crossing is about 4½ miles north of Casselman on the South Nation River. A drawing showing the location and general dimensions of the site is shown in the Appendix.

It is understood that the alignment and location of the proposed bridge were determined on the basis of the proposed location of the new county road between Casselman and Bourget, and

that the proposed grade of the crossing was chosen on the basis of hyrologic data available for the site. The bridge will be a two lane multi-span structure 600 to 700 feet in length with the deck about 40 feet above the level of normal river flow.

The site which was investigated is about 300 feet south of a proposed river crossing location investigated and reported on to the Department of Highways, Ontario, by Geocon Ltd. in January, 1967.* The Geocon Ltd. work reports "The presence of obviously active failure zones on both sides of the river at this location, ..." and "... a 6 inch clay layer with the consistency of a viscous liquid was encountered within a failed zone at a depth of 56 feet below ground level". Because of these observations and their implications with regard to the construction of a crossing structure at or near the site investigated by Geocon Ltd., the work proposed, carried out, and reported on herein was quite extensive and detailed.

2. Datum

All elevations quoted in this report are referenced to geodetic benchmarks.

3. Geologic Conditions

The site lies within the physiographic region known as the Russell and Prescott Sand Plains. In this area the sand mantle lies above elevation 180± feet and overlies a deposit of

* T 7947 - Report to Department of Highways, Ontario, on Preliminary Soil Conditions and Foundations, Proposed South Nation River Crossing, South East Freeway, Hwy. #417.

marine clay which extends to elevations varying between 115± feet and 129± feet. The clay deposit is underlain by a stratum of glacial till which in turn is underlain by a grey limestone of the Ottawa Formation, and which has a fairly flat surface varying between elevations 85± feet and 88± feet across the site.

As can be seen from the stratigraphy plot in the Appendix, the South Nation River has cut a terraced valley through the area in question, and has left deposits of very fine sand, silt, clay, and organic material overlying the marine clay on two of the terraces.

There is substantial evidence of slope failures and flow slides having occurred along the South Nation River in the general area of the proposed crossing. However, at the exact location of the site, a careful study of aerial photographs, close inspection of the surface terrain, and observations on continuous soil samples recovered during the field investigation reveal no evidence of recent sliding having occurred.

4. Earthquake Potential

The site lies about one mile north of a major fault which extends from the Hogs Back in the City of Ottawa to the City of Montreal, P.Q. This fault, like most others south of the Ottawa River, is not considered to be active. As a point of interest, the epicentres of most earthquakes recorded in Eastern Ontario are north of the Ottawa River and the maximum earthquake intensity reported in the Casselman area is equivalent to 6 as measured

on the Richter Scale.* The horizontal ground acceleration consistent with a disturbance of this magnitude is about 0.1 g.

5. Field Investigation

The field investigation consisted of five continuously sampled boreholes, and three boreholes sampled at specified intervals together with standard penetration tests and field vane shear tests as appropriate. An accompanying five boreholes were made to take standard penetration and field vane shear tests. The borings were made with a conventional diamond drill rig adapted for soil mechanics purposes. The field investigation was carried out during the period February 19th to March 26th, 1971 with equipment owned and operated by F. E. Johnston Drilling Co. Ltd., Ottawa, Ontario.

Samples of granular material above the clay stratum and in the till beneath the clay were obtained in a 2 inch outside diameter split spoon sampler which was driven into the soil in accordance with ASTM specifications for the Standard Penetration Test. Cohesive materials were sampled with a 2 inch inside diameter piston sampler. Bedrock was proven in four of the boreholes by recovering AXT size rock core samples.

* Dr. A. E. Stevens, Seismology Division, Geological Survey of Canada, Private Communication.

The groundwater conditions at the site were determined by recording the water levels in the open boreholes. The piezometric levels in the till stratum were found by installing piezometers in that stratum at two borehole locations and sealing the boreholes off in the overlying clay.

6. Laboratory Investigation

All samples were examined and their descriptions logged in the laboratory. The following laboratory tests were carried out on specified samples to determine the engineering properties of the soils encountered-:

a) bulk densities

b) natural moisture contents

c) Atterberg limits

d) grain size analysis

e) undrained shear tests

*f) drained shear tests

The results of these tests were used to classify the soil with regard to type and consistency and in analyses of the stability of slopes at the site. The test results are plotted on the appropriate borehole logs and summary sheets in the Appendix.

7. Soil Conditions

A stratigraphy plot showing the various soil types encountered is shown in the Appendix. A more detailed description of the soils encountered at each borehole location is shown on

* The results of the drained shear tests will be used in effective stress stability analyses for the final soils report to be completed by May 30th, 1971.

the accompanying borehole logs. A description and summary of the field and laboratory work done on each soil type is as follows-:

7.1 Sand - Surface Deposit

What remains of the deposit referred to as part of the Russell and Prescott Sand Plains at the site was encountered at the location of borehole #11. This surface deposit consists of about 7 feet of fine to very fine sand with intermittent seams of silt, silty clay, and clay.

Standard penetration tests done in this material are plotted on the borehole log and on the stratigraphy plot. The relative density of this stratum varies from loose to compact.

7.2 Alluvial Deposit

7.2.1 West Side of River

That portion of the site between borehole #6(b) and the river which was investigated with boreholes 1, 2, 6(a), and 6 (b) consists of a geologically recent river deposit. The soil is stratified with the top 3± feet consisting of fine sandy silt grading down to silty clay. The silty-clay is firm to stiff in consistency and its silt content increases with depth to about 11± feet where the soil becomes primarily silt.

At 12± feet the soil material is classified as a fine silty sand and its gradation continues to become generally more granular with depth to a fine to medium sand. Also, below a depth of 12± feet to the bottom of this stratum there are intermittent layers of clay, silty-clay, and silt varying in thickness up to 3 inches. There is also some organic content, including peat, roots, twigs, wood chips, and decomposed material between 16± feet and the bottom of the alluvial deposit.

Standard penetration tests were carried out in the granular zones and the results are plotted on the borehole logs and on the stratigraphy plot. The "N" values vary between 2 and 16 blows per foot indicating relative densities between loose and compact.

7.2.2 East Side of River

The portion of the site investigated with borehole #9 also consists of a geologically recent deposit of alluvium. This stratum, which is composed of layers of soil varying in grain size from medium sand to clay, and in layer thickness from very thin to about 4 inches, extends to a depth of 16± feet.

The results of standard penetration tests carried out in this material are plotted on the borehole logs and on the stratigraphy plot. The "N" values vary from 1 to 15 blows per foot indicating relative densities between loose and compact.

7.3 Marine Clay

7.3.1 Desiccated Zone

The upper portion of the sensitive marine clay at all borehole locations except #1, 6a), 6b) and 9 on the alluvial terraces was desiccated to depths ranging from 7 to 15 feet. The thickness of this layer generally decreases toward the river. The material is mottled, brown to grey-brown in colour and has some organic content.

The results of field and laboratory tests on this material are shown on the borehole logs and are summarized in the Appendix.

7.3.2 Non-desiccated Zone

Below the desiccated zone the marine clay is generally gray in colour with some gray-brown layers. This stratum extends to elevation 115± feet to 129± feet and includes random lenses of granular material varying in thickness from a fraction of an inch to about 1'9". The granular material varies from silt to fine sand. There is no conclusive evidence that these lenses are continuous across the site.

The results of field and laboratory tests on this material are shown on the borehole logs and are summarized in the Appendix.

7.4 Glacial Till

A deposit consisting of a heterogeneous mixture of clay, silt, sand, and gravel was encountered below the marine clay deposit at all borehole locations. This stratum extends to elevation 85± feet to 88± feet and is about 35± feet in thickness across the site.

Most samples of the till are granular in nature; however, a few indicated some plasticity with the presence of clay. Boulders up to 3½ feet in vertical extent were encountered in boreholes #3 and #7. Grain size distribution curves for a number of samples are included in the Appendix.

7.5 Bedrock

Core samples of bedrock were taken at the locations of boreholes #1, 3, 7, and 9. The bedrock surface was found to be relatively flat across the site, varying in surface elevation between elevation 85± feet and 88± feet with no uniform slope in any direction.

Core recovery was essentially 100% at all locations indicating a sound material. The composition of the recovered cores is dominantly limestone with small shale impurities throughout as well as thin shale seams at irregular intervals.

8. Groundwater

Groundwater levels in the boreholes were monitored throughout the field investigation. The observed groundwater levels are shown on the borehole logs and on the stratigraphy plot. Since groundwater can be expected to be at the surface during the spring season, this level is assumed to exist when calculations involving shear strength are made.

9. Artesian Pressure in the Glacial Till

Two piezometers were installed and sealed in the glacial till stratum at the locations of boreholes #1 and 9. A plot of the piezometric head vs. time, using the river level as base, and a plot of piezometric head and river level vs time using the pre run-off river level as base are shown in the Appendix. Since the hydraulic head is higher than the ground surface at these locations, measures will probably have to be taken to lower this head to the ground surface or below in order to improve the stability of the site.

10. Design Considerations

The geotechnical problems associated with the construction of a bridge at this site involve two principal considerations: a) the stability of earth slopes, and b) the choice of bridge foundations.

The slope stability problem involves consideration of the sensitive nature of the clay deposit, the presence of an artesian pressure in the till stratum underlying the clay, the annual rapid lowering of the river level after peak flooding, and the seismicity of the area in which the site lies.

The choice of bridge foundations depends upon the nature of the clay and glacial till deposits as well as upon the seismicity of the site area.

11. Discussion and Recommendations

The dominant soil material at the site is the stratum of sensitive marine clay. The thickness of the deposit across the site varies approximately according to the erosion pattern of the South Nation River. The desiccated portion of this stratum varies from firm to hard in consistency and is underlain by a non-desiccated layer of the same parent material which varies from very soft to firm in consistency. In general this stratum is highly compressible with water contents in excess of liquid limits almost throughout. If the material is loaded to the extent that its structure breaks down, large settlements can be expected. The clay deposit is underlain by a deposit of glacial till about 36± feet in thickness across the site. The till is underlain by approximately horizontally bedded shaly limestone at elevation 85± feet to 88± feet.

11.1 Stability of Slopes

In view of the risk of slope failures at the site due to the nature of the clay deposit and the seismicity of the area, analyses have been carried out to assess the stability of the existing slopes. The results of these analyses are shown in the Appendix and have led to recommendations concerning desireable final slope geometries which have also been analyzed for stability.

The design of earth slopes against earthquake forces has generally employed pseudstatic methods of analysis. Such methods include a) the use of empirical rules, b) assumed rigid body response of the soil mass, and c) the use of a viscoelastic model of soil behavior.* The validity of all of these techniques is limited by available knowledge since there have been very few cases of slope failures caused by seismic forces where the soil conditions have been sufficiently well established to provide any more than a qualitative guide for extropolation to new sites.

Whereas pseudostatic methods provide a means of comparing various embankment sections, there is really no reliable way of determining the necessary seismic information for a particular site to apply in the analysis. Furthermore, these techniques do not explain the real mechanism of slope failure under seismic conditions.

* Wiegel, R.L., "Earthquake Engineering". Prentice-Hall Inc., Englewood Cliffs, N.J., (1970).

There are some new and more appropriate techniques available for the analysis of earth slopes under dynamic conditions which are of particular interest and value in assessing the stability of earth slopes in sensitive saturated clays such as those at the site in question. These techniques involve laboratory testing of a very sophisticated nature to determine the modulus of the soil material and its damping characteristics under dynamic loading conditions.

In view of the lack of reliability of simple and available analytical tools and the current difficulties and expense associated with dynamic testing, it is considered that the choice of a factor of safety of 1.5 against stability failures under static conditions will provide a factor of safety against failure under the seismic conditions which might occur at this site of greater than 1.0.

11.1. Existing Slope Geometry

Total stress stability analyses for the existing slope geometry were carried out for the static case using an electronic computer. The minimum factor of safety was found to be about 1.0 which suggests that stabilizing measures for the slope need to be taken if a crossing structure is built at this site.

11.1.2 Recommended Slope Geometry

The slope configuration as shown in profile in the Appendix was analysed for the static case under total stress conditions with the soil properties as shown on the drawing. The minimum factor of safety for the recommended geometry is 1.5. This factor is considered adequate to provide sufficient safety against failure due to seismic conditions which might occur at this site.

11.1.3 Effective Stress Stability Analysis

Effective stress stability analysis of the proposed slope geometry using the results of consolidated-drained triaxial tests are being carried out and will be discussed in a subsequent report due by 30 May, 1971. In addition, the stability of the slopes at the site under conditions of rapid draw down will be discussed in that report.

11.2 Consolidation

For the proposed slope geometry, the maximum height of fill, will be in the order of 10 feet. The location of this fill is shown in the Appendix.

No consolidation tests were done on the sampled material; however, it is reasonable to assume a preconsolidation pressure of 1500± psf for the desiccated clay material over which the fill will be placed. Any settlements which take place will be due to "elastic" compression and should not exceed 1 or 2 inches.

11.3 Relief of Artesian Pressure in the Glacial Till

In order to provide relief for the artesian pressure in the glacial till to the extent that the piezometric head in the till is at or lower than the ground surface it is recommended that an appropriate drainage system be provided. The condition is of concern where the ground surface elevation is lower than 170± feet. In the report to follow by 30 May, 1971 recommendations concerning the location, design, and construction of such a drainage system will be made.

11.4 Foundations

It is recommended that bridge piers and abutments be supported on expanded base piles founded in the glacial till. End bearing piles driven to the bedrock surface can be considered as an alternative but the presence of boulders and the very dense nature of the till material may precipitate difficulties in the driving operation.

It is recommended that if displacement piles are used that preboring methods be applied for their installation in order to prevent excessive disturbance to the clay.

If there are any queries concerning the contents of this report please do not hesitate to call us.

Preliminary Report April 15, 1971

E. B. Fletcher, Ph.D., P.Eng.

FOUNDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 1

PROJECT South Nation River Bridge
LOCATION Township of Cambridge, Lot 8 - Con. II - Sta. 902+51 11.5' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX, BX, AX, AXT core

DRILLING DATE 19 Feb 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
163.3 / 0'0"	Ground Surface					
	Topsoil - organic sandy silt		1	SS	6	
1'6"	Silty - sand organic Alluvium		2	TP	PM	61
			3	TP	PM	75
3'6" / 159.3			4	TP	PM	46
5'0"	Alluvium Silty - clay brown - stratified soft to firm		5	TP	PM	64
			6	TP	PM	63
	▽ observed G.W.L.		7	TP	PM	98
8'6" / 153.3			8	TP	PM	92
10'0"						
10'9"	Clayey - Silt brown, stratified, firm		9	TP	PM	97
12'3"			10	TP	PM	97
148.3			11	TP	PM	96
15'6"	Alluvium Silty - sand stratified occ. layers of silty-clay, silty-clay, & clay organic content - peat, twigs, roots, wood chunks.		12	TP	PM	98
			13	TP	PM	93
			14	TP	PM	94
143.3 / 20'0"			15	TP	PM	99
			16	TP	PM	93
			17	TP	PM	98
138.3 / 25'0"			18	TP	PM	99
			19	TP	PM	96
			20	TP	PM	93
133.3 / 30'0"			21	TP	PM	89
			22	TP	PM	78
			23	TP	PM	93
128.3 / 35'0"			24	TP	PM	76

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

20 40 60 80 %

FOUNDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 1

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
128.3						
35'6"	Clay gray firm		25	TP	PM	97
			26	TP	PM	100
			27	TP	PM	100
123.3	39'2".		28	TP	PM	50
46'6"	Glacial Till heterogeneous mixture of clay, silt, sand, & gravel.		29	SS	24	
			30	SS	30	31
			31	SS	12	0
			31A	ST	21	28
118.3			32	SS	50	26
45'0"			33	SS	16	0
			33A	ST	16	10
			34	SS	42	35
113.3			35	SS	40	40
50'0"			36	SS	70	50
			37	SS	79	48
108.3			38	SS	33	54
55'0"			39	SS	40	50
			40	SS	43	42
103.3			41	SS	41	57
60'0"			42	SS	28	25
98.3			43	SS	30	63
65'0"			44	SS	236	65
			45	SS	285	80
93.3			46	SS	116	65
70'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH

FIELD VANE SHEAR *

~~LAB VANE SHEAR~~ Quick Triaxial X (ϵ)

UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:

NATURAL MOISTURE CONTENT (W)

LIQUID LIMIT (W_l)

PLASTIC LIMIT (W_p)

20 40 60 80 %

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 1

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
93.3						
70'8"			46	SS	116	65
			47	SS	90	100
88.3	74'7"		48	SS	248	83
75'0"						
			49	AXT RC		67
83.3						
80'0"	Bedrock		50	AXT RC		100
	Limestone with shale impurities and intermittent thin shale seams.					
78.3						
85'0"			51	AXT RC		100
75.5						
97'10"	End of borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FORDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 2

PROJECT South Nation River Bridge
LOCATION Township of Cambridge, Lot 8 - Con. II - Sta. 902+53 27.5' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NA

DRILLING DATE 1 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FT (N)	SAMPLES: % RECOVERY	DYNAMIC PENETRATION RESISTANCE BLOWS/FT. / STRENGTH	CONSISTENCY: NATURAL MOISTURE CONTENT (W) / LIQUID LIMIT (W_l) / PLASTIC LIMIT (W_p)
162.9 / 0'0"	Ground Surface							
157.9 / 5'0"								
152.9 / 10'0"								
147.9 / 15'0"								
142.9 / 20'0"			1	SS	2	33		
137.9 / 25'0"								
132.9 / 30'0"								
127.9 / 35'0"			2	SS	3	0		

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W) ⟶
LIQUID LIMIT (W_l) —○—
PLASTIC LIMIT (W_p) ⊢—
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 2

PROJECT _____ DRILLING DATE _____
LOCATION _____ REPORT DATE _____
DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____
SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

SOILS PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS/FT.	CONSISTENCY :
Elev. / Depth	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY	STRENGTH FIELD VANE SHEAR * LAB VANE SHEAR X UNCONF COMP STRENGTH(q_u) 0.5 1.0 1.5 2.0 k.s.f.	NATURAL MOISTURE CONTENT (W) —▷◁— LIQUID LIMIT (W_l) —○— PLASTIC LIMIT (W_p) ⊢—⊣ %
127.9								
35'0"			3	WS			* undisturbed * disturbed	
126.1								
36'9"	End of borehole ✓							

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 3

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 8 - Con. II - Sta. 900+20 63' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX, BX, AX, AXT core

DRILLING DATE 2 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
180.7	Ground Surface					
0'0"	Topsoil - organic clayey-silt		1	SS	9	78
0'7"			2	SS	18	21
			3	TP	PM	100
175.7			4	TP	PM	41
5'0"	▽ Observed G.W.L.		5	TP	PM	100
	Clay & silty-clay		6	TP	PM	100
	brown to gray-brown		7	TP	PM	100
	desiccated		8	TP	PM	84
170.7	firm to hard		9	TP	PM	94
10'0"			10	TP	PM	99
165.7			11	TP	PM	100
15'0"			12	TP	PM	96
			13	TP	PM	100
	Clay		14	WS		
160.7	gray - pink banded		15	WS		
20'0"	non - desiccated		16	WS		
	soft to firm		17	WS		
	occ. brown layer		18	WS		
	Black organic streaks throughout		19	TP	PM	100
155.7			20	TP	PM	94
25'0"	silty-sand layers -:		21	TP	PM	98
	3" 14'2" to 19'5"		22	TP	PM	100
	1'3" 42'5" to 43'6"		23	TP	PM	100
	6" 44'3" to 44'9"		24	TP	PM	100
150.7	occ. silt partings		25	TP	PM	100
30'0"						
145.7						
35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
Quick Triaxial X (ε)
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 K.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %

(25%) (6%) (12%) (7%) (6%) (6%) (7%) (5%) (5%) (5%)

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 3

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
145.7 / 35'0"			26	TP	PM	94
			27	TP	PM	89
			28	TP	PM	88
140.7 / 40'0"			29	TP	PM	100
			30	TP	PM	100
			31	TP	PM	86
135.7 / 45'0"			[illegible]	TP	PM	100
			33	TP	PM	100
			34	TP	PM	100
130.7 / 50'0"			35	TP	PM	96
			36	TP	PM	95
			37	TP	PM	98
			38	TP	PM	99
125.7 / 55'0"			39	TP	PM	98
			40	TP	PM	98
57'5"			41	TP	PM	50
120.7 / 60'0"			42	SS	52	50
	Glacial Till heterogeneous mixture of clay, silt, sand & gravel		43A	ST		
115.7 / 65'0"			43	SS	46	0
			43B	ST		
110.7 / 70'0"			44	SS	118	60

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
~~LAB VANE SHEAR~~ Quick Triaxial X
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %

X (5%)
X (6%)
X (5%)
X (3.5%)
X (5%)

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 3

PROJECT _____ DRILLING DATE _____
LOCATION _____ REPORT DATE _____
DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____
SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT (N)	SAMPLES % RECOVERY
110.7						
70'0"			44			
105.7			45	SS	65	6
75'0"			46	ST		50
100.7			47	SS	80	53
80'0"						
95.7			48	SS	340	65
85'0"			49	WS		
			50	SS	313	100
90.7						
90'0"						
91'5"	Limestone boulders in matrix of very fine sand		51	AXT RC		37
88.7						
93'0"						
96'0"	Bedrock		52	AXT RC		92
	Limestone with shale impurities and intermittent thin shale seams					
80.7			53	AXT RC		100
100'0"						
75.7			54			
105'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 3

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

SOILS PROFILE		SAMPLES					DYNAMIC PENETRATION RESISTANCE BLOWS/FT.	CONSISTENCY: NATURAL MOISTURE CONTENT (W) ⋈ LIQUID LIMIT (W_l) —O— PLASTIC LIMIT (W_p)
Elev. / Depth	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY	STRENGTH: FIELD VANE SHEAR * ; LAB VANE SHEAR X ; UNCONF COMP STRENGTH (q_u) k.s.f.	%
75.7								
105'0" / 74.0			S4	AXT RC		100		
106'9"	End of Borehole							

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 4

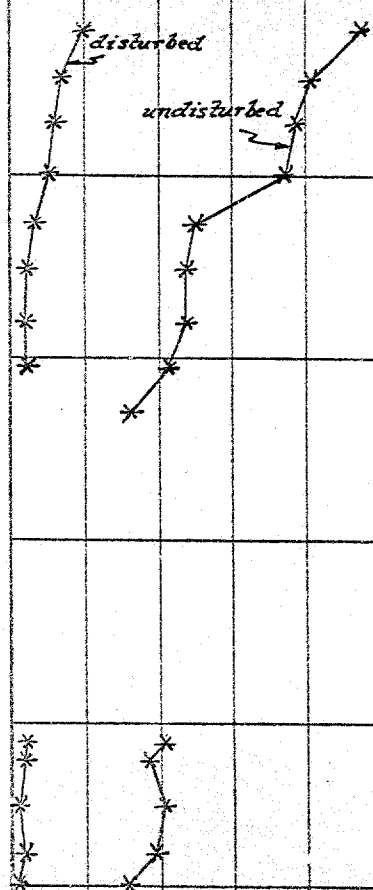
PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 8 - Con. II - Sta. 900+205 21.9' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX

DRILLING DATE 14 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
181.5 / 0'0"	Ground Surface					
176.5 / 5'0"						
171.5 / 10'0"						
166.5 / 15'0"						
161.5 / 20'0"			1	TP	PM	77
			2	TP	PM	95
			3	TP	PM	93
156.5 / 25'0"			4	TP	PM	92
			5	TP	PM	79
			6	TP	PM	24
151.5 / 30'0"						
146.5 / 35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.



CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 4

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FT (N)	% RECOVERY
146.5						
35'0"						
141.5						
40'0"						
136.5						
45'0"						
131.5						
50'0"						
126.5						
55'0"			7	SS	38	65
122.5			8	SS	74	0
59'0"	End of borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 5

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 8 - Con II - Sta. 898+16.5 1.8' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX, BX

DRILLING DATE 10 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
185.1 / 0'0"	Ground Surface					
0'7"	Topsoil - organic clayey-silt					
1'2"	▽ observed G.W.L.		1	SS	11	33
			2	SS	9	73
			3	TP	PM	100
			4	TP	PM	86
180.1 / 5'0"	Silty-clay & Clay brown to gray-brown desiccated firm to hard		5	TP	PM	80
			6	TP	PM	78
			7	TP	PM	100
			8	TP	PM	93
			9	TP	PM	83
175.1 / 10'0"			10	TP	PM	93
			11	TP	PM	77
12'6"			12	TP	PM	100
			13	TP	PM	100
170.1 / 15'0"			14	TP	PM	99
	Clay gray - pink banded non - desiccated soft to firm occ. brown layer black organic streaks through out		15	TP	PM	100
			16	TP	PM	100
165.1 / 20'0"			17	TP	PM	100
			18	TP	PM	99
			19	TP	PM	100
160.1 / 25'0"			20	TP	PM	100
	silty-sand layers -: 1'6" 36'6" to 38'0" 1'6" 43'9" to 45'3"		21	TP	PM	100
			22	TP	PM	100
	occ. silt partings		23	TP	PM	98
155.1 / 30'0"			24	TP	PM	96
			25	TP	PM	100
			26	TP	PM	100
150.1 / 35'0"			27	TP	PM	100

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

20 40 60 80 %

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 5

PROJECT _____ DRILLING DATE _____
LOCATION _____ REPORT DATE _____
DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____
SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
150.1						
35'0"			27	TP	PM	100
			28	TP	PM	100
			29	TP	PM	75
			30	SS	10	100
145.1						
40'0"			31	TP	PM	100
			32	TP	PM	100
			33	TP	PM	100
140.1			34	TP	PM	97
45'0"			35	TP	PM	100
			36	TP	PM	100
			37	TP	PM	100
135.1						
50'0"			38	TP	PM	97
			39	TP	PM	98
			40	TP	PM	100
130.1			41	TP	PM	100
55'0"						
56'3"			42	TP	PM	95
			43	SS	81	60
			44	WS		
			45	WS		
125.1			46	WS		
60'0"	Glacial Till heterogeneous mixture of clay, silt, sand, & gravel		47	SS		83
			48	WS		
			49	SS		44
120.1						
65'0"			50	SS	46	30
			51	SS	21	74
			52	ST		
			53	WS		
			54	SS	50	46
			55	WS		
115.1			56	WS		
70'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) K.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

20 40 60 80 %

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 5

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FT (N)	% RECOVERY
115.1						
70'0"			57	WS		
			58	WS		
			59	WS		
110.1			60	SS	79	80
75'0"			61	WS		
			62	WS		
			63	WS		
105.1			64	SS	160	61
80'0"			65	WS		
			66	WS		
			67	WS		
			68	WS		
100.1			69	SS	90	49
85'0"						
95.1			70	SS	483	100
90'0"						
90.1			71	SS	140/6"	100
95'0"					300/2"	
89.0			72	SS	700/6"	100
97'2"	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W) ——▶◀——
LIQUID LIMIT (W_l) ——○——
PLASTIC LIMIT (W_p) ——|——

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 5A

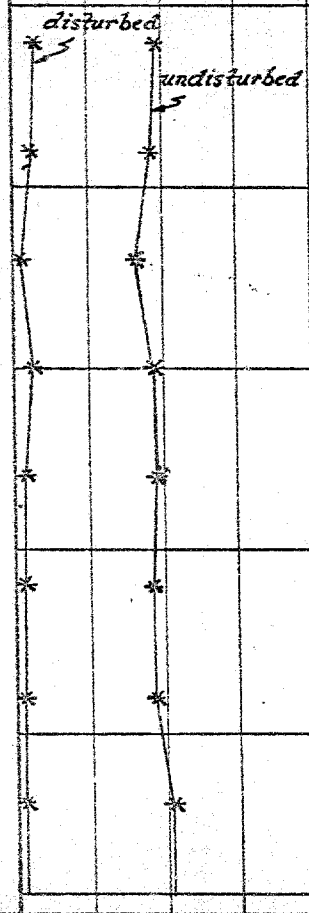
PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 8 - Con. II - Sta. 898+18.5-18.1'W ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX

DRILLING DATE 22 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FT (N)	% RECOVERY
185.1	Ground Surface					
0'0"			1	SS	9	63
			2	SS	17	50
180.1						
5'0"						
175.1						
10'0"						
170.1						
15'0"						
165.1						
20'0"						
160.1						
25'0"						
155.1						
30'0"						
150.1						
35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.



CONSISTENCY :
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 5A

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

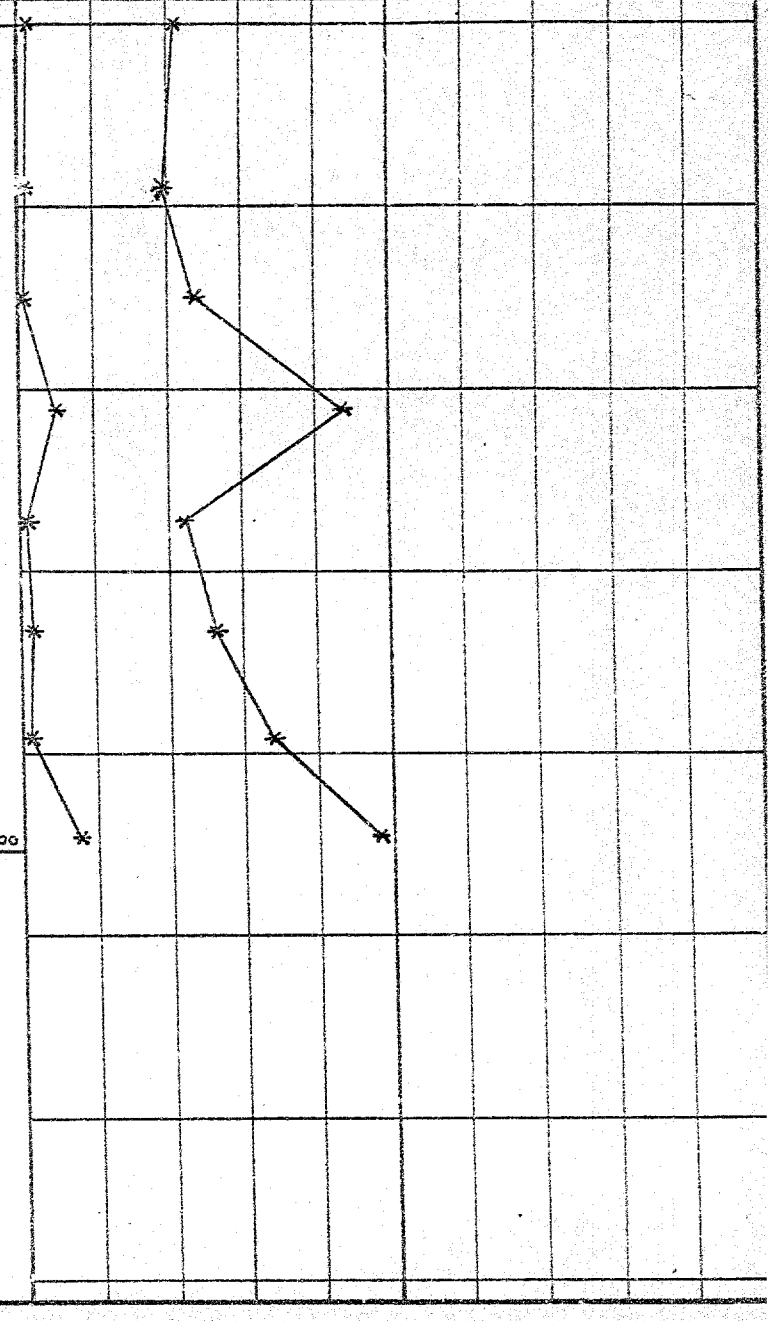
SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT (N)	SAMPLES % RECOVERY
150.1						
35'0"			3	SS	16	
145.1						
40'0"						
140.1						
45'0"						
135.1						
50'0"						
130.1						
55'0"						
127.4			4	SS	100/3"	100
57'8"	End of borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY :
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%



FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 6A

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 8 - Con. II - Sta. 900+98.5. 8' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX

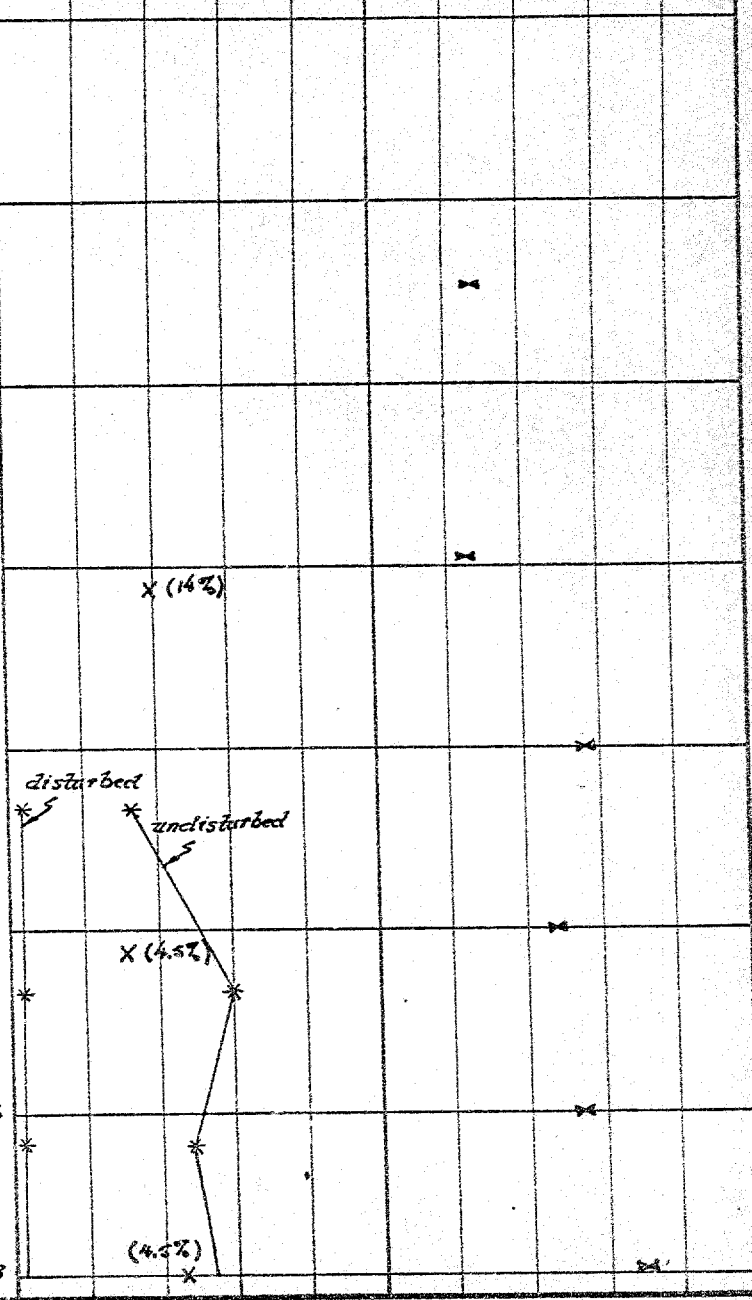
DRILLING DATE 17 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
166.2	Ground Surface ▽					
0'0"	Topsoil - organic sandy-silt					
	observed G.W.L. at surface		1	SS	5	77
	Silty - sand organic Alluvium		2	SS	17	69
161.2 / 5'0"			3	SS	PM	97
			4	TP	PM	92
8'0"						
156.2 / 10'0"	Silty - clay Brown - stratified soft to firm Alluvium		5	SS	10	95
			6	SS	3	70
12'6"			7	SS	PM	100
151.2 / 15'6"			8	TP	PM	94
	Clay gray - pink banded non - desiccated soft to firm occ. brown layer black organic streaks throughout traces of silt and fine sand		9	TP	PM	97
146.2 / 20'0"						
			10	TP	PM	97
141.2 / 25'0"						
			11	TP	PM	96
136.2 / 30'0"						
			12	TP	PM	93
131.2 / 35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
~~VANE SHEAR~~ Quick Triaxial X(ε)
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %



FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 64

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT (N)	SAMPLES % RECOVERY
131.2						
35'0"						
126.2			13, 14	TP SS	PM	74
40'0"						
40'6"	Glacial Till heterogeneous mixture of clay, silt, sand, & gravel		15	SS	55	35
121.2			16	SS	45	0
45'0"						
			17	WS		
116.6						
49'7"	End of borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 6B

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 8 - Con. II - Sta. 901+79.4 - 9.8' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX

DRILLING DATE 19 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
165.5	Ground Surface					
0'0"	Topsoil - organic silty - clay		1	SS	15	30
0'7"			2	SS	13	25
160.5						
5'0"	Silty - clay brown - stratified very soft to firm Alluvium		3	SS	PM	100
155.5						
10'0"			4	SS	PM	95
150.5						
15'6"						
145.5						
20'0"			5	SS	3	75
20'10"	Alluvium Silty - sand stratified occ. layers of silty-clay clayey silt, & clay organic content - peat twigs, roots, wood chunks					
140.5						
25'0"			6	SS	4	0
135.5						
29'6"						
30'0"	Clay gray - pink banded firm		7	TP	PM	90
130.5						
35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

disturbed
undisturbed

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 6B

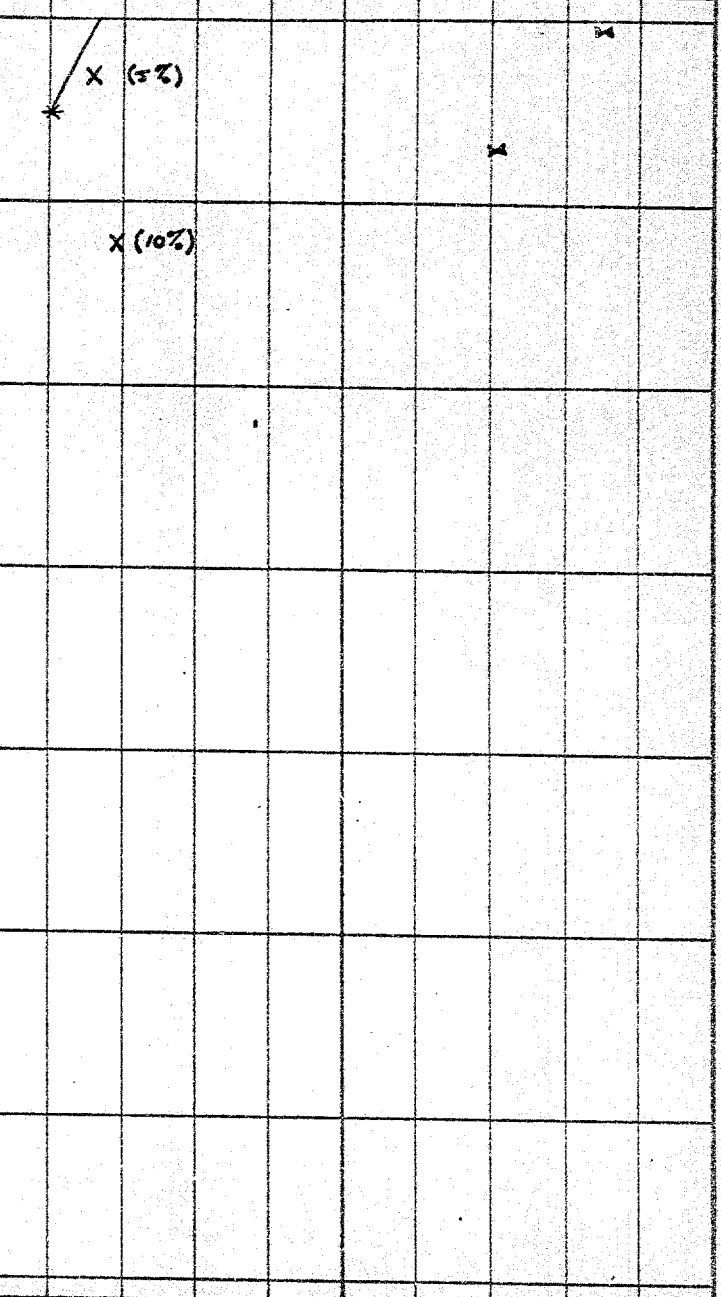
PROJECT _____ DRILLING DATE _____
LOCATION _____ REPORT DATE _____
DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____
SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FT (N)	% RECOVERY
130.5						
35'0"			8	TP	PM	100
			9	TP	PM	100
125.5						
40'0"			10	SS	74	100
40'6"	Glacial Till		11	SS	35	43
122.0						
43'6"	End of borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
~~LAB VANE SHEAR~~ Quick Triaxial X (ε)
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%



FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 7

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 7 - Con. III - Sta. 904+90.9 - 168' LT ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX, BX, AX, AXT Core

DRILLING DATE 18 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY	DYNAMIC PENETRATION RESISTANCE BLOWS/FT. / STRENGTH
156.0 / 0'0"	Ground Surface 7						
0'0"	Topsoil - organic sandy-silt	~~	1	SS	3	29	
0'7"	Clay & silty-clay brown to gray-brown desiccated soft to firm		2	SS	7	22	
151.0 / 5'0"			3	SS	6	30	
			4	SS	3	80	
7'0"			5	TP	PM	100	X (7%)
146.0 / 10'0"			6	TP	PM	91	
	Clay gray - pink banded non-desiccated soft to stiff occ. brown layer black organic streaks throughout silty-sand layer:- 1'9" 20'9" to 22'6" occ. silt partings		7	TP	PM	99	X (3%)
			8	TP	PM	100	
141.0 / 15'0"			9	TP	PM	100	X (5%)
			10	TP	PM	100	
			11	TP	PM	100	X (5%)
			12	TP	PM	99	
136.0 / 20'0"			13	TP	PM	95	X (4%)
			14	TP	PM	86	
			15	TP	PM	100	X (5%)
131.0 / 25'0"			16	TP	PM	98	
			17	TP	PM	100	X
			18	TP	PM	100	
126.0 / 30'0"			19	TP	PM	100	X
			20	TP	PM	100	
			21	TP	PM	99	X
121.0 / 35'0"			22	TP	PM	100	

STRENGTH
FIELD VANE SHEAR *
~~LAB VANE SHEAR~~ Quick Triaxial X (ϵ)
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 7

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
121.0						
35'0"			22	TP	PM	100
			23	TP	PM	96
			24	TP	PM	92
			25	SS	28	32
116.0	39'6"					
40'0"			26,	SS	66	30
			27	SS		17
			28	SS	32	30
111.0						
45'0"			29	SS	50	33
	Glacial Till					
	heterogeneous mixture of clay, silt, sand, & gravel		30	SS	123	60
106.0			31	SS	200	0
50'0"			32,	SS	250	90
	boulders from -: 51'6" to 54'0" and 57'0" to 60'0"		33, 34	SS, WS	250	44
			35	AXT RC		27
101.0						
55'0"			36	SS	270	95
			37	SS	158	55
			38	AXT RC		0
96.0			39	AXT RC		0
60'0"						
			40	SS	140	50
			41	SS	90	60
			41A	WS		
91.0						
65'0"			42	SS	140	90
			43	SS	135	91
			44	SS	142	81
86.0						
70'0"	69'4" Bedrock		45	AXT RC		100

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) K.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 7

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FT (N)	SAMPLES: % RECOVERY
86.0						
70'0"						
	Bedrock		45	AXT RC		100
81.0						
75'0"	*Limestone with shale impurities and intermittent thin shale seams*		46	AXT RC		100
76.0						
80'0"			47	AXT RC		100
73.5						
82'6"	*End of borehole*					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 8

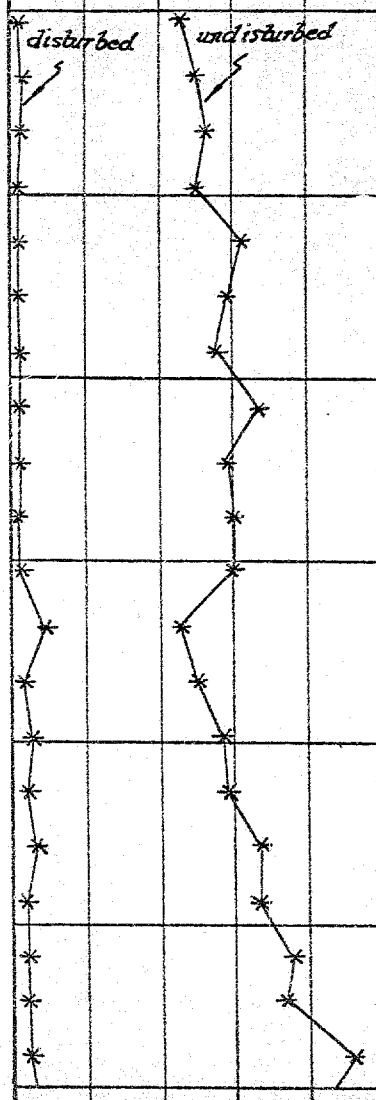
PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 7 - Con. III. - Sta. 904+93.1 - 32.7' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX

DRILLING DATE 24 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
156.4 / 0'0"	Ground Surface 7		1	SS	3	17
			2	SS	4	37
151.4 / 5'0"						
146.4 / 10'0"						
141.4 / 15'0"						
136.4 / 20'0"						
131.4 / 25'0"						
126.4 / 30'0"						
121.4 / 35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.



CONSISTENCY :
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 8

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

SOILS PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS/FT.	CONSISTENCY :
Elev. / Depth	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY	STRENGTH FIELD VANE SHEAR * LAB VANE SHEAR X UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.	NATURAL MOISTURE CONTENT (W) ⟶ LIQUID LIMIT (W_l) —○— PLASTIC LIMIT (W_p) ⟷ %
121.4								
35'0"								
116.4			3	SS	28	33		
115.9								
40'6"	End of borehole							

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 9

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 7 - Con. III - Sta 905+73.6 18.3' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX, BX, AX, AXT core

DRILLING DATE 18 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY	DYNAMIC PENETRATION RESISTANCE BLOWS/FT. / STRENGTH
177.4	Ground Surface						
0'0"	Topsoil - organic v. fine sand						
0'6"			1	SS	2	44	
	Alluvium		2	SS	15	46	
	Silty - sand						
172.4	organic						
5'0"			3	TP	PM	56	
167.4							
10'0"							
12'6"			4	SS	PM	95	
162.4							
15'0"			5	TP	PM	100	X (6%)
			6	TP	PM	89	
	Clay		7	TP	PM	100	X (4%)
157.4			8	TP	PM	100	
20'0"	gray - pink banded		9	TP	PM	100	X (4%)
	non - desiccated		10	TP	PM	97	
	soft to stiff		11	TP	PM	100	X (5%)
	sandy - silt layers:						
152.4	1'8" 42'10" to 44'6"		12	TP	PM	89	
25'0"	occ. silt partings		13	TP	PM	98	X (5%)
			14	TP	PM	100	
147.4			15	TP	PM	100	X (5%)
30'0"			16	TP	PM	98	
			17	TP	PM	92	X (6%)
142.4			18	TP	PM	100	
35'0"							

STRENGTH
FIELD VANE SHEAR *
~~LAB VANE SHEAR~~ Quick Triaxial X (ϵ)
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 9

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
142.4						
35'0"			18	TP	PM	100
			19	TP	PM	100
			20	TP	PM	100
137.4			21	TP	PM	100
40'0"			22	TP	PM	100
			23	TP	PM	100
			24	TP	PM	81
132.4						
45'			25	TP	PM	95
			26	TP	PM	100
			27	TP	PM	100
127.4			28	TP	PM	100
50'0"			29	TP	PM	90
			30	TP	PM	37
			31	TP	PM	2
122.4						
55'0"			32	TP	PM	99
			33	TP	PM	95
57'6"			34	TP	PM	86
			35	SS	48	52
117.4						
60'0"	Glacial Till heterogeneous mixture of clay, silt, sand, & gravel					
			36	SS	116	22
112.4						
65'0"			37	WS		
			38	SS	70	13
107.4						
70'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH

FIELD VANE SHEAR *

~~LAB VANE SHEAR~~ Quick Triaxial X(ε)

UNCONF COMP STRENGTH (q_u)

0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY :

NATURAL MOISTURE CONTENT (W)

LIQUID LIMIT (W_l)

PLASTIC LIMIT (W_p)

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 9

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
107.4						
70'0"			38	SS	70	13
102.4			39	SS	79	40
75'0"						
97.4			40	SS	63	33
80'0"						
			41	SS	144	87
92.4						
85'0"			42	SS	550	55
			43	WS		
87.4						
90'0"			44	SS	143	91
91'1"			45	AXT RC		21
82.4	Bedrock					
95'6"	Limestone with shale impurities and intermittent thin shale seams.		46	AXT RC		100
77.4						
100'6"			47	AXT RC		100
74.9						
102'6"	End of borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 10

PROJECT South Nation River Bridge — DRILLING DATE 25 Mar 71

LOCATION Township of Cambridge - Lot 7. Con III - Sta. 905+96.3 - 37.4'U/S — REPORT DATE 20 Apr 71

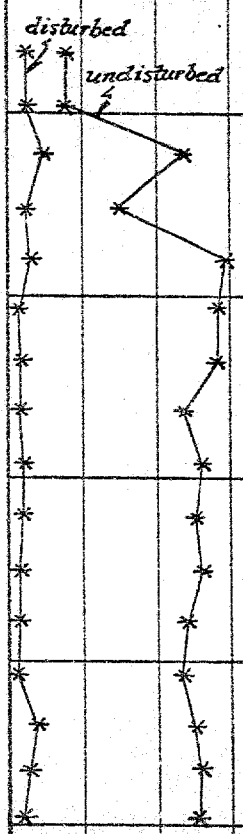
DATUM Geodetic — BOREHOLE TYPE Wash — DRAWN BY G.M.

SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX — CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
177.3	Ground surface					
0'0"			1	SS	3	29
172.3						
5'0"			2	SS	4	67
167.3						
10'0"			3	SS	2	92
162.3						
15'0"						
157.3						
20'0"						
152.3						
25'0"						
147.3						
30'0"						
142.3						
35'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.



CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 10

PROJECT _____ DRILLING DATE _____

LOCATION _____ REPORT DATE _____

DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____

SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT (N)	% RECOVERY
142.3 / 35'0"						
137.3 / 40'0"						
			4	SS		93
132.3 / 45'0"			5	SS		100
127.3 / 50'0"						
122.3 / 55'0"						
120.4 / 56'11"	End of borehole ✓					

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u)
0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

%

FONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 11

PROJECT South Nation River Bridge
LOCATION Township of Cambridge - Lot 7 - Con III - Sta. 906+93.9 20.3' Lt ℄
DATUM Geodetic BOREHOLE TYPE Wash
SAMPLER HAMMER WEIGHT 140 lb. DROP 30 inches BOREHOLE DIA. NX

DRILLING DATE 24 Mar 71
REPORT DATE 20 Apr 71
DRAWN BY G.M.
CHECKED BY E.B.F.

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
187.6 / 0'0"	Ground surface					
0'0"	Topsoil - organic sandy-silt		1	SS	3	83
	Sand layers of silt and clayey-silt		2	SS	13	100
182.6 / 5'0"			3	SS	6	100
7'0"	Clay & silty-clay brown to gray-brown desiccated soft to firm		4	TP	PM	91
177.6 / 10'0"			5	TP	PM	90
12'9"			6	TP	PM	100
172.6 / 15'0"	Clay gray - pink banded non-desiccated firm to stiff occ. brown layer black organic streaks throughout sandy-silt layer -: 1'6" - 54'0" to 55'6" occ. silt partings		7	TP	PM	99
			8	TP	PM	100
167.6 / 20'0"			9	TP	PM	100
162.6 / 25'0"			10	TP	PM	100
			11	TP	PM	100
157.6 / 30'0"			12	TP	PM	100
152.6 / 35'0"			13	TP	PM	97

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) 0.5 1.0 1.5 2.0 k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)
20 40 60 80 %

TONDEX LTD.
FOUNDATION ENGINEERS

RECORD OF BOREHOLE 11

PROJECT _____ DRILLING DATE _____
LOCATION _____ REPORT DATE _____
DATUM _____ BOREHOLE TYPE _____ DRAWN BY _____
SAMPLER HAMMER WEIGHT _____ lb. DROP _____ inches BOREHOLE DIA. _____ CHECKED BY _____

Elev. / Depth	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT (N)	% RECOVERY
152.6						
35'0"			13	TP	PM	99
			14	TP	PM	100
147.6						
40'0"			15	TP	PM	100
			16	TP	PM	100
142.6						
45'0"			17	TP	PM	99
137.6						
50'0"			18	TP	PM	100
132.6						
55'0"			19	TP	PM	90
			20	TP	PM	100
127.6						
60'0"			21	TP	PM	100
			22	TP	PM	99
122.6						
65'0"			23	TP	PM	100
	Till at 68'5" ±					
117.6	End of Borehole 70'9" ±		24	TP	50	100
70'0"						

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

STRENGTH
FIELD VANE SHEAR *
LAB VANE SHEAR X
UNCONF COMP STRENGTH (q_u) k.s.f.

CONSISTENCY:
NATURAL MOISTURE CONTENT (W)
LIQUID LIMIT (W_l)
PLASTIC LIMIT (W_p)

%

FIELD RECONNAISSANCE REPORT
REQUIRED BY FOUNDATION SECTION
FOR

FF-69
SEPT. 1968

W.P. NO. 35-66-15 HIGHWAY NO. 417 DISTRICT 9 SITE PLAN NO. E-4685-1 (WBL) E-4684-1 (EBL) PROFILE NO. C-327-3-4
RIVER CROSSING ☒ GRADE SEPERATION ☐ R.R.X. ☐ OTHER (SPECIFY) Township Roads
ALTERNATE SCHEME (IF ANY)

EXISTING SITE CONDITIONS

DESCRIPTION:

TOPOGRAPHY: HILLY ☐ ROLLING ☐ VALLEY ☐ GULLIED ☐ FLAT, ☒
VEGETATION: TREES ☒ BRUSH ☐ GRASS ☒ SWAMP ☐ FARM CROPS ☒ CLEARED ☐
SNOW COVER: 0"-6" ☐ 6"-12" ☐ >12" ☐ Vegetation along east shore
ROCK OUTCROP (SPECIFY LOCATIONS) None visible

UNDERGROUND UTILITIES:

	UTILITY COMPANY	TELEPHONE NO. FOR DEFINITE LOCATION
1	None	
2		
Aerial 3	Telephone & Hydro wires - east side of river (40' E of Rd.)	
4		
5		

EXISTING STRUCTURE(S): N/A

FOUNDATIONS: SPREAD FOUNDATIONS ☐ SIZE ELEVATION(S)
PILES ☐ TYPE LENGTH(S)
DESIGN LOAD T.S.F. TONS/PILE
CONDITION OF STRUCTURE

APPROACHES: CUT ☐ FILL ☐ SIDE SLOPES
BERMS YES ☐ NO ☐

OTHER OBSERVATIONS (USE BACK OF SHEET TO DESCRIBE ANY FAILURES IN AREA, PAST PERFORMANCE OF EXISTING APPROACHES & STRUCTURE, ETC.)

ACCESSIBILITY

IS STRUCTURE LOCATED ON D.H.O. RIGHT OF WAY? YES ☐ NO ☒ IF NO,
HAS PERMISSION BEEN OBTAINED TO ENTER PROPERTY? YES ☒ &NO ☒ IFNO,
PROPERTY OWNER(S):

	NAME	ADDRESS	TELEPHONE NO.
1	The Agricultural Rehabilitation & Development Directorate of Ont.	?	
~~2~~			
2 ~~3~~	Laurent Racine	?	
* SURVEY ONLY 3 ~~4~~	Casey & Gaetanne De Vocht	R.R. 4, Casselman	764-2092

WHO WILL OBTAIN NECESSARY PERMISSION? Property Section, Eastern Region
HAS SITE BEEN SURVEYED & STAKED? YES ☒ NO ☐ IF YES, DATE OF MOST RECENT SURVEY
WILL CLEARING BE NECESSARY TO ENTER SITE AREA? YES ☒ NO ☐ along east shore
IS SITE ACCESSIBLE TO WHEELED VEHICLES? YES ☒ NO ☐

IF RIVER CROSSING:
WILL A RAFT BE NECESSARY? YES ☒ NO ☐ IF YES, GIVE MAX. DEPTH OF WATER Approx. 20 FT
CURRENT: SWIFT ☐ MODERATE ☐ SLOW ☒

DRILLING OPERATIONS

NEAREST SOURCE OF WATER (GIVE HAULING DISTANCE, IF KNOWN) At site
ADDITIONAL INVESTIGATION REQUIRED FOR THE FOLLOWING PURPOSES:
ALTERNATE SCHEME: YES ☐ NO ☒ IF YES, SPECIFY
HYDROLOGIC REASONS: YES ☐ NO ☐ IF YES, SPECIFY (SCOUR, ETC.)

REMARKS

NEAREST AVAILABLE ACCOMODATION: Hotels in Casselman, approx. one mile east from site.
OTHER COMMENTS:

DATE December 3, 1969
REGIONAL BRIDGE Planning & LOCATION ENGINEER

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE Casselman BOREHOLE No. (1) GROUND EL

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH D
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4.5	—	—	0	Tr	100	High	shiny	None	High	Earthy	Reddish Brown - Grey	None	V. Stiff	(desiccated) Clay, v. thin silt or	
2	5.5-7.0	# 140	—	0	Tr	100	"	"	"	"	"	"	"	"	desiccated clay; occ.	
4	12-13½	—	—	—	0	100	"	"	"	"	"	"	"	Stiff	desicc. silty clay to	

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES R

REMARKS:— Sa. 1, 2 & 4 have blocky structure & are quite "brittle"

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

Casselman BOREHOLE No. (1) GROUND ELEVATION

NE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ay	None	High	Earthy	Reddish Brown - Grey	None	V. Stiff	(desiccated) Clay, v. thin silt or f. sand partings	CH
	"	"	"	"	"	"	desiccated clay; occ. f sand pockets	CH
	"	"	"	"	"	Stiff	desicc. silty clay to clay.	CL-CH

OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

ky structure & are quite "brittle"

FF 22

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE Casselman BOREHOLE No. (2) GROUND ELE

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DES
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	3-4½	—	—	0	0	100	high	shiny	None	High	Earthy	Reddish Brown Grey	None	v. Stiff	desiccated clay.
2	6-7½	—	—	0	0	100	"	"	"	"	"	"	slow	"	" "
4	12-13½	—	—	0	0	100	"	"	"	"	"	"	None	Firm	clay - boundary of de
11	47-48½	1"	sub-angular	Tr	95	5	none	dull	Quick	—	"	Grey	slow	—	Medium Sand - uniformly
12	50-51½	½"	angular	Tr	95	5	"	"	"	—	"	"	"	—	" " "
13	55-56½	½"	"	Tr	95	5	"	"	"	—	organic & acid.	"	"	—	Sand - med-crse; very slightly

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES RE

REMARKS:-

AT RC: 68.5-73.5 Rc = 100% Shaley L.S. SOUND. ~~Shale~~ seams

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

SITE Casselman BOREHOLE No. (2) GROUND ELEVATION

ON / NTAGE SILT & CLAY	DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
100	high	shiny	None	High	Earthy	Reddish Brown Grey	None	v. Stiff	desiccated clay.	CH
100	"	"	"	"	"	"	slow	"	" "	CH
100	"	"	"	"	"	"	None	firm	clay - boundary w/ desiccated Zone @ 12.5'	CH
5"	none	dull	Quick	—	"	grey	slow	—	Medium Sand - uniformly graded; Tr. Gravel	SP
5"	"	"	"	—	"	"	"	—	" " " " " " & silt	SP
5"	"	"	"	—	organic w/acid.	"	"	—	Sand - med - crse; very slightly organic, Tr. odd Gravel	SP

ST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

315 Rec = 100% Shaley L.S. SOUND. w/shale seams, slightly fossiliferous

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DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE Casselman BOREHOLE No. (5) GROUND E

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE GRAVEL	PERCENTAGE SAND	PERCENTAGE SILT & CLAY									
1	3-4½	#100	—	0	20	80	med	Shiny	none	med	Earthy	mottled Grey	none	Stiff	clayey Silt with San
2	6-7½	—	—	0	0	100	High	"	"	"	"	Red Br. Gr	"	"	clay, desiccated
3	9-10½	—	—	0	0	100	High	Shiny	none	med	"	Reddish Br. & Grey	"	Firm	clay, slightly desi
9	40-41½	½"	angular	5	95	5	Non	dull	Quick	—	"	Grey	Slow	—	fine-med Sand, odi g
10	50-51½	1"	angular	40	30	30	med		"	low	"	"	Strong		Mixt. Silt, Sand & grav
11	55-55.3	1"	"	40	30	30	low	dull	"	"	"	"	"		" " " "

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:-

A+T RC: 58.3–65.7. Rec 99%. Sound Shaley LS occ. shal slightly fos

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MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

SITE Casselman BOREHOLE No. (5) GROUND ELEVATION

STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ed	Shiny	none	med	Earthy	Mottled Grey	none	Stiff	clayey Silt with Sand, desiccated.	CL-CL
	"	"	"	"	"	"	"	" " " " " } Boundary @ 6.5' depth.	CL
gh	"	"	"	"	Red Br. Cl	"	"	clay, desiccated. } @ 6.5' depth.	CH
gh	Shiny	none	med	"	Reddish Br. & Grey	"	Firm	clay, slightly desiccated.	CH
ore	dull	Quick	—	"	Grey	Slow	—	Fine-med sand, odd gravel, occ. small cohesive pieces of glacial Till	SP
d	—	"	low	"	"	Strong		Mixt. Silt, Sand & gravel w/some clay	CL ML
w	dull	"	"	"	"	"		" " " " " "	CL-ML

RRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

1. Rec 99%. Sound Shaley LS occ. shale seams, slightly fossiliferous

FF 22

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING DIVISION

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE _____ BOREHOLE No. (6) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WIT
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	3-5	-	-	0	10	90	med	dull	none	high	Earthy	mottled Brown & Rusty	no.	Stiff	CLAYEY SILT WITH S
2	5-7	—	—	0	15	85	"	"	"	"	"	mottled Grey Rust streaks	"	"	CLAYEY SILT SOME W/L SA
3	7-9	—	—	0	5	95	low	"	"	low	org.	Grey & DK. Brown	"	Firm	ORGANIC SILT STRE (estimate 50% O
4	9-11	—	—	0	0	100	high	Shiny	"	"	Earthy	Grey	"	"	CLAY OR SILTY CL
5	11-13	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CL
6	13-15	—	—	0	0	100	"	"	"	"	"	"	"	"	CLAY - SILTY CL
7	17-19	—	—	0	0	100	"	"	"	"	"	"	"	"	CLAY - SILTY CL
									"						

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLE

REMARKS:-

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MATERIALS AND TESTING DIVISION

VISUAL CLASSIFICATION SHEET

SITE _____ BOREHOLE No. (6) GROUND ELEVATION _____

DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
med	dull	none	high	Earthy	mottled Brown & Rusty	no.	Stiff	CLAYEY SILT WITH SOME SAND; desiccated	CL
"	"	"	"	"	mottled Grey & Rust streaks	"	"	CLAYEY SILT w/ SOME SAND; desiccated	CL
low	"	"	low	org.	Grey & Dk. Brown	"	Firm	ORGANIC SILT STREAKED w/ GREY CLAY (estimate 50% ORG SILT, 50% CLAY BY VOLUME).	OL/CH
high	Shiny	"	"	Earthy	GREY	"	"	CLAY OR SILTY CLAY; Tr. org mottling	CI CH
"	"	"	"	"	"	"	"	SILTY CLAY - CLAY; org. mottling	"
"	"	"	"	"	"	"	"	CLAY - SILTY CLAY; org. mottling	"
"	"	"	"	"	"	"	"	CLAY - SILTY CLAY; org mottling	"

CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F118 SITE _____ BOREHOLE No. (7) GROUND EL

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DE
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-5	—	—	0	15	85	med	dull	none	med	Earthy	Rusty Brown	no	Stiff	CLAYEY SILT w/ Som	
2	5-7	—	—	0	10	90	"	"	"	"	"	"	"	"	CLAYEY SILT w/ T	
3	7-9	—	—	0	0	100	low	"	"	low	org.	Dk. Br to Black	"	Firm	ORGANIC SILT - M	
4	9-11	—	—	0	0	100	"	"	"	"	"	"	"	"	ORGANIC SILT - M	
5	11-13	—	—	0	0	100	"	"	"	"	"	"	"	"	ORGANIC SILT -	
6	13-15	—	—	0	0	100	med	Shiny	none	low	Earthy	Grey w/ Black mottling	No	Soft	SILTY CLAY - CLAY, org	
7	15-17	—	—	0	0	100	"	"	"	"	"	"	"	Firm	SILTY CLAY - CLAY, or	
8	17-19	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CLAY, o	
9	19-21	—	—	0	0	100	"	"	"	"	"	"	very weak	"	SILTY CLAY - CLAY, o	

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES R

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

TE _____ BOREHOLE No. (7) GROUND ELEVATION _____

SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
dull	none	med	Earthy	Rusty Brown	NO	Stiff	CLAYEY SILT w/ SOME SAND; desiccated	CL
"	"	"	"	"	"	"	CLAYEY SILT w/ TR. SAND; desiccated	CL
"	"	low	org.	DK. Br to Black	"	Firm	ORGANIC SILT - MUCK; TR. DEC. WOOD	OL
"	"	"	"	"	"	"	ORGANIC SILT - MUCK. TR. WOOD	OL
"	"	"	"	"	"	"	ORGANIC SILT - MUCK	OL
Shiny	none	low	Earthy	Grey w/ Black mottling	No.	Soft	SILTY CLAY - CLAY, org. mottling	CI CH
"	"	"	"	"	"	Firm	SILTY CLAY - CLAY, org. mottling	CI CH
"	"	"	"	"	"	"	SILTY CLAY - CLAY, org. mottling	CI CH
"	"	"	"	"	Very weak	"	SILTY CLAY - CLAY; org. mottling Tr. Shell fragments	CI CH

IED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F 118 SITE _____ BOREHOLE No. (8) GROUND EL

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH D
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	3-5	¼	—	0	10	90	High	Shiny	None	Med	Earthy	Brown w/ Dk. Br ochre mott.	No	Stiff	CLAY w/ numerous V. Smal desicca
2	6-8	—	—	0	5	95	"	"	"	"	"	Brown to Grey	"	"	CLAY - grey portion has org
3	8-10	—	—	0	Tr	100	low	dull	None	V. low	organ	Dark Brown	"	Soft	ORGANIC SILT — M
4	10-12	—	—	0	Tr	100	low	"	"	"	"	"	"	"	ORGANIC SILT = MU
5	12-14	—	—	0	Tr	100	"	"	"	"	"	"	"	"	ORGANIC SILT - MUC
6	14-16	#40	-	0	25	75	"	"	Quick	low	organ.	Grey to Dk Brn	"	"	ORGANIC SILT w/ some SA
7	16-18	—	—	0	0	100	high	shiny	None	low	Earthy	Grey	"	Firm	SILTY CLAY - CLAY,
8	18-20	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CLAY;

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES R

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

SITE _____ BOREHOLE No. (8) GROUND ELEVATION _____

	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
	Shiny	None	Med	Earthy	Brown w/ Dk. Br Oshire Mott.	No	Stiff	CLAY w/ numerous V. small sand pockets desiccated & mottled	CH
	"	"	"	"	Brown to Grey	"	"	CLAY - grey portion has org. mottling. Transition zone	CH
	dull	None	V. low	ovgan	Dark Brown	"	Soft	ORGANIC SILT - MUCK Tr wood frags	OL OM
	"	"	"	"	"	"	"	ORGANIC SILT - MUCK Tr wood frags	OL - OM
	"	"	"	"	"	"	"	ORGANIC SILT - MUCK	OL OM
	"	Quick	low	organ.	Grey to Dk Brn	"	"	ORGANIC SILT w/ some SAND; Pdry w/ clay?	OL
	Shiny	None	low	Earthy	Grey	"	Firm	SILTY CLAY - CLAY; org. mottling	CI - CH
	"	"	"	"	"	"	"	SILTY CLAY - CLAY; slight ovg. mottling	CI CH

IRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE Cassel man BOREHOLE No. (9) GROUND ELE

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DES
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	0-2	—	—	0	5	95	med	Shiny	none	low	Earthy	mottled Brown	none	firm	Clayey Silt w/ Tr. Sand
2	2-4	—	—	0	15	85	"	"	"	"	"	"	Slow	"	Clayey Silt w/ occ. Sand
3	4-6	—	—	0	10	90	"	"	"	low occ. high	"	"	none	firm occ. stiff	clayey Silt w/ T
4	6-8	—	—	0	20	80	"	"	none	med	"	mott. RB	None	Firm	mott. Red-Br. to Grey clayey
		—	—	0	15	85		dull		V low	org.	Black		Soft	organic Silt w/
5	8-10	—	—	0	Tr	100	low	dull	slow to none	v low	"	"	"	soft	org. Silt w/ dec. wood
6	10-12	—	—	0	0	100	"	"	none	"	"	"	"	"	" " "
7	12-14	—	—	0	0	100	med	Shiny	"	"	org & Earthy	Red-Brown	"	V Soft	Bldy. clay & org
8	14-16	—	—	0	0	100	high	"	"	low	Earthy	Grey	none	Soft	Grey clay, blocky
9	41½-43	—	—	0	20	80	none to low	dull	Quick	—	"	"	strong	—	Fine Sandy SILT

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES RE

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

Cassolman BOREHOLE No. (9) GROUND ELEVATION

DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
none	low	Earthy	mottled Brown	none	firm	Clayey Silt w/ Tr. Sand; roots – topsoil Bdry	CL
"	"	"	"	slow	"	Clayey Silt w/ occ. Sand pockets	CL
"	low occ. high	"	"	none	firm occ. stiff	clayey Silt w/ Tr. Sand. laminated mottling	CL
none	med	"	mott. RB	None	Firm	mott. Red-Br. to Grey clayey silt w/ Sand.	CL
	v low	org.	Black		soft	organic Silt w/ dec wood frags.	OL
slow to none	v low	"	"	"	soft	org. Silt w/ dec. wood pieces;	OL
none	"	"	"	"	"	" " " "	OL
"	"	org & Earthy	Red-Brown	"	V soft	Bdy. clay & org. Silt – Poor SAMPLE	CH
"	low	Earthy	Grey	none	Soft	Grey clay. Blocky structure, Sensitive	CH
Quick	–	"	"	strong	–	Fine Sandy SILT	SM

T ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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VISUAL CLASSIFICATION SHEET

PROJECT 69F118 SITE _____ BOREHOLE No. 1 (10) GROUND EL

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DI
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1A	3-5	-	-	0	15	85	Med	dull	None	med	Earthy	Grey mott.	No	soft firm	CLAYEY SILT-TR. SAND;
1B	3-5	-	-	0	15	85	"	"	"	"	"	Grey slight mott.	"	firm	CLAYEY SILT W/THIN SAND SE
2	5-7	-	-	-	-	100	low	"	"	low	org.	DK. BR. BLACK	"	soft	ORGANIC SILT-MUCK
3	7-9	-	-	-	-	100	"	"	"	"	"	"	"	"	ORGANIC SILT- MUC
4	9-11	-	-	-	-	100	"	"	"	"	"	"	"	"	ORGANIC- SILT-
5	11-13	-	-	-	10	90	"	"	"	"	"	"	"	"	ORG. SILT- MUCK, & WOOD MIXED
6	13-15	-	-	-	0	100	High	Shiny	"	"	Earthy	Grey	"	firm	CLAY OR SILTY CL
7	15-17			-	0	100	"	"	"	"	"	"	"	"	CLAY OR SILTY CL
8	17-19			-	0	100	"	"	"	"	"	"	weak	m	CLAY; org. Mottling

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES R

REMARKS:-

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VISUAL CLASSIFICATION SHEET

SITE _____ BOREHOLE No. 1 (10) GROUND ELEVATION _____

STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ked	dull	None	med	Earthy	Grey mott.	No	soft firm	CLAYEY SILT-TR. SAND; OCC. ORG. STREAKS	CL
	"	"	"	"	Grey slight mott.	"	firm	CLAYEY SILT W/THIN SAND SEAMS, BDRY WITH ORGANIC SILT ?	CL
low	"	"	low	org.	DK. BR. BLACK	"	soft	ORGANIC SILT-MUCK, WOOD FRAGS.	OC
"	"	"	"	"	"	"	"	ORGANIC SILT- MUCK; WOOD FRAGS.	OL
"	"	"	"	"	"	"	"	ORGANIC- SILT- MUCK; OCC. WOOD PIECES	OL
"	"	"	"	"	"	"	"	ORG. SILT- MUCK & WOOD, COARSE SAND MIXED IN - Prob. Seam in org. Layer.	OL
tiff	Shiny	"	"	Earthy	Grey	"	firm	CLAY OR SILTY CLAY; org. mottling	CI CH
"	"	"	"	"	"	"	"	CLAY OR SILTY CLAY; org. mottling	CI CH
"	"	"	"	"	"	weak	"	CLAY; org. mottling, Tr. shell frags.	CH

ARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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VISUAL CLASSIFICATION SHEET

PROJECT 69-118 SITE _____ BOREHOLE No. (11) GROUND E

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION: LARGEST GRAIN SIZE	SHAPE	PERCENTAGE: GRAVEL	SAND	SILT & CLAY	DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
NSM 1	7-8½	-	-	-	Tr	100	Med	-	slow	V. low	org.	Dark Brown	No	V. Soft	ORGANIC SILTY-CLAY
2	10-11½	-	-	-	Tr	100	low	dull	none	"	"	"	"	Soft	ORGANIC SILT -
9	40-41½	# 10	-	0	low	Tr	none	"	Quick	-	Earthy	Grey	Strong	-	SAND
10	45-46½	# 10	-	0	100	Tr	"	"	"	-	"	"	"	-	SAND
11	50-52	1"	angular	50	35	15	low	"	"	-	"	"	"	-	SILT, SAND & GRAVEL

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:-

A+T RC. 52'-9" - 57'-11" Rec = 97%: SOUND Shaley L.S., a

LS & slightly f

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SITE _____ BOREHOLE No. (11) GROUND ELEVATION _____

DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ded	–	slow	V. low	org.	Dark Brown	No	V. Sft	ORGANIC SILTY-CLAY, WOOD FRAGMENTS Tr. SAND	OM
low	dull	none	"	"	"	"	Soft	ORGANIC SILT – MUCK – wood frags.	OC
one	"	Quick	–	Earthy	Grey	strong	–	SAND	SW
"	"	"	–	"	"	"	–	SAND	SW
ow	"	"	–	"	"	"	–	SILT, SAND & GRAVEL – non cohesive	TILL?

CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

2'-9" – 57'-11" rec = 97%: SOUND Shaley L.S., seams of shale
LS & slightly fossiliferous

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PROJECT 69-F 118 SITE _____ BOREHOLE No. (12) GROUND E

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH D
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1A	16½-17	#40	—	0	15	85	low	dull	slow	V. low	Organ.	Dark Brown	No.	V. soft	Organic SILT, Tr. Sa	
1B	17-18½	—	—	0	0	100	med	shiny	none	low	Earthy	Grey-Black mottling	No.	Soft	CLAY or Silty CLAY (not ver	
2	18½-20½	—	—	0	0	100	"	"	"	"	"	"	weak	"	SILTY CLAY w/ o (not	
3	20½-22½	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY w/ or	
4	22½-24½	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY To C	
5	24½-26½	—	—	0	0	100	"	"	"	"	"	"	"	Firm	SILTY CLAY, org. mottl	
6	26½-28½	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY or CLAY	
7	28½ 30½	¼"	Subang	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY— CLAY, org. me	

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:—

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E _____ BOREHOLE No. (12) GROUND ELEVATION _____

HINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
dull	slow	V. low	Organ.	Dark Brown	No.	V. Soft	Organic SILT, Tr Sand & clay	OL
shiny	none	low	Earthy	Grey-Black mottling	No.	Soft	CLAY or Silty CLAY org. mottling, Tr. SILT (not very sensitive to remolding)	CI CH
"	"	"	"	"	weak	"	~~One~~ SILTY CLAY w/ org. mottling, Tr. SILT (not very sensitive)	CI
"	"	"	"	"	"	"	SILTY CLAY w/ org. mottling.	CI
"	"	"	"	"	"	"	SILTY CLAY To CLAY w/ org. mottling	CI CH
"	"	"	"	"	"	firm	SILTY CLAY, org. mottling; silt pockets or seams.	CI
"	"	"	"	"	"	"	SILTY CLAY or CLAY, org. mottling	CI CH
"	"	"	"	"	"	"	SILTY CLAY — CLAY, org. mott 1 (ONE) 1/4" ~~REC~~ SIZE GRAVEL ? (RAFTED ?)	

D OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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PROJECT 69F118 SITE _____ BOREHOLE No. (14) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION: LARGEST GRAIN SIZE	SHAPE	PERCENTAGE: GRAVEL	SAND	SILT & CLAY	DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
WASH→ 2	37-40	#2	—	0	100	Fr	none	dull	Quick	—	Earthy	Grey	weak	—	SAND - Fine - m
4	48-50	1" 3/4	sub-ang	20	70	10	"	"	"	—	"	"	Strong		SAND with some g (no gradation

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLE

REMARKS:—

Apt RC: 53'-4-58'.4 Rec = 99%. Sound. Shaley L.S. w Shale zea

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SITE _____ BOREHOLE No. (14) GROUND ELEVATION _____

N	TAGE		DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
	SILT & CLAY											
P	Fr	none	dull	Quick	—	Earthy	Grey	Weak	—		SAND - Fine - Med, Tr. decayed Wood	SW
2	10	"	"	"	—	"	"	Strong			SAND with some gravel Tr. silt (no gradation from sand to gravel)	S

IST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

4 - 58.4 Rec = 99%. Sound. Shaley L.S. w/ shale seams & slightly fossiliferous.

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PROJECT 69-F-118 SITE _____ BOREHOLE No. (15) GROUND ELEV

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION: LARGEST GRAIN SIZE	SHAPE	PERCENTAGE: GRAVEL	SAND	SILT & CLAY	DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESC
8	33-34½	1/8"	angul	0	0	100	High	Shiny	none	low	Earthy	grey	wk	firm	CLAY - SILTY CLAY, Tr org
9	35-37	#20	—	0	95	5	none	dull	Quick	none	"	"	"	—	Fine - Med SAND
WASH 12	43-45	#10	angul	0	95	5	"	"	"	"	"	"	strong	—	SAND
✱ 13	45-47	½"	angula.	50	30	20	low	"	"	med	"	"	"	—	Mix. SILT - SAND - GRAV
Grab 14	50-51.2	1"	angular	50	25	25	med	"	slow	high	"	"	"		Mix SILT or CLAYEY SILT,
1	from Twl. 13-14½	0	—	0	0	100	High	Shiny	None	low	Earthy	grey	wk.	firm	CLAY; org. mottlin

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REA

REMARKS:- ✱ not submitted for Test

Att Rec rec = 57".

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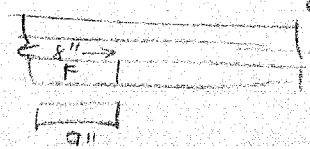
E _____ BOREHOLE No. (15) GROUND ELEVATION _____

SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
Shiny	none	low	Earthy	grey	wk	firm	CLAY - SILTY CLAY; Tr org mottling. ONE 1/8" PIECE.	CI CH
dull	quick	none	"	"	"	—	Fine - Med SAND	SW
"	"	"	"	"	strong	—	SAND	SW
"	"	med	"	"	"	—	Mix. SILT - SAND - GRAVEL, Tr. CLAY	TILL
"	slow	high	"	"	"		Mix SILT or CLAYEY SILT, SAND & GRAVEL	TILL
Shiny	None	low	Earthy	grey	wk.	firm	CLAY; org. mottling	CH

ED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

end for test

Att Rc rec = 57". SOUND Sh. L.S. Shale seams. Al. foraminiferous Fe fractures — vertically not unknown



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PROJECT 69-F-118 SITE Casselman BOREHOLE No. (16) GROUND E

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	3-4½	—	—	0	0	100	high	Shiny	none	high	Earthy	Reddish Br	slow	v. Stiff	desiccated clay
2	6-7½	-	—	0	0	100	"	"	"	"	"	"	none	"	" "
3	9-10½	-	—	0	0	100	"	"	"	"	"	mottled Red-Br Grey	"	"	" "
4	12-13½	-	—	0	0	100	"	"	"	med	"	Grey	"	firm	clay
12	50-51½	# 100	—	0	100	Tr	none	dull	Quick	—	"	"	slo.	—	Poorly graded Fine-

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:-

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SITE Casselman BOREHOLE No. (16) GROUND ELEVATION

DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
high	Shiny	none	high	Earthy	Reddish Br.	Slow	V. Stiff	desiccated clay	CH
"	"	"	"	"	"	none	"	" "	CH
"	"	"	"	"	mottled Red-Br Grey	"	"	" "	CH
"	"	"	med	"	Grey	"	firm	clay	CH
none	dull	Quick	—	"	"	Sl.	—	Poorly graded Fine - Med Sand	SP

CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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PROJECT 69F118 SITE _____ BOREHOLE No. (17) GROUND ELE

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION: LARGEST GRAIN SIZE	SHAPE	PERCENTAGE: GRAVEL	SAND	SILT & CLAY	DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DES
2	3'-10" 5'-4"	–	–	0	0	100	High	Shiny	none	High	Earthy	Red-Br Banded	No.	Hard	CLAY, desiccated; occ
4	7'-2" 8'-8"	—	–	0	0	100	"	"	"	"	"	"	strong	V-Stiff	CLAY, desiccated, mott
6	10½-12	–	—	0	0	100	"	"	"	"	"	"	weak	Stiff	CLAY, desiccated, mottle
15	50-51½	½"	angular	1	94	5	none	dull	Quick	—	"	Grey	Strong	–	Fine-Med- SAND, Tr. silt
16 SIDE SAMPLE	55-56½	# 20	–	0	95	5	"	"	"	—	"	"	"	—	Fine -Med SAND, Tr
17	60-61½	1"	angular	40	30	30	low	"	Quick slow	—	"	"	"	–	Mixt. SILT, SAND & GRA
★ 18	65-65½	1"	sub angul	70	20	10	none	"	slow	—	"	"	"		GRAVEL IN SILT- SA

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES RE

REMARKS:- ★ not sufficient for lab test. Apt Rc. 65.5–70.5 Rec= shaley LS. B/R

★@ 66.5-68.5 flatter, closer jointing & rock. seamy; slightly

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BOREHOLE No. (17) GROUND ELEVATION

DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
none	High	Earthy	Red-Br Banded	No.	Hard	CLAY, desiccated; occ. 1/4" thick SILT seams	CH
"	"	"	"	strong	V-stiff	CLAY, desiccated, mottled. Thin red bands.	CH
"	"	"	"	weak	Stiff	CLAY, desiccated, mottled. Thin SILT seams	CH
Quick	—	"	Grey	Strong	—	Fine-Med- SAND, Tr. silt & odd gravel	SW
"	—	"	"	"	—	Fine -Med SAND, Tr silt	SW
Quick Slow	—	"	"	"	—	Mixt. SILT, SAND & GRAVEL.	TILL
slow	—	"	"	"		GRAVEL IN SILT-SAND MATRIX	TILL

IT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

Lab test.

ATT RC. 65.5 — 70.5' Rec = 90% SOUND **

shaley LS. B/R. occ shale

seams; slightly fossiliferous

.5 faults, close jointing grade.

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PROJECT 69-F-118 SITE Casselman BOREHOLE No. (18) GROUND ELI

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DE
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4½	-	—	0	0	100	high	Shiny	None	high	Earthy	Reddish Brown	none	Hard	desiccated	clay
2	6-7½	-	—	0	0	100	"	"	"	"	"	"	Slow	V. Stiff	desiccated	clay
3	9-10½	-	—	0	0	100	"	"	"	"	"	"	None	Stiff	"	"
12	50-51½	# 60	—	0	100	Tr	none	dull	Quick	—	Earthy	Grey	Strong	—	Fine Med Sand	
14	60-61½	1"	angular	80	15	5	—	—	Quick	—	"	"	"	—	Gravel with silt & sa	

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES RE

REMARKS:-

BX L: RC: 65.5-70.8 - Rec = 97%. Sound Shaley L.S. fossiliferous zone

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Gasselman BOREHOLE No. (18) GROUND ELEVATION

ME	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
iny	None	high	Earthy	Reddish Brown	none	Hard	de iccated clay	CH
	"	"	"	"	Slow	V. Stiff	desiccated clay, v. thin silt partings	CH
	"	"	"	"	None	Stiff	" " , mottled.	CH
///	Quick	-	Earthy	Grey	Strong	—	Fine - med Sand, uniformly graded.	SP-SM
	Quick	-	"	"	"	—	Gravel with silt & sand - mixture Tr. clay	GM

OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

97%. Sound shaley L.S. Fossiliferous zones. occ. shale seams.

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PROJECT 69-F-118 SITE CASSELMAN BOREHOLE No. (19) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WIT
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	5'-6.5'	Sand	—	0	25	75	med	Shiny	none	med	Earthy	Mott: Grey	none	firm	clayey Silt w/	
2	10'-11.5'	—	—	0	0	100	high	Shiny	"	med	"	Grey	none	firm	clay	
3	44'-45'	#60	—	0	90	10	none	dull	Quick	—	"	"	strong	—	Fine - med Sand	

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPL

REMARKS:—

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SITE CASSELMAN BOREHOLE No. (19) GROUND ELEVATION

STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ed	Shiny	none	med	Earthy	Mott. Grey	none	firm	clayey Silt to Sand, Tr. org.	CL
igh	Shiny	"	med	"	Grey	none	firm	clay	CH
one	dull	Quick	—	"	"	strong	—	Fine - med Sand, unif. graded	SF

RRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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PROJECT 69F118 SITE _____ BOREHOLE No. (20) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	0-2	-	—	0	25	75	low	dull	slow	low	~~Earthy~~ ~~Org~~	Brown	No		clayey SILT-
2	2-4	—	—	0	15	85	med	Shiny	None	High	"	Mott. Brown-Grey	No	Hard	CLAYEY SILT TO SILTY CLAY, Tr. SAND.
3	4-6	—	—	0	15	85	"	"	"	med	"	Mott-Grey	No	Stiff	CLAYEY SILT TO SILTY CLAY - Tr SAND,
4	6-8	—	—	0	20	80	"	"	"	"	"	"	"	"	ORGANIC SILT- BORY CL
		—	—	0	Tr	100	v low	dull	"	low	org.	Black	"	soft	
5	8-10	—	—	0	20	80	med	Shiny	"	low	Earthy	Grey w/ Brown streaks	"	firm	CLAYEY SILT WITH
6	10-12	—	—	0	0	100	high	"	"	"	"	Grey	"	Soft	SILTY CLAY ~~or~~ CLA
7	12-14	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CL
8	14-16	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CL
9	16-18	—	—	0	0	100	"	"	"	"	"	"	"	"	CLAY or SILTY

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

SITE _____ BOREHOLE No. (20) GROUND ELEVATION _____

STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ow	dull	slow	low	Earthy ~~Org~~	Brown	NO		clayey SILT - TOPSOIL,	-
ed	Shiny	None	High	"	Mott. Brown-Grey	NO	Hard	CLAYEY SILT To SILTY CLAY, Tr. SAND; desiccated	CI
	"	"	med	"	mott-Grey	NO	Stiff	CLAYEY SILT To SILTY CLAY - Tr. SAND; desiccated	CI
	"	"	"	"	"	"	"	ORGANIC SILT - BDRY WITH MOTTLED GREY CL. SI - SI. CL	OL
ow	dull	"	low	org.	Black	"	SOFT		
ed	Shiny	"	low	Earthy	Grey w/ Brown Streaks	"	Firm	CLAYEY SILT WITH SOME SAND	CL
igh	"	"	"	"	Grey	"	Soft	SILTY CLAY ~~or CLAY~~; Tr org. mottling	CI-CH
"	"	"	"	"	"	"	"	SILTY CLAY - CLAY; some org. mottling	CI CH
"	"	"	"	"	"	"	"	SILTY CLAY - CLAY; org. mottling	CI CH
"	"	"	"	"	"	"	"	CLAY or SILTY CLAY; org. mottling	CH

ARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F118 SITE _____ BOREHOLE No. (20) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
10	18-20	—	—	0	0	100	High	Shiny	None	low	Earthy	Grey	weak	Soft	CLAY; org. mottl
11	8-8½										~~EARTHY~~		No	Firm	mottled Grey Si·CL-
12	8½-9½										ORG.	Dk GREY	STR.	Soft	Grey CLAY MIXED W

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

TE _____ BOREHOLE No. (20) GROUND ELEVATION _____

SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
shiny	None	low	Earthy	Grey	weak	Soft	CLAY; org. mottling - Tr. shell frags.	CH
			Earthy		No	Firm	mottled Grey Sl. CL - WOOD FRAGS.	CL
			ORG.	Dk GREY	STR.	Soft	Grey CLAY MIXED W/ SAND CONTAINING SHELLS.	CH / OL

IED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F 118. SITE _____ BOREHOLE No. (21) GROUN

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION		PERCENTAGE			DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION W
		LARGEST GRAIN SIZE	SHAPE	GRAVEL	SAND	SILT & CLAY									
1	3-4½	—	—	0	5	95	Med	Shiny	None	Med	Earthy	Ochre Brown	no.	Stiff	CLAYEY SILT - SILTY Tr. SAND
2	6-7½	—	—	0	5	95	"	"	"	"	"	Mott. Grey	"	"	CLAYEY SILT - SILT
2A	7½-9	—	—	0	0	100	"	"	"	"	"	"	"	Firm	CLAYEY SILT - T²A
		—	—	0	5	95	low	dull	"	low	organ	D.Br.	"	Soft	ORGANIC SILT-
3A	10½-12½	—	—	0	0	100	"	"	"	V. low	"	Brown-Black	"	"	ORGANIC SILT - MU
3B	12½-14½	—	—	0	0	100	"	"	"	"	"	"	"	"	ORG SILT - M
		—	—	0	0	100	High	shiny	none	low	Earthy	Grey	no	Firm	SILTY CLAY,
10	43-44½	—	—	0	95	5	none	dull	Quick	—	"	"	Weak	—	Fine - Med SAN
11	48-49½	1"	angular	3	85	12	"	"	"	—	"	"	strong	—	silty SAND, isolat

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMP

REMARKS:-

AXT RC 53.5 - 57.5 Rec. 90% : Sound Shaley L.S. slightly fossiliferous.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

E _____ BOREHOLE No. (21) GROUND ELEVATION _____

MINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
Shiny	None	Med	Earthy	Ochre Brown	no.	Stiff	CLAYEY SILT - SILTY CLAY. desiccated mottled Tr. SAND	CL CI
"	"	"	"	Mott Grey	"	"	CLAYEY SILT - SILTY CLAY - desiccated mottled	CL CI
"	"	"	"	"	"	Firm	CLAYEY SILT - TRANSITION TO ↓	CL
dull	"	low	organ	D. Br.	"	Soft	ORGANIC SILT - MUCK - Tr. WOOD FRAGS	OL
"	"	V. low	"	Brown-Black	"	"	ORGANIC SILT - MUCK - WOOD FRAGS.	OL
"	"	"	"	"	"	"	ORG. SILT - MUCK - WOOD FRAGS	OL
Shiny	none	low	Earthy	Grey	ns	Firm	SILTY CLAY, org. mottling	CI
dull	Quick	—	"	"	Weak	—	Fine - Med SAND.	SW
"	"	—	"	"	strong	—	silty SAND, isolated gravel. Tr. clay	SW

ED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

. 90% : Sound Shaley L.S. slightly fossiliferous. occ. Shale seams.

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MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE _____ BOREHOLE No. (22) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	3-5	—	—	0	5	95	Med	dull	none	Med	Earthy	Rusty Brown	No	Stiff	SILTY CLAY — or CLAYEY S
2A	6-8	—	—	0	5	95	"	"	"	"	"	Mott. Grey	"	"	CLAYEY SILT, Tr SAND
* 2B	6-8	—	—	0	0	100	low	"	"	low	Organ	DARK Brown	"	Firm	ORGANIC SILT
3	8-10	—	—	0	0	100	"	"	"	"	"	"	"	"	ORGANIC SILT — M
4	10-12														DECAYED WOOD &
5	12-14	—	—	0	0	100	low	dull	none	low	org	Black	"	Firm	ORGANICS & ORG. SI
6B	14-15¼	—	—	0	0	100	"	"	"	"	"	"	"	"	ORGANIC SILT —
6A	15¼-16	—	—	0	0	100	High	shiny	"	"	Earthy	Grey	No	Soft	CLAY, slight org
7	16-18	—	—	0	0	100	"	"	"	"	"	"	"	"	CLAY org
8	18-20	—	—	0	0	100	"	"	"	"	"	"	"	"	CLAY

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:— * not suitable for test

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

E _____ BOREHOLE No. (22) GROUND ELEVATION _____

SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
dull	none	med	Earthy	Rusty Brown	No	Stiff	SILTY CLAY - or CLAYEY SILT; desiccated. Tr SAND	CL CI
"	"	"	"	Mott. Grey	"	"	CLAYEY SILT, Tr SAND & ORG. MATTER.	CL
"	"	low	Organ	DARK BROWN	"	Firm	ORGANIC SILT	OL
"	"	"	"	"	"	"	ORGANIC SILT - MUCK w/ wood frags.	OL
							DECAYED WOOD & A PIECE OF MOTTLED CLAYEY SILT.	
dull	none	low	org	Black	"	Firm	ORGANICS & ORG. SILT - MUCK - WOOD FRAGS.	OL
"	"	"	"	"	"	"	ORGANIC SILT - MUCK.	OL
shiny	"	"	Earthy	Grey	No	soft	CLAY, slight org. mottling	CH
"	"	"	"	"	"	"	CLAY } org. mottling	CH
"	"	"	"	"	"	"	CLAY	CH

ED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

for testing

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DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-118 SITE Casselman BOREHOLE No. (23) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	0-2	—	—	0	15	85	low	Shiny	none	med	Earthy	Mott' Br.	none	firm	Clayey silt w/	
2	2-3½	—	—	0	20	80	"	"	Slowly none	low	"	"	"	"	"	"
3	5-6½	—	—	0	5	95	med	"	none	high	"	mott' red Br.	"	stiff	Silty clay, desi	
4	7-8½	—	—	0	Tr	100	low	dull	"	low	org	Black	"	Soft	org. silt	
5	9-10½	—	—	0	Tr	100	"	"	"	"	"	"	"	"	"	"
6	11-12½	—	—	0	0	100	"	"	"	"	"	"	"	"	"	"
7	13-14½	—	—	0	15	85	"	"	"	"	"	"	"	—	org. silt w/ coarse Sa	
8	43½-45	¼"	angular	Tr	90	10	none	"	Quick	—	Earthy	Grey	strong		Uniform fine-med	

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLE

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

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SITE Cassel/man BOREHOLE No. (23) GROUND ELEVATION

DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
low	Shiny	none	med	Earthy	mott. Br.	none	firm	Clayey silt w/ Tr. sand org - Topsoil	CL
"	"	slowly none	low	"	"	"	"	" " " ½ Tr org. —	CL
med	"	none	high	"	mott. red Br.	"	stiff	silty clay, desiccated, sand pockets	CL
low	dull	"	low	org	black	"	soft	org. silt Tr. dec. wood	OL
"	"	"	"	"	"	"	"	" " " " "	OL
"	"	"	"	"	"	"	"	" " " " "	OL
"	"	"	"	"	"	"	—	org. silt w/ coarse Sand, dec wood Bolry with grey clay	
none	"	Quick	—	Earthy	Grey	strong		Uniform fine med sand, Tr. silt add gravel	SP

CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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VISUAL CLASSIFICATION SHEET

PROJECT 69 F 119 SITE _____ BOREHOLE No. (24) GROUND EL

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DE
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	3-5	—	—	0	20	80	med	dull	none	med	Earthy	Br-Grey Mottled	No.	Firm	clayey SILT - w/ fine
2	5-7	—	—	0	10	90	low	"	slow none	low	org.	Grey-DK. Brown	"	Soft	ORGANIC SILT - SOME
3	7-9	—	—	0	Tr	100	"	"	none	V. low	"	Black DK. Grey	"	"	ORGANIC - MUCK - SE
4A	9-10	—	—	0	5	95	"	"	"	"	"	"	"	"	ORGANIC - MUCK - T
4B	10-11	—	—	0	0	100	high	Shiny	"	low	Earthy	Grey	"	Firm	SILTY CLAY - org. mot
5	11-13	—	—	0	0	100	"	"	"	"	"	"	"	Soft	SILTY CLAY - org. mo
6	13-15	—	—	0	0	100	"	"	"	"	"	"	"	Firm	SILTY CLAY - org.
7	16-18	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - org.
8	18-20	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CLAY

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES R

REMARKS:-

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MATERIALS AND TESTING OFFICE

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BOREHOLE No. (24) GROUND ELEVATION

DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
none	med	Earthy	Bl-Grey mottled	NO.	Firm	clayey SILT - w/ fine sand & Tr. organics	CL
Slow none	low	org.	Grey-DK-Brown	"	Soft	ORGANIC SILT - SOME SILTY CLAY & F. SAND	OL
none	V. low	"	Black DK. Grey	"	"	ORGANIC - MUCK - ~~STAM~~ of GREY Si-CLAY	OL OM
"	"	"	"	"	"	ORGANIC - MUCK - Tr. sand. DECAYED WOOD CHIPS	OL OM
"	low	Earthy	Grey	"	Firm	SILTY CLAY - org. mottling not very sensitive	CI
"	"	"	"	"	soft	SILTY CLAY - org. mottling - sensitive.	CL
"	"	"	"	"	Firm	SILTY CLAY - org. mottling	CI
"	"	"	"	"	"	SILTY CLAY - org. mottling	CI
"	"	"	"	"	"	SILTY CLAY - CLAY - org. mittling	CI CH

ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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VISUAL CLASSIFICATION SHEET

PROJECT 69F118 SITE _____ BOREHOLE No. (25) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION		PERCENTAGE			DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	GRAVEL	SAND	SILT & CLAY									
1	6'9"-8'-9"	—	—	0	0	100	low	dull	none	low	org.	Dk Br Grey	No.	Soft	Org. SILT (MUCK)
2	8'9"-10'-9"	—	—	0	0	100	"	"	"	"	"	Dark Brown	"	"	ORGANIC SILT
3A	10'-9" 11'-4"	—	—	0	0	100	"	"	"	V. low	"	"	"	Very Soft	ORG. SILT - MU
3B	11'-4" 12'-9"	—	—	0	0	100	High	Shiny	"	low	Earthy	Grey	"	Firm	CLAY, slight org
4	12-9 14-9	—	—	0	0	100	"	"	"	"	"	"	"	"	SILTY CLAY - CLA
5	14-9 16-9	1/2"	Sub ang.	Tr	0	100	"	"	"	"	"	"	"	Soft	CLAY, org. mottling
6	16-9 18-9	—	—	0	0	100	"	"	"	"	"	"	Weak	Firm	CLAY, org. mottli
7	18-9 20-9	1"	Sub ang (Flat)	Tr	0	100	"	"	"	"	"	"	Weak	Firm	CLAY, org. mottlin

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

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TE _____ BOREHOLE No. (25) GROUND ELEVATION _____

SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
dull	none	low	org.	Dk Br Grey	No.	Soft	Org. SILT (MUCK) - Thin silty clay seams	OL
"	"	"	"	Dark Brown	"	"	ORGANIC SILT ± MUCK.	OM
"	"	Low	"	"	"	Very Soft	ORG. SILT - MUCK.	OM
shiny	"	low	Earthy	Grey	"	Firm	CLAY, slight org. mottling - Bdry w/ ORG. MUCK	CH
"	"	"	"	"	"	"	SILTY CLAY - CLAY, org. mottling not V. sensitive	CL CH
"	"	"	"	"	"	Soft	CLAY, org. mottling - & isolated pieces of gravel 1/2" apart in specimen.	CH
"	"	"	"	"	Weak	Firm	CLAY, org. mottling	CH
"	"	"	"	"	Weak	Firm	CLAY, org. mottling; isolated gravel Flat ↕ 1"	CH

IED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

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MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F 118 SITE _____ BOREHOLE No. (26) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WIT
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
* 1	12-14														ORG. SILT + DEC.
2	14-16														GREY CLAY,
3	16-18														4
4	18-20														4
5	25-27														4
6	30-32														4

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPL

REMARKS:- * insufficient for testing

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MATERIALS AND TESTING OFFICE

~~No samples in lab~~ ?

VISUAL CLASSIFICATION SHEET

SITE _____ BOREHOLE No. (26) GROUND ELEVATION _____

DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
								ORG. SILT + DEC. WOOD. ALSO - GREY CLAY	
								GREY CLAY, ORG. MOTTLING	
								〃	
								〃	
								〃	
								〃	

CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

for testing

FF 22

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

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PROJECT 69-116 SITE _____ BOREHOLE No. (27) GROUND E

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION: LARGEST GRAIN SIZE	SHAPE	PERCENTAGE: GRAVEL	SAND	SILT & CLAY	DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH I
1	17½-19	—	—	0	0	100	High	Shiny	none	low	Earthy	Grey	Weak	Firm	CLAY, org mott
* 7	35½-37	± 20	—	0	90	10	none	dull	Quick	—	"	"	"	—	SILTY SAND, Pieces
8	40-42	# 20	—	0	95	5	"	"	"	—	"	"	"	—	~~SILTY~~ SAND -
9	46-48	1/11 1/4	Sub-angul	1	99	0	"	"	"	—	"	"	"	—	SAND, ISOLATE
#10 9A	46-48	—	—	0	10	90	"	"	"	—	"	"	Strong		SILT (Probably

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:- * Not suff. for lab testing AXT RC · 48.0 — 53.2', Rec =

Shale seams

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MATERIALS AND TESTING OFFICE

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BOREHOLE No. (27) GROUND ELEVATION

DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
none	low	Earthy	Grey	Weak	Firm	CLAY, org. mottling. Tr. shell frags	CH
Quick	—	"	"	"	—	SILTY SAND, PIECES OF INDURATED CLAY	SM
"	—	"	"	"	—	~~SILTY~~ SAND - POORLY GRADED (UNIFORM)	SP
"	—	"	"	"	—	SAND, ISOLATED GRAVEL	SW
"	—	"	"	strong		SILT (Probably seam or layer in SAND)	ML-SM

ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

testing AxT Rc · 48.0 — 53.2#. Rec = 97% SOUND sh L.S.
Shale seams, slightly fossiliferous

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MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69 F 16 SITE _____ BOREHOLE No. (29) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION: LARGEST GRAIN SIZE	SHAPE	PERCENTAGE: GRAVEL	SAND	SILT & CLAY	DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
3A	27-28½		slivers ↕ 3/8" long	-	0	100	High	Shiny	none	low	Earthy	grey	No	firm	SILTY CLAY OR C
5 — TW Samp	33-34½	#4	angular	0	To	100	"	"	"	"	"	"	"	"	SILTY CLAY OR CLA
6	35-37	½"	angular	Tr.	95	5	none	dull	Quick	—	"	"	WK	—	fine-med SAND; o
7A	40-41½	—	—	0	95	5	"	"	"	—	"	"	Strong	—	fine-med SAND
★ 7B	40-41½	1"	Sub ang.	80	20		low	"	slow	med	"	"	"	—	mixt. GRAVEL
★ 8	wash 40-44	½"	angular	100		0	—	—	—	—	—	"	"		COARSE SAND

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:- ★ Insufficient for test

AXT RC. 44'-3" - 47'-8"; 47'-8" - 52'-0"; SOUND sh

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

SITE _____ BOREHOLE No. (29) GROUND ELEVATION _____

SIMILARITY	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ish	Shiny	none	low	Earthy	grey	No	firm	SILTY CLAY OR CLAY; org. mottling	CI CH
"	"	"	"	"	"	"	"	SILTY CLAY OR CLAY; org. mottling	"
fine	dull	quick	—	"	"	wk	—	fine - med SAND, ODD GRAVEL, Tr. silt	SW
"	"	"	—	"	"	strong	—	fine - med SAND	SW
w	"	slow	med	"	"	"	—	mixt. GRAVEL & CL. SILT & SAND	TILL
—	—	—	—	—	"	"		COARSE SAND & FINE GRAVEL	

RRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

A×T RC · 44'-3" - 47'-8"; rec = 86 % 1 thin (1/8") mud seam @ 47'-4"

47'-8" - 52'-0"; 98 % rec · Otherwise SOUND sh.-L.S. Shale Seams.

FF 22

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F118 SITE _____ BOREHOLE No. (31) GROUN

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION W
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
7	from TW 25-26½	—	—	0	0	100	High	Shiny	none	low	Earthy	Grey	No	Firm	CLAY, slight
8	29½-31	# 20	—	0	100	0	none	dull	quick	—	"	"	weak	—	SAND
9	35-36½	# 20	—	0	95	5	"	"	"	—	"	"	"	—	SAND, Tr-Sil
✱ 10	40-42	1½"	sub ang.	75	15	10	—	—	—	—	"	"	Strong		GRAVEL, SILT &

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMP

REMARKS:-

✱ not sufficient for grain size

ATTRC; 43.0 —

Slig

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

BOREHOLE No. (31) GROUND ELEVATION

	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
ry	None	low	Earthy	Grey	No	Firm	CLAY, slight org. mottling.	CH
	Quick	—	"	"	weak	—	SAND	SW
	"	—	"	"	"	—	SAND, Tr. SILT	SW
	—	—	"	"	Strong		GRAVEL, SILT & SAND. Tr. clay	TILL ?

UT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

for grain size

ATT RC; 43.0 – 48.3; Rec 98% SOUND

Shaley L.S.

Slightly fossiliferous

FF 22

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69F118-2 SITE Casselman BOREHOLE No. 7 (32) GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	5-6½	—	—	0	0	100	high	shiny	none	high	Earthy	Reddish Brown	none	Hard		desiccated
2	6-6½	—	—	0	0	100	"	"	none / Quick	med / —	"	"	"	Firm	—	clay - Bdry wt SILT SEAM 2"
5	10-10½	#60	—	0	95	5	none	dull	Quick	—	"	Grey	Sl.	—		fine Uniform

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

SITE Casselman BOREHOLE No. 7 (32) GROUND ELEVATION

DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
high	shiny	none	high	Earthy	Reddish Brown	none	Hard	desiccated clay	CH
"	"	none	med	"	"	"	Firm	clay - Bdry w/ desicc. zone	CH
		Quick	—	"	"	"	—	SILT seam 2" thick	ML
none	dull	Quick	—	"	Grey	Str.	—	fine Uniform Sand	SF

CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69 F 18 SITE Casselman BOREHOLE No. 33 GROUND

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WIT
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1A	3-7"-5'-1"	—	—	0	Tr	100	High	Shiny	None	High	Earthy	Mott Red Br.	No	V. Stiff	CLAY- desiccated
3	7'-2" 8'-8"	—	—	0	Tr	100	"	"	"	"	"	"	"	"	CLAY. desiccate
5	10'-3" 11'-9"	—	—	0	Tr	100	"	"	"	"	"	"	"	stiff	CLAY- desiccat
* 15	51½-53	#40	—	0	70	30	none	dull	quick	—	"	Grey	weak	—	SILTY SAND,
16	57-57½	½"	sub-angul	5	70	25	none	"	"	—	"	"	"	—	SILTY SAND, Tr
* 17	60-62	1"	angular	75	15	10	—	—	—	—	—	"	Strong		GRAVEL with

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPL

REMARKS:- * not enough for lab testing

A+T Rc: 62'-4" — 67'-
Shaley LS
slightly fra

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

Casselman BOREHOLE No. 33 GROUND ELEVATION

NE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
hiny	None	High	Earthy	Mott. Red Br.	No	V. Stiff	CLAY - desiccated & mottled, Tr. Sand	CH
	"	"	"	"	"	"	CLAY. desiccated, brittle.	CH
	"	"	"	"	"	stiff	CLAY - desiccated. Greyish Zones	CH
dull	Quick	—	"	Grey	weak	—	SILTY SAND, Tr. clay	SW
	"	—	"	"	"	—	SILTY SAND, Tr. clay, occ. gravel	SW
—	—	—	—	"	Strong		GRAVEL WITH CLAY, SILT, SAND.	GC?

OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

for lab testing.

A+T Rc: 62'-4" - 67'-8", Rec = 95% SOUND
Shaley LS. occ. Shale Seams.
slightly fossiliferous

FF 22

#69-F-118

W.P. 35-66-15

H.W.Y. #417 (EB LAND WBL)

SOUTH NATION RIVER

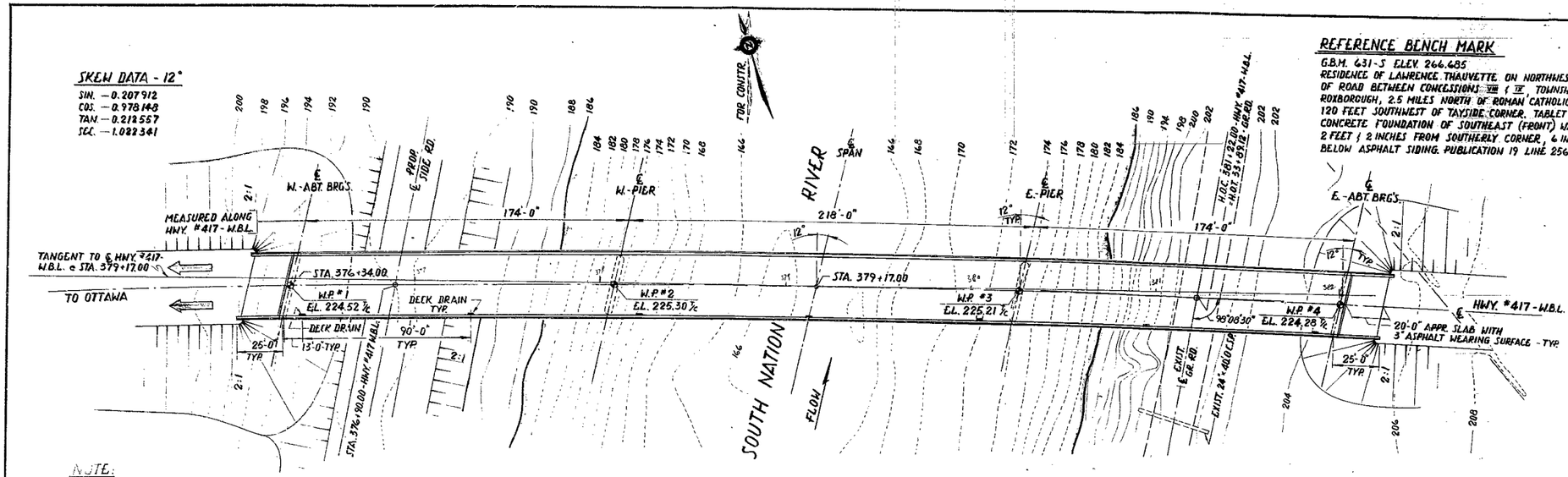
STRUCTURES

SKEW DATA - 12°

SIN. — 0.207 912
COS. — 0.978 148
TAN. — 0.212 557
SEC. — 1.022 341

REFERENCE BENCH MARK

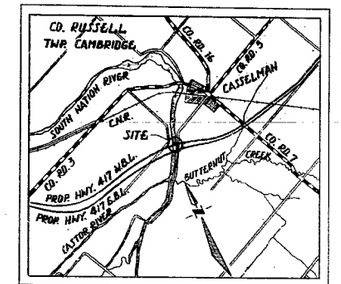
G.B.M. 431-S ELEV. 266.685
RESIDENCE OF LAWRENCE THAUVETTE ON NORTHWEST SIDE OF ROAD BETWEEN CONCESSIONS VIII & IX, TOWNSHIP OF ROXBOROUGH, 2.5 MILES NORTH OF ROMAN CATHOLIC CHURCH, 120 FEET SOUTHWEST OF TAYSIDE CORNER, TABLET IN CONCRETE FOUNDATION OF SOUTHEAST (FRONT) WALL, 2 FEET & 2 INCHES FROM SOUTHERLY CORNER, 4 INCHES BELOW ASPHALT SIDING. PUBLICATION 19 LINE 256



PLAN

SCALE: 1" = 50'-0"

NOTE:
- W.P. DENOTES WORKING POINT
- ℄ DENOTES TOP OF CONCRETE WEARING SURFACE



KEY PLAN
SCALE: 1 IN. = 1 MI.

NOTES

CLASS OF CONCRETE

DECK, BARRIER WALLS — 4000 P.S.I.
PIERS, ABUTMENTS & FOOTINGS — 3000 P.S.I.
REMAINDER AS NOTED

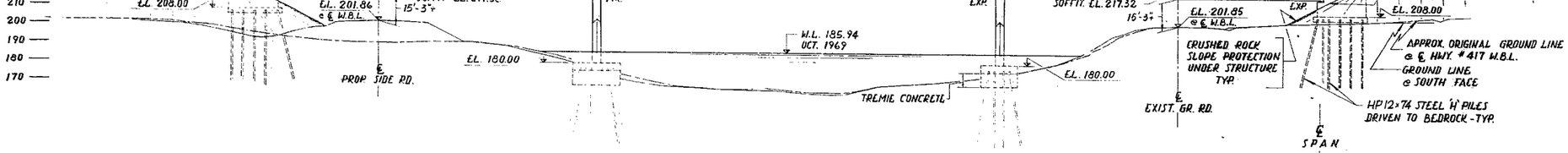
CLEAR COVER ON REINF. STEEL

FOOTINGS & ABUTMENTS 3"
PIERS & APPR. SLABS 2"
TOP OF DECK 1½", BOTT. 1"
BARRIER WALLS ½"
— OR AS OTHERWISE NOTED

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ±⅛".
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

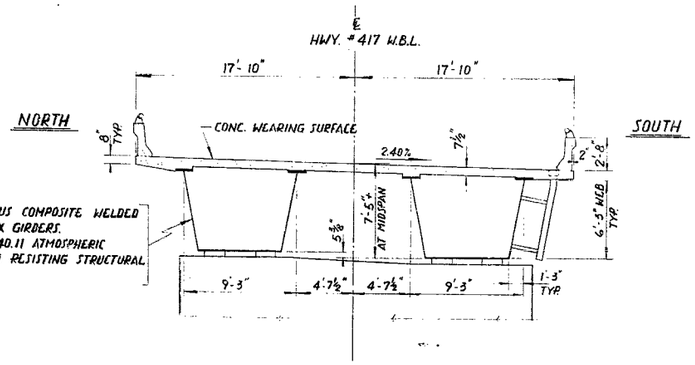
LIST OF DRAWINGS



ELEVATION

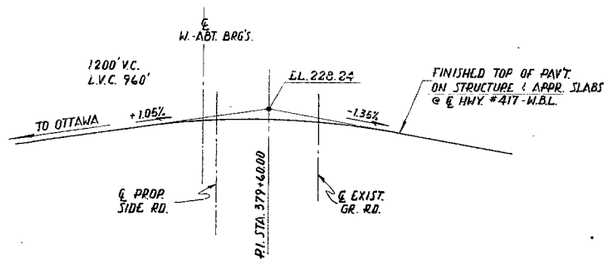
SCALE: 1" = 50'-0"

NOTE:
FOR TEMPORARY CLEARANCES AT SIDE ROAD AND GRAVEL ROAD DURING CONSTRUCTION SEE STD. BD-92-1 ON DWG. D-6826-23



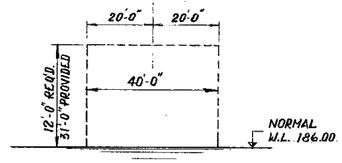
TYP. DECK SECTION

SCALE: 3/16" = 1'



PROFILE OF HWY. #417 W.B.L.

N.T.S.



NAVIGATIONAL CLEARANCE DIAGRAM

N.T.S.

REVISIONS

DATE	BY	DESCRIPTION

69-F-118

PRINT RECORD

No.	FOR	DATE
4	C.A.	11/71

REGISTERED PROFESSIONAL ENGINEER — K. A. [illegible] — PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

SOUTH NATION RIVER BRIDGE - W.B.L.

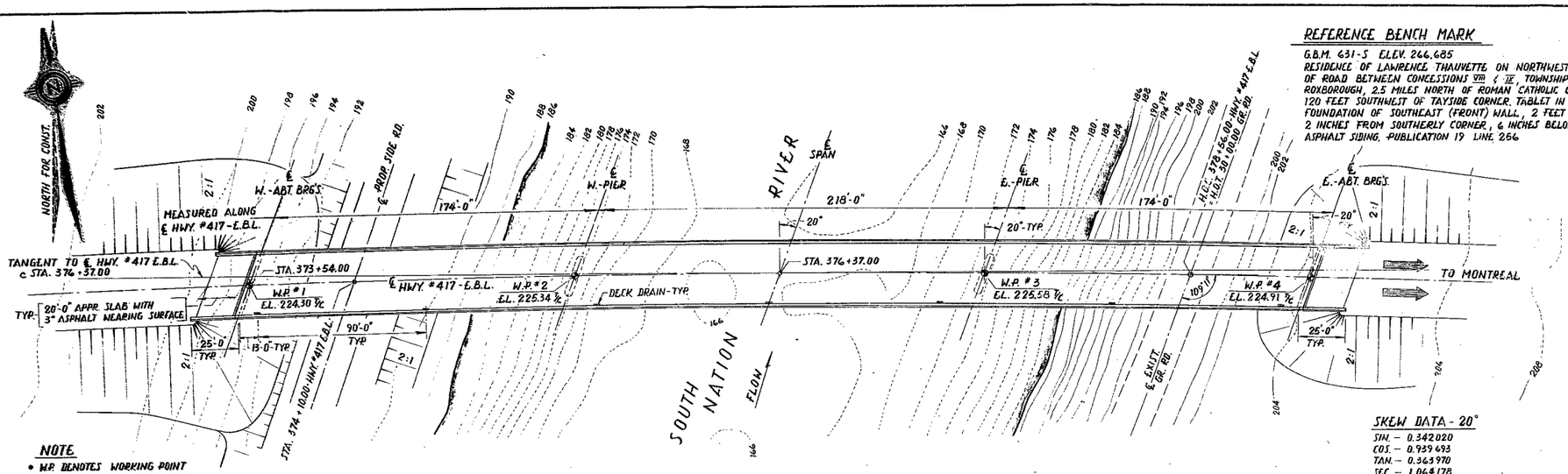
1 MILE WEST OF CASSELMAN

KING'S HIGHWAY No. 417 — DIST. No. 9
CO. RUSSELL
TWP. CAMBRIDGE — LOT 12 — CON. VII

— GENERAL LAYOUT —

APPROVED	BRIDGE ENGINEER			SITE No. 27-210	W.P. No. 35-66-22
DESIGN	A.W.	CHECK	G.A.	CONTRACT Nos.	
DRAWING	A.A.	CHECK	A.A. G.A.	DRAWING No.	D-6826-1
DATE	NOV. /70	LOADING	HS20-44		

TRANSLAR 2M-8-69

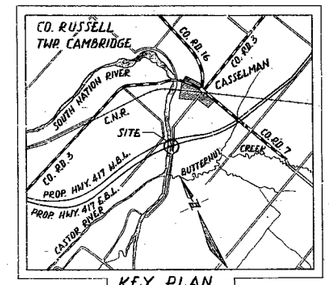


PLAN
SCALE : 1"=30'-0"

NOTE
- W.P. DENOTES WORKING POINT
- ℄ DENOTES TOP OF CONCRETE WEARING SURFACE

SKEW DATA - 20°
SIN. — 0.342020
COS. — 0.939693
TAN. — 0.363970
SEC. — 1.064178

REFERENCE BENCH MARK
G.B.M. 631-S ELEV. 246.685
RESIDENCE OF LAWRENCE THAUVETTE ON NORTHWEST SIDE OF ROAD BETWEEN CONCESSIONS VIII ℄ IX, TOWNSHIP OF ROXBOROUGH, 2.5 MILES NORTH OF ROMAN CATHOLIC CHURCH, 120 FEET SOUTHWEST OF TAYSIDE CORNER. TABLET IN CONC. FOUNDATION OF SOUTHEAST (FRONT) WALL, 2 FEET ℄ 2 INCHES FROM SOUTHERLY CORNER, 6 INCHES BELOW ASPHALT SIDING. PUBLICATION 19 LINE 266



KEY PLAN
SCALE : 1 IN. = 1 MI.

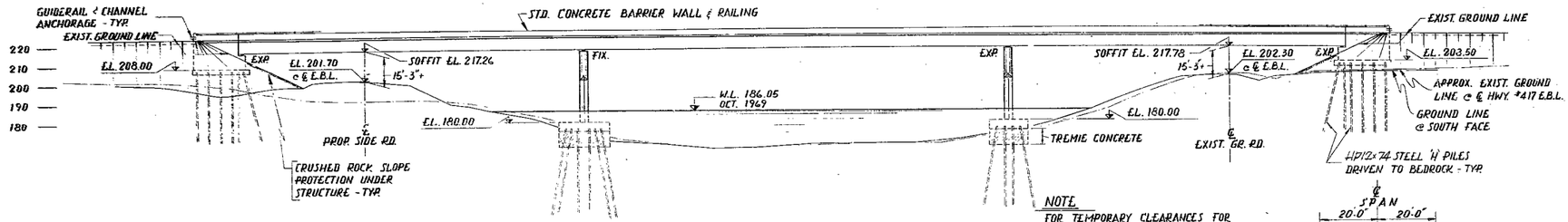
NOTES

CLASS OF CONCRETE
DECK, BARRIER WALLS — 4000 P.S.I.
PIERS, ABUTMENTS ℄ FOOTINGS - 3000 P.S.I.
REMAINDER AS NOTED

CLEAR COVER ON REINF. STEEL
FOOTINGS ℄ ABUTMENTS — 3"
PIERS ℄ APPR. SLABS — 2"
TOP OF DECK 1½", BOTT. 1"
BARRIER WALLS 1½"
} OR AS OTHERWISE NOTED

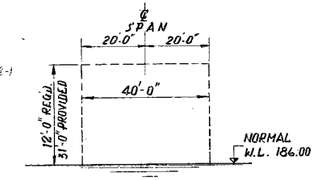
CONSTRUCTION NOTES
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ±⅛.
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

LIST OF DRAWINGS

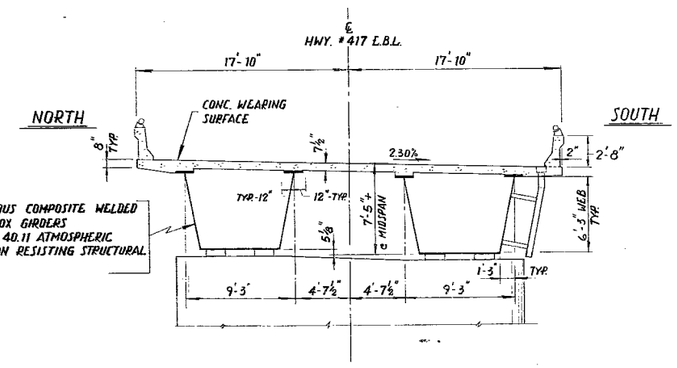


ELEVATION
SCALE : 1"=30'-0"

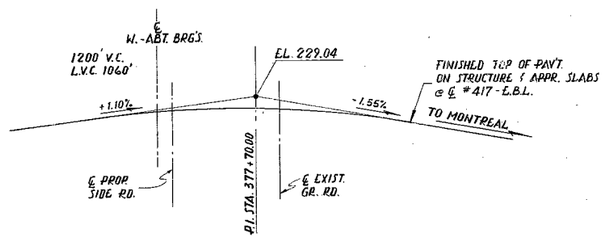
NOTE
FOR TEMPORARY CLEARANCES FOR SIDE ROAD AND GRAVEL ROAD DURING CONSTRUCTION SEE STD. BD-92-1 ON DWG. D-6824-22



NAVIGATIONAL CLEARANCE DIAGRAM
N.T.S.



TYP. DECK SECTION
SCALE : 3/16"=1'-0"



PROFILE OF HWY. #417-E.B.L.
N.T.S.

FOR REDUCED PLAN
USE SCALE "FLOW"
0 1 2 3
3 INCHES ON ORIGINAL PLAN

REGISTERED PROFESSIONAL ENGINEERS — CIVIL — A. A. WITECKI — PROVINCE OF ONTARIO

PRINT RECORD		
No.	FOR	DATE
1	Q-R-C.	NOV.

REVISIONS		
DATE	BY	DESCRIPTION

69-F-118

SOUTH NATION RIVER BRIDGE - E.B.L.
1 MILE WEST OF CASSELMAN

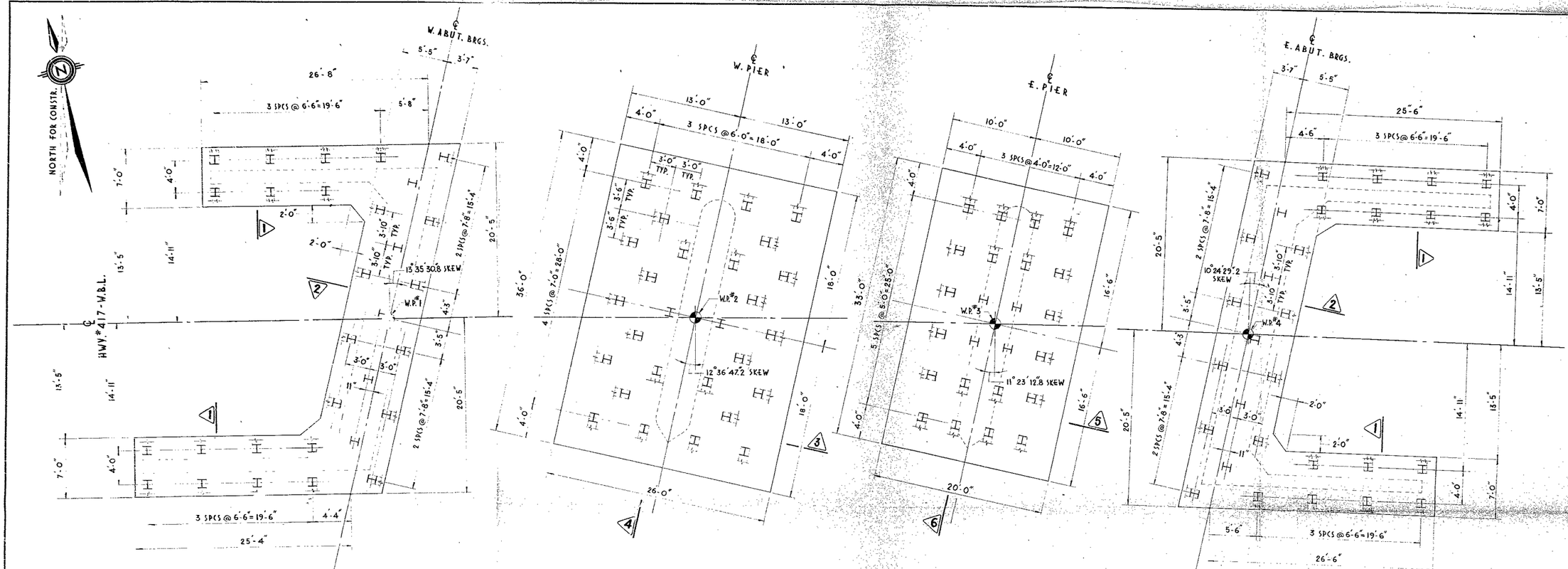
KING'S HIGHWAY No. 417 — DIST. No. 9
CO. RUSSELL
TWP. CAMBRIDGE — LOT 12 — CON. VII

GENERAL LAYOUT

APPROVED ____ BRIDGE ENGINEER

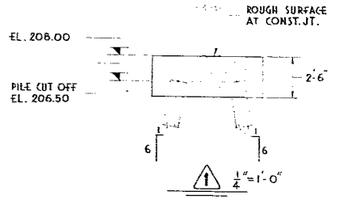
DESIGN	A.W.	CHECK	G.A.	SITE No. 27-210	W.P. No. 35-66-15
DRAWING	A.A.	CHECK	A.W. G.A.	CONTRACT No.	
DATE	NOV. 170	LOADING	HS20-44	DRAWING No.	D-6824-1

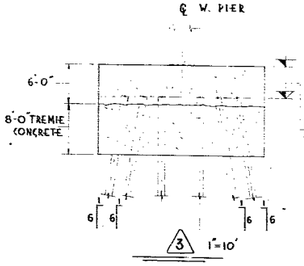
TRANSLAM 234-0-69

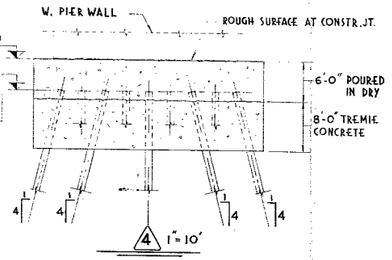


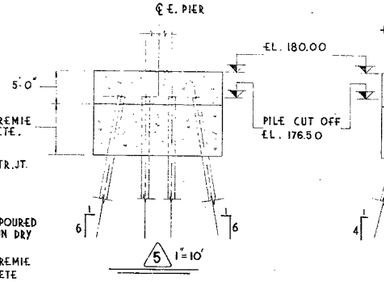
FOUNDATION LAYOUT

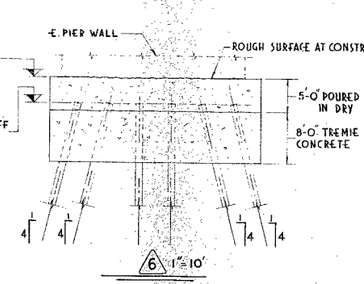
SCALE: 5/16" = 1'-0"

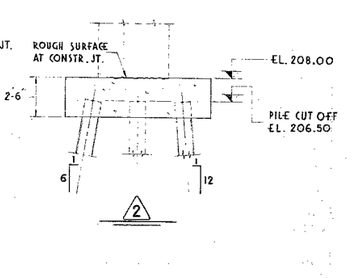












— PILE DATA —

LOCATION	N° REQ'D.	LENGTH	TYPE	DESIGN LOAD
W. ABUT.	30 ✓	74'-0"	12BP74 "H" PILES	95 T/PILE
E. ABUT.	30 ✓	68'-0"		
W. PIER	28 ✓	40'-0"		
E. PIER	24 ✓	36'-0"		

NOTES

- PILE SPACINGS TO BE MEASURED AT UNDERSIDE OF POURED-IN-DRY FOOTINGS.
- PILES TO BE DRIVEN TO REFUSAL IN ACCORDANCE WITH STD. BD B2-7 ON DWG. D-6826-23
- ANY TEMPORARY SHEETING USED FOR PLACING TREMIE CONCRETE IN PIER FOOTINGS MUST NOT BE LEFT IN ABOVE EL. 180.00.

REGISTERED PROFESSIONAL ENGINEERS — CIVIL — A. A. WITECKI — PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

PRINT RECORD

No.	FOR	DATE

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

69-F-718

SOUTH NATION RIVER BRIDGE - W.B.L.

1 MILE WEST OF CASSELMAN

KING'S HIGHWAY No. 417 — DIST. No. 9
CO. RUSSELL
TWP. CAMBRIDGE — LOT 12 — CON. VII

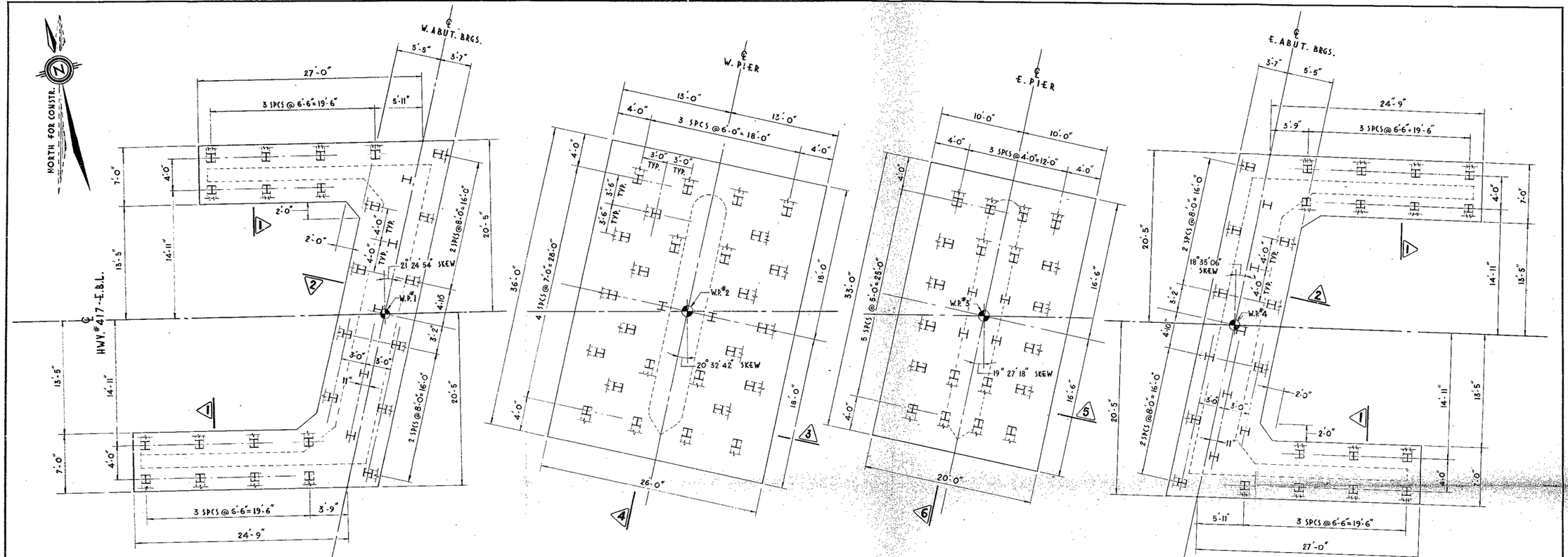
FOUNDATION LAYOUT

APPROVED _____ BRIDGE ENGINEER

DESIGN	A.W	CHECK	G.A
DRAWING	G.C.	CHECK	G.A
DATE	NOV./'70	LOADING	HS20-44

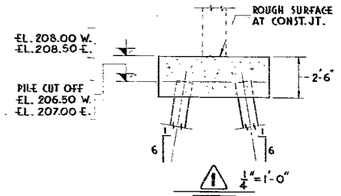
SITE No. 27-217 — W.P. No. 35-66-22
CONTRACT Nos.
DRAWING No. D-6826-4

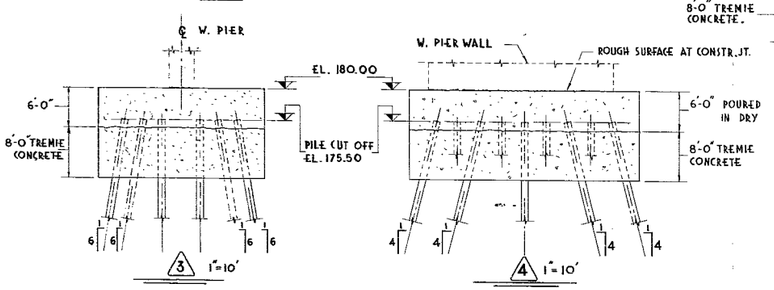
TRANSLAR 2X-3-69

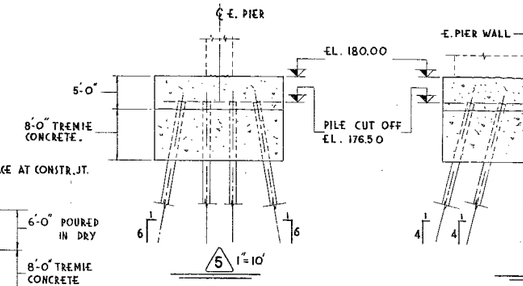


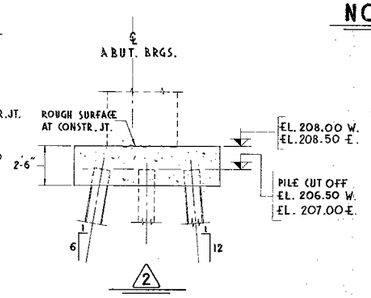
FOUNDATION LAYOUT

SCALE: 3/16" = 1'-0"









— PILE DATA —

LOCATION	Nº REQ'D.	LENGTH	TYPE	DESIGN LOAD
W. ABUT.	✓30	[77] 75'-0"	12BP74 "H" PILES	95T/PILE
E. ABUT.	✓30	[73] 72'-0"		
W. PIER	✓28	[47] 44'-0"		
E. PIER	✓24	[41] 44'-0"		

NOTES

- PILE SPACINGS TO BE MEASURED AT UNDERSIDE OF POURED-IN-DRY FOOTINGS.
- PILES TO BE DRIVEN TO REFUSAL IN ACCORDANCE WITH STD. BD B2-7 ON DWG. D-6824-23
- ANY TEMPORARY SHEETING USED FOR PLACING TREMIE CONCRETE IN PIER FOOTINGS MUST NOT BE LEFT IN ABOVE EL. 180.00

PRINT RECORD

No.	FOR	DATE

REVISIONS

DATE	BY	DESCRIPTION

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

69-F-118

SOUTH NATION RIVER BRIDGE - E.B.L.

1 MILE WEST OF CASSELMAN

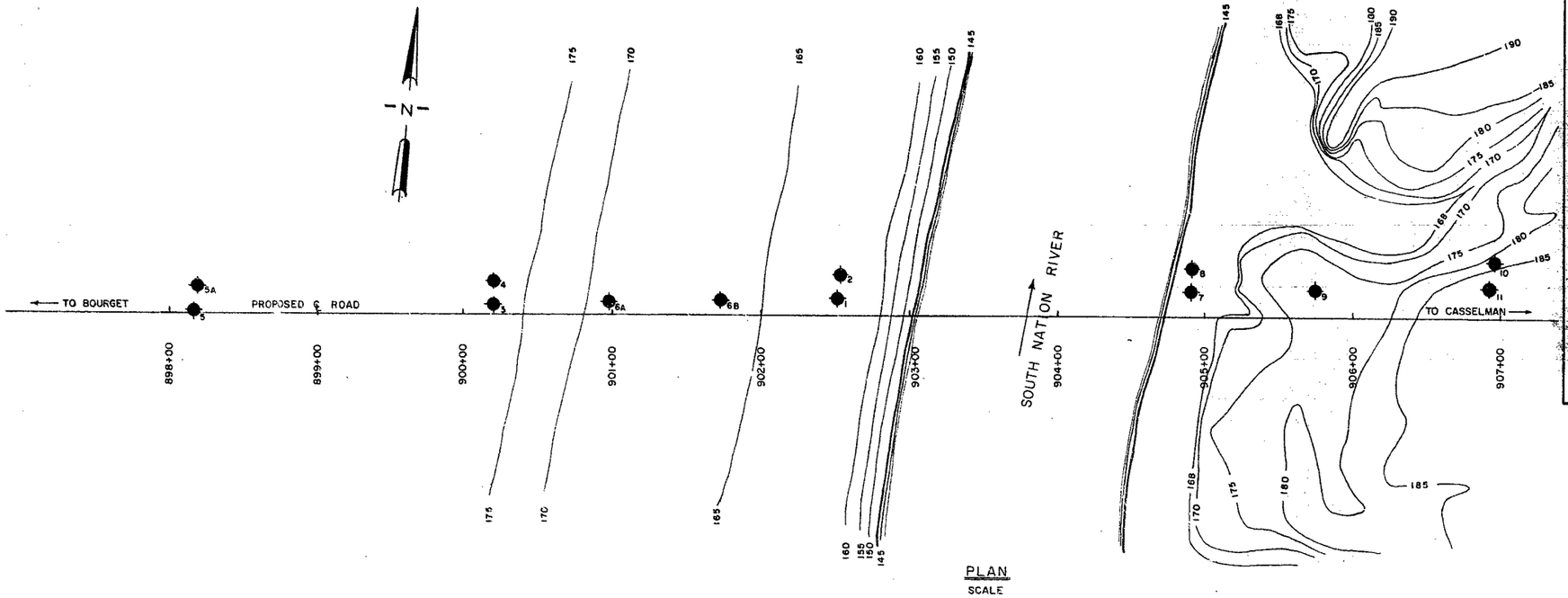
KING'S HIGHWAY No. 417 DIST. No. 9
CO. RUSSELL
TWP. CAMBRIDGE LOT 12 CON. VII

FOUNDATION LAYOUT

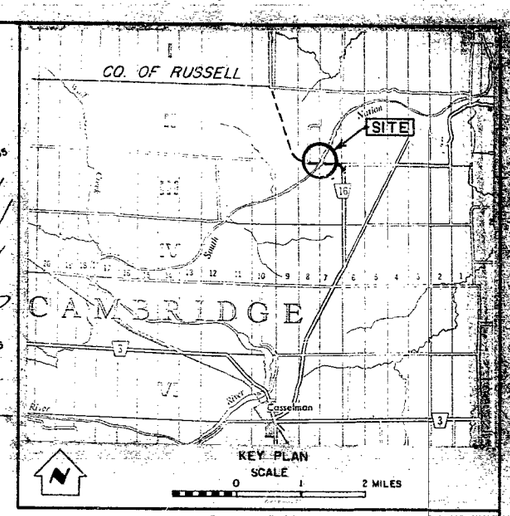
APPROVED _____ BRIDGE ENGINEER

DESIGN	A.W	CHECK	G.A.
DRAWING	G.C.	CHECK	G.A.
DATE	NOV/'70	LOADING	HS20-44

SITE No. 27-210 W.P. No. 35-66-15
CONTRACT Nos.
DRAWING No. D-6824-4



PLAN
SCALE
1"= 40'



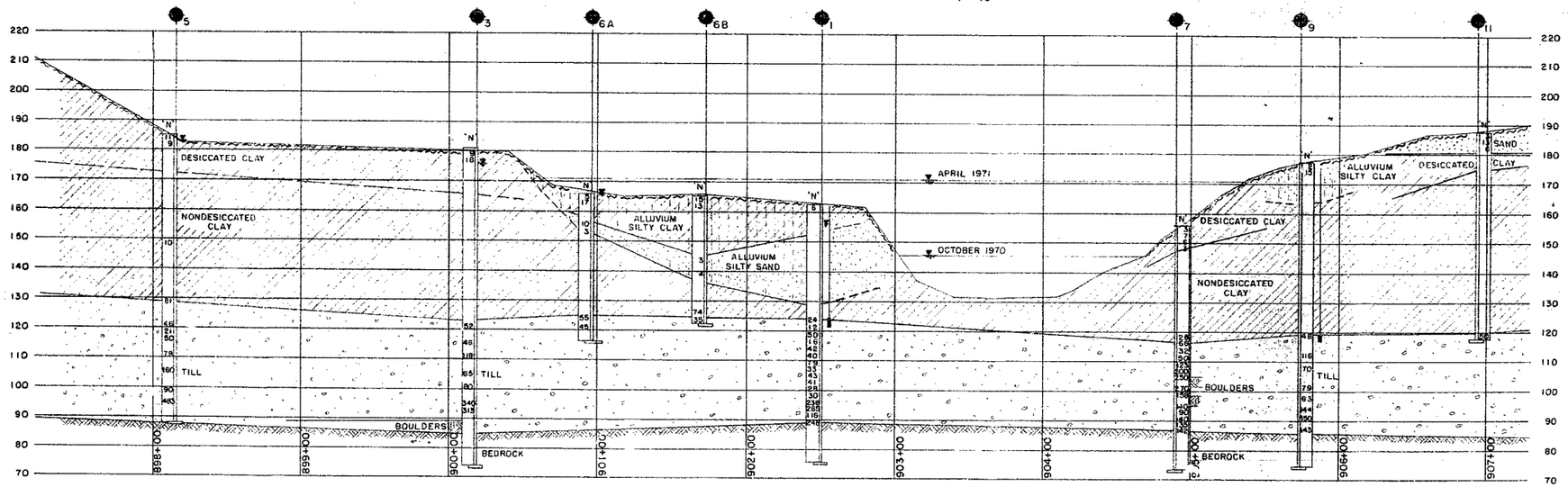
LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.
- Piezometer.

NO.	ELEVATION	STATION	OFFSET
1	163.33	902+51	11.5 LT.
2	162.89	902+53.5	27 LT.
3	180.71	900+20	6.3 LT.
4	181.45	900+20.5	21.9 LT.
5	185.14	898+16.5	1.8 LT.
5A	185.10	898+18.5	18.1 LT.
6A	166.20	900+98.5	8 LT.
6B	165.54	901+74.4	9.8 LT.
7	156.00	904+90.9	16.8 LT.
8	156.39	904+93.1	32.7 LT.
9	177.36	905+73.6	18.7 LT.
10	177.32	906+96.3	37.4 LT.
11	187.61	906+93.9	20.3 LT.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.



PROFILE
SCALE
1"= 40' HOR.
1"= 20' VER.

REVISIONS			
DATE	BY	DESCRIPTION	

FONDEX LTD.
376 CHURCHILL AVE., OTTAWA, ONT.

SOUTH NATION RIVER

UNITED COUNTIES OF PRESCOTT & RUSSELL
CO. RUSSELL
TWP. CAMBRIDGE LOT 7 & 8 CON. 2 & 3

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D.	CHECKED	JOB NO.	DRAWING NO.
DRAWN	CHECKED		
DATE		SITE NO	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	