

70-F-64	37-66-7&18	Hwy. 417 & C.N.R.	31G-67
W.O.	W.P.	LOCATION	GEOCRES NO.

• DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: Contract 73-40

REMARKS

**GEOCRES**

INDEXING CARD FOR REPORTS NOT MICROFILMED

GI-20 AUG. 74

REPRODUCED DOCUMENT MAY  
APPEAR AS MULTI-FEED ON FILM

Cont 73-40

FIELD RECONNAISSANCE REPORT  
REQUIRED BY FOUNDATION SECTION  
FOR

FF-69  
SEPT. 1968

E-4698-1 (W. B. L.)

W.P. NO. 37-66-07 HIGHWAY NO. 417 DISTRICT 9 SITE PLAN NO. E-4699-1 PROFILE NO. 9-FI-85  
RIVER CROSSING ☐ GRADE SEPERATION ☐ R.R.X. ☒ OTHER (SPECIFY) (E. B. L.)  
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" ☐  
ROCK OUTCROP (SPECIFY LOCATIONS) None

UNDERGROUND UTILITIES: UTILITY COMPANY \_\_\_\_\_ TELEPHONE NO. FOR DEFINITE LOCATION \_\_\_\_\_

1 None

2 \_\_\_\_\_

3 \_\_\_\_\_

4 \_\_\_\_\_

5 \_\_\_\_\_

EXISTING STRUCTURE(S):

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 ☒ IF NO,

PROPERTY OWNER(S):

NAME

ADDRESS

TELEPHONE NO.

1 Contact Property Section-Eastern Region

2 \_\_\_\_\_

3 \_\_\_\_\_

4 \_\_\_\_\_

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 ☒

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 \_\_\_\_\_ FT.

CURRENT: SWIFT ☐ MODERATE ☐ SLOW ☐

DRILLING OPERATIONS

NEAREST SOURCE OF WATER (GIVE HAULING DISTANCE, IF KNOWN) 4.8 mi. S.E. of site-Rigaud River at

ADDITIONAL INVESTIGATION REQUIRED FOR THE FOLLOWING PURPOSES: \_\_\_\_\_ Cty. Rd 24 North of

ALTERNATE SCHEME: YES ☐ NO ☐ IF YES, SPECIFY \_\_\_\_\_ Dalkeith

HYDROLOGIC REASONS: YES ☐ NO ☐ IF YES, SPECIFY (SCOUR, ETC.) \_\_\_\_\_

REMARKS

NEAREST AVAILABLE ACCOMODATION: Hawkesbury - Normandie Motel

OTHER COMMENTS: \_\_\_\_\_

DATE July 13, 1970

REGIONAL BRIDGE Planning LOCATION ENGINEER H. H. H. H.

MEMORANDUM

To: Mr. G. W. ...  
 From: Mr. ...  
 Date: July 13, 1970.

From: Mr. ...  
 To: Mr. ...

Date: July 13, 1970.

Attention:

Our File Ref.

In Reply To

SUBJECT: W.P. 37-66-07, Site 31-294,  
 C.N.R. Overhead (H. B. L. & W. B. L. Structures),  
 (2.6 Miles East of Highway 34 Interchange),  
 Highway 417, District 9 - Ottawa

70-11064

We are sending you herewith two prints each of Bridge Site Plans E-4698-1 (W. B. L.) and E-4699-1 (H. B. L.) on which we have marked the proposed location of the above structures. 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 October 21, 1970.

T. C. Kingsland  
 Regional Bridge Planning Engineer

TCK/hl

Encls.

c.c. (with encl.)

Bridge Office Files Section (Mr. S. McCombie)

c.c. Mr. R. Forrest

CNR Overhead

## MEMORANDUM

GEOCRES 319-67

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: October 22, 1970

OUR FILE REF.

IN REPLY TO

NOV - 8 1970

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For

CONT 73-40

The Proposed Overhead Structures at  
The Crossing of Hwy. #417 (Eastbound  
And Westbound Lanes) and the C.N.R.  
Twp. of Lochiel, County of Glengarry  
District No. 9 (Ottawa)

W.O. 70-11064 -- W.P. 37-66-07  
W.P. 37-66-18

319-67
GEOCRES No.

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 feel free to contact our Office.

AGS/MdeF  
Attach.

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

Foundations Files  
Gen. Files

*A. G. Stermac*  
A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER

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  7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT

For

The Proposed Overhead Structures at  
The Crossing of Hwy. #417 (Eastbound  
And Westbound Lanes) and the C.N.R.  
Twp. of Lochiel, County of Glengarry  
District No. 9 (Ottawa)

W.O. 70-11064 -- W.P. 37-66-07

W.P. 37-66-18

## 1. INTRODUCTION:

The Foundation Section was requested to carry out a subsurface investigation for the overhead structures at the crossing of the C.N.R. and Hwy. #417 (Eastbound and Westbound lanes). The request was contained in a memo from the Eastern Region Bridge Section (Mr. T. C. Kingsland, Regional Bridge Planning Engineer), dated July 13, 1970. An investigation was subsequently carried out by the Foundation Section to determine the subsoil, bedrock and groundwater conditions at the site.

This report contains the results of the investigation, together with recommendations pertaining to the foundations of the proposed structures as well as the stability and settlement of the approach embankments.

## 2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located in the vicinity of the C.N.R. in the Township of Lochiel, County of Glengarry, approximately 2 miles southeast of the Village of Vankleek Hill. The surrounding terrain, which is grass-covered and being used as farmland, is flat to gently undulating in relief between elevations 300 and 306.

The single track, C.N.R. line, is carried on an embankment which is approximately 4 feet above the surrounding terrain. A two-lane gravel surfaced Township Road is located about 70 feet east of the railway track. Like the railway, the road is elevated about 4 feet above the terrain. An east to west trending drainage

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

ditch, approximately 3 feet deep, traverses the site. The flow in the ditch is channelled beneath the railway and roadway by means of corrugated steel culvert pipe.

The site is situated in the complex physiographic region known as the "Glengarry Till Plain". This area is characterized by the presence of an undulating to rolling glacial till plain composed of long drumlinoidal ridges as well as a few well defined drumlins. The glacial till deposit is generally less than 25 feet in depth. Localized low-lying areas are often in-filled with soft compressible clay subsoils, and in some instances, swamp deposits. The thickness of these surficial materials are generally less than 15 feet. The overburden is underlain by limestone bedrock of the Trenton and Black River formation, Ordovician Period.

3. FIELD AND LABORATORY INVESTIGATION:

Fifteen sampled boreholes, fourteen of which were accompanied by a dynamic cone penetration test, were put down during the course of the field study. A cone test was put down as well. The borings were advanced by means of conventional diamond drill rigs adapted for soil sampling purposes. In addition, a borehole, put down in January, 1969, as part of the preliminary investigation for Hwy. #417, is included because of its close proximity to this site. This is designated as B.H. #17.

Samples of the glacial till were obtained in a 2" O.D. split-spoon sampler, which was hammered into the ground in accordance with the specifications for the Standard Penetration Test. The dynamic cone penetration tests were advanced using the same method. Samples of the cohesive stratum were obtained in 2" I.D. Shelby tubes which were manually pushed into the soil. In-situ vane tests were also carried out within this zone to determine the undrained shear strength and the sensitivity of the clay. Bedrock was proven at 14 of the boring locations by obtaining either AXT or BXT rock core samples.



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

The groundwater level conditions across the site were determined by recording the water levels in the open boreholes during the course of the investigation.

The locations and elevations of all the boreholes are shown on Drawings No. W.O. 70-11064A (Hwy. #417 - W.B.L.) and B (Hwy. #417 - E.B.L.). An estimated stratigraphical profile along the centre-line of the W.B. and E.B. lanes are also presented on the respective drawings. The surveying was carried out by personnel from the Kingston Regional Engineering Surveys Section. All elevations are referenced to Geodetic datum.

All the samples were subjected to careful visual examination both in the field and in the laboratory. Laboratory tests were performed on selected samples to determine the engineering properties of the various soil types, namely:

Natural Moisture Content  
Grain-Size Distribution  
Atterberg Limits  
Undrained Shear Strength  
Consolidation Testing

The results of the laboratory testing are plotted on the "Record of Borelog" sheets and summarized on Figures #3 to 7, all of which are contained in Appendix I of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

Along the proposed W.B. lane of Hwy. #417, a soft to firm sensitive clay stratum is present; the thickness of this stratum generally varies from 9 to 14.5 feet. The cohesive subsoil is underlain by a thin (2 to 7.5 feet) glacial till deposit which, in turn, is followed by limestone bedrock. Along the E.B. lane, located to the south of the aforementioned lane, the surficial

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

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

cohesive stratum is often absent. At these locations the glacial till protrudes within a few feet of ground surface.

The stratigraphical profiles, shown on Drawings No. W.O. 70-11064 A and B, were derived from the borehole data as illustrated on the "Record of Borehole" sheets.

Following is a description of the different soil types encountered from the ground surface down to bedrock.

4.2) Clay to Silty Clay (Sensitive):

Beneath a thin (1 to 2 feet) layer of topsoil or organic silt a) along the W.B.L. of Hwy. #417; and b) at B.H.'s #8, 9 and 10 put down in the vicinity of the E.B.L., is a stratum composed of sensitive grey clay to silty clay. The thickness of this subsoil, where encountered, varies from 2 to 12.5 feet, being typically of the order of 9 feet. At those locations where the stratum is most extensive, the upper 3 to 4 feet is often desiccated forming a crust. Layers of silty sand, up to 3 feet in thickness, are spaced randomly throughout the cohesive subsoil. Grain-size distribution curves for samples of the stratum are plotted on Figure #3.

The engineering properties of the clay to silty clay, which are plotted on the "Record of Borelog" sheets, are also summarized in tabular form, as follows:

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

4.2) Clay to Silty Clay (Sensitive): (cont'd.) ...

<u>Identity Tests:</u>		<u>Range</u>	<u>(Average)</u>
Bulk Density (p.c.f.)	( $\gamma$ )	93 - 118	(98)
Liquid Limit (%)	( $W_L$ )	29 - 97	(65)
Plastic Limit (%)	( $W_P$ )	17 - 28	(25)
Natural Moisture Content (%)	( $W$ )	27 - 87	(65)
Liquidity Index	( $I_L$ )	0.6 - 2.4	(1.4)

Compressibility Characteristics:

Initial Void Ratio	( $e_o$ )	2.4 and 2.9	} 2 Tests
Compression Index	( $C_c$ )	1.8 and 3.6	
Degree of Preconsolidation (p.s.f.)	( $P_c - P_o'$ )	2,800 and 2,000	

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

In Situ Field Vane Tests	200 - 850
Laboratory Tests	300 - 1,100
Sensitivity ( $S_t$ )	2 - 18 (9)

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

4.2) Clay to Silty Clay (Sensitive): (cont'd.) ...

The Atterberg limit test results, given in the table, are also summarized on the Plasticity Chart, Figure #4. The testing indicates that the cohesive subsoil is inorganic with the plasticity ranging from intermediate to high. The natural moisture content is consistently at or above the liquid limit; this was exemplified by the relatively high liquidity index values obtained. These values are an indication of the very sensitive nature of the subsoil.

The field and laboratory undrained shear strength results are plotted on the Record of Borelog sheets, and summarized on Figure #5. The results indicate that the consistency of the clay varies from soft to firm, being stiff where an upper desiccated zone was encountered.

The consolidation characteristics of the cohesive stratum were determined by carrying out two laboratory consolidation tests, the results of which are shown as Void Ratio vs. Pressure plots on Figure #6. Referring to the table, it can be seen that the deposit is preconsolidated by between 2,000 to 2,800 p.s.f. in excess of existing overburden pressure. The upper desiccated zone is preconsolidated to a degree in excess of the range quoted above. The relatively high values obtained for the Compression Index ( $C_c$ ) and the Initial Void Ratio ( $e_0$ ) are typical of the values obtained for sensitive marine clay material.

4.3) Heterogeneous Mixture of Silt, Sand and Gravel, with some Clay (Glacial Till):

The cohesive stratum, where encountered, or the surficial cover elsewhere, is underlain by a deposit of glacial till which is heterogeneous in composition. The thickness of this deposit varies from 2.5 to 18.5 feet, being most extensive in the vicinity of the proposed E.B.L. where the cohesive stratum overlying it is less extensive. In general, the glacial till is granular in nature -

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

4.3) Heterogeneous Mixture of Silt, Sand and Gravel, with some Clay (Glacial Till): (cont'd.) ...

i.e., composed of silt, sand and gravel with a trace of clay. There are localized random cohesive zones throughout, however, in these areas the matrix is composed of clayey silt binding sand and gravel. Boulders, up to 5 inches in size, are occasionally present in the lower portion of the deposit in those areas where the deposit is most extensive. Grain-size distribution curves, for samples obtained with a 2" O.D. split-spoon sampler, are plotted on Figure #7.

Standard Penetration testing was carried out within the deposit; the 'N' values obtained range from 19 blows/ft. to 108 blows for 9 inches, being typically greater than 50 blows/ft. Based on these values, it is estimated that the relative density of the overall deposit varies from compact to very dense. In the upper portion of the glacial till, at a few boring locations - (refer to B.H.'s #5, 6, 9 and 15), this pattern was interrupted; here 'N' values between 7 and 12 blows/ft. were observed. It is believed that the material in such zones, which is in a loose to compact state, has been 'reworked' in the geologic past by mechanical and chemical processes.

4.4) Limestone Bedrock:

The overburden is underlain by limestone bedrock which has occasional interbeds of shale up to 5 inches thick throughout. The bedrock was proven in 14 of the borings by obtaining between 4 and 12 feet of either AXT or BXT rock core samples. The elevation of the bedrock varies from 285 to 294, corresponding to depths below ground surface of 12.5 to 19 feet. In general, the bedrock surface is at a higher elevation in the vicinity of the proposed E.B.L. of Hwy. #417.

At some of the boring locations the upper 1.5 to 3 feet of the bedrock is in a fractured condition. Below this upper fractured zone the bedrock is basically sound as evidenced by the high percentage of core recovered.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out in the open boreholes, during the period of the field investigation. The results of these observations are plotted on the "Record of Borelog" sheets and on Drawings No. W.O. 70-11064A and B. Based on the recorded results, it is estimated that the groundwater level in the overburden and bedrock ranges between elevations 300.5 and 303.5,

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct twin overhead structures at the crossing of Hwy. #417 (E.B. and W.B. lanes) and the C.N.R. in the Township of Lochiel, County of Glengarry. The present proposal calls for parallel structures, which will be approximately 270 feet apart; each structure will be 48 feet wide and have 4 spans:

- W.B. Lane Structure - 50' - 54' - 54' - 48' (Total Length 206 feet)
- E.B. Lane Structure - 49' - 54' - 54' - 42' (Total Length 199 feet)

The profile grade of Hwy. #417, in the vicinity of the structures, will vary between elevations 334 and 338. The associated approach fills will, therefore, have maximum heights which vary from 30 feet, along the West approach to the structures, to 33 feet along the East approaches.

The recommendations pertaining to foundation design will be quite different for the two proposed structures, since the subsoil encountered at either location varies markedly. This being the case, the discussion pertaining to each structure will be presented separately in the sub-sections to follow.

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

6.2) Westbound Lane Structure (Refer to Dwg. No. 70-11064A):

6.2.1) Proposed Scheme -

A 9 to 14.5 feet thick soft, compressible clay stratum is present at a shallow depth below ground surface at this structure crossing. The cohesive stratum is underlain by a thin glacial till deposit followed, in turn, by limestone bedrock.

The presence of the sensitive cohesive stratum at a shallow depth below ground surface, is the governing factor from a foundation point of view, since it will be necessary to ensure that it is not overstressed by either the embankment or the structure foundation loadings.

1) Stability of Approach Fills -  
- - - - -

The critical condition for stability of an embankment on slightly overconsolidated cohesive subsoils, as is the case at this site, generally occurs during or immediately following the construction period. This being the case, a total stress analysis ( $\phi = 0$ ) provides a suitable means of assessing the stability of the embankment sections. In this method of analysis, stability is governed by the applied loads and by the stress-strain and undrained shear strength characteristics of the foundation and embankment soils.

Analyses have been carried out, therefore, in terms of total stresses, both manually and by the use of the electronic computer, to determine the stability of the approaches.

The geometric sections at the approaches, and the soil properties for the fill and natural subsoil, assumed for computational purposes, are presented on Figure #1, in Appendix I of this report. The results of the analyses, including the heights of fill involved and berm requirements, are presented in the following table. It should be noted that standard 2:1 slopes were used in the computations.

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

6.2) Westbound Lane Structure (Refer to Dwg. No. 70-11064A):  
(cont'd.) ...

6.2.1) Proposed Scheme - (cont'd.) ...

1) Stability of Approach Fills - (cont'd.) ...  
-----

<u>Approach</u>	<u>Height of Fill</u>	<u>Berm Requirements (Mid-Height)</u>
West	* 30 feet	20 feet
	25 feet	10 feet
	20 feet	Nil
East	* 33 feet	15 feet
	27 feet	10 feet
	20 feet	Nil

A smooth transition should be effected between the berm requirements for various heights of fill.

\* Note: Proposed Height in Vicinity of Structure.

Referring to the table, it can be seen that, if the profile grades proposed are adopted, then berms will be required in both the longitudinal and transverse direction in the immediate vicinity of the structure. The necessity of longitudinal berms will entail the lengthening of the structure by 35 feet.

It should be stressed that the berm requirements presented in the table are applicable for that portion of the alignment located between Stations 184+00 and 187+50. The two borings put down outside these limits (refer to B.H.'s #6 and 7) appear to indicate that the cohesive subsoil is: a) less extensive and b) more competent than what is present within the limits. This being the case, berms may not be required in the transverse direction beyond the stations quoted above.



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

6.2) Westbound Lane Structure (Refer to Dwg. No. 70-11064A):  
(cont'd.) ...

6.2.1) Proposed Scheme - (cont'd.) ...

ii) Settlement Considerations -  
-----

The sensitive clay stratum will undergo settlements due to consolidation, over a period of time, under the weight of the approach embankments. Settlement computations were, therefore, carried out, the results of which are summarized on Figure #1.

The maximum consolidation settlement will take place beneath the West approach. It is estimated that this settlement could be of the order of 15 to 18 inches. The consolidation settlement beneath the East approach will, however, be less since the cohesive subsoil is not as compressible in this area. It is estimated that the settlement at this approach will range between 8 and 10 inches.

The total amount of the predicted settlement, at both approaches, should take place within a period of 24 to 30 months. About 50% should, however, occur within 6 to 8 months.

Since the predicted settlements will occur relatively quickly, it would be advantageous to place the fills prior to construction of the structure, in order to minimize post-construction maintenance. If scheduling permits, a period of at least 9 months should be provided for this purpose. In any event, final paving should be delayed as long as possible.

iii) Structure Foundations -  
-----

At the proposed pier and abutment locations, compressible clay is located at a shallow depth below the surface. For this reason, it is recommended that the piers be supported on end-bearing piles driven to bedrock. The pile tip elevations would range from 286 to 289.

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

6.2) Westbound Lane Structure (Refer to Dwg. No. 70-11064A):  
(cont'd.) ...

6.2.1) Proposed Scheme - (cont'd.) ...

iii) Structure Foundations - (cont'd.) ...  
- - - - -

The allowable pile load at the pier locations, would be dependent on the section chosen - for example, 14 BP 74 steel H-piles may be designed for 95 tons/pile.

At the abutment locations, however, the piles will be subjected to a negative skin frictional load due to consolidation of the cohesive foundation subsoil under the weight of the approach fills. In order to take this effect into consideration, it is recommended that the ultimate capacity of the pile section chosen be reduced by about 20 percent for design purposes. For example, 14 BP 74 steel H-piles can be designed for 75 tons/pile.

An earth cover of at least 4 feet should be provided to the underside of the pier pile caps for frost protection purposes.

At the location of the pier foundations, the groundwater level is about 2-1/2 to 3 feet below ground surface (i.e., about 1-1/2 feet above the base of the pile caps. Since the caps will be located in the relatively impervious cohesive stratum no major dewatering problems are anticipated. Any groundwater seepage or surface run-off into the excavation could be handled by conventional techniques (such as pumping from sumps).

No bouldery or rock fill should be placed in areas through which piles are to be driven.

6.2.2) Alternative Scheme - Sub-excavation of Clay Stratum:

i) Limits of Sub-excavation -  
- - - - -

If the compressible clay stratum is left in place, then:

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

6.2) Westbound Lane Structure (Refer to Dwg. No. 70-11064A):  
(cont'd.) ...

6.2.2) Alternative Scheme - Sub-excavation of Clay  
Stratum: (cont'd.) ...

i) Limits of Sub-excavation - (cont'd.) ...  
-----

- a) berms will be required in the longitudinal and transverse direction to ensure the stability of the embankment sections; and
- b) consolidation settlements will be induced in the foundation subsoil by the fill loadings.

These aspects were discussed in detail in Sub-section 6.2.1). The thickness of the clay, in the critical areas, varies from about 9 to 15 feet. Because of the nominal thickness of this deposit, it is considered that it would be feasible to completely sub-excavate the material and by so doing, eliminate the berm requirements as well as the consolidation settlement that would have been induced in the cohesive subsoil.

The cohesive subsoil should be completely sub-excavated from within the plan limits of the proposed approach fills. The recommended geometry of the sub-excavations is shown on Figure #2. Because of the space restrictions between the toe of the proposed West approach fill and the existing C.N.R. track, the slope of the sub-excavation, in this area, may have to be steeper than the 1:1 generally recommended. This may be accomplished by employing closed steel sheet piling. The sheeting should be driven to bedrock.

The sub-excavations will have to extend for a reasonable distance behind the abutments, in order to obtain the most beneficial results. It is considered that the most optimum extension could best be determined by putting down additional shallow borings to fully delineate the vertical and lateral extent of the compressible cohesion stratum, particularly west of Station 184+00 and east of Station 187+50. This programme will be carried out by this Section if this scheme is adopted.

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

6.2) Westbound Lane Structure (Refer to Dwg. No. 70-11064A):  
(cont'd.) ...

6.2.2) Alternative Scheme - Sub-excavation of Clay  
Stratum: (cont'd.) ...

i) Limits of Sub-excavation - (cont'd.) ...  
- - - - -

The sub-excavations so formed, should be backfilled with a granular type of material to a level extending at least 1 foot above the prevailing groundwater level. Any other acceptable earth fill could be used above this level.

ii) Structure Foundations -  
- - - - -

The piers and abutments may be supported on end-bearing steel H-piles driven to bedrock, as discussed in detail in Sub-section 6.2.1), iii).

As an alternative, at the abutment locations only, spread footings may be employed. The spread footings can be perched within the approach fills. The fill material, below the tops of the footings, should consist of well compacted G.B.C. Class 'A' material, and should extend to a horizontal distance of at least 10 feet from the footing edges in the plane of the footing tops. This portion of the fill should be constructed with side slopes no steeper than 2:1. The remainder of the fill should be completed to about profile grade for a distance of 50 feet behind the abutments before re-excavation for the abutment footings. An allowable bearing value of 2.0 t.s.f. may be used in design.

Differential settlement will occur between the spread footing supported abutments and the adjacent piers on piles. The magnitude of this settlement should be within 1 inch.

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

6.3) Eastbound Lane Structure (Refer to Dwg. No. 70-11064B):

Over the major portion of this structure crossing a thin (7 to 15 feet thick) competent glacial till deposit is encountered a few feet below ground surface. The glacial till is underlain by limestone bedrock. An exception to this pattern occurs in the vicinity of the proposed West abutment (refer to B.H. #8); here 10.5 feet of firm to stiff clay overlies the glacial till deposit.

i) Approach Fills

Embankments of the height contemplated (30 feet West approach, 33 feet East approach) will be inherently stable with respect to a deep-seated failure, provided standard 2:1 slopes are employed.

The cohesive foundation subsoil, located beneath the West approach, will consolidate due to the induced fill loading. Computations carried out indicate that the magnitude of this settlement could be of the order of 8 inches. The total amount of this settlement should take place within a period of 24 to 30 months, while 50% should occur within 6 to 8 months.

The East approach fill will be placed on the competent glacial till deposit. The settlement induced in the glacial till, by the fill loading, will be elastic in nature - i.e., take place during or immediately following the construction period. The magnitude of this settlement should not exceed 1 inch.

In order to reduce the magnitude of the post-construction maintenance requirements, associated with the settlement occurring beneath the West approach embankment, it would be advantageous to place the fills prior to construction of the structure. If scheduling permits, a period of at least 9 months is recommended for this purpose. In any event, final paving should be delayed as long as possible.

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

6.3) Eastbound Lane Structure (Refer to Dwg. No. 70-11064B):  
(cont'd.) ...

ii) Structure Foundations -

The piers can be founded on spread footings located within the competent glacial till deposit. The base of the footings should be provided with at least 4 feet of earth cover for frost protection purposes. Footings, satisfying the above requirements, could be designed using an allowable bearing value of 3.0 t.s.f.

The footing level will be at or slightly below the groundwater level recorded during the period of the investigation. Since the glacial till is relatively pervious, boiling may occur at foundation level due to the unbalanced hydrostatic pressure head. Further, some groundwater seepage may occur into the excavations. One method of controlling these complications would be to construct a drainage ditch around the perimeter at each of the footing locations. The invert of this ditch should extend at least 2 feet below the proposed footing level. The water collected in this ditch should be gravity drained to a sump from where it can be pumped away from the construction area.

Settlement of the glacial till will occur due to the footing pressure. The magnitude of this settlement should be negligible, providing the foundation subsoil is not loosened by groundwater seepage or surface run-off. In this regard, it is recommended that a working pad of lean concrete, or alternatively, a mat composed of well compacted granular material, be immediately placed on the subsoil once the footing grade is reached.

The abutments for the structure may be perched within the approach fills. They can be supported on end-bearing piles driven to bedrock. For estimating purposes, the following pile tip elevations can be assumed:

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

6.3) Eastbound Lane Structure (Refer to Dwg. No. 70-11064B):  
(cont'd.) ...

ii) Structure Foundations - (cont'd.) ...

West Abutment -- 288

East Abutment -- 292

The allowable load will be dependent on the pile section selected. At the West abutment location, however, the allowable load will have to be reduced due to the negative skin frictional load placed on the pile by the clay stratum, which is consolidating under the weight of the approach fill. This aspect was discussed in detail in Sub-section 6.2.1), iii). For example, 14 BP 74 steel H-piles can be designed as follows:

West Abutment -- 75 tons/pile.

East Abutment -- 95 tons/pile.

No bouldery or rock fill should be placed in areas where piles are to be driven.

Differential settlement may occur between the pile-supported abutments and the adjacent piers, which are founded on spread footings. It is estimated, however, that this settlement will be of the order of 1/2 inch, which should be within tolerable limits for the type of structure contemplated.

7. MISCELLANEOUS:

The field work, performed during the period of August 6 to 28, 1970, was carried out under the immediate supervision of Mr. A. R. Newman, Student Technician (Field).

The equipment was owned and operated by the F. E. Johnston Drilling Company Ltd.,

This report was written by Mr. B. T. Darch, Senior Foundation Engineer.

This project was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

November, 1970.

APPENDIX I



## FOUNDATION SECTION

CHECKED BY 

[illegible]



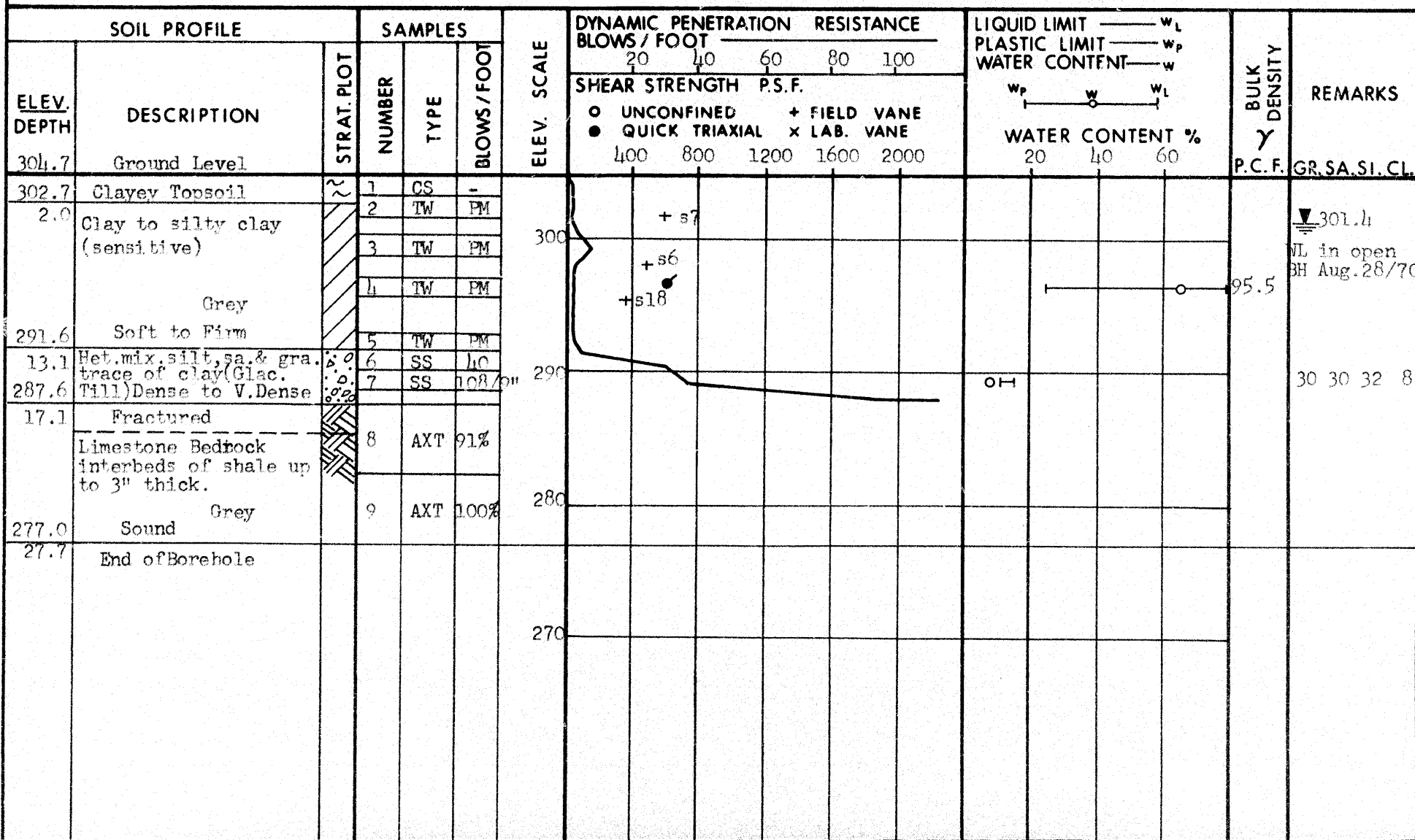


DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-11064 LOCATION Hwy. 417 W.B.L. Sta. 186 + 23 o/s 30' Rt. ORIGINATED BY ARN  
 W.P. 37-66-07 BORING DATE August 24, 1970 COMPILED BY BTD  
 DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing-AXT Rock Core; Cone CHECKED BY SL



## FOUNDATION SECTION

CHECKED BY                     

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 6

FOUNDATION SECTION


JOB 70-11064 LOCATION Hwy. 417 W.B.L. Sta. 182 + 85 Ø ORIGINATED BY ARN  
 W.P. 37-66-07 BORING DATE August 27, 1970 COMPILED BY BTD  
 DATUM Geodetic BOREHOLE TYPE Wahsboring-NX, BX Casing; Cone CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$				BULK DENSITY $\gamma$ P.C.F.	REMARKS				
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.						WATER CONTENT %			
							20	40	60	80	100	P.S.F.						WATER CONTENT %			
												P.S.F.						WATER CONTENT %			
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						SHEAR STRENGTH P.S.F.					WATER CONTENT %										

300.5

WL in open BH  
Aug. 28/70

## FOUNDATION SECTION

JOB	70-11064	LOCATION	Hwy. 417 WBL Sta. 188 + 21 @	ORIGINATED BY	ARN
W.P.	37-66-07	BORING DATE	August 25 & 26, 1970	COMPILED BY	BTD
DATUM	Geodetic	BOREHOLE TYPE	Washboring-NX, BX Casing, AXT Rock Core; Cone	CHECKED BY	

[illegible]



## FOUNDATION SECTION

JOB	<u>70-11064</u>	LOCATION	<u>Sta. 185 + 00 30' Lt. E.B.L.</u>	ORIGINATED BY	<u>ARN</u>
W.P.	<u>37-66-07</u>	BORING DATE	<u>August 28, 1970</u>	COMPILED BY	<u>BTD</u>
DATUM	<u>Geodetic</u>	BOREHOLE TYPE	<u>Washboring-NX,BX Casing-BXT,AXT Rock Core: Cone</u>	CHECKED BY	<u>[Signature]</u>

[illegible]



DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 70-11064 LOCATION Sta. 185 + 46 18' Rt. E.B.L. ORIGINATED BY ARN  
 W.P. 37-66-07 BORING DATE August 26, 1970 COMPILED BY BTD  
 DATUM Geodetic BOREHOLE TYPE Washboring-NX, AX Casing-AXT Rock Core; Cone CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$		BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
305.1	Ground Level											
304.1	Clayey Topsoil		1	CS	-							
1.0	Clay (desiccated)		2	TW	FM							
301.6	Very Stiff											
3.5	Reworked Zone		3	SS	12							
	Het. mix. of silt, sand & gravel, trace of clay		4	SS	27							
			5	SS	18							
			6	SS	27							
	Grey		7	SS	19							
289.4	Compact to Dense		8	SS	63/8'							
15.7	Fractured		9	AXT	37%							
	Limestone Bedrock											
	Shale interbeds		10	AXT	60%							
283.0	Sound											
22.1	End of Borehole											

300.6  
 WL in open  
 BH Aug. 28/70

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE


## RECORD OF BOREHOLE No. 10

## FOUNDATION SECTION

JOB	70-11064	LOCATION	Sta. 186 + 03 30' Lt. E.B.L.	ORIGINATED BY	ARN
W.P.	37-66-07	BORING DATE	August 7, 1970	COMPILED BY	BTD
DATUM	Geodetic	BOREHOLE TYPE	Washboring-NX, BX Casing-BXT, AXT Rock Core; Cone	CHECKED BY	<i>[Signature]</i>

[illegible]

## FOUNDATION SECTION

JOB	70-11064	LOCATION	Sta. 186 + 51 18' Rt. E.B.L.	ORIGINATED BY	ARN
W.P.	37-66-07	BORING DATE	August 5 & 6, 1970	COMPILED BY	BTD
DATUM	Geodetic	BOREHOLE TYPE	Wahboring-BX Casing-AXT,BXT Rock Core	CHECKED BY	

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 70-11064 LOCATION Sta. 186 + 99 20' Lt. E.B.L. ORIGINATED BY ARN  
 W.P. 37-66-07 BORING DATE August 6 & 7, 1970 COMPILED BY BTD  
 DATUM Geodetic BOREHOLE TYPE Wasporing-BX Casing-BXT, AXT Rocke Core; Cone CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 20 40 60
							20	40	60	80	100	400	800	1200			
306.8	Ground Level																
305.8	Clayey Topsoil		1	SS	15	300											
1.0	Het. mix. silt, sand and gravel, trace of clay (Glacial Till) boulders up to 4" in size particularly below el. 297.)		2	SS	51												
			3	SS	82												
			4	SS	101												
			5	SS	107												
			6	SS	117												
292.0	Very Dense					290											
14.8	Limestone Bedrock interbeds of shale up to 4" thick Grey		7	BXT	100%												
			8	AXT	100%												
281.9	Sound		9	AXT	100%												
24.9	End of Borehole					280											

302.7  
 51 29 16 4  
 WL in open  
 BH Aug. 7/70

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 13

FOUNDATION SECTION

JOB 70-11064

LOCATION Sta. 183 + 50 @ E.B.L.

ORIGINATED BY ARN

W.P. 37-66-07

BOXING DATE August 26, 1970


COMPILED BY BTD

DATUM Geodetic

BOREHOLE TYPE Washboring-NX, BX Casing-BXT Rock Core; Cone

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	WATER CONTENT % $w_p$ — $w$ — $w_L$			
306.8	Ground Level														
1.0	Het. mix. of silt, sand & gravel, trace of clay (Glacial Till) boulders up to 5" in size throughout		1	SS	24										
			2	BXT	85 7/8"										
			3	BXT	87 7/8"										
			4	SS	138										
			5	SS	115										
294.3	Very Dense		6	SS	120										
12.5	Fractured		7	SS	120										
	Limestone Bedrock		8	SS	120										
286.9	Sound		9	BXT	40%										
			10	BXT	100%										
19.9	End of Borehole														

 302.0  
Aug. 26/70

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 14

FOUNDATION SECTION

JOB 70-11064 LOCATION Sta. 188 + 49 @ E.B.L. ORIGINATED BY ARN  
 W.P. 37-66-07 BORING DATE August 7, 1970 COMPILED BY HTD  
 DATUM Geodetic BOREHOLE TYPE Washboring-BX, AX Casing-BXT, AXT Rock Core: Cone CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					$w_p$
307.3	Ground Level																
306.3	Clayey Topsoil		1	SS	5												
1.0	Reworked Zone		2	SS	9												
	Het. mix. silt, sand and gravel, trace of clay (Glacial Till) boulders up to 7" in size		3	BXT	23%												
			4	AXT	87%												
293.7	Very Dense		5	AXT	40%												
13.6	Fractured		6	AXT	55%												
	Limestone Bedrock shale interbeds Grey		7	AXT	89%												
283.9	Sound		8	AXT	100%												
23.4	End of Borehole																

303.7  
 WL in open  
 BH Aug. 7/70

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 15

FOUNDATION SECTION

JOB 70-11064

LOCATION Sta. 186 + 71 118' Lt. W.B.L.

ORIGINATED BY ARN

W.P. 37-66-07

BORING DATE August 25, 1970

COMPILED BY BTD

DATUM Geodetic

BOREHOLE TYPE Washboring-NX Casing; Cone

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS/FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
305.2	Ground Surface											
0.5	Reworked Zone		1	SS	13							
			2	SS	7							
	Het. mix. silt, sand and gravel, trace to some clay (Glacial Till)		3	SS	39							
			4	SS	45							
			5	SS	32							
	Grey		6	SS	69							
286.7	Dense to Very Dense		7	SS	42							
18.5	End of Borehole		8	SS	110							

301.7  
WL in open  
BH Aug. 28/70



## FOUNDATION SECTION

CHECKED BY

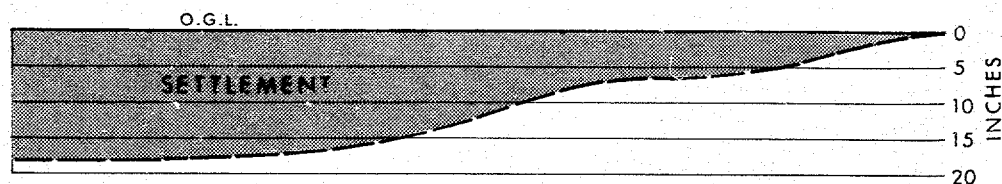
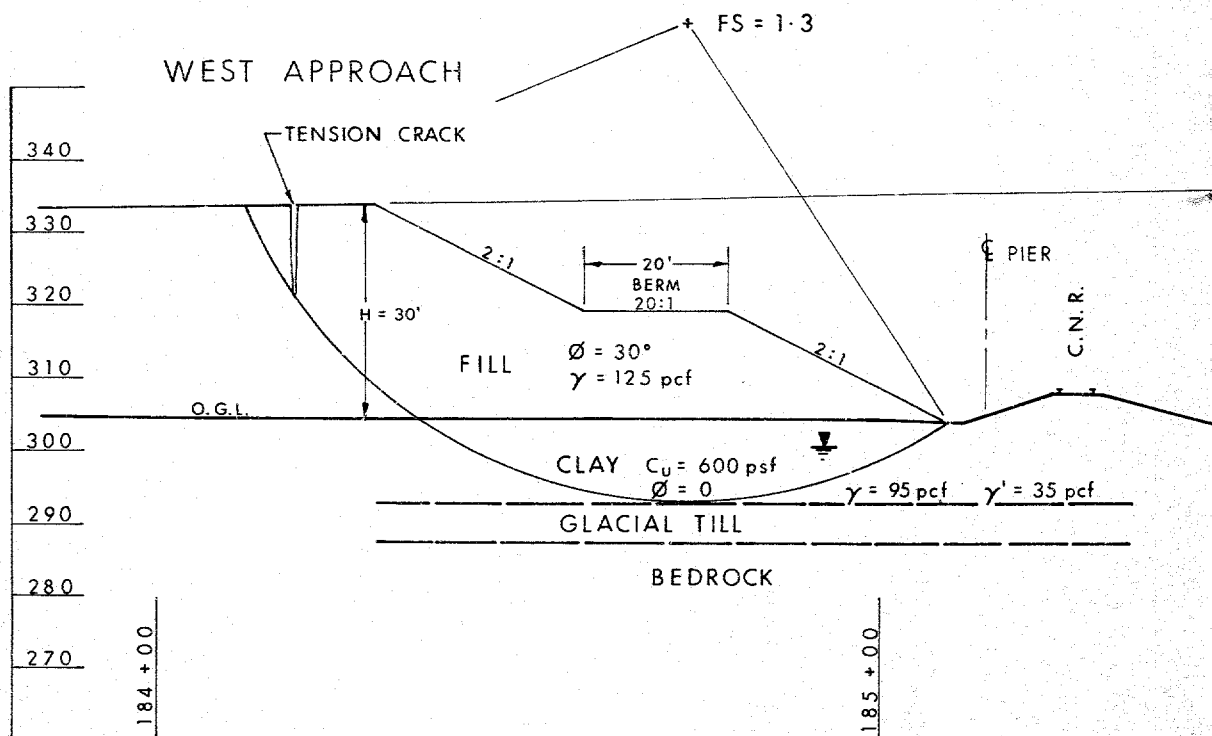
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## RECORD OF BOREHOLE No. 17 (Site 24 68-F-90) FOUNDATION SECTION

JOB 70-11064 LOCATION Hwy. 417 W.B.L. Sta. 186 + 05 o/s 98' Lt. C ORIGINATED BY VK  
W.P. 37-66-07 BORING DATE Jan. 22 & 23, 1969 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing - BXL Rock Core CHECKED BY [Signature]

[illegible]



# LEGEND

- + - Critical Circle
- FS - Factor of Safety
- H - Height of Fill
- ▬ - Water Level

Q PROF

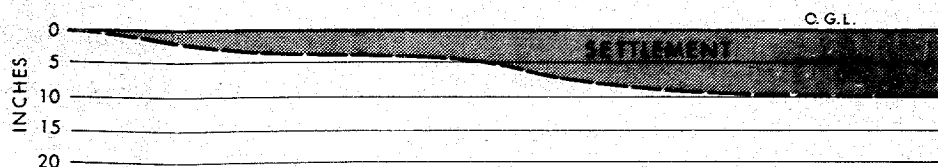
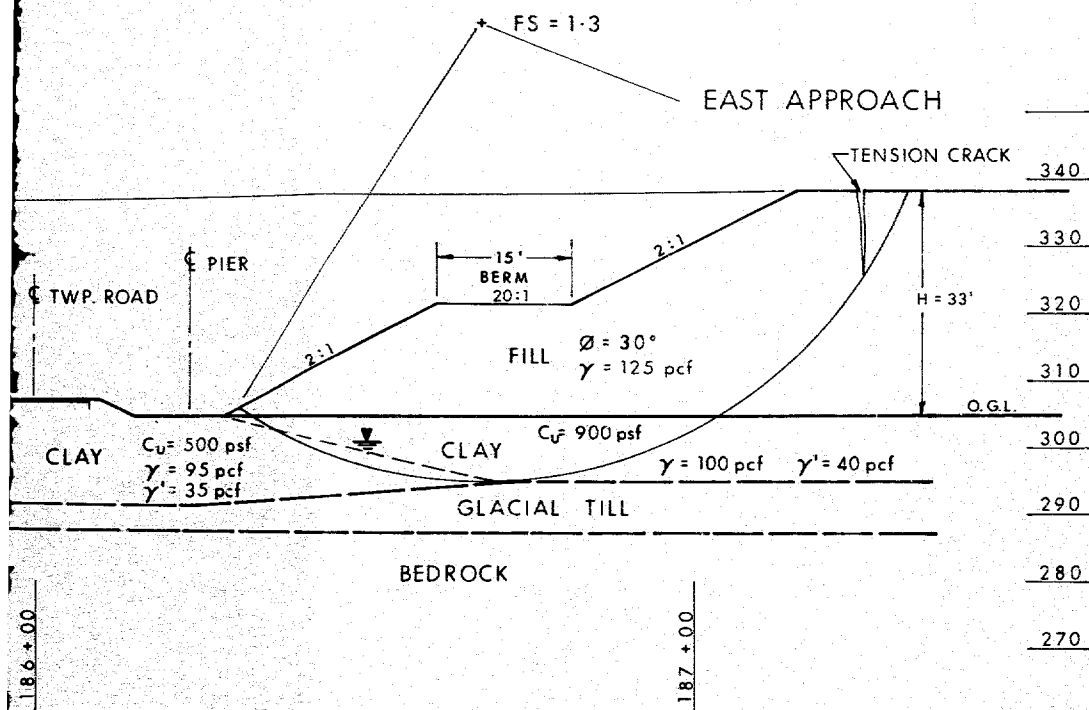
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CONSOL

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100 %

50 %





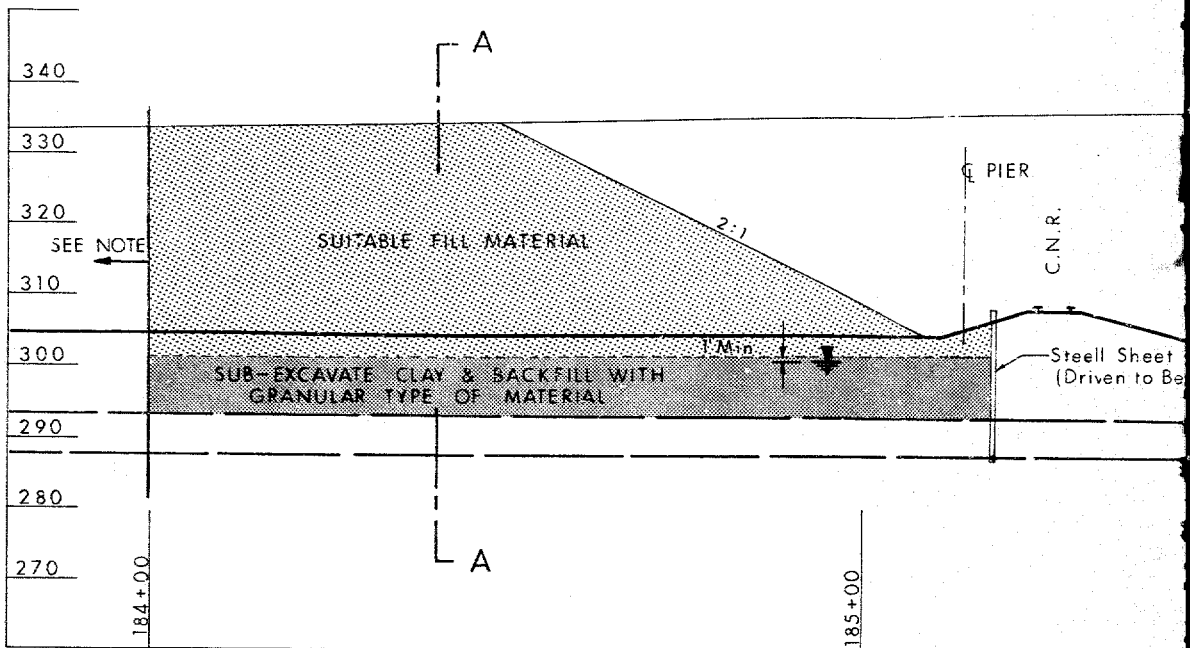
SUMMARIZED RESULTS OF STABILITY AND SETTLEMENT ANALYSES  
 HIGHWAY 417 - W.B.L. OVER C.N.R. & TWP. ROAD

JOB 70-11064

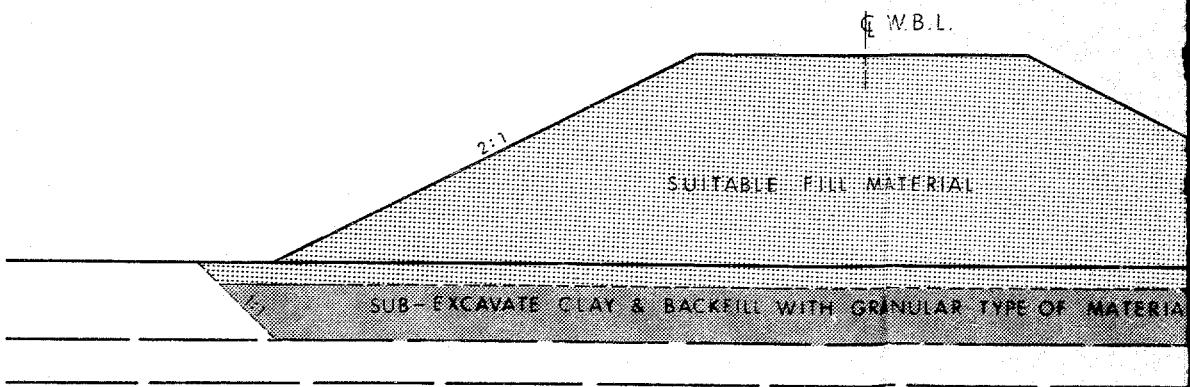
W.P. 37-66-07

FIGURE NO. 1

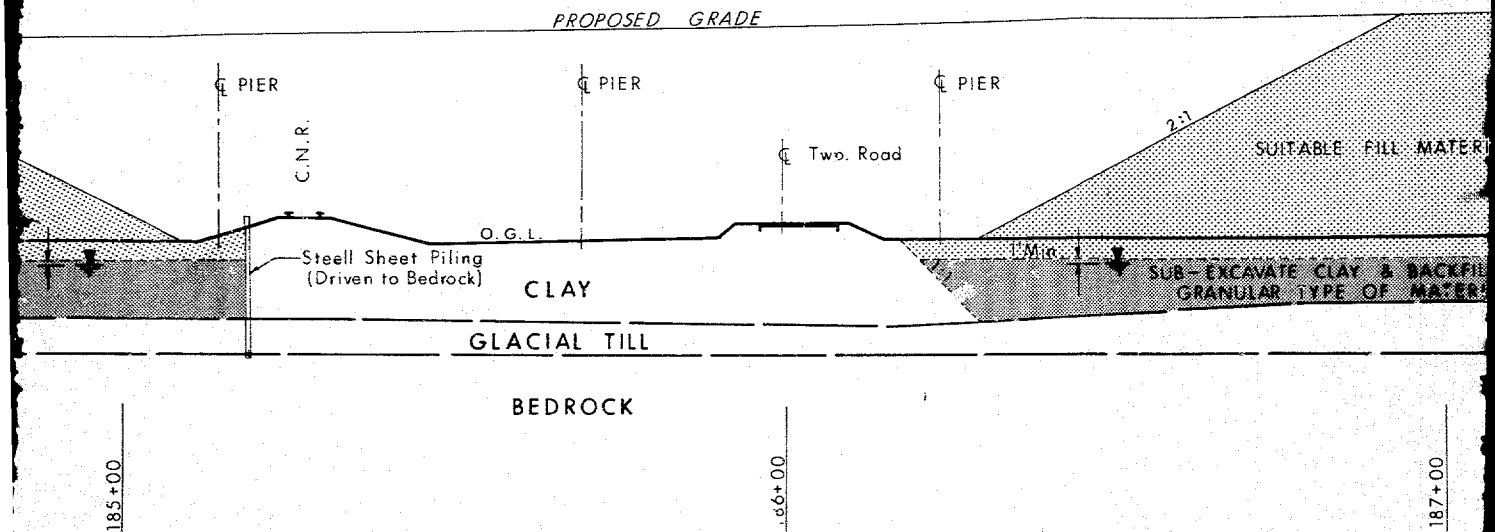
# WEST APPROACH



PRO



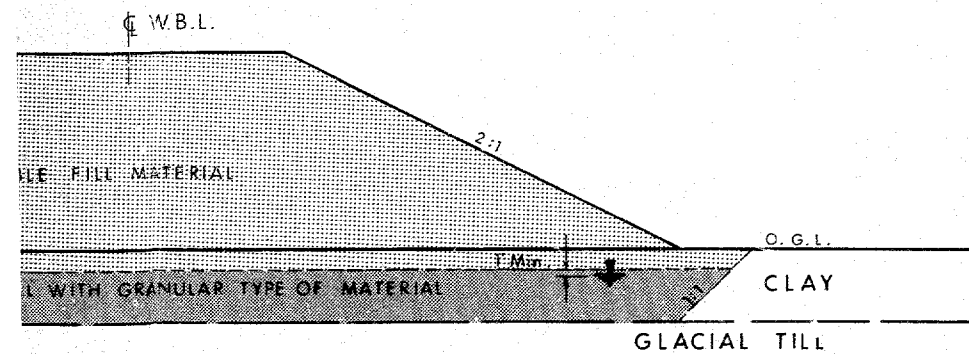
A-A  
TYPICAL SECTION



CL PROFILE HWY. 417 W.B.L.  
SCALE 1" = 20'

NOTE:

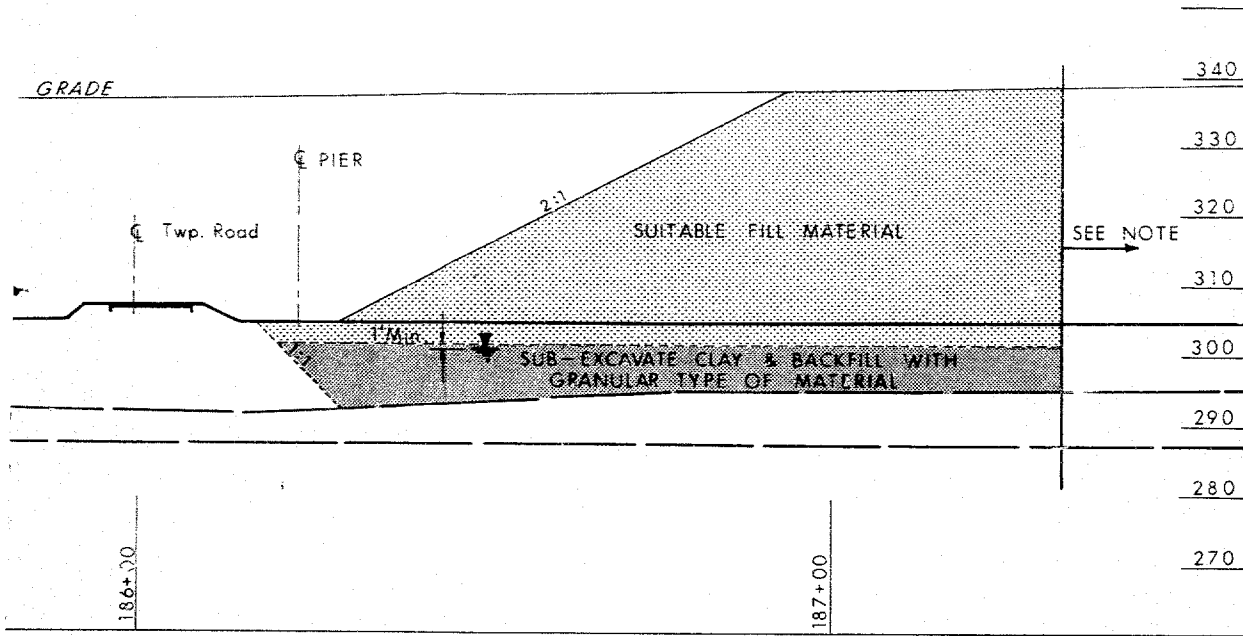
Extent of Sub-Excavation  
determined by future  
Foundation Section



A-A  
TYPICAL SECTION

SUB-EXCAVATION  
HIGHWAY 417-W.B.L.

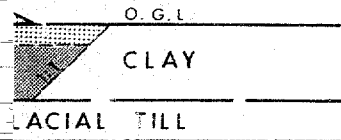
# EAST APPROACH



W.B.L.

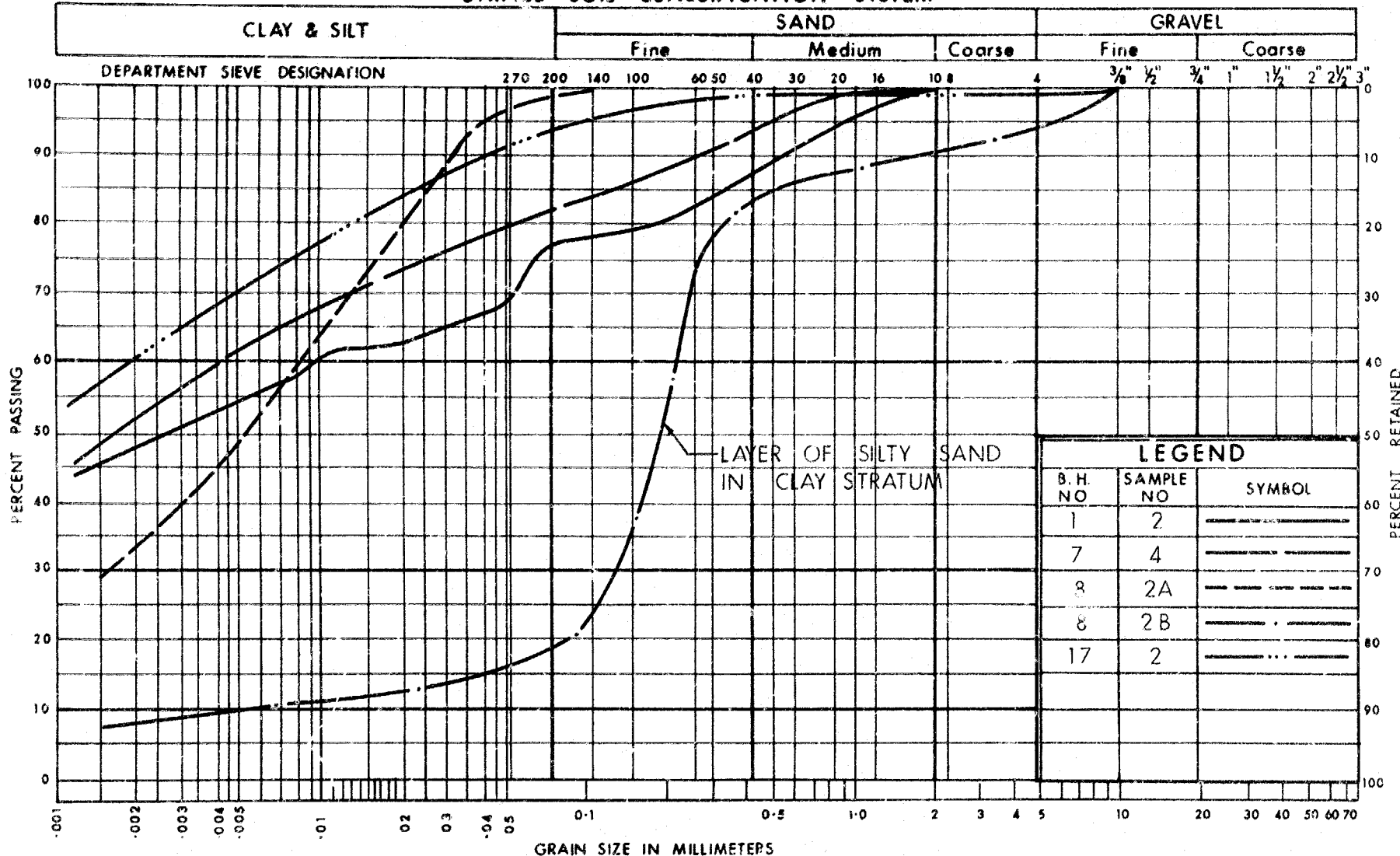
## NOTE:

Extent of Sub-Excavation past this point to be determined by future supplementary investigation by Foundation Section



SUB-EXCAVATION OF SOFT CLAY STRATUM  
HIGHWAY 417-W.B.L. OVER C.N.R. & TWP. ROAD

# UNIFIED SOIL CLASSIFICATION SYSTEM

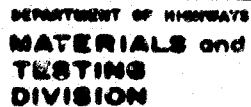
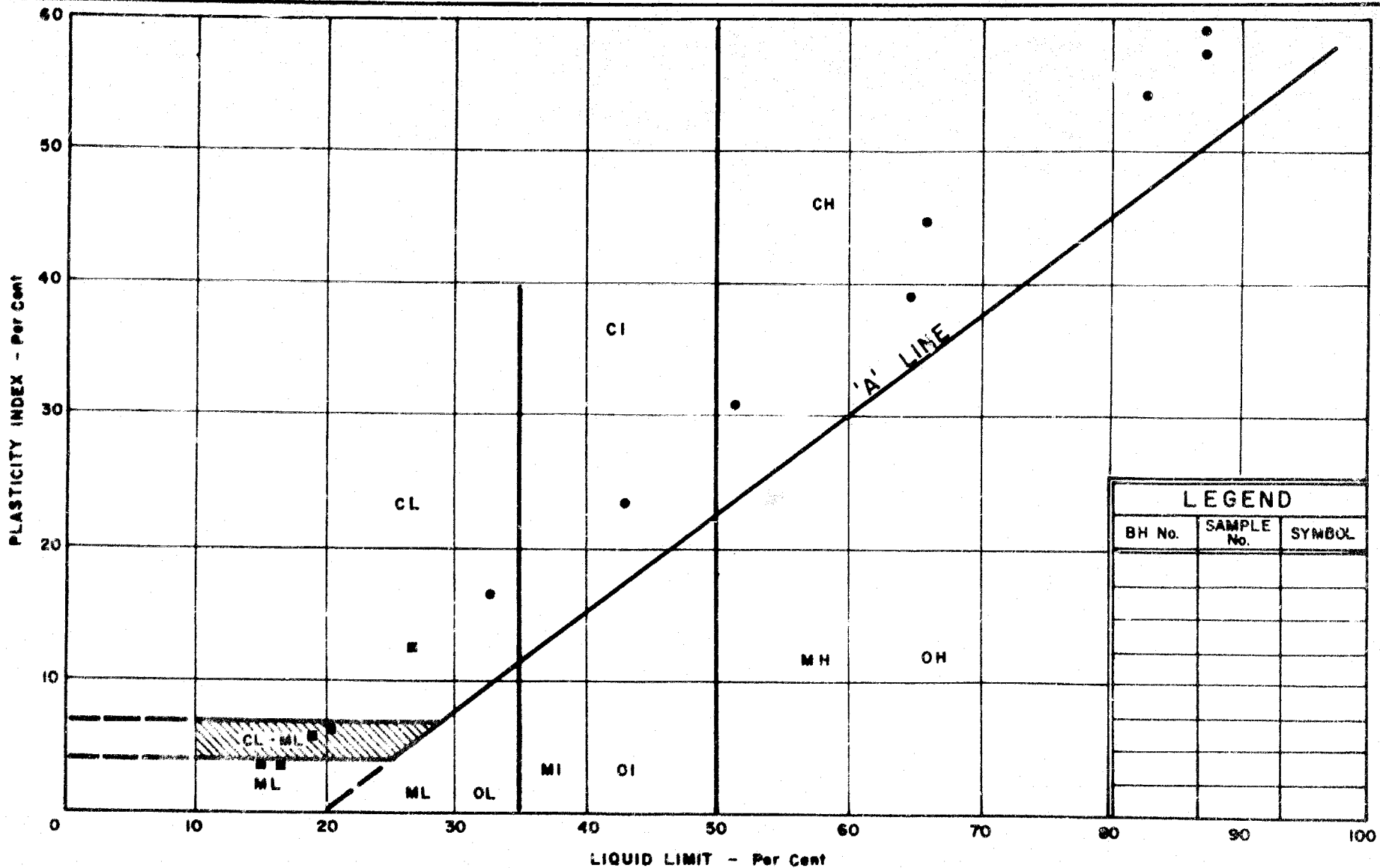


DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## GRAIN SIZE DISTRIBUTION CLAY TO SILTY CLAY (Sensitive)

W.P. No. 37-66-07  
JOB No: 70-11064  
FIG. NO. 3





# PLASTICITY CHART

- CLAY TO SILTY CLAY (Sensitive)
- GLACIAL TILL

W.F. No. 37-66-07

JOB No. 70 - 11064

FIG. NO. 4

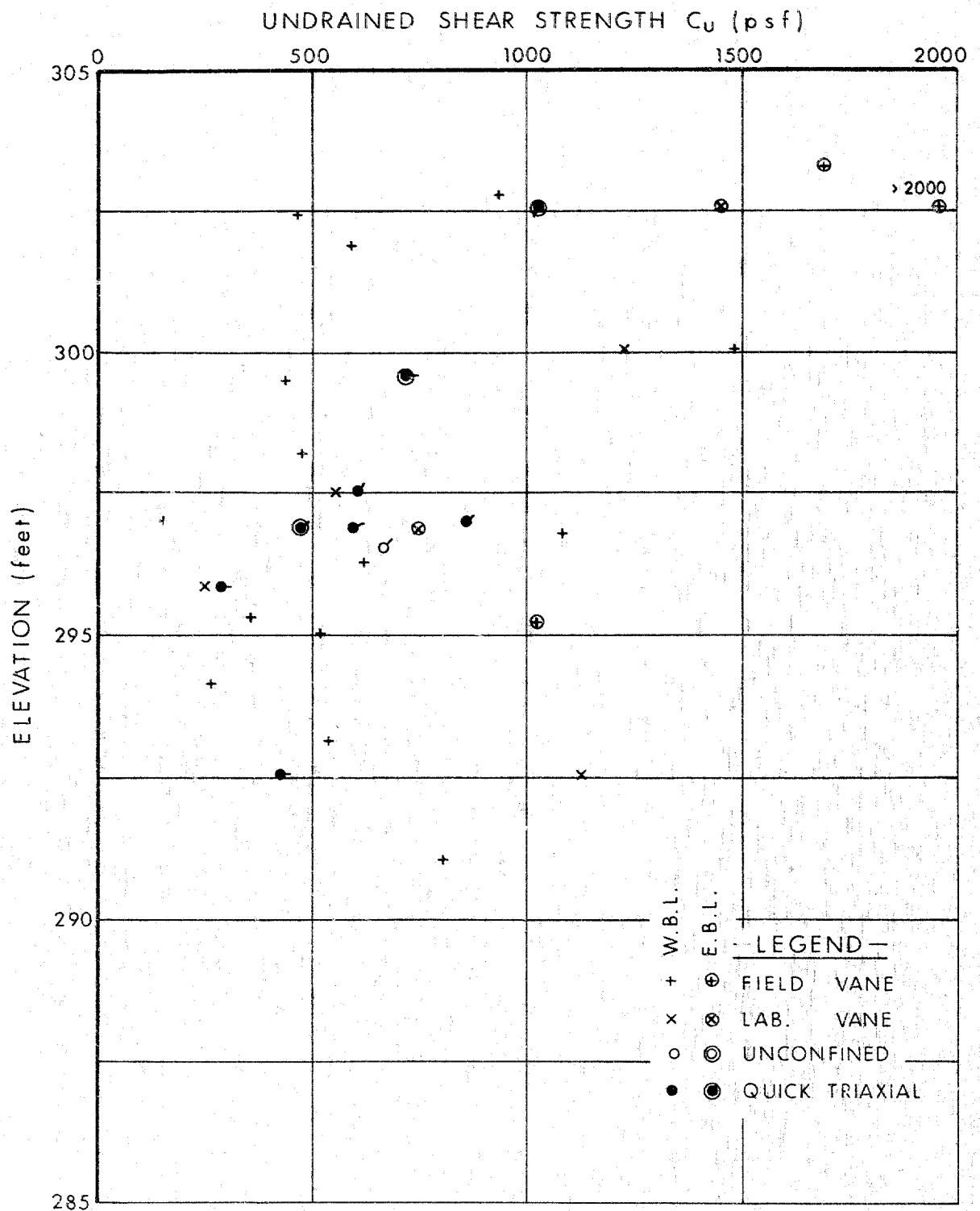


Fig. 5

# VOID RATIO-PRESSURE CURVES

JOB NO. 70-11064

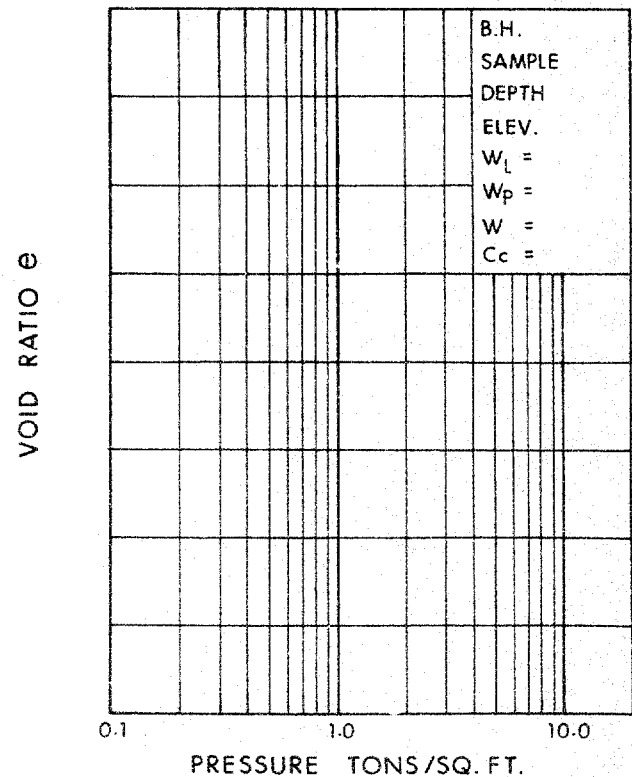
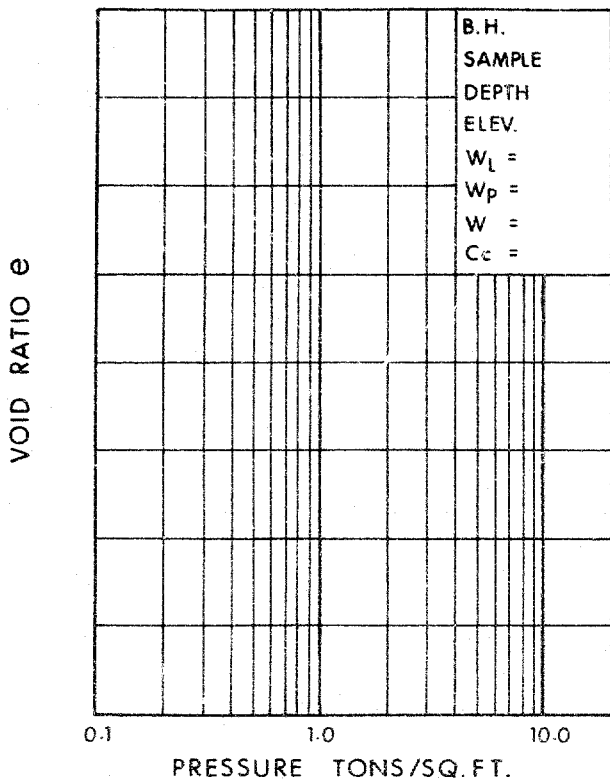
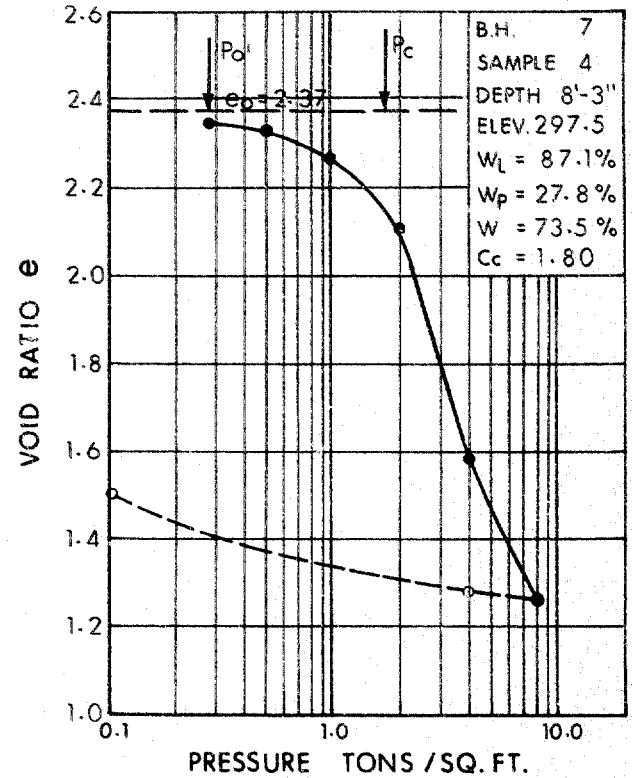
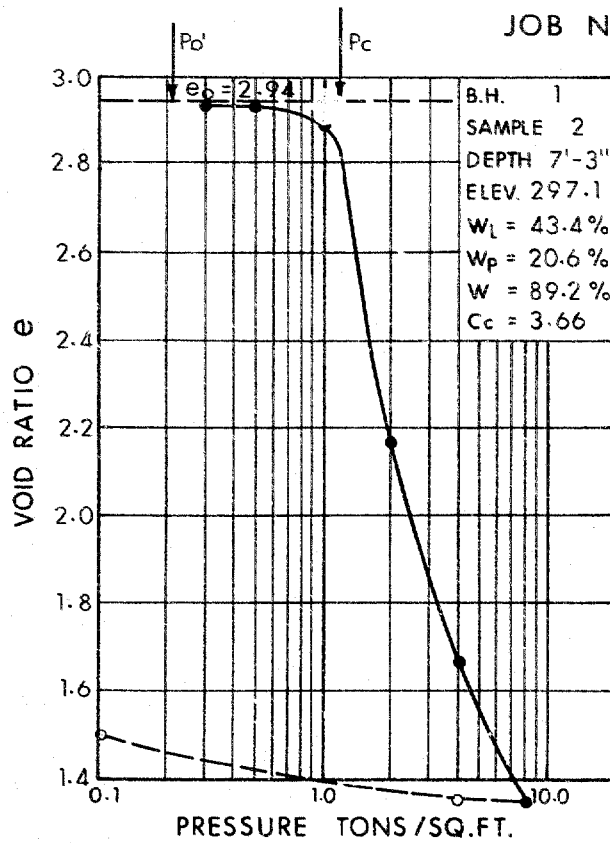
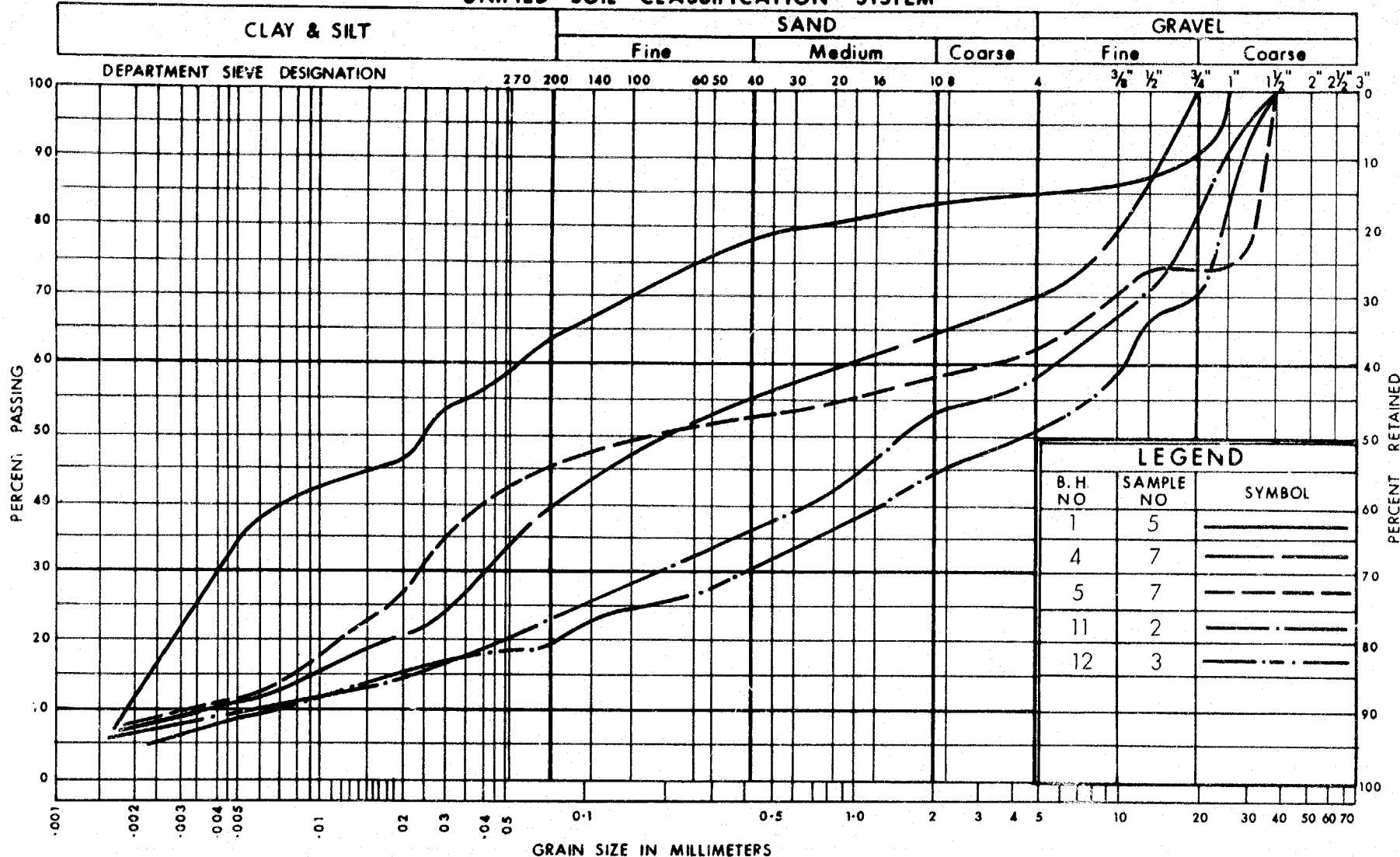


FIG. 6

# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## GRAIN SIZE DISTRIBUTION GLACIAL TILL

HET. MIX. OF SILT, SAND & GRAVEL TRACE OF CLAY

W.P. No. 37-66-07

JOB No: 70-11064

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, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

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

### TYPE OF SAMPLE

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

### SOIL TESTS

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

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

### GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

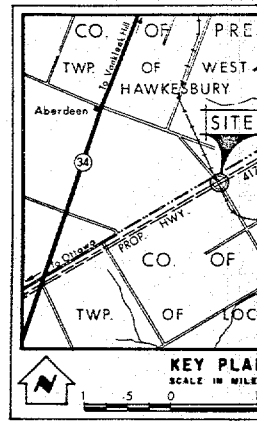
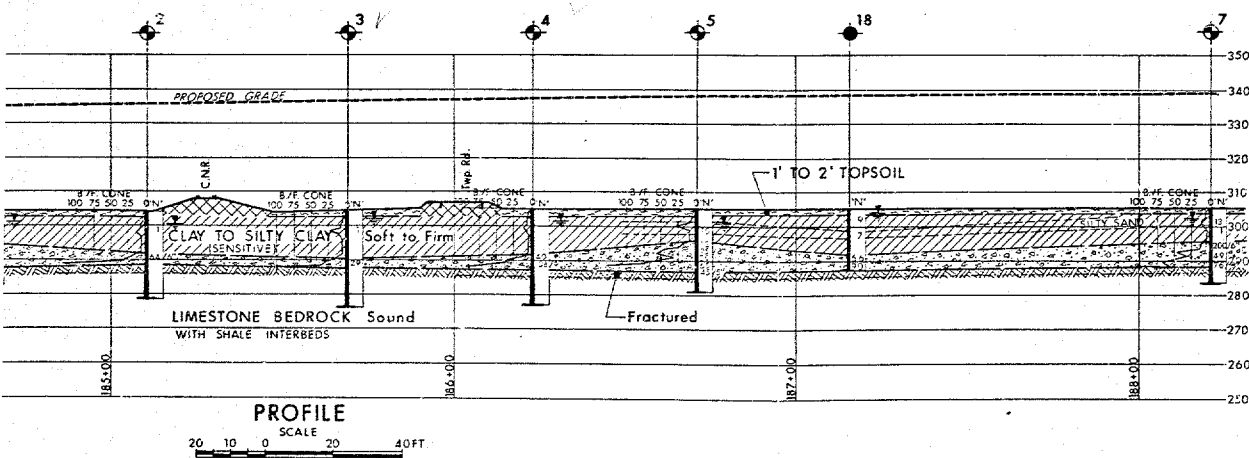
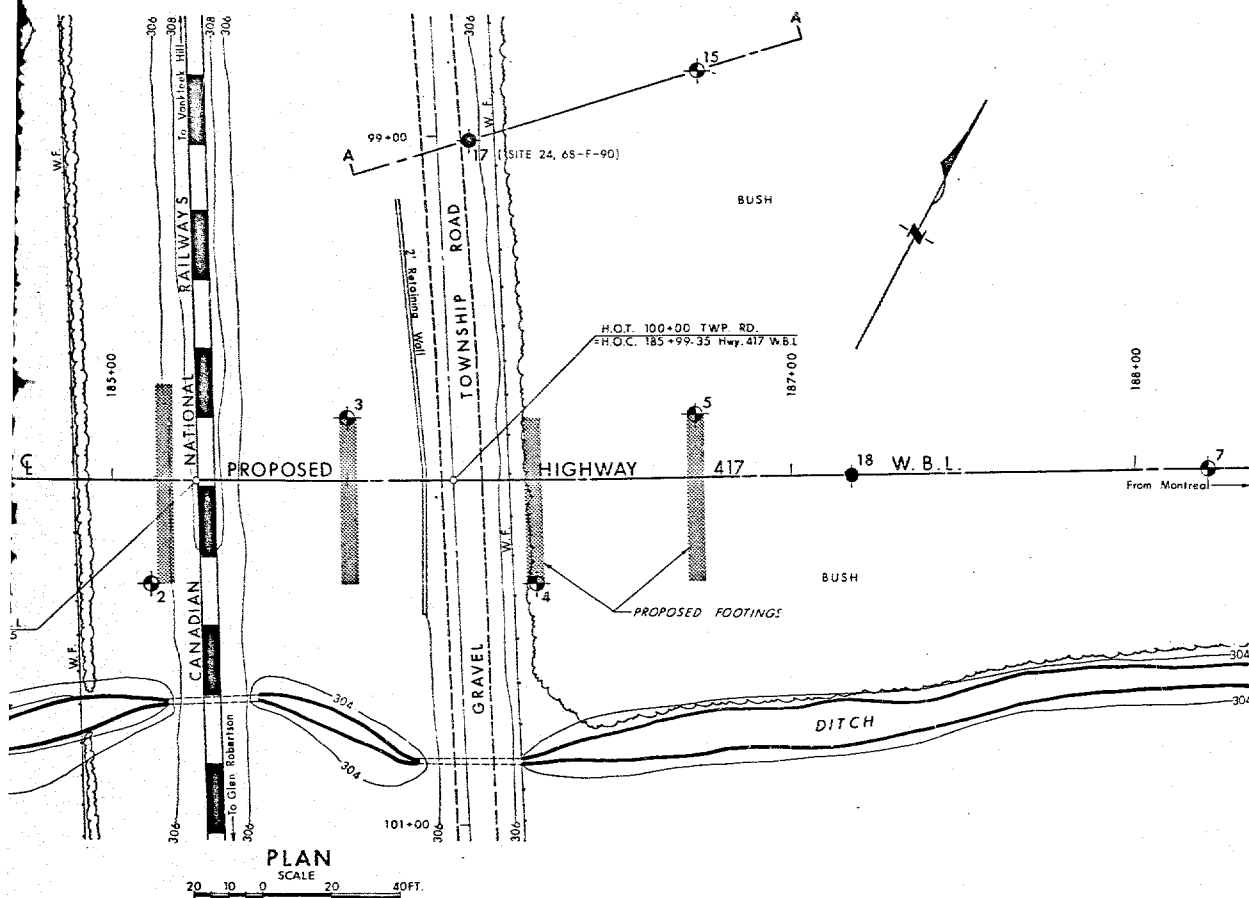
### FOUNDATIONS

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

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL





**LEGEND**

- Bore Hole
- Cone Penetration Test
- Bore & Cone Penetration Test
- Water Levels established by field investigation

NO.	ELEVATION	STATION
1	304.4	184+6
2	303.9	185+1
3	304.8	185+6
4	304.7	186+2
5	304.7	186+7
6	303.8	182+8
7	305.8	188+2
15	313.2	186+7
16	304.4	184+6
17	306.5	186+0
18	305.0	187+1
19	304.0	183+8
20	304.0	183+4
21	303.0	182+4

The boundaries between soil strata have been established by Bore Hole locations. Between Bore Holes from geological evidence and may be subject to change.

**REVISIONS**

NO.	DATE	BY	DESCRIPTION
1	Feb. 71	G.P.	BORE HOLES 18, 19, 20 & 21

**DEPARTMENT OF HIGHWAYS  
MATERIALS & TESTING OFFICE**

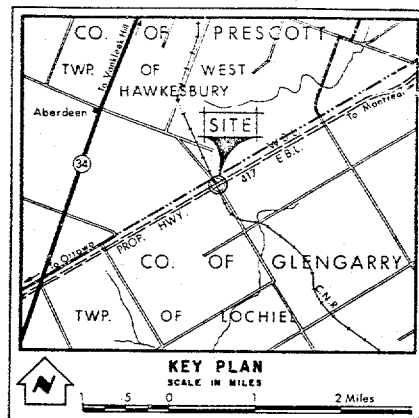
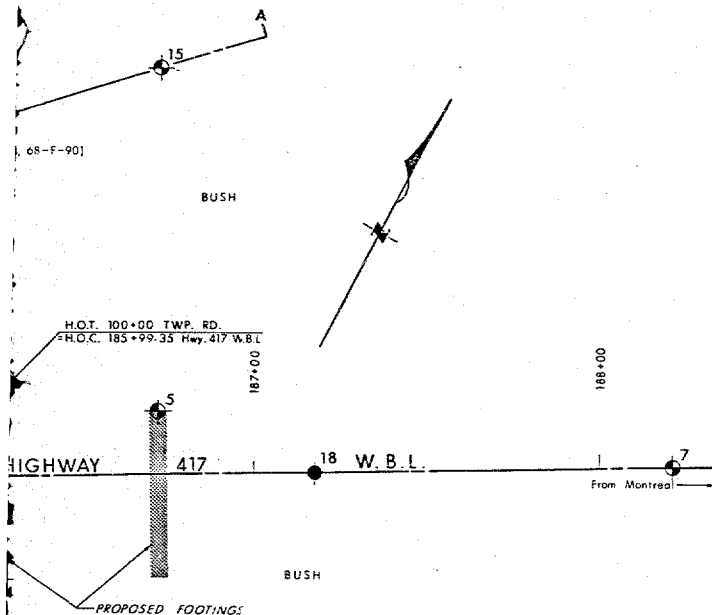
**CAN. NAT. RWY'S & (VANKLEEK)**

KING'S HIGHWAY NO. 417 W.B.L.  
CO. GLENGARRY  
TWP. LOCHIEL

**BORE HOLE LOCATION**

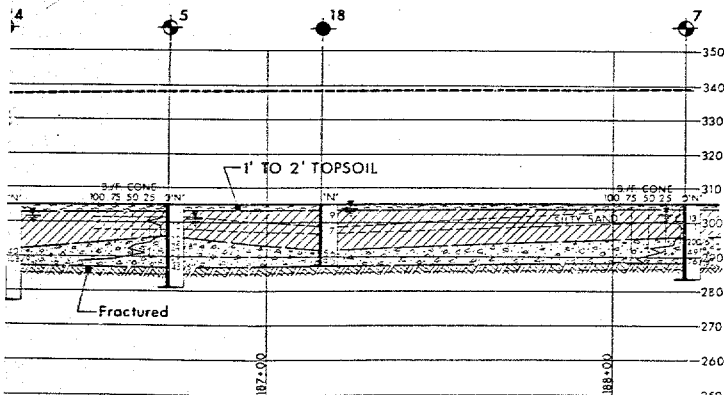
SUB'D. B.T.D. CHECKED ☒ W.P. NO. 37-66  
DRAWN ☒ CHECKED ☒ JOB NO. 70-110  
DATE Oct. 19, 1970 SITE NO.  
APPROVED *[Signature]* POINT NO.





LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation. Aug. 1970		
	Holes 18, 19, 20 & 21 Jan. 1971		
NO.	ELEVATION	STATION	OFFSET
1	304.4	184+65	18' LT
2	303.9	185+11	30' RT
3	304.8	185+69	18' LT
4	304.7	186+23	30' RT
5	304.7	186+71	18' LT
6	303.8	182+85	6
7	305.8	188+21	6
15	305.2	186+71	118' LT
16	304.4	184+65	118' LT
17	306.5	186+05	98' LT
18	305.0	187+17	6
19	304.0	183+59	6
20	304.0	183+46	6
21	303.0	182+42	6

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.



REVISION	DATE	BY	DESCRIPTION
1	Feb. 71	G.P.	BORE HOLES 18, 19, 20 & 21 ADDED

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE - FOUNDATION SECTION

**CAN. NAT. RWY'S & TOWNSHIP RD.**

(VANKLEEK HILL)

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

CO. GLENGARRY

TWP. LOCHIEL LOT 13 & 14 CON. IX

**BORE HOLE LOCATIONS & SOIL STRATA**

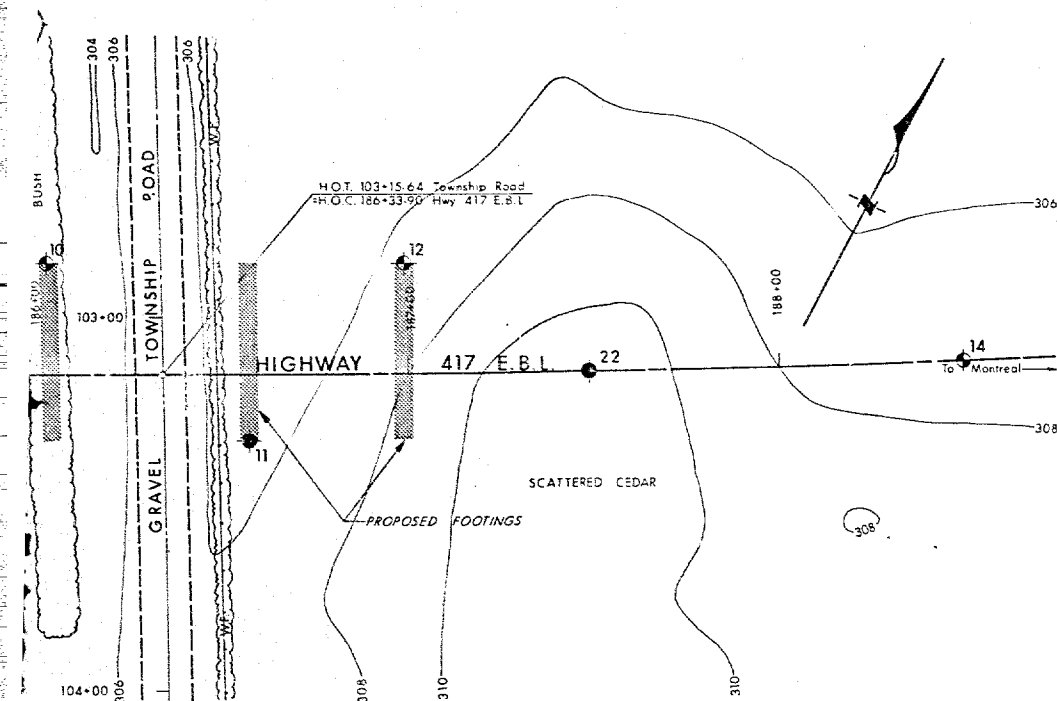
SUBM'D. B.T.D. CHECKED: WP NO. 37-66-07 M.B.T. DRAWING NO.

DRAWN: CHECKED: JOB NO. 70-11064 70-11064A

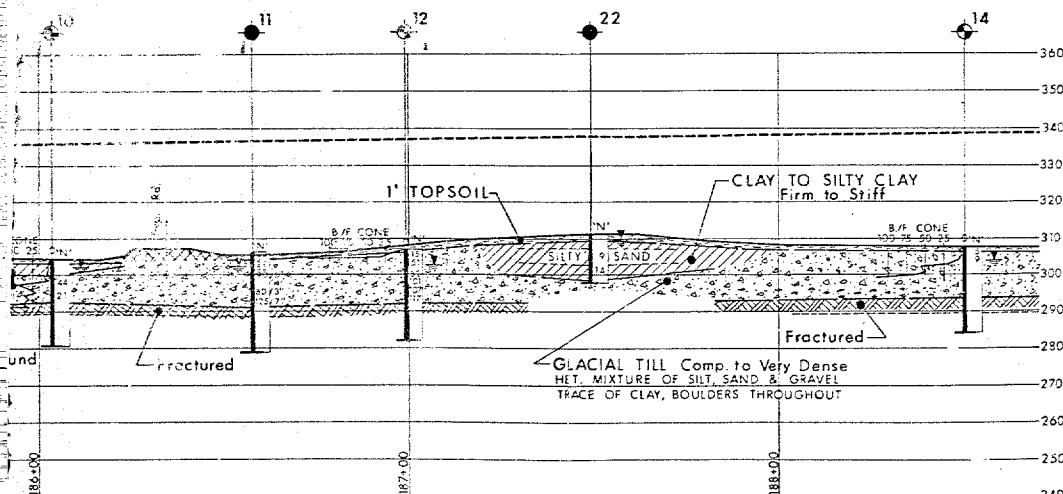
DATE Oct. 19, 1970 SITE NO. BRIDGE DRAWING NO.

APPROVED: *Signature* CONT. NO.





PLAN  
SCALE  
20 40 FT.



PROFILE  
SCALE  
20 40 FT.

SEE DRAWING 70-11064A



KEY PLAN  
SCALE IN MILES

### LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, Aug. 1970 Holes 22 & 23 Jan. 71

NO.	ELEVATION	STATION	OFFSET
8	304.2	185+00	30' LT.
9	305.1	185+46	18' RT.
10	304.9	186+03	30' LT.
11	305.9	186+51	18' RT.
12	306.8	186+99	30' LT.
13	306.8	187+50	☐
14	307.3	188+49	☐
22	311.0	187+49	☐
23	305.0	186+23	☐

### 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
Feb 71	G.P.		BORE HOLES 22 & 23 ADDED

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

CAN. NAT. RWY'S & TOWNSHIP RD.  
(VANKLEEK HILL)

KING'S HIGHWAY NO. Prop. 417 E.B.L. DIST. NO. 9  
CD. GLENGARRY  
TWP. LOCHIEL LOT 13 & 14 CON. IX

### BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. B.T.F.	CHECKED	W.P. NO. 37-66-07	M.B.T. DRAWING NO.
DRAWN	CHECKED	JOB NO. 70-11064	70-11064B
DATE	Oct. 20, 1970	SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

REF. NO. E-4699-1

## MEMORANDUM

70-11064

To: Mr. T. Kingsland,  
Regional Bridge Planning Engineer,  
KINGSTON, Ontario.

From: Road Design Section,  
KINGSTON, Ontario.

ATTENTION:

DATE: December 18th, 1970.

Our File Ref.

IN REPLY TO

SUBJECT: W.P. 37-66-18 - W.B.L. - Site 31-294 - C.N.R. and Township  
Road Overhead - Highway #417 - District #9 Ottawa

As requested, we have investigated proposal 2 mentioned in your memorandum of December 2nd, 1970 and submit the following:

Excavation of soft clay materials have been considered using all information presently available, i.e.

1. Foundation Investigation Report
2. Materials and Testing Soils Profile

It should be noted however, that the Materials and Testing Section do not consider their hand auger borings adequate to determine the extent of the underlying materials for structure design purposes.

The quantities involved are:

Earth Excavation	13,000 c.y.
Earth Backfill (borrow)	15,000 c.y.

Considering that the clay materials are too wet for construction purposes (as discussed with Materials and Testing) the total material involved is 28,000 c.y.

An accurate justification cost can only be obtained if additional cross sectional bore holes are obtained by the Foundation Section and the quantity prices verified by the Estimating Section in Head Office.

*[Signature]*  
R. T. Molano,  
FOR: G. McMillan,  
SR. PROJECT DESIGN ENGINEER.

REM/GM/mac

c.c. - J. Graspier, ATT: H. Meyer  
A. G. Stenace ✓  
R. Forrest

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

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

Bridge Office,  
Downsview

February 10, 1971

C.N.R. & Twp. Rd. Overhead - E.B.L.  
W.P. 37-66-07, Site No. 31-294  
Highway 417, E.B.L., District No. 9

70-11064

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6932-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$154,000, which 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. B. Davis  
A. Stermac  
R. Forrest  
J. Anderson

*For Piers spread footings recommended  
while pile support used in design.*

*mak*

## MEMORANDUM

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

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

Attention: Mr. H. McCombie

Date: February 11, 1971

Our File Ref.

IN REPLY TO

## SUBJECT:

## ADDITIONAL BOREHOLES

At

The Proposed Overhead Structures at the  
Crossing of Hwy. #417 (Westbound Lane)  
And the C.N.R.

Twp. of Lochiel -- County of Glengarry  
District No. 9 (Ottawa)

W.O. 70-11064 -- W.P. 37-66-18

Further to the memo from the Road Design Section - (Kingston), dated December 18, 1970, we have recently completed additional borings at the above mentioned site to determine the limits of the sub-excavation of the clay stratum at the structure approaches as discussed in our Foundation Report W.O. 70-11064 Sub-section 6.2.2).

A total of 4 boreholes (B.H.'s 18, 19, 20, & 21) were carried out during the course of the recent investigation. The borings revealed that the subsoil conditions are generally similar to those encountered in the original report.

Incorporating the recent borings, a revised stratigraphical profile has been obtained along the centre-line of the proposed Hwy. #417 Westbound lane. This is shown on revised Drawing 70-11064A, enclosed with this memo. The Record of Borelog sheets for the additional borings are also enclosed, and these should be included along with our Foundation Report.

Our recommendations with regard to the sub-excavation of the clay stratum, are as follows:

i) At the East approach the sub-excavation should extend to Station 187+50. A smooth transition should be effected between Station 187+50 and 187+75.

ii) For the West approach the sub-excavation should extend to Station 183+25.

Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Office - Admin. Bldg.  
Attn: Mr. S. McCombie

2

February 11, 1971

Re: Additional Boreholes -- W.O. 70-11064, W.P. 37-66-18 ...

ii) Any organic pockets located within the plan limits of the approach fills, beyond the sub-excavation limits, should be excavated for their full depth.

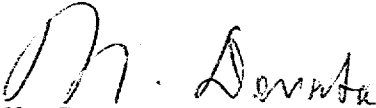
The details of the sub-excavation are given on Figure #2 of our original Foundation Report.

Settlements will take place in the cohesive subsoil beyond the limits of the sub-excavation due to the surcharge loading of the approach fills.

In order to reduce the magnitude of the post-construction maintenance requirements, it would be advantageous to place both the East and West fills prior to construction of the structure. If scheduling permits, a period of at least 9 months is recommended for this purpose. In any event, final paving should be delayed as long as possible.

Should you require further information pertaining to this project, please feel free to contact this Office.

MD/MdeF  
Attach.

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

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

Foundations Files  
Gen. Files

## MEMORANDUM

TO: Mr. T. C. Kingsland,  
Regional Bridge Planning Engineer,  
KINGSTON, Ontario.

FROM: Road Design Section,  
KINGSTON, Ontario.

ATTENTION:

DATE: March 1st, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 37-66-07 & W.P. 37-66-18 - Highway #417 - C.N.R. and  
Township Road Overhead - District #9 Ottawa.

The following are Road Design comments regarding Preliminary Plans D-6932-PI and D-6966-PI.

1. The grade lowering of 0.70 feet on the East Bound Lane is noted and should be forwarded to Regional Materials and Testing Section for their information.
2. The east piers of both structures will be in the future ditch of the reconstructed Township Road. Will this cause any problem?
3. The note on the drawings regarding backfilling of sub-excavated areas mentions "granular material" while the Foundation Report recommends "granular type materials". Please advise of correct terminology.
4. Additional information is still required from the Foundation Section to determine the extent of sub-excavation under the approach fills.
5. Does the revised slope of 1 3/4:1 on the westerly approach fill eliminate the need for steel sheet piling adjacent to the C.N.R. tracks as recommended by the Foundation Section. (See Figure 2 W.P. 37-66-07).
6. As per our discussion a 50 foot clear work and storage area in the vicinity of the perched abutments, will be provided, during the grading stage for the future pile driving operation, with a 10% access grade.
7. It is assumed that perforated pipe will be used to drain the area behind the abutments.

*R. T. Molaro*  
R. T. Molaro,  
FOR: G. McMillan,  
SR. PROJECT DESIGN ENGINEER.

RTM/GM/mac

c.c. - J. Gruspier

Copies made for: (TCK/hl: 5/III/71)

✓ C. S. Grebski - Att. K. Bassi  
A. G. Stermac - Att. M. Devata

D.H.C.  
KINGSTON  
RECEIVED

MAR 1 1971

BRIDGE  
OFFICE



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

Bridge Section,  
Kingston, Ontario.

Mr. G. McMillan

March 5, 1971.

W.P. 37-66-01 & -02, Highway 417,  
C.N.R. and Township Road Overhead  
W.P. 37-66-07 (E.B.L.) & W.P. 37-66-18 (W.B.L.), Site 31-294,  
Highway 417, District 9 - Ottawa

With reference to the comments contained in Mr. Molaro's letter of March 1st on the preliminary drawings for the above structures, D-6932-P1 and D-6966-P1, the replies to these are as follows:

1. The grade lowering of 0.70 ft. at the E.B.L. structure has been notified to Regional Materials & Testing Section.
2. No problem will arise from placing the east piers of both structures in the future ditch of the reconstructed Township Road. We will, however, require from you bottom of ditch elevations and preferably, a sketch showing the location of the centre and side slopes of the ditch in relation to the piers.
3. The note on the drawings regarding granular materials will be changed to "granular type materials", if it is left on the bridge drawings at all.
4. Foundation Section have now issued an addendum dated March 1st, 1971 to their original foundation report for this site. The addendum establishes the plan limits for sub-excavation at the approach fills for the W.B.L. structure.
5. The forward slope of the approach fills of 1 3/4:1 does not eliminate the need for supporting the track during the sub-excavation of the adjacent layer of sensitive clay. A satisfactory method of carrying this out will have to be devised.

6. The work and storage area as defined in your letter would be satisfactory. There would appear to be no benefit resulting from placing the whole of the fill above top of abutment footing elevations at this particular site.
7. Perforated pipe will be used to drain the area behind the abutments in accordance with the bridge office standards.

T. C. Kingsland  
Regional Bridge Planning Engineer

TCK/hl

c. c.

C. S. Grebski - Att. K. Bassi

J. E. Graspier

/A. G. Stermac - Att. M. Devata

S. McComble

MEMORANDUM

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

FROM: C. S. Grebski,  
Bridge Office

ATTENTION:

DATE: June 22, 1971.

OUR FILE REF.

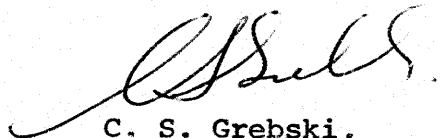
IN REPLY TO

SUBJECT: C.N.R. & Township Road O'Head - E.B.L.  
2.3 miles South of Vankleek Hill  
W.P. #37-66-07 Site #31-294  
Hwy. No. 417 E.B.L. Dist. #9

70-110-64

Attached herewith are 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:s

Attach.

c.c. Foundation Office

no comment

Mr. M.A.  
Jm

MEMORANDUM

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

FROM: C. S. Grebski,  
Bridge Office

ATTENTION:

DATE: June 23, 1971.

OUR FILE REF.

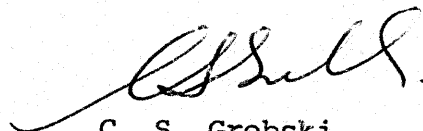
IN REPLY TO

SUBJECT: C.N.R. & Twp. Rd. O'Head W.B.L.  
2.3 miles South of Vankleek Hill  
W.P. #37-66-18 Site #31-294  
Hwy. #417 W.B.L. Dist. #9

70-110-64

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:s

Attach.

c.c. Foundation Office

E. B. L. —

W. B. L. —

No comments

No excavation of soft clay is shown or mentioned anywhere.

*[Handwritten initials and date]*  
13 July 71

*[Handwritten initials and date]*  
APC.  
5/11/71

OCT 4. 1971

W.O. 70-11064

W.P. 37-66-07

HWY 417.

37-66-18

NOTE:

OUR REPORT DRAWG. NO 2

HOW SHOULD THE STEEL SHEET PILE WALL,  
NECESSARY FOR SUPPORT OF CNR TRACKS,  
BE TIED BACK? (QUESTION BY G. McMILLAN)  
SYSTEMS DESIGN - KILGUSTON)

ANSWERS:

(1) EXCAVATION SHOULD BE DONE  
IN STRIPS ~~AND~~ BACKFILL IMMEDIATELY.  
IN THIS WAY ONLY A VERY SHORT SECTION  
OF THE WALL WILL REMAIN UNSUPPORTED, EXPOSED  
AT ANY ONE TIME. TO BE SPECIFIED BY DTC IN CONTRACT.

(2) DRIVING OF THE SHEETING INTO TILL  
WILL ASSURE SUFFICIENT TOE HOLD. THE  
UPPER PORTION OF THE WALL SHOULD BE  
TIED BACK TO A DEAD MAN ON THE OTHER  
SIDE OF THE TRACKS. THE TIEBACKS CAN BE  
PUT THROUGH HOLES DRILLED UNDER THE  
TRACKS OR INTO NARROW TRENCHES DUG  
BETWEEN THE RAILWAY ~~TRACKS~~ <sup>TIES</sup>. THE INTEGRITY  
AND SAFETY OF ~~ALL~~ CONSTRUCTION <sup>TO</sup> BE  
THE CONTRACTOR'S RESPONSIBILITY.

(3) SLOW DOWN OF TRAINS SHOULD  
BE MANDATORY

ALL ABOVE BY TELEPHONE

AGS.

AUG. 4. 1971 4 PM

## MEMORANDUM

To: Mr. A. G. Stermac,  
Principal Foundations Engineer,  
Foundations Office,  
DOWNSVIEW, Ontario.

FROM: Systems Design Section,  
KINGSTON, Ontario.

ATTENTION:

DATE: October 18th, 1971.

OUR FILE REF.

IN REPLY TO


SUBJECT: W.P. 37-66-01 - Highway #417 - Foundation Report #70-11064  
Proposed Overhead at 417 and C.N.R. - District #9 Ottawa

We have further considered the method of sub-excavation of the clay stratum at the above site and wish to submit for your review and recommendations the enclosed sketch showing alternative schemes.

As can be seen from the sketch, excavating within the plan limits of the embankment and back at a 1:1 slope would place the top of the excavation unacceptably close to the tracks and the township road. Figure 2 of the Foundation Report recommends the use of steel sheet piling to support the railway embankment, however, it is questionable whether the thin layer of glacial till is sufficient to support the piling. It has been suggested that a second set of piles be driven on the other side of the tracks and the first set tied back to them. Another alternative would be to drive a set of piles on the same side of the tracks as the first set and place struts between them.

Since neither of the above methods appear absolutely satisfactory, we have shown on the enclosed sketch, various limits for the sub-excavation which might allow the work to be performed without the use of piling. If the railway embankment was still considered unstable, sheet piling could be driven on the excavation side of the tracks for added support.

It would be appreciated if you would review these schemes at your earliest convenience and forward your recommendations to this office.

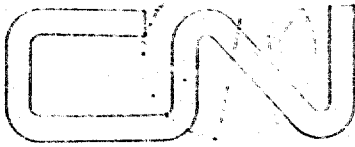
  
G. McMillan,  
FOR: S. J. Markiewicz,  
REGIONAL SYSTEMS DESIGN ENGINEER.

GM/SJM/mac

c.c. - E. Saint  
M. Peverett

*Discussed with Mr. E. McMillan on telephone and concluded that railway ~~part~~ portion will be shown on the drawing, without specifying any method of construction.*

*Dr. Stewart  
Oct 25th 1971*



Canadian National Railways Law Department

Pierre Taschereau, Q.C.  
Vice-President & General Counsel

G. M. Cooper  
General Solicitor

J. M. Duncan  
Assistant General Counsel

W. P. Winslow, Q.C.  
Assistant General Solicitor

H. J. G. Pye  
Commission Counsel

Wm. J. Law  
R. J. Lafrenière  
Solicitors

D. Bekhor  
Attorney

Montreal,  
December 17, 1971.

File: 369-3-2930

Mr. C. W. Rump,  
Secretary,  
Railway Transport Committee,  
Canadian Transport Commission,  
Ottawa, Ont.

Dear Sir:      File 26711.3070 - Twin overhead bridges,  
                  Mile 11.34, Vankleek Subd.

Reference is made to your letter dated August 6, 1971 in connection with the Department of Transportation and Communications' application of July 22nd.

The detailed plans submitted by the Department are satisfactory to the Railway insofar as general features, track requirements and clearances are concerned. With regard to Drawings D-6932-2 and D-6966-2 showing the bore hole locations and soil strata, the drawings have been examined and the following comments are made:

The design of the falsework for the eastbound lane, pier #1 on Drawing D-6932-2 was found to be satisfactory. However, the falsework for westbound lane pier #1 on Drawing D-6966-9 was found to be inadequate and should be redesigned to satisfy the following conditions:

1. Borehole #2 on Highway's Drawing D-6966-2 should be used for the design. It shows that the site for pier #1 westbound lane consists of some 12' of sensitive clay overlying dense till.

..... 2

2. Driving of piles for the pier could disturb the clay and therefore a remoulded strength of the clay should be used in the design of the falsework.
3. The possibility of a slip circle passing through clay zone below the sheetings should be considered. Sheetings extending into the dense till may be necessary to obtain an adequate factor of safety.
4. Train load shall be taken as equal to a surcharge load of 1,000# per square foot.

Yours very truly,

M. J. G. FYZ

Commission Counsel.

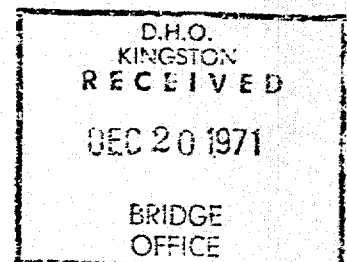
RGJ/wc

cc:

→ Mr. T. C. Kingsland,  
Regional Bridge Planning Engineer,  
Dept. of Transportation & Communications,  
Bridge Section,  
Postal Bag 4000,  
KINGSTON, Ont.

Copies made for: (TCK/hl: 29/12/71)

A. J. Percy  
S. J. Markiewicz - Att. G. McMillan  
A. G. Stermac - Att. M. Devata  
K. G. Bassi  
C. S. Grebski





Bridge Section, Postal Bag 4000, Kingston, Ontario

Your File: 369-S-2930

December 29, 1971

Mr. H. J. Pye,  
Commission Counsel,  
Canadian National Railways,  
Law Department,  
Montreal, Quebec.

Dear Sir:

SUBJECT: W.P. 37-66-07 & -18, Site 31-294  
Canadian National Railways Overhead  
Eastbound and Westbound Lane Structures  
File 26711.3070-Mile 11.34-Vankleek Subd.  
Highway 417, District 9 - Ottawa

I refer to your letter dated December 17, 1971, to Mr. C. W. Rump, Canadian Transport Commission, concerning the above structures and, in particular, to your comments on the track protection for pier #1 of the westbound lane structure shown on Drawing D-6966-9.

The approach fills for both structures will be placed as part of the grading and drainage contract and the structures themselves will be built later in the follow-up paving contract.

Before placing the approach fills for the westbound lane structure, the sensitive clay shown on Drawing D-6966-2 will be removed and replaced with selected sub-grade material. The limits of sub-excavation are shown on our Systems Design Office proposed contract sheet #19. The approach fills and other new construction carried out as part of the grading and drainage contract are shown in plan on sheet #18. Two copies of sheets #18 and #19 are enclosed.

It is proposed that when the grading and drainage contract has been awarded the Contractor shall submit to this Department details of his proposed method for sub-excavating the clay and for track protection. Two copies are enclosed of the three relevant proposed Special Provisions covering this portion of the

work, including construction of the approach fills. It is assumed that sheet piles extending into the till or some other equally satisfactory method of supporting the ground will be necessary at this stage. The Contractor's proposals will of course be submitted by this Department for your approval prior to commencing work.

The track protection shown on Drawing D-6966-9 applies to the foundation work to be carried out as part of the structural work included in the later paving contract when all sub-excavation and backfilling is completed and the approach fills have been placed. At this stage it should not be necessary to extend the sheeting of pier #1 track protection below the elevation shown on the above-mentioned drawing.

I shall be glad to receive your comments on the above proposed procedures and your approval of Drawing D-6966-9 in view of the above explanations.

Yours truly,

T. C. Kingsland  
Regional Bridge Planning Engineer

TCK/hl

Encls.

c.c. (n.i.o.o.) - encls.

A. J. Percy

S. J. Markiewicz - Att. G. McMillan

✓ A. G. Stermac - Att. M. Devata

K. G. Bassi

C. S. Grebski

Mr. C. S. Grebski,  
Structural Design Engineer,  
Downsview, Ontario.

Bridge Section,  
Kingston, Ontario.

Mr. K. G. Bassi

December 29, 1971.

W.P. 37-66-07 & -18, Site 31-294  
Canadian National Railways Overhead  
Eastbound and Westbound Lane Structures  
Highway 417, District 9 - Ottawa

70-11-664

I enclose a copy of letter dated December 17, 1971 from Mr. H. J. G. Pye, Commission Counsel, C.N.R., to Mr. C. W. Rump, Canadian Transport Commission, together with a copy of my reply. I enclose also copies of Regional Systems Design sheets #18 and #19 and the three proposed Special Provisions referred to in my letter of December 29th dealing with sub-excavation and placing of approach fills.

Regional Systems Design are to indicate on sheet #19 the stations marking the limits of sub-excavation in the longitudinal direction. On the west side of the tracks this station will not be farther from the track than the sheeting forming the east side of the track protection for pier #1 shown on Drawing D-6966-9, i.e., Station 185+15 on centre line W.B.L.

We are forwarding copy of this letter and enclosures to Mr. M. Devata, Foundation Section, and shall be glad to receive any comments you or Mr. Devata may have in this matter.

T. C. Kingsland  
Regional Bridge Planning Engineer

TCK/hl

Encls.

c.c. (with encls.)

✓ M. Devata

M. Stoyanoff

A. J. Percy

A meeting was held at the Structural Office with Mr. K. Bassi and Mr. C. S. Grebski. The comments made by all of us will be submitted in minutes and distributed to Tom Kingsland.

M. Devata  
Tom 6th / 1972.

Gordon Carton, Q.C.

Structural Planning Section, Postal Bag 4000, Kingston, Ontario

Your File: 269-3-2990

March 1, 1972

Mr. H. J. Iye,  
Commission Counsel,  
Canadian National Railways,  
Law Department,  
Montreal, Quebec.

70-11-064

Dear Sir:

SUBJECT: W.P. 37-66-07 & -1a, Site 31-294  
Canadian National Railways Overhead  
Eastbound and Westbound Lane Structures  
File 26711.3070-Mile 11.34-Vankleek Subd.  
Highway 417, District 2 - Ottawa

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Further to my letter of December 29, 1971, concerning track protection for the westbound lane structure, we now enclose two copies of additional special provisions dealing with the Railway Protection and Approach Fill Embankment Protection to be included in our tender documents for your approval.

I shall be glad to receive your comments and approval as early as possible.

Yours truly,

T. C. Kingstand  
Regional Structural Planning Engineer

TCR/hl  
Encl.

c.c. - C. W. Rump (+ encl.)  
Secretary-Railway Transport Committee  
Ottawa

c.c. (n.i.o.o.)

A. J. Percy - S. J. Markiewicz-Att. G. McMillan  
V. G. Stermac-Att. M. Devata  
K. G. Bassi  
C. S. Grebski

MINISTRY  
XXXXXXXXXXXXXXXXXX

Telephone:  
745-6841

530 Tremblay Road,  
Ottawa, Ontario,  
K1G 0E4  
June 30, 1972.

G.H. Workman,  
Assistant Chief Engineer,  
Design & Construction,  
C.N.R. Headquarters Building,  
Engineering Department,  
Montreal, Quebec.

Dear Sir:

RE: CONTRACT 72-22, HWY 417, C.N.R. CROSSING

I believe you have received from Mr. H.H. Cramb, P. Eng., a copy of his letter to Mr. J.E. Callaghan, dated June 25, 1972, submitting drawings of the shoring proposed by Bot Construction Ltd., to support your track during the adjacent excavation of sensitive clay.

May we please have your comments on this proposal in order that we may evaluate it as soon as possible.

Yours very truly,



L.M. Peverett,  
District Construction  
Engineer.

LMP/ml  
CC/ A.G. Stermac,  
T.C. Kingsland,  
R.E. Singleton.

MEMORANDUM

TO: Mr. A.G. Stermac,  
Principal Foundations Engineer,  
Foundations Office,  
Downsview.

FROM: District #9, Ottawa.

ATTENTION:

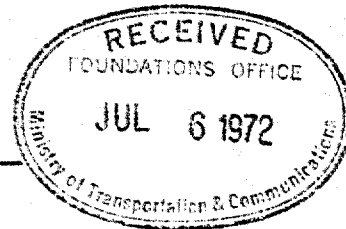
DATE: June 30, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT:

CONTRACT 72-22, HIGHWAY 417,  
C.N.R. CROSSING



Attached are:

- copy of letter from J.H. Crumb, P. Eng.,  
of Bot Construction Ltd., dated June 23, 1972,  
together with a copy of his drawing 72-22-1
- copy of my letter of this date to Mr. G.H.  
Workman, P. Eng., of C.N.R.

May we please have your comments on Bot's submission.

*[Handwritten signature]*

LMP/ml  
CC/ T.C. Kingsland,  
R.E. Singleton.

L.M. Peverett,  
Dist. Const. Eng.

Attached.

*by telephone on July 14/72*  
Advised Max, about the temporary track protection scheme  
submitted by Bot Construction Ltd. ~~and see~~ and see  
the enclosed drawing for comment. Action slip and copy of  
the drawing into sub sub data form mailed to him. M.A.  
July 14/72

Telephone:  
745-6841

530 Tremblay Road,  
Ottawa, Ontario,  
K1G 0R4  
July 14, 1972.

Bot Construction Limited,  
1225 Speers Road,  
Oakville, Ontario.

ATTENTION: MR. J.H. CRUMB, P. ENG.

Dear Sir:

RE: CONTRACT 72-22, HWY 417, C.N.R. CROSSING

Upon receipt of your letter of June 23, 1972, we wrote to Mr. G.H. Workman asking for his comments upon the proposals contained in your Drawing No. 72-22-1.

We have not yet received a reply from Mr. Workman, and so are unable to make any final decision as to the approval of your proposals. However, we have noted that both sets of sheet piling are shown as penetrating to elevation 284.5 approximately, whereas the soils information for the contract indicates the likelihood of rock being encountered at about elevation 289 (Boreholes #2 and #3). It appears that this may not have been taken into account, and we would appreciate your comments.

Yours very truly,

LMP/ml  
CC/ G.H. Workman,  
A.G. Stermac,  
A.E. McKim,  
T.C. Kingsland,  
R.E. Singleton.

L.M. Feyerett,  
District Construction  
Engineer.

0378

OTTA DOWN 7 NOV 22/72 3.46P VR

J A CRUICKSHANK CONST ENGR

RE OVERHEAD STRUCTURE AT CROSSING OF HWY NO.417

W.B.L. AND CNR TWP ROAD WP70-11064 WP37-66-18

WE UNDERSTAND THAT THE WEST APPROACH TO THIS STRUCTURE IS TO BE  
CONSTRUCTED NOW (NOV 1972) WHILE THE EAST APPROACH IS TO BE  
CONSTRUCTED IN THE SPRING OF NEXT YEAR SINCE THE PARNT SOFT  
CLAY STRATA HAS BEEN SUB EXCAVATED AND THE SUB EXCAVATION BACK-  
FILLED WE CONTEMPLATE NO STABILITY PROBLEMS IS THIS

~~CHANGED J.A. CRUICKSHANK~~

1) THE WEST APPROACH IS CONSTRUCTED TO THE GEOMETRICK CONFIGURATION

GIVEN ON DEED NO.19 CONTRACT NO.72-22 AND TO THE FILL IS  
PROPERLY PLACED AND COMPACTED

B T DARCH PROJECT FOUNDATIONS ENGR

FOR

M DAVATA SUPVR FOUNDATIONS ENGR

AW

0378





D.D. AS

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

Copy for the information of  
Mr. M. Devata

---

Mr. J. Cruickshank  
Construction Engineer  
OTTAWA, Ontario

Systems Design Office  
KINGSTON, Ontario

Mr. H. Alguire

July 17th, 1973 70-F-64

Contract 73-40 - Highway 417 - From  
Highway 34 Easterly - District 9, Ottawa

WR 37-66-02  
07  
08  
18

As per your request, I have discussed, with M. Devata, the possible necessity for restrictions on the start of structure work in view of the late placement of approach fills on the grading contract. By the time this contract is awarded, the fills will have been in place for three months and it is felt, therefore, that no restriction will be required. It would, however, be advantageous if the paving of the approaches could be left as late as possible to allow for maximum consolidation.

There will be a restriction with regard to the cement treated base in that the contractor should not operate vehicles or equipment on C. T. B. which has been in place less than two weeks, nor will he be allowed to pave over C. T. B. which has been in place less than ten weeks.

As noted by yourself, there should be a special provision included to ensure openings in the falsework at County Road 24 to allow the grading contractor passage along the grade.

G. McMillan  
For: S. J. Markiewicz  
Sr. Project Design Engineer

GM/SJM/dal

c c. - M. Devata  
M. Batten

PRIORITY

1973 JUL 19

AM 9:42

70-F-64

WP 37-66-02

00322

MX KINR JULY 18 1973 12:00

OTIA 2

MR J CRUICKSHANK CONSTRUCTION ENGINEER OTTAWA

ATT: H ALGUIRE

PRIORITY

COPIES TO:

DOWN 5: M DEVATA FOUNDATIONS OFFICE DOWNSVIEW

00323

M BATTEN MATERIALS AND TESTINGS KINR 1

00324

RE: CONTRACT 73-40 - HIGHWAY 417 - FROM

HIGHWAY 34 EASTERLY - DISTRICT 9, OTTAWA

AS PER YOUR REQUEST, I HAVE DISCUSSED, WITH M DEVATA, THE POSSIBLE NECESSITY FOR RESTRICTIONS ON THE START OF STRUCTURE WORK IN VIEW OF THE LATE PLACEMENT OF APPROACH FILLS ON THE GRADING CONTRACT. BY THE TIME THIS CONTRACT IS AWARDED, THE FILLS WILL HAVE BEEN IN PLACE FOR THREE MONTHS AND IT IS FELT, THEREFORE, THAT NO RESTRICTION WILL BE REQUIRED. IT WOULD, HOWEVER, BE ADVANTAGEOUS IF THE PAVING OF THE APPROACHES COULD BE LEFT AS LATE AS POSSIBLE TO ALLOW FOR MAXIMUM CONSOLIDATION.

THERE WILL BE A RESTRICTION WITH REGARD TO THE CEMENT TREATED BASE IN THAT THE CONTRACTOR SHOULD NOT OPERATE VEHICLES OR EQUIPMENT ON C.T.B. WHICH HAS BEEN IN PLACE LESS THAN TWO WEEKS, NOR WILL HE BE ALLOWED TO PAVE OVER C.T.BM WHICH HAS BEEN IN PLACE LESS THAN TEN WEEKS.

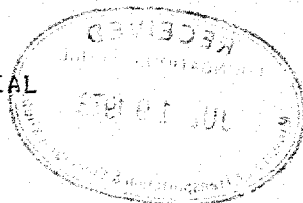
AS NOTED BY YOURSELF, THERE SHOULD BE A SPECIAL PROVISION INCLUDED TO ENSURE OPENINGS IN THE FALSEWORK AT COUNTY ROAD 24 TO ALLOW THE GRADING CONTRACTOR PASSAGE ALONG THE GRADE.

G MC MILLAN

FOR S J MARKIEWICZ

SR PROJECT DESIGN ENGINEER SYSTEMS DESIGN KINGSTON

SAC



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Ontario

# ACTION REQUEST

40-1037 (2-72)

DATE

Nov 13/73

TO *Tony Stearns*

FROM *B. Davis*

TELEPHONE NO.

☐ - PLEASE CALL

☐ - WISHES  
APPOINTMENT

☐ - RETURNED  
YOUR CALL

☐ - WILL  
CALL BACK

☐ - NOTE AND  
FILE

☐ - PROVIDE  
MORE DETAILS

☐ - PLEASE  
ANSWER

☐ - NOTE AND  
FORWARD

☒ - FOR YOUR  
INFORMATION

☐ - DRAFT REPLY FOR  
MY SIGNATURE

☐ - NOTE AND  
RETURN

☐ - FOR YOUR  
APPROVAL

☐ - INVESTIGATE AND  
REPORT

☐ - NOTE AND  
SEE ME

☐ - FOR YOUR  
SIGNATURE

☐ - TAKE APPRO-  
PRIATE ACTION

☐ - RETURN  
WITH COMMENTS

☐ - PER YOUR  
REQUEST

☐

COMMENTS:

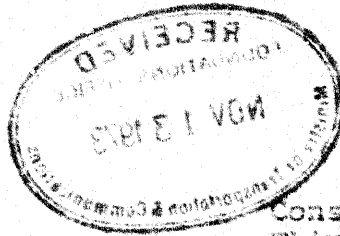
*Was this anticipated in  
the Jan. report?*

*BD*

CALL TAKEN BY:

TIME

SUPER IMPOSED DOCUMENT MAY  
APPEAR AS MULTI-FEED ON FILM



Mr. J.M. Childs,  
District Engineer,  
District 9, Ottawa.

Construction office,  
Third Floor, Central Bldg.

Mr. J.A. Cruickshank

November 5, 1973.

Contract 73-40, C.N.R. & Twp. Rd. O'Read,  
E.B.L, W.P. 37-66-07, Site 31-294, Hwy. 417, Dist. 9.

This will confirm telephone discussion with Mr. H. Alquire of your office today regarding the pier foundations on the above structure.

As stable ground was not encountered until 1 foot below the bottom of foundations for pier #2 we recommend the pouring of 1 foot of mass concrete below the designed foundations.

If similar conditions are encountered for the remaining pier foundations the same solution should be employed.

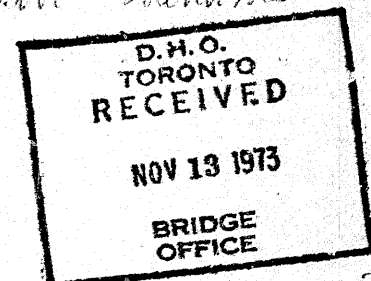
*S.O.*  
S. Oikawa, ✓  
for W.T. Hashizume,  
Regional Construction Engineer,  
Structures.

SO/JC

c.c. B.R. Davis ✓

Discussed with District Personnel, Bill Hawthorne and Eric Basse of Structural office with regard to above mentioned problem and conclusion are as follows:

The ground fill is not generally uniform over the footing area and in order to achieve a uniform elevation, pouring of mass concrete up to 1 ft is the most economical solution. No matter how heavy put down at this location, it will be difficult to establish precise elevations. Discussed with Basse & Davis. *M.D. 10th Nov/73*



DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 70-11064 SITE Hwy 417 - CNR BOREHOLE No. 18 GROUND ELEVATION 305.0

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALTANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNGRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	2'-0" 3'-6"	3/4"	Rounded	2	18	80	High	Shiny	None	High	Earthy	Grey	Slight	Stiff	clay to silty clay. some sand - trace of gravel	CL
2	6'-0" 7'-6"	1/4"	"		80	40	Med	Dull	Quick to Nil	Med	"	"	Strong	Loose or Firm	Silty Sand with Layers of clay up to 1" thick - white shells throughout	SF
3	10'-0" 11'-6"	1"	Sub Angular	10	40	50	High Med	Shiny Dull	Nil Slow	High Med	"	"	Med Strong	Stiff "	Clay Not mixture of clayey silt sand & gravel	CH CL
4	15'-0" 16'-6"	3/4"	Angular	10	30	60	Med	Dull	Nil	Med	"	"	"	Hard	Not mixture of clayey silt, sand & gravel	CL
5	16'-6" 18'-0"	1"	"	15	30	55	Med to High	"	Slow	Med to High	"	"	"	"	"	CL

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

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 70-11164 SITE Hwy 417 - CNR BOREHOLE No. 2019 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
2	5'-9" 7'-3"	-	-	-	-	100	Med to High	Shiny	Nil	Med to High	Earthy	Grey	Slow	Firm	Clay - some fine sand with shells around sample - probably from above	CH
3	8'-0" 9'-6"	1"	Sub Angular	15	55	30	Med to Low	Dull	Slow	Med to Low	"	"	Strong	Compact	Net. mixture of silt, sand & gravel - trace of clay	SF
4	10'-0" 11'-6"	1 1/2"	Angular	15	45	40	"	"	"	"	"	"	"	Hard	Net mixture of clayey silt, sand & gravel	CL

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

REMARKS:-

# VISUAL CLASSIFICATION SHEET

PROJECT 70-11064 SITE Hwy 417 - CNR BOREHOLE No. 22 20 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	0'-0" 2'-0"														see field notes	
2	2'-0" 4'-0"	-	-	-	-	100	High	Dull	None	High	Organic	Grey	Med	Firm	brown organic material Silty clay - some white shells	PI CI
3	4'-0" 6'-0"	-	-	-	-	100	11	Shiny	None	"	Earthy	Dark Grey	Med	"	silty clay to clay with shells	
4	6'-0" 8'-0"	2 1/2"	Angular	20	50	30	Low	Dull	Med	Low	"	Grey	Strong	Compact	Hot mixture of silt, sand & gravel. trace of clay	SF
5	8'-0" 10'-0"	1"	"	20	60	20	Nil	Dull	Quick	Nil	"	"	"	Dense	Silty sand with some gravel	SF
6	10'-0" 12'-0"	1 1/2"	Sub Angular	20	60	20	"	"	"	Nil	"	"	"	Compact	Silty sand with some gravel - pieces of shells throughout	SF
7	12'-0" 3'-9"	1"	Angular	10	50	30	Med	"	" Slow	Med	"	"	"	Very Dense	Hot mixture of silt, sand & gravel - trace of clay	S

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

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 70-11064 SITE Hwy 417 - CNR BOREHOLE No. 23 21 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	0'-0 2'-0	-	-	-	20	80	High	Dull	Nil	High	Slightly Organic	Brownish Grey	Strong	Soft	Top 6" brown organic mat'l clayey silt to silty clay with some sand - shell pieces throughout	CI
2	2'-0 4'-0	1/2"	Sub Angular	5	5	90	11	Shiny	None	"	Earthy	Dark Grey	"	Stiff	silty clay to clay - trace of sand & gravel	CI
3	4'-0 6'-0	-	-	-	-	100	"	"	"	"	"	"	"	"	clay	CH
4	6'-0 8'-0	3/4"	Sub Angular	10	60	30	Nil	Dull	Quick	Nil	"	Grey	"	Dense	Hot mixtures of silt, sand & gravel, trace of clay	SF
5	8'-0 8'-6														clayey silt with sand & gravel - occ shells	CL

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

REMARKS:-



DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 70-11064 SITE Hwy 417 - CNR BOREHOLE No. 1822 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
2	5.0 6.6	1½	Sub Angular	10	75	15	Nil	Dull	Quick	Nil	Earthy	Dark Grey	Strong	Loose	Fine sand some cobb. trace of gravel & clay - white shells throughout	SP
3	8.0 8.6	-	-	-	-	100	Med to High	Shiny	Nil	Med to High	"	Grey	No Reac	Stiff	Clay to silty clay	CH

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

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT <u>70-11064</u>		SITE <u>Hwy 417 - CNR</u>		BOREHOLE No. <u>2123</u>		GROUND ELEVATION _____										
SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	2'-0" 3'-6"	1"	Sub Angular	15	30	45	Med to Low	Dull	Slow	Med to Low	Earthy	Brownish Grey	Strong	Hard	Clayey silt with sand & semi gravel - trace of shells	CL
2	5'-0" 6'-6"	1"	Angular	20	50	30	Low	"	"	Low	"	"	"	Very Dense	Wet mixture of silt, sand & gravel, trace of clay	SF
3	8'-0" 9'-6"	1 1/2"	Sub Angular	20	50	30	"	"	"	"	"	Grey	"	Very Dense	"	SF

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

REMARKS:-

3 Labels.

General Layout

"

"

Found.

"

"

"

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 316-67

DIST. 9 REGION EASTERN

W.P. No. 37-66-7 & 18

CONT. No. 73-40

W. O. No. 70-P-64

STR. SITE No. 31-294

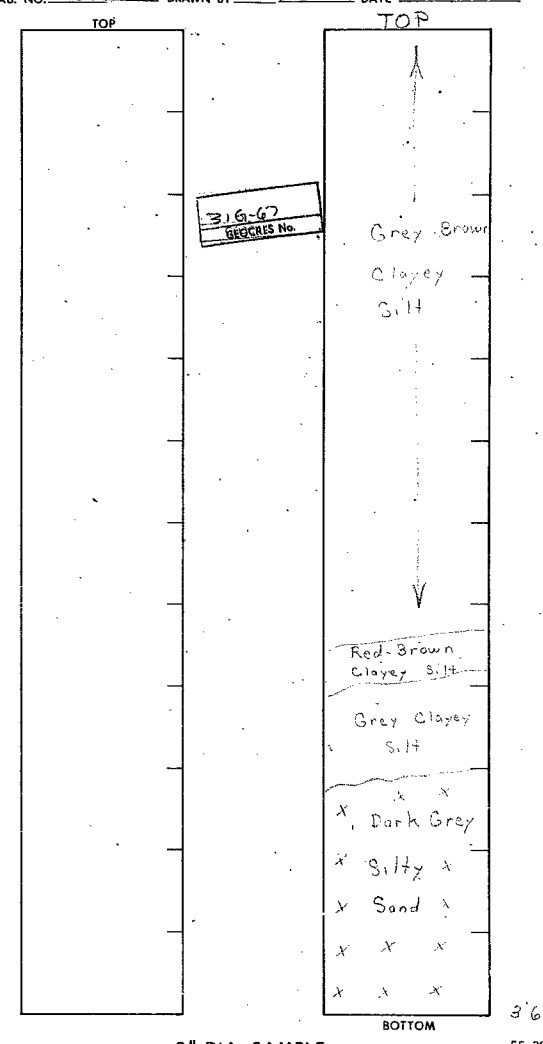
HWY. No. 417

LOCATION HWY. 417 & CNR.

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 17

REMARKS: DOCUMENTS TO BE UNFOLDED  
BEFORE MICROFILMED

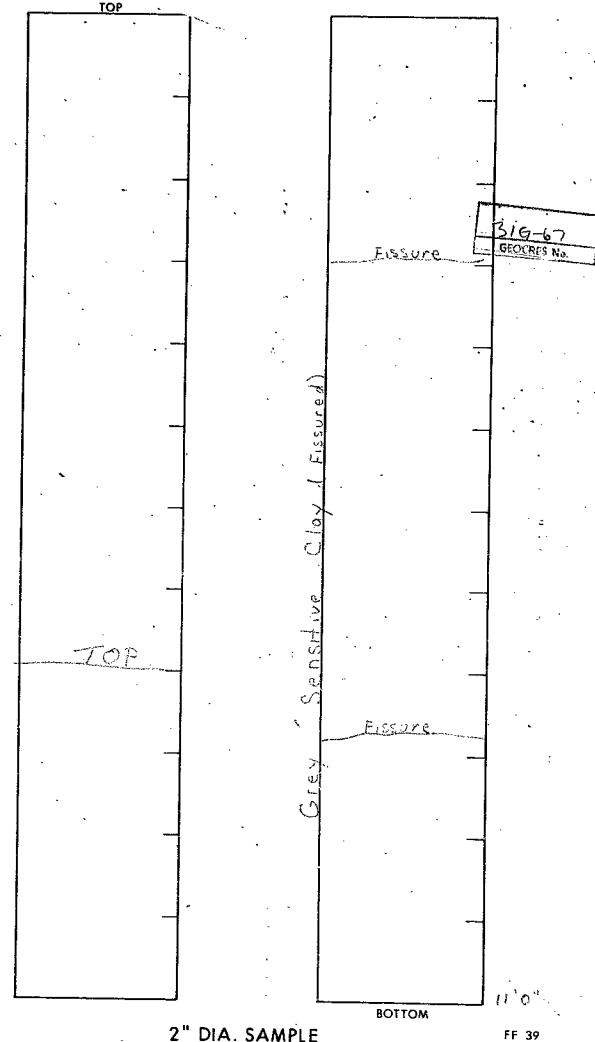
PROJECT 70-110 H. NO. 1022 SAMPLE NO. 1  
LAB. NO. 57281 DRAWN BY J.C.C. DATE



2" DIA. SAMPLE

FF 39

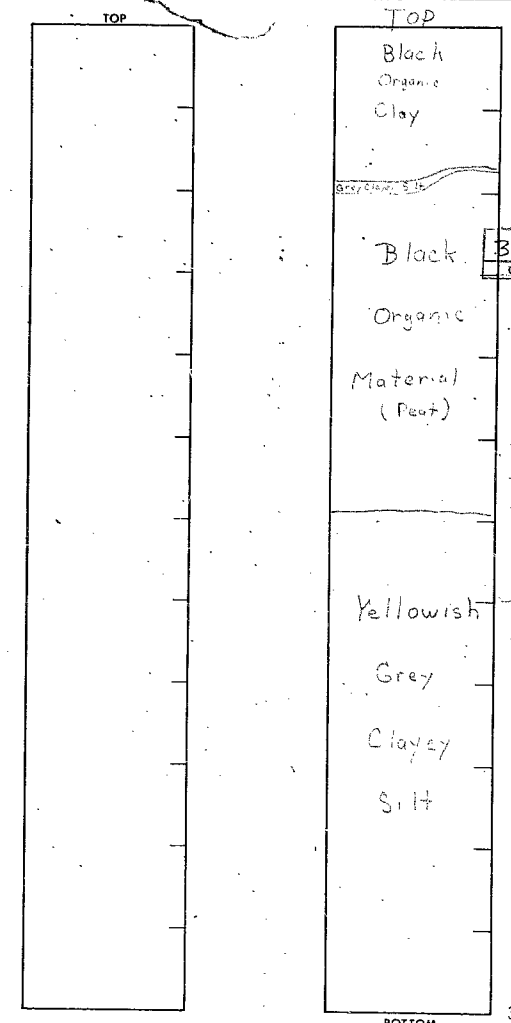
PROJECT 2-11064 H. NO. 22 SAMPLE NO. 4  
LAB. NO. 77 DRAWN BY GC DATE           



2" DIA. SAMPLE

FF 39

PROJECT 70-11264 H. NO. 120 SAMPLE NO. 1  
LAB. NO. 37280 DRAWN BY C. C. DATE



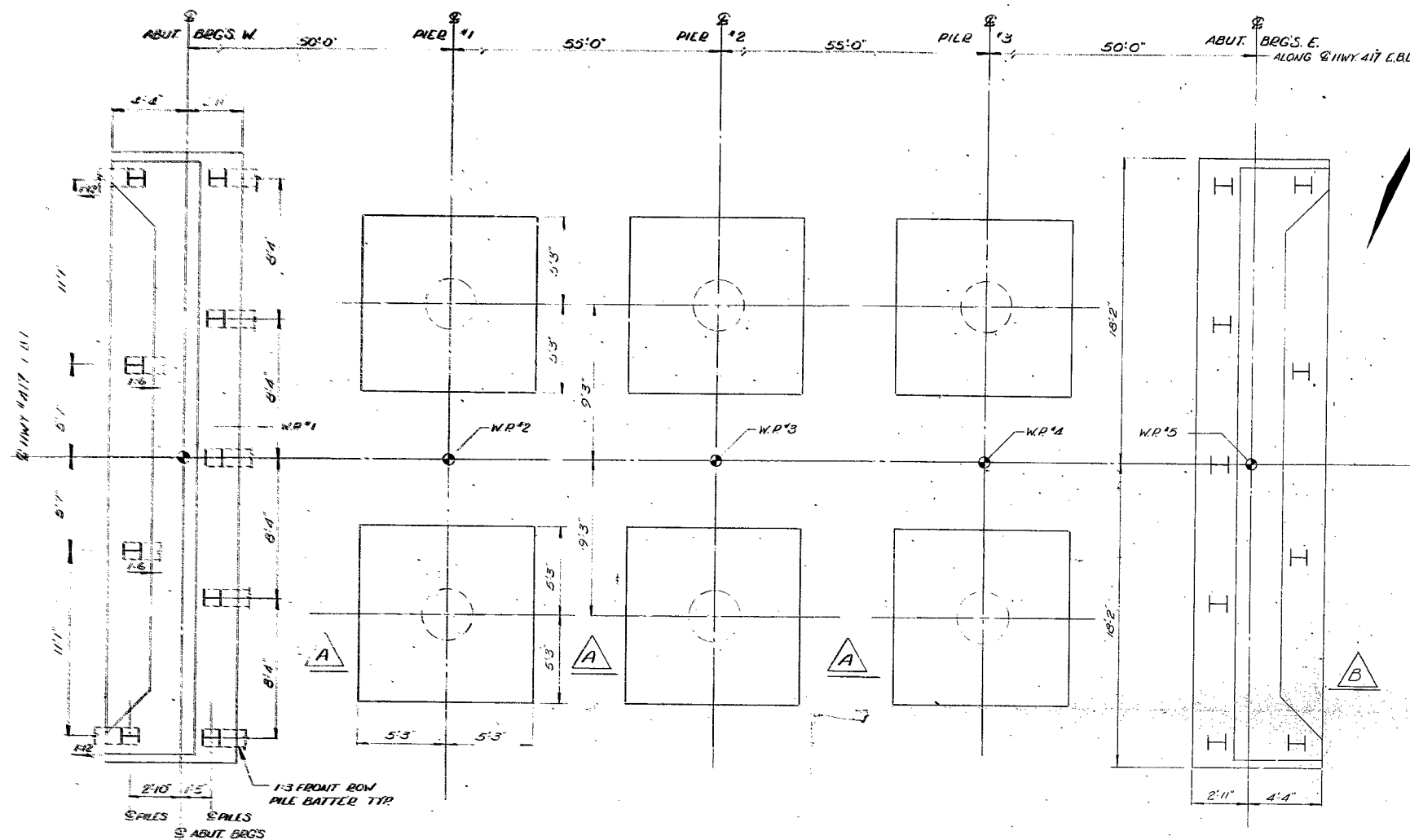
36-67  
GEOLOGICAL No.

2" DIA. SAMPLE

3'6"  
FF 39

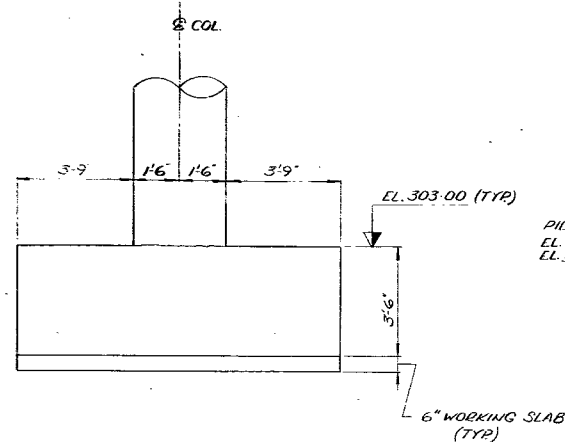




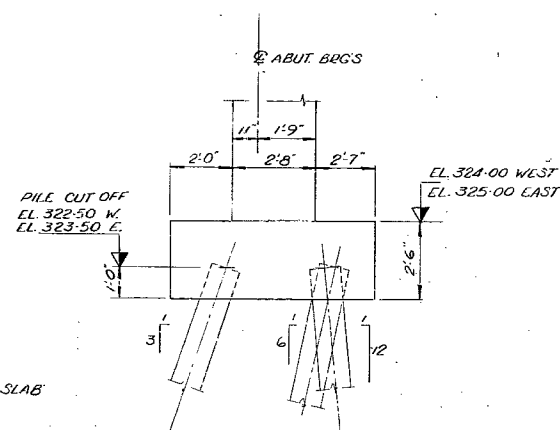


FOOTING LAYOUT

SCALE 1/4 IN. = 1 FT.



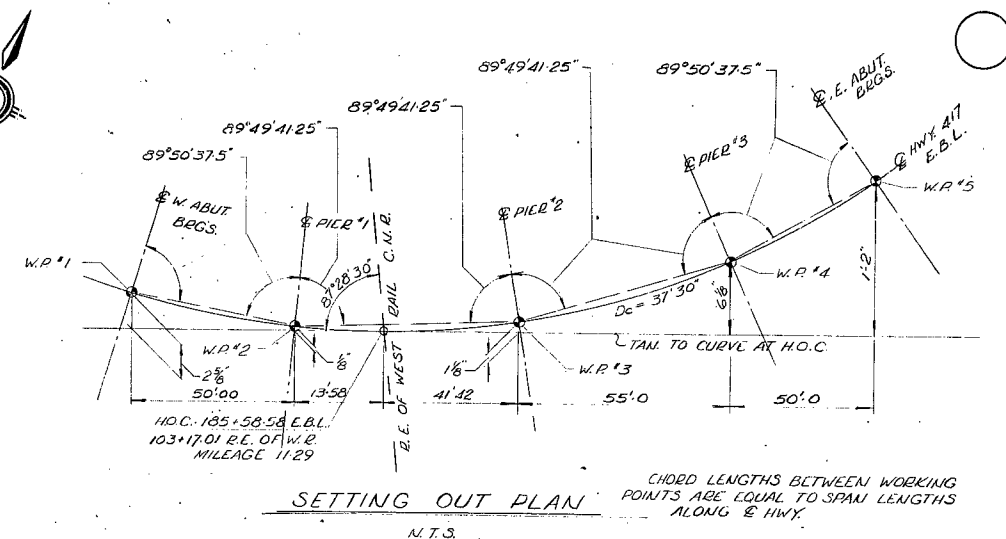
A  
SCALE 3/8 IN. = 1 FT.



B  
SCALE 3/8 IN. = 1 FT.

NOTES:

- PILES TO BE DRIVEN TO BEDROCK
- SPACING OF PILES TO BE MEASURED AT UNDERSIDE OF FOOTINGS
- DIMENSIONS PILE LAYOUT & BATTER SIMILAR FOR BOTH ABUTS.
- DIMENSIONS SIMILAR FOR ALL PIER FOOTINGS
- BOTTOM REIN. TO BE SPACED TO AVOID PILES
- SEE DWG'S D6932-415 FOR FOOTING REINFORCING.



PILE DATA				
LOCATION	BATTER	N°	TYPE	LENGTH
WEST ABUT.	AS SHOWN	9	12 BP-53	38'-0"
EAST ABUT.	AS SHOWN	9	12 BP-53	36'-0"

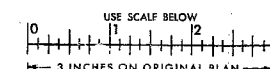
PILE DESIGN LOAD TO TONS/PILE

SIG-67  
GEODETIC No.

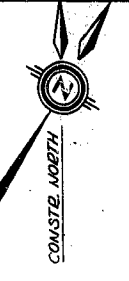
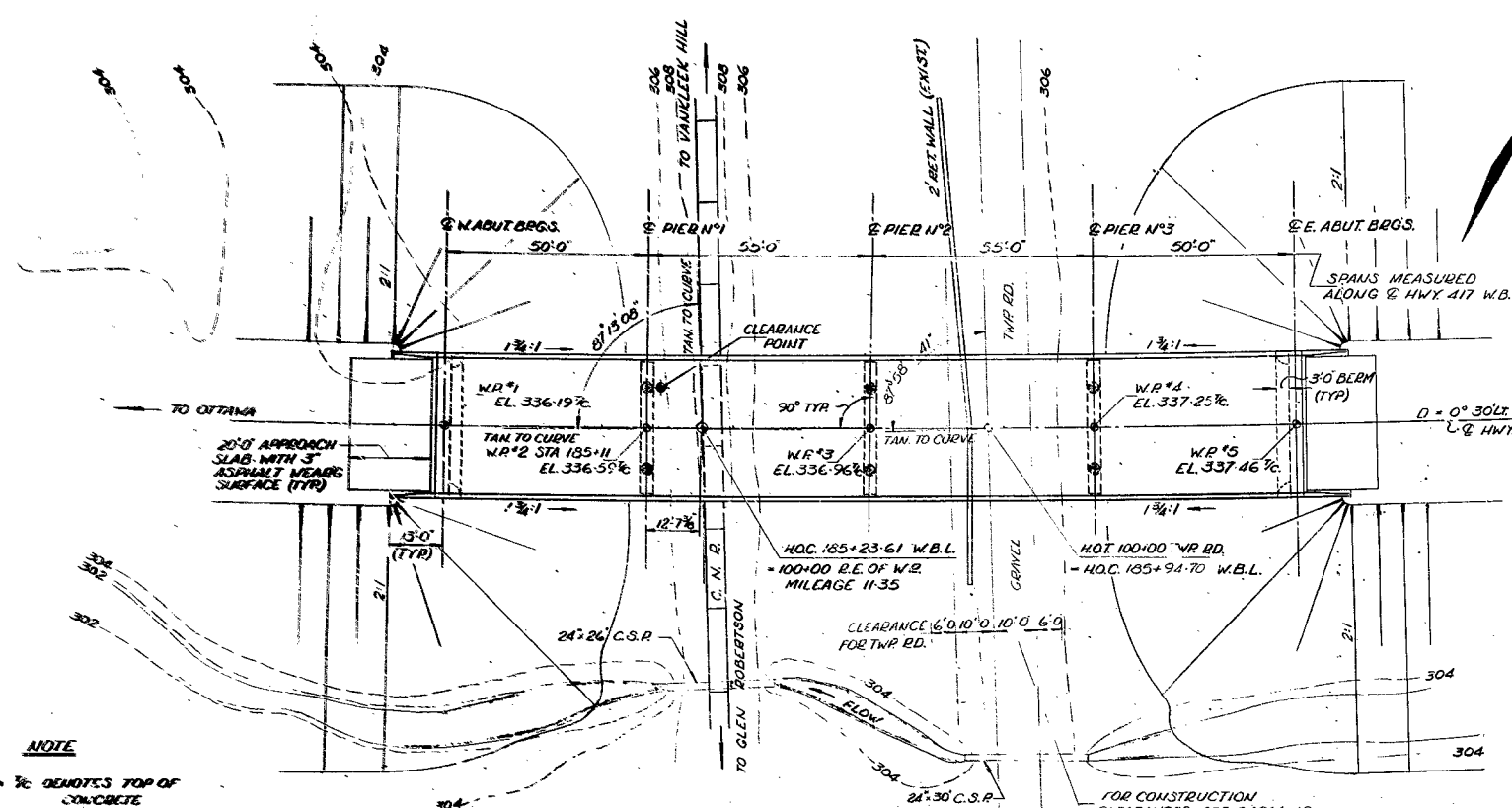
REVISIONS	DATE	BY	DESCRIPTION



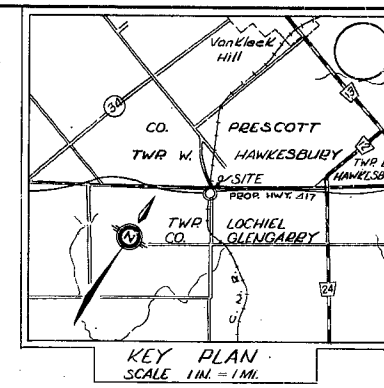
FOR REDUCED PLAN



70-110-64	
CANADIAN NATIONAL RAILWAYS & TWP. DD. OHEAD.	
EAST BOUND LANE	
2.3 MILES SOUTH OF VANKLEEK HILL	
KING'S HIGHWAY No. 417 E.B.L.	DIST. No. 9
CO. GLENGARRY	
TWP. LOCHIEL	LOT 13 & 14 CON. 1X
FOUNDATION LAYOUT	
APPROVED	SITE No. 31-294 W.P. No. 57-66-07
DESIGN M.J.O. CHECK R.S.R.	CONTRACT Nos.
DRAWING M.J.O. CHECK R.S.R.	DRAWING No. D6932-3
DATE JAN 71	LOADING 11/20/71



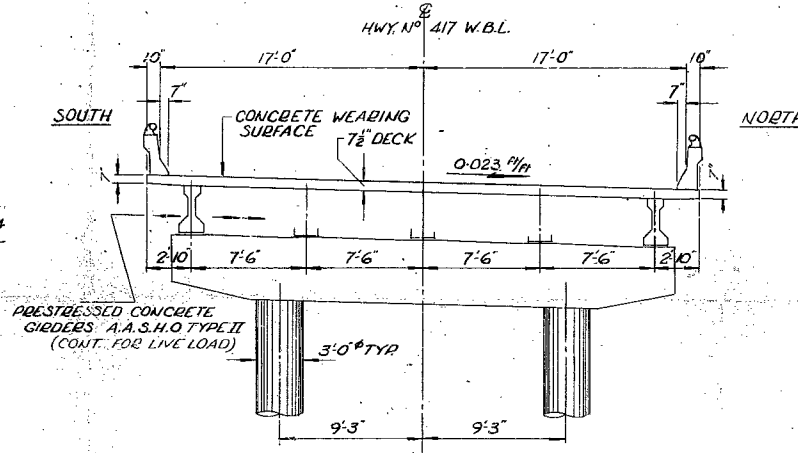
- LIST OF DRAWINGS**
- D6966-1 GENERAL LAYOUT
  - 2 BOLL HOLE LOCATION & SOIL STRATA
  - 3 FOUNDATION LAYOUT
  - 4 ABUTMENT DETAILS
  - 5 PIER DETAILS & REINF.
  - 6 PRESTRESSED GIRDERS & BEARINGS
  - 7 DECK DETAILS & REINF.
  - 8 20' APPROACH SLAB FOR BARRIER WALLS
  - 9 RAILWAY TRACK PROTECTION (PIER#1)
  - 10 CONCRETE BARRIER WALL (2'8" HIGH)
  - 11 DETAILS OF 9' HIGH STEEL PARAPET RAILING
  - D6966-12 STANDARD DETAILS



**NOTE**

- 1/2" DENOTES TOP OF CONCRETE
- W.P. DENOTES WORKING POINT
- CURVE DATA W.B.L.  
 $\Delta$  24° 38'  
 $R$  0° 30' LT  
 $R$  1459' 16"  
 $T$  250' 99"  
 $L$  4986' 67"  
 $E$  269' 96"

**PLAN**  
SCALE 1 IN. = 20 FT.



**TYP DECK SECTION**  
SCALE 3/4" = 1 FT.

**NOTES**

**CLASS OF CONCRETE**

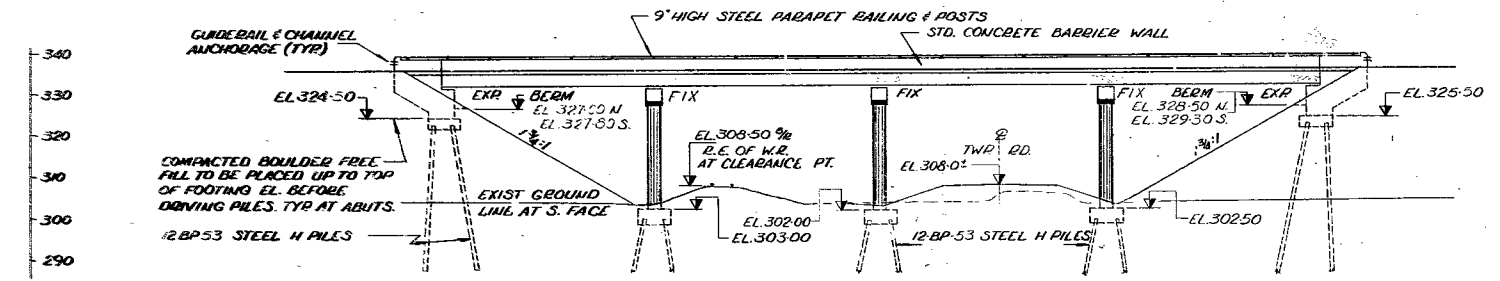
DECK & BARRIER WALLS 4000 P.S.I.  
 PRESTRESSED GIRDERS & COLUMNS 5000 P.S.I.  
 BOLL-HINDER 3000 P.S.I.

**CLAR COVER ON REINFORCING STEEL**

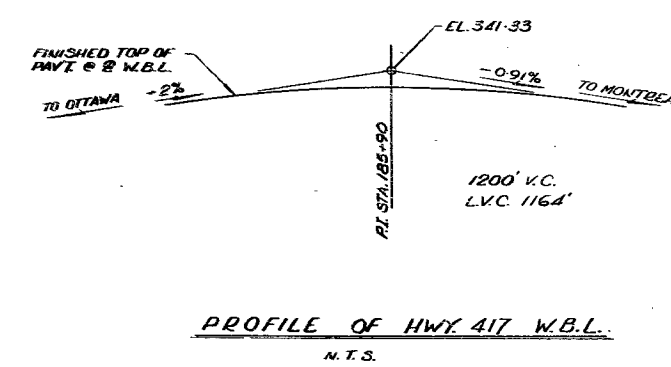
FOOTINGS & ABUTMENTS 3"  
 DECK TOP & BOTTOM 1 1/2"  
 BARRIER WALLS 1 1/2"  
 PIER CAP, COLUMNS & APPR. SLABS 2"

**CONSTRUCTION NOTES**

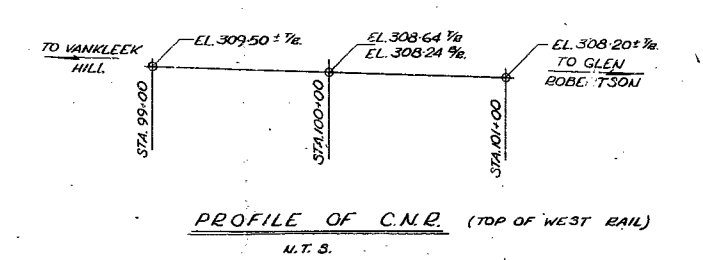
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BLARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF +1/4" NO CONCRETE IS TO BE PLACED ABOVE THE ABUTMENT BLARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED



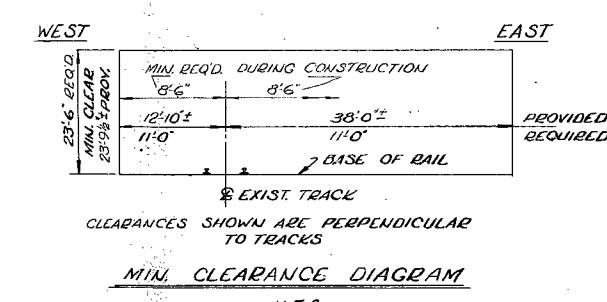
**ELEVATION**  
SCALE 1 IN. = 20 FT.



**PROFILE OF HWY 417 W.B.L.**  
N.T.S.



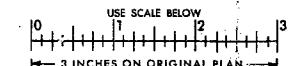
**PROFILE OF C.N.R. (TOP OF WEST RAIL)**  
N.T.S.



**MIN. CLEARANCE DIAGRAM**  
N.T.S.



FOR REDUCED PLAN  
USE SCALE BELOW



B.M. EL. 310.68 GEODETIC DATUM  
 N.E.W. IN S. ROOT OF 2'0" TWIN CEDAR  
 209'0" LT. OF STA. 183+71 W.B.L.

REV.	DATE	BY	DESCRIPTION

70-118-64

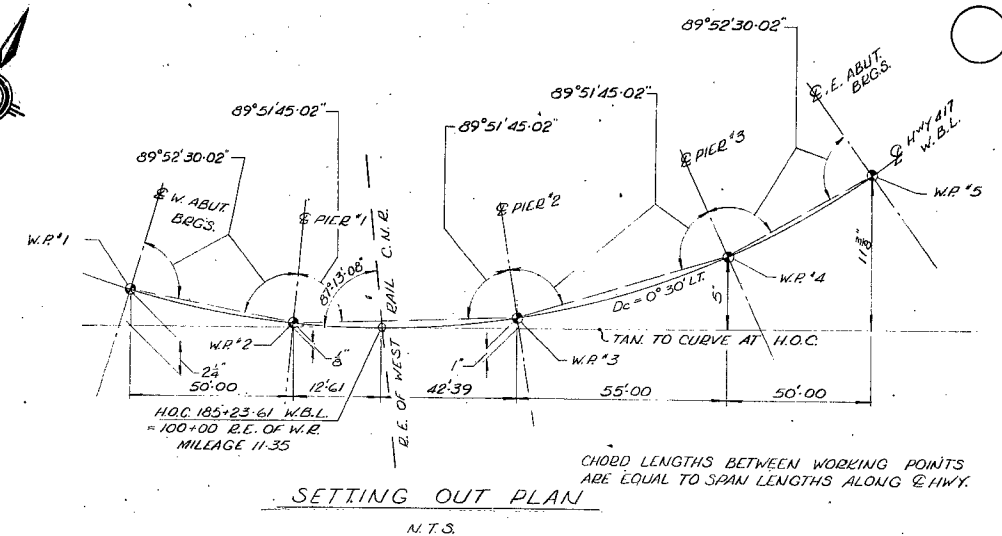
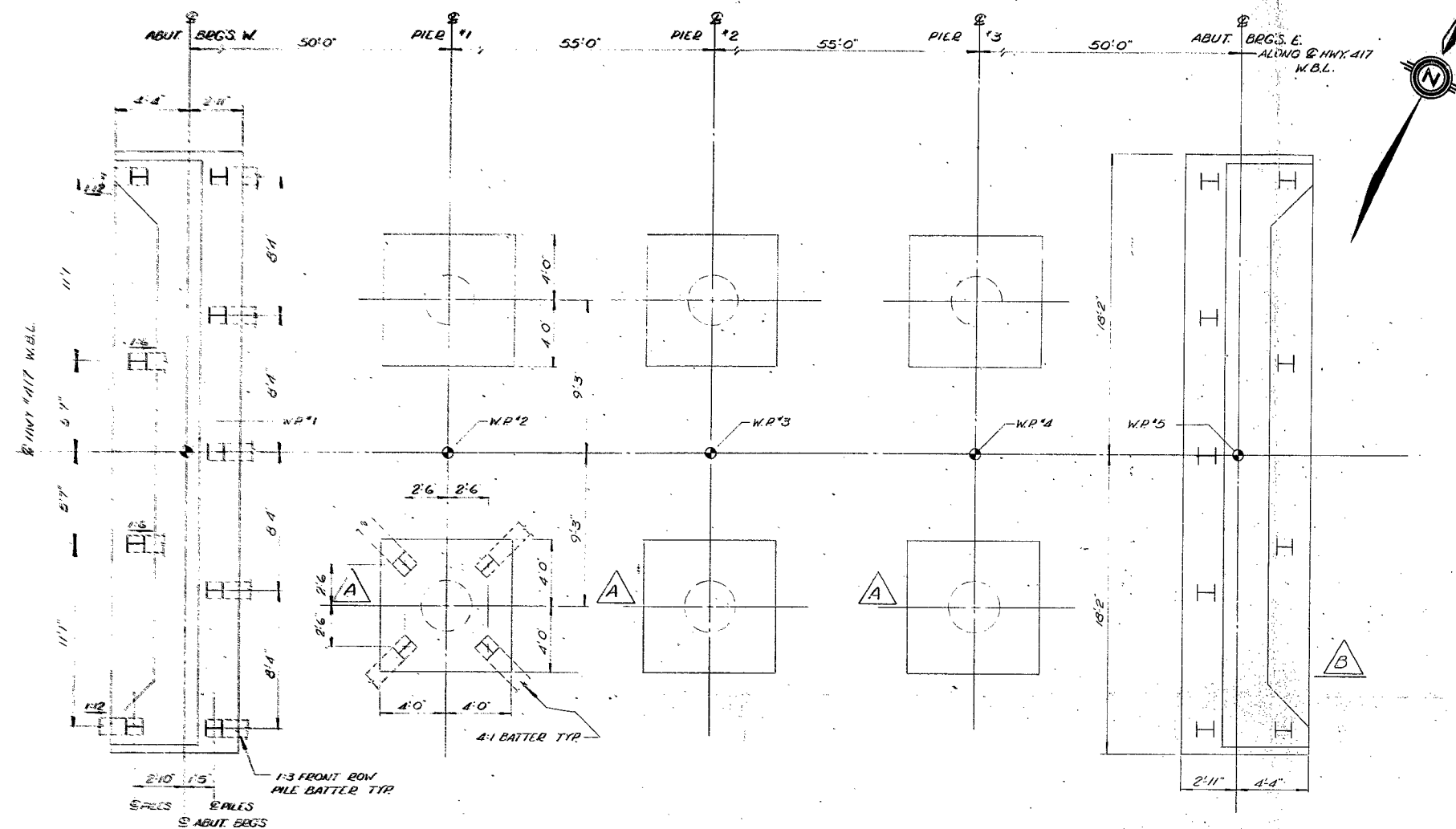
**CANADIAN NATIONAL RAILWAYS & TWP. RD. O'HEAD**

2.3 MILES SOUTH OF VANKELEK HILL  
 KING'S HIGHWAY No. 417 W.B.L. DIST. No. 9  
 CO. GLENAGARRY  
 TWP. LOCHIEL LOT 13 & 14 CON. 1X

**GENERAL LAYOUT**

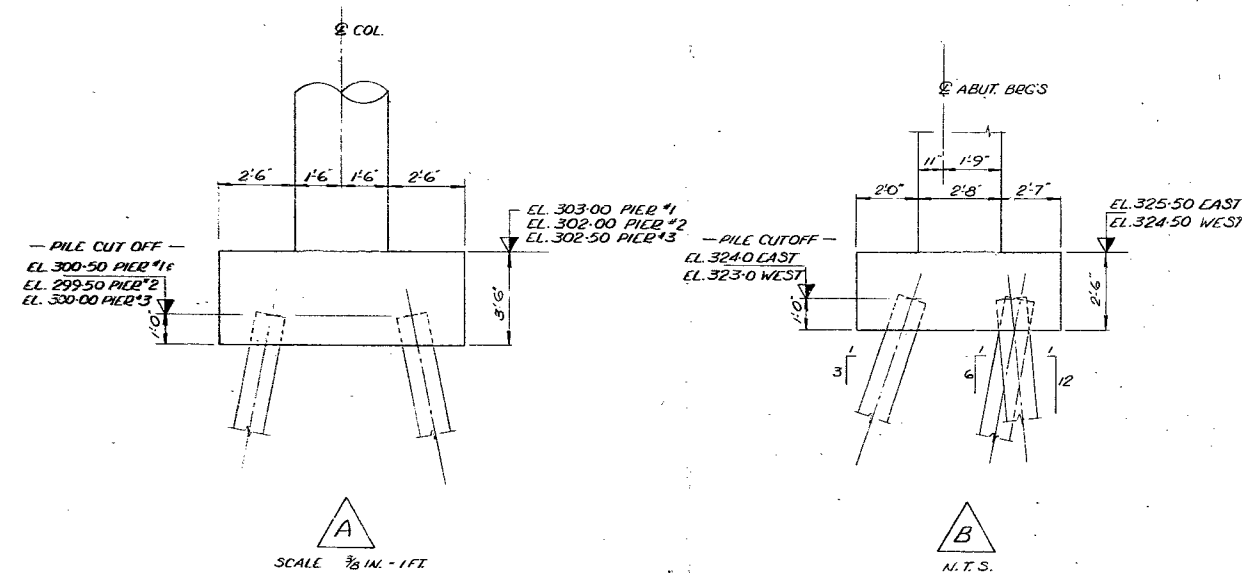
APPROVED \_\_\_\_\_ SITE No. 31-294 W.P. No. 37-66-18

DESIGN H.J.O. CHECK H.J.O. CONTRACT No. \_\_\_\_\_  
 DRAWING H.J.O. CHECK R.S.P. DRAWING No. D6966-1  
 DATE JUL 71 LOADING 4/520/40



PILE DATA				
LOCATION -	BATTER	N <sup>o</sup>	TYPE	LENGTH
WEST ABUT.	AS SHOWN	9	12-BP-53	40'0"
PIER N <sup>o</sup> 1	1:4	8	do.	15'0"
PIER N <sup>o</sup> 2	1:4	8	do.	15'0"
PIER N <sup>o</sup> 3	1:4	8	do.	15'0"
EAST ABUT.	AS SHOWN	9	do.	40'0"

PILE DESIGN LOAD 70 TONS/PILE



- NOTES:
- PILES TO BE DRIVEN TO BEDROCK
  - SPACING OF PILES TO BE MEASURED AT UNDERSIDE OF FOOTINGS
  - DIMENSIONS-PILE LAYOUT & BATTER SIMILAR FOR BOTH ABUTTS.
  - DIMENSIONS AND PILE LAYOUT SIMILAR FOR ALL PIERS
  - BOTTOM REIN. TO BE SPACED TO AVOID PILES
  - SEE DWG'S D6966-415 FOR FOOTING REINFORCING.

[illegible]

70-110-64	
<u>CANADIAN NATIONAL RAILWAYS &amp; TWP DD OHEAD</u> WEST BOUND LANES <u>2.3 MILES SOUTH OF VANKLEEK HILL</u>	
KING'S HIGHWAY No. <u>417 W.B.L.</u>	DIST. No. <u>9</u>
CO. <u>GLENGARRY</u>	
TWP. <u>LOCHIEL</u>	LOT <u>13 &amp; 14</u> CON. <u>1X</u>