

#68-F-90

W.P. #36-66, 37-66

Hwy. #417 (LINE'D)

Hwy. #34

EASTERLY TO

Hwy #17

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## MEMORANDUM

To: Mr. J. L. Forster,  
Functional Planning Engr.,  
Eastern Region,  
KINGSTON, Ontario.

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

ATTENTION:

DATE: March 18, 1969

MAR 24 1969

OUR FILE REF:

IN REPLY TO

SUBJECT:

## PRELIMINARY FOUNDATION REPORT

For

Proposed Hwy. 417 - (Line 'D')  
Hwy. 34 Easterly to Hwy. 17 -  
Structure Sites 22, 23, 23A, 24, 25, 26,  
26A, 27, 28 - Counties of Glengarry and  
Prescott - District No. 9 (Ottawa)  
W.J. 68-F-90 -- W.P. 37-66  
W.P. 36-66

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

We believe that the information contained therein will prove adequate for your immediate use. Should you require further data, or clarification of the report, please feel free to contact this Office.

AGS/MdeF

Attach.

cc: Messrs. J. L. Forster (2)

B. R. Davis (2)

H. A. Tregaskes

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Foundations Files ✓

Gen. Files

*A. G. Sternac*  
A. G. Sternac

PRINCIPAL FOUNDATION ENGINEER

PRELIMINARY FOUNDATION REPORT  
For

Proposed Hwy. 417 - (Line 'D')  
Hwy. 34 Easterly to Hwy. 17 -  
Structure Sites 22, 23, 23A, 24, 25, 26,  
26A, 27, 28 - Counties of Glengarry and  
Prescott - District No. 9 (Ottawa)  
W.J. 68-F-90 -- W.P.s 37-66, 36-66

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1. INTRODUCTION:

The Foundation Section was requested to provide preliminary subsoil information at the proposed structure and creek crossings along Hwy. 417 (Line 'D'), namely, between Vars and the Quebec Border. This portion of the proposed highway is approximately 52 miles in length. The request was contained in a memo from the Eastern Region Functional Planning Section (Mr. J. L. Forster, Regional Functional Planning Engineer), dated December 10, 1968. An investigation was subsequently carried out by this Section to determine the subsoil conditions at the crossings.

This report presents preliminary information on the subsoil and groundwater conditions encountered at the proposed structure crossings of Hwy. 417, located between Hwy. 34 and Hwy. 17. Also included are recommendations pertaining to foundation design and stability and settlement of approach embankments.

A preliminary Foundation Report has already been submitted on that portion of the alignment -

- i) following existing Hwy. 17 (Quebec Border Westerly)
- and
- ii) Casselman Easterly to Hwy. 34.

A Foundation Report for the remaining section, namely, between Vars and the South Nation River, will be submitted in due course.

## 2. DESCRIPTION OF THE SITES AND GEOLOGY:

The proposed alignment for Hwy. 417, from Hwy. 34 easterly to Hwy. 17, is located within the Counties of Glengarry and Prescott. The terrain is undulating in relief, between about elevation 215 and 280. A localized hummock exists, however, in the vicinity of Site 24; at this location high ground is at about elevation 325. The land is basically being utilized for farming purposes. The surficial drainage in the area is controlled by the Rigaud River located immediately to the south of the proposed alignment.

Geographically the majority of the alignment, in this section, is situated in the physiographic region known as the "Glengarry Till Plains". This area is characterized by drumlinized ridges with the intervening flats floored with clays, and in some cases, swamp deposits. The glacial till is stoney in texture and generally less than 25 ft. in thickness. The overburden is underlain by limestone and shale bedrock of the Chazy Group, Ordovician Period.

Site 23 is located within an arm of the "Winchester Clay Plains", an area in which the predominant stratum is composed of a sensitive marine clay deposited in the geologic past by the Champlain Sea. The clay, which is encountered at a relatively shallow depth below ground surface, varies anywhere from 10 to 40 feet in thickness. The clay overlies glacial till which, in turn, is followed by bedrock.

## 3. FIELD AND LABORATORY WORK:

A detailed sampled borehole was put down at Structure Sites No. 22, -23, 23A, 24, 25, 26, 26A, 27 and 28, during the course of the investigation.

The locations of the structure sites and borings are shown on Drawing No. 68-F-90A, located in the Appendix of this report. The location of the boreholes and elevations (referenced

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

to an arbitrary datum) at the respective sites, were provided by the Engineering Surveys Section (Eastern Region). The elevations given in the report, however, have been referenced to the ground surface contours given on the County Militia maps (scale 1:50,000, contour interval 25 feet - Geodetic origin).

Samples of the overburden were taken using standard sampling equipment and techniques. Bedrock was proven at some of the boring locations by obtaining BXL rock core samples. Laboratory testing was carried out on selected samples to determine the engineering properties of the overburden.

The subsoil conditions encountered at the boring locations, are shown on the Record of Borelog sheets; a stratigraphical profile along the alignment has been inferred from this data, and is shown on Drawing 68-F-90A. The results of the laboratory and in situ testing carried out, are shown on the borelog sheets as well as on Figures 1 to 4, inclusive, all of which are located in the Appendix of this report.

4. SUBSOIL CONDITIONS:

A brief resumé of the subsoil conditions encountered at each site is presented below:

SITE #22

Ground Elev. - 250 ±  
Groundwater Elev. - 242 (approx.)

Depth

0' - 2.0'	Topsoil.
2.0' - 36.0'	Silty Sand & Gravel ( <u>Glacial Till</u> ) - Very Dense. (Boulders up to 5" in size below a depth of 5') .

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

SITE #23

Ground Elev. - 215  $\pm$   
Groundwater Elev. - 205 (approx.)

Depth

0' - 3.5'	Silty Sand with Gravel ( <u>Roadway Fill</u> ) - Compact.
3.5' - 33.7'	<u>Clay</u> to <u>Silty Clay</u> - Firm to Stiff.
33.7' - 39.0'	Clayey Silt with Sand & Gravel ( <u>Glacial Till</u> ) - Stiff.
39.0' - 46.0'	<u>Shale Bedrock</u> - weathered to sound at a depth of 44'.

SITE #23A (652 ft. north of Site #23)

Ground Elev. - 223  $\pm$   
Groundwater Elev. - 215 (approx.)

0' - 2.0'	Silty Sand & Gravel ( <u>Roadway Fill</u> ) - Compact.
2.0' - 12.5'	<u>Clay</u> to <u>Silty Clay</u> - Very Stiff to Stiff.
12.5' - 31.5'	Silty Sand & Gravel ( <u>Glacial Till</u> ) - Dense to Very Dense.

SITE #24

Ground Elev. - 320  $\pm$   
Groundwater Elev. - 316 (approx.)

0' - 4.0'	Silty Sand & Gravel ( <u>Roadway Fill</u> ) - Compact.
4.0' - 12.0'	<u>Clay</u> to <u>Silty Clay</u> - Very Stiff to Firm
12.0' - 19.0'	Silty Sand & Gravel ( <u>Glacial Till</u> ) - Compact to Very Dense.
19.0' - 23.0'	Limestone Bedrock - Fractured to Sound at a depth of 21'.

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

SITE #25

Ground Elev. - 280  $\pm$   
Groundwater Elev. - 276 (approx.)

Depth

0' - 2.0' Silty Sand & Gravel (Roadway Fill) - Compact.  
2.0' - 20.5' Silty Sand & Gravel (Glacial Till) - Very Dense.

SITE #26

Ground Elev. - 275  $\pm$   
Groundwater Elev. - 270 (approx.)

0' - 4.0' Silty Sand & Gravel (Roadway Fill) - Compact.  
4.0' - 32.0' Clay to Silty Clay - Soft to Firm.  
32.0' - 44.0' Silty Sand & Gravel (Glacial Till) - Dense to Very Dense. (Boulders up to 10" in size below a depth of 35').  
44.0' - 49.0' Limestone Bedrock - Sound.

SITE #26A (located 250 ft. west of Site #26)

Ground Elev. - 280  $\pm$   
Groundwater Elev. - 274 (approx.)

0' - 4.0' Silty Sand & Gravel (Roadway Fill) - Dense.  
4.0' - 6.0' Silty Clay - Stiff.  
6.0' - 25.1' Silty Sand & Gravel (Glacial Till) - Very Dense. (Boulders up to 10" in size below a depth of 8').



4. SUBSOIL CONDITIONS:

SITE #27

Ground Elev. - 275 ±  
Groundwater Elev. - 270 (approx.)

<u>Depth</u>	
0' - 1.0'	<u>Topsoil.</u>
1.0' - 8.0'	Silty Sand & Gravel ( <u>Glacial Till</u> ) - Very Dense. (Boulders up to 12" size throughout).
8.0' - 15.8'	<u>Limestone Bedrock</u> - Sound.

SITE #28

Ground Elev. - 270 ±  
Groundwater Elev. - 265 (approx.)

0' - 2.0'	<u>Clayey Silt</u> with some Sand & Gravel - Stiff.
2.0' - 14.5'	Silty Sand & Gravel ( <u>Glacial Till</u> ) - Very Dense. (Boulders up to 8" in size below a depth of 11').
14.5' - 20.8'	<u>Shale Bedrock</u> - Fractured to Sound at a depth of 17'.

5. DISCUSSION AND RECOMMENDATIONS:

Proposed Hwy. 417 (Line 'D'), will be a 4-lane highway incorporating a wide median. The discussion presented herein is applicable for that portion of the alignment of the proposed highway from Hwy. 34 easterly to Hwy. 17.

It is understood that underpass structures will be constructed at the major crossings proposed within the above section, namely, at Sites No. 22, 23A, 24, 25, 26A, 27 and 28. At this stage the profile grades have not been finalized; it is understood however, that the associated approach fills will be of the order of 22 to 23 feet.

Preliminary recommendations pertaining to structure foundations, as well as stability and settlement of approach fills, are summarized in tabular form as follows:

# FOUNDATION RECOMMENDATIONS

Site No.	Approx. Exist. Ground Elev. (ft.)	R E C O M M E N D A T I O N S			Remarks
		<u>STRUCTURES</u>	<u>EMBANKMENTS</u>	Comments	
22	250 ±	<u>Piers</u> Spread footings within glacial till, provided with 5' of earth cover for frost protection purposes, allowable bearing pressure up to 5 t.s.f.		No stability problems for Standard 2:1 slopes.	
25	280 ±	<u>Abutments</u> Spread footings within the approach fills constructed of granular material, allowable bearing pressure 2 t.s.f. - or, alternatively, end- bearing piles driven to practical refusal within glacial till. - estimated elevations: Site 22 - 235 Site 25 - 265 - designed for max. capacity of the pile section chosen.	22' (Slopes 2:1)		

# FOUNDATION RECOMMENDATIONS

Site No.	Approx. Exist. Ground Elev. (ft.)	R E C O M M E N D A T I O N S			Remarks
		<u>STRUCTURES</u>	<u>EMBANKMENTS</u>	Comments	
23A	223 ±	<u>Piers &amp; Abutments</u> End-bearing piles driven to practical refusal within the glacial till, or to bedrock - designed for max. capacity of pile section chosen. (Bedrock not proven at this location; however, it is estimated that the bedrock surface is at about elev. 180 (approx.).	22' (Slopes 2:1)	<u>Stability</u> No stability problems contemplated for standard embankments with standard 2:1 slopes. <u>Probable Consolidation Settlement</u> 1) Embankments in vicinity of structure 1" to 2" in 6 months (max.) 2) North & South Approaches to Structure Settlements, induced in foundation subsoil could significantly exceed the above values. Refer to subsection 5.1.	

cont'd. /9 ...

# FOUNDATION RECOMMENDATIONS

Site No.	Approx. Exist. Ground Elev. (ft.)	R E C O M M E N D A T I O N S			Remarks
		<u>STRUCTURES</u>	Max. Height of Approach Fill (Assumed)	<u>EMBANKMENTS</u>  Comments	
24	320 ±	<u>Piers &amp; Abutments</u>  End-bearing piles driven to bedrock - designed for max. capacity of the pile section chosen.	22'  (Slopes 2:1)	<u>Stability</u>  No stability problems for Standard 2:1 slopes  <u>Probable Consolidation Settlement</u>  2" to 3" in 6 months (Max.)	Settlements will take place in a relatively short period of time. Consid- eration should be given to constructing the approach fills prior to construction of the struc- ture founda- tions.

cont'd. /10 ...

# FOUNDATION RECOMMENDATIONS

Site No.	Approx. Exist. Ground Elev. (ft.)	R E C O M M E N D A T I O N S			Remarks
		<u>STRUCTURES</u>	Max. Height of Approach Fill (Assumed)	<u>EMBANKMENTS</u>  Comments	
26A	275 ±	<p><u>Piers</u></p> <p>Spread footings within glacial till, at or below elev. 274, allowable bearing pressure up to 4 t.s.f.</p> <p><u>Abutments</u></p> <p>Spread footings constructed within the approach fills, composed of granular material, allowable bearing pressure 2 t.s.f., or alternatively, end-bearing piles driven to practical refusal within glacial till - estimated tip elevation 250 - designed for max. capacity of the pile section chosen.</p>	22' (Slopes 2:1)	<p><u>Stability</u></p> <p>No stability problems contemplated for embankments with Standard 2:1 slopes.</p> <p><u>Probable Consolidation Settlement</u></p> <p>1) In Vicinity of Structure along West Approach - negligible.</p> <p>2) East Approach to Structure - Settlements induced in foundation subsoil could be as much as 18". Refer to Sub-section 5.1.</p>	It would be beneficial to move the structure location as far westerly as possible in order to minimize the heights of the approach fills placed on the compressible cohesive subsoil encountered east of this site.

cont'd. /11 ...

# FOUNDATION RECOMMENDATIONS

Site No.	Approx. Exist. Ground Elev. (ft.)	R E C O M M E N D A T I O N S			Remarks
		<u>STRUCTURES</u>	<u>EMBANKMENTS</u>	Comments	
27	275 ±	<u>Piers</u>  Spread footings within glacial till, or to bedrock - allowable bearing pressure up to 5 t.s.f. and 20 t.s.f., respectively.	22' (Slopes 2:1)	No stability problems for Standard 2:1 slopes.	-
28	270 ±	<u>Abutments</u>  Spread footings constructed within the approach fills, composed of granular material - allowable bearing pressure 2 t.s.f.  or, alternatively, end-bearing piles driven to bedrock - designed for max. capacity of the pile section chosen.			

cont'd. /12 ...

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

5.1) Approach Embankments - Sites 23A and 26A:

At these sites additional boreholes were put down, at locations which will be occupied by approach fills, namely, at Sites 23 and 26. These borings revealed that the subsoil conditions are not uniform over the entire area. For instance, the thickness of the compressible stratum at structure Sites 23A and 26A is 10 and 2 feet, respectively, while at Sites 23 and 26 the stratum is 30 and 28 feet, respectively.

Considerable consolidation settlements may occur if approach fills are constructed in areas underlain by such a compressible stratum, as will probably be the case for some portions of

- i) the south approach fill for structure Site 23A,  
and
- ii) the east approach fill for structure 26A.

The maximum magnitude of the consolidation settlements anticipated for the aforementioned embankments are presented in the table in Section 5.

In view of the anticipated settlements beneath the embankments constructed along Hwy. 34 and the Township Road, respectively, consideration should be given to lowering the profile grade of Hwy. 417 in these areas. This will result in lower fill heights in areas underlain by compressible clay, and consequently, the settlements will be reduced.

Since the thickness of the compressible stratum is known to be variable across the two sites, it will be necessary to determine the vertical and lateral extent of the deposit during the final investigation phase. At this stage the magnitudes of the settlements expected can be more accurately defined.

6. SUMMARY:

The results of a preliminary foundation investigation for the structure crossings, of that portion of Hwy. 417 from Hwy. 34 easterly to Hwy. 17, are presented in this report. The Sites involved are Nos. 22, 23, 23A, 24, 25, 26, 26A, 27 and 28.

The subsoil at the sites is generally composed of shallow deposits of granular glacial till, which directly overlies limestone or shale bedrock. At a few of the sites - in particular, Sites 23 and 26 - a compressible stratum of sensitive clay, up to 30 feet in thickness, directly overlies the glacial till deposit.

Preliminary comments regarding,

- i) the type of foundation acceptable,
- ii) stability and settlement of approach embankments, and
- iii) additional recommendations,

are presented in this report.

It should be stressed that this report is of a preliminary nature. A complete foundation investigation will be required at all structure sites, when design details become available.

7. MISCELLANEOUS:

The field work for this project was carried out during the period of January 15 to February 5, 1969, under the supervision of Mr. V. Korlu, Project Foundation Engineer.

The equipment used was owned and operated by P. E. Johnston Drilling Co. Ltd.

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

March 1969



Appendix A

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FOUNDATION SECTION

JOB	68-F-90	LOCATION	Hwy. 417 (Line D)	ORIGINATED BY	BTD
W.P.	36-66-05	BORING DATE	Jan. 15 & 16, 1969	COMPILED BY	BTD
DATUM	Geodetic	BOREHOLE TYPE	Washboring - BX Casing	CHECKED BY	<i>AK</i>

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		SHEAR STRENGTH P.S.F.		WATER CONTENT %				
							$\circ$ UNCONFINED $\bullet$ QUICK TRIAXIAL	+ FIELD VANE x LAB. VANE	$w_p$ — $w$ — $w_L$ 20 40 60				
250 ±	Ground Level												
248.0	Sandy silt with trace of clay (Topsoil)	TO	1	SS	11								
2.0	Silty sand & gravel (Glacial Till)	TO											
	(boulders up to 5" in size below elev. 245)	OT	2	SS	118								
		TO											
		TO	3	SS	110	240							
		OT											
		TO	4	SS	187								
	(Brown to Grey)	OT											
		TO				230							
		OT											
	Very dense	TO	5	SS	238								
		OT											
		TO				220							
		OT											
214.0		TO	6	SS	158								
36.0	End of Borehole					210							

FOUNDATION SECTION

ORIGINATED BY VK

COMPILED BY VK

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. Site 23 A

FOUNDATION SECTION

JOB 68-F-90 LOCATION Hwy 417 (Line D) 652 ft. north of site 23 ORIGINATED BY VK  
 W.P. 36-66-05 BORING DATE Feb. 4 & 5, 1969 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing CHECKED BY *✓*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT — $w_L$	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	PLASTIC LIMIT — $w_p$		
223 ±	Ground Level						SHEAR STRENGTH P.S.F.	WATER CONTENT %		
							○ UNCONFINED + FIELD VANE	$w_p$ — $w$ — $w_L$		
							● QUICK TRIAXIAL × LAB. VANE	20 40 60		
221.0	Silty sand & gravel (Roadway Till) Compact	XXXX								GR. SA. SI. CL.
2.0	Clay to silty clay, trace of sand & gravel (seams of silt & sand up to 2" thick throughout) (mottled brown)		1	SS	29	220				C 6 34 60
			2	SS	13					215
210.5	very stiff to stiff		3	SS	11					W in open BH
12.5	Silty sand to sandy silt with gravel (Glacial Till) (occasional seams & layers of clayey silt up to 4" thick throughout) (grey)		4	SS	32	210				
			5	SS	40					33 35 30 2
			6	SS	36	200				
191.5	Dense to very dense)		7	SS	72	190				16 32 51 1
31.5	End of Borehole									

C 6 34 60  
 215  
 in open  
 BE

33 35 30 2

16 32 51 1

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. Site 24

FOUNDATION SECTION

JOB 68-F-90 LOCATION Hwy. 417 (Line D) ORIGINATED BY VK  
W.P. 37-66-01 BORING DATE Jan. 22 & 23, 1969 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing - BXL Rock Core 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 Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
320 ±	Ground Level						400	800	1200	1600	2000		20	40	60	
0.0	Silty sand & gravel (Roadway Fill) Compact															
316.0																
4.0	Desiccated crust (mottled brown) very stiff		1	SS	11											
	Clay to silty clay with a trace of sand & grav.															
308.0	(grey) Firm		2	TW	PM	310										
12.0	Silty sand & gravel trace of clay (Glacial Till)(grey)		3	SS	19											
301.0	Compact to dense Crystalline Limestone															
19.0	Bedrock, with irreg, shaly seams (grey)		4	BXL	50%	300										
297.0	fractured to sound.		5	BXL	100%											
23.0	End of Borehole															

316  
WL in open  
BH  
1 5 34 60

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. Site 25

FOUNDATION SECTION

JOB 68-F-90 LOCATION Hwy. 417 (Line D) ORIGINATED BY VK  
 W.P. 37-66-01 BORING DATE Jan. 24, 27 & 28, 1969 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing CHECKED BY

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. LOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT % $w_p$ — $w$ — $w_L$ 20 40 60			
280 +	Ground Level						<div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL x LAB. VANE</div>					
278.0	Silty sand & gravel (Roadway Fill) Compact	1	SS	100/6"								276
2.0	Silty sand & gravel (Glacial Till)	2	SS	50								WL in open
	(Boulders up to 20" in size below elev. 275)	3	SS	72	270							28 43 (29)
	(Brown)	4	SS	120/8"								36 56 ( 8)
259.5	Very dense	5	SS	100/5"	260							
20.5	End of Borehole				250							

DATUM Geodetic

BOREHOLE TYPE Washboring - NX, BX Casing - BXL Rock Core

CHECKED BY

REMARKS

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. Site 26A

FOUNDATION SECTION

JOB 68-F-90 LOCATION Hwy. 417 (line D) - 250 ft. west of site 26 ORIGINATED BY VK  
W.P. 37-66-03 BORING DATE Feb. 5, 6 & 7, 1969 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing - BXL Rock Core CHECKED BY

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		SHEAR STRENGTH P.S.F.		WATER CONTENT % $w_p$ — $w$ — $w_L$ 20 40 60				
280 ±	Ground Level						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE						
0.0	Silty sand & gravel (Roadway Fill) Dense												WL in open BH
276.0	Silty clay with sand & gr., tr. of orgs. Stiff		1	SS	14								274
274.0	Silty sand & gravel (Glacial till)		2	SS	129	270							49 39 10 2
6.0	(layers of clayey silt up to 5" thick throughout)												
	(boulders up to 10" in size below el. 272)		3	SS	41	260							9 42 35 14
	(grey)												
254.9	Very dense		4	SS	100/2"								
25.1	End of Borehole					250							



DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. Site 27

FOUNDATION SECTION

JOB 68-F-90

LOCATION Hwy. #417 (Line D) - C.P.R. Tracks

ORIGINATED BY VK

W.P. 37-66-03

BORING DATE Feb. 5 and 6, 1969

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Washboring - BX Casing - BXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— $w_L$		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	RESISTANCE	PLASTIC LIMIT ——— $w_p$	WATER CONTENT ——— $w$		
275 +	Ground Level											
	Silty sand, Topsoil.											
1.0	Silty sand & gravel (Glacial till) (boulders up to 12" in size throughout)		1	SS	80/6"	270						
267.0	(Brown to Grey) V. Dense											
8.0	Crystalline limestone bedrock, occasional shaly seams (grey)		2	BXL RC	90% Rec							
259.2	sound		3	BXL RC	100% Rec	260						
15.8	End of Borehole					250						

270

WL in open BH

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING OFFICE

## RECORD OF BOREHOLE No. Site 28

FOUNDATION SECTION

JOB 68-F-90

LOCATION Hwy. #417 (Line 'D') - Refer to Drawing 68-F-90A

ORIGINATED BY LTD

W.P. 37-66-03

BORING DATE Jan. 27 and 28, 1969

COMPILED BY VK

DATUM Geodetic

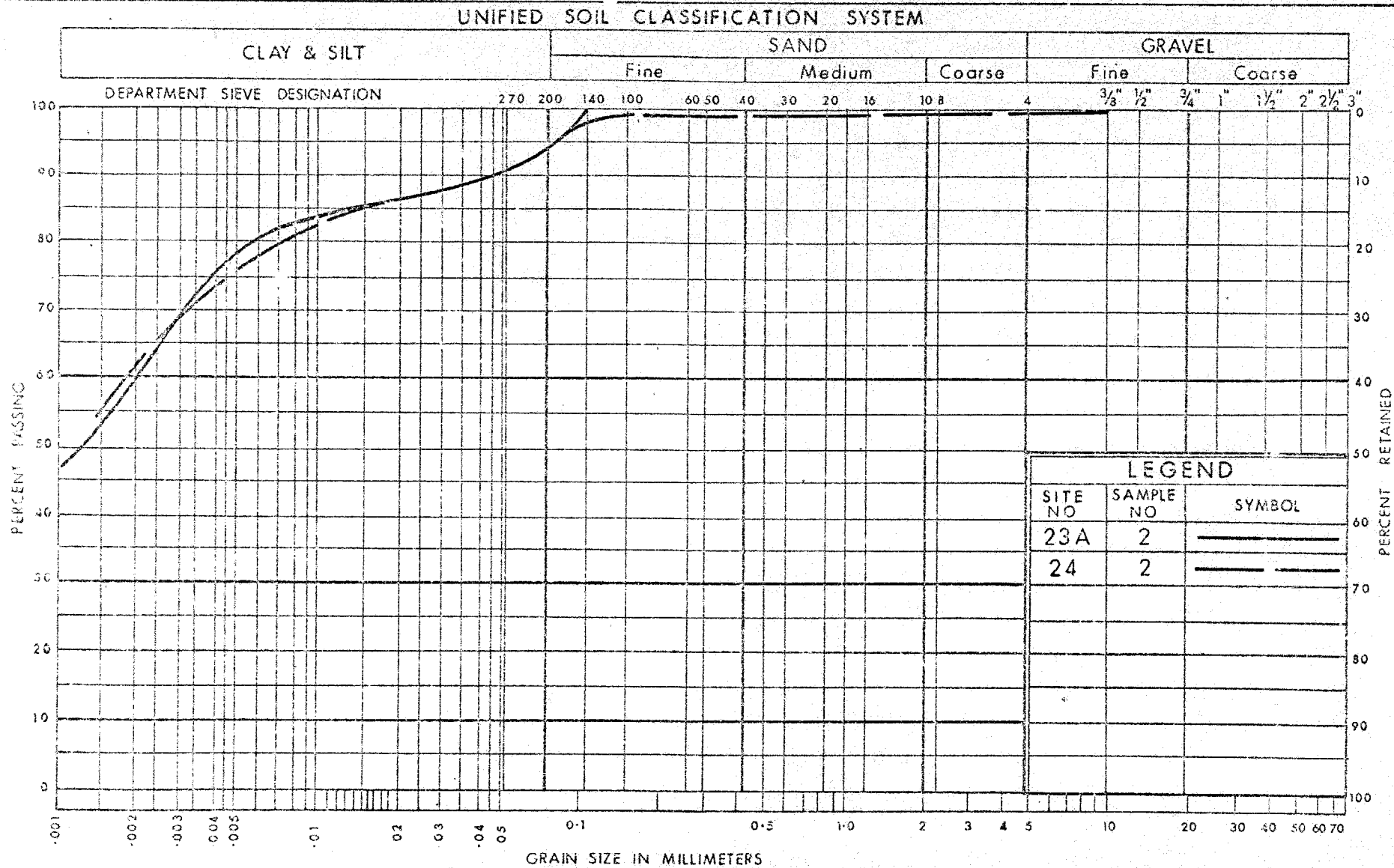
BOREHOLE TYPE Washboring - NX &amp; BX Casing - BXL Rock Core

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— $w_L$		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— $w_p$	WATER CONTENT ——— $w$		
270 ±	Ground Level						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE	$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 20 40 60			
0.0	Clayey silt with some sand & gravel. Stiff.		1	SS		17					
268.0											
2.0	Silty sand and gravel (Glacial Till)		2	SS		127					
	(Boulders up to 8" in size below elev. 259) (Brown to Grey)										
			3	SS		80					
255.5	Very dense		4	BXL RC		57% Rec.					
14.5	Calcareous shale bedrock with shaly limestone interbeds (black)		5	BXL RC		66% Rec.					
249.2	fractured to sound at		6	BXL RC		75% Rec.					
20.8	End of Borehole										

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

265  
 23 43 28 6  
 WL in open BH



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

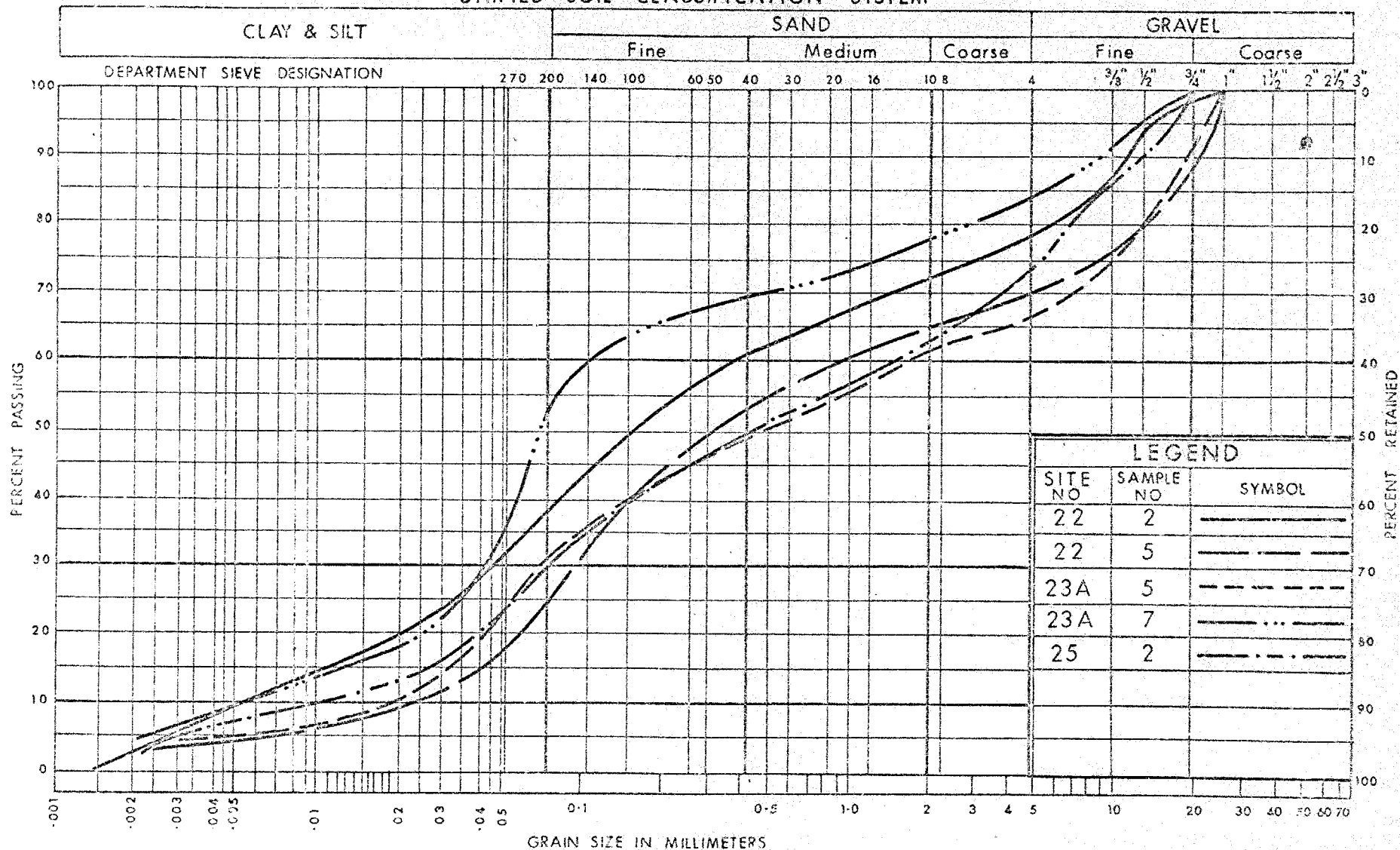
**GRAIN SIZE DISTRIBUTION**  
**CLAY TO SILTY CLAY**  
(Sensitive)

W.P. No. 36 & 37-66

JOB No. 68-F-90

FIG. NO. 1

# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

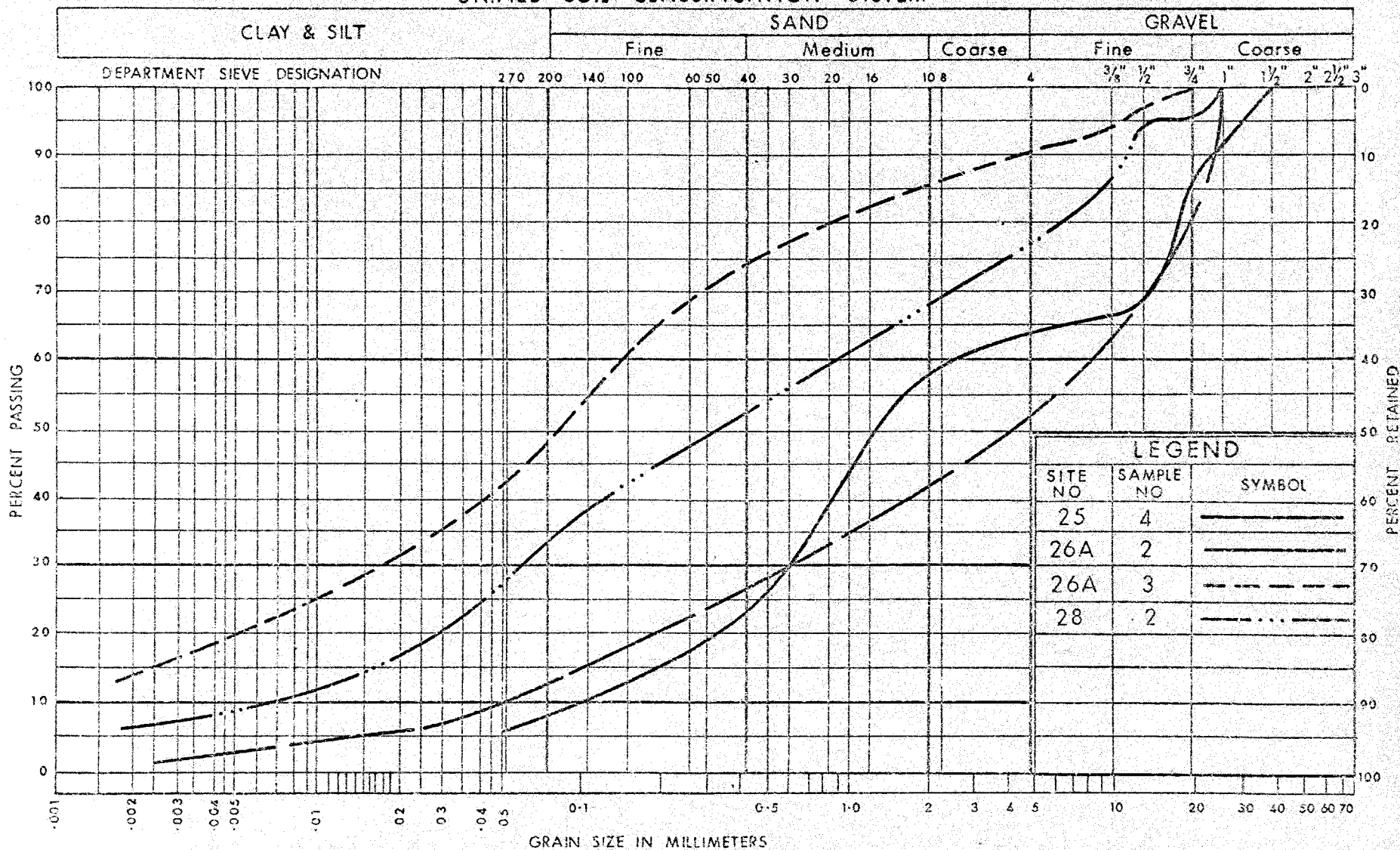
GRAIN SIZE DISTRIBUTION  
SILTY SAND & GRAVEL  
(Glacial Till)

W.P. No. 36 & 37-66

JOB No. 68-F-90

FIG. NO. 2

# UNIFIED SOIL CLASSIFICATION SYSTEM



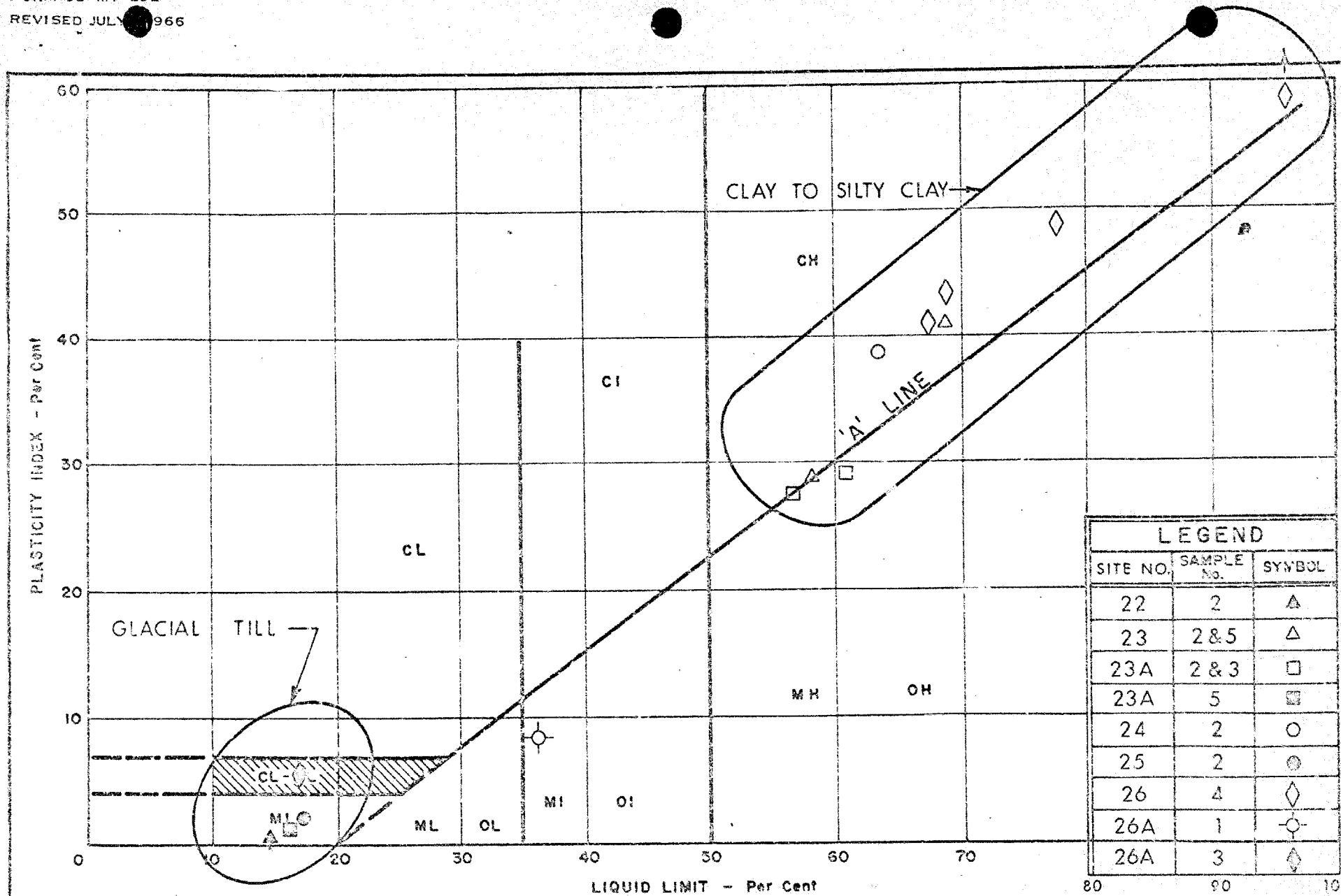
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

GRAIN SIZE DISTRIBUTION  
SILTY SAND & GRAVEL  
(Glacial Till)

W.P. No. 36 & 37-66

JOB No. 68-F-90

FIG. NO. 3



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## PLASTICITY CHART

W.P. No. 36-66 & 37-66

JOB No. 68-F-90

FIG. NO. 4

## 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

SS	SPLIT SPOON	TW	THINWALL OPEN
WS	WASHED SAMPLE	TP	THINWALL PISTON
SB	SCRAPER BUCKET SAMPLE	OS	OESTERBERG SAMPLE
AS	AUGER SAMPLE	FS	FOIL SAMPLE
CS	CHUNK SAMPLE	RC	ROCK CORE
ST	SLOTTED TUBE SAMPLE		
	PH	SAMPLE ADVANCED HYDRAULICALLY	
	PM	SAMPLE ADVANCED MANUALLY	

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	LV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FV	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
	INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
$\mu$	COEFFICIENT OF FRICTION
S.	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

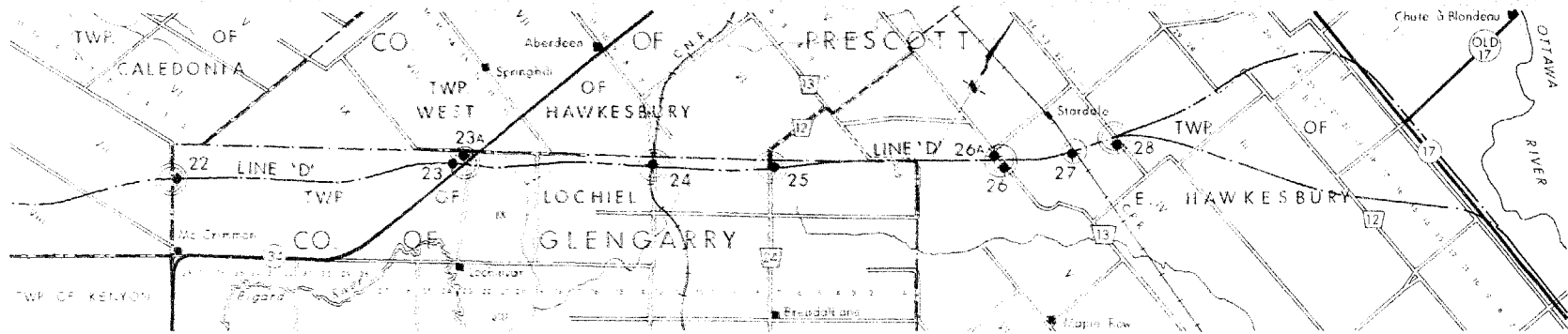
### FOUNDATIONS

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

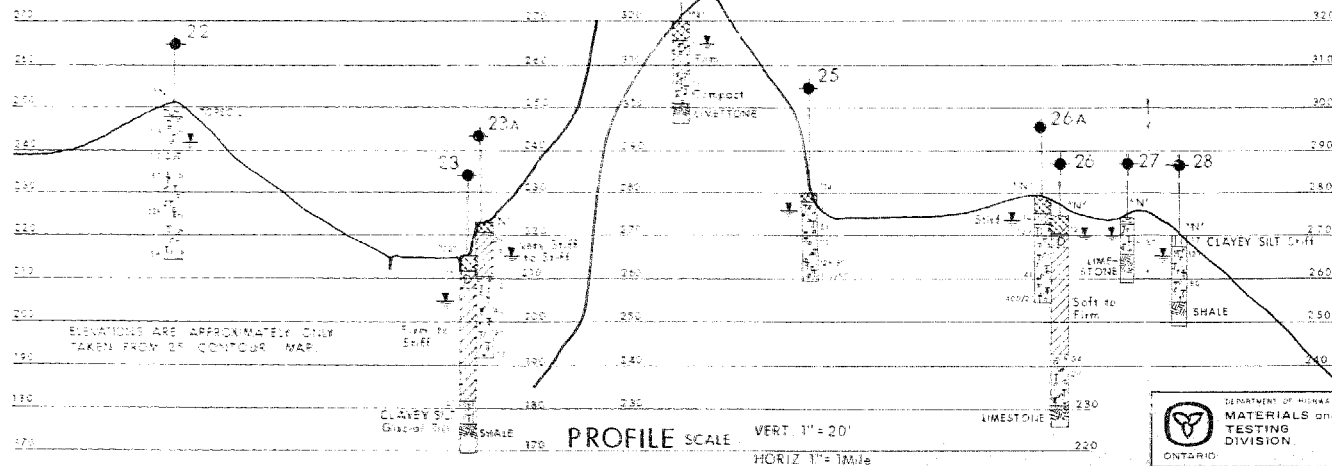
### SLOPES

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





PLAN SCALE 1"=1 Mile



# LEGEND

- ROADWAY FILL  
SILT, SAND & GRAVEL Comp. to Dense
- CLAY TO SILTY CLAY (D-Dedicated zone)  
TRACE OF SAND & GRAVEL
- SILT SAND & GRAVEL (Glacial Till)  
BOULDERS V Dense
- BEDROCK
- BORE HOLE
- WATER LEVELS
- Structure and Interchange
- Structure



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION  
ONTARIO

DATE March 11, 1969

PRELIMINARY INVESTIGATION HWY. 417 LINE 'D'  
SITES: 22, 23, 23A, 24, 25, 26, 26A, 27 & 28  
[4 MILES WEST OF HWY. 34 TO HWY. 17]  
W.P. 36 & 37-66 DIST. NO. 9 JOB 68-F-90

APPROVED *Christman* DRAWING NO. 68-F-90A

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE FOR SITE 29

FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. Sta. 183+00  
 W.P. 37-66-05 BORING DATE Jan. 24, 28, 29 & 30, 1969  
 DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing - BXL Rock Core

ORIGINATED BY BTD  
 COMPILED BY VK  
 CHECKED BY

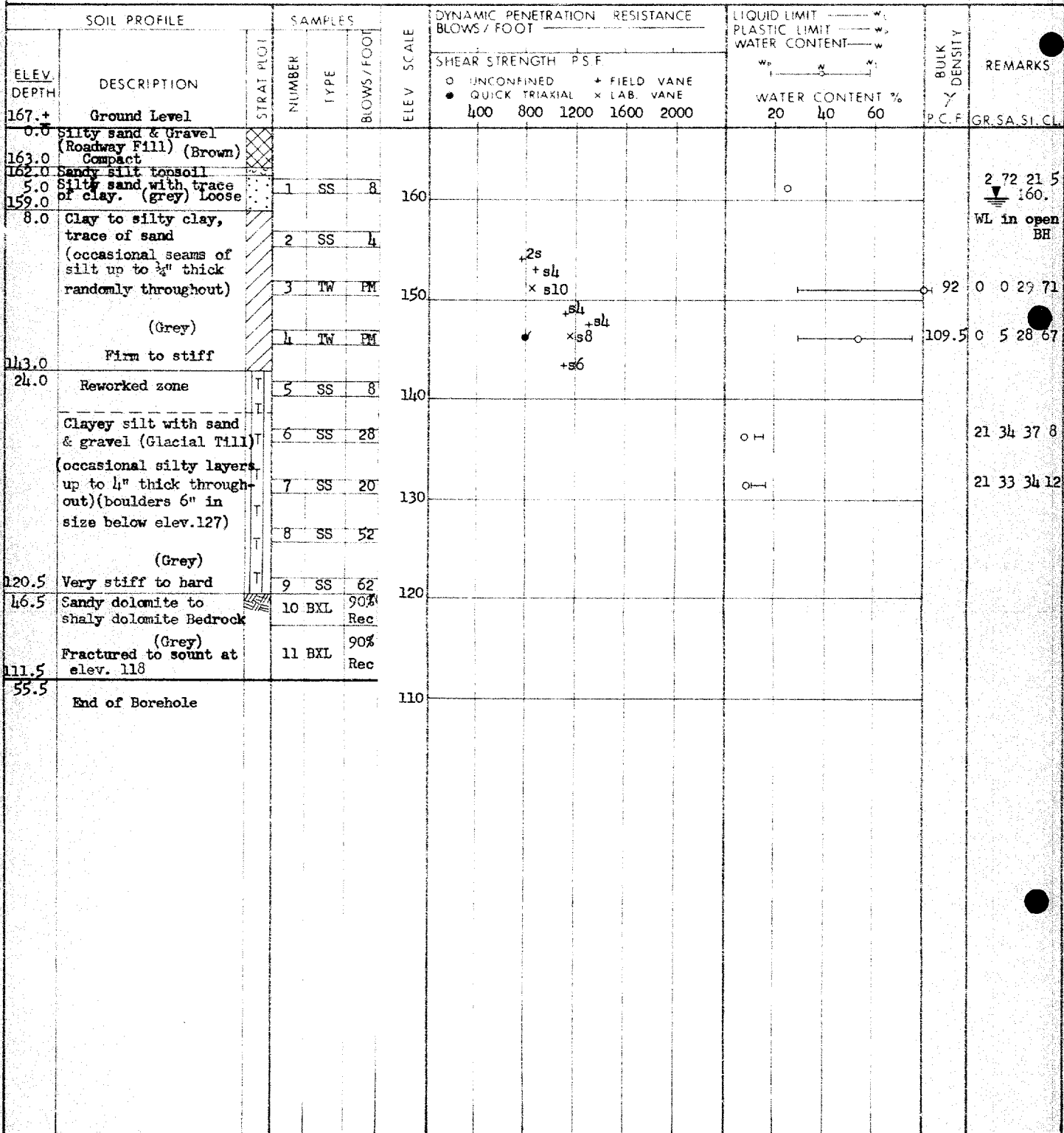
SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w <sub>p</sub> PLASTIC LIMIT — w <sub>p</sub> WATER CONTENT — w		BULK DENSITY	REMARKS	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F.				WATER CONTENT %
224.4	Ground Level						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	20 40 60		
0.0	Silty sand & gravel (Glacial Till) (occasional layers of hard clayey silt with sand & gravel up to 4" thick throughout - boulders up to 8" in size throughout) (Brown)	1	SS	121/9"	220					
		2	SS	132						
		3	SS	100/3"	210					
		4	SS	104						
204.5	Very dense									
19.5	Dolomite Bedrock with shaly dolomite interbeds	5	BXL	100%						
200.7	fractured to sound at elev. 202	6	BXL	98%	200					
23.3	End of Borehole									

21h.

WL in open  
BH

214.  
 WL in open  
 BH

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. Sta. 329+00 ORIGINATED BY LTD  
W.P. 37-66-05 BORING DATE Jan. 17, 20 & 21, 1969 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Washboring - BX, BX & AX Casing - AXT Rock Core CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2 SITE 30

FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. 417 (Line D) 600' North of BH #1 ORIGINATED BY VK  
W.P. 37-66-05 BORING DATE Feb. 14 & 15, 1969 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Washboring - BK Casing CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_P$ WATER CONTENT $w$	BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT					
155.1	Ground Level								
0.0	Silty sand & Gravel								
151.0	(Roadway Fill) Compact								
4.0	Desiccated Crust	1	SS	11	150				
	Stiff								
	Clay to silty clay, trace of sand. (Grey)	2	SS	3					
141.5	Firm								
139.0	Clayey silt with sand & gr. (Glas. Till) v. stiff to hard	3	SS	11	140				
16.0	End of Borehole								

148.

WL in open  
BH

11.8.

WL in open  
BH

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE FOR SITE 31

FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. Sta. 336+00  
W.P. 37-66-05 BORING DATE Jan. 22 & 23, 1969  
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX, AX Casing - AXT Rock Core

ORIGINATED BY LTD  
COMPILED BY VK  
CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT		BLOWS/FOOT	PSF	PLASTIC LIMIT	WATER CONTENT		
151.2	Ground Level										
0.0	Silty sand & gravel (Roadway fill) (Brown)	1	SS	83	150						WL in open BH
117.0	Very dense										117.0
4.0	Reworked zone stiff	2	SS	10							117.33 12
	Clayey silt with sand & gravel (Glacial Till)	3	SS	39	140						21 37 34 8
	(occasional seams of silt & sand up to 4" thick throughout)	4	SS	16							
	(Grey-brown to grey)	5	SS	29	130						18 33 40 9
		6	SS	26							
121.5	Very stiff to hard.										
29.5	Shaly dolomite bed- rock, with interbeds of shale up to 18" thick (Grey)	7	AXT	85% Rec	120						
111.2	Fractured to sound at elev. 117	8	AXT	95% Rec							
39.8	End of Borehole				110						

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE FOR SITE 88

FOUNDATION SECTION

JOB 68-F-91

LOCATION Hwy. 417 (Line D) Approx. sta. 496 + 75

ORIGINATED BY BTD

W.P. 36-66

BORING DATE Jan. 20, 21 &amp; 22, 1969

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Washboring - BX, A/C Casing

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — %			BULK DENSITY Y P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. POS.	NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT %			
143.0	Ground Level							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			20 40 60		
0.0	Silty sand & gravel (Roadway Fill) (Brown) Very dense.		1	SS	51	140							
139.0													
4.0	Silty sand to sandy silt with a trace of clay & organic matter (creek bed deposit) (Grey) Compact		2	SS	21							org. 1.5%	0 51 36 7
132.0			3	SS	8							org. 0.3%	3 38 47 12
11.0	Clayey silt with sand & gravel (Glacial Till) (Boulders up to 5" in size throughout) (Grey)		4	BLX	75%	130							WL in open BH
124.0	Hard		5	SS	>100								5 49 36 10
19.0	Sand & gravel with a trace of silt (occasional partings of clay, up to 1/4" thick throughout) (Grey & brown)		6	SS	54	120							
			7	SS	130								1 92 ( 7)
			8	SS	112								
109.0	Very dense					110							
34.0	Silty clay with a trace of sand & gravel  (grey)		9	SS	57								0 2 65 33
			10	SS	51	100							0 1 59 40
	Hard												
92.0						90							
51.0	Sand & gravel with a trace of silt (boulders up to 6" in size throughout)												
84.0	Very dense. (Brown)												
59.0	End of Borehole					80							

PRE-CONTRACT REVIEW MEETING

WORK PROJECT: 37-66-01

68-F-90

HIGHWAY NO.: 417

TYPE OF WORK: GRADING, DRAINAGE, GRANULAR BASE AND CEMENT TREATED BASE

LOCATION: FROM 0.68 MILE EAST OF HIGHWAY 34 EASTERLY 4.35 MILES.

A PRE-CONTRACT REVIEW MEETING for the above noted WORK PROJECT was held in the KINGSTON REGIONAL OFFICE on THURSDAY, OCTOBER 21st, 1971 in BOARD ROOM # 2, commencing at 11:00 a.m.

ATTENDANCE:

R. E. Singleton	- - - - -	Project Supervisor Ottawa
M. Peverett	- - - - -	Construction Engineer Ottawa
H. Alguire	- - - - -	Construction Supervisor Ottawa
P. B. McKay	- - - - -	Regional Supt. Engineering Audit, Kingston
H. Meyer	- - - - -	Project Soils Engineer, Kingston
M. Batten	- - - - -	Sr. Soils Supervisor, Kingston
G. McMillan	- - - - -	Sr. Project Design Engineer, Kingston
R. Molaro	- - - - -	Hwy. Design Supervisor, Kingston
A. Scott	- - - - -	Group Leader, Kingston

1. District inquired whether or not there was any allowance for settlement of fill in clay flats. Materials and Testing suggested that the usual 15% added to the earth fill was sufficient to cover any settlement.
2. A note for stripping of organic material from existing ditches regardless of height of fill should be shown on contract drawings.
3. Interceptor ditches should be included in the contract to prevent erosion of cut ditch backslopes.
4. Sheet #15, Railway protection is to be indicated on drawings and a lump sum item and special provision to be included.
5. Inclusion of a special provision indicating that the approach fills at the C.N.R. overhead W.B.L. are to be built at the same time to ensure equilibrium of the surrounding materials.
6. Selected sub grade material is to be used as backfill to the swamp at C.N.R. overhead on the W.B.L. A separate item to be included.
7. G. McMillan, indicated that with the implementation of the above the Foundation Section anticipated no unusual problems when excavation of material is carried out in the vicinity of C.N.R. tracks on the W.B.L.

Cont'd.....

8. Special provision to indicate the placing of boulder free material in areas where pile driving is to take place.
  9. References on contract drawings to DD-406 should be changed to refer to DD-407.
  10. 6" perforated pipe sub drains should be placed on Highway #417 in the vicinity of the County Road 24 overpass. Where the slope paving fill embankment blocks the normal ditch line.
  11. Pavement depth on detour changed to  $1\frac{1}{2}$ " H.L. 4 from 2". This removes paving of detour from sundry and it will form an item.
  12. Transition points to be removed from detour.
  13. Insert standard SD4-71 for culvert in muskeg.
  14. Replace all revised standards.
  15. It was decided to use 50% of the stripping as topsoil and the remaining stripping to be used as fill outside of a 2:1 slope. Two items for topsoil will be shown on the contract.
  16. Note to be shown on Breakdown Sheets Remarks Column indicating that material excavated from ditches, muskeg excavation and the stripping used as fill will be placed outside of a 2:1 slope.
  17. Grader Rental will be removed as a contract item and placed under sundry.
  18. Insertion of a special provision for the placing of approach fills within 4 months of the start of grading operations to provide for maximum embankment settlement.
- District request 25 copies of contract books.



1971 FEB 18 PM 4:08

68-F-90

MY KINR FEB 18/71 4 PM

00341

CTTA 1 TO J E CALLAGHAN DIST ENGR

DOWN 6 COPY TO A G STERMAC M AND T

M STOYANOFF BRIDGE CONST ENGR

KINR COPIES TO J GRUSPIER M AND T

H MCKAY ENG AUDIT

M ERNESAKS FUNCTIONAL PLANNING

T C KINGSLAND BRIDGE OFFICE

P BILLINGS PEG DIRECTOR

R FORREST SCHEDULING CO-ORDINATOR

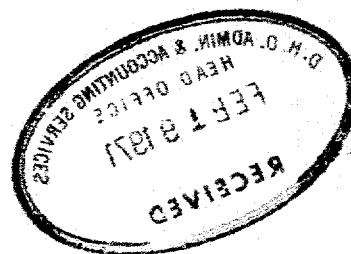
RE WP 36-66-01 HWY 417, FROM 1.8 MILES EAST OF CTY RD 3A E'LY TO

CTY RD 21 DIST NO. 9 OTTAWA

THE PRE-CONTRACT REVIEW MEETING FOR THE ABOVE NOTED PROJECT WILL BE HELD ON TUESDAY MARCH 2, 1971 IN THE OTTAWA DISTRICT OFFICE, COMMENCING AT 10:30 A.M. CONTRACT DRAWINGS AND DOCUMENTS WILL BE ISSUED ON FEB 22/71.

G RICKER ROAD DESIGN

JM



Discussed with Tom Kingsland and it was agreed that ~~one~~ there ~~is~~ is no need attend this grading pre-contract Review meeting at Ottawa.

M. Devine  
26th Feb/1971

## MEMORANDUM

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

FROM: Foundation Section  
Laboratory Bldg.  
DOWNSVIEW, Ontario

ATTENTION:

DATE: June 25, 1970

OUR FILE REF.

IN REPLY TO

JUN 29 1970

## SUBJECT:

Proposed Underpass Structure at the  
Crossing of Hwy. #417 (Line 'D') and  
Hwy. #34 (Alternate Site 23B)  
Twp. of Lochief, County of Glengarry  
W.O. 68-11090 W.P.'s 36-66 and 37-66

1. INTRODUCTION:

A preliminary foundation investigation was carried out at alternate sites (Sites #23 and 23A) for the aforementioned structure in January and February, 1969. The results of this investigation, including preliminary recommendations pertaining to foundation design at the respective sites, were presented in report No. W.J. 68-F-90 (submitted March 18, 1969.).

Recently the Foundation Section was verbally requested by Mr. T. C. Kingsland, Regional Bridge Planning Engineer, to carry out a supplementary investigation at another possible crossing of these two highways (designated as Site #23B). This letter contains the factual results obtained from this latest investigation, together with preliminary recommendations pertaining to the foundation design for a structure located at this latter site.

2. SUBSOIL AND BEDROCK CONDITIONS:

A single borehole was put down at Sites 23 and 23A during the original investigation. Three sampled boreholes were put down at Site 23B during this most recent investigation. Borelog sheets for all the pertinent boring are appended to this letter. The locations of the sites and borings, in relation to one another, are shown in plan on Drawing No. W.J. 68-F-90B, which is also appended.

A stratum of compressible clay (35 feet thick at site #23) was encountered at a shallow depth below ground surface at the previous sites. At Site 23B, however, the clay stratum is absent. Here a competent glacial till protrudes to within a few feet of the ground surface.

### 3. DISCUSSION:

The structure at the crossing of proposed Hwy.'s #417 and 34 will be multi-span and of the underpass type. If either Site 23 or 23A is adopted as the structure location, the existing alignment of Hwy. #34 will be maintained and Hwy. #417 will cross it at a skew angle of about 52 degrees. However, if Site 23B is employed Hwy. #34 will be realigned and the skew angle at the crossing will be reduced to approximately 30 degrees. (refer to accompanying drawing).

Recommendations pertaining to the foundation design, for a proposed structure located at either Site 23 or 23A, were presented in the preliminary report. Because of the presence of the compressible clay at these sites, it will be necessary to found the structural elements on end bearing piles driven to practical refusal within the glacial till or to bedrock. Berms will likely be required to ensure the stability of the approach fills, particularly the south approach where the fill heights are expected to be the highest. Further, consolidation settlement will be induced in the foundation subsoil due to the surcharge loading of the approach fills. The magnitude of this settlement will be dependent on the final location chosen, as discussed in the report submitted.

No foundation problems are anticipated if Site #23B is adopted since the compressible clay is absent at this location. The foundations for a structure located at this site could be designed as follows:

i) intermediate piers--founded on spread footings located within the glacial till stratum using an allowable bearing value of up to 4.0 t.s.f.

ii) abutments 'perched' within the approach fills--spread footings located within a zone composed of well compacted granular material using an allowable bearing value of 2.5 t.s.f.

There will be no deep-seated stability problems for embankments, with 2:1 slopes and of the heights contemplated (max. 25 feet).

4. CONCLUSIONS:

All of the sites discussed above are feasible from a foundation point of view as potential structure locations, provided the recommendations presented in Section #3 are adhered to. The final selection should be made by weighing the relative merits of the alternate locations. It should be stressed that a detailed foundation investigation will be required once the final structure location has been selected.

If you have any queries with respect to any of the aforementioned discussion, or if we can be of any further assistance, please contact this office.

*for* *B.T. Darch*  
M. Devata  
Supervising Foundation Engineer

For:

BTD:lm

A. G. Stermac  
Principal Foundation Engineer

cc:

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

Foundation Files  
General Files

FOUNDATION SECTION

ORIGINATED BY **VK**

COMPILED BY VK

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. Site 23 A

FOUNDATION SECTION

JOB 68-P-90 LOCATION Hwy 417 (Line D) 652 ft. north of site 23 ORIGINATED BY VK  
W.P. 36-66-05 BORING DATE Feb. 4 & 5, 1969 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing CHECKED BY VK

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		SHEAR STRENGTH PSF ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE			$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 20 40 60				
223 ±	Ground Level													
221.0	Silty sand & gravel (Roadway Till) Compact													
2.0	Clay to silty clay, trace of sand & gravel (seams of silt & sand up to 2" thick throughout) (mottled brown)		1	SS	29	220								
			2	SS	13									
210.5	very stiff to stiff		3	SS	11									
12.5	Silty sand to sandy silt with gravel (Glacial Till) (occasional seams & layers of clayey silt up to 4" thick throughout) (grey)		4	SS	32	210								
			5	SS	40									
			6	SS	36	200								
191.5	Dense to very dense)		7	SS	72	190								
31.5	End of Borehole													

0 6 34 60  
215  
WLF in open BH

33 35 30 2

16 32 51 1

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE No. 1 - Site #23B

FOUNDATION SECTION

MATERIALS &amp; TESTING OFFICE

JOB 68-F-90

LOCATION

Hwy. 417 &amp; Revised Hwy. 34

ORIGINATED BY DD

W.P. 36-66

BORING DATE

May 5, 1970

COMPILED BY BTB

DATUM Geodetic

BOREHOLE TYPE

Washboring, BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	BLows / FOOT	PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$		
249.2	Ground Level											
247.2	Clayey silt (Topsoil)											
2.0	Reworked Zone (mottled Grey-Brown)		1	SS	102/6"							
	Het. mix. of clayey silt, sand & gravel (Glacial Till)		2	SS	33	240						
	Grey Hard		3	SS	68							
230.9	Dense to Very Dense											
18.3	End of Borehole BX Casing met practical refusal					230						

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. 2 - Site #23 B FOUNDATION SECTION

JOB 68-F-90 LOCATION Hwy. 417 & Revised Hwy. 34 ORIGINATED BY DD  
W.P. 36-66 BORING DATE May 4 & 5, 1970 COMPILED BY BTB  
DATUM Geodetic BOREHOLE TYPE Washboring- NX, BX Casing- AXT Rock Core CHECKED BY *AK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— $w_L$		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	BLows / Foot	PLASTIC LIMIT ——— $w_p$	WATER CONTENT ——— $w$		
							SHEAR STRENGTH P.S.F.		WATER CONTENT %			
							○ UNCONFINED + FIELD VANE		$w_p$ ——— $w$ ——— $w_L$			
							● QUICK TRIAXIAL x LAB. VANE					
249.5	Ground Level											
247.5	Clayey Silt (Topsoil)											
2.0	Sand, with some silt, fragments of shale		1	SS	35							
243.5	Dense		2	SS	85							
6.0	Het. mix. of clay, silt, sand & gravel (Glacial Till)		3	SS	34	240						
	Grey Hard or		4	SS	71							
229.5	Dense to very Dense					230						
20.0	Boulder Zone (Boulders up to 8" in size)		5	AXT	20%							
			6	AXT	40%							
			7	AXT	30%	220						
215.2												
34.3	End of Borehole					210						

242.

WL in open BH

242.  
NL in open  
BH

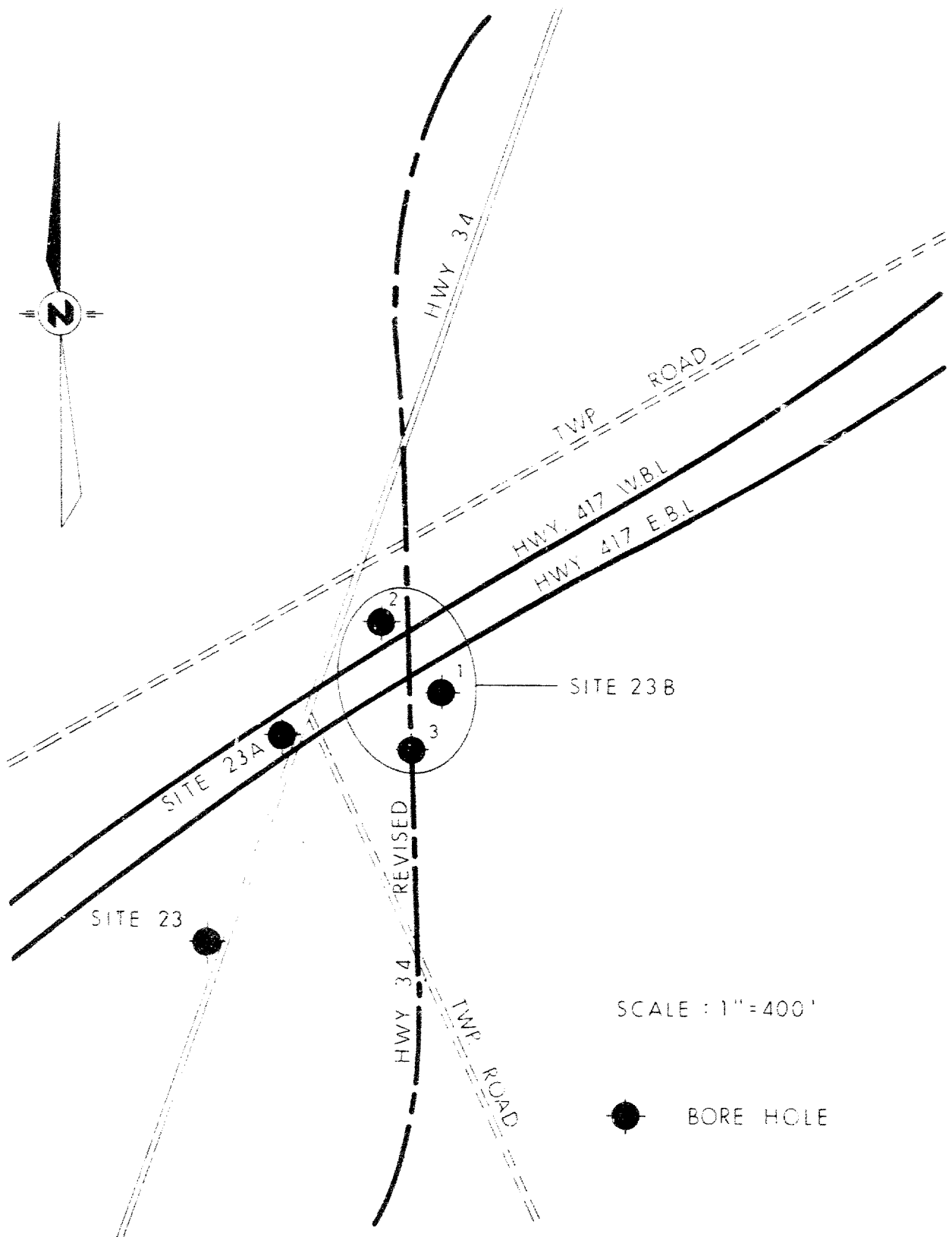


DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 3 - Site #23 B FOUNDATION SECTION

JOB 68-F-90 LOCATION Hwy. 417 & Revised Hwy. 34 ORIGINATED BY DD  
 W.P. 36-66 BORING DATE May 5, 1970 COMPILED BY BTB  
 DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY *LR*

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		SHEAR STRENGTH PS F		$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT %				
							<input type="radio"/> UNCONFINED      + FIELD VANE <input checked="" type="radio"/> QUICK TRIAXIAL    x LAB. VANE						
248.5	Ground Level												
246.5	Clayey Silt (Topsoil)												
2.0	Clay layer. Stiff												
	Het. mix. of clay, silt, sand & gravel (Glacial Till)		1	SS	63	240						241. WL in open BH	
	Grey		2	SS	35								
233.5	Hard or Dense to very Dense												
15.0	End of Borehole					230							



SCALE : 1"=400'

● BORE HOLE

DRAWING NO. 68-F-90B

Mr. M. R. Arnesaks,  
Regional Functional Planning Engineer,  
Kingston, Ontario.

Bridge Section,  
Kingston, Ontario.

Mr. A. J. Percy

March 26, 1970.

W.P. 34-66 to 37-66, Highway 417, Co-ordinating Committee,  
W.P. 36-66-11, Twp. Rd. Underpass East of Co. Rd. 21, Site 27-218,  
W.P. 36-66-13, Hwy. 34 Interchange Underpass, Site 31-282.

With reference to the minutes of the meeting held on March 13, we submit herewith preliminary cost estimates in respect of alternative alignments at W.P. 36-66-11, Twp. Rd. Underpass East of Co. Rd. 21, and W.P. 36-66-13, Hwy. 34 Interchange Underpass:

	<u>Estimated Cost</u>
<u>W.P. 36-66-11-Twp. Rd. Underpass East of County Road 21</u>	
Proposed Alignment (40° skew) - - - - -	\$ 216,000
Alternative Alignment (8° skew) - - - - -	\$ 158,000
<u>W.P. 36-66-13-Hwy. 34 Interchange Underpass</u>	
Proposed Alignment (52° skew) - - - - -	\$ 264,000
Alternative Alignment (30° skew) - - - - -	\$ 192,000

The above estimates are for structure costs only. In the case of Highway 34 structure no allowance has been made for any difference in foundation conditions between the two alignments. The preliminary foundation report for this site indicates variable conditions. Mr. M. Devata, Foundation Section, has been asked to carry out a further investigation along the alternative alignment.

I have no further comments relating to the other subjects discussed at the meeting.

T. C. Kingsland  
Regional Bridge Planning Engineer

TCK/hl

c.c. Mr. B. R. Davis  
✓ Mr. A. G. Stermac (Att. Mr. M. Devata)  
Mr. S. J. Markiewicz  
Mr. J. E. Gruspier  
Mr. R. Forrest  
Bridge Office Files (Mr. S. McCombie)

## MEMORANDUM

NJ68-E90

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

FROM: Bridge Section,  
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: March 25, 1970.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 34-66 to W.P. 37-66, Hwy. 417, Co-ordinating Committee  
W.P. 36-66-13, Hwy. 34 Interchange Underpass, Site 31-292,  
District 9 - Ottawa

With reference to the meeting held on March 13, 1970, I enclose a part copy of the aerial mosaic (400 ft. to 1 inch) showing the alternative sites for the Highway 34 Interchange structure.

As discussed at the meeting I shall be glad if you will arrange for additional boreholes to be put down in order to determine foundation conditions on the alternative (30° skew angle) alignment.

*T. C. Kingsland*

T. C. Kingsland  
Regional Bridge Planning Engineer

TCK/hl  
Encl.

c. c. Mr. M. R. Ernesaks (Att. Mr. A. J. Percy)  
Mr. S. J. Markiewicz (Att. Mr. A. E. Irving)  
Mr. J. Gruspier  
Bridge Office Files Section (Mr. S. McCombie)  
Mr. R. Forrest

## MEMORANDUM

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

From: Functional Planning Office,  
Kingston, Ontario.

ATTENTION:

DATE: December 10, 1968.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 35-66 to 37-66, Hwy. 417, Vars to Quebec Border,  
District 9 - Ottawa

At a meeting on December 3rd, 1968, at this office with Mr. M. Devata and the Regional staff concerning the above projects, it was agreed that preliminary foundation information is required for the structure sites on the recommended corridor. This will assist this section in establishing the final alignment in detail.

Please accept this memo as our request to have the preliminary investigations carried out.

Mr. Devata advised that he would prefer to start the investigation at Vars immediately and proceed eastward to Casselman to complete as much as possible prior to the New Year. We are in agreement with this procedure and would suggest a schedule as follows, which is based on the present construction program.

1st Priority	-	Structure Sites 1 to 3 inclusive - 8 SITES
		Structure Sites 79, 80 and 81 - 3
2nd Priority	-	Structure Sites 29, 30, 31 & 88 - 4
3rd Priority	-	Structure Sites 82 to 83 inclusive - 2
		85 to 87 inclusive - 3
		22 to 28 inclusive - 7
		+ 84 - 1
		<u>28 SITES</u>

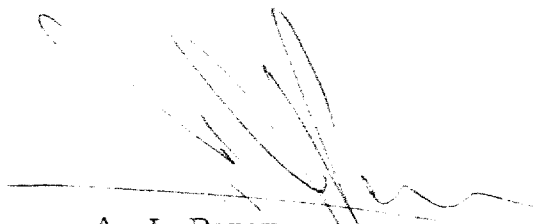
The site numbers referred to are shown on the mosaic which was forwarded to you on November 14th, 1968 with the exception of Site #88 which is at the intersection of Highway 17 and the County Road at the Quebec Border.

We have arranged to have Engineering Surveys stake out and tie in the structure sites with existing landmarks and establish assumed bench mark elevations for future reference.

W.J. 68-F-~~86~~ 88 ...../2  
 68-F-~~87~~ 89  
 68-F-~~88~~ 90  
 68-F-~~89~~ 91

Mr. W. Hutton of your office was in this office on December 9th, 1968, at which time he was given a mosaic for his reference and introduced to Engineering Surveys staff working on the project.

We trust the above meets with your approval.

A handwritten signature in dark ink, appearing to read 'A. J. Percy', is written over a horizontal line.

A. J. Percy,  
For: J. L. Forster,  
Regional Functional Planning Engineer.

AJP/mjh  
c. c.  
S. J. Markiewicz  
G. Scott  
J. E. Gruspier  
A. G. Boucher  
L. Timson  
H. A. Aron  
K. M. Williams

DEPARTMENT OF HIGHWAYS ONTARIO  
DESIGN BRANCH - ENGINEERING SURVEYS DIVISION  
SURVEY REQUEST

Job Name VARS T. CASSELMAN CUMBERLAND RUSSELL  
Hwy. No. 417 District # 2 - OTTAWA Region KINGSTON  
W.P. No. 35-66-1103 Work Schedule \_\_\_\_\_ Priority (If Not a W.P.) \_\_\_\_\_  
Date DEC 2/68 Date of Previous Request (If Any) \_\_\_\_\_  
Req'd. By [Signature] Title PA. S. - PLANNING Section FRONT. PLANNING  
Signature \_\_\_\_\_

Future Design Standards

Hwy. Class No. \_\_\_\_\_ Design Speed \_\_\_\_\_ Median Width \_\_\_\_\_ R/W Width \_\_\_\_\_

Survey Information

Limits of Survey VICINITY VARS & CASSELMAN

Bridge Site Plans Req'd. At \_\_\_\_\_

Railway Crossing Plans Req'd. At \_\_\_\_\_

Pipe Line Crossing Plans Req'd. At \_\_\_\_\_

Instructions (Note Any Special Requirements or Drafting Instructions)

- ① STAKE OUT FUTURE STRUCTURE SITES # 1, 2, 3, 4, 5, 6, 7, 8, 19 & 80 FOR PRELIMINARY FOUNDATION INVESTIGATION IN CO-OPERATION WITH FOUNDATION SECTION.
- ② TIE IN STRUCTURE SITES TO EXISTING LANDMARKS
- ③ SET UP ASSUMED BENCHMARKS TO TIE IN SITE ELEVATIONS FOR FUTURE CORRELATION WHEN GEODSIC B.M.'S ESTABLISHED.
- ④ ESTABLISH FOLLOWING INFORMATION FOR BRIDGE OFFICE:  
(a) ~~ROUGH PROFILE REPRESENTATIVE OF RIVER CROSSINGS AT SITES # 5, 7, 8 & 80~~  
(b) ~~REFERENCE B.M. ASSUMED AT SITE # 4 WITH SITE # 5~~  
~~A-15 AT SITE # 6 WITH SITES # 7 & 8~~
- ⑤ SITES SHOWN ON ACCOMPANYING AERIAL PHOTOS & MOSAIC  
PLEASE RETURN AERIAL PHOTOS AS SOON AS POSSIBLE

(4.1 Copy)

December 12/68.

MEMO: TO FILES 68-F-~~86~~. 88  
68-F-~~87~~. 89  
68-F-~~88~~. 90  
68-F-~~89~~. 91

RE PRELIMINARY FOUNDATION INVESTIGATIONS  
HWY. # 417 - 28 STRUCTURE SITES.

BECAUSE OF PHYSIOGRAPHIC AND GEOLOGIC  
SIMILARITIES IT IS RECOMMENDED THAT THE  
SITES BE SUB-DIVIDED INTO THE FOLLOWING  
WORK PROJECT NOS.

- 1/ W.J. 68-F-~~86~~ 88 W.P. 35-66 SITES 1 to 8, inclusive  
(VARS TO SOUTH NATION RIVER) 79 and 80
- 2/ W.J. 68-F-~~87~~ 89 W.P. 35-66 SITE 81  
W.P. ~~37~~-66 SITES 82, 83, 84, 85, 86, 87  
(SOUTH NATION RIVER EAST TO MC CRIMMON)
- 3/ W.J. 68-F-~~88~~ 90 W.P. 37-66 SITES 22 to 28, inclusive  
(MC CRIMMON EAST TO ~~NEW~~ HWY. #17.)
- 4/ W.J. 68-F-~~89~~ 91 W.P. 36-66 SITES 29, 30, 31 and 88.  
(ALONG NEW HWY. #~~17~~ 17 to QUEBEC BORDER)