

## MEMORANDUM

To: Mr. C. S. Moase,  
Manager,  
Special Services Section,  
Admin. Bldg.

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

DATE: September 16, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

## FOUNDATION INVESTIGATION REPORT

For

Proj. 401, Service Centre E-11,  
Co. of Glenferry, Twp. of Lancaster,  
Con. T, Lots 4-5, District No. 9  
N.J. 64-F-80 -- M.P. 52-63-02

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

If during construction, fill materials are stockpiled at the site, the height of the stockpile should not exceed 15 feet to guard against base failure.

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

KYL/MceP  
Attach.

cc: Messrs. C. S. Moase (4)  
E. J. Orr  
H. D. McMillan  
L. E. Walker  
J. S. Graspier  
A. Watt

  
A. G. Sternac,  
PRINCIPAL FOUNDATION ENGINEER

Foundations Office  
Gen. Files ✓

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# FOUNDATION INVESTIGATION REPORT

For

Hwy. 401, Service Centre E-11,  
Co. of Glengarry, Twp. of Lancaster,  
Con. T. Lots 4-5, District No. 9  
W.J. 64-F-80 -- W.P. 52-63

## 1. INTRODUCTION:

At the request of Mr. W. Whittle, Service Centre Supervisor, a foundation investigation was carried out at the site of the proposed new Service Centre E-11, in order to explore the subsoil conditions and assess bearing values for the support of the future buildings to be constructed.

## 2. FIELD WORK:

The field work was carried out by drilling nine boreholes with dynamic cone penetration tests adjacent to each. In addition, three separate dynamic cone penetration tests were also made. Borehole explorations consisted of in-situ vane tests and the recovery of 2" I.D. Shelby tube samples in the cohesive layers and 2" O.D. split-spoon samples in the till layer. The locations and elevations of the boreholes and the estimated stratigraphical profiles are shown on the attached drawing, No. 64-F-80A.

## 3. SUBSOIL CONDITIONS:

The stratigraphy of the subsoil at the site was found to be as follows: Overlying a very dense glacial till layer is a deposit of marine clay varying in thickness from 22 ft. to 54 ft.

cont'd. /2 ...

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

The upper 9 ft. - 12 ft. of this layer is desiccated and forms a stiff to very stiff crust. This crust material has a shear strength range of 1100 to more than 2000 p.s.f., strength decreasing with depth. The remainder of the clay deposit is non-oxidized and has a soft to firm consistency with a shear strength range of 280 to 390 p.s.f. The ground water level, measured in the boreholes, was found to be 4 ft. to 6 ft. below the existing ground level.

4. DISCUSSION AND RECOMMENDATIONS:

It is proposed to erect a new Service Centre at this site. Work involved will be the construction of a number of buildings, together with paved areas and access roads. Recommendations pertaining to the design of the paved areas and access roads have been given in a separate report prepared by Mr. J. E. Gruspier, Regional Materials Engineer. The present report is concerned solely with the foundations for the proposed new buildings.

In view of the existing subsoil conditions with the stiff material of the clay layer being confined to the upper 9 - 12 feet, if spread footing type foundations are contemplated, it will be necessary to found them as high as possible in the desiccated zone of the clay subsoil. Since approximately 5 feet of fill will be placed over the entire site area, it will be possible to locate the footings at a relatively shallow depth below the present ground level and still have enough cover for frost protection. It is therefore recommended that the footings for the future buildings be founded at a depth of about 3 feet below the present ground level (el. 161  $\pm$ ),

cont'd. /3 ...

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

at approximate elevation 158.0 at which depth a net safe pressure of 1.0 T.S.F. may be achieved, provided the footing width is restricted to 4 feet or less.

Since the area will be covered with about 5 feet of fill, settlement of the subsoil due to consolidation of the clay deposits will occur over a long-term period. It is believed, however, that the magnitude of these settlements will be of a small order and further, that differential settlements will be small enough to be tolerated by the proposed structures. It would be extremely beneficial if the fill could be placed well in advance of the building construction in order that a large percentage of the total settlement could take place during this time. It is recommended, therefore, that a period of about a year be allowed to elapse between completion of fill operations and construction of the foundations for the new buildings.

If the recommended footing pressure is inadequate for the future buildings, or if the latter cannot tolerate even slight differential settlements, the alternative solution to the problem would be piled foundations, end bearing in the very dense glacial till stratum. For this purpose, steel H-piles could be assumed to achieve their maximum allowable capacity (dependent on the pile section) within about 5 feet of the surface of the till stratum. The upper boundary of the till stratum is shown on the accompanying Drawing #64-F-80A.

cont'd. /4 ...

- 4 -

5. SUMMARY:

A foundation investigation at the site of proposed Service Centre E-11, is reported.

Subsoil was found to consist of from 22 to 54 feet of very stiff to soft marine clay underlain by very dense glacial till. The upper 9 - 10 feet of the clay stratum is desiccated and has a stiff to very stiff consistency.

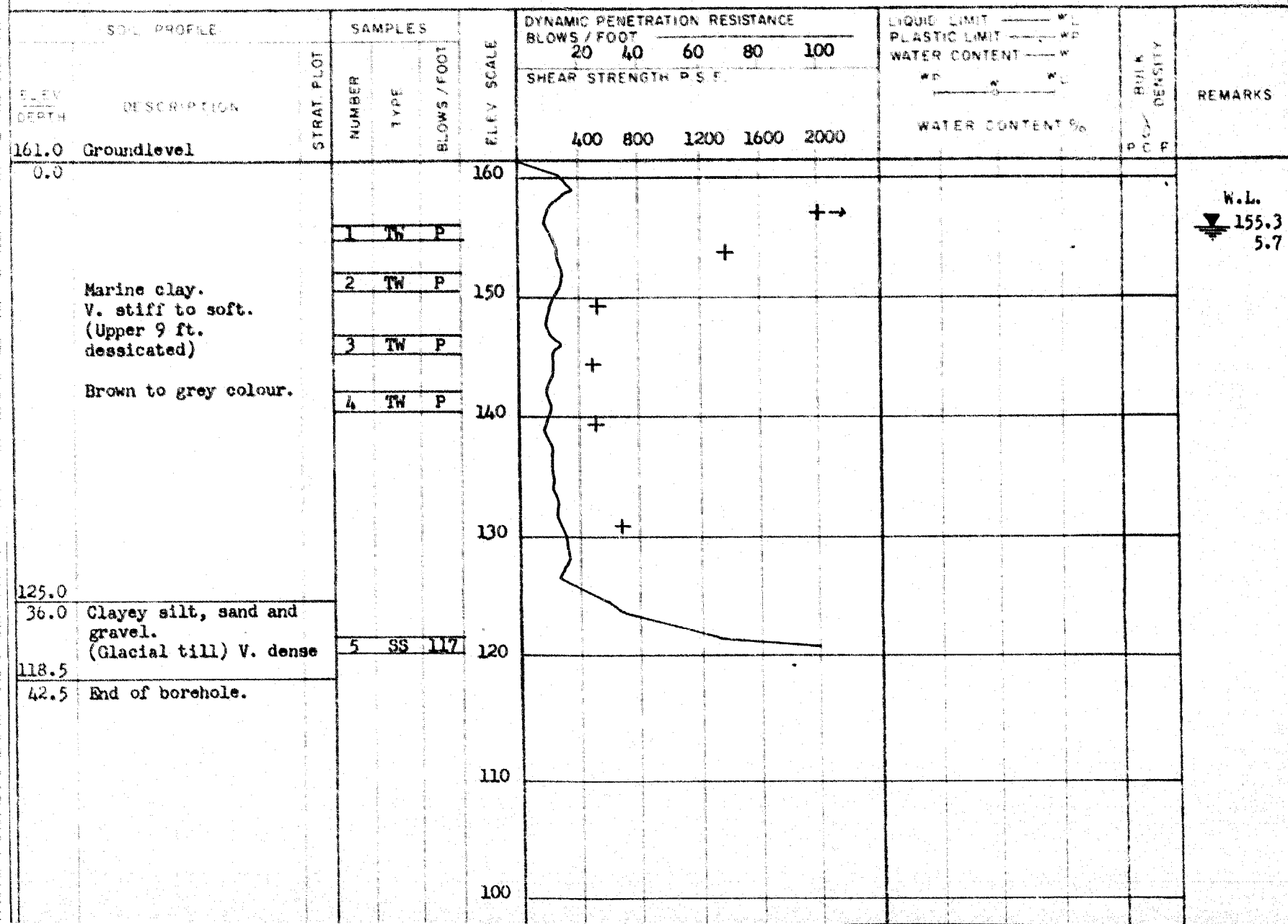
It is recommended that the proposed 5 ft. of fill be placed about one year in advance of the building construction and that the building be founded at a depth of 3 ft. below present ground level at approximate elevation 158.0. For footings less than 4 feet in width, a safe pressure of 1 T.S.F. may be assumed for design purposes. An alternative solution utilizing end-bearing piles is suggested if considerations of footing pressures and differential settlements render spread footings impractical.

6. MISCELLANEOUS:

The field work was carried out during the period September 2 - 11, 1964. Equipment used was owned and operated by Johnston Drilling Co., Ottawa. Work was supervised by Mr. V. Korlu, Project Foundation Engineer, who also prepared this report under the supervision of Mr. K. G. Selby, Senior Foundation Engineer.

September 1964

APPENDIX I.

JOB 64-F-80  
W.P. Service Centre E-11  
Lancaster  
DATUM GeodeticLOCATION 429/15 44.5' Lt.BORING DATE Sept. 2, 1964.BOREHOLE TYPE Penn-DrillORIGINATED BY V.K.COMPILED BY V.K.CHECKED BY K.G.S.



CHECKED BY K.G.S.

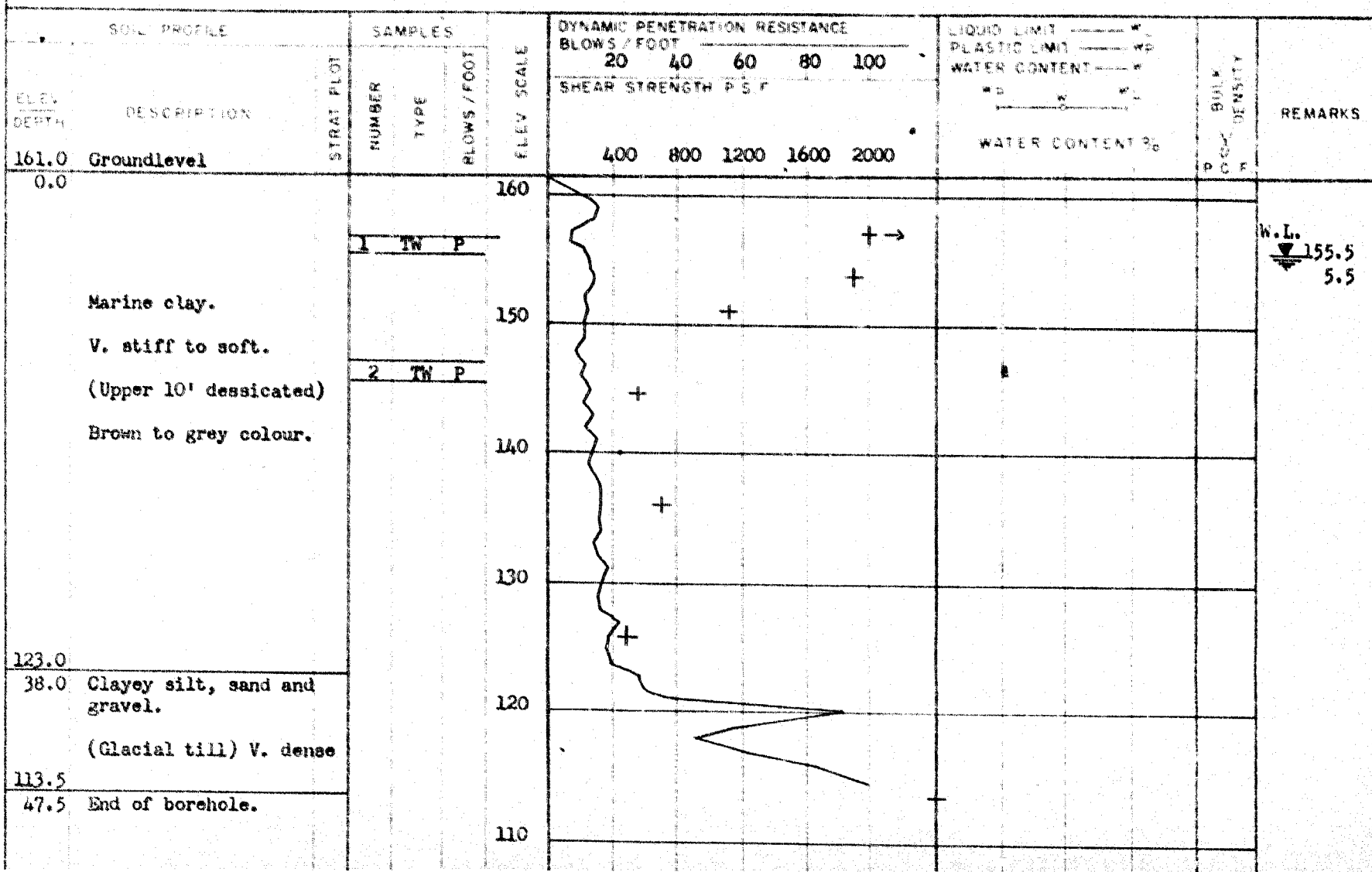
SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — %	BULK DENSITY PCF	REMARKS					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER		TYPE				BLOWS / FOOT				
									20	40	60	80	100
SHEAR STRENGTH P.S.F.						WATER CONTENT %							
						400	800	1200	1600	2000			
161.0	Groundlevel												
0.0					160								
			1	TW	P								
			2	TW	P								
	Marine clay.												
	V. stiff to soft.												
	(Upper 10' dessicated)		3	TW	P								
	Brown to grey colour.												
			4	TW	P								

RECORDED BY **K.G.S.**

[illegible]

JOB 64-P-80LOCATION 431425 600' Lt.ORIGINATED BY V.K.

W.P.


BORING DATE Sept. 3, 1964.COMPILED BY V.K.DATUM GeodeticBOREHOLE TYPE Penn DrillCHECKED BY K.G.S.

JOB 64-F-80LOCATION 431/20 470' Lt.ORIGINATED BY V.K.

W.P. \_\_\_\_\_

BORING DATE Sept. 4, 1964.COMPILED BY V.K.DATUM GeodeticBOREHOLE TYPE Penn DrillCHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT _____ PLASTIC LIMIT _____ WATER CONTENT _____		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT	20	40	60	80	100		
161.0	Groundlevel							400	800	1200	1600	2000		
0.0						160								
	Marine clay.		1	TW	P									
	V. stiff to soft.					150					+			
	(Upper 10' dessicated)													
	Brown to grey colour.		2	TW	P	140					+			
133.0														
28.0	Clayey silt, sand &		3	SS	42	130								
129.0	gravel. (Glacial till)													
32.0	Dense.													
	End of borehole.													
						120								
						110								

W.L.  
 156.3  
 4.7

JOB 64-F-80

LOCATION 431/10 345' Lt.

ORIGINATED BY V.K.

W.P.

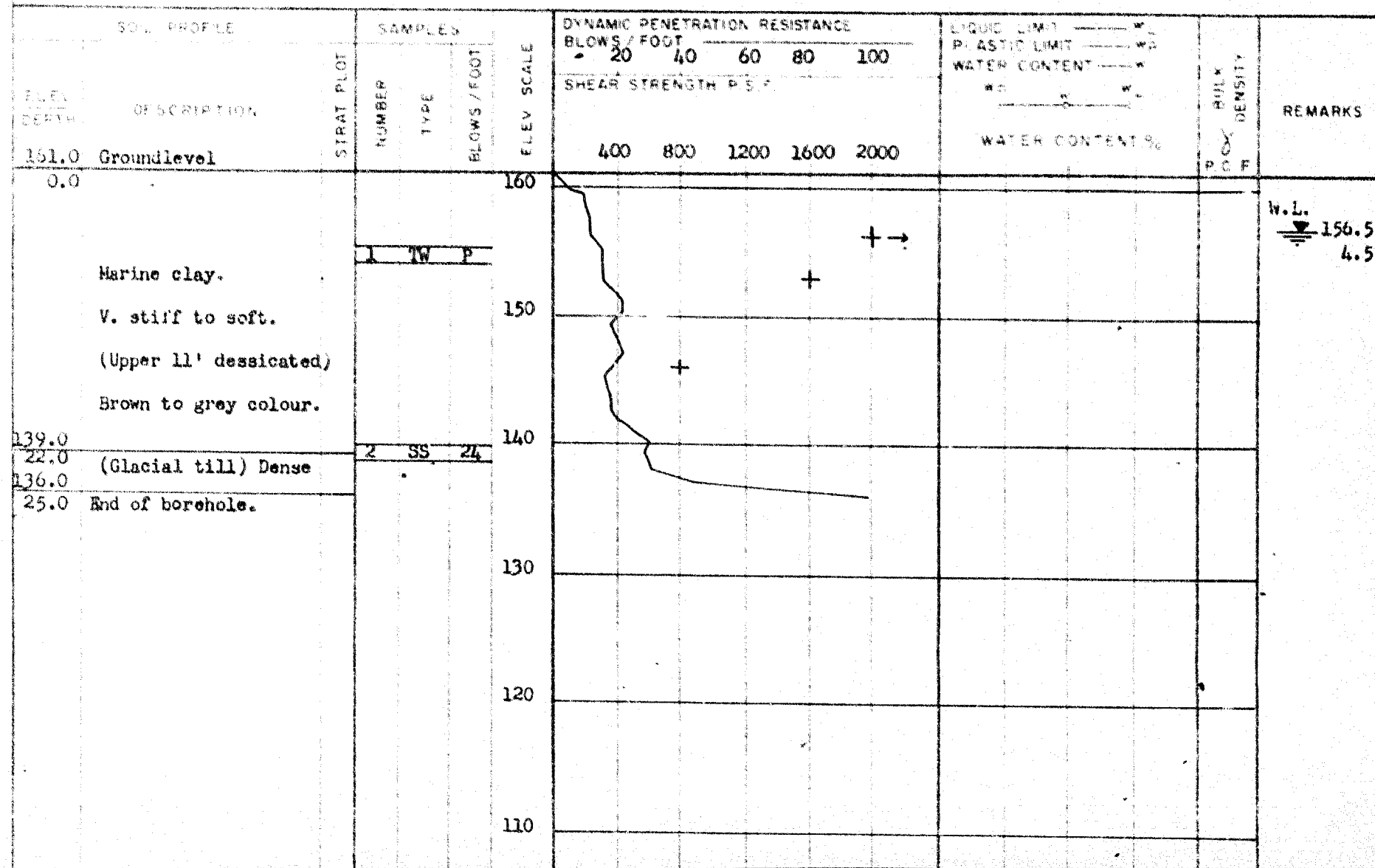
BORING DATE Sept. 4, 1964.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY K.G.S.



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

JOB 64-F-80LOCATION 432/65 400' Lt.ORIGINATED BY V.K.

W F

BORING DATE Sept. 8, 1964.COMPILED BY V.K.DATUM GeodeticBOREHOLE TYPE Dynamic Cone Penetration.CHECKED BY K.G.S.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F.	LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W W <sub>P</sub> — W — W <sub>L</sub> WATER CONTENT %	BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE BLOWS / FOOT					
161.0								
0.0				160				
				150				
				140				
134.0								
27.0	End of Cone Penetration.			130				

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO 8

FOUNDATION SECTION

JOB 64-F-80

LOCATION 429/10 320' Lt.

ORIGINATED BY V.K.

W.P.

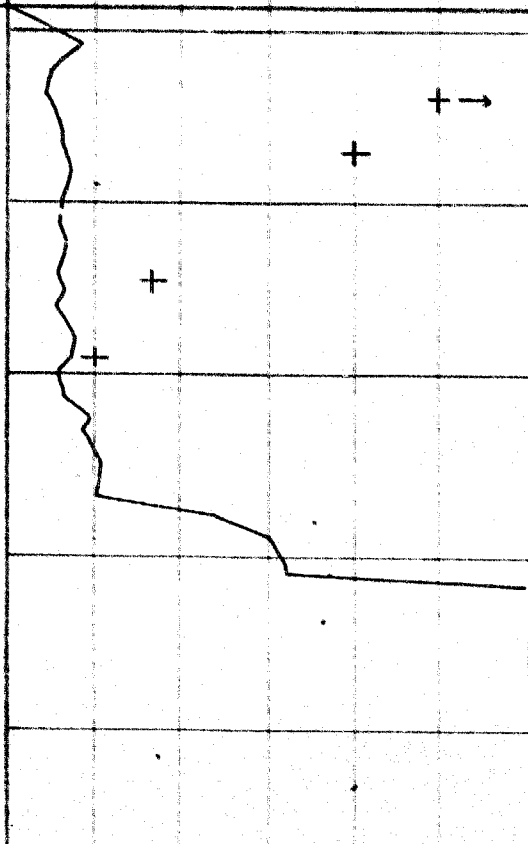
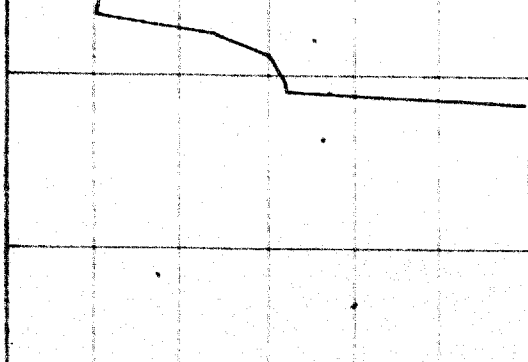
BORING DATE Sept. 10, 1964.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY K.G.S.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT _____ % PLASTIC LIMIT _____ % WATER CONTENT _____ %		BULK DENSITY PCF	REMARKS								
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE		20	40	60	80	100	SHEAR STRENGTH P S F											
161.0	Groundlevel				400	800	1200	1600	2000	WATER CONTENT %											
0.0				160																	
	Marine clay.	1	TW P																		
	V. stiff to soft.	2	TW P	150																	
	(Upper 10' dessicated)			140																	
	Brown to grey colour.																				
133.0																					
28.0	Clayey silt, sand and gravel. (Glacial till)	3	SS 3B	130																	
128.5	Dense																				
32.5	End of borehole.			120																	

W.L. 155.0

6.0

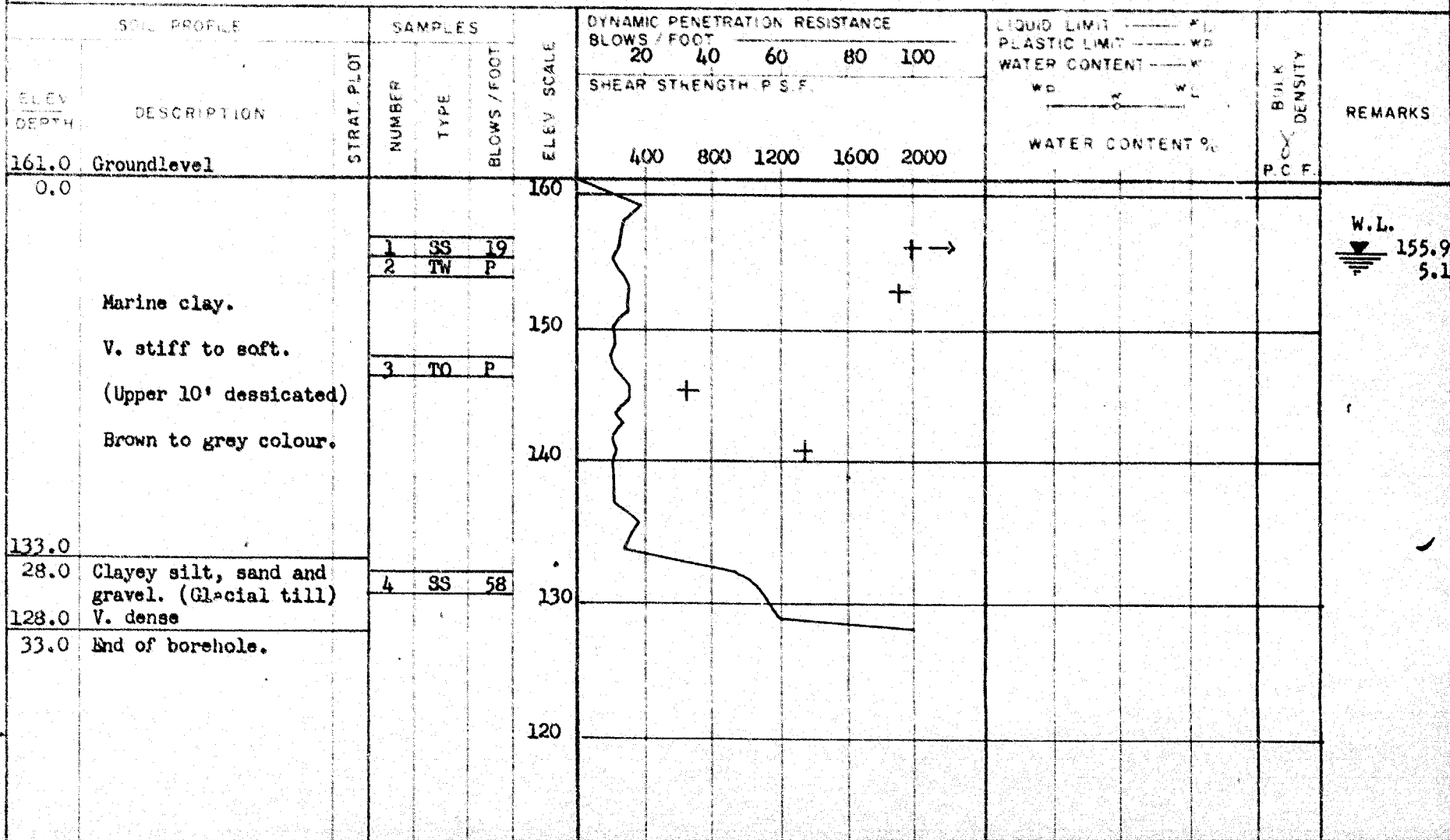
W.L. 155.0  
6.0

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

# RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

JOB 64-F-80 LOCATION 427/10 340' Lt. ORIGINATED BY V.K.  
W. P.                      BORING DATE Sept. 8, 1964. COMPILED BY V.K.  
DATUM Geodetic BOREHOLE TYPE Penn Drill CHECKED BY K.C.S.





DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

JOB 64-F-80

LOCATION 427/20 470' Lt.

## RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

A.T.

BORING DATE Sept. 9, 1964.

ORIGINATED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penn Drill

COMPILED BY V.K.

CHECKED BY K.G.S.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT _____ W <sub>L</sub> PLASTIC LIMIT _____ W <sub>P</sub> WATER CONTENT _____ W <sub>c</sub>		REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	W <sub>P</sub> ——— W <sub>L</sub>		
						SHEAR STRENGTH P S F					WATER CONTENT %		
					400	800	1200	1600	2000				
161.0	Groundlevel				160								
0.0													
		1	TO	P									
					150								
		2	TO	P									
					140								
					130								
120.0					120								
118.5	Glacial till; V. dense	3	SS	68-									
42.5	End of borehole.			86 for 4"									

W.L. 155.0  
6.0

CHECKED BY K.G.S.

W.L. 156.0  
5.0

CHECKED BY K.G.S.

ELEV DEPTH	DESCRIPTION
161.0	Groundlevel
0.0	
110.5	
50.5	End of Cone Penetration

## 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

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	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
$c_u$	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

## MEMORANDUM

64-T 20

To: Mr. H. D. McMillan,  
Road Design Engineer,  
Road Design Office,  
Downsview.

From: Materials and Testing Division,  
Kingston.

Date: September 8, 1964

Our File Ref.

In Reply To

Subject: Highway 401, Service Centre E-11,  
One -Half mile west of Quebec Boundary.

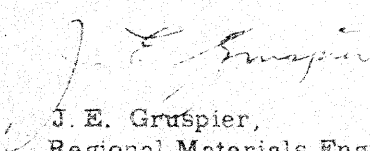
Attached is the soils design report for the Service Centre E-11 to be located on the north side of Highway 401 just west of the Ontario - Quebec boundary.

It is understood that this project has a high priority at this time in order that grading operations at the site may be commenced this fall. Under normal conditions, grading operations cannot start in the spring until about the beginning of June.

The general area is underlain by a shallow desiccated clay layer over a very soft clay to till at about a 30' depth. A foundation investigation is presently underway to obtain detailed soils information at the site.

Your attention is draw to recommendation #4 in the report. Since it is general practice to stockpile granular base materials for use on the parking areas, any stockpile constructed at the site will have to be of a very limited height due to the soft sub-soil conditions noted.

Should you have any queries, please contact this office.

  
J. E. Graspier,  
Regional Materials Engineer.

JEG/cam

c. c. H. A. Tregaskes,  
T. C. Muir,  
W. Wigle  
L. E. Walker (2)  
S. McCombie  
J. Ford (2)

R. Gascoyne,  
D. A. MacDonald  
A. StermacJ  
G. A. Wrong (2)  
File.

# SOILS DESIGN REPORT

Hwy. 401

One-Half Mile West of Quebec Boundary

Service Centre E-11

Proposed Grading, Drainage, Granular Base Project

## GENERAL DATA

This report is for the grading, granular and paving work required at the above site in preparation for the construction of the Service Centre. It is not known at this time who will be preparing the design estimate. No plans or profiles are available other than a general site plan, unnumbered, which indicates the proposed alignment revision required to relocate the north service road around the site. This relocation is presently being carried out by the District under Highway 401 Contract 64-88.

## PHYSIOGRAPHY AND SOILS DATA

The site is located within the Lancaster Clay Plain Physiographic Region with local materials consisting of a shallow depth of desiccated firm to stiff fat clay over soft to very soft fat clay over a dense bouldery sand till at 30'±. The clay is a marine clay laid down when the area was inundated by the post-glacial Champlain Sea.

## INVESTIGATION

The soils investigation was limited to the placing of two borings using a hand auger and peat sample to penetrate the stiff and soft layers respectively. This indicated that the site is underlain by 30" of silty very fine sand over a stiff fat clay to 6'± over a non desiccated soft, saturated, fat clay to firm till bottom at 30'.

No further investigation was carried out at this time since a power investigation is presently being carried out by the Foundation Section in order to determine the shear strength and bearing capacity of foundation materials.

#### GRANULAR MATERIALS

Granular materials are generally scarce in this area with the most probable sources of Sand Cushion being in the River Beaudette area within the Province of Quebec to the east at an average haul distance of 3 miles. The O'Connell Pit in this area was used for the production of GBC Class "A" and 5/8" Type "B" on the adjacent Highway 401 granular and paving contract and will probably also be available for this project.

Course aggregate for hot mix paving will be available from a commercial source in Cornwall while sand will probably be obtained from the River Beaudette area as above.

#### BORROW MATERIALS

Since Highway 401 in this area is 5'± above the general groundline, a considerable quantity of borrow will be required. Local borrow of very fine sand and silt and saturated clays are unacceptable for use on this project due to their frost susceptibility and high moisture content. A dense bouldery sand till borrow is available to the north at an average haul distance of one mile. However, due to the excavation difficulties encountered with this material, it is expected that earth borrow material will consist of a fine silty sand from the Province of Quebec to the east at an average haul distance of 2 miles. This material was used during the construction of Highway 401 in this area.



## RECOMMENDATIONS

### 1. Type of Granular Contract

It is recommended that this project be called as a "GBC Class 'A' and Sand Cushion Contract".

### 2. Depth and Width of Granular Materials

Granular materials should consists of 6" GBC Class 'A' over 12" Sand Cushion. This material should be placed to a minimum of 5' beyond the edge of the proposed pavement for lateral stability. These depths may be revised at the time of construction due to the type of earth borrow used.

### 3. Depth and Type of Asphalt Pavement

The proposed pavement should consist of the following:

1 1/2" HL 3 Surface Course

4" (2 Lifts) HL 6 Binder Course

### 4. Limitation in Height of Stockpiles

Due to the unstable nature of the underlying soft marine clay in this area, the height of granular stockpiles placed under this contract must be controlled. These restrictions will be presented in the Foundation Section report after an analysis of their investigation results.

### 5. Backfill to Culverts

All material required to backfill culverts within the zone of frost penetration should consist of Sand Cushion material.

### 6. Standard Special Provisions

The standard special provisions, "Compaction of Sand Cushion Materials"

and "Stockpiling of GBC Class 'A' Crushed Gravel", should be included in the documents for this project.

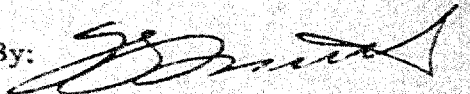
7. Effect of Construction Season

Due to the general high water table and poor surface drainage in this area, it is desirable to place all of the earth fill required for the project this fall. If this is not possible, a minimum of 2' earth fill should be constructed.

8. Stripping of Topsoil

Since the profile grade over this site will be in the order of 4' to 5' above the general groundland, no stripping of topsoil will be required.

Prepared By:



T. G. Smith,  
Sr. Project Soils Engineer.

Approved By:

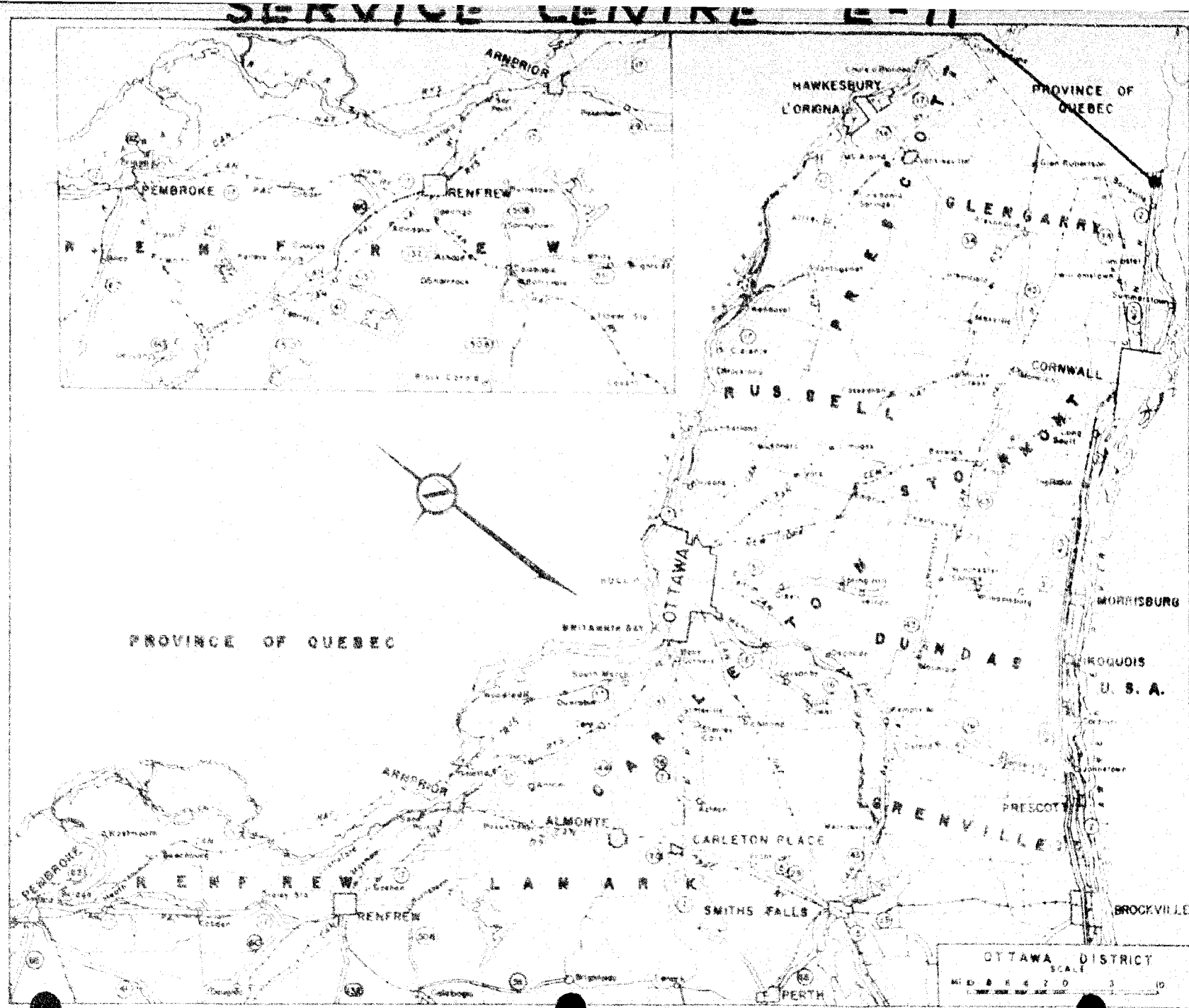


J. E. Gruspier,  
Reg. Materials Engineer.

Sept. 8, 1964

TGS/cam

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT



A. Stermac

Mr. W. Whittle,  
Service Centre Supervisor.

Mr. A. Rutka,  
Materials & Testing  
Engineer.

September 2, 1964.

64-F-20

Service Centre E-11, Lot 4 & 5, Con. I, Twp. of Lancaster.

Further to our conversation of September 1, 1964, regarding the soils information at this site, I wish to advise that our detailed investigation will be starting today, and a complete soils report will not be available until about September 15th. However, this site has been reviewed by our Regional Materials Engineer, who advises that the area is quite flat and low, and that a considerable amount of fill will be required to bring it up to the level of Highway 401.

Preliminary hand borings indicate 7' of firm clay over 20' of very soft clay, then dense till or bedrock. This will be confirmed with the detailed borings. The water table is however, very close to the surface all year round.

Due to the high water table, and poor surface drainage, construction difficulties are often encountered, particularly during the rainy periods in the Fall and in the Spring. Depending upon the amount of Spring rainfall, it is possible that the ground would be wet until June 1st or later, and that the construction equipment could not move on to the site until that time.

Therefore, if there is any urgency with the construction of the service centre, it would be desirable to place a working platform of fill over the entire area, up to a thickness of 2', this Fall. The ground would be firm and capable of supporting the wheel loads. If the total depth of fill and granular base is 3' or more, the top soil would not have to be stripped. The balance of the fill could be placed under a future grading contract, and I understand the total fill will be in the neighbourhood of 4-5'.

The fill material, in all likelihood, will come from Quebec, and will be of a sandy nature similar to the fill material used on Highway 401. The local tills are about 2 miles away, and are very dense and bouldery, and generally not economical to use.

AR

A. Rutka,  
Materials & Testing Engineer

AM/pa  
c.c. Messrs. L. Walker, A. Stermac,  
G. Wong J. Gussier

Materials & Testing Div.

Hwy. 401 & Keele St.,  
Downsview, Ontario,  
Foundation Section,  
Room 107, Lab. Bldg.

November 25, 1964.

Mr. D. A. Selby,  
Selby Sub-Surface Investigation  
Company, Limited,  
2430 O'Brien Blvd.,  
St. Laurent, P. Q.

Subject: Proposed Service Centre E - 11  
Co. of Glengarry, Twp. of Lancaster

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Dear Sir:

Regarding your request (by telephone) for additional information resulting from the Foundation Investigation carried out recently at the above mentioned site we would like to inform you that the type of information you require cannot be obtained without further cost to the Department. Some information from investigations carried out at adjacent sites is, however, available and if you would like to call at our Office here this can be made available to you.

Sincerely yours,

*A. G. Stermac*

A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER.

KS/pb

A. Stermac

Mr. W. Whittle,  
Service Centre Supervisor,  
Special Services Section.

Mr. A. Rutka,  
Materials & Testing Engineer.

September 15, 1965.

Hwy. 401 Service Centre R11

Following our discussion with the Shell Oil Company representatives on September 9th, the site was inspected by our Senior Foundation Engineer, Mr. M. Devata, who has prepared the attached report of his findings.

Basically no factual information is available to us regarding the reported settlement, except for local reported settlements by the contractor. While some local settlement no doubt has occurred, its magnitude is unknown. It is known that the original ground was quite low, and it is possible that local pockets of deeper muck or top soil exist. Under the weight of the fill these pockets would compress more than the adjacent ground, thus explaining the local settlements. This is the only explanation that we can offer.

It is understood that the remainder of the graded area is retaining its contours well. The soil below the black top soil is desiccated clay 9 - 12' in thickness, below which is the soft clay. This clay has been pre-consolidated, and the weight of the fill should not cause significant settlement due to consolidation. The fill over the service area is of the same height as over Highway 401 at this location, and no settlement is visible on Highway 401. We do not believe that there will be any more significant settlement in the service centre area, but we have asked the District to take some levels for verification purposes.

A.L

AA/pa  
Attach.

c.c. Messrs. L. Walker,  
A. Stermac,  
J. Gruspier.

A. Rutka,  
Materials & Testing Engineer.

Mr. A. Rutka,  
Materials & Testing Engineer,  
Materials & Testing Division,  
Room 102, Lab. Bldg.

Mr. M. Devata,  
Senior Foundation Engr.,  
Foundation Section,  
Rm. 107, Lab. Bldg.  
September 14, 1965

Site Visit to Hwy. #401, Service Centre E-11,  
Co. of Glengarry, Twp. of Lancaster, Con.1, Lots 4 - 5.  
District #9 -- W.J. 64-F-80 -- W.P. 52-63.

The above-mentioned site was visited on the evening of September 10, 1965, by the writer, together with Mr. G. Gibson, Project Supervisor, Ottawa District, following advice the previous day by the Shell Oil Company that excessive localized settlements (up to 2 ft.) had occurred over a relatively short period of time. The following is a summary of the subsoil conditions at the site as stated in our Foundation Report W.J. 64-F-80, W.P. 52-63, of September 16, 1964, together with observations made during the recent visit.

#### SUBSOIL CONDITIONS:

Overlying a very dense glacial till layer is a deposit of marine clay varying in thickness from 22 ft. to 54 ft. The upper 9 ft. - 12 ft. of this layer is desiccated and forms a stiff to very stiff crust. This crust material has a shear strength range of 1100 to more than 2000 p.s.f., strength decreasing with depth. The remainder of the clay deposit is non-oxidized and has a soft to firm consistency with a shear strength range of 280 to 880 p.s.f. The ground water level, measured in the boreholes, was found to be 4 ft. to 6 ft. below the existing ground level.

#### OBSERVATIONS:

1) According to Mr. G. Gibson, Project Supervisor, Ottawa District, the general area of the Service Centre was filled during September 1964, with 2 to 3 ft. of granular material (sand cushion) directly over 6" to 12" organic topsoil with no prior stripping of original ground. No information is presently available as to ground conditions or amount of fill placed.

During June 1965, the general area was brought up to grade by using 56,000 tons of granular material (sand cushion). This material was compacted to the current Departmental procedures, and the results of the in-situ compaction tests were well above the requirements specified.

Sept. 14/65

1) (cont'd.) ...

The Contractor was ready to complete the form work in the general area where curb and gutters, sidewalks and traffic islands are scheduled to be constructed. It was noticed that certain areas of the graded portion were 6" to 9" below grade. Subsequently, on September 2, 1965, under the supervision of Ottawa District of the Department, approximately 1,200 tons of sand cushion was placed to bring the surface up to grade.

On September 8, 1965, after a heavy rain-fall, the Contractor claimed that certain limited areas were again 3" to 6" below grade. This was confirmed by the District personnel of the Department.

2) Careful visual observations of the general area revealed no excessive washing of the surface material.

3) The major portion of the Service Centre structure was complete and seems to be in satisfactory condition. This is founded on Franki piles with the floor slabs tied in with the footings.

4) This general area is fairly level and Hwy. #401 runs approx. 400 ft. south of the service station structure. The profile grade of Hwy. #401 is approx. the same as the finished grade of the Service Centre; consequently, it can be assumed that at least 3 ft. of granular base course material was placed under Hwy. #401.

There are no visible cracks or signs of settlement on the concrete pavement of Hwy. #401 and hence, it can be concluded that with similar loading and subsoil conditions to Hwy. #401, settlements should be negligible.

5) In this general area, the Department has constructed several structures incorporating fills over similar subsoil conditions. Most of these structures are instrumented for settlement observations, and our records indicate that these subsoils under fills in excess of 20 ft. high, have rarely settled over 18" to 24" in the three years after construction.

6) It is believed that the major portion of the previously observed settlements on this site are probably due to the compression of the original organic topsoil.

7) The District were advised to install a grid of stakes in the areas where settlements are believed to have occurred. It is understood that, using a reliable benchmark, the elevations of these stakes will be checked daily, starting on September 11, 1965.

cont'd. .... 3



Sept. 14/65

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- 8) It is also advisable that some open pits or power auger holes be used to determine the depth of the existing sand cushion.

MD/MdeF

M. Devata,  
SENIOR FOUNDATION ENGINEER

cc: Foundations Office  
Gen. Files

# 64-F-80

W.P. # 52-63-02

Hwy. # 401

SERVICE

CENTRE E-11

