

MEMORANDUM

23-69-50  
W.P. 208-63-2

TO: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Division.

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

Attention: Mr. S. McCombie

DATE: February 24, 1966

OUR FILE REF.

IN REPLY TO

FEB 28 1966

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Structure at the Crossing of Q.E.W.  
and Fruitland Rd., Twp. of Saltfleet,  
District #4 (Hamilton)

W.J. 66-F-10

--

W.P. 209-63

Included with  
W.P. 206-63-2.

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

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

AGS/MdeF  
Attach.

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

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (2)  
H. Greenland  
T. J. Kovich  
A. Watt

Foundations Office  
Gen. Files

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FOUNDATION INVESTIGATION REPORT  
For  
Structure at the Crossing of Q.E.W.  
and Fruitland Rd., Twp. of Saltfleet,  
District #4 (Hamilton)  
W.J. 65-F-10    --    W.P. 209-63

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed underpass of the Q.E.W. and Fruitland Rd., Twp. of Saltfleet, was received from the Bridge Location Section, in a memo dated December 1, 1965. Following this request, a field investigation was carried out by this Section to determine the subsoil conditions.

This report contains the information resulting from the field investigation and laboratory test results, together with discussion and recommendations pertaining to the design of the proposed bridge foundations and the approach fills.

2. DESCRIPTION OF THE SITE:

The proposed structure site is located at the intersection of Q.E.W. and Fruitland Rd., Twp. of Saltfleet. The surrounding area is very flat, cultivated farmland. The site is situated in the area commonly known as "Niagara Fruit Belt" which coincides with the physiographic region known as the "Iroquois Plain". The main deposit of the region is clayey silt derived from underlying Queenston shale.

3. DESCRIPTION OF FIELD AND LABORATORY WORK:

A preliminary foundation investigation consisting of one sampled borehole and one cone penetration test, was carried out by this Section in March 1965, and the results submitted in our report W.J. 65-F-28. During the present investigation 3 sampled boreholes and 3 cone penetration tests were carried out. The holes were carried

cont'd. /2 .....

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

out with a power auger and samples were obtained at various intervals.

The disturbed samples were recovered by means of a standard 2-inch O.D. split-spoon sampler driven into the soil with a 140-lb. hammer falling freely a distance of 30 inches.

Undisturbed samples were obtained by means of 2-inch I.D. Shelby tubes pushed 18 inches into the soil by the augering machine.

Field vane tests were carried out immediately after Shelby tube sampling, to determine the shear strength of the cohesive material.

4. LABORATORY TESTS:

Samples were visually examined and identified in the field and subsequently in the laboratory. Tests were carried out in the laboratory on a selection of samples to determine:

1. Bulk density.
2. Moisture content.
3. Atterberg limits.
4. Grain size distribution.
5. Unconfined compressive strength.

The locations and elevations of all boreholes are shown on Dwg. No. 66-F-10A, together with the estimated soil profile. Results of field and laboratory tests are presented on the borelog sheets in Appendix I of this report.

5. SUBSOIL CONDITIONS:

5.1) General:

The stratigraphy at the site was found to be generally uniform. A detailed description of the various soil types encountered during the investigation is shown in Appendix I of this report, and

cont'd. /3 .....

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

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

is also given in subsequent paragraphs. The estimated stratigraphical profile shown on Dwg. No. 66-F-10A, is based upon this information.

5.2) Clayey Silt with Sand and occasional Gravel:

This layer extends down from the ground surface and varies in thickness from 41.5 ft. in B.H. #1 to 49 ft. in B.H. #3.

Physical properties of the material in the deposit as determined from laboratory and field tests, are summarized as follows:

Liquid Limit	(W <sub>L</sub> )	--	22%	-	35%
Plastic Limit	(W <sub>p</sub> )	--	14%	-	20%
Moisture Content	(W)	--	10%	-	18%

Grain size distribution curves indicate the following average composition: gravel 3%, sand 17%, silt 46%, and clay 34%:

Unconfined shear strength	--	3,580 p.s.f. - 4,350 p.s.f.
Field Vane shear strength	--	> 2,000 p.s.f.
'N' values	--	23 blows/ft. - 194 blows/ft.

From the above shear strengths and 'N' values, the consistency of the deposit may be described as very stiff to hard.

5.3) Silty Sand to Sandy Silt with occasional Gravel:

Underlying the deposit of clayey silt, a thin stratum of silty sand to sandy silt with occasional gravel was encountered in all boreholes except B.H. #4. The stratum is approximately 4 ft. thick with Standard Penetration test results ranging from 100 blows/ft. to 152 blows/4 in. From these values the relative density of the stratum may be estimated as very dense.

cont'd. /4 .....

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

5.4) Shale Bedrock:

The silty sand to sandy silt with occasional gravel deposit is underlain by shale bedrock. The bedrock was penetrated in B.H.'s #1 and #4 by augering 5 ft. and 6 ft., respectively. This indicates that the upper 5 ft. to 6 ft. of the bedrock has been subjected to excessive weathering.

6. GROUND WATER:

Water level observations in the boreholes were carried out during the time of the field investigation. These indicate that the ground water level varies considerably over the site, ranging from elevation 247 to elevation 257.

7. DISCUSSION AND RECOMMENDATIONS:

It is proposed to reconstruct the existing Q.E.W. to a six/eight-lane controlled access highway from Stoney Creek traffic circle to St. Catharines. In addition, two-lane service roads are proposed to be built on both sides of the future Q.E.W. This reconstruction program necessitates the construction of several underpass structures.

At the crossing of Fruitland Rd. and Q.E.W., an underpass structure is proposed. Present proposals call for a six-span (38'-73'-77'-73'-38') structure with approach fills having a maximum height of about 25' above existing ground level.

Since the upper layers of the subsoil consist of a very stiff to hard deposit of clayey silt with some sand and occasional gravel, conditions are favourable for spread footing support, and in the case of proposed piers, it is recommended that footings be placed at approximate elev. 257 with an allowable pressure of 3 t.s.f.

The proposed abutments may be constructed within the approach fills and supported on 12"  $\emptyset$  displacement piles driven to, but not beyond elevation 245. A 12"  $\emptyset$  pile could carry an allowable

cont'd. /5 .....

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

load of 30 tons. During construction of the approaches, care should be taken to ensure that no bouldery fill is placed at locations through which piles have to be driven.

No major dewatering problems are anticipated because of the low permeable nature of the subsoil.

No stability problems are anticipated provided that standard 2:1 slopes are constructed.

8. SUMMARY:

The subsoil stratification at the site is as follows: A very stiff to hard clayey silt deposit is underlain by a very dense silty sand to sandy silt followed by shale bedrock.

It is recommended to place the pier footings at about elev. 257 and use a safe net bearing pressure of 3 t.s.f. The abutments should be supported on 12" Ø displacement piles driven to elev. 245. These piles can support a safe load of 30 tons per pile. The proposed approach fills do not present any stability problems.

9. MISCELLANEOUS:

The field work, performed during the period January 15 to 29, 1966, together with the preparation of this report, was undertaken by Mr. F. Wang, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer.

Equipment used was owned and operated by Dominion Soil Investigation Limited.

February 1966

## APPENDIX I



CHECKED BY \_\_\_\_\_

[illegible]

## MATERIALS &amp; TESTING DIVISION

RECORD OF BOREHOLE NO.

1

FOUNDATION SECTION

JOB 66-F-10

LOCATION W.E.W. & Fruitland Rd. Sta. 31-78 18' Lt.

ORIGINATED BY P.L.W.

W. P. 209-63

BORING DATE Jan. 18 - 19, 1966.

COMPILED BY P.L.W.

DATUM Geodetic

BOREHOLE TYPE Augering

CHECKED BY \_\_\_\_\_

[illegible]

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— wp WATER CONTENT ——— w		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	WATER CONTENT % 10 20 30			
261.0	Groundlevel										
0						260					Gr3%Sa18% Si149%Cl 30%
			1	SS	34						
			2	SS	52						
			3	SS	43						
			4	SS	42	250					
			5	SS	30						
	Clayey silt with sand and occasional gravel.		6	SS	37	240					
			7	SS	32						
	Very stiff to hard.		8	SS	34	230					
			9	SS	46						
			10	SS	63	220					
			11	SS	83						
212.0											Gr2%Sa14% Si141%Cl 43%
49.0	Silty sand with some gravel.	0.0	12	SS	100	210					
206.7	V. dense.	0.0	13	SS	152	1/4"					
54.3	End of borehole. Probable Bedrock										Gr13%Sa45% Si130%Cl 4%

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO.

FOUNDATION SECTION

## MATERIALS &amp; TESTING DIVISION

JOB 66/F-10 (65-F-28)

LOCATION Q.E.W. & Fruitland Rd., Sta. 30/70 39' Rt.

ORIGINATED BY T.C.

W.P. 209-63

BORING DATE March 16, 1965.

COMPILED BY T.C.

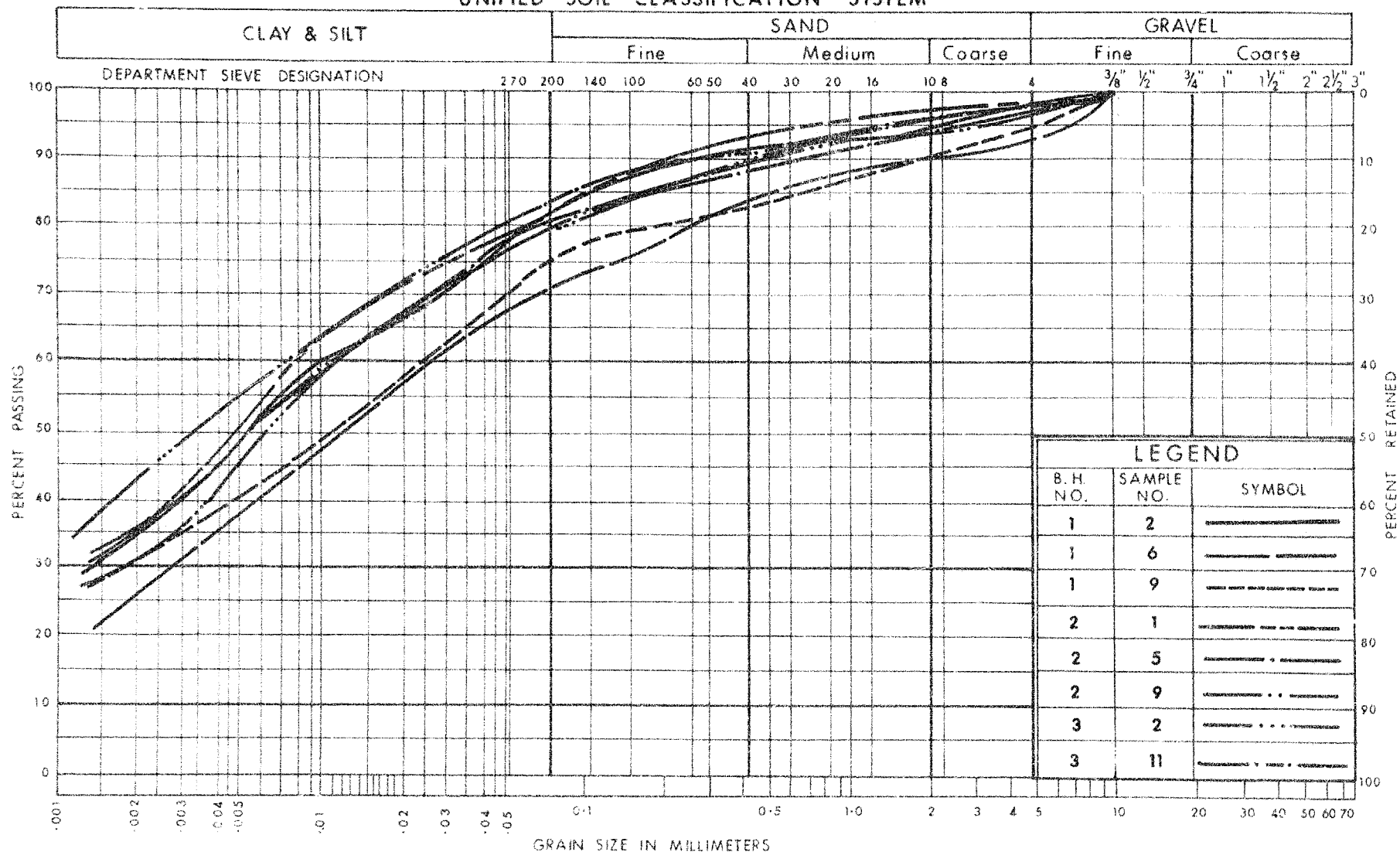
DATUM G.S.C.

BOREHOLE TYPE Penndrill

CHECKED BY \_\_\_\_\_ M.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY  P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			Wp ——— W ——— WL WATER CONTENT % 10 ——— 20 ——— 30		
262.0	Groundlevel											
0			1	SS	43	260						Gr 5% Sal 8% Si 47% Cl 30%
			2	SS	42							
251.0	(Brown)		3	SS	37							
11.0	(Grey)		4	SS	23	250						El 252.5
			5	SS	27							Observed in borehole
	Clayey silt with sand and occasional gravel.		6	SS	62	240						
			7	SS	42							
	Very stiff to hard.		8	SS	40	230						
			9	SS	50							
			10	SS	100	10" 220						
216.0			11	SS	90	6"						
45.5	Shale, (weathered) reddish brown refusal.		12	SS	100	8"	210					
210.5												
51.5	End of borehole.											
						200						

# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

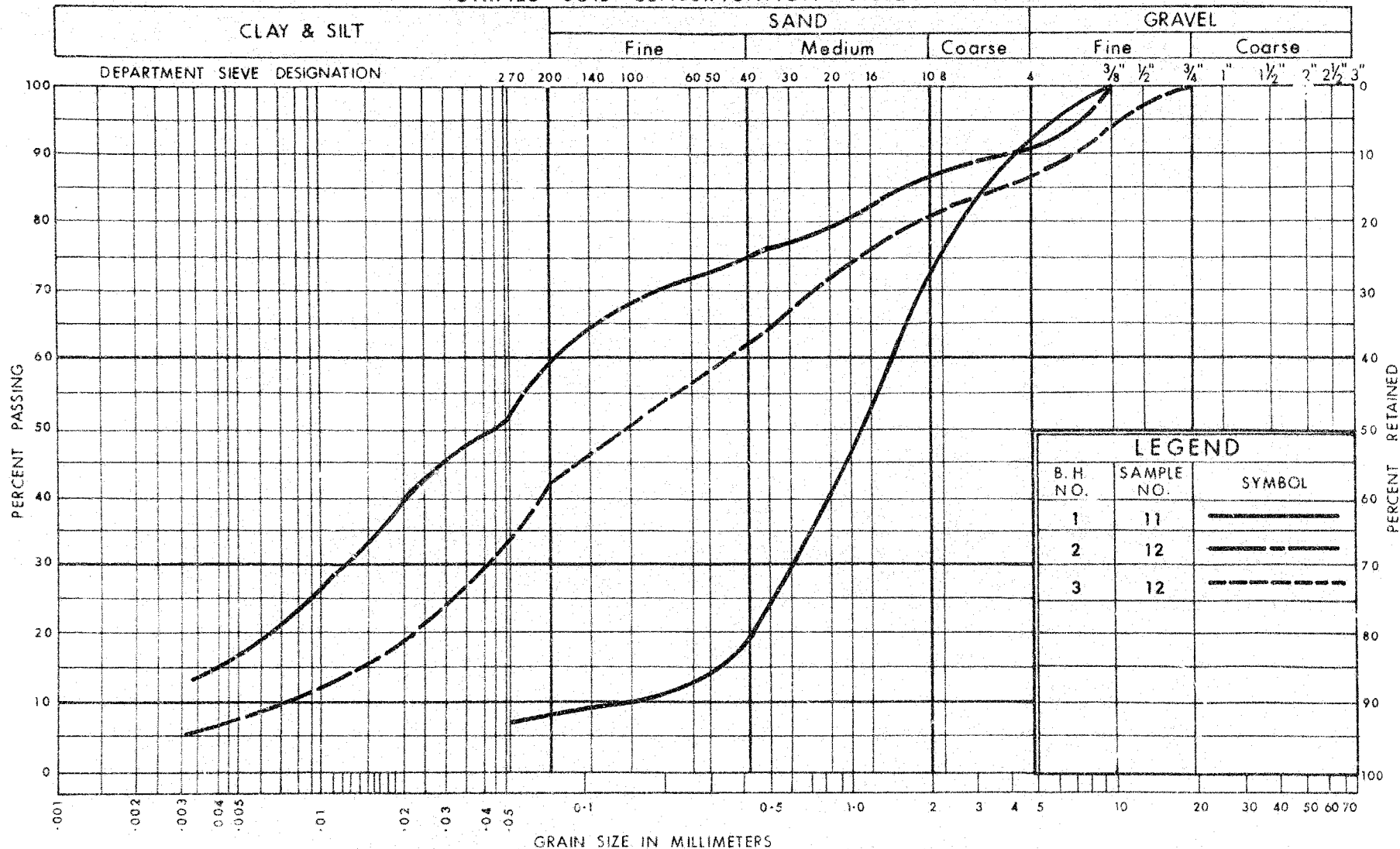
## GRAIN SIZE DISTRIBUTION

CLAYEY SILT WITH SAND & OCCASIONAL GRAVEL

W.P. No. 209-63

JOB No. 66-F-10

# UNIFIED SOIL CLASSIFICATION SYSTEM



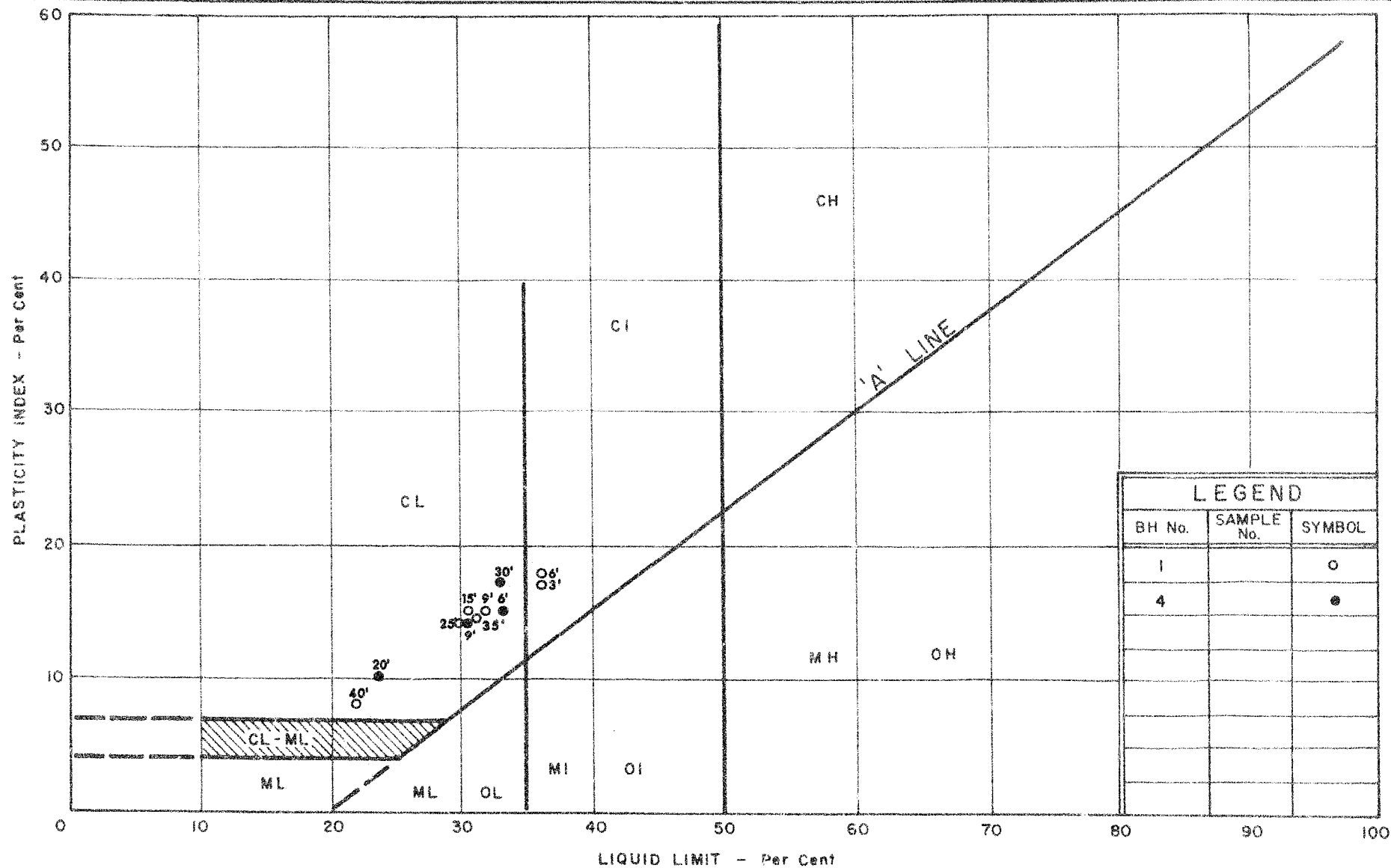
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## GRAIN SIZE DISTRIBUTION

SILTY SAND TO SANDY SILT WITH SOME GRAVEL

W.P. No. 209 - 63

JOB No. 66 - F - 10



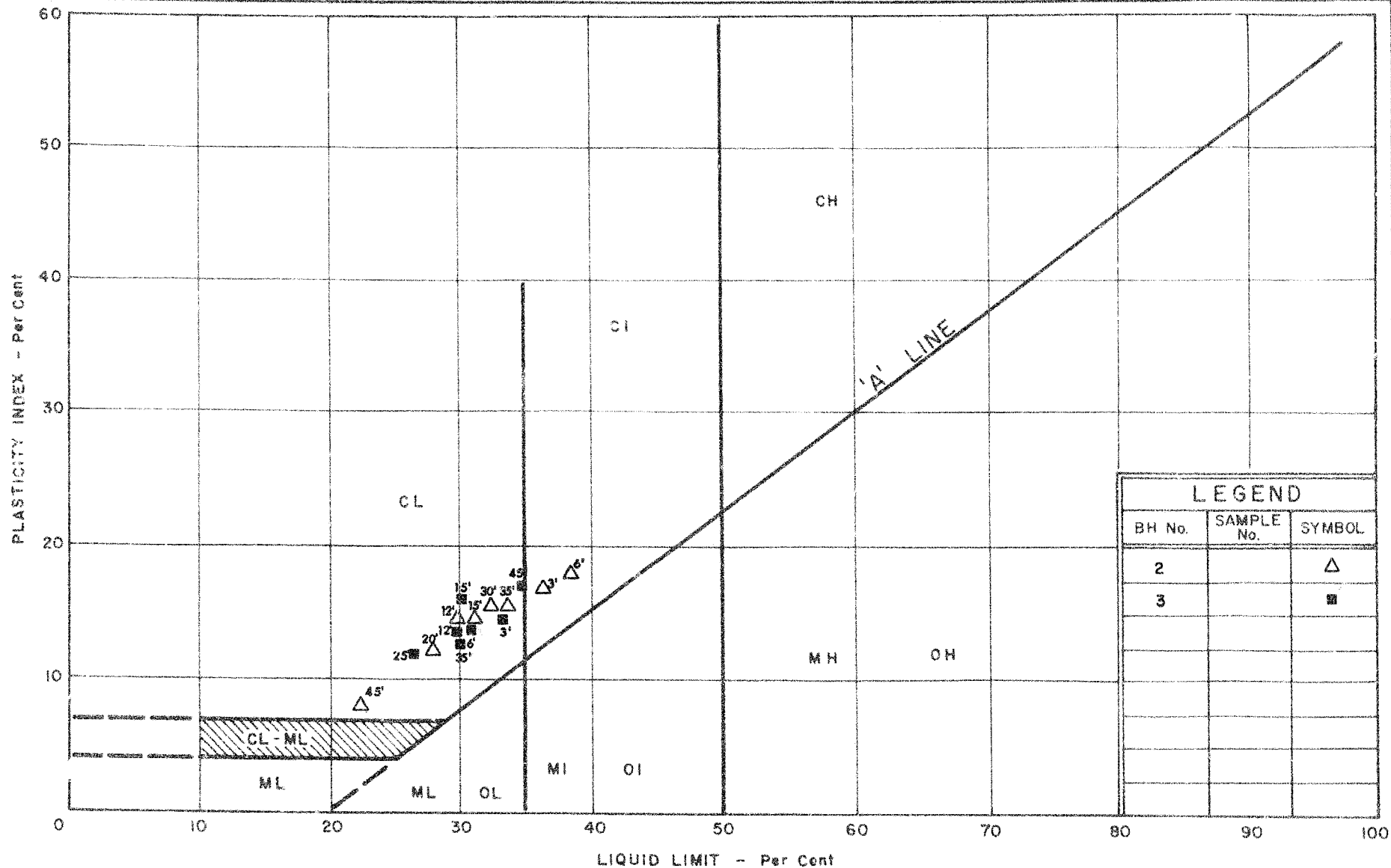
LEGEND		
BH No.	SAMPLE No.	SYMBOL
1		○
4		●



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# PLASTICITY CHART

W.P. No. 209-63  
JOB No. 66-F-10



LEGEND		
BH No.	SAMPLE No.	SYMBOL
2		△
3		■



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## PLASTICITY CHART

W.P. No. 209-63  
JOB No. 66-F-10



## 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
$S_r$	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

66-F-10

W. S. Melinyshyn  
Regional Bridge Location Eng.  
Admin. Bldg.

Foundation Section  
Materials & Testing Div.  
Lab. Bldg.

December 21, 1966

Fruitland Underpass  
Twp. of Saltfleet  
District #4, Hamilton  
W.P. 209-63-1 Hwy. Q.E.W.

We have reviewed the preliminary drawing D-5909-P1 for the above structure.

Since 50 ton/pile is required for the abutment foundation we estimate that the steel 'H' piles should be driven to approx. El. 220.0 and not to El. 245.0 as shown on your drawing.

*M. Devata*

MD:mt

M. Devata  
Supervising Foundation Engineer  
for: A. G. Stermac  
Principal Foundation Engineer

cc. Foundation File ✓  
General File

## DEPARTMENT OF HIGHWAYS, ONTARIO

## MEMORANDUM

Mr. A. Stettin,  
Principal Foundation Engineer,  
Room 107, Lab. Bldg.

From: Bridge Division,  
Downsview, Ontario.

Date: December 1, 1965.

One File Ref.

IN REPLY TO

SUBJECT: Gray's Side Road Underpass, W.P. 207-63, - 66-1-1  
Millens Road Underpass, W.P. 208-63, 66-1-7  
Fruitland Road Underpass, W.P. 209-63, 66-1-10 ✓  
Clover Road Underpass, W.P. 210-63, 66-1-6  
Hex. Q.E.W. - Dist. 4.

Attached please find a plan showing the proposed underpasses with the probable location of footings shown in red.

Would you kindly arrange foundation investigations at the above sites and provide us with the information necessary to design the structures.

All structures will carry the side-roads over the existing Q.E.W. with approximately 20' of fill on the approaches.

Your office has completed a preliminary foundation report (Q.E.W. from Stoney Creek Traffic Circle to St. Catherine's) under W.J. 65-F-28.

WSM/sp

*J. S. Melnyshyn*  
W. S. Melnyshyn,  
Regional Bridge Location Engineer.

cc. A. Crowley  
R. Forrest

CRIMINAL JUSTICE FEB 23 1966

MEMORANDUM

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

FROM: Bridge Division,  
Downsview, Ontario

DATE: November 2, 1966

OUR FILE REF.

IN REPLY TO

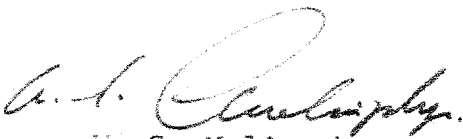
SUBJECT:

The Fruitland Road Underpass,  
W.P. 209-63-1,  
The C.N.R. Overhead at Fruitland Road,  
W.P. 209-63-2,  
Q.E.W., District 4

Herewith one print each of our drawings D-5909-P1 and D-6045-P1 for the above structures.

Please review our drawings in the light of your foundation investigation and inform us of your comments and/or approval.

WSM/pr  
Encl.

  
W. S. Melinyshyn,  
Regional Bridge Location Engineer

Oct 17th 1966

Sub - Structure @ the Crossing of Q.E.W.  
and Fruitland Rd, Twp of Saltfleet  
Dist # 4 (Hamilton), WJ 66-F-10

Further to the discussion between this section and the Bridge Office, the following preliminary design details were ~~submitted~~ given verbally to the Bridge Office.

Bridge office indicated the following footing elevations for the structure

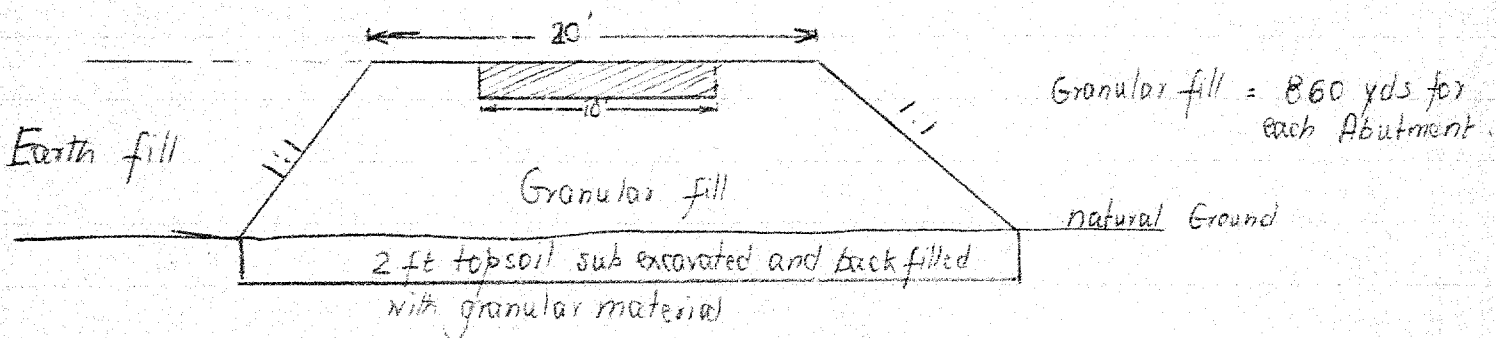
North Abutment 264.5

South Abutment 266.0

Pier 257.0 (Why so deep) (This is for frost protection)

~~This section feels~~

In our opinion designer should consider spread footings on compacted fill for the abutment foundations. The details should be as follows:



cost of granular material (crushed stone)	\$ 3.50 / yd
" Earth material	\$ 1.25 / yd
" slag	\$ 2.50 / yd.

#66-F-10

W.P.#209-63-1

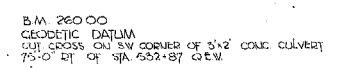
Q.E.W.

CROSSING

FRUITLAND RD.





[illegible]

DEPARTMENT OF HIGHWAYS ONTARIO  
HIGHWAY DIVISION

FRUITLAND ROAD UNDERPASS

3.2 MI. E. OF HWY #20 TO HWY 10 CIRCLE

KING'S HIGHWAY NO. Q.E.W. DIST. NO. 4

CO. WENTWORTH  
TWP. SALTFLAT LOT 14 & 15 CON. D.F. #1

PRELIMINARY

FILE NO. 209-6 209-6

APPROVED \_\_\_\_\_

SUBJECT DESCRIPTION \_\_\_\_\_

CONTRACT NO. \_\_\_\_\_

DRAWN BY J.C.D. CHECKED J.E. DRAWING NO. D-5909-P

DATE 1971 12-20-71

