

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

W.P. 8-6-63

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

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

Attention: Mr. S. McCombie

DATE: July 11, 1966

OUR FILE REF.

IN REPLY TO

AUG 23 1966

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Proposed C.N.R. Overhead at
Fruitland Road, Township of
Saltfleet, District #4 (Hamilton)

W.J. 66-F-58 -- W.P. 209-63-2

Cancelled file
206-63

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

We believe that the factual data and recommendations contained therein, will be adequate for your design requirements. Should additional information be required, please feel free to contact our Office.

AGS/MdeF
Attach.

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

Foundations Office
Gen. Files ✓

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

TABLE OF CONTENTS

1. INTRODUCTION.
 2. SUBSOIL CONDITIONS:
 - 2.1) General.
 - 2.2) Clayey Silt with some Sand and traces of Gravel.
 - 2.3) Shale Bedrock.
 3. GROUNDWATER.
 4. DISCUSSION AND RECOMMENDATIONS.
 5. MISCELLANEOUS.
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FOUNDATION INVESTIGATION REPORT
For
Proposed C.N.R. Overhead at
Fruitland Road, Township of
Saltfleet, District #4 (Hamilton)
W.J. 66-F-58 -- W.P. 209-63-2

1. INTRODUCTION:

A request to carry out a foundation investigation for the proposed underpass at the crossing of the C.N.R. and Fruitland Road, was received from the Bridge Location Section - (memorandum from Mr. W. Melinyshyn, dated June 7, 1966). Subsequently, an investigation consisting of four sampled boreholes and two dynamic cone penetration tests, was carried out by the Foundation Section.

Presented in this report are the results of this investigation, together with our recommendations for the foundation design of the proposed structure and approaches.

The site is a portion of the Niagara Fruit Belt, lying between the Niagara Escarpment and Lake Ontario, in the Township of Saltfleet. During the Pleistocene period the site was inundated by Lake Iroquois, which carved the present relatively flat topography from the underlying glacial deposit. The glacial deposit extends to the bedrock (Queenston Shale).

2. SUBSOIL CONDITIONS:

2.1) General:

Subsoil at the site consists of a 9- to 14-ft. deposit of clayey silt with some sand and traces of gravel directly overlying shale bedrock.

cont'd. /2 ...

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

2.2) Clayey Silt with some Sand and traces of Gravel:

This material was encountered immediately below the topsoil in all boreholes. Thickness of the deposit varied from 9 ft. in borehole 1 to 13.5 ft. in borehole 3. Standard Penetration Test (N) values in the stratum generally varied from 29 blows/ft. to 107 blows/ft., with one isolated value of 7 blows/ft. obtained at 3 ft. in borehole 3. From the above values, the consistency of the deposit may be estimated as hard.

2.3) Shale Bedrock:

Immediately below the clayey silt deposit, shale bedrock was encountered. The upper 0.5 ft. to 1 ft. of the bedrock was badly weathered. Contact elevations for the sound bedrock varied from 253 to 257.5. Sound bedrock was proved by drilling from 4.5 ft. to 8.8 ft. of core in the four boreholes.

3. GROUNDWATER:

During the time of investigation, groundwater observations were carried out in the boreholes. These indicate that the groundwater level varies between elevation 266 - 268 in the boreholes. The exact groundwater levels are shown on the borelog sheets attached to this report.

4. DISCUSSION AND RECOMMENDATIONS:

A three-span overhead structure (40' - 40' - 40') is proposed at the crossing of the Canadian National Railway and Fruitland Side Road some 9.5 miles west of Grimsby in the Twp. of Saltfleet.

Subsoil at the site consists of 9 to 14 ft. of hard clayey silt, followed by shale bedrock. The upper 6 to 12 inches of the shale bedrock has been subjected to extensive weathering.

cont'd. /3 ...

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

It is recommended that the proposed structure be founded on spread footings located within the hard clayey silt stratum or on sound shale bedrock. A safe bearing pressure of 3 t.s.f. may be used for design purposes for footings located within the clayey silt stratum some 5 ft. below the finished grade. For footings founded on the sound shale bedrock, a safe bearing pressure of 10 t.s.f. may be used.

If perched abutments are contemplated, they may be constructed within the approach fills and supported on end-bearing piles driven to practical refusal to shale bedrock. Design loads to be used are dependent on the pile section selected and may be 80 tons per pile in the case of 12 BP 74 steel H-piles. 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 during construction of footings.

The proposed approach fills will be in the order of 30 ft. above the existing ground surface. No stability problems are anticipated for the standard 2:1 slopes.

5. MISCELLANEOUS:

The field work, performed during the period June 14, 1966 to June 16, 1966, together with the preparation of this report, was undertaken by Mr. L. Palmer, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed the report.

Equipment used was owned and operated by Canadian Longyear Co. Ltd.

July 1966

APPENDIX I

RECEIVED BY THE SECRETARY OF THE ARMY

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOE 66-F-58

W. P. 200-63-2

DATUM Geodetic

RECORD OF BOREHOLE NO. 1

LOCATION Fruitland Rd & C.N.R.: Sta. 47+00. 38.7' Rt.

BORING DATE June 14, 1966.

BOREHOLE TYPE Washboring, BX: BXL, Cone

FOUNDATION SECTION

ORIGINATED BY L. P.

COMPILED BY W.T.E.

CHECKED BY M.D.

[illegible]

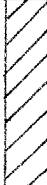

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-58 LOCATION Fruitland Rd. & C.N.R., Sta. 45+77. O/S 39.5' Lt. ORIGINATED BY L.P.
W.P. 209-63-2 BORING DATE June 15, 1966. COMPILED BY W.T.E.
DATUM Geodetic BOREHOLE TYPE Washboring BX. BXL, Cone CHECKED BY M.D.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— w _L			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.		PLASTIC LIMIT ——— w _p	WATER CONTENT ——— w	WATER CONTENT %		
							20 40 60 80 100		w _p	w	w _L			
265.5	Groundlevel													
0.0	Clayey silt with some sand and traces of gravel.		1	SS	29	260								Elev. 265.5
			2	SS	68									
254.0	Hard.		3	SS	43									
253.0	Weathered		4	SS	62 7/8"	250								Rec. 100%
12.5	Shale Bedrock (Sound)		5	RC BXL	-									
248.5														
17.0	End of borehole.													

WATER CONTENT %
WP ——— W ——— WL

30/4"
Hammer Bouncing

FOUNDATION SECTION

CHECKED BY _____ M.D.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.				PLASTIC LIMIT ——— WP	WATER CONTENT ——— W	WATER CONTENT %		
							20	40	60	80	100	WP	W			
269.0	Groundlevel															
0.0	Clayey silt with some sand and traces of gravel.		1	SS	7	260									▼ W.L. El. 267.2	
	Hard.		2	SS	67											
			3	SS	108											
255.5	Weathered		4	SS	66	250									Rec. 79% Rec. 86%	
14.0	Shale Bedrock		5	RC BXL	-											
	(Sound)		6	RC BXL	-											
246.8																
22.2	End of borehole.															

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 66-F-58

LOCATION Sta. 46/58; O/S 35.7' Lt.

ORIGINATED BY L.P.

W.P. 209-63-2



BORING DATE June 16, 1966.

COMPILED BY W.T.E.

DATUM Geodetic

BOREHOLE TYPE Washboring BX: BXI

CHECKED BY M.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT _____ W _L			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT					PLASTIC LIMIT _____ W _P				
							20 40 60 80 100					WATER CONTENT _____ W				
							SHEAR STRENGTH P.S.F.					W _P W _L				
							WATER CONTENT %									
265.7	Groundlevel														W.L.	
0.0	Clayey silt with some sand and gravel.		1	SS	65	260									El. 265.7	
256.8	Hard weathered		2	SS	69											
10.3	Shale Bedrock (Sound)		3	SS	51	26"									Rec. 84%	
			4	RC BXL	-										Rec. 100%	
246.9			5	RC BXL	-	250										
18.8	End of borehole.															

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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

GENERAL

π	$= 3.1416$
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_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
β	ANGLE OF SLOPE TO HORIZONTAL

MEMORANDUM

To: Mr. A. G. Stearns,
Principal Foundation Engineer,
Room 107, Lab. Building.

From: Bridge Division,
Downsview, Ontario

DATE: November 2, 1966

See File No.

IN REPLY TO

Subject:

The Fruitland Road Underpass,
W.P. 209-63-1,
The C.H.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. Melnyshyn,
Regional Bridge Location Engineer

66-1-58

MEMORANDUM

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

From: Bridge Division,
Downsview, Ontario.

Date: June 7th, 1966.

Our File Ref.

In Reply To:

SUBJECT:

W.P. #211-63, Site #18-20,
Eighteen Mile Creek,
W.P. #214-63, Site #18-22,
Sixteen Mile Creek,
✓ W.P. #209-63-2, Site #36-216,
C.N.R. Overhead at Fruitland Road,
Q.E.W., District #4.

Further to my memo of May 26th I am enclosing herewith one print each of the bridge site plans E-4737-1 and E-4736-1 for Eighteen and Sixteen mile creeks. The probable location of footings have been marked in red. At Sixteen Mile Creek extra boreholes have been shown in green for the future widening of the existing structures. At Eighteen Mile Creek footings have also been shown in blue for the extension of the existing culvert. It has not yet been decided which type of structure will be built at this location.

Also enclosed is a print of E-4738-1 for the C.N.R. structure on Fruitland Road to the south of the Fruitland Interchange. No preliminary structure site report is available for this project since it has just recently been added to the program.

Attached are the site reports for Sixteen and Eighteen Mile Creeks. Eighteen Mile Creek is particularly inaccessible for your machinery and also will require floating of the drill rig in the marshy area.

Would it be possible to have some sort of hole put down in the centreline of the creeks to aid in the calculations of scour? This would also apply to Fifteen Mile Creek previously sent to you.

JFW/cew

Encl.

cc. R. Forrest

A. Crowley

W.S. Melinyshev
W.S. Melinyshev,

Regional Bridge Location Engineer.

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

030130 01 2:33

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B

HAMN DOWN 2 JUNE 14/66 225P VR

H GREENLAND DIST ENGR

ATTN W D HAM MTCE ENGR

RE CNR OVERHEAD AT FRUITLAND ROAD QEW DIST 4 HAMILTON WP209-63-2,

WJ66-F-58

THE FIELD INVESTIGATION IS IN PROGRESS FOR THE ABOVE MENTIONED
PROJECT THIS IS FOR YOUR INFORMATION.

M DEVATA SEN FOUND ENGR FOR A G STERMAC MAT AND TESTING

BB

file this please
M. Devata

Sub - CNR overhead at Fruitland Rd

Q E.W. Dist # 4

W J 66-F-58

W P 209-63-2

1) Obtained necessary permission to drill in their property by contacting Mr. Weber of CNR (265-2351) in Toronto on June 14/66. A foreman will be at the site during drilling operations for the pier footings of the above mentioned project.

2) A tele type was sent to the Maintenance Engineer of Dist # 4 about the drilling operation in his area.

3) Tom Kovich was informed by phone regarding the above mentioned job.

M. Devata
June 14/66.

66F-58

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

Foundation Section
Materials & Testing Div.
Lab. Bldg.

Dec. 21, 1966

C.N.R. Overhead at Fruitland Rd.
Twp. of Saltfleet, District #4, Hamilton

W.P. 209-63-2 W.J. 66-F-58

We have reviewed the preliminary drawing D-6045-F1 for the above-mentioned structure with regard to the proposed foundations. The designer appears to have conformed with the recommendations contained in our foundation investigation report.

MD:mt

M. Devata

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

cc; Foundation Office ✓
General Office

MEMORANDUM

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

From: Bridge Division,
Downsview, Ontario.

Date: June 7th, 1966.

Our File Ref.

In Reply To:

SUBJECT:

W.P. #211-63, Site #18-20, *See Note*
Eighteen Mile Creek,
W.P. #214-63, Site #18-22, *See Note*
Sixteen Mile Creek,
W.P. #209-63-2, Site #36-216,
C.N.R. Overhead at Fruitland Road,
Q.E.W., District #4.

66-F-63

66-F-62 ✓

SEPT 14/66

66-F-58 Completed

Further to my memo of May 26th I am enclosing herewith one print each of the bridge site plans E-4737-1 and E-4736-1 for Eighteen and Sixteen mile creeks. The probable location of footings have been marked in red. At Sixteen Mile Creek extra boreholes have been shown in green for the future widening of the existing structures. At Eighteen Mile Creek footings have also been shown in blue for the extension of the existing culvert. It has not yet been decided which type of structure will be built at this location.

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JFW/cew

Encl.

cc. R. Forrest

A. Crowley

W. S. Melnyshyn
W.S. Melnyshyn,

Regional Bridge Location Engineer.

Handy 12-1966

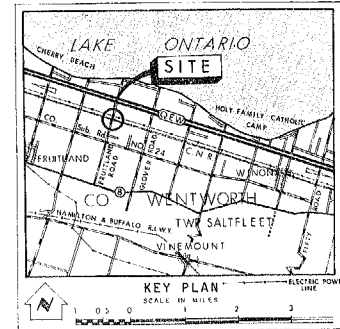
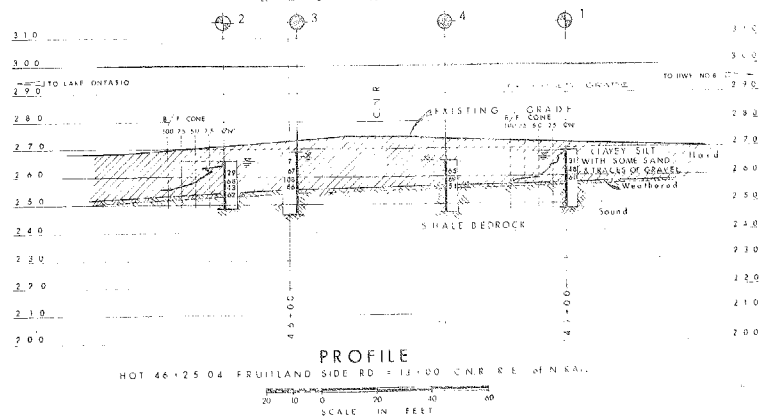
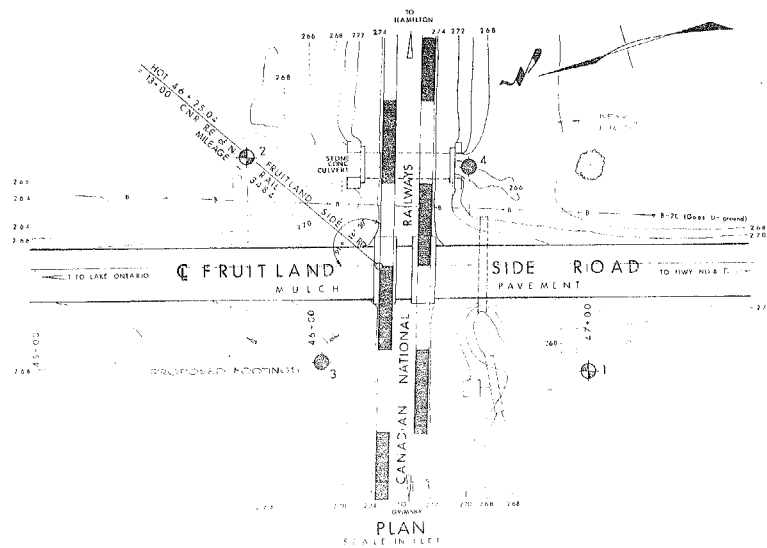
#66-F-58

W.P. #209-63-2

FRUITLAND

SIDE RD. E

C.N.R.



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Hole 3 Cone Penetration Hole		
	Water Levels established at time of field investigation		

NO.	ELEVATION	STATION	OFFSET
1	269.0	47+60	38.7' R
2	265.1	47+40	39.5' L
3	267.0	48+00	34.5' R
4	265.7	48+10	35.7' L

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

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING DIVISION - FOUNDATION SECTION			
FRUITLAND SIDE ROAD			
CANADIAN NATIONAL RAILWAYS			
CO. WENTWORTH		DIST NO. 4	
TWP. SALTFLY		LOT 14, 15, CON. 1	
BORE HOLE LOCATIONS & SOIL STRATA			
DESIGNED L.P.	CHECKED A.L.	W.P. NO. 209-63-2	PLAN DRAWING NO.
DRAWN J.N.	CHECKED J.C.	JOB NO. 66-F-58	66-F-58A
DATE 10.1.1964	A.U.G. 1964	SITE NO.	BRIDGE DRAWING NO.
APPROVED	IN CHARGE	SENT NO.	

REF. NO. 8-4738-1