

M.P. 704-64.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. M. Toye,
Bridge Engineer,
Bridges Division.

From: Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Testing Div.,

Attention: Mr. S. McMillan

Date: September 21, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Structure at C.N.R. and
Development Road 183 (County Rd. 22)
Lincoln County, Co. of Clinton, Ont.
District No. 4

W.J. 64-7-73

--

M.P. ~~704-64~~

704-64

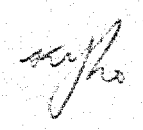
Attached, we are forwarding to you, our detailed
foundation investigation report on the subsoil conditions
existing at the above structure site.

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

KVL/MdeF
Attach.

cc: Messrs.

A. M. Toye (3)
H. A. Gregaskes
H. D. McMillan
G. K. Hunter (2)
H. Greenland
T. J. Kovich
A. Watt


A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

Foundations Office
Gen. Files

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF SITE.
 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL CONDITIONS:
 - 4.1) General.
 - 4.2) Fill Material.
 - 4.3) Clayey Silt with Sand and Occasional Gravel (Glacial Till).
 5. GROUND WATER CONDITIONS.
 6. DISCUSSION & RECOMMENDATIONS.
 7. SUMMARY.
 8. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT

For

Proposed Structure at C.N.R. and
Development Road 683 (County Rd. 22),
Lincoln County, Twp. of Clinton, Ont.
District No. 4

W.J. 64-F-73 -- W.P. 707-62

1. INTRODUCTION:

A request dated July 28, 1964, for a foundation investigation at the site of the proposed structure at the C.N.R. and Development Rd. 683 (Vineland Rd.). was received from C. C. Parker & Parsons, Brinckerhoff Ltd.

A field investigation was carried out by this Section during August 1964, to determine the subsoil conditions at the above-mentioned site. Presented in this report are the results of our investigation together with our recommendations pertaining to the design of the structure foundations and approach cuts.

2. DESCRIPTION OF SITE:

The site is located about 3 miles north of Vineland. The surrounding area is generally flat, and consists mostly of orchards.

Physiographically, the site is located in the region referred to as the "Trogubis Plain".

3. FIELD AND LABORATORY WORK:

The soil investigation at this site comprised of two sampled boreholes and four dynamic cone penetration tests. The

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

borings were carried out by means of conventional diamond drilling equipment adapted for soil sampling purposes.

Samples were recovered at required depths, by means of a 2" O.D. split-spoon sampler. The dimensions of the split-spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test.

The location and elevations of all the boreholes are shown on Drawing No. 64-F-73A, which accompanies this report.

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

- i) Natural Moisture Contents.
- ii) Bulk Densities.
- iii) Atterberg Limits.
- iv) Grain Size Distributions.

4. SUBSOIL CONDITIONS:

4.1) General:

The subsail conditions at the site were found to be generally uniform with relatively minor variations only.

From ground level downward, the various soil types encountered, are as follows:

4.2) Fill Material:

The embankment fill is about 10 ft. in height and carries the three C.N.R. rail tracks at this crossing. The fill material

cont'd. /3 .

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

4.2) Fill Material: (cont'd.) ...

is generally composed of a heterogeneous mixture of clayey silt, sand and occasional gravel, and was found in a loose to compact state, with 'N' values ranging from 6 to 13 blows per foot.

4.3) Clayey Silt with Sand and Occasional Gravel (Glacial Till):

Underlying the fill material, the deposit of clayey silt with sand and occasional gravel, was observed in all the boreholes. This stratum was proved to a maximum depth of 50 ft. below the existing ground surface.

Atterberg limits, moisture contents and grain-size distribution test results for this deposit are as follows:

Liquid Limit Range	.....	23%	to	32%
Plastic Index Range	.....	14%	to	17%
Moisture Content Range	..	13%	to	17%

Grain Size Distribution: -

Gravel	.....	2%	to	18%
Sand	.....	19%	to	28%
Silt	.....	35%	to	54%
Clay	.....	19%	to	31%

Standard Penetration Test or 'N' values ranged from 16 to in excess of 100 blows per foot in this deposit. This indicates that the consistency of the deposit is very stiff to very hard.

cont'd. /4 ...

5. GROUND WATER CONDITIONS:

Observations carried out during the time of the field investigation, indicate the water level is approx. 8.0 ft. below ground surface in B.H. #2 and no water in B.H. #1. A drainage ditch is located very close to B.H. #2 and, therefore, it could be assumed that the water level observed in the borehole may not be the true water level.

6. DISCUSSION & RECOMMENDATIONS:

It is proposed to construct a subway at the intersection of the C.N.R. tracks and Development Rd. No. 683 (Lincoln County Rd. No. 22).

The proposed grade for the Dev. Rd. at the crossing is at approximate elevation 287.0. In order to have adequate frost protection, the footings should be located at least 5.0 ft. below this grade. At this location the subsoil conditions are favourable for spread footing type of foundations. A safe bearing load of 3 t.s.f. may be used for design purposes. The anticipated differential settlement will be negligible and consideration could be given for a rigid frame structure.

The observed water on the south side (B.H. #2) is believed to be surface water originating from the adjoining ditch located on the south side of the C.N.R. tracks. Precautions should be taken to prevent softening of foundation material by surface water during construction.

Stability problems are not anticipated for the proposed cut section adopting standard 2:1 side slopes.

7. SUMMARY:

It is proposed to construct a subway structure at the C.N.R. and Development Rd. 683 (Lincoln County Rd. 22) intersection.

The subsoil at the site consists of 10 ft. of railway embankment fill, underlain by a very stiff to very hard glacial deposit consisting of clayey silt, sand and occasional gravel.

It is recommended to found the proposed structure on spread footings placed at elevation \pm 282 ft. or below, with a safe bearing pressure of 3 t.s.f.

No stability problems are anticipated for the proposed cut sections using 2:1 standard slopes.

8. MISCELLANEOUS:

The field work was carried out during August 4 to August 6, 1964, under the supervision of Mr. V. Korlu, Project Foundation Engineer, who also wrote this report. The report was reviewed by Mr. M. Devata, Senior Foundation Engineer.

The drilling equipment was supplied by Dominion Soil Investigation Ltd. of Toronto.

September 1964

APPENDIX I.

CHECKED BY M.D.

[illegible]

CHECKED BY M.D.

Gr-3
Sa-24
Si-54

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 64-F-73

LOCATION Sta. 701+24; 25' to Right.

ORIGINATED BY V.K.

W P 707-62

BORING DATE Aug. 5, 1964.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Cone Penetration Test

CHECKED BY M.D.

[illegible]

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

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

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

TYPE OF SAMPLE

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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_i	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
τ_l	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

C. C. PARKER & PARSONS, BRINCKERHOFF LTD.
CONSULTING ENGINEERS
795 MAIN STREET WEST
HAMILTON, ONTARIO
CANADA

July 28, 1964.

Mr. T. Stermac, P. Eng.,
Foundations Section,
Department of Highways, Ontario,
Parliament Buildings,
Toronto, Ontario.

Dear Sir:

⁷⁰⁴⁻⁶⁴
Re: W.P. ~~707-62~~, Development Road 683, Lincoln County Road
No. 22, District 4, Hamilton

We enclose two prints of drawing 2019 B.H. showing the location of boreholes we would like you to make to enable us to determine the type of structure and allowable bearing pressure to be used for the proposed subway on the Development Road 683. We have shown a simple span structure but if conditions are favourable we could perhaps use a rigid frame structure.

Note: WP has been changed from 707-62 to 704-64 for instructions of Mr. T. Hannon on Dec 18, 1964.

Yours very truly,

C.C. Parker & Parsons, Brinckerhoff Ltd.,

C.K. Moulson

C. K. Moulson, P. Eng.,

for:

J. W. Disher, P. Eng.,
Project Manager.

CKM:m
Encl.

Teletype sent to District
Informed Mr T. J. Kovich

M. Savata
July 31/64.

MEMORANDUM

TO: Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

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

Attention: Mr. S. McCombie

DATE: December 1, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Structure at C.N.R. and
Development Road 683 (County Rd. 22)
Lincoln County, Twp. of Clinton, Ont.
District #4
W.J. 64-F-73

W.P. 704-64

The above Foundation Investigation Report in your files
reads "W.P. 707-62". Would you please make the necessary
revisions and change it to W.P. 704-64.

AS/pb

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

cc: Messrs. A. M. Toye (3)
H. A. Tregaskes
H. D. McMillan
G. K. Hunter (2)
H. Greenland
T. J. Kovich
A. Watt

Foundations Office -
Gen. Files

Mr. S. McCombie,
Bridge Planning Engr.,
Bridge Division.

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

Attn: Mr. W. Melnyshyn

May 13, 1965

C.N.R. Subway,
1.2 Miles South of Q.E.W.,
Dev. Rd. #683, W.P. 704-64,
District #4. W.J. 64-F-73

We have reviewed the Preliminary Plan
No. C-20740 prepared by the C.N.R. for the above-
mentioned structure.

The designer appears to have followed the
recommendations contained in the foundation report.

M. Devata
M. Devata,
SENIOR FOUNDATION ENGINEER

MD/MdeF

For:
K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

cc: Foundations Office ✓
Gen. Files

MEMORANDUM

To: Mr. K. Y. Lo,
Supervising Foundation Eng.,
Lab. Blag.

FROM: Bridge Division,
Downsview, Ontario.

DATE: May 11, 1965.

OUR FILE REF.

IN REPLY TO

SUBJECT: C.N.R. Subway
1.2 mi. South of Q.E.W.
Dev. Rd. #683 W.P. 704-64
District #4.

Enclosed please find a print of the preliminary bridge plan No. C-20740 prepared by the C.N.R.

A foundation investigation at the above site was done by the Department in August 1964. (Report No. W.J. 64-F-73)

Would you please review the plan and inform us if you have any comments or let us have your approval if satisfactory.

W. S. Melinyshyn

W. S. Melinyshyn,
Regional Bridge Location Engineer.

WSM/eb

No comments.

64-F-73

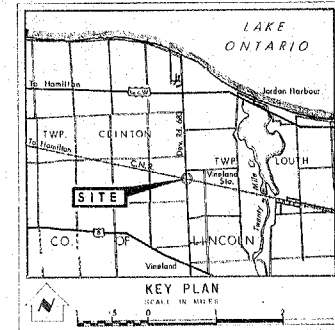
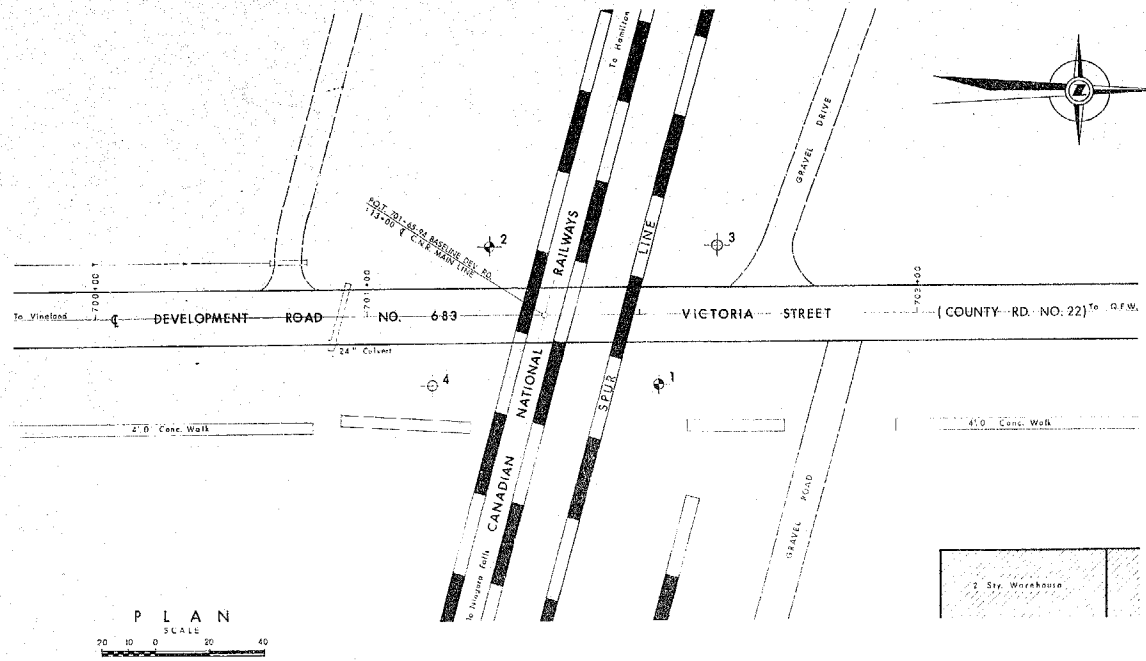
W.P. # 707-62

NEW W.P. # 704-64

DEV. RD. # 683

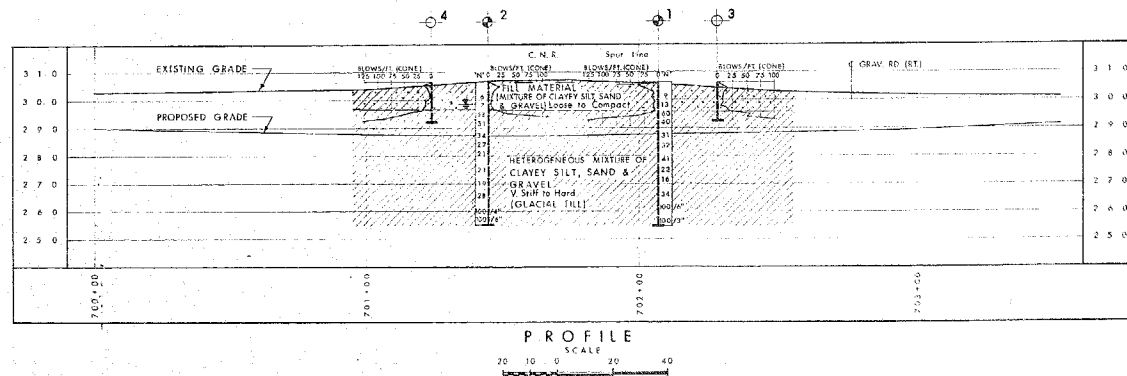
in C.N.R.

430500 E.
4780800 N
33143 W



LEGEND				
	Bore Hole			
	Core Penetration Hole			
	Bore Hole Core Penetration Hole			
	Water Levels established at time of field investigation (Aug. 4, 1964)			
NO.	ELEVATION	STATION	OFF SET	
1	3 0 6 0	7 0 2 + 0 7	25' RT.	
2	3 0 6 3	7 0 1 + 45	25' LT.	
3	3 0 6 0	7 0 2 + 28	25' LT.	
4	3 0 6 3	7 0 1 + 24	25' RT.	

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.



NO.	DATE	BY	CHKD.	APP'D.
1				
2				
3				
4				

DEPARTMENT OF HIGHWAYS - ONTARIO
NATURAL & RESEARCH DIVISION - FOUNDATION SECTION

CANADIAN NATIONAL RAILWAY

KING'S HIGHWAY NO. DEVELOPMENT ROAD NO. 683 DIST. NO. 4
CO. LINCOLN, N. & S. 4
TWP. LOUTH & CLINTON LOT 23 & 1 CON. II & III

BORE HOLE LOCATIONS & SOIL STRATA

DESIGNED BY W. M. K.	CHECKED BY D. M.	DATE 14 AUG. 1964	W.P. NO. 707-62	JOB NO. 64-F-73	BORE HOLE NO. 64-F-73 A
APPROVED BY C. G. PARKER			PROJECT DRAWING NO. W/P 704-64		

REV. - C. G. PARKER AND PARSONS, BRINCKERHOFF, LTD. NO. 2019 - 811