

## DEPARTMENT OF HIGHWAYS ONTARIO

## MEMORANDUM

file 28-2.

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

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

DATE: September 14, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Simcoe Patrol Yard  
Part Lot 1, Con. 9, Twp. of Townsend,  
Hwy. #24A, District #2 (London, Ont.)  
W.J. 65-F(R)-64 -- W.P. (Nil)

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 feel free to contact our Office

AGS/MdeF  
Attach.

cc: Messrs. C. S. Moase (4)  
E.J. Orr  
D. W. Farren  
H. C. Dernier  
J. Roy  
A. Watt

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

Foundations Office  
Gen. Files

FOUNDATION INVESTIGATION REPORT  
For  
Simcoe Patrol Yard  
Part Lot 1, Con. 9, Twp. of Townsend,  
Hwy. #24A, District #2 (London, Ont.)  
W.J. 65-F(R)-64 -- W.P. (Nil)

A request for a foundation investigation at the site of the proposed D.H.O. Patrol Yard at Simcoe, was received from Special Services Section, during April 1965.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the site. Following are the results of this investigation, together with our recommendations.

The field investigation consisted of 3 sampled boreholes and 6 dynamic cone penetration tests.

The subsoil at the site was found to be uniform over the proposed location, and consists of about three different deposits. The boundaries of these deposits are shown on the accompanying Dwg. No. 65-F(R)-64A.

1.) Silty Fine Sand:

This layer was encountered in all boreholes with a slight variation in thickness: 6' to 8', and extends from ground level to an average elevation of 758.5'. The material consists of yellow to brown coloured silty fine sand with traces of medium sand and decayed organic substances. The relative density may be described as compact. The 'N' values ranged from 16 to 21 blows per foot. The average moisture content was found to be: 24.2%.

cont'd. /2 ...

2.) Silt:

This stratum underlies the silty fine sand material, with a thickness of 17'. The colour of this silt deposit is grey. The upper portion contains traces of fine sand (3 to 5%). The relative density may be described as loose to compact, with an average 'N' value of 11 blows per foot.

3.) Sandy Silt to Silty Sand:

The silt layer is underlain by compact to dense sandy silt to silty sand material. The lower boundaries were not determined since the borings were terminated in this layer.

In view of the above, it is estimated that for the proposed building, a safe net pressure of 0.5 t.s.f. may be achieved at a depth of 6 feet below ground level. No stability problems are anticipated for a proposed sand pile within the site area.

Attention is drawn to the fact that the subsoil has a high permeability and it is quite possible that water contaminated with salt will be able to drain away through it. A well supplying water to a private house is located some 1,500 feet easterly from the site, and in view of the above facts, the danger of salt contamination must be presumed to exist. The water level was found to be 6' to 8' in the boreholes.

With regard to possible future paved and gravelled areas, the following recommendations were received from the

cont'd. /3 ...

Regional Materials Engineer:

"It is recommended that provision be made for 30" of granular on all traffic areas. This depth of granular should consist of 4" G.B.C. Class A over 26" of Sand Cushion.

The average depth of stripping may be taken as 9" for design purposes.

The asphalt should consist of 1½" H.L.3 surface course and 2" H.L.6 modified binder course.

The compaction item should be placed at 100% for a wobble wheel roller and tractor."

The field work was carried out during the period of June 8 to June 10, under the direction of Mr. P. Payer, Project Foundation Engineer, who also prepared this report under the supervision of Mr. K. G. Selby, Senior Foundation Engineer.

September 1965

APPENDIX I

## 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

$\pi$	$\approx 3.1416$
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

65-F-64

Mr. A. Gater,  
Regional Design Engineer,  
London

Materials & Testing,  
London

September 9, 1965.

Re: Proposed Simcoa Patrol Yard

On August 30, 1965 six hand auger holes were placed at the proposed site.

It was found that the subsoil consisted of a silty loam under an average of 9" of topsoil.

It is recommended that provision be made for 30" of granular on all traffic areas. This depth of granular should consist of 4" G.B.C. Class A over 26" of sand cushion.

The average depth of stripping may be taken as 9" for design purposes.

The asphalt should consist of 1 1/2" H.L. 3 surface course and 2" H.L. 6 Modified binder course.


The compaction item should be placed at 100% for a wobble wheel roller and tractor.

BS/jb

cc: G.A. Wrona  
T. Sternac  
H.C. Bernier  
D. Suzuki

file

for:

  
D. Suzuki  
J.R. Roy  
Regional Materials Engineer



Cincoes Patrol Yard

DATE Aug. 30/65

T.H. # 1

0-10" Tpsl.

10"-20" Lt. Br.Si.Lo.-V.F.Sa.Lo.

20"- Lt. Br.Si.Lo.

T.H. # 2

0-5" Tpsl.

5"-48" Lt. Br.Si.Lo.

T.H. # 3

0-8" Tpsl.

8"-36" Lt.Br. Si.Lo. (Moist @ 35")

T.H. # 4

0-8" Tpsl.

8"-36" Lt.Br.Si.Lo.

T.H. # 5

0-10" Tpsl.

10"-36" Lt. Br.Si.Lo.

T.H. # 6

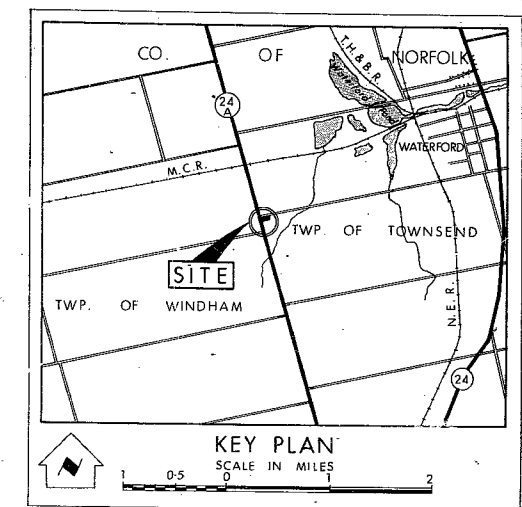
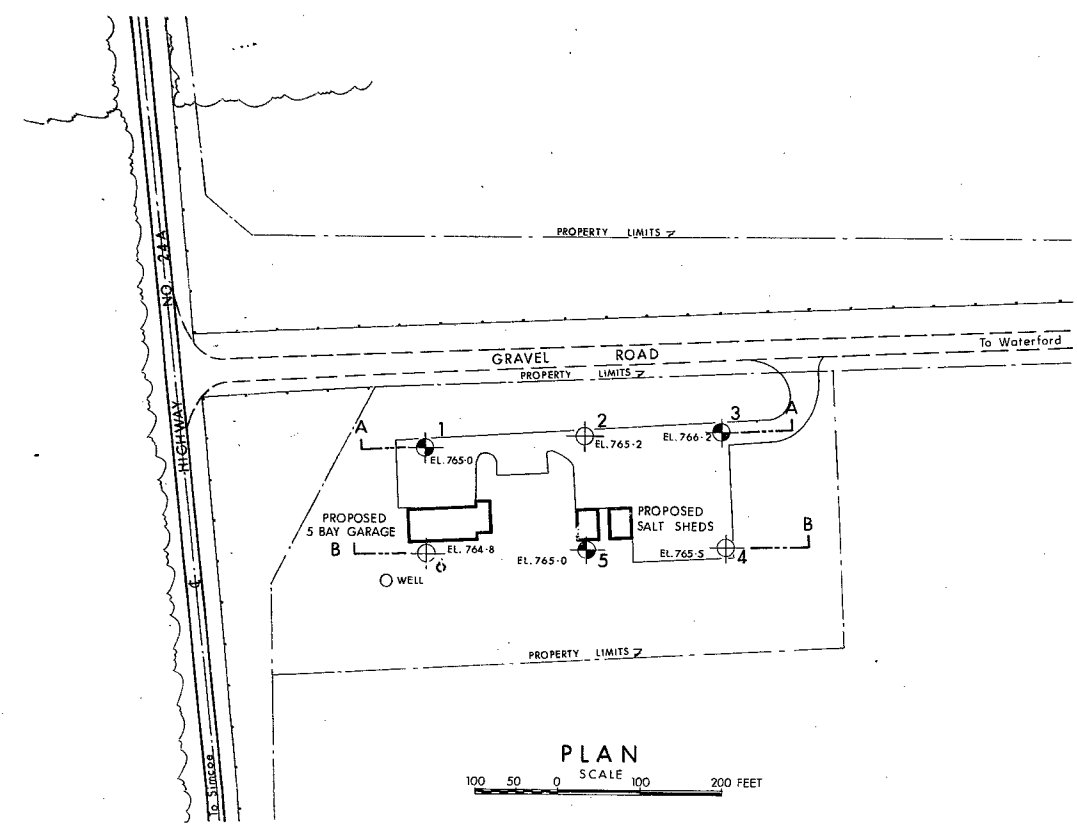
0-11" Tpsl.

11"-10" Lt. Br.Si.Lo.-V.F.Sa.Lo.

18"-24" Br.Si.Cl.Lo.

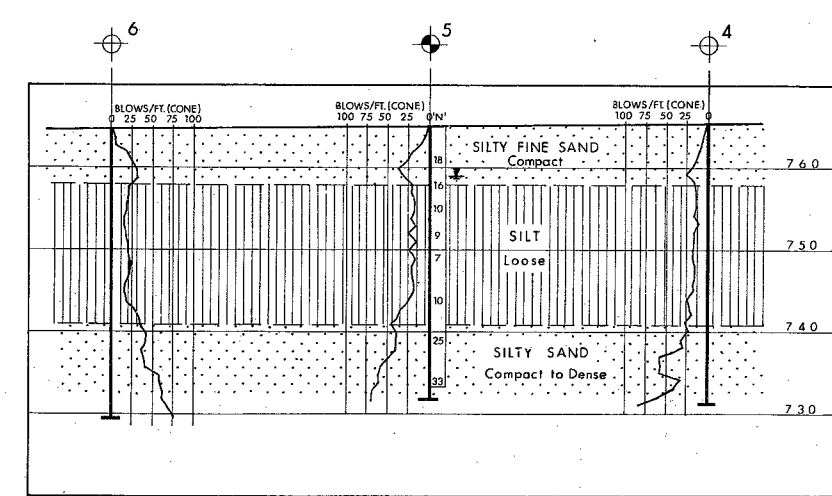
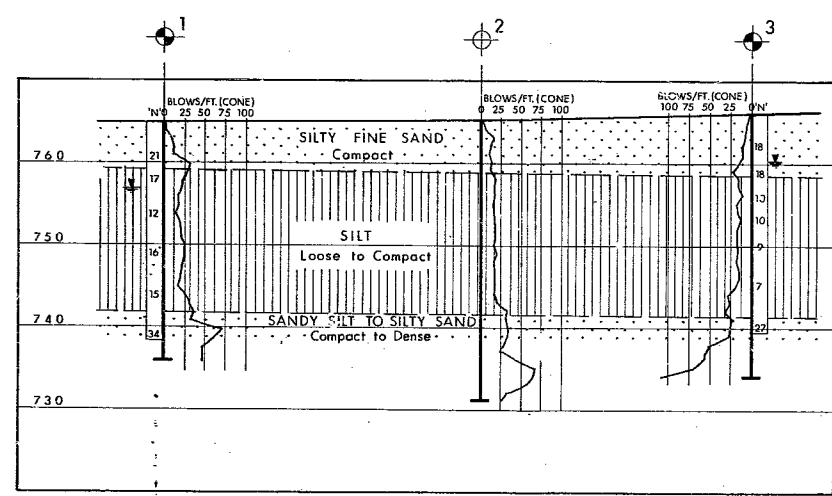
24"-36" Lt. Br.F.Sa.V.F.Lo.

#65-F(R)-64  
HWY. #24A  
SIMCOE PATROL  
YARD  
TOWNSEND TWP.



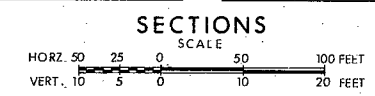
LEGEND

- ⊕ Cone Penetration Hole
- ⊙ Bore & Cone Penetration
- ⬇ Water Level (9 June 1965)



A - A

B - B



- 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 & RESEARCH SECTION			
PROPOSED SIMCOE PATROL YARD			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY. 24 A	DISTRICT 2	COUNTY NORFOLK	
TOWNSHIP TOWNSEND	LOT 1	CON. IX	
LOCATION 5 Miles North of Simcoe			
DRAWN BY: S. O.	CHECKED BY:	W.P.	
DATE 21 JULY 1965	APPROVED BY:	DRAWING NO.	
SCALE AS SHOWN		65-F(R)-64A	