

MEMORANDUM

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

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

DATE:

OCT 26 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Additional Construction at
D.H.O. Patrol Yard at Harrow, Hwy. #18
Lot 1, Conc. 2, Colchester Township,
District #1 (Chatham)
W.J. 65-F(R)-103 -- W.P. (Nil)

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

We believe that the factual data and recommendations contained therein, will suffice for your design requirements. Should further 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
F. C. Brown
J. Roy
A. Watt

Foundations Office
Gen. Files

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

FOUNDATION INVESTIGATION REPORT
For
Proposed Additional Construction at
D.H.O. Patrol Yard at Harrow, Hwy. #18,
Lot 1, Conc. 2, Colchester Township,
District #1 (Atham)
W.J. 65-F(R)-103 -- W.P. (N11)

It is proposed to construct a new 4-bay metal garage and to relocate the sand pile at the above D.H.O. Patrol Yard located on Hwy. #18, about 5 miles West of Harrow. A request for a foundation investigation, dated August 11, 1965, was received from the Special Services Section.

Subsequently, a field investigation was carried out by this Section in order to determine the subsoil conditions. Three boreholes were drilled at selected locations. The locations and elevations of these boreholes are shown on Dwg. 65-F(R)-103A, which is attached to this report.

A twelve-inch surface layer of topsoil was found in all boreholes. Immediately below the topsoil, a deposit of clayey silt with sand, extending to the end of the boreholes was encountered. Standard Penetration Test (N) values varied from 6 blows/ft. to 70 blows/ft. One field vane test gave a result of 1,920 p.s.f. Based on these values, the consistency of the stratum may be estimated as firm to hard. Because of the relatively impermeable nature of the subsoil, it was not possible to obtain ground water levels during the time of investigation.

It is recommended that the garage be supported on spread footings placed at elevation 600 or lower. A safe bearing pressure

cont'd. /2 ...

of 2 t.s.f. may be used for design purposes. No stability problems with regard to the sand pile are anticipated.

There are a number of wells located in the area surrounding the Patrol Yard, the nearest being about 400 ft. towards the east. These wells are generally quite deep and protected with steel casing.

The recommendations given by Mr. J. R. Roy, Regional Materials Engineer, for grading and paving are as follows:

It is recommended that provision be made for 24 in. granular (6 in. G.B.C. "A" and 18 in. Sand Cushion) on this Patrol Yard. Any topsoil encountered within 3 ft. of profile grade should be removed and replaced with acceptable material up to the upgrade level. The Hot Mix asphalt pavement should consist of a 2-in. HL6 (modified) binder course and a 1½-in. HL6 (modified) surface course. It is also recommended that a 6-in. sub-drain pipe be installed around the edges of the area which is to be paved. This pipe should be placed 1 ft. below the subgrade, with an outlet to the adjacent road drainage.

The field investigation carried out on September 22 and 23, 1965, together with the preparation of this report, was undertaken by Mr. R. Magi, Project Foundation Engineer. The project was under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

October 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

| | | | |
|-----|---------------------------------|------|-----------------|
| 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 |
| 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 |
| 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_o | 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 |

#65-F(R)103

HWY #18

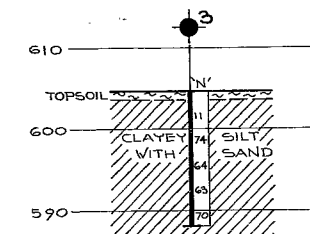
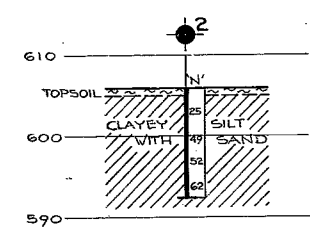
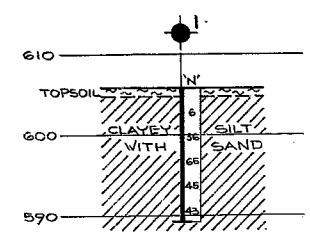
D.H.O. PATROL

YARD

HARROW

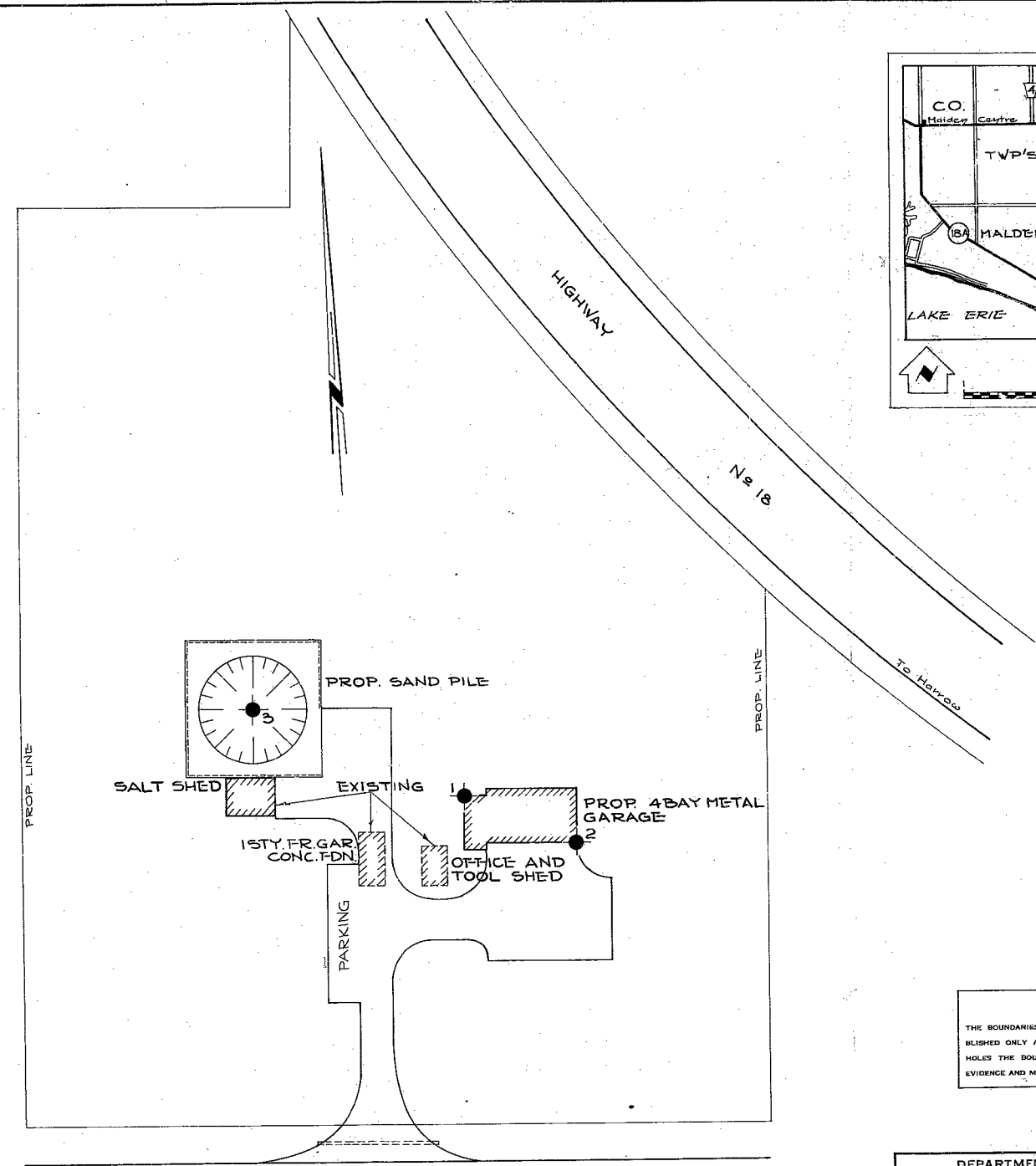
354600E
4655900N

40 J 2W



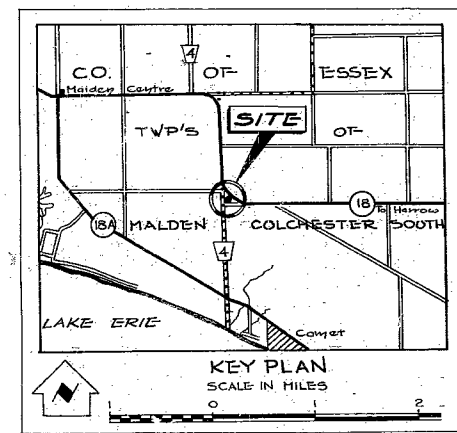
BOREHOLE STRATIGRAPHY
SCALE IN FEET

ROAD ALLOWANCE BETWEEN TOWNSHIP OF MALDEN AND COLCHESTER SOUTH



ROAD ALLOWANCE BETWEEN CONS I & II

PLAN
SCALE IN FEET



- 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 | | | |
| HARROW PATROL YARD | | | |
| SHOWING POSITIONS & ELEVATIONS OF HOLES | | | |
| HWY. 16 | DISTRICT 1 | COUNTY ESSEX | |
| TOWNSHIP COLCHESTER SOUTH LOT 1 | CON. II | | |
| LOCATION 4 MILES WEST OF HARROW | | | |
| DRAWN BY: DGH | CHECKED BY: [Signature] | W.P. | |
| DATE 20 OCT. 1965 | APPROVED BY: [Signature] | DRAWING NO. | |
| SCALE 1 IN. = 50 FT. | | 65-F(R) 103A | |