

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

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

Attention: Mr. S. McCombie

DATE: June 22, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Overhead Structures at the
Intersection of C.N.R. and Hwy. 401,
Twp. of Etobicoke, County of York,
District No. 6, Toronto.

W.J. 64-F-31

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W.P. 239-60

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 future
design work. Should you require additional information,
please do not hesitate to contact our Office.

AGS/MdeF
Attach.

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

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

Foundations Office
Gen. Files ✓

MEMORANDUM

MURPHY

APRIL 29 1964

✓ 64-F-31

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

FROM: Bridge Division,
Downsview, Ontario.

Atten: Mr. M. Devata,
Senior Foundation Engineer.

DATE: April 28, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: Islington Ave. Interchange-Hwy. 401,
Bridge Site #38-187 | W.P. #238-60 | 64-F-34
C.N.R. O'head West of Islington, Hwy. 401,
Bridge Site #38-186 | W.P. 239-60 | 64-F-31
Basket Weave East of Islington, Hwy. 401,
64-F-35 — W.P. # 243-63, | Structure on | N-W Ramp Islington | 64-F-36
to 401, De Leuw Drawing # C-163-184,
Structure on | W-E Ramp Belfield Rd. to 401, | 64-F-37
District # 6 Highway # 401.

This is to request site investigations necessary for the design of the above structures. The approximate footing locations are shown in red on the drawing delivered to your office.

Profiles of the Islington interchange area will be forwarded to you as soon as possible.

There should be no problem involved in trespassing on private property, however if there is any doubt, please contact Ross Walker of De Leuw Cather Company Limited.

J.W. Carter

JWC/kd

J.W. Carter,
for J.B. Curtis,
Regional Bridge Location Engineer.

Informed District and Regional Material's Engineer by phone.

M. Devata
April 27/64

W. P. 85-59-6

GDGB
Fav.W. of Humber to
Belfield Rd.

W. P. 239-60-1

Str.

Br. #1 - W. Bd. Ramp to
Belfield Rd. over CNR.

-2

Str.

Br. #2 - Present CNR O'Head
for E&W Bd. Centre Cores.

-3

Str.

Br. #3 - S. Collector & E. Bd.
Ramps from Belfield Rd. over
CNR.

W. P. 442-64

Str.

Br. #4 - E. Bd. Ramp from
Belfield Rd. over N. Collector
& E. & W. Bd. centre Core.

W. P. 608-64

St

Br. #5 N. to S. Bd. Ramp to
N. Collector.

W. P. 238-60

St

Br. #6 ^{Islington} ~~Kipling Ave.~~ O'Pass.

W. P. 243-63

St

Br. #7 Basket Weave E. of
Islington.

W. P. 85-59-7

GDGB

From Belfield Rd. to E. end
Hwy. 27 Interchange.

W. P. 250-61

Struct.

Kipling Ave. U'Pass.

W. P. 251-61

Str.

-1 Dixon Rd. O'Pass.

Dixon Rd.

Str.

-2 E. Bd. 401 to S. Bd.
Dixon Rd.

St

-3 W. Bd. 401 to N. Bd.
Dixon Rd.

W. P. 612-64

St

Martin Grove Rd. O'Pass.

For

Proposed Overhead Structures at the
Intersection of C.N.R. and Hwy. 401,
Twp. of Etobicoke, County of York,
District No. 6, Toronto.

W.J. 64-F-31 -- W.P. 239-60

It is proposed to construct two additional overhead structures adjacent to the existing one at the C.N.R. and Hwy. 401 intersection, one-half mile west of Islington Avenue. At the request of the Bridge Location Engineer, Mr. J. Curtis (memo dated April 28, 1964), a foundation investigation was carried out in order to determine the subsoil conditions existing at the site of the proposed structures.

This report contains the results of the investigation, together with our recommendations pertaining to the design of the foundations.

The field investigation consisted of four sampled boreholes. Adjacent to each borehole, a dynamic cone penetration test was also carried out. The locations and elevations of the boreholes are shown on the attached Dwg. 64-F-31A.

The subsoil conditions at this site were found to be generally uniform. Subsoil consists of a firm to hard heterogeneous mixture of clayey silt, sand and fine gravel (glacial till), becoming slightly less cohesive with increasing depth. The upper 5 ft. to 10 ft. of this layer consists of fill material with a firm to stiff consistency. The remainder of the deposit has a

cont'd. /2 ...

consistency ranging from very stiff to hard, with 'N' values in the order of 21 to more than 100 blows/ft. The physical properties as determined in the laboratory, are as follows:

| | |
|------------------|-----------|
| Liquid Limit | 11% - 39% |
| Plastic Limit | 10% - 19% |
| Moisture Content | 7% - 22% |

The elevations of the water levels in the boreholes are as follows:

| | <u>Elev.</u> |
|---------|--------------|
| B.H. #1 | - 516.4 |
| B.H. #2 | - 510.5 |
| B.H. #3 | - 500.4 |
| B.H. #4 | - 506.0 |

The existing structure is supported on spread footings founded at approximate elevation 498.0. It is recommended that the new structures be also founded on spread footings at the same elevation with a design pressure of 3 T.S.F.

No dewatering problems are anticipated with regard to the proposed footing excavations, since the subsoil is relatively impermeable.

No stability problems are anticipated with regard to the proposed structure approaches, provided standard 2:1 side slopes are constructed.

The field work was carried out during April 28 to May 7, 1964, under the supervision of Mr. V. Korlu, Project Foundation Engineer, who also wrote this report. This report was reviewed by Mr. M. Devata, Senior Foundation Engineer.

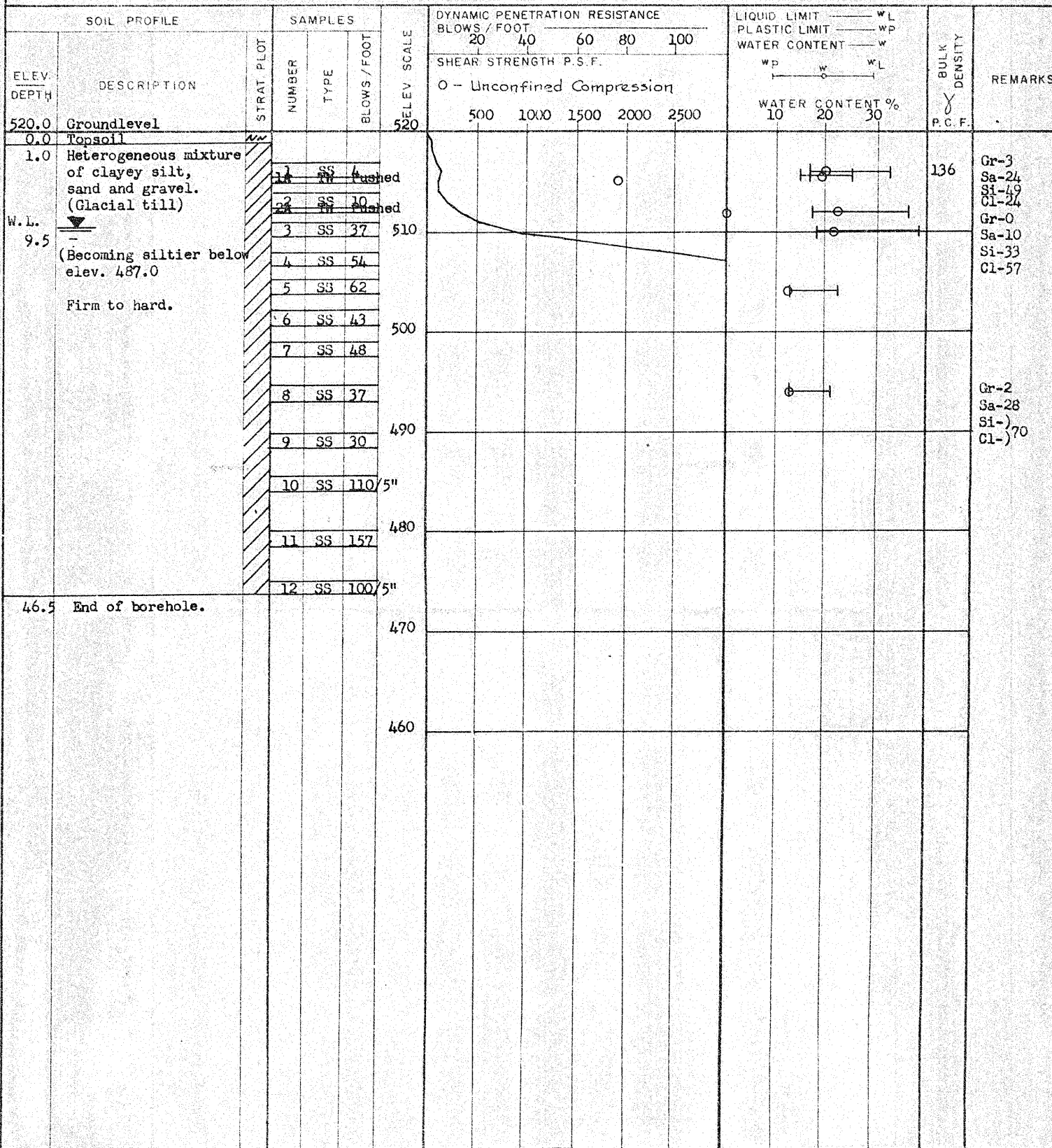
The drilling equipment was supplied by Johnston Drilling Co. of Toronto.

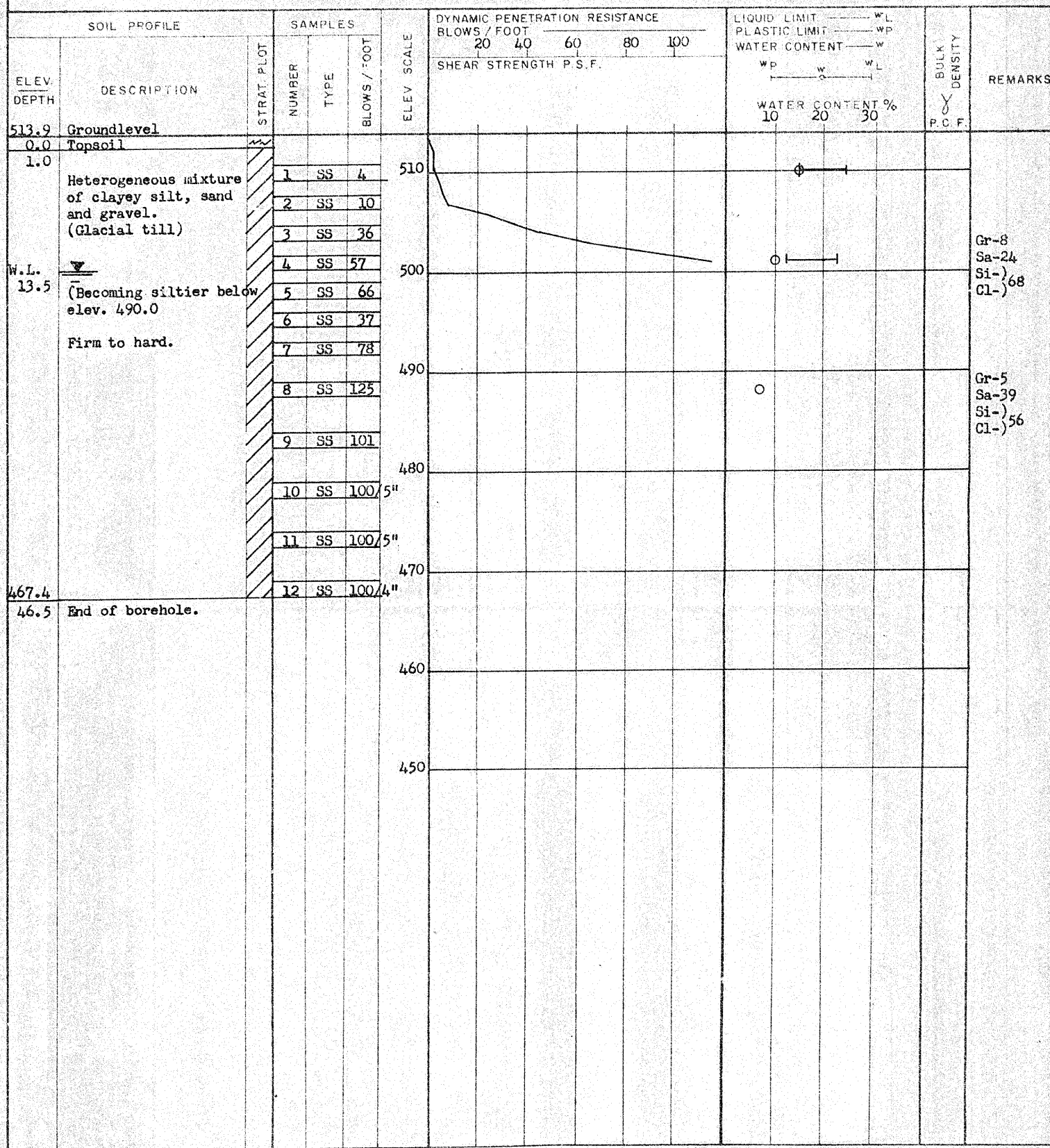
June 1964

APPENDIX I.

| SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | PLASTIC LIMIT | | WATER CONTENT | | BULK DENSITY | REMARKS |
|--------------|-------|---|-------------|--------------------------------|------|--------------|----|---------------|----|---------------|-----|--------------|---------|
| ELEV | DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | 20 | 40 | 60 | 80 | 100 | | |
| 519.9 | 0.0 | Groundlevel | | | | | | | | | | | |
| | 0.0 | Topsoil | | | | | | | | | | | |
| 1.0 | 1.0 | Heterogeneous mixture of clayey silt, sand and gravel. (Glacial till) Firm to hard. | | 1 | SS | 5 | | | | | | | |
| 3.5 | 3.5 | | | 2 | SS | 4 | | | | | | | |
| | | | | 3 | SS | 4 | | | | | | | |
| | | | | 4 | SS | 4 | | | | | | | |
| | | | | 5 | SS | 59 | | | | | | | |
| | | | | 6 | SS | 38 | | | | | | | |
| | | (Becoming siltier below elev. 491.0) | | 7 | SS | 46 | | | | | | | |
| | | | | 8 | SS | 52 | | | | | | | |
| | | | | 9 | SS | 56 | | | | | | | |
| | | | | 10 | SS | 105/6" | | | | | | | |
| | | | | 11 | SS | 80/6" | | | | | | | |
| 473.4 | 46.5 | End of borehole. | | 12 | SS | 141 | | | | | | | |

JOB 64-F-31 LOCATION Hwy. 401 & C.N.R., 440/38, 117' to Rt. of E ORIGINATED BY V.K.
W.P. 239-60 BORING DATE April 30, 1964. COMPILED BY V.K.
DATUM Geodetic BOREHOLE TYPE Wash & Bore NX Casing. CHECKED BY M.D.



JOB 64-F-31
W.P. 239-60
DATUM GeodeticLOCATION Hwy. 401, C.N.R.; 437+77, 24.9' to Lt. of C
BORING DATE May 4, 1964.
BOREHOLE TYPE Wash & Bore NX Casing.ORIGINATED BY V.K.
COMPILED BY V.K.
CHECKED BY M.D.

108 64-F-31

LOCATION Hwy. 401 & C.N.R.; 437/88, 112' to Lt.

ORIGINATED BY V.K.

W. P. 239-60

BORING DATE May 6, 1964.

COMPILED BY _____ V.K.

DATUM Geodetic

BOREHOLE TYPE Wash & Bore NX Casing.

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. 0 - Unconfined Compression | WATER CONTENT % | | | |
| 513.8 | Groundlevel | | | | | | 500 1000 1500 2000 2500 | 10 20 30 | | | |
| 0.0 | Topsoil | | | | | | | | | | |
| 1.0 | | | | | | | | | | | |
| W.L. | Heterogeneous mixture of clayey silt, sand with gravel. (Glacial till) Stiff to hard. | | 1 | TW | Push | 510 | | | | | Gr-3 Sa-24 Si-51 Cl-22 |
| 7.8 | | | 2 | SS | 17 | | | | | | Gr-2 Sa-25 Si-) 73 Cl-) |
| | | | 3 | SS | 30 | | | | | | |
| | Becoming siltier below elev. 490.0 | | 4 | SS | 108 | 500 | | | | | |
| | | | 5 | SS | 83 | | | | | | |
| | | | 6 | SS | 39 | | | | | | Gr-3 Sa-28 Si-45 Cl-24 |
| | | | 7 | SS | 100/6" | 490 | | | | | |
| | | | 8 | SS | 145/6" | | | | | | Gr-20 Sa-40 Si-) 40 Cl-) |
| | | | 9 | SS | 100/2" | 480 | | | | | |
| 472.3 | | | 10 | SS | 150/6" | | | | | | |
| 41.5 | End of borehole. | | | | | 470 | | | | | |
| | | | | | | 460 | | | | | |
| | | | | | | 450 | | | | | |

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 _u | UNCONFINED COMPRESSION | L.V. | LABORATORY VANE |
| Q | UNDRAINED TRIAXIAL | F.V. | FIELD VANE |
| Q _{cu} | CONSOLIDATED UNDRAINED TRIAXIAL | C | CONSOLIDATION |
| Q _d | DRAINED TRIAXIAL | S | SENSITIVITY |

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 |

#64-F-31

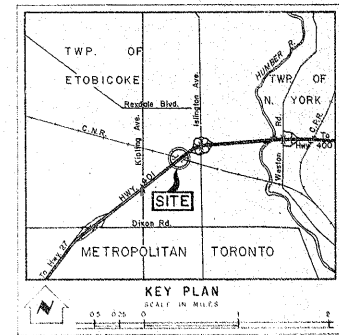
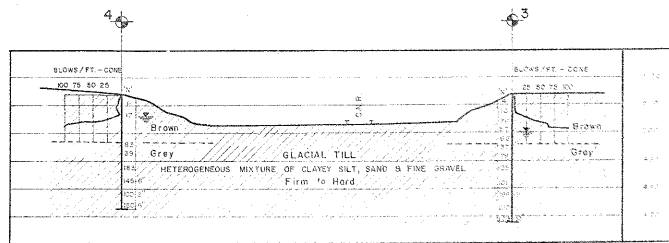
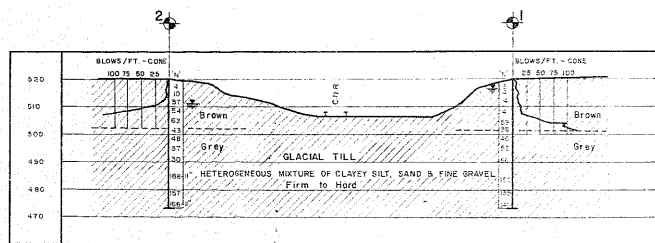
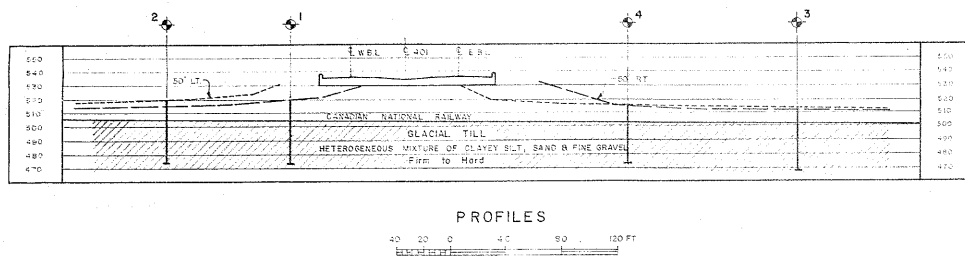
W.P. #239-60

HWY. #401 &





C.N.R. INT. PROP.

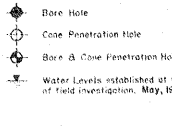
OVERHEAD

STRUCTURES



LEGEND

-  Bare Hole
-  Cone Penetration Hole
-  Bare & Cone Penetration Hole
-  Water Levels established at time of field investigation. **May, 1964**



- 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.

| DATE | | TIME | | LOCATION | | OBSERVERS | | WEATHER | | WIND | | SEA | | TEMP | | PRESS | | HUMID | | VISIB | | REMARKS | |
|---|---|------|---|----------|---|-----------|---|---------|----|------|----|-----|----|------|----|-------|----|-------|----|-------|----|---------|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| <p>1. Name of vessel: <i>USSC</i></p> <p>2. Service: <i>USCGC</i></p> <p>3. Commanding Officer: <i>LTJG</i></p> <p>4. Officer in Charge: <i>LTJG</i></p> <p>5. Name of observer: <i>LTJG</i></p> <p>6. Name of observer: <i>LTJG</i></p> <p>7. Name of observer: <i>LTJG</i></p> <p>8. Name of observer: <i>LTJG</i></p> <p>9. Name of observer: <i>LTJG</i></p> <p>10. Name of observer: <i>LTJG</i></p> <p>11. Name of observer: <i>LTJG</i></p> <p>12. Name of observer: <i>LTJG</i></p> <p>13. Name of observer: <i>LTJG</i></p> <p>14. Name of observer: <i>LTJG</i></p> <p>15. Name of observer: <i>LTJG</i></p> <p>16. Name of observer: <i>LTJG</i></p> <p>17. Name of observer: <i>LTJG</i></p> <p>18. Name of observer: <i>LTJG</i></p> <p>19. Name of observer: <i>LTJG</i></p> <p>20. Name of observer: <i>LTJG</i></p> <p>21. Name of observer: <i>LTJG</i></p> <p>22. Name of observer: <i>LTJG</i></p> <p>23. Name of observer: <i>LTJG</i></p> <p>24. Name of observer: <i>LTJG</i></p> | | | | | | | | | | | | | | | | | | | | | | | |

| | | | |
|--|---------------------------------|---------------------------|--|
| DEPARTMENT OF HIGHWAYS - ONTARIO METEOROLOGICAL RESEARCH DIVISION - CLIMATOLOGY SECTION | | | |
| CANADIAN NATIONAL RAILWAY ISLINGTON AVE. INTERCHANGE | | | |
| KING'S HIGHWAY NO. 401 | | DIST NO. 6 | |
| METROPOLITAN | | TORONTO | |
| TWP. ETOBICOKE | | CON. | |
| BORE HOLE LOCATIONS & SOIL STRATA | | | |
| CORE NO. 1 DATE: JUNE 5, 1964 | HOLE NO. 239-60 DATE: 6-4-61 | B.R. DRAWING NO. 64-F-31A | |
| DRAWN BY: <i>W. J. G. ...</i> CHECKED BY: <i>W. J. G. ...</i> | DIST NO. 6 TOWN OF ... | BRIDGE CHAINING NO. | |

[illegible]