DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-162

DIST. 6 REGION

W.P. No. 23-79-04

CONT. No. 89-84

W. O. No.

STR. SITE No. 24-72

HWY. No.

LOCATION Widening of Etobicoke Creek Crossing at Hwy 7 New

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO DB-BR 1344 81-05

# METRIC

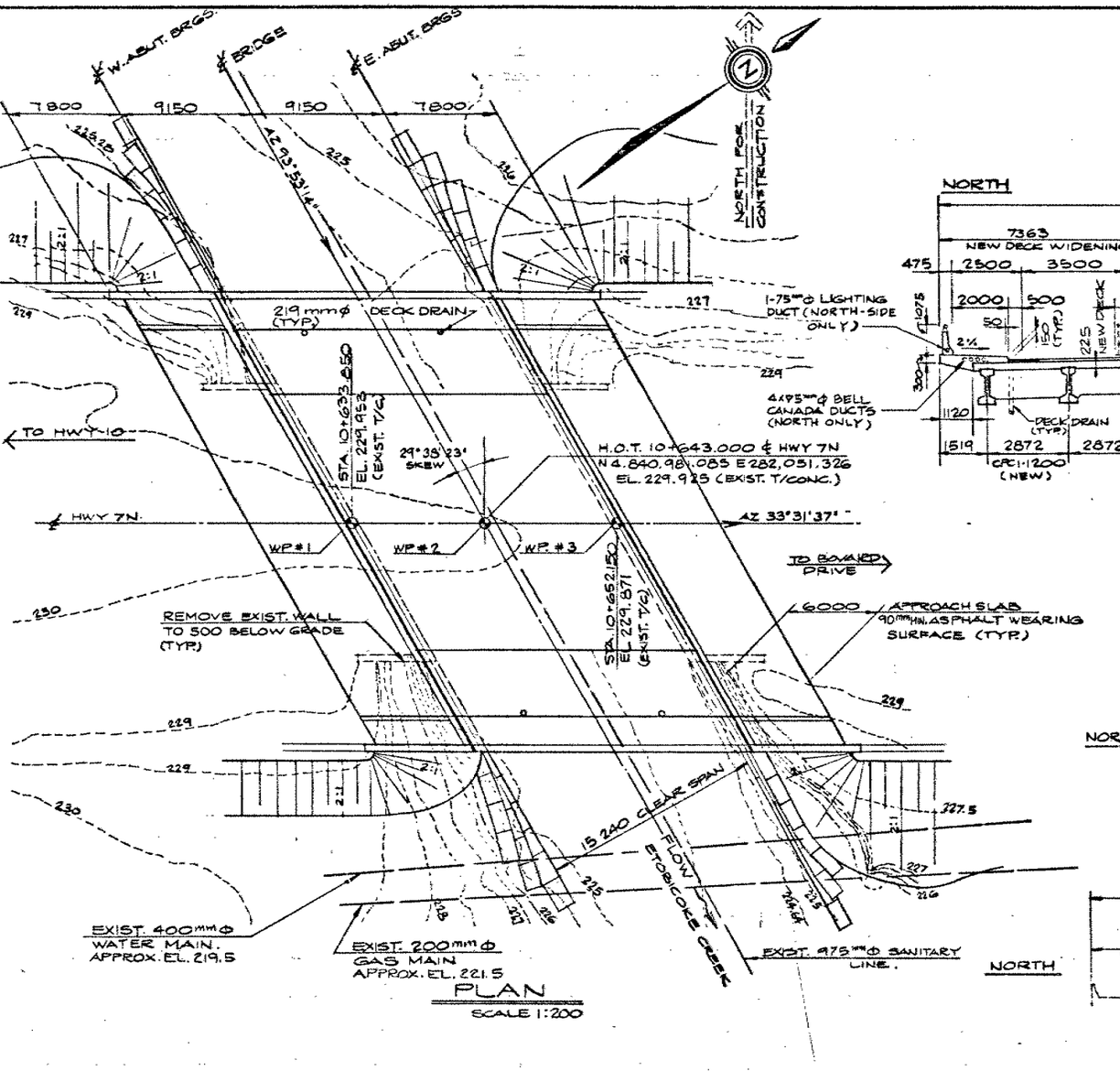
DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

DIST 6 HWY 7 NEW
CONT No
WP No 23-79-04

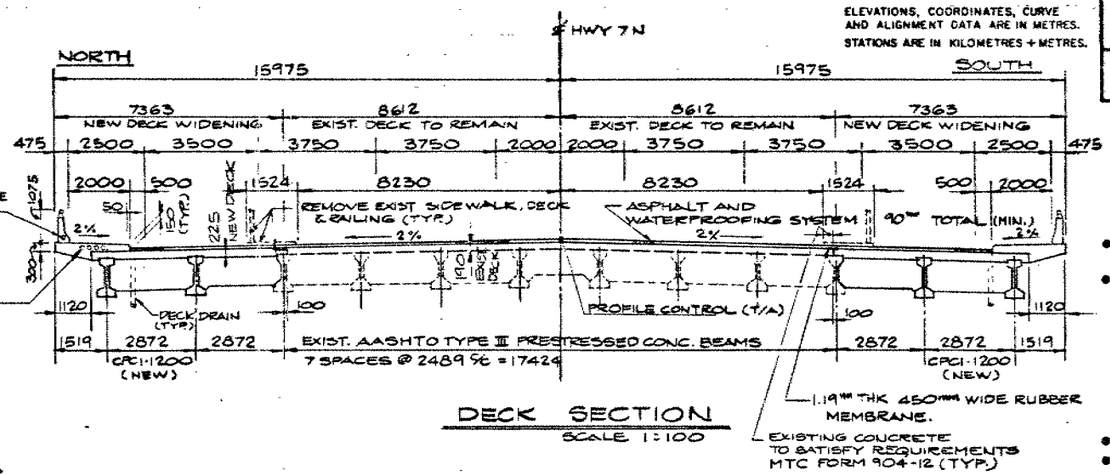
ETOBICOKE CREEK HWY 7 NEW STRUCTURE WIDENING
GENERAL ARRANGEMENT

SHEET

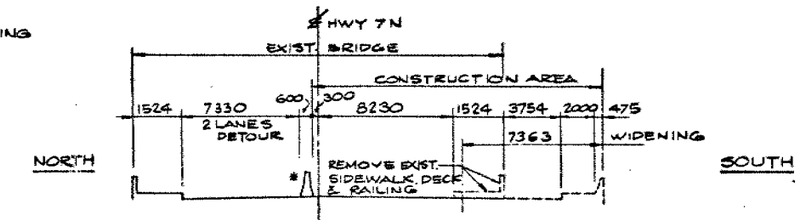
COLE, SHERMAN



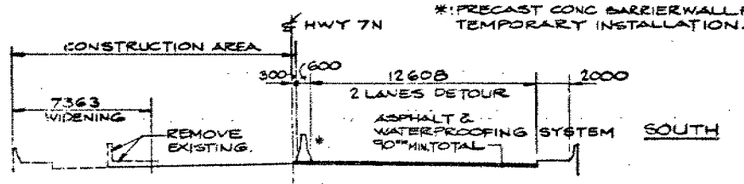

## PLAN
SCALE 1:200




## DECK SECTION
SCALE 1:100

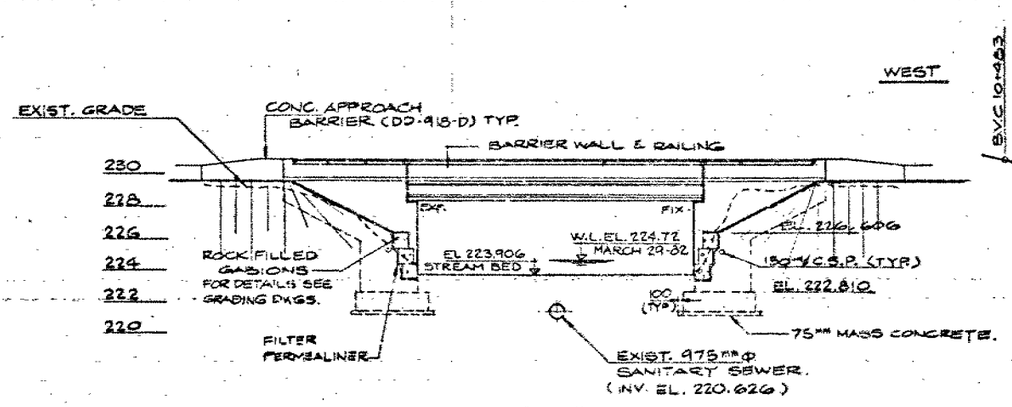



## 1ST STAGE OF CONSTRUCTION
N.T.S.

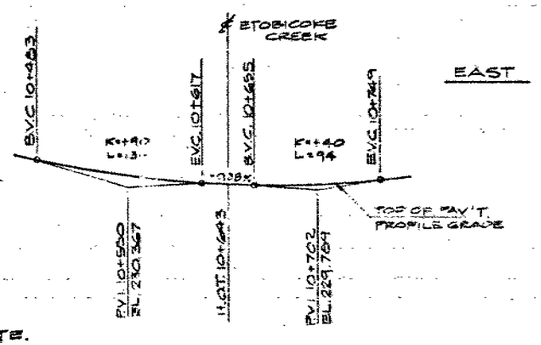



*: PRECAST CONC BARRIERWALL FOR TEMPORARY INSTALLATION.

## 2ND STAGE OF CONSTRUCTION
N.T.S.




## ELEVATION
SCALE 1:200




## PROFILE HWY 7N
N.T.S.

## NOTES:

### CLASS OF CONCRETE
- PRESTRESSED GIRDERS, DECK DIAPHRAGMS & SIDEWALKS ---- 35 MPa
- REMAINDER ---------- 30 MPa

### REINFORCING STEEL
REINFORCING STEEL SHALL BE GRADE 400. BARS MARKED WITH THE SUFFIX 'C' SHALL BE COATED BARS.

### CLEAR COVER TO REINF. STEEL
- FOOTINGS 100 ± 25mm
- ABUTMENTS AND RETAINING WALL FRONT FACE 80 ± 20
- DECK TOP 70 ± 20
  BOT. 40 ± 10
- REMAINDER 70 ± 20mm

### CONSTRUCTION NOTES
- THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH TOLERANCE OF ±3mm.

### CONSTRUCTION SEQUENCE.
- DETOUR TRAFFIC TO 2 NORTH LANES OF EXISTING DECK.
  CARRY OUT REMOVALS OF ABUTMENT, WINGWALLS, DECK, SIDEWALK & RAILINGS.
  CONSTRUCT ABUTMENT AND WINGWALLS
  INSTALL BEAMS.
  REMOVE FAULTY CONCRETE FROM THE DECK AND FOR EXPANSION JOINTS AND APPROACH SLABS INSTALLATION.
  REPAIR EXISTING DECK WITH 30 MPa CONC., CONSTRUCT DECK WIDENING.
  INSTALL APPROACH SLABS AND EXPANSION JOINTS FOR STAGE I.
  INSTALL WATERPROOFING MEMBRANE ASPHALT, 90mm MIN.
  MOVE TRAFFIC TO SOUTH SIDE OF BRIDGE.
  REPEAT THE PROCEDURE FOR THE NORTH SIDE OF DECK STAGE II.

### LIST OF DRAWINGS
1. GENERAL ARRANGEMENT
2. BORE HOLE LOCATIONS
3. EXIST. BRIDGE REMOVAL DETAILS
4. FOOTING LAYOUT
5. WEST ABUTMENT
6. EAST ABUTMENT
7. PRESTRESSED GIRDERS AND BEARINGS.
8. DECK SLAB
9. SCREED ELEVATIONS
10. BARRIER WALL WITH SIDEWALK
11. RAILING FOR BARRIER WALL
12. 6000mm APPROACH SLAB
13. STANDARD DETAILS (I)
14. STANDARD DETAILS (II)
15. BRIDGE DATE & SITE NUMBER DATA.
16. AS CONSTRUCTED ELEV. & DIMENSIONS.
17. ELECTRICAL EMBEDDED WORK
18. PLAN QUANTITY SHEET (I)
19. PLAN QUANTITY SHEET (II)

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

A.M.A. NATHOO — PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

| REVISIONS | | | |
|---|---|---|---|
| | DATE | BY | DESCRIPTION |
| | | | |

| | | | |
|---|---|---|---|
| DESIGN A.M.A.N. | CHECK D.R. | LOADING HS-20-44 | DATE DEC. '82 |
| DRAWING [illegible] | CHECK A.L.S. | SITE 24-05-72 | DWG |

# METRIC

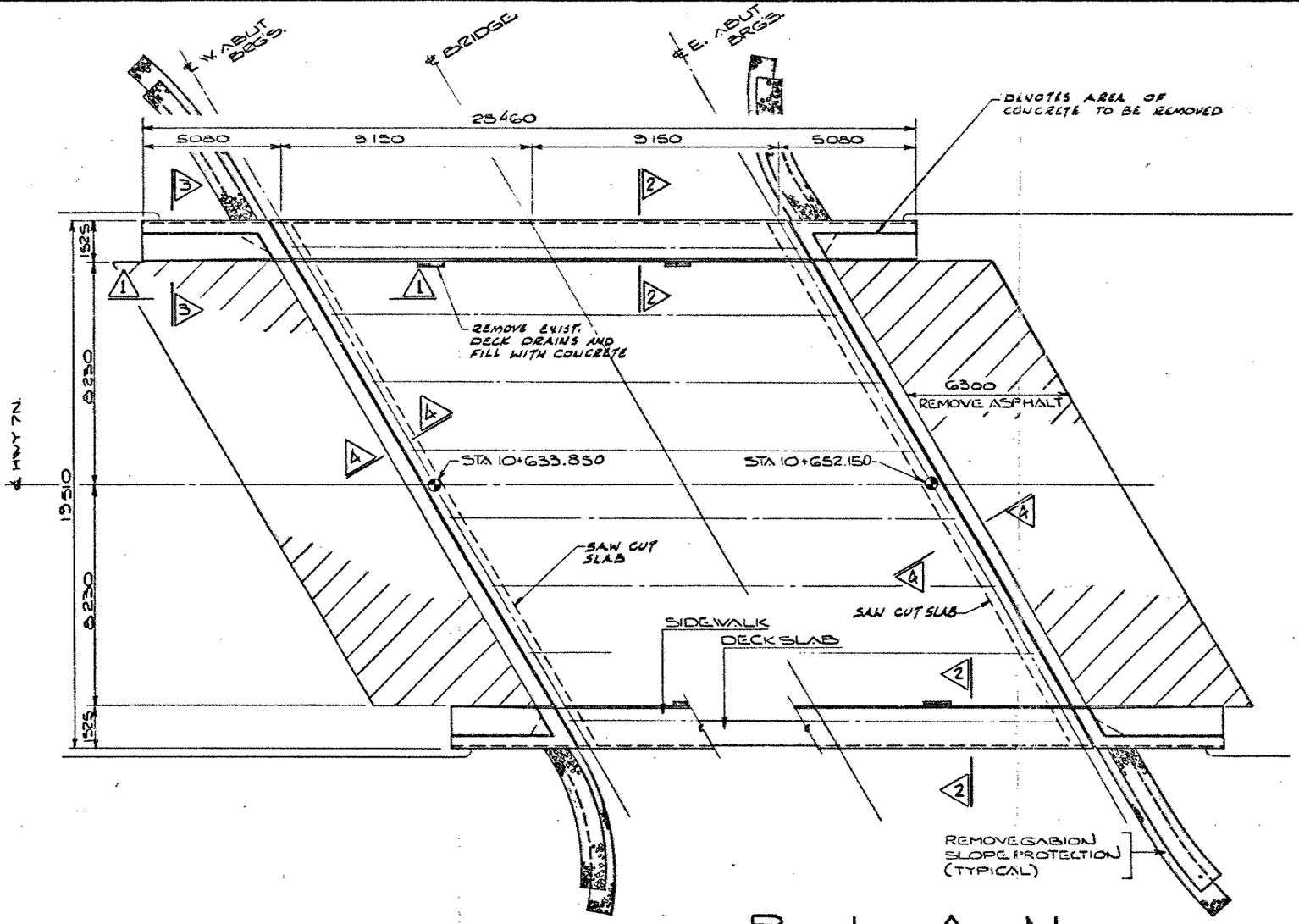
DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

DIST 6 HWY 7 NEW
CONT No
WP No 23-79-04

ETOBICOKE CREEK - HWY 7 NEW
STRUCTURE WIDENING
EXIST. BRIDGE REMOVAL DETAILS

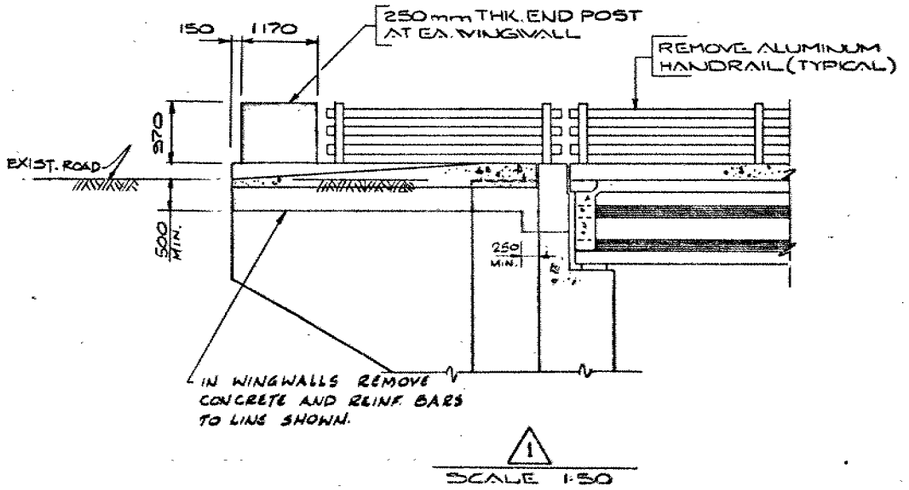
SHEET

COLE, SHERMAN

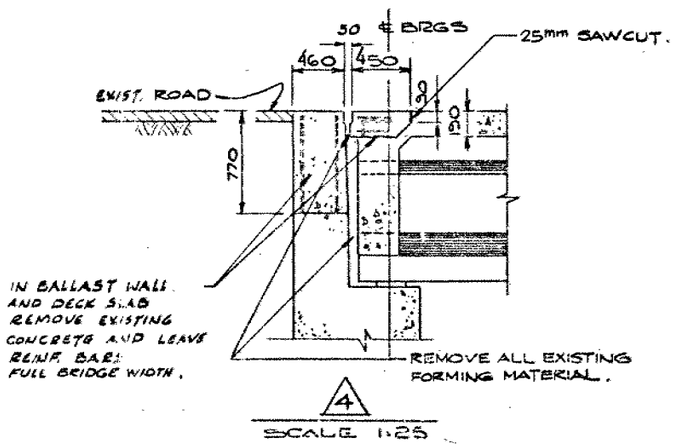



## PLAN

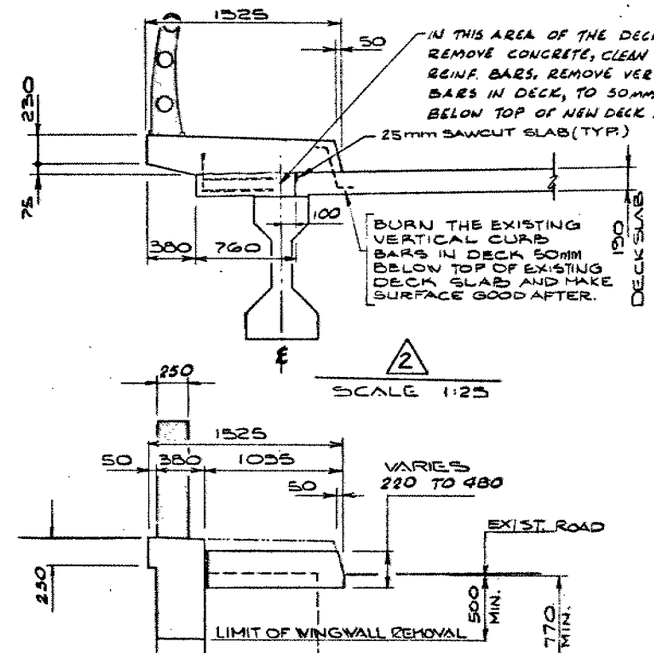
SCALE 1:100



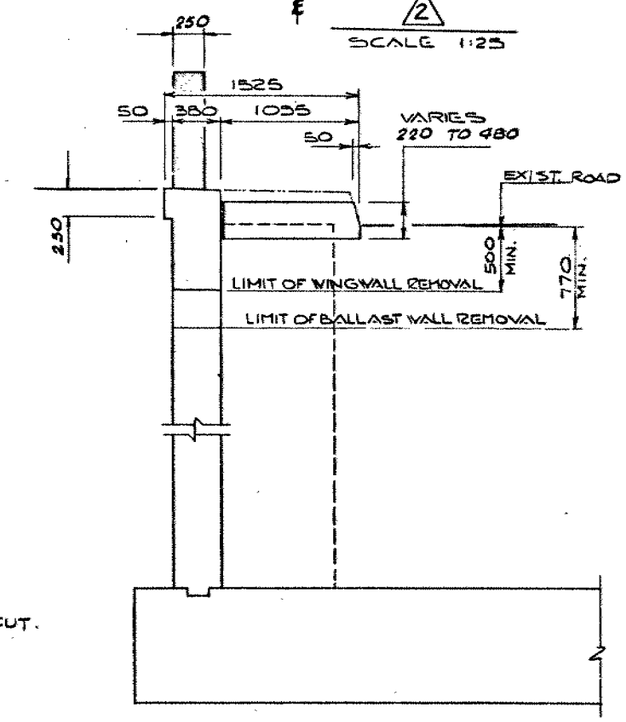

1 SCALE 1:50




4 SCALE 1:25




2 SCALE 1:25




3 SCALE 1:25

A.N.A. MATHOO — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |
| | | |

| | | | | | |
|---|---|---|---|---|---|
| DESIGN | M.S. | CHECK D.Q. | LOADING HS-20-44 | DATE DEC. 82 |
| DRAWING | B.M. | CHECK R.L.E. | SITE 24-149-72 | DWG 3 |

# FOUNDATION INVESTIGATION REPORT

## CONTRACT NO 89-84



Ontario
Ministry of
Transportation and
Communications

# I N D E X



NOTE: For the purposes of this contract, this report supersedes all other reports prepared by or for the Ministry in connection with the above-noted project.

# EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ($c_u$) AS FOLLOWS:

| $c_u$ (kPa) | 0 - 12 | 12 - 25 | 25 - 50 | 50 - 100 | 100 - 200 | >200 |
|---|---|---|---|---|---|---|
| | *VERY SOFT* | *SOFT* | *FIRM* | *STIFF* | *VERY STIFF* | *HARD* |

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 - 5 | 5 - 10 | 10 - 30 | 30 - 50 | >50 |
|---|---|---|---|---|---|
| | *VERY LOOSE* | *LOOSE* | *COMPACT* | *DENSE* | *VERY DENSE* |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

| RQD (%) | 0 - 25 | 25 - 50 | 50 - 75 | 75 - 90 | 90 - 100 |
|---|---|---|---|---|---|
| | *VERY POOR* | *POOR* | *FAIR* | *GOOD* | *EXCELLENT* |

JOINTING AND BEDDING:

| SPACING | 50mm | 50 - 300mm | 0.3m - 1m | 1m - 3m | >3m |
|---|---|---|---|---|---|
| JOINTING | *VERY CLOSE* | *CLOSE* | *MOD. CLOSE* | *WIDE* | *VERY WIDE* |
| BEDDING | *VERY THIN* | *THIN* | *MEDIUM* | *THICK* | *VERY THICK* |

# ABBREVIATIONS AND SYMBOLS

## FIELD SAMPLING

| | | | |
|---|---|---|---|
| S S | SPLIT SPOON | T P | THINWALL PISTON |
| W S | WASH SAMPLE | O S | OSTERBERG SAMPLE |
| S T | SLOTTED TUBE SAMPLE | R C | ROCK CORE |
| B S | BLOCK SAMPLE | P H | T W ADVANCED HYDRAULICALLY |
| C S | CHUNK SAMPLE | P M | T W ADVANCED MANUALLY |
| T W | THINWALL OPEN | F S | FOIL SAMPLE |

## STRESS AND STRAIN

| | | |
|---|---|---|
| $u_w$ | kPa | PORE WATER PRESSURE |
| $r_u$ | 1 | PORE PRESSURE RATIO |
| $\sigma$ | kPa | TOTAL NORMAL STRESS |
| $\sigma'$ | kPa | EFFECTIVE NORMAL STRESS |
| $\tau$ | kPa | SHEAR STRESS |
| $\sigma_1, \sigma_2, \sigma_3$ | kPa | PRINCIPAL STRESSES |
| $\epsilon$ | % | LINEAR STRAIN |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | % | PRINCIPAL STRAINS |
| E | kPa | MODULUS OF LINEAR DEFORMATION |
| G | kPa | MODULUS OF SHEAR DEFORMATION |
| $\mu$ | 1 | COEFFICIENT OF FRICTION |

## MECHANICAL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $m_v$ | $kPa^{-1}$ | COEFFICIENT OF VOLUME CHANGE |
| $C_c$ | 1 | COMPRESSION INDEX |
| $C_s$ | 1 | SWELLING INDEX |
| $C_\alpha$ | 1 | RATE OF SECONDARY CONSOLIDATION |
| $c_v$ | $m^2/s$ | COEFFICIENT OF CONSOLIDATION |
| H | m | DRAINAGE PATH |
| $T_v$ | 1 | TIME FACTOR |
| U | % | DEGREE OF CONSOLIDATION |
| $\sigma'_{vo}$ | kPa | EFFECTIVE OVERBURDEN PRESSURE |
| $\sigma'_p$ | kPa | PRECONSOLIDATION PRESSURE |
| $\tau_f$ | kPa | SHEAR STRENGTH |
| $c'$ | kPa | EFFECTIVE COHESION INTERCEPT |
| $\phi'$ | -° | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$ | kPa | APPARENT COHESION INTERCEPT |
| $\phi_u$ | -° | APPARENT ANGLE OF INTERNAL FRICTION |
| $\tau_R$ | kPa | RESIDUAL SHEAR STRENGTH |
| $\tau_r$ | kPa | REMOULDED SHEAR STRENGTH |
| $S_t$ | 1 | SENSITIVITY = $\frac{c_u}{\tau_r}$ |

## PHYSICAL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $\rho_s$ | $kg/m^3$ | DENSITY OF SOLID PARTICLES |
| $\gamma_s$ | $kN/m^3$ | UNIT WEIGHT OF SOLID PARTICLES |
| $\rho_w$ | $kg/m^3$ | DENSITY OF WATER |
| $\gamma_w$ | $kN/m^3$ | UNIT WEIGHT OF WATER |
| $\rho$ | $kg/m^3$ | DENSITY OF SOIL |
| $\gamma$ | $kN/m^3$ | UNIT WEIGHT OF SOIL |
| $\rho_d$ | $kg/m^3$ | DENSITY OF DRY SOIL |
| $\gamma_d$ | $kN/m^3$ | UNIT WEIGHT OF DRY SOIL |
| $\rho_{sat}$ | $kg/m^3$ | DENSITY OF SATURATED SOIL |
| $\gamma_{sat}$ | $kN/m^3$ | UNIT WEIGHT OF SATURATED SOIL |
| $\rho'$ | $kg/m^3$ | DENSITY OF SUBMERGED SOIL |
| $\gamma'$ | $kN/m^3$ | UNIT WEIGHT OF SUBMERGED SOIL |

| | | |
|---|---|---|
| e | 1,% | VOID RATIO |
| n | 1,% | POROSITY |
| w | 1,% | WATER CONTENT |
| $S_r$ | % | DEGREE OF SATURATION |
| $w_L$ | % | LIQUID LIMIT |
| $w_p$ | % | PLASTIC LIMIT |
| $w_s$ | % | SHRINKAGE LIMIT |
| $I_p$ | % | PLASTICITY INDEX = $w_L - w_p$ |
| $I_L$ | 1 | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$ |
| $I_C$ | 1 | CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$ |
| $e_{max}$ | 1,% | VOID RATIO IN LOOSEST STATE |

| | | |
|---|---|---|
| $e_{min}$ | 1,% | VOID RATIO IN DENSEST STATE |
| $I_D$ | 1 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| D | mm | GRAIN DIAMETER |
| $D_n$ | mm | n PERCENT - DIAMETER |
| $C_U$ | 1 | UNIFORMITY COEFFICIENT |
| h | m | HYDRAULIC HEAD OR POTENTIAL |
| q | $m^3/s$ | RATE OF DISCHARGE |
| v | m/s | DISCHARGE VELOCITY |
| i | 1 | HYDRAULIC GRADIENT |
| k | m/s | HYDRAULIC CONDUCTIVITY |
| j | $kN/m^3$ | SEEPAGE FORCE |

FOUNDATION INVESTIGATION REPORT

FOR

Etobicoke Creek Structure Widening

W.P. 23-79-04 Site 24-145-72

Hwy.7N, District 6, Toronto

PREFACE:

This report is a copy of the factual information from the Foundation Investigation Report prepared by B.P. Walker Associates Ltd. for this project.

INTRODUCTION

This report contains the results and recommendations of a foundation investigation at the above site. The field work for this project was carried out during the period February 17 to February 23, 1982 and consisted of 4 borings sampled through the overburden and cored into rock.

SITE DESCRIPTION

The existing structure carries Bovaird Drive (New Highway 7) over Etobicoke Creek and is located 0.6 km east of Highway 10. The bridge consists of a single simple supported span. The structure is in reasonably good condition and shows no major signs of foundation distress. It is proposed

to widen the deck to suit the requirements of Highway 7 New.

Physiographically, the site occurs in the Halton-Peel till plain which is characterized by a thin sheet of glacial till resting on bedrock. The bedrock is the Queenston shale which is of Ordovician age.

Etobicoke Creek flows southward through flat to gently undulating terrain.

SUBSURFACE CONDITIONS

The borings were made on top of the ice of the creek or at the edge of the bank. Thus, the initial soil at the bottom of the creek consisted at some locations of alluvium. Overlying the competent unweathered shale bedrock there is weathered shale and reworked shale till. The reworked shale till is very difficult to distinguish from the weathered shale.

The boundaries between the various soil types and the soil properties are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on the borehole data, are shown on Drawing No. 237904-A. **

The various subsoil types encountered are briefly described in the following paragraphs.

** NOTE: Refer to Sheet No. 86 of the Contract Drawings.

Silty Clay with Sand, Gravel (Alluvium)

Alluvium occurred at the creek bottom at 2 locations. At borehole 2, the alluvium consisted of silty clay with sand, gravel.

This soil is soft and of low plasticity.

Sandy Gravel with Silt (Alluvium)

Alluvium also occurred at borehole 3. At this location, the soil consisted of sandy gravel with silt. This soil is granular and dense.

Silty Clay with Sand (Reworked Shale Till)

Immediately below the alluvium at 2 borings and immediately below creek bottom at the other 2 borings is a deposit which represents reworked shale. This deposit is red-brown with occasional olive green or grey zones. It is massive in appearance and friable. The deposit is of low plasticity as shown by the Plasticity Chart, Fig. 1. The consistency of the deposit is hard as indicated by the N values which range from 90 to 120 for 15cm. Generally, the moisture content is less than 10%. In many cases the split spoon sample became wet as it was being withdrawn through the water, with the result that the moisture content of many samples is not considered representative of the deposit in the ground. Typical grain size distribution is shown in Fig 2. This deposit continues to a considerably greater depth at locations to the west of the bridge than at locations east of the bridge.

Shale (Weathered)

This deposit is very similar in appearance, consistency and grain size distribution to the overlying reworked shale till. It did however have more frequent zones which showed bedding than the overlying reworked shale till. In terms of origin however, it represents the insitu bedrock which has become weathered. This deposit varies in thickness from 0.5m to 3.1m. The weathered shale was identified visually and on the basis of augering. It was possible to auger into the weathered shale but not into the unweathered shale bedrock.

Shale Bedrock

Unweathered shale bedrock was encountered at each borehole location and proven by coring for a depth of 3 metres. At locations west of the bridge it occurred at elevation 215.5 to 217.1 while east of the bridge it occurred at elevation 221.4 to 221.9. The bedrock consists mostly of red-brown shale with occasional green or grey calcareous shale or limestone bands. The deposit is bedded. The core recovery varied from 80% to 98% while the R.Q.D. varied from 14% to 37%. This data indicates very poor rock quality.

Groundwater

Groundwater levels in the borings were not kept accurately as the borings were made from the frozen creek level. The water levels throughout the year will reflect prevailing creek level.

MISCELLANEOUS

The field work for this investigation was performed under the supervision of Mr. Lawrence Quinn, Technician. The drilling equipment was owned and operated by Atcost Drilling Company, Concord, Ontario.

NOTE: The preceding report is a copy of the factual information from the Foundation Investigation Report prepared by B.P. Walker Associates Ltd. (consulting geotechnical engineers for this project), under the technical supervision of the MTC Foundation Design Section.

D.H. Dundas

D.H. Dundas, P. Eng.
Sr. Foundations Engineer

M. Devata

M. Devata, P. Eng.
Chief Foundations Engineer
(East)

# A P P E N D I X

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 1 METRIC

W P 23-79-04 LOCATION Co-ords, N.4840975.5; E282028.5 ORIGINATED BY L.O.
DIST 6 HWY 7 NEW BOREHOLE TYPE Hollow Stem Auger, BXL Core COMPILED BY B.P.W.
DATUM Geodetic DATE 82-02-17 CHECKED BY

| ELEV / DEPTH | SOIL PROFILE DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 224.7 | Ice Surface | | | | | | | | | | |
| 0.0 | Ice & Water | | | | | | 224 | | | | |
| 223.6 | Creek Bottom | | | | | | | | | | |
| 1.1 | Silty Clay with Sand (Reworked Shale Till) | | 1 | SS | 98 | | 223 | | | | |
| | | | 2 | SS | 90 | | 222 | | | | 0 17 50 33 |
| | Low Plasticity, | | 3 | SS | 60 /15cm | | 221 | | | | |
| | Red-Brown, | | 4 | SS | 60 /15cm | | 220 | | | | |
| | Hard, | | 5 | SS | 60 /10cm | | 219 | | | | |
| 218.6 | | | | | | | | | | | |
| 6.1 | Shale | | 6 | SS | 60 /8cm | | 218 | | | | |
| | Weathered, | | | | | | 217 | | | | |
| | Red-Brown with occasional Green Zones | | 7 | SS | 100 /13cm | | 216 | | | | |
| | Hard | | 8 | SS | 100 /8cm | | | | | | |
| 215.5 | | | | | | | 215 | | | | |
| 9.2 | Shale Bedrock Unweathered, Very Hard, Bedded, Red-Brown with occasional Green Limestone Layers | | 9 | | | | 214 | | | | RQD=14% |
| | | | 10 | RC BXL | 81% REC | | 213 | | | | |
| 212.5 | | | | | | | | | | | |
| 12.2 | End of Borehole | | | | | | | | | | |

Note: Water Level Not Established

+3, ×5 : Numbers refer to Cone Index

15 20 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 2 METRIC

W P 23-79-04 LOCATION Co-ords, N.4840973.5; E282065.5 ORIGINATED BY L.Q.
DIST 6 HWY 7 NEW BOREHOLE TYPE Hollow Stem Auger, BXL Core COMPILED BY B.P.W.
DATUM Geodetic DATE 82-02-19 CHECKED BY

| SOIL PROFILE ELEV/DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 224.8 | Ice Surface | | | | | | | | | | |
| 0.1 / 223.9 | Silty Clay with Sand, Gravel (Alluvium) Soft | | | | | | 224 | | | | |
| 0.9 | Silty Clay with Sand (Reworked Shale Till) | | 1 | SS | 11 | | | | | | |
| 223.0 | Hard, Low Plasticity | | 2 | SS | 60 | /10cm | 223 | | ○ | | 0 40 43 17 |
| 1.8 | Shale | | | | | | | | | | |
| 221.9 | Weathered Hard | | 3 | SS | 65 | /10cm | | | ○ | | |
| 2.9 | Shale Bedrock Unweathered, Very Hard, Bedded; Red-Brown with occasional Limestone Layers | | 4 | RC BXL | 98% REC | | 222 | | | | RQD=36% |
| | | | | | | | 221 | | | | |
| | | | 5 | | | | 220 | | | | |
| 218.9 | | | | | | | 219 | | | | |
| 5.9 | End of Borehole | | | | | | | | | | |

Note: Water Level Not Established

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to 20 15 -> 5 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 3 METRIC

W P 23-79-04 LOCATION Co-ords. N.4840986.6; E282075.4 ORIGINATED BY L.Q.
DIST 6 HWY 7 NEW BOREHOLE TYPE Solid Auger, BXL Core COMPILED BY B.P.W.
DATUM Geodetic DATE 82-02-18 CHECKED BY

| SOIL PROFILE ELEV/DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 224.6 | Ice Surface | | | | | | | | | | |
| 0.0 | Ice & Water | | | | | | | | | | |
| 224.2 | Creek Bottom | | | | | | 224 | | | | |
| 0.4 | Sandy Gravel with Silt (Alluvium) | | | | | | | | | | |
| 223.4 | Dense | | 1 | SS | 32 | | | | o | | |
| 1.2 | Silty Clay with Sand, (Reworked Shale Till) Low Plasticity | | 2 | SS | 60/15cm | | 223 | | o | | 0 23 54 23 |
| 221.9 | Hard | | 3 | SS | 120/15cm | | 222 | | o | | |
| 2.7 | Shale | | | | | | | | | | |
| 221.4 | Weathered, Hard | | 4 | SS | 63/8cm | | | | o | | |
| 3.2 | Shale Bedrock Unweathered Very Hard, Bedded, Red-Brown with occasional Grey Limestone Layers | | 5 | RC BXL | 89% REC | | 221 | | | | RQD=18% |
| | | | 6 | | | | 220 | | | | |
| 218.4 | | | | | | | 219 | | | | |
| 6.2 | End of Borehole Note: Water Level Not Established | | | | | | | | | | |

+3, ×5 : Numbers refer to 20 15 → 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 4

METRIC

W P 23-79-04 LOCATION Co-ords. N.4840989.0; E282037.5 ORIGINATED BY L.O.

DIST 6 HWY 7 NEW BOREHOLE TYPE Solid Auger, BXL Core COMPILED BY B.P.W.

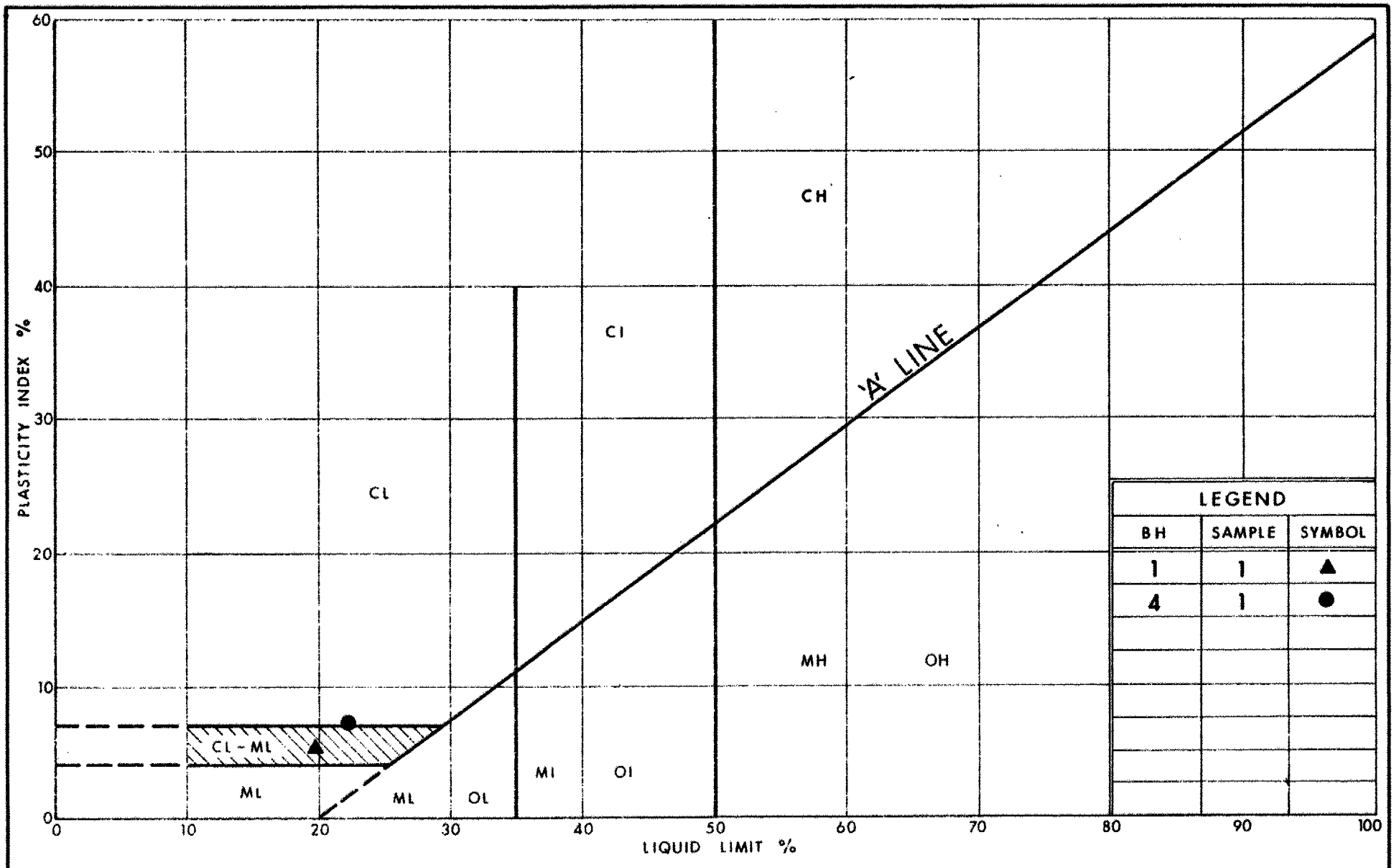
DATUM Geodetic DATE 82-02-18 CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, x LAB VANE) | PLASTIC LIMIT $W_P$ / NATURAL MOISTURE CONTENT $W$ / LIQUID LIMIT $W_L$ WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | | | | |
| 224.7 | Ice Surface | | | | | | | | | | |
| 0.0 | Ice & Water | | | | | | | | | | |
| 224.1 | Creek Bottom | | | | | | 224 | | | | |
| 0.6 | Silty Clay with Sand | | 1 | SS | 100 /15cm | | | | o — | | |
| | (Reworked Shale Till) Low Plasticity | | 2 | SS | 60 /8cm | | 223 | | o | | 0 20 53 27 |
| | | | 3 | SS | 100 /15cm | | | | o | | |
| | Red-Brown | | | | | | 222 | | | | |
| | Hard | | 4 | SS | 100 /13cm | | 221 | | o | | |
| | | | 5 | SS | 100 /13cm | | 220 | | o | | 0 22 45 33 |
| 218.6 | | | | | | | 219 | | | | |
| 6.1 | Shale | | 6 | SS | 100 /10cm | | | | o | | |
| | Weathered; Red-Brown, | | | | | | 218 | | | | |
| 217.1 | Hard | | | | | | | | | | |
| 7.6 | Shale Bedrock | | | | | | 217 | | | | |
| | Unweathered, Very Hard, Bedded, Red-Brown with occasional Grey Limestone Layers | | 7 | RC BXL | 80% REC | | 216 | | | | RQD=37% |
| | | | 8 | | | | 215 | | | | |
| 214.0 | | | | | | | | | | | |
| 10.7 | End of Borehole | | | | | | | | | | |
| | Note: Water Level Not Established | | | | | | | | | | |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to 20 15 ☆ 5 (%) STRAIN AT FAILURE

Oct 75, FF-S-21




Ministry of Transportation and Communications
Ontario

# PLASTICITY CHART

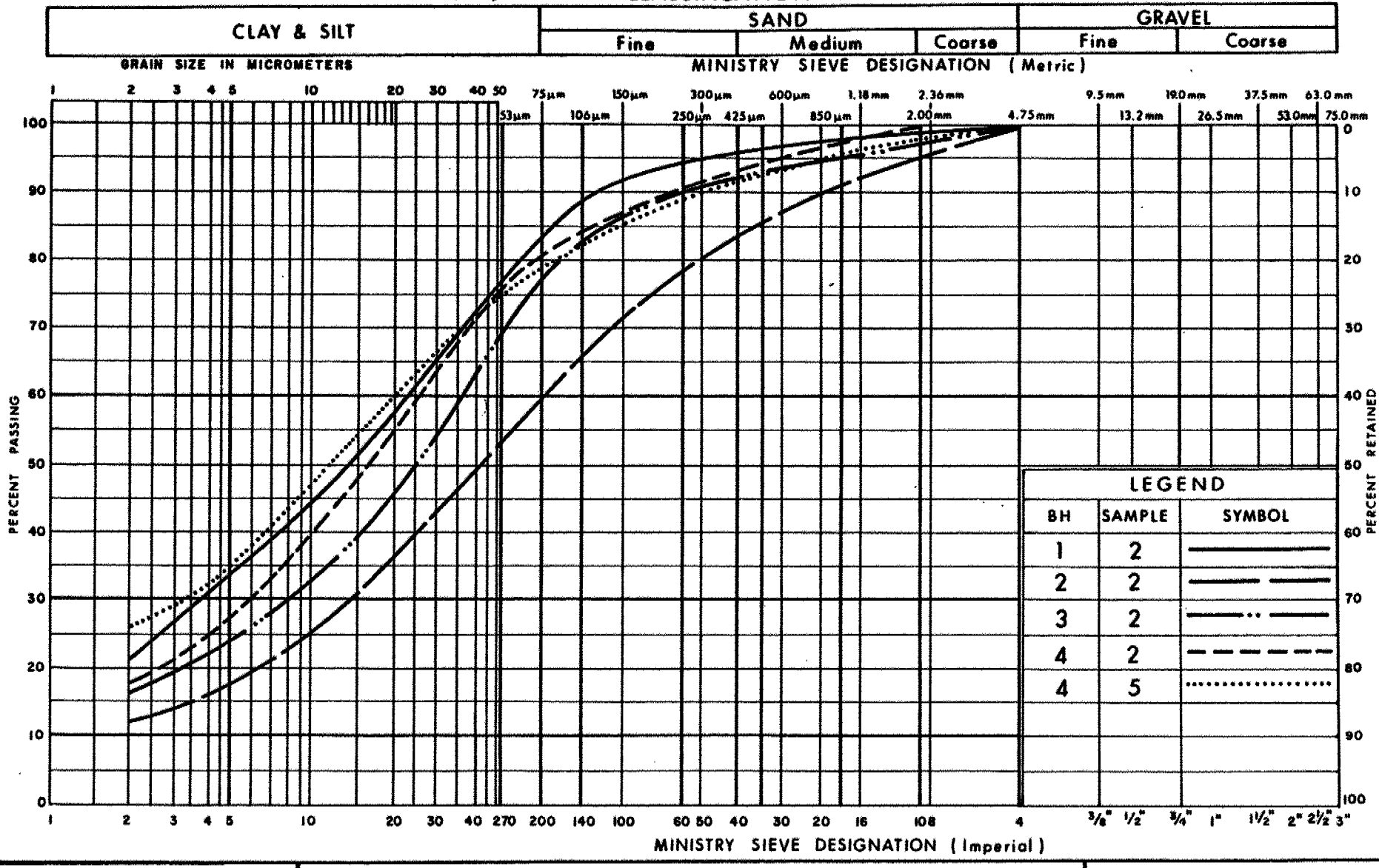
## SILTY CLAY WITH SAND (Reworked Shale Till)

FIG No 1

WP 23-79-04

13

# UNIFIED SOIL CLASSIFICATION SYSTEM




Ministry of Transportation and Communications
Ontario

## GRAIN SIZE DISTRIBUTION

SILTY CLAY WITH SAND (Reworked Shale Till)

FIG No 2

W P 23-79-04

Cont No
89-84

FOUNDATION INVESTIGATION
Hwy 7 New Widening over
Etobicoke Creek
W.P. 23-79-04 Site 24-72
District 6, Ontario

**B. P. WALKER ASSOCIATES LTD.**

**B.P.Walker Associates Ltd.**

**Consulting Geotechnical, Inspection and Testing Engineers**

*101 Amber Street, Suite 2, Markham, Ontario, L3R 3B2* *(416)491-4075*

April 1, 1982

Project No. 1631-2/2

CBOC 30M12-162

Ministry of Transportation
and Communications
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Attention: Mr. Murty Devata, P. Eng

FOUNDATION INVESTIGATION
Hwy 7 new Widening over
Etobicoke Creek
Site 24-72
District 6, Ontario
W.P. 23-79-04

Dear Sir:

INTRODUCTION

This report contains the results and recommendations of a foundation investigation at the above site. The field work for this project was carried out during the period February 17 to February 23, 1982 and consisted of 4 borings sampled through the overburden and cored into rock.

SITE DESCRIPTION

The existing structure carries Bovaird Drive (New Highway 7) over Etobicoke Creek and is located 0.6 km east of Highway 10. The bridge consists of a single simple supported span. The structure is in reasonably good condition and shows no major signs of foundation distress. It is proposed

to widen the deck to suit the requirements of Highway 7 New.

Physiographically, the site occurs in the Halton-Peel till plain which is characterized by a thin sheet of glacial till resting on bedrock. The bedrock is the Queenston shale which is of Ordovician age.

Etobicoke Creek flows southward through flat to gently undulating terrain.

## SUBSURFACE CONDITIONS

The borings were made on top of the ice of the creek or at the edge of the bank. Thus, the initial soil at the bottom of the creek consisted at some locations of alluvium. Overlying the competent unweathered shale bedrock there is weathered shale and reworked shale till. The reworked shale till is very difficult to distinguish from the weathered shale.

The boundaries between the various soil types and the soil properties are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on the borehole data, are shown on Drawing No. 237904-A.

The various subsoil types encountered are briefly described in the following paragraphs.

Silty Clay with Sand, Gravel (Alluvium)

Alluvium occurred at the creek bottom at 2 locations. At borehole 2, the alluvium consisted of silty clay with sand, gravel.

This soil is soft and of low plasticity.

Sandy Gravel with Silt (Alluvium)

Alluvium also occurred at borehole 3. At this location, the soil consisted of sandy gravel with silt. This soil is granular and dense.

Silty Clay with Sand (Reworked Shale Till)

Immediately below the alluvium at 2 borings and immediately below creek bottom at the other 2 borings is a deposit which represents reworked shale. This deposit is red-brown with occasional olive green or grey zones. It is massive in appearance and friable. The deposit is of low plasticity as shown by the Plasticity Chart, Fig. 1. The consistency of the deposit is hard as indicated by the N values which range from 90 to 120 for 15cm. Generally, the moisture content is less than 10%. In many cases the split spoon sample became wet as it was being withdrawn through the water, with the result that the moisture content of many samples is not considered representative of the deposit in the ground. Typical grain size distribution is shown in Fig 2. This deposit continues to a considerably greater depth at locations to the west of the bridge than at locations east of the bridge.

Shale (Weathered)

This deposit is very similar in appearance, consistency and grain size distribution to the overlying reworked shale till. It did however have more frequent zones which showed bedding than the overlying reworked shale till. In terms of origin however, it represents the insitu bedrock which has become weathered. This deposit varies in thickness from 0.5m to 3.1m. The weathered shale was identified visually and on the basis of augering. It was possible to auger into the weathered shale but not into the unweathered shale bedrock.

Shale Bedrock

Unweathered shale bedrock was encountered at each borehole location and proven by coring for a depth of 3 metres. At locations west of the bridge it occurred at elevation 215.5 to 217.1 while east of the bridge it occurred at elevation 221.4 to 221.9. The bedrock consists mostly of red-brown shale with occasional green or grey calcareous shale or limestone bands. The deposit is bedded. The core recovery varied from 80% to 98% while the R.Q.D. varied from 14% to 37%. This data indicates very poor rock quality.

Groundwater

Groundwater levels in the borings were not kept accurately as the borings were made from the frozen creek level. The water levels throughout the year will reflect prevailing creek level.

## DISCUSSION AND RECOMMENDATIONS

It is proposed to widen the present structure at Highway 7 New over Etobicoke Creek to suit the requirements of Highway 7 New. The abutments need to be extended by approximately 7m on each side. The new elevation will be approximately the same as at present (approximately 230m). From the Peto Associates Ltd. report of January, 1970 we understand that foundations for the structure consisted of footings placed in the shale at an elevation of approximately 222m.

In view of the close proximity of the reworked shale till to the creek bottom, foundations for the structure should be quite straightforward.

### Structure Foundations

We recommend that foundations consist of footings placed in competent natural soil or rock. Footings placed on either reworked shale till or weathered shale should be designed using a factored bearing capacity at ULS of 1000 kPa. Footings should be placed at a depth of 0.5m into reworked shale till. This places footings at elevations 222.9m to 223.6m. Footings placed at this depth should not be detrimentally affected by the existence of a sanitary sewer beneath the creek as located in Dwg 237904-A. The footings will be located below a $45^{o}$ line from the edge of the sanitary sewer. Thus, it is of no consequence whether the sewer was installed by open cut or by tunnelling.

Footings may also be placed on the unweathered shale bedrock. They should be designed using a factored bearing capacity at ULS of 1500 kPa. Footings should be placed at a depth of 0.5m into unweathered shale bedrock. This places footings at an elevation of 221.4m and 220.9m to the east of the existing structure and, at an elevation of 215.0m and 216.6m to the west of the structure.

For foundations designed as given above, the resulting settlement should be less than 6mm. The loading required to produce detrimental settlement of the structure will be considerably more than the factored bearing capacity at ULS for both the reworked shale till and the unweathered shale bedrock. The factored bearing capacity at Serviceability Limit States will, therefore, not be the governing factor in the design of the above structure. There is no harm in footings to the east of the existing structure being founded on the unweathered shale bedrock while footings on the other side are founded on the reworked shale till. Clearly, the respective design bearing pressures should be used.

In assessing the earth pressure of the backfill against the abutments, the following equivalent fluid pressure may be assumed:

a) At ultimate limit states:
   i) active state : 8 kPa/m
   ii) at rest state: 10 kPa/m

b) At serviceablity limit states:
   i) active state : 6.5 kPa/m
   ii) at rest condition : 8.5 kPa/m

In order to use the above values it is essential that approved free-draining granular backfill be used.

Adequate permanent drainage should be provided for the backfill to ensure that water pressure does not buildup.

All footings should be placed below a depth of 1.2m to avoid frost penetration. All footings should be placed at a sufficient depth and with adequate protection to prevent scouring.

## CONSTRUCTION CONSIDERATIONS

The alluvium is a permeable soil which will allow free flow of water from the stream. The underlying reworked shale, weathered shale and unweathered shale should contain very little free water and are considered reasonably impermeable to the flow of water from the stream. Thus, the dewatering system should mainly be concerned with the control of seepage through the alluvium. We do not expect serious water problems with excavation into or below the reworked shale. These soils however can breakup and soften when opened up during excavation. Thus, care should be taken to remove all loosened soil before pouring concrete for foundations. Alternatively a skin coat of concrete can be poured immediately after excavation to prevent this loosening.

## APPROACHES

There could be considerable settlement of the alluvium due to the addition of about 6m of fill. Thus, we recommend that the alluvium be removed and replaced with granular backfill. The grading and compaction of the backfill should meet M.T.C. standards.

MISCELLANEOUS

The field work for this investigation was performed under the supervision of Mr. Lawrence Quinn, Technician. The drilling equipment was owned and operated by Atcost Drilling Company, Concord, Ontario.

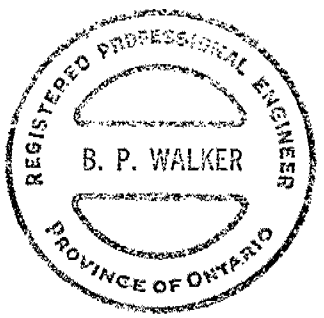
We are pleased to provide this service for you. If you should have any questions, please contact this office.

Yours very truly,

B.P. WALKER ASSOCIATES LTD.

B P Walker

B.P. Walker, Ph.D., P. Eng




13 to client

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 1 METRIC

W P 23-79-04 LOCATION Co-ords, N.4840975.5; E282028.5 ORIGINATED BY L.O.

DIST 6 HWY 7 NEW BOREHOLE TYPE Hollow Stem Auger, BXL Core COMPILED BY B.P.W.

DATUM Geodetic DATE 82-02-17 CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT $W_L$ — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | | | | |
| 224.7 | Ice Surface | | | | | | | | | | |
| 0.0 | Ice & Water | | | | | | | | | | |
| 223.6 | Creek Bottom | | | | | | 224 | | | | |
| 1.1 | Silty Clay with Sand (Reworked Shale Till) | | 1 | SS | 98 | | 223 | | | | |
| | | | 2 | SS | 90 | | 222 | | | | 0 17 50 33 |
| | Low Plasticity, | | 3 | SS | 60 | /15cm | | | | | |
| | Red-Brown, | | 4 | SS | 60 | /15cm | 221 | | | | |
| | Hard, | | 5 | SS | 60 | /10cm | 220 | | | | |
| 218.6 | | | | | | | 219 | | | | |
| 6.1 | Shale | | 6 | SS | 60 | /8cm | 218 | | | | |
| | Weathered, | | | | | | | | | | |
| | Red-Brown with occasional Green Zones | | 7 | SS | 100 | /13cm | 217 | | | | |
| | Hard | | 8 | SS | 100 | /8cm | 216 | | | | |
| 215.5 | | | | | | | | | | | |
| 9.2 | Shale Bedrock Unweathered, Very Hard, Bedded, Red-Brown with occasional Green Limestone Layers | | 9 | RC BXL | 81% REC | | 215 | | | | RQD=14% |
| | | | 10 | | | | 214 | | | | |
| 212.5 | | | | | | | 213 | | | | |
| 12.2 | End of Borehole | | | | | | | | | | |
| | Note: Water Level Not Established | | | | | | | | | | |

+3, ×5 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 2

METRIC

W P 23-79-04 LOCATION Co-ords, N.4840973.5; E282065.5 ORIGINATED BY L.Q.

DIST 6 HWY 7 NEW BOREHOLE TYPE Hollow Stem Auger, BXL Core COMPILED BY B.P.W.

DATUM Geodetic DATE 82-02-19 CHECKED BY

| SOIL PROFILE ELEV/DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 224.8 | Ice Surface | | | | | | | | | | |
| 0.1 / 223.9 | Silty Clay with Sand, Gravel (Alluvium) Soft | | | | | | 224 | | | | |
| 0.9 | Silty Clay with Sand (Reworked Shale Till) | | 1 | SS | 11 | | | | | | |
| 223.0 | Hard, Low Plasticity | | 2 | SS | 60 | /10cm | 223 | | | | 0 40 43 17 |
| 1.8 | Shale | | 3 | SS | 65 | /10cm | | | | | |
| 221.9 | Weathered Hard | | | | | | 222 | | | | |
| 2.9 | Shale Bedrock Unweathered, Very Hard, Bedded, Red-Brown with occasional Limestone Layers | | 4 | RC BXL | 98% REC | | 221 | | | | RQD=36% |
| 218.9 | | | 5 | | | | 220 | | | | |
| | | | | | | | 219 | | | | |
| 5.9 | End of Borehole | | | | | | | | | | |

Note: Water Level Not Established

$+^3$, $\times^5$ : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

# RECORD OF BOREHOLE No 3

METRIC

W P 23-79-04 LOCATION Co-ords. N.4840986.6; E282075.4 ORIGINATED BY L.Q.

DIST 6 HWY 7 NEW BOREHOLE TYPE Solid Auger, BXL Core COMPILED BY B.P.W.

DATUM Geodetic DATE 82-02-18 CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH: o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | | | | |
| 224.6 | Ice Surface | | | | | | | | | | |
| 0.0 / 224.2 | Ice & Water / Creek Bottom | | | | | | | | | | |
| 0.4 | Sandy Gravel with Silt (Alluvium) | | | | | | 224 | | | | |
| 223.4 | Dense | | 1 | SS | 32 | | | | o | | |
| 1.2 | Silty Clay with Sand, (Reworked Shale Till) Low Plasticity | | 2 | SS | 60/15cm | | 223 | | o | | 0 23 54 23 |
| 221.9 | Hard | | 3 | SS | 120/15cm | | 222 | | o | | |
| 2.7 | Shale | | | | | | | | | | |
| 221.4 | Weathered, Hard | | 4 | SS | 63/8cm | | | | o | | |
| 3.2 | Shale Bedrock Unweathered Very Hard, Bedded, Red-Brown with occasional Grey Limestone Layers | | 5 | RC BXL | 89% REC | | 221 | | | | RQD=18% |
| 218.4 | | | 6 | | | | 220 | | | | |
| 6.2 | End of Borehole | | | | | | 219 | | | | |

Note: Water Level Not Established

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 4 — METRIC

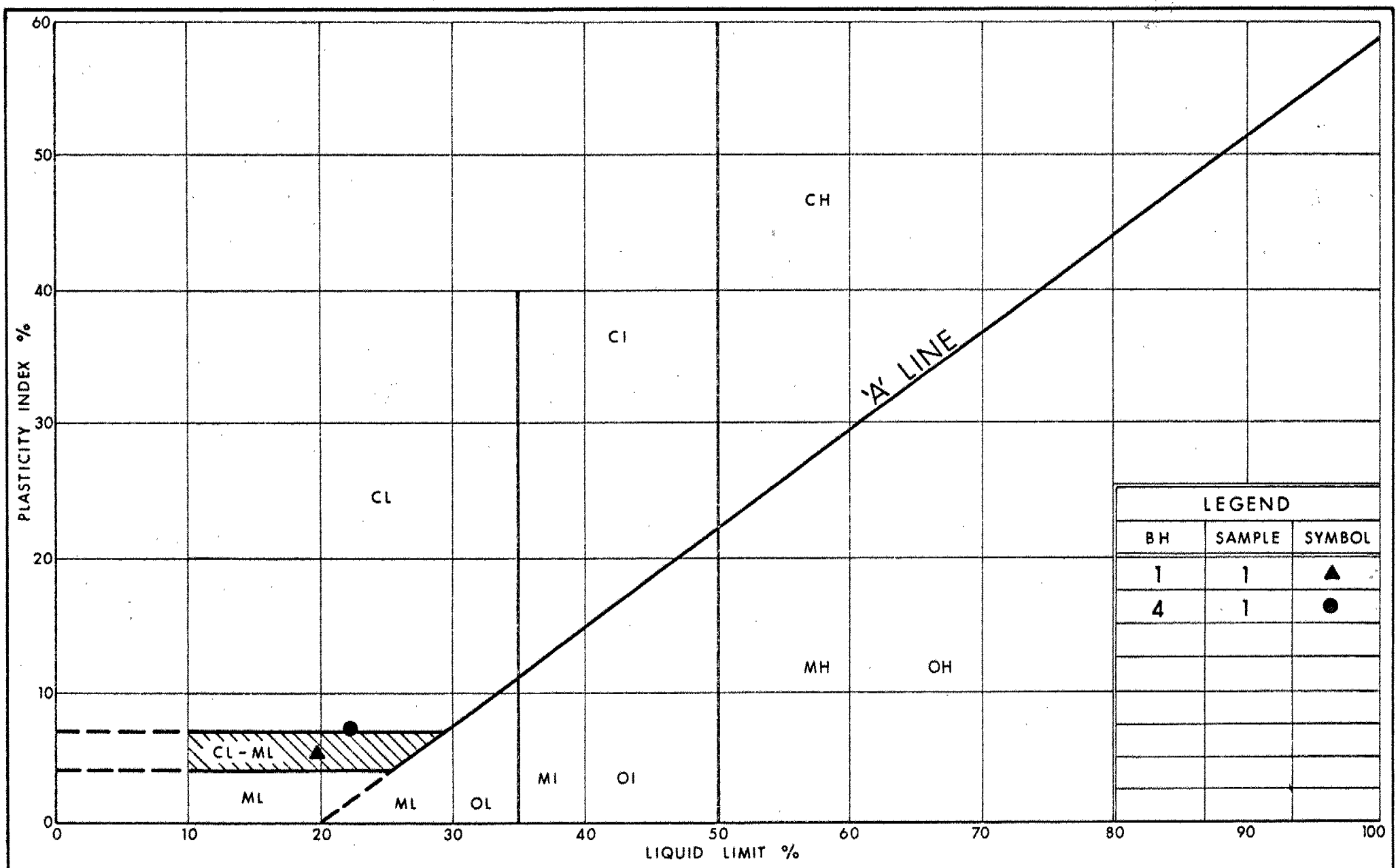
W P 23-79-04 LOCATION Co-ords, N.4840989.0; E282037.5 ORIGINATED BY L.Q.
DIST 6 HWY 7 NEW BOREHOLE TYPE Solid Auger, BXL Core COMPILED BY B.P.W.
DATUM Geodetic DATE 82-02-18 CHECKED BY

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) | PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT $W_L$ — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 224.7 | Ice Surface | | | | | | | | | | |
| 0.0 | Ice & Water | | | | | | | | | | |
| 224.1 | Creek Bottom | | | | | | 224 | | | | |
| 0.6 | Silty Clay with Sand (Reworked Shale Till) Low Plasticity | | 1 | SS | 100 /15cm | | | | ○ | | |
| | | | 2 | SS | 60 /8cm | | 223 | | ○ | | 0 20 53 27 |
| | Red-Brown | | 3 | SS | 100 /15cm | | 222 | | ○ | | |
| | Hard | | 4 | SS | 100 /13cm | | 221 | | ○ | | |
| | | | 5 | SS | 100 /13cm | | 220 | | ○ | | 0 22 45 33 |
| 218.6 | | | | | | | 219 | | | | |
| 6.1 | Shale Weathered; Red-Brown, | | 6 | SS | 100 /10cm | | 218 | | ○ | | |
| 217.1 | Hard | | | | | | | | | | |
| 7.6 | Shale Bedrock Unweathered, Very Hard, Bedded, Red-Brown with occasional Grey Limestone Layers | | 7 | RC BXL | 80% REC | | 217 | | | | RQD=37% |
| | | | 8 | | | | 216 | | | | |
| 214.0 | | | | | | | 215 | | | | |
| 10.7 | End of Borehole | | | | | | | | | | |

Note: Water Level Not Established

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

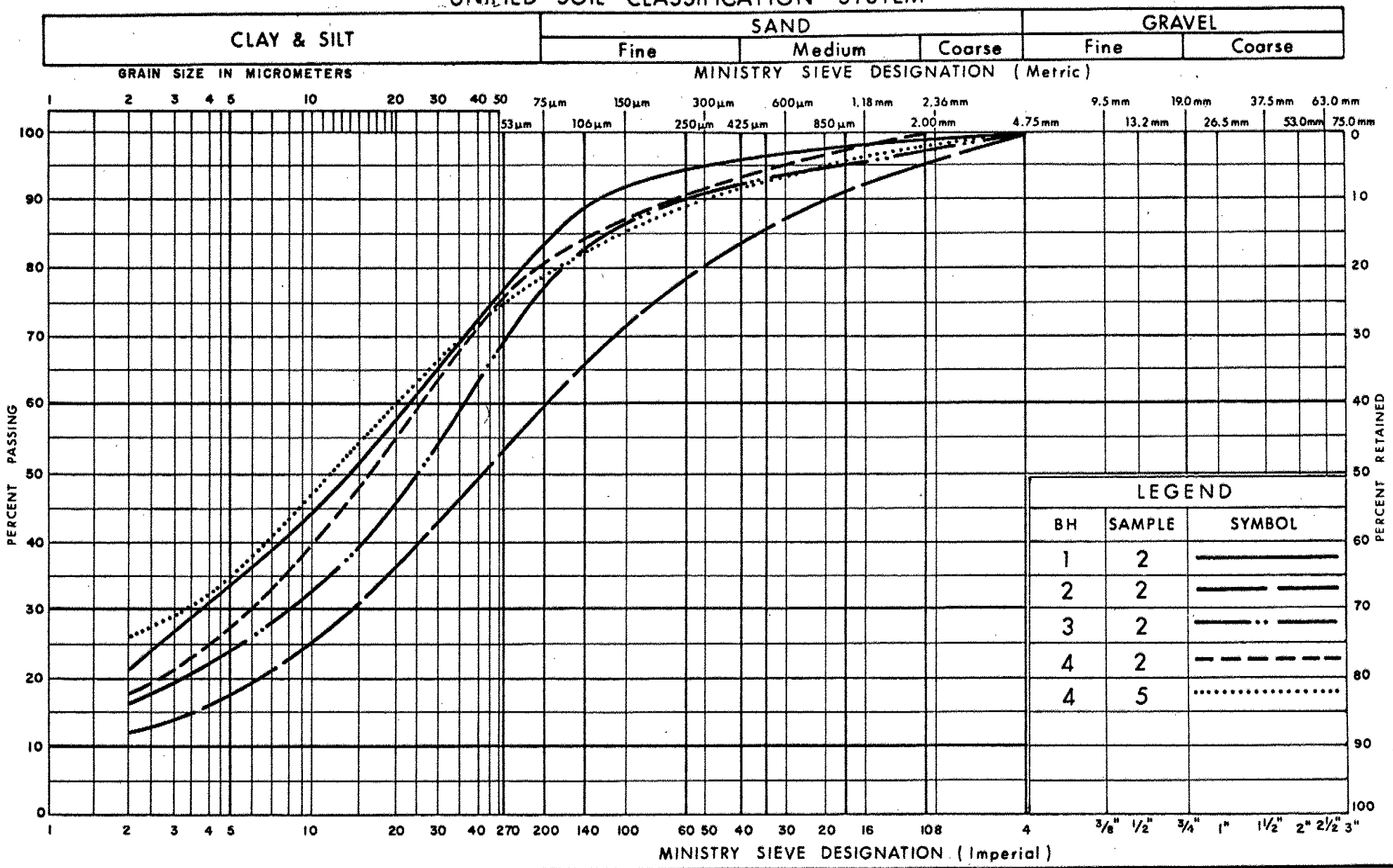



Ministry of Transportation and Communications
Ontario

# PLASTICITY CHART
## SILTY CLAY WITH SAND (Reworked Shale Till)

FIG No 1
WP 23-79-04

# UNIFIED SOIL CLASSIFICATION SYSTEM




Ministry of Transportation and Communications
Ontario

## GRAIN SIZE DISTRIBUTION

SILTY CLAY WITH SAND (Reworked Shale Till)

FIG No 2

W P 23-79-04

# EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ($c_u$) AS FOLLOWS:

| $c_u$ (kPa) | 0 - 12 | 12 - 25 | 25 - 50 | 50 - 100 | 100 - 200 | >200 |
|---|---|---|---|---|---|---|
| | *VERY SOFT* | *SOFT* | *FIRM* | *STIFF* | *VERY STIFF* | *HARD* |

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 - 5 | 5 - 10 | 10 - 30 | 30 - 50 | >50 |
|---|---|---|---|---|---|
| | *VERY LOOSE* | *LOOSE* | *COMPACT* | *DENSE* | *VERY DENSE* |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

| RQD (%) | 0 - 25 | 25 - 50 | 50 - 75 | 75 - 90 | 90 - 100 |
|---|---|---|---|---|---|
| | *VERY POOR* | *POOR* | *FAIR* | *GOOD* | *EXCELLENT* |

JOINTING AND BEDDING:

| SPACING | 50mm | 50 - 300mm | 0.3m - 1m | 1m - 3m | >3m |
|---|---|---|---|---|---|
| JOINTING | *VERY CLOSE* | *CLOSE* | *MOD. CLOSE* | *WIDE* | *VERY WIDE* |
| BEDDING | *VERY THIN* | *THIN* | *MEDIUM* | *THICK* | *VERY THICK* |

# ABBREVIATIONS AND SYMBOLS

## FIELD SAMPLING

| | | | |
|---|---|---|---|
| S S | SPLIT SPOON | T P | THINWALL PISTON |
| W S | WASH SAMPLE | O S | OSTERBERG SAMPLE |
| S T | SLOTTED TUBE SAMPLE | R C | ROCK CORE |
| B S | BLOCK SAMPLE | P H | T W ADVANCED HYDRAULICALLY |
| C S | CHUNK SAMPLE | P M | T W ADVANCED MANUALLY |
| T W | THINWALL OPEN | F S | FOIL SAMPLE |

## STRESS AND STRAIN

| | | |
|---|---|---|
| $u_w$ | kPa | PORE WATER PRESSURE |
| $r_u$ | 1 | PORE PRESSURE RATIO |
| $\sigma$ | kPa | TOTAL NORMAL STRESS |
| $\sigma'$ | kPa | EFFECTIVE NORMAL STRESS |
| $\tau$ | kPa | SHEAR STRESS |
| $\sigma_1, \sigma_2, \sigma_3$ | kPa | PRINCIPAL STRESSES |
| $\epsilon$ | % | LINEAR STRAIN |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | % | PRINCIPAL STRAINS |
| E | kPa | MODULUS OF LINEAR DEFORMATION |
| G | kPa | MODULUS OF SHEAR DEFORMATION |
| $\mu$ | 1 | COEFFICIENT OF FRICTION |

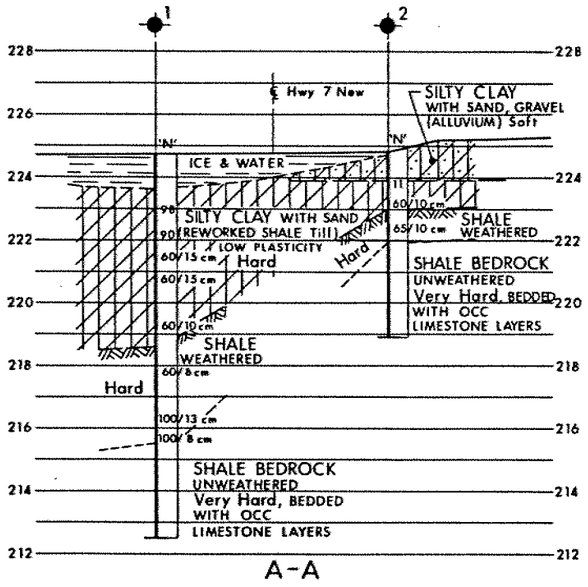
## MECHANICAL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $m_v$ | $kPa^{-1}$ | COEFFICIENT OF VOLUME CHANGE |
| $C_c$ | 1 | COMPRESSION INDEX |
| $C_s$ | 1 | SWELLING INDEX |
| $C_\alpha$ | 1 | RATE OF SECONDARY CONSOLIDATION |
| $c_v$ | $m^2/s$ | COEFFICIENT OF CONSOLIDATION |
| H | m | DRAINAGE PATH |
| $T_v$ | 1 | TIME FACTOR |
| U | % | DEGREE OF CONSOLIDATION |
| $\sigma'_{vo}$ | kPa | EFFECTIVE OVERBURDEN PRESSURE |
| $\sigma'_p$ | kPa | PRECONSOLIDATION PRESSURE |
| $\tau_f$ | kPa | SHEAR STRENGTH |
| $c'$ | kPa | EFFECTIVE COHESION INTERCEPT |
| $\phi'$ | -° | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$ | kPa | APPARENT COHESION INTERCEPT |
| $\phi_u$ | -° | APPARENT ANGLE OF INTERNAL FRICTION |
| $\tau_R$ | kPa | RESIDUAL SHEAR STRENGTH |
| $\tau_r$ | kPa | REMOULDED SHEAR STRENGTH |
| $S_t$ | 1 | SENSITIVITY = $\frac{c_u}{\tau_r}$ |

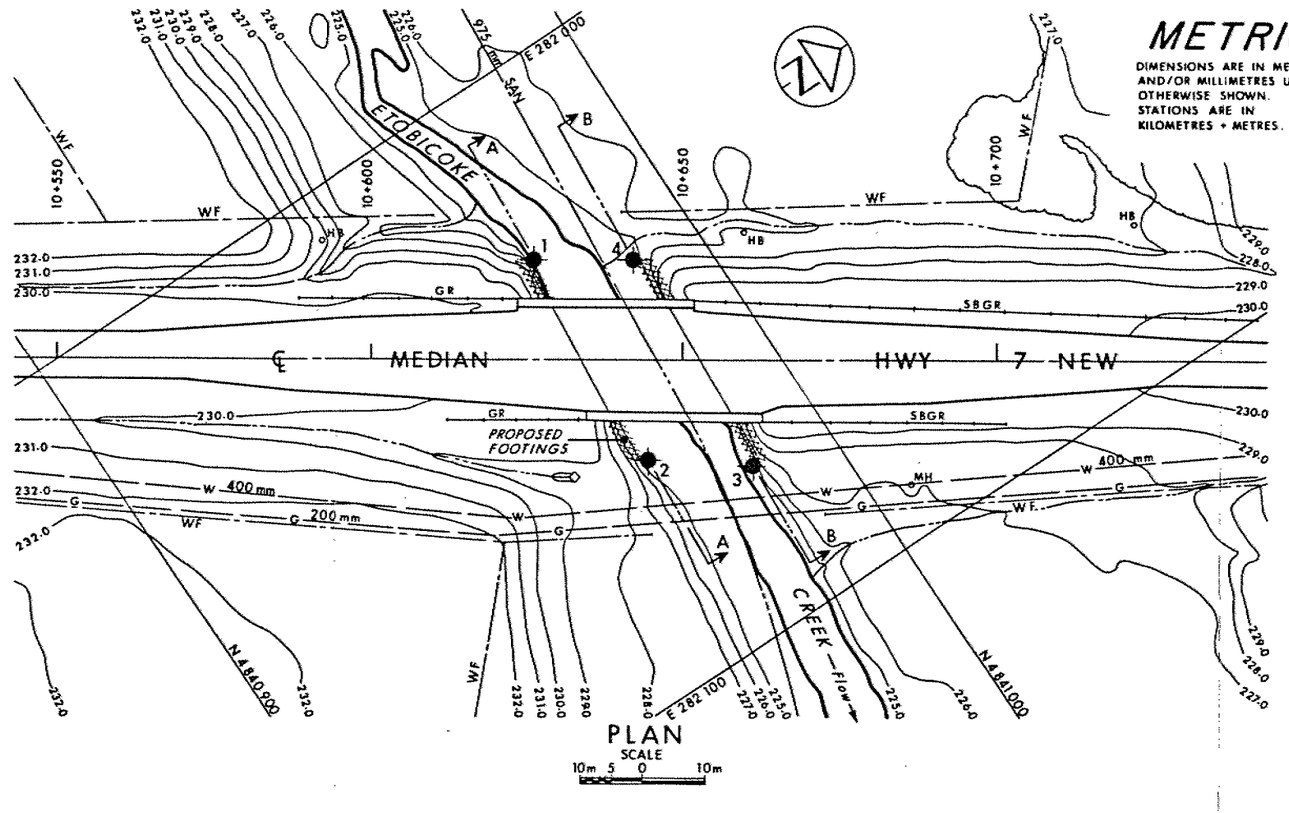
## PHYSICAL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $\rho_s$ | $kg/m^3$ | DENSITY OF SOLID PARTICLES |
| $\gamma_s$ | $kN/m^3$ | UNIT WEIGHT OF SOLID PARTICLES |
| $\rho_w$ | $kg/m^3$ | DENSITY OF WATER |
| $\gamma_w$ | $kN/m^3$ | UNIT WEIGHT OF WATER |
| $\rho$ | $kg/m^3$ | DENSITY OF SOIL |
| $\gamma$ | $kN/m^3$ | UNIT WEIGHT OF SOIL |
| $\rho_d$ | $kg/m^3$ | DENSITY OF DRY SOIL |
| $\gamma_d$ | $kN/m^3$ | UNIT WEIGHT OF DRY SOIL |
| $\rho_{sat}$ | $kg/m^3$ | DENSITY OF SATURATED SOIL |
| $\gamma_{sat}$ | $kN/m^3$ | UNIT WEIGHT OF SATURATED SOIL |
| $\rho'$ | $kg/m^3$ | DENSITY OF SUBMERGED SOIL |
| $\gamma'$ | $kN/m^3$ | UNIT WEIGHT OF SUBMERGED SOIL |

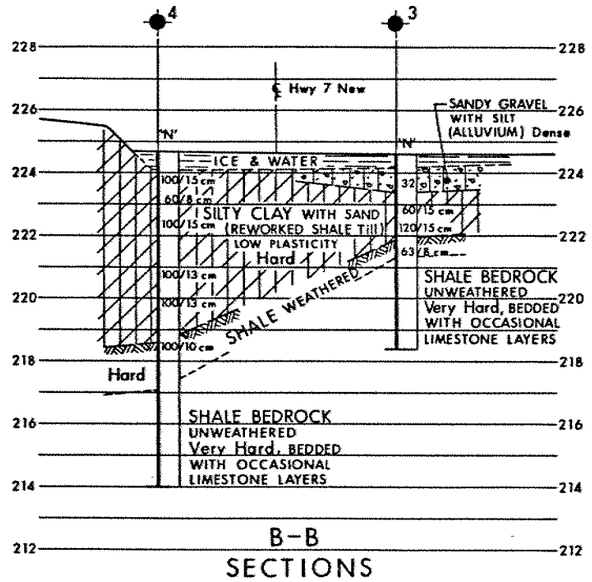
| | | |
|---|---|---|
| e | 1,% | VOID RATIO |
| n | 1,% | POROSITY |
| w | 1,% | WATER CONTENT |
| $S_r$ | % | DEGREE OF SATURATION |
| $w_L$ | % | LIQUID LIMIT |
| $w_P$ | % | PLASTIC LIMIT |
| $w_S$ | % | SHRINKAGE LIMIT |
| $I_P$ | % | PLASTICITY INDEX = $w_L - w_P$ |
| $I_L$ | 1 | LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$ |
| $I_C$ | 1 | CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$ |
| $e_{max}$ | 1,% | VOID RATIO IN LOOSEST STATE |
| $e_{min}$ | 1,% | VOID RATIO IN DENSEST STATE |
| $I_D$ | 1 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| D | mm | GRAIN DIAMETER |
| $D_n$ | mm | n PERCENT - DIAMETER |
| $C_U$ | 1 | UNIFORMITY COEFFICIENT |
| h | m | HYDRAULIC HEAD OR POTENTIAL |
| q | $m^3/s$ | RATE OF DISCHARGE |
| v | m/s | DISCHARGE VELOCITY |
| i | 1 | HYDRAULIC GRADIENT |
| k | m/s | HYDRAULIC CONDUCTIVITY |
| j | $kN/m^3$ | SEEPAGE FORCE |




A-A

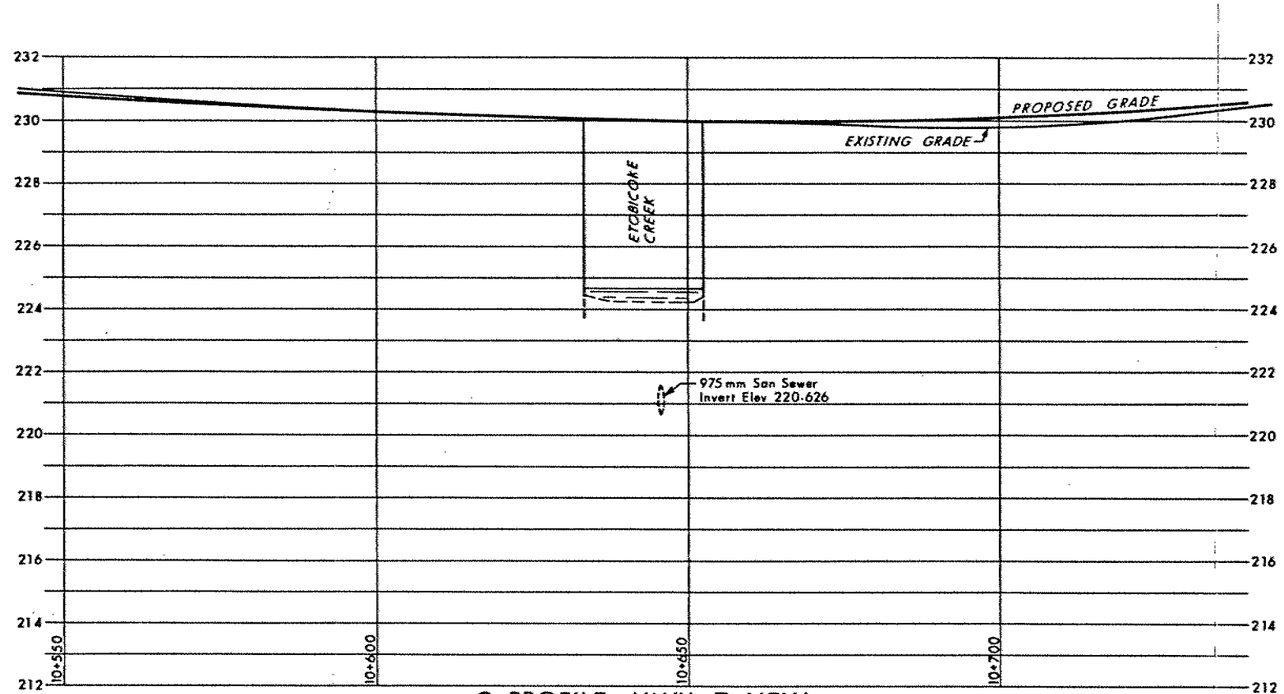



PLAN
SCALE
10m 5 0 10m




B-B

SECTIONS
SCALE
HOR 10m 5 0 10m
VERT 2m 1 0 2m




℄ PROFILE HWY 7 NEW
SCALE
HOR 10m 5 0 10m
VERT 2m 1 0 2m

BBM 229-857
BRASS PLAQUE ON SOUTH FACE OF CONC BRIDGE
10.0 Rt STA 10+663.5
BBM IS BRAMPTON BENCH MARK
Elev UPDATED TO 1978 DATUM

REF COLE SHERMAN CONS ENG
Dwg No 4981-S1 , 1981 12 11

## METRIC

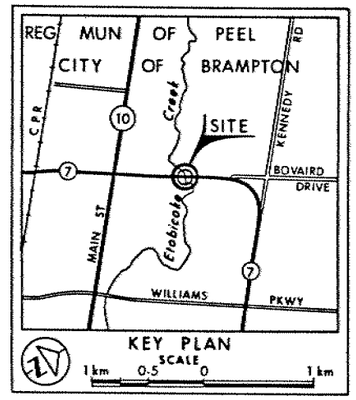
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS ARE IN KILOMETRES + METRES.

CONT No
WP No 23-79-04

HWY 7 NEW WIDENING OVER ETOBICOKE CREEK
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

**B. P. Walker Associates Ltd.**




LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation
  WL Not Established

| No | ELEVATION | CO-ORDINATES NORTH | EAST |
|---|---|---|---|
| 1 | 224.7 | 4 840 975.5 | 282 028.5 |
| 2 | 224.8 | 4 840 973.5 | 282 065.5 |
| 3 | 224.6 | 4 840 986.6 | 282 075.4 |
| 4 | 224.7 | 4 840 989.0 | 282 037.5 |

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

| REVISIONS | | | |
|---|---|---|---|
| DATE | BY | DESCRIPTION | |

Geocres No 30M12-162

| | | | |
|---|---|---|---|
| HWY No 7 NEW | | | DIST 6 |
| SUBM'D BPW | CHECKED | DATE 1982 03 26 | SITE 24-72 |
| DRAWN ADS | CHECKED | APPROVED | DWG 237904-A |