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Golder Associates

GEOCRES # 31D-384

# ADDENDUM A
# FOUNDATION INVESTIGATION AND DESIGN
# HIGH FILL SECTION STATIONS 25+130 TO 25+280
# HIGHWAY 404 EXTENSION
# DAVIS DRIVE TO HERALD ROAD
# REGIONAL MUNICIPLAITY OF YORK
# GWP: 421-98-00

Submitted to:

McCormick Rankin Corporation
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

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September 2000 991-1162B

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2180 Meadowvale Boulevard
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September 27, 2000 991-1162B

McCormick Rankin Corporation
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

ATTENTION: Ms. Denise Morneau, P.Eng.

**RE: FOUNDATION INVESTIGATION AND DESIGN – ADDENDUM A**
**HIGH FILL SECTION STATIONS 25+130 TO 25+280**
**HIGHWAY 404 EXTENSION**
**DAVIS DRIVE TO HERALD ROAD**
**REGIONAL MUNICIPLAITY OF YORK GWP: 421-98-00**

Dear Sirs:

Golder Associates Ltd. has been retained by McCormick Rankin Corporation (McCormick Rankin) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out a foundation investigation at the site of the proposed high fill sections along the Highway 404 extension in the Region of York, Ontario. The project consists of the extension of Highway 404 from Davis Drive northerly to Herald Road and includes a partial interchange with twin overpass structures at Highway 404 and Herald Road.

Our previous Report No. 991-1162B, titled "Foundation Investigation and Design, High Fill Section Stations 25+630 to 25+860, Highway 404 Extension", dated January 2000 addressed the proposed high fill section along the Highway 404 extension between about Stations 25+630 and 25+860. Due to on-going negotiations between MTO and the adjacent landowners, the proposed high fill section between about Stations 25+130 and 25+280 could not be investigated at that time. We were given authorization to proceed with the investigation for the remaining high fill section in late August 2000 after MTO acquired the lands. This report provides the results of the investigation for the proposed high fill section and based on the results, recommendations are provided on the geotechnical aspects of design.

## SITE DESCRIPTION

The site is located approximately 2 km south of Herald Road and 1.5 km west of Woodbine Avenue, immediately north of the Town of Newmarket, in the Regional Municipality of York.

The topography of the site area is generally level with a regional trend sloping down to the south towards Lake Ontario. The ground surface at the site varies locally from about Elevations 277 m to 280 m. Based on the available information, the proposed grade of Highway 404 within the proposed high fill section varies from about Elevations 283.5 m to 282.8 m from south of north, respectively.

The lands in the vicinity of site are mainly agricultural. The lowest area within the proposed high fill section consists of long grass and is flanked to the north and south by heavily vegetated areas consisting primarily of mature trees. The lowest section appears to pond water during wet periods of the year, but was dry at the time of site investigation.

The original MTO foundation report for the Davis Drive underpass located to the south of the site was reviewed for this report, and is referenced as:

- GEOCRES 31D-262, titled "Highway 404 Underpass at Regional Road 31 (Davis Drive)", W.P. 160-74-40, Highway 404, District 6, Toronto, dated September 1978.

## INVESTIGATION PROCEDURES

The field work for this investigation was carried out on September 8, 2000. Borehole 17 was put down within the limits of the proposed high fill section along the proposed centreline at Station 25+215. It was decided by us that time to carry out a second borehole at Station 25+200 (Borehole 18) as a check on the low 'N' values obtained in the upper portion of the soil.

The investigation was carried out using a track-mounted CME-55 drill rig supplied and operated by Master Soil Investigations of Toronto, Ontario. In the boreholes, samples of the overburden were obtained at regular intervals of depth using 50 mm outside diameter split-spoon samplers in

accordance with the Standard Penetration Test (SPT) procedures. The boreholes were extended to depths of about 6.4 m below the existing ground surface. Groundwater conditions in the open boreholes were observed throughout the drilling operations.

The field work was supervised on a full-time basis by a member of our engineering staff who located the boreholes in the field, directed the drilling, sampling and in-situ testing operations, and logged the boreholes. The soil samples were identified in the field, placed in labelled containers and transported back to our laboratory in Mississauga for further examination. Water content, grain size distribution, and Atterberg limit tests were carried out on selected samples. The results of the testing are shown on the attached Record of Borehole sheets and on Figures 1 and 2.

A plan and profile of the proposed Highway 404 between Davis Drive and Herald Road were provided to us in digital format by McCormick Rankin. J.D. Barnes Limited, professional land surveyors, staked the proposed Highway 404 centreline in the field at 25 m intervals. The borehole locations were located in the field by Golder personnel and were referenced relative to the stations indicated on the stakes. The approximate ground surface elevations at the borehole locations were determined from the profile drawing. The stations of the boreholes are indicated on the Record of Boreholes Sheets and the location of the boreholes are shown on Drawing 1.

## GENERAL SITE GEOLOGY AND STRATIGRAPHY

### Site Geology

The site is located in the physiographic region known as the Oak Ridges Moraine, which was formed between two opposing movements of ice during the late Wisconsinan period of glaciation (Chapman and Putnam, "The Physiography of Southern Ontario", 3rd Edition, 1984). The topography of the Oak Ridges Moraine is hilly, with knob and basin relief that is typical for an end moraine. The subsoils for this region are generally comprised of sandy materials, which are underlain by glacial till. Interbeds of fine sand, silt, and clay are also common. Bedrock is generally deep below the ground surface in this region; previous investigations carried out by others in the general area found the bedrock surface is at depths between 180 m and 240 m below the ground surface.

**Site Stratigraphy**

The detailed subsurface soil and groundwater conditions encountered in the boreholes, together with the results of the laboratory tests carried out on selected soil samples, are given on the attached Record of Borehole sheets following the text of this report. The stratigraphic boundaries shown on the borehole sheets are inferred from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. Subsoil conditions will vary between and beyond the borehole locations.

In summary, the subsoils at the site generally consist of a surficial layer of topsoil underlain by firm to hard clayey silt glacial till encountered at about Elevation 276.5 m. The clayey silt till was not fully penetrated in the boreholes, but proved to a thickness of about 5.7 m.

The location of the borings are shown on the attached Drawing 1. A detailed description of the subsurface conditions encountered in the boreholes for this investigation is provided in the following sections.

**Topsoil**

A surficial layer of topsoil about 690 mm thick was encountered in the boreholes.

**Clayey Silt Till**

Below the topsoil a deposit of clayey silt glacial till exists, with the surface of the deposit encountered at about Elevations 276.6 m and 276.3 m in Boreholes 17 and 18, respectively. A trace to some sand and trace gravel were noted within the till deposit. A grain size distribution curve for a selected sample of the clayey silt till is shown on Figure 1. Standard Penetration Testing (SPT) carried out within the till deposit measured 'N' values of 6 blows to 30 blows per 0.3 m in the upper 4.5 m, indicating a firm to very stiff consistency. Below this depth, the till is hard with measured 'N' values of greater than 100 blows per 0.3 m.

Atterberg limits testing carried out on a selected sample of the clayey silt till measured a liquid limit and a plasticity index of about 23 percent and 8 percent, respectively. This classifies the till as inorganic and of low plasticity. The results of the Atterberg limits testing are shown on

Figure 2. The natural water content measured for selected samples of the till range from about 10 percent to 23 percent, with an average of about 17 percent, and are less than the plastic limit. The measured water contents decrease with depth.

### Groundwater Conditions

Water levels were noted in the open boreholes during and upon completion of the drilling operation. Water was noted at about 2 m depth upon completion of drilling. The groundwater level is inferred to be within about 4 m depth based on the change in colour of the glacial till subsoil at this depth.

It should be noted that groundwater levels are expected to fluctuate seasonally and are expected to be higher during wet periods of the year.

## ENGINEERING RECOMMENDATIONS

### General

This section of the report provides our recommendations on the geotechnical aspects of design of proposed high fill section between about Stations 25+130 and 25+280 based on our interpretation of the factual information obtained during the investigation. It should be noted that the interpretation and recommendations are intended for use only by the design engineer. Where comments are made on construction they are provided only in order to highlight those aspects which could affect the design of the project. Those requiring information on aspects of construction should make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction method and scheduling.

It is understood that Highway 404 will be extended from Davis Drive northerly to Herald Road, a distance of about 2.4 km. This extension will entail the conversion of the existing partial interchange at Davis Drive to a full interchange and the construction of a new partial interchange at Herald Road, including twin overpass structures. The project also involves the widening of the Herald Road / Woodbine Avenue intersection. The works described in this report are associated with the proposed high fill section between about Stations 25+130 and 25+280 along the proposed Highway 404 extension. Our previous Report No. 991-1162A, dated May 2000 and Report No. 991-1162B, dated January 2000 provided recommendations for the proposed twin

bridge structures at Herald Road and the high fill section between about Stations 25+630 and 25+860, respectively. The recommendations provided for the high fill section between Stations 25+630 and 25+860 are similar to the recommendations provided in this report since the subsurface conditions and proposed embankment heights are similar.

**Embankment Construction**

The subsoils at relatively shallow depth consist of generally stiff to hard clayey silt till. Although cobbles and boulders were not encountered within the boreholes, they typically exist within till deposits and as such are likely to be present. Water was observed at about 2 m depth in the open boreholes upon the completion of drilling. The groundwater level is inferred to be within about 4 m of the ground surface in the area of the high fill section based on the change in colour of the till deposit. The lowest area within the proposed high fill section appears to pond water during wet periods of the year, but was dry at the time of site investigation.

The profile drawing of the proposed grade of Highway 404 is shown at about Elevations 283.5 m to 282.8 m from the south to north within the high fill section. This indicates the embankment will be up to 6 m in height.

The topsoil should be stripped from below the embankment areas and all subgrade soils should be proof-rolled prior to fill placement. Construction of the embankment above the prepared subgrade may be carried out using clean earth fill meeting specifications OPSS 212 or Select Subgrade Material meeting specifications with OPSS 1010, depending on material availability. All embankment fill should be placed in regular lifts with loose thickness not exceeding 300 mm, and be compacted to at least 95 percent of the material's Standard Proctor maximum dry density. The final lift prior to placement of the granular subbase or base course should be compacted to 100 percent of the Standard Proctor maximum dry density. Inspection and field density testing should be carried out by qualified geotechnical personnel during all fill placement operations to ensure that appropriate materials are used and that adequate levels of compaction have been achieved. The permanent soil slopes of the embankment should be maintained not steeper than 2 horizontal to 1 vertical (2H:1V). Vegetation cover should be established on all soil slopes to protect embankment fill against surficial erosion, as per OPSS 572.

The embankment subgrade soil consists of a firm to very stiff clayey silt till for 4.5 m becoming hard with depth. In-situ vane testing was not carried out within the till, however, the undrained shear strength of the till is conservatively estimated to increase from about 50 kPa to greater than 100 kPa with depth. Providing that the embankment subgrade is properly prepared with side slopes maintained at 2 horizontal to 1 vertical, the calculated factor of safety for the highest (i.e. 6 m) embankment section will be greater than 2.0, which indicates the embankment is stable. Settlement of the embankment fills, properly placed and compacted, and of the underlying firm to hard clayey silt till is estimated to be less than 50 mm.

**GOLDER ASSOCIATES LTD.**

Dan K. Breeze, B.Sc.

Anne S. Poschmann, P.Eng.
Principal

Fintan J. Heffernan, P.Eng.
Designated MTO Contact

REGISTERED PROFESSIONAL ENGINEER A. S. POSCHMANN PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER F. J. HEFFERNAN PROVINCE OF ONTARIO

DKB/ASP/FJH/clg
S:\FINALDAT\1100\991-1162\2000\1162BIL1.DOC

Attachment(s): List of Abbreviations and Symbols
Record of Boreholes 17 and 18
Drawing 1 - Borehole Location Plan
Figure 1 - Grain Size Distribution Curve - Clayey Silt Till
Figure 2 - Plasticity Chart - Clayey Silt Till

# LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

## I. GENERAL

$\pi$ = 3.1416
ln x, natural logarithm of x
$\log_{10}$ x or log x, logarithm of x to base 10
g acceleration due to gravity
t time
F factor of safety
V volume
W weight

## II. STRESS AND STRAIN

$\gamma$ shear strain
$\Delta$ change in, e.g. in stress: $\Delta\sigma$
$\varepsilon$ linear strain
$\varepsilon_v$ volumetric strain
$\eta$ coefficient of viscosity
$\nu$ Poisson's ratio
$\sigma$ total stress
$\sigma'$ effective stress ($\sigma' = \sigma - u$)
$\sigma'_{vo}$ initial effective overburden stress
$\sigma_1,\sigma_2,\sigma_3$ principal stresses (major, intermediate, minor)
$\sigma_{oct}$ mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
$\tau$ shear stress
u porewater pressure
E modulus of deformation
G shear modulus of deformation
K bulk modulus of compressibility

## III. SOIL PROPERTIES

### (a) Index Properties

$\rho(\gamma)$ bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$ dry density (dry unit weight)
$\rho_w(\gamma_w)$ density (unit weight) of water
$\rho_s(\gamma_s)$ density (unit weight) of solid particles
$\gamma'$ unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
$D_R$ relative density (specific gravity)of solid particles ($D_R = \rho_s/\rho_w$) (formerly $G_s$)
e void ratio
n porosity
S degree of saturation

* Density symbol is $\rho$. Unit weight symbol is $\gamma$ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

### (a) Index Properties (con't.)

w water content
$w_l$ liquid limit
$w_p$ plastic limit
$I_P$ plasticity Index = $(w_l - w_p)$
$w_S$ shrinkage limit
$I_L$ liquidity index = $(w - w_p)/I_p$
$I_C$ consistency index = $(w_l - w)/I_p$
$e_{max}$ void ratio in loosest state
$e_{min}$ void ratio in densest state
$I_D$ density index = $(e_{max} - e)/(e_{max} - e_{min})$ (formerly relative density)

### (c) Hydraulic Properties

h hydraulic head or potential
q rate of flow
v velocity of flow
i hydraulic gradient
k hydraulic conductivity (coefficient of permeability)
j seepage force per unit volume

### (d) Consolidation (one-dimensional)

$C_c$ compression index (normally consolidated range)
$C_r$ recompression index (overconsolidated range)
$C_S$ swelling index
$C_\alpha$ coefficient of secondary consolidation
$m_v$ coefficient of volume change
$c_v$ coefficient of consolidation
$T_v$ time factor (vertical direction)
U degree of consolidation
$\sigma'_p$ pre-consolidation pressure
OCR Overconsolidation ratio $=\sigma'_p/\sigma'_{vo}$

### (e) Shear Strength

$\tau_p$, $\tau_r$ peak and residual shear strength
$\phi'$ effective angle of internal friction
$\delta$ angle of interface friction
$\mu$ coefficient of friction = tan $\delta$
c' effective cohesion
$c_u, s_u$ undrained shear strength ($\phi = 0$ analysis)
p mean total stress $(\sigma_1 + \sigma_3)/2$
p' mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q $(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
$q_u$ compressive strength $(\sigma_1 - \sigma_3)$
$S_t$ sensitivity

Notes: 1. $\tau = c' + \sigma' \tan\phi'$
2. Shear strength = (Compressive strength)/2

# LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

## I. SAMPLE TYPE

| | |
|---|---|
| AS | Auger sample |
| BS | Block sample |
| CS | Chunk sample |
| SS | Split-spoon |
| DS | Denison type sample |
| FS | Foil sample |
| RC | Rock core |
| SC | Soil core |
| ST | Slotted tube |
| TO | Thin-walled, open |
| TP | Thin-walled, piston |
| WS | Wash sample |

## II. PENETRATION RESISTANCE

**Standard Penetration Resistance (SPT), N:**

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

**Dynamic Cone Penetration Resistance; $N_d$:**

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

**PH:** Sampler advanced by hydraulic pressure
**PM:** Sampler advanced by manual pressure
**WH:** Sampler advanced by static weight of hammer
**WR:** Sampler advanced by weight of sampler and rod

**Piezo-Cone Penetration Test (CPT)**

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 $cm^2$ pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance ($Q_t$), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

## III. SOIL DESCRIPTION

### (a) Cohesionless Soils

| Density Index (Relative Density) | N Blows/300 mm or Blows/ft. |
|---|---|
| Very loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very dense | over 50 |

### (b) Cohesive Soils

| Consistency | $c_u, s_u$ kPa | $c_u, s_u$ psf |
|---|---|---|
| Very soft | 0 to 12 | 0 to 250 |
| Soft | 12 to 25 | 250 to 500 |
| Firm | 25 to 50 | 500 to 1,000 |
| Stiff | 50 to 100 | 1,000 to 2,000 |
| Very stiff | 100 to 200 | 2,000 to 4,000 |
| Hard | over 200 | over 4,000 |

## IV. SOIL TESTS

| | |
|---|---|
| w | water content |
| $w_p$ | plastic limit |
| $w_l$ | liquid limit |
| C | consolidation (oedometer) test |
| CHEM | chemical analysis (refer to text) |
| CID | consolidated isotropically drained triaxial test[1] |
| CIU | consolidated isotropically undrained triaxial test with porewater pressure measurement[1] |
| $D_R$ | relative density (specific gravity, $G_s$) |
| DS | direct shear test |
| M | sieve analysis for particle size |
| MH | combined sieve and hydrometer (H) analysis |
| MPC | Modified Proctor compaction test |
| SPC | Standard Proctor compaction test |
| OC | organic content test |
| $SO_4$ | concentration of water-soluble sulphates |
| UC | unconfined compression test |
| UU | unconsolidated undrained triaxial test |
| V | field vane (LV-laboratory vane test) |
| $\gamma$ | unit weight |

**Note:** 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

# RECORD OF BOREHOLE No 17

1 OF 1

**METRIC**

PROJECT 991-1162
W.P. 421-98-00
DIST 6 HWY 404
DATUM GEODETIC

LOCATION STA. 25+215 Centreline
BOREHOLE TYPE 114mm SOLID STEM AUGERS
DATE September 8, 2000

ORIGINATED BY DKB
COMPILED BY DKB
CHECKED BY ASP

| 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 kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 277.30 | GROUND SURFACE | | | | | | | | | | |
| 0.00 | Topsoil | | 1 | 50 DO | 6 | | 277 | | | | |
| 276.61 | | | | | | | | | | | |
| 0.69 | Clayey Silt, trace to some sand, trace gravel<br>Firm to hard<br>Brown becoming grey at 3.9m depth<br>Moist<br>(Glacial Till) | | 2 | 50 DO | 6 | | 276 | | | | |
| | | | 3 | 50 DO | 8 | | | | ○ | | |
| | | | 4 | 50 DO | 12 | | 275 | | ⊢● | | 1 12 65 22 |
| | | | 5 | 50 DO | 17 | | 274 | | | | |
| | | | 6 | 50 DO | 18 | | | | ○ | | |
| | | | 7 | 50 DO | 55/.15 | | 273 | | | | |
| 270.90 | | | 8 | 50 DO | 59/.15 | | 272 | | | | |
| 6.40 | END OF BOREHOLE<br><br>Water level observed in open borehole at 2m depth (El.275.3m) upon completion of drilling. | | | | | | 271 | | | | |

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

$\circ^{3\%}$ STRAIN AT FAILURE

# RECORD OF BOREHOLE No 18

1 OF 1

**METRIC**

PROJECT 991-1162
W.P. 421-98-00
DIST 6 HWY 404
DATUM GEODETIC

LOCATION STA. 25+200 Centreline
BOREHOLE TYPE 114mm SOLID STEM AUGERS
DATE September 8, 2000

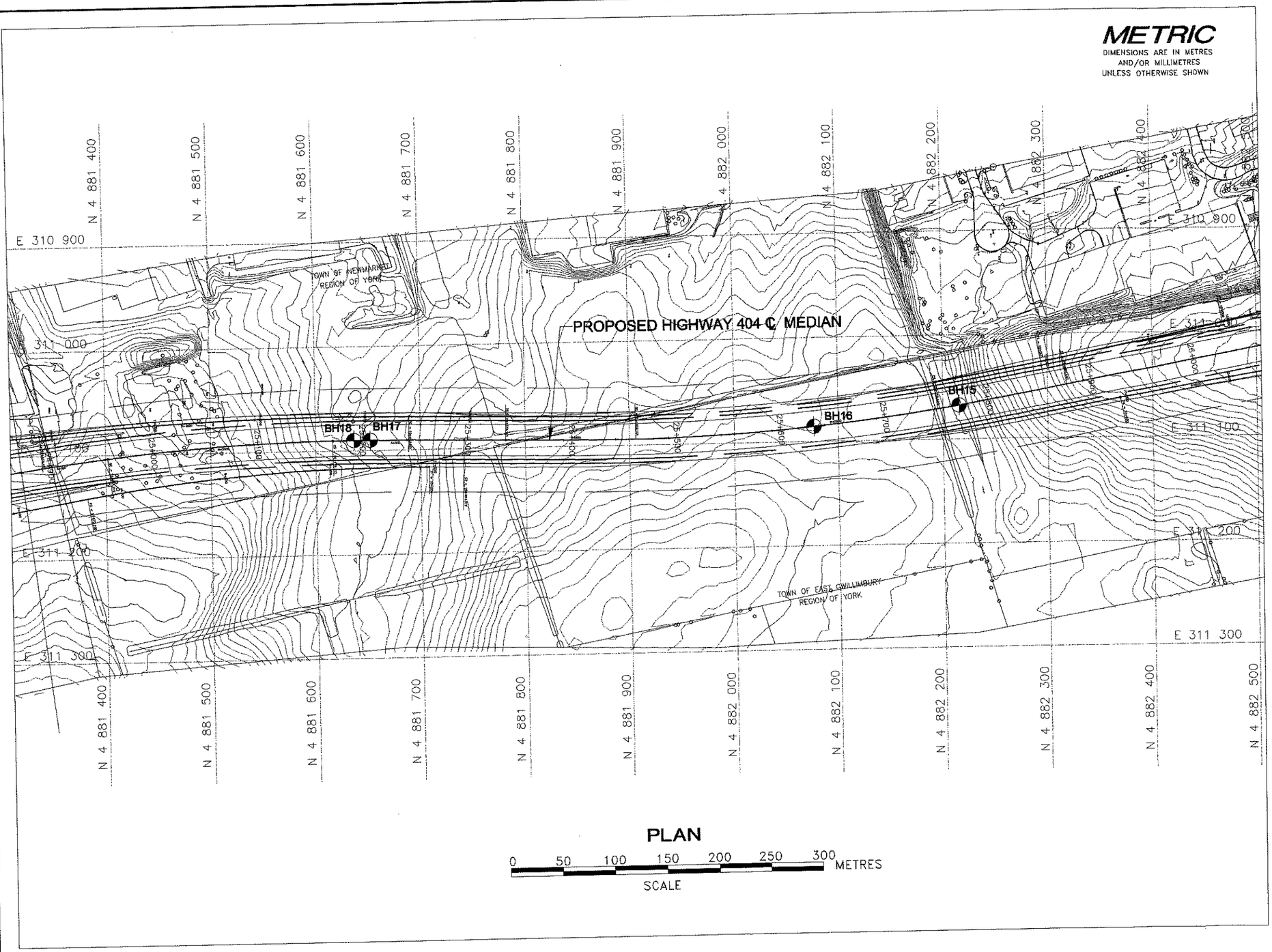
ORIGINATED BY DKB
COMPILED BY DKB
CHECKED BY ASP

| 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 kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 277.00 | GROUND SURFACE | | | | | | | | | | |
| 0.00 | Topsoil | | 1 | 50 DO | 4 | | | | | | |
| 276.31 | | | | | | | | | | | |
| 0.69 | Clayey Silt, trace to some sand, trace gravel<br>Firm to hard<br>Brown becoming grey at 4m depth<br>Moist<br>(Glacial Till) | | 2 | 50 DO | 6 | | 276 | | | | |
| | | | 3 | 50 DO | 6 | | 275 | | ○ | | |
| | | | 4 | 50 DO | 13 | | 274 | | | | |
| | | | 5 | 50 DO | 24 | | | | | | |
| | | | 6 | 50 DO | 30 | | 273 | | ○ | | |
| | | | 7 | 50 DO | 60/.15 | | 272 | | | | |
| | | | 8 | 50 DO | 57/.15 | | | | | | |
| 270.60 | | | 9 | 50 DO | 65/.15 | | 271 | | ○ | | |
| 6.40 | END OF BOREHOLE<br><br>Water level observed in open borehole at 2m depth (El.275.0m) upon completion of drilling. | | | | | | | | | | |

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

○ 3% STRAIN AT FAILURE

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN




**PLAN**

0 50 100 150 200 250 300 METRES

SCALE

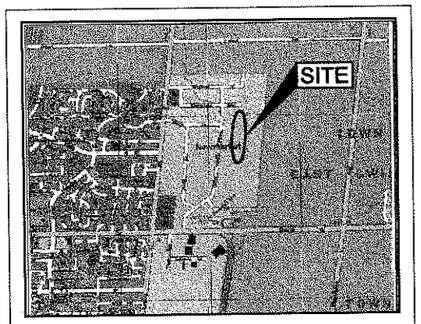
DIST No. 6 HWY 404
CONT No.
WP No. 421-98-00

SHEET

HIGHWAY 404
HIGH FILL STA. 25+630 TO 25+860
AND STA. 25+130 TO STA. 25+280
BOREHOLE LOCATION PLAN

Golder Associates

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA




KEY PLAN

LEGEND

Borehole

| No. | ELEVATION | STATION | OFFSET |
|---|---|---|---|
| BH15 | 282.7 * | 25+780 | ℄ MEDIAN |
| BH16 | 283.6 * | 25+640 | ℄ MEDIAN |
| BH17 | 277.3 * | 25+215 | ℄ MEDIAN |
| BH18 | 277.0 * | 25+200 | ℄ MEDIAN |

* ELEVATION INFERRED FROM PROFILE

NOTES
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REFERENCE
This drawing was created from digital file's "S300-RA1.dwg 300-RA2.DWG, AND HWY404PROFILE.DWG, provided by McCormick Rankin Corp.

| NO. | DATE | BY | REVISION |
|---|---|---|---|
| 3 | 00/09/14 | ASP | ADDENDUM A |
| 2 | 00/01/19 | ASP | FINAL |
| 1 | 00/01/11 | ASP | REVIEW |

Geocres No.

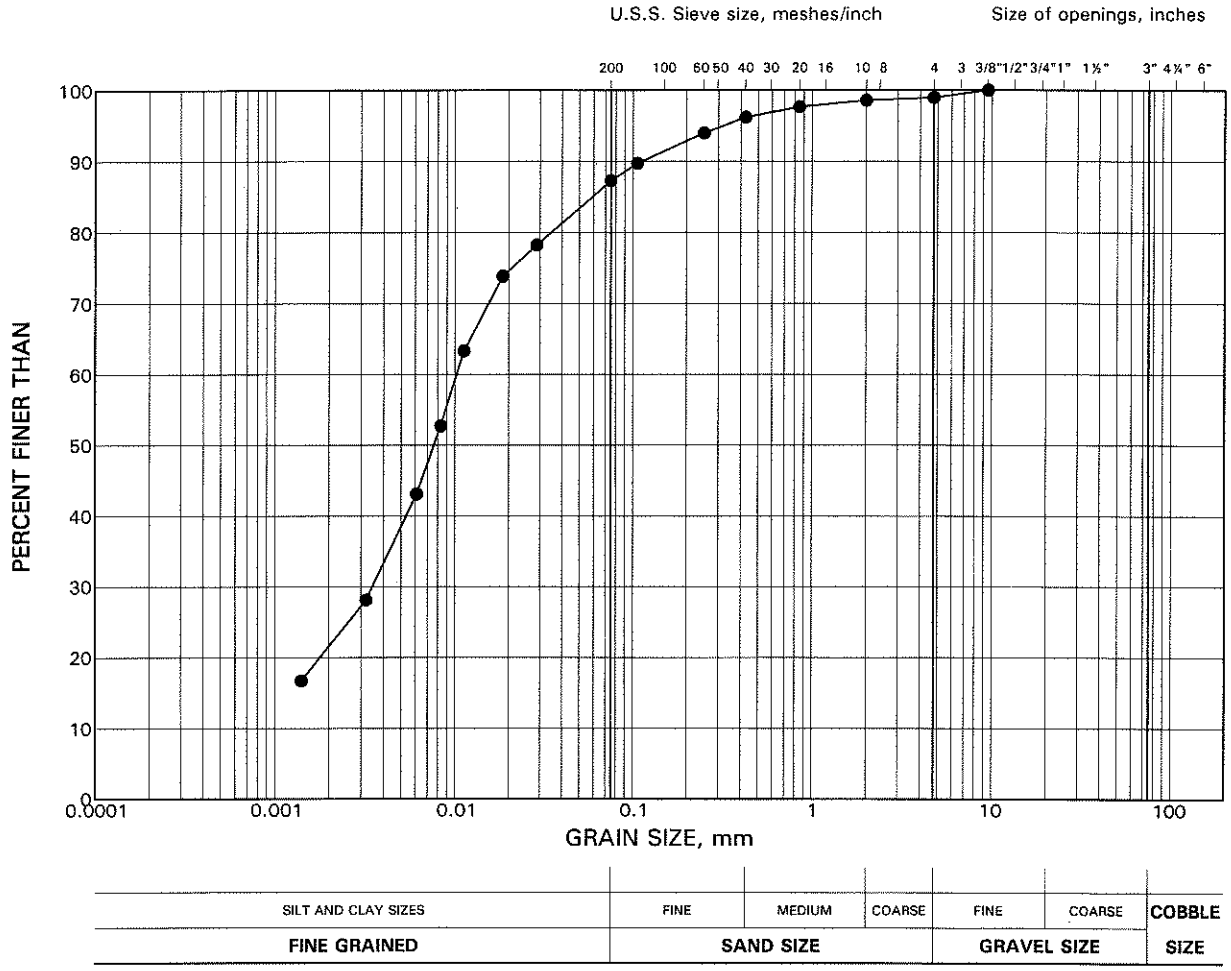
| | | | |
|---|---|---|---|
| HWY 404 | PROJECT NO.: 991-1162B | | DIST. 6 |
| SUBM'D. DKB | CHKD: ASP | DATE: 1999 12 16 | SITE |
| DRAWN: JFC | CHKD. ASP | APPD. | DWG. 1 |

01162B01.DWG.DWG

1" = 1" imp. (1:4,000MS)

# GRAIN SIZE DISTRIBUTION
Clayey Silt (Glacial Till)

FIGURE 1

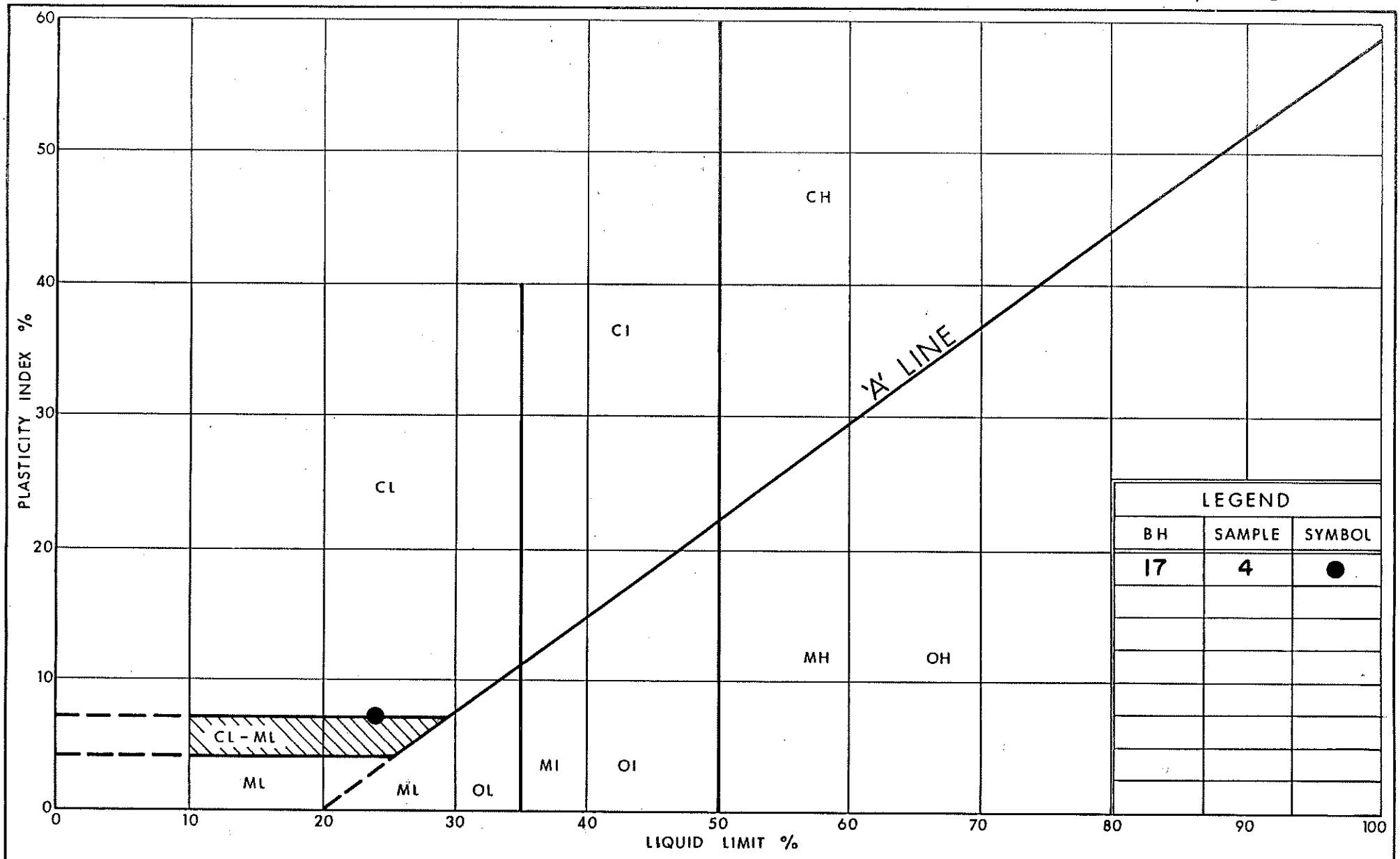



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | ELEVATION (m) |
|---|---|---|---|
| ● | 17 | 4 | 274.4 |

Project 991-1162

**Golder Associates**




Ministry of Transportation
Ontario

# PLASTICITY CHART

## CLAYEY SILT (GLACIAL TILL)

FIG No 2

W P 421-98-00