

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 40-77-00

DIST 6

HWY 89 Extension STR SITE ---
from York Rd. 12 to Hwy. 12

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FOUNDATION INVESTIGATION REPORT

for Preliminary Study of

Hwy. 89 Extension from York Rd. 12 to Hwy. 12

W.P. 40-77-00

District 6, Toronto

INTRODUCTION

This report contains the results of a preliminary foundation investigation for seven proposed structures along the alignment of the planned extension of Hwy. 89 from York Rd. 12 to Hwy. 12. Fieldwork was completed between January 25 to February 9, 1983 and consisted of 8 sampled boreholes advanced by means of hollow stem augers to depths of 87 feet below the ground surface. In addition, two of the proposed sites were investigated previously by consultants for other agencies, and their results have been incorporated into this report.

The purpose of the investigation was to identify potential problem areas (design and construction) and assist the planners in determining the feasibility and approximate cost of the proposed new Hwy. 89 extension. However, detailed foundation investigations will be required when the final geometries, grades, and alignment of the proposed highway have been determined.

SITE DESCRIPTION AND GEOLOGY

The area under consideration is located south of Lake Simcoe within the Regional Municipalities of York and Durham. The area for this portion of the Hwy. 89 Extension stretches some 21 miles easterly between York Rd. 12 and Hwy. 12. Approximately 17 miles is planned to follow the existing alignment of York Rd. 32, with the remaining 4 miles to be constructed south of Udora and eventually connecting with Hwy. 7 at the intersection of Hwys. 12 and 7.

Physiographically, the study area is located within the region known as the Simcoe Lowlands. Extending south from Lake Simcoe, the general description of the area is a low, swampy sandy plain. The Black River and Pefferlaw Brook are the major streams, but do not provide adequate drainage of the area. Zephyr Creek, Mount Albert Creek, and Uxbridge Brook are the major tributaries, and are located in long, swampy valleys roughly 1 mile wide and heavily forested. Several areas of drumlinized till are present within the study area, breaking the continuity of the plain. In general, land use in the proposed right-of-way consists mainly of forest and swampy lowlands, with scattered rural residential and agricultural properties.

SUBSURFACE CONDITIONS

In general, subsurface conditions across this portion of the Hwy. 89 Extension are fairly uniform. Extending from the ground surface to depths of up to 8 feet are organic materials comprised of very soft peat or very loose organic silt. Below the organics are predominantly granular materials consisting of very loose to dense fine sands and silts, with occasional zones of firm to hard silty clay of low to intermediate plasticity.

Subsurface Conditions Cont'd.

Underlying the above mentioned subsoils at depths varying from 35 to 85 feet below the ground surface is a glacial till stratum of undetermined thickness. The till is comprised either mainly of very dense sand and gravel, or a hard heterogeneous mixture of silty clay, sand and gravel.

The subsoil conditions encountered from the ground surface downward, together with laboratory test results, are presented in the Record of Borehole Sheets and also described in the Foundation Recommendation tables.

GROUNDWATER CONDITIONS

In general, groundwater levels were encountered at or near the ground surface in the vicinities of the various structural sites. An artesian condition was also encountered at an approximate elevation on the west side of Pepperlaw Brook (Site A5).

DISCUSSION AND RECOMMENDATIONS

This portion of the proposed Hwy. 89 will require the crossing of six waterways and one railway. The recommended grade for the Hwy. 89 Extension will involve fill heights in the order of 5 to 40 feet.

Our comments for the feasibility, design, and construction of the various structures are given on the Foundation Data Sheets included in the Appendix of this report. A data sheet is provided for each of the seven structures, with the area location described on these sheets and also shown on Drawing No. 407700-A. The original ground elevation range given and proposed grades are based on a small scale ϕ profile and as such the accuracy is not great. Also, subsurface conditions are described very briefly and are based on generally not more than one boring

Discussion and Recommendations Cont'd.

per site. Boreholes have been located with reference to identifiable landmarks at each proposed crossing, as no line has yet been stated in the field for the planned highway extension.

1. Structure Recommendations

General details of structure recommendations are provided below.

Spread Footings: This alternative is given for abutments and piers where subsurface conditions are considered fairly competent. The maximum founding elevation and corresponding maximum factored design capacities are provided. Spread footings should be provided with a minimum of 5 feet of earth cover for frost protection purposes. Where the abutment footing is located in granular materials and the water table is at or above the footing founding level, a dewatering scheme would be required to prevent the base of the footing from boiling due to unbalanced excess hydrostatic head. In addition, where spread footings are to be founded on cohesive deposits subject to softening upon exposure, it would be necessary to protect the footing base from softening by placing mass concrete upon completion of the footing excavation.

End Bearing Piles: The recommendation for this alternative provides the estimated pile tip elevation. End bearing piles can be designed for the maximum allowable structural capacity which is dependent upon the particular pile section chosen. It is generally assumed that steel H-piles will be used, and that pile driving would be field controlled by the Hiley Formula.

Discussion and Recommendations Cont'd.

Friction Piles: This foundation alternative is recommended for abutments and piers where it is considered to be suitable with an end bearing pile. The loading recommendations are given for a #36 timber pile of specified length.

2. Recommendation - Approaches

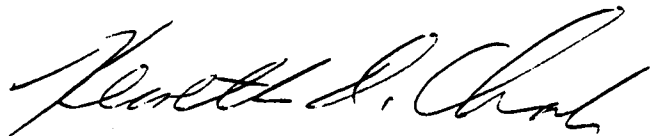
The recommendations for fill slopes at the various structures are based on the preliminary grades and assuming fills are constructed of acceptable free draining granular materials to current M.T.C. specifications.

3. Remarks

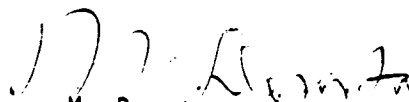
This column discusses actual creek/river flood plain and bed conditions, and other considerations or comments to be evaluated during this stage of design.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. K. Chak, Trainee Engineer, using equipment owned and operated by Atcost Soil Drilling Inc.. This report was written by Mr. Chak and reviewed by Mr. M. Devata, Senior Foundations Engineer.



K.D. Chak
Project Engineer



M. Devata
Senior Foundations
Engineer

APPENDIX

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A1 LOCATION York Rd. 32' at Maskinonge River (Norris Creek)

ORIGINAL GROUND ELEV 743 PROP HWY Hwy. 89 Extension GRADE ELEV 748

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|--|---|--|--|
| | STRUCTURE | APPROACHES | |
| <p><u>Reference Boreholes: 1, 1A, 1B</u></p> <p><u>BH 1</u></p> <p>0 - 3.0' Silty sand w/organics very loose</p> <p>3 - 14.0' Sandy silt, trace gravel loose to very dense</p> <p>14 - 18.0' Fine sand very dense</p> <p>18 - 35.0' Silt dense to very dense</p> <p>35 - 62.0'+ Plastic silt and fine sand layered very stiff to hard or very dense</p> <p><u>BH 1A, 1B</u></p> <p>0 - 4.0' Silty sand w/organics</p> <p>4 - 15.0' Sandy silt with gravel compact to very dense</p> <p>15 - 36.0'+ Fine sand, some silt very dense</p> | <p><u>Abutments</u></p> <p>1. Spread footings at or below elevation 735.0. Designed for a factored capacity at U.L.S. of 4.5 tsf. and a capacity at S.L.S. Type II of 3.0 tsf..</p> <p>2. A dewatering scheme will be required.</p> | <p>Fill heights in the order of 5.0 ft. will be stable with 2:1 slopes</p> | <p>The proposed 10.0 ft widening of the present culvert will require expansion joints to articulate settlements between the new and existing structures.</p> <p>Sheeting should be used to prevent any inflow of water into the excavation. It should be extended to elevation 731.0.</p> <p><u>Photo No. 1, 2</u></p> |

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A2 LOCATION York Rd. 32 at Black River

ORIGINAL GROUND ELEV 744 (estimated) PROP HWY Hwy. 89 Extension GRADE ELEV 751

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|---|--|---|---|
| | STRUCTURE | APPROACHES | |
| <p><u>Reference Boreholes: 2, 2A</u></p> <p><u>BH 2</u></p> <p>2 - 9.0' Gravelly to fine sand, very loose</p> <p>9 - 17.0' Organic silt with sand, very soft</p> <p>17 - 34.5' Fine to med. sand loose to compact</p> <p>34 - 39.5' Silty clay, trace of sand and gravel stiff</p> <p>39 - 42.0' Fine sand, compact</p> <p>42 - 50'+ Glacial till very dense</p> <p><u>BH 2A</u></p> <p>9 - 11.5' Organic silt very soft</p> <p>11 - 34.0' Fine sand, compact</p> <p>34 - 44.0 Silty clay firm to stiff</p> <p>44 - 46.0' Sandy silt</p> <p>46 - 49'+ Glacial till very dense</p> | <p>A steel-truss bridge is presently situated at this intersection and carries the existing York Rd. 32 over the Black River. A foundation investigation was carried out for a proposed replacement structure by Site Investigation Services Limited in 1972 (this report is on file in the Structural Office).</p> <p><u>Abutments</u></p> <p>1. End bearing piles. Estimated pile tip elevation below 695.0. Designed for maximum allowable structural capacity of the pile.</p> <p>2. A dewatering scheme will be required for construction of the pile caps.</p> | <p>Excavation of the surficial organic silt and sand, is the most viable alternative available to reduce settlements and ensure stability of the proposed 10.0 ft. approach fills</p> | <p>Approx. 3.0 ft. of settlement has occurred under the present 5.0 ft. fills.</p> <p><u>Photo No. 3, 4</u></p> |

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A3 LOCATION York Rd. 32 at C.N.R. Crossing

ORIGINAL GROUND ELEV 760-761 PROP HWY Hwy. 89 Extension GRADE ELEV 780-810

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|--|---|--|---|
| | STRUCTURE | APPROACHES | |
| <u>Reference Boreholes: 3</u> 0 - 1.5' Organic silt very soft 1.5-11.0' Layers of silty clay and silt firm or loose 11 - 35.8' Silty sand to sandy silt, dense 35.8-57.0' Layers of silty clay and silt firm or loose 57 - 87.0'+ Glacial till dense to v. dense | <u>Abutments and Piers</u> 1. End bearing piles. Estimated pile tip elevation of 675.0. Designed for maximum allowable structural capacity of the pile. | Proposed fill heights in the order of 40 ft. will cause some stability con- cerns. 1. Subexcavation of the upper 11.0 ft. of organics and silty clay & silt will be required 2. The use of a light- weight fill material is recommended. 3. A mid-height 40.0 ft. berm in both the later- al and longitudinal direction, combined with the above alter- natives should be con- sidered to ensure stability of the fills. | Poor soil conditions exist between elev. 725 and 700, requir- ing further detailed investigation and analysis. In addition, a pile driving criteria should be developed. <u>Photo No. 5, 6</u> |

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A4 LOCATION York Road 32 at Zephyr Creek

ORIGINAL GROUND ELEV 767 PROP HWY Hwy. 89 Extension GRADE ELEV 770

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|---|--|--|---|
| | STRUCTURE | APPROACHES | |
| <p><u>Reference Boreholes:</u> 4,5</p> <p>0 - 3.0' Roadway fill compact</p> <p>3 - 7.0' Organic soil (peat) soft</p> <p>7 - 16.0' Fine sand, trace of gravel compact to loose</p> <p>16 - 23.0' Silty clay very stiff</p> <p>23 - 64.0' Layers of sandy silt and fine sand loose to compact</p> <p>64.0'+ Glacial till very dense</p> | <p><u>Abutments</u></p> <ol style="list-style-type: none"> 1. Wooden friction piles to elevation 722.0. Based on a #36 timber pile, a factored capacity at U.L.S. of 35 tons per pile and at S.L.S. Type II of 20 tons per pile can be estimated for design purposes. 2. End bearing piles. Estimated pile tip elevation of 700.0. Designed for maximum allowable structural capacity of the pile. 3. A dewatering scheme will be required for construction of the pile caps. | <p>No stability problems are anticipated for the proposed 3.0 ft. fills with 2:1 slopes.</p> | <p>The present structure at this site is a wooden bridge founded on timber piles. The site is located in a swampy lowland area, with a meandering Zephyr Creek undefined by tall grass and scrub growth</p> <p><u>Photo No. 7</u></p> |

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A5 LOCATION Pefferlaw Brook Crossing

ORIGINAL GROUND ELEV 760 PROP HWY Hwy. 89 Extension GRADE ELEV 770

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|--|---|--|---|
| | STRUCTURE | APPROACHES | |
| <p><u>Reference Boreholes: 6,7</u></p> <p style="text-align: center;"><u>BH 6</u></p> <p>0 - 7.0' Organic silt very soft</p> <p>7 - 18.0' Fine sand compact to v. dense</p> <p>18 - 37.0' Silty Clay stiff to hard</p> <p>37 - 50.0' Silty sand</p> <p style="text-align: center;"><u>BH 7</u></p> <p>0 - 5.0' Sandy silt with organics very loose</p> <p>5 - 24.0' Fine sand compact to dense</p> <p>24 - 43.0' Silty clay very stiff to hard</p> <p>43 - 58.0' Silty sand</p> <p>58 - 66.5'+ Glacial till very dense</p> | <p><u>Abutments and Piers</u></p> <ol style="list-style-type: none"> 1. End bearing piles. Estimated pile tip elevation of 700.0. Designed for maximum allowable structural capacity of the pile. A dewatering scheme will be required. 2. Additional filter material will be needed underneath the pile caps to prevent the loss of fines due to the presence of artesian ground-water conditions encountered at the west side of the brook. | <p>Fill heights in the order of 10.0 ft. will be stable with 2:1 slopes with a required excavation of approx. 7.0 ft. of organics and loose surficial soils.</p> | <p>During the fieldwork, the brook had depths of up to 3.0 ft..</p> <p>The eastern bank is heavily wooded and is at the base of a gentle slope to the west.</p> <p>The western bank is fairly flat and is covered with grass and scrub growth.</p> <p style="text-align: right;"><u>Photo No. 8</u></p> |

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A6 LOCATION Uxbridge Brook Crossing

ORIGINAL GROUND ELEV 780-784 PROP HWY Hwy. 89 Extension GRADE ELEV 787-792

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|---|---|--|---|
| | STRUCTURE | APPROACHES | |
| Reference Boreholes: 8 | <u>Abutments</u> | | |
| 0 - 3.0' Organic soil (peat) very soft | 1. Spread footings at or below elevation 765.0. Design for a factored capacity at U.L.S. of 8.0 tsf, and capacity at S.L.S. Type II of 4.0 tsf. | 1. Approximately 7.0 ft. of surficial organic and loose materials are to be excavated. | The east side of Uxbridge Brook at this location is a swampy lowland area. The creek bed is undefined by tall grass and scrub growth. |
| 3 - 5.0' Sand and gravel compact | | | |
| 5 - 7.0' Sandy silt loose | 2. End bearing piles. Estimated pile tip elevation of 756.0. Designed for maximum allowable structural capacity of the pile. | 2. Fill heights of 12.0 ft. will be stable with 2:1 slopes. | The west side of the creek is well defined and slopes moderately to the east. It is fairly heavily wooded |
| 7 - 12.0' layers of silt and silty clay stiff to very stiff | | | |
| 12 - 23.5' Silt, trace of sand dense | 3. A dewatering scheme will be required for both of the above alternatives. | | |
| 23.5'+ Glacial till hard | | | |
| | | | <u>Photo No. 9</u> |

FOUNDATION DATA SHEET

W P 40 - 77 - 00 SITE A7 LOCATION Vrooman Creek Crossing

ORIGINAL GROUND ELEV 855 PROP HWY Hwy. 89 Extension GRADE ELEV 858-860

| SUBSURFACE CONDITIONS | RECOMMENDATIONS | | REMARKS |
|--|---|--|---|
| | STRUCTURE | APPROACHES | |
| <u>Reference Boreholes: 9</u> 0 - 7.0' Organic soil (peat) very soft 7 - 13.0' Sandy silt, trace of gravel loose to compact 13 - 28.0'+ Glacial till hard | <u>Abutments</u> 1. Spread footings at or below elevation 840.0. Designed for a factored capacity at U.L.S. of 8.0 tsf and a capacity at S.L.S. Type II of 4.0 tsf. 2. End bearing piles. Estimated pile tip elevation of 832.0. Designed for maximum allowable structural capacity of the pile. 3. A dewatering scheme will be required for both of the above alternatives. | 1. Approx. 9.5 ft. of organics and loose silt is to be excavated. 2. Fill heights in the order of 5.0 ft. will be stable at 2:1 slopes. | At this location during the field-work, the creek was undefined due to flooding of the surrounding lowland area. The depth of water at this location was variable from 1.0 to 3.0 ft.. Pending further hydrological study, a concrete box type culvert or steel pipe arch may be suitable at this location. <u>Photo No. 10</u> |

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N_c .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON "A" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

| S_u (PSF) | 0 - 250 | 250 - 500 | 500 - 1000 | 1000 - 2000 | 2000 - 4000 | > 4000 |
|-------------|-----------|-----------|------------|-------------|-------------|--------|
| | VERY SOFT | SOFT | FIRM | STIFF | VERY STIFF | HARD |

DENSITY: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

| 'N' (BLOW/FT) | 0 - 5 | 5 - 10 | 10 - 30 | 30 - 50 | > 50 |
|---------------|------------|--------|---------|---------|------------|
| | VERY LOOSE | LOOSE | COMPACT | DENSE | VERY DENSE |

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), 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 | 2" | 2" - 12" | 1' - 3' | 3' - 10' | > 10' |
|----------|------------|----------|------------|----------|------------|
| JOINTING | VERY CLOSE | CLOSE | MOD. CLOSE | WIDE | VERY WIDE |
| BEDDING | VERY THIN | THIN | MEDIUM | THICK | VERY THICK |

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. \bar{C}_{IU} = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

SS SPLIT SPOON
WS WASH SAMPLE
ST SLOTTED TUBE SAMPLE
BS BLOCK SAMPLE
CS CHUNK SAMPLE
TW THINWALL OPEN
TP THINWALL PISTON
OS OSTERBERG SAMPLE
FS FOIL SAMPLE
RC ROCK CORE
PH T.W. ADVANCED HYDRAULICALLY
PM T.W. ADVANCED MANUALLY

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE
 w SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_q, N_c BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_o INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_p PLASTIC LIMIT
 w_s SHRINKAGE LIMIT
 I_p PLASTICITY INDEX = $w_L - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_e EXCESS u
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 σ_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 σ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ'_n = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 α_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 O_c OVERCONSOLIDATION RATIO (OCR)

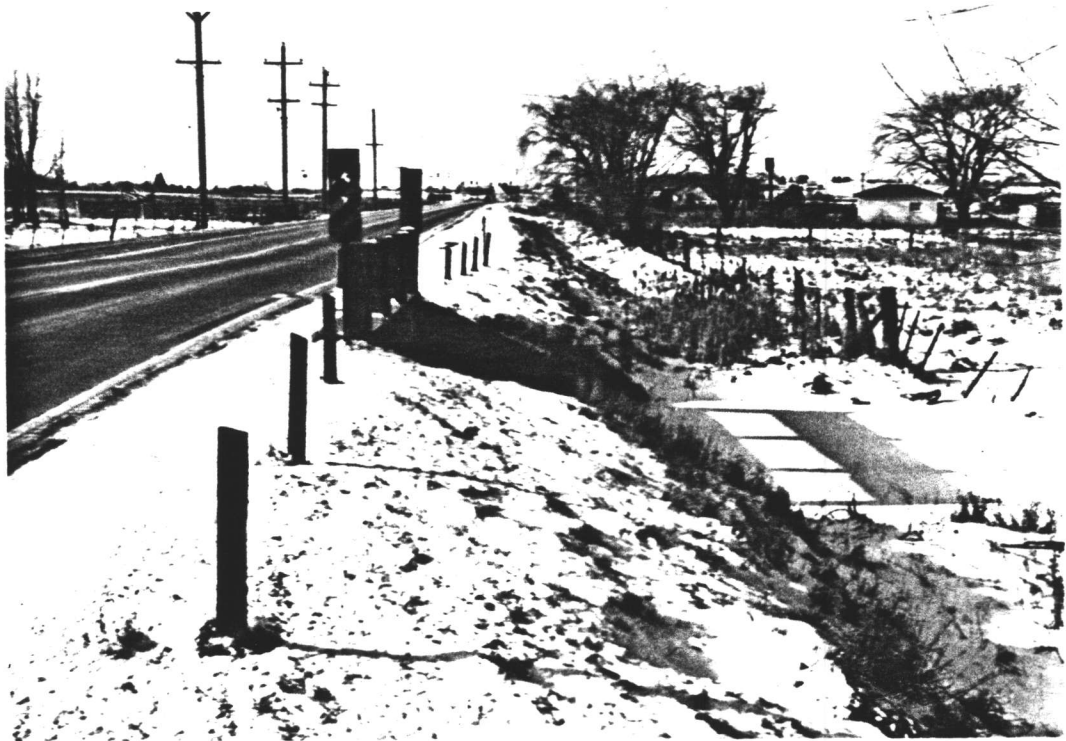


Photo 1

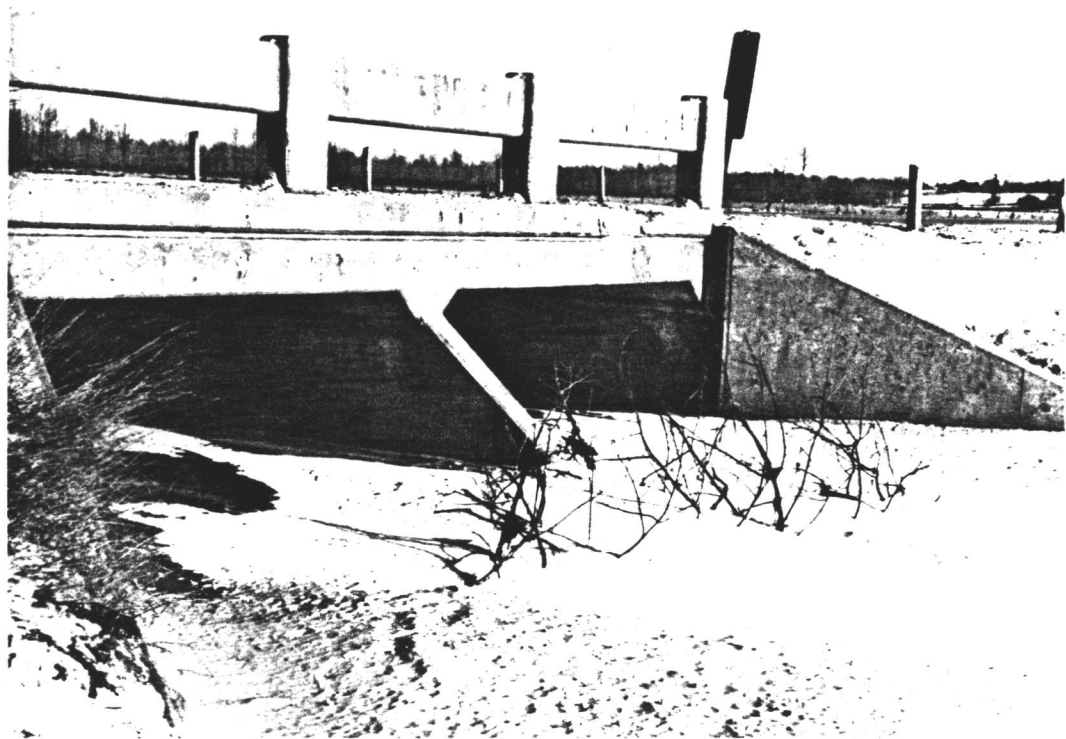


Photo 2

SITE A1 - Maskinonge River
(Norris Creek)



Photo 3

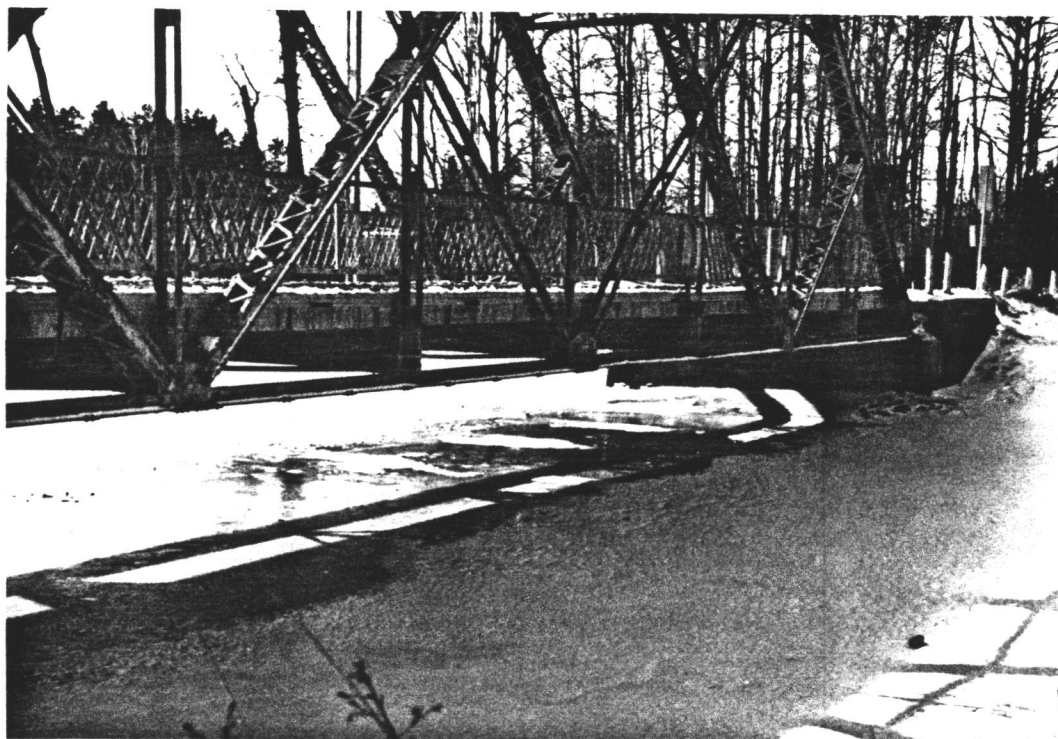


Photo 4

SITE A2 - Black River

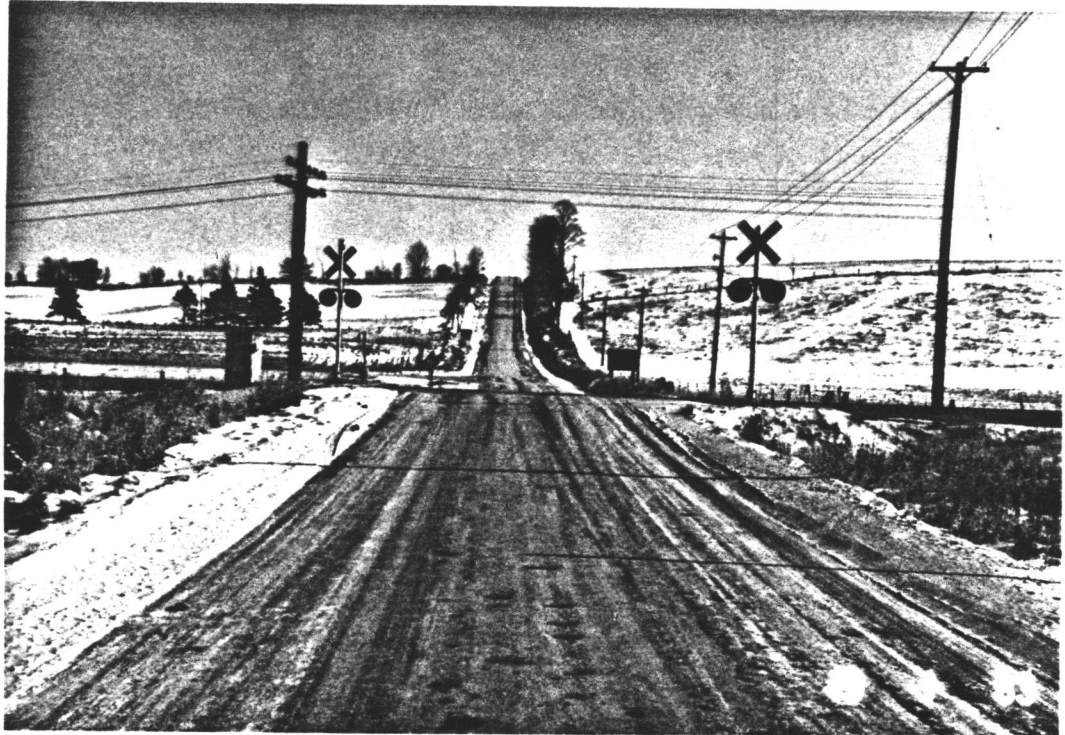


Photo 5



Photo 6

SITE A3 - C N R Crossing

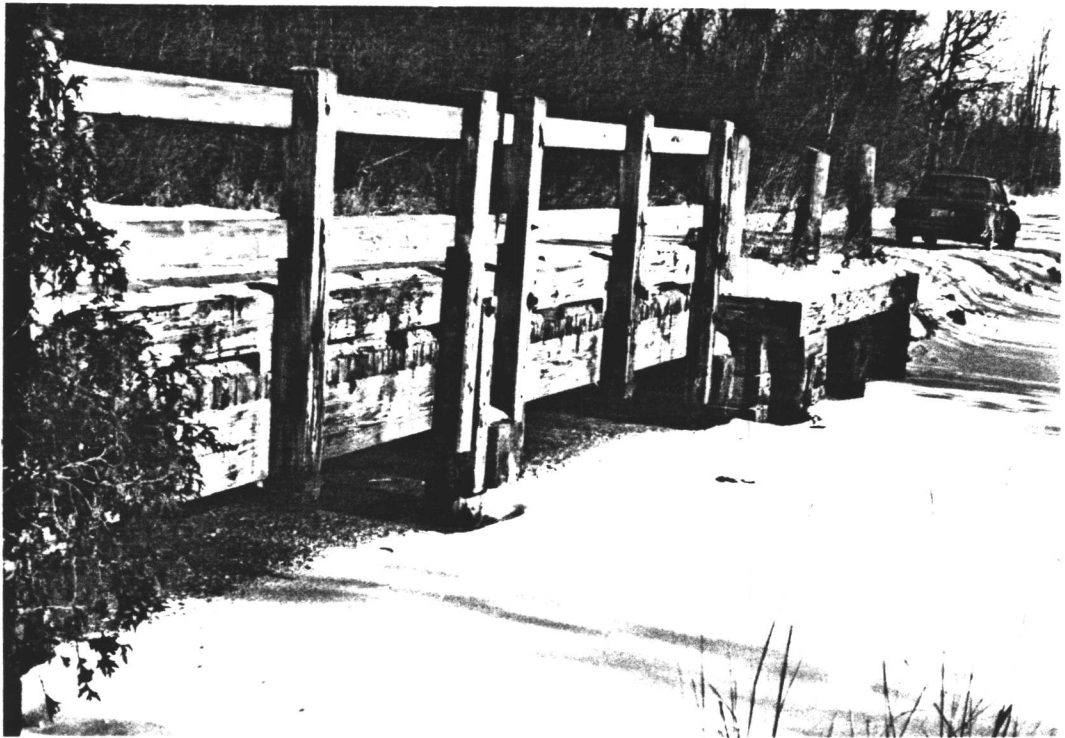


Photo 7
SITE A4 - Zephyr Creek



Photo 8
SITE A5 - Pfefferlaw Brook



Photo 9
SITE A6 - Uxbridge Brook



Photo 10
SITE A7 - Vrooman Creek

RECORD OF BOREHOLE No 1 (SITE A1)

York Rd. 32 & Maskinonge River (Norris Creek)

W P 40-77-00

LOCATION (See Field Notes)

ORIGINATED BY KC

DIST 6 HWY 89 Ext. 'n

BOREHOLE TYPE Hollow Stem Augers and Cone Test

COMPILED BY KC

DATUM Geodetic

DATE 83 01 25

CHECKED BY *SP*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 40 60 80 100 | | | | | | |
| 743.5 | Ground Surface | | | | | | | | | | | | | |
| 0.0 | Silty Sand with org. Very Loose | | 1 | SS | 3 | | 740 | | | | | | | GR SA SI CL |
| 740.5 | | | 2 | SS | 6 | | | | | | | | | |
| 3.0 | Sandy Silt, trace Gravel | | 3 | SS | 22 | | | | | | | | | 2 38 47 13 |
| | Loose to Very Dense | | 4 | SS | 30 | | | | | | | | | |
| | Grey | | 5 | SS | 50 | | | | | | | | | 3 17 69 11 |
| 729.5 | | | | | | | 730 | | | | | | | |
| 14.0 | Fine Sand, Very Dense | | 6 | SS | 75 | | | | | | | | | |
| 725.5 | Brown | | | | | | | | | | | | | |
| 18.0 | Silt Dense to Very Dense | | 7 | SS | 46 | | 720 | | | | | | | |
| | Brown-Grey | | 8 | SS | 50 | | | | | | | | | 0 3 95 2 |
| | | | 9 | SS | 52 | | | | | | | | | |
| 708.5 | | | | | | | 710 | | | | | | | |
| 35.0 | Layers of Plastic Silt and Fine Sand | | 10 | SS | 35 | | 700 | | | | | | | |
| | Very Stiff to Hard or Very Dense | | | | | | | | | | | | | |
| | Brown-Grey | | 11 | SS | 66 | | | | | | | | | |
| | | | | | | | 690 | | | | | | | |
| 682.0 | | | 12 | SS | 66 | | | | | | | | | |
| 61.5 | End of Borehole | | | | | | | | | | | | | |

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 1A (SITE A1) (Formerly BM 1 Done by William Trow & Assoc Ltd)
York Rd. 32 & Maskinonge River (Norris Creek)
(See Trow Report in File)

W P 40-77-00 LOCATION York Rd. 32 & Maskinonge River (Norris Creek) ORIGINATED BY WTA
DIST 6 HWY 89 Ext.'n BOREHOLE TYPE Modified Diamond Drill COMPILED BY WTA
DATUM Geodetic DATE 60 04 01 CHECKED BY [Signature]

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 743.6 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Silty Sand with Organics | | | | | | | | | | | | | | | | |
| 739.0 | Brown | | | | | | | | | | | | | | | | |
| 4.6 | Sandy Silt with Gravel Compact to Very Dense | | 1 | SS | 22 | | | | | | | | | | | | |
| | | | 2 | SS | 73 | | | | | | | | | | | | |
| | Grey | | | | | | | | | | | | | | | | |
| 728.6 | | | 3 | TH | 24 | 6" | | | | | | | | | | | |
| 15.0 | | | | | | | | | | | | | | | | | |
| | Fine Sand Very Dense | | 4 | SS | 68 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 717.6 | Grey | | 5 | SS | 55 | | | | | | | | | | | | |
| 26.0 | End of Borehole | | | | | | | | | | | | | | | | |



Ministry of
Transportation and
Communications

RECORD OF BOREHOLE No 1B (SITE A1) (Formerly BH 2 Done by William Trow & Assoc Ltd)

W P 40-77-00 LOCATION York Rd. 32 & Maskinonge River (Norris Creek) ORIGINATED BY WTA
DIST 6 HWY 89 Ext.'n BOREHOLE TYPE Modified Diamond Drill COMPILED BY WTA
DATUM Geodetic DATE 60 04 01 CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--------------------------------------|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 743.8 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Silty Sand with Organics Brown | | | | | | | | | | | | | | | | |
| 740.8 | | | | | | | | | | | | | | | | | |
| 3.0 | Sandy Silt with Gravel Compact | | 1 | SS | 22 | | 740 | | | | | | | | | | |
| | | | 2 | SS | 20 | | | | | | | | | | | | |
| 734.0 | Grey | | | | | | | | | | | | | | | | |
| 9.8 | | | 3 | TW | 65 | | | | | | | | | | | | |
| | Fine Sand, some Silt Very Dense | | 4 | SS | 119 | | 730 | | | | | | | | | | |
| | Grey | | 5 | SS | 75/ | 6" | | | | | | | | | | | |
| | | | | | | | 720 | | | | | | | | | | |
| 717.6 | | | 6 | SS | 50/ | 2" | | | | | | | | | | | |
| 26.2 | End of Borehole | | | | | | | | | | | | | | | | |

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



Ministry of
Transportation and
Communications
Ontario

RECORD OF BOREHOLE No 2 (SITE A2) (Formerly BH 1 Done by Site Investigation Services)

W P 40-77-00 LOCATION (See Site Investigation Report in Files) ORIGINATED BY SIS
DIST 6 HWY 89 Ext. 'n BOREHOLE TYPE Hollow Stem Augers COMPILED BY SIS
DATUM Geodetic DATE 72 08 08 CHECKED BY *CP*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|------------------------|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 749.0 | Ground Surface | | | | | | | | | | | | | | | | GR SA SI CL |
| 0.0 | Gravelly to Silty Sand | | | | | | | | | | | | | | | | |
| | Fine Sand | | 1 | SS | 4 | | | | | | | | | | | | |
| | Loose | | | | | | | | | | | | | | | | |
| | Brown | | | | | | | | | | | | | | | | |
| 740.3 | | | | | | | 740 | | | | | | | | | | |
| 8.7 | Organic Silt with Sand | | 2 | SS | 2 | | | | | | | | | | | | |
| | and wood fragments | | 3 | SS | 2 | | | | | | | | | | | | |
| | Very Soft | | 4 | SS | 1 | | | | | | | | | | | | |
| | Black | | 5 | SS | 1 | | | | | | | | | | | | |
| 732.0 | | | 6 | SS | 7 | | 730 | | | | | | | | | | |
| 17.0 | Medium to Fine Sand | | | | | | | | | | | | | | | | |
| | Loose | | | | | | | | | | | | | | | | |
| | Grey | | | | | | 720 | | | | | | | | | | |
| 714.5 | | | 7 | SS | 9 | | | | | | | | | | | | |
| 34.5 | Silty Clay of low | | | | | | | | | | | | | | | | |
| | Plasticity, Trace Sand | | 8 | SS | 12 | | | | | | | | | | | | |
| | & Gravel, Stiff, Grey | | 9 | SS | 22 | | 710 | | | | | | | | | | |
| 709.5 | Fine Sand with Silt | | | | | | | | | | | | | | | | |
| 39.5 | Compact, Grey | | | | | | | | | | | | | | | | |
| 707.5 | (Glacial Till) | | | | | | | | | | | | | | | | |
| 41.5 | Het. mixture of Silty | | 10 | SS | 38 | | | | | | | | | | | | |
| | Clay of low plasticity | | | | | | | | | | | | | | | | |
| | Sand & Gravel, Very | | | | | | | | | | | | | | | | |
| | Dense, Grey | | 11 | SS | 155 | | 700 | | | | | | | | | | |
| 699.0 | | | | | | | | | | | | | | | | | |
| 50.0 | End of Borehole | | | | | | | | | | | | | | | | |

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 2A (SITE A2) (Formerly BH 2 Done by) York Rd. 32 & Black River Site Investigation Services

W P 40-77-00 LOCATION (See Site Investigation Report in Files) ORIGINATED BY SIS
DIST 6 HWY 89 Ext. 'n BOREHOLE TYPE Hollow Stem Augers COMPILED BY SIS
DATUM Geodetic DATE 72 08 09 CHECKED BY SP.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT Y | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|------------------------------------|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 749.3 | Bridge Deck | | | | | | | | | | | | | | | | |
| 748.3 | Concrete | | | | | | | | | | | | | | | | |
| 1.0 | Air | | | | | | | | | | | | | | | | |
| 743.1 | | | | | | | | | | | | | | | | | |
| 6.2 | Water | | | | | | | | | | | | | | | | |
| 740.5 | | | | | | | | | | | | | | | | | |
| 8.8 | Organics | | | | | | | | | | | | | | | | |
| 738.0 | | | 1 | SS | 4 | | 740 | | | | | | | | W=85% | | |
| 11.3 | | | | | | | | | | | | | | | | | |
| | Fine Sand with occ. Gravel | | 2 | SS | 14 | | | | | | | | | | | | |
| | Compact | | 3 | SS | 12 | | | | | | | | | | | | |
| | | | 4 | SS | 16 | | 730 | | | | | | | | | | |
| | Grey | | 5 | SS | 20 | | | | | | | | | | | | |
| | | | 6 | SS | 13 | | | | | | | | | | | | |
| | | | 7 | SS | 21 | | | | | | | | | | | | |
| | | | 8 | SS | 35 | | 720 | | | | | | | | | | |
| 717.0 | | | | | | | | | | | | | | | | | |
| 32.3 | | | 9 | SS | 19 | | | | | | | | | | | | |
| | Silty Clay with thin Silt Seams | | 10 | SS | 12 | | | | | | | | | | | | |
| | Firm to Stiff | | | | | | | | | | | | | | | | |
| | Grey | | 11 | SS | 9 | | 710 | | | | | | | | | | |
| 705.5 | | | 12 | SS | 15 | | | | | | | | | | | | |
| 43.8 | | | | | | | | | | | | | | | | | |
| 703.5 | Sandy Silt, Dense | | 13 | SS | 36 | | | | | | | | | | | | |
| 45.8 | (Glacial Till) | | | | | | | | | | | | | | | | |
| | Silty Fine Sand | | | | | | | | | | | | | | | | |
| 700.3 | Very Dense, Grey | | 14 | SS | 50 | 1" | | | | | | | | | | | |
| 49.0 | End of Borehole | | | | | | | | | | | | | | | | |

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



Ministry of
Transportation and
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Ontario

RECORD OF BOREHOLE No 3 (SITE A3)


W P 40-77-00 LOCATION York Rd. 32 at C.N.R.
DIST 6 HWY 89 Ext'n. BOREHOLE TYPE Hollow Stem Augers and Cone Test ORIGINATED BY KC
DATUM Geodetic DATE 83 01 26, 27 COMPILED BY KC
CHECKED BY GP

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 760.5 | Ground Surface | | | | | | | | | | | | | | | | |
| 759.0 | Black organic silt | | 1 | SS | 3 | | 760 | | | | | | | | | | |
| 1.5 | Layers of silty clay of low plasticity and silt Firm or loose Grey | | 2 | SS | 4 | | | | | | | | | | | | |
| | | | 3 | SS | 4 | | | | | | | | | | | | |
| 749.5 | | | 4 | TW | PM | | | | | | | | | | | | |
| 11.0 | Silty sand to sandy silt Dense Grey-Brown | | 5 | SS | 34 | | 750 | | | | | | | | | | |
| | | | 6 | SS | 42 | | | | | | | | | | | | |
| | | | 7 | SS | 33 | | 740 | | | | | | | | | | |
| | | | 8 | SS | 30 | | | | | | | | | | | | |
| 724.7 | | | 9 | SS | 13 | | 730 | | | | | | | | | | |
| 35.8 | Layers of silty clay of low plasticity and silt Firm or loose Grey | | 10 | SS | 7 | | 720 | | | | | | | | | | |
| | | | 11 | SS | 5 | | 710 | | | | | | | | | | |
| 703.5 | | | 12 | SS | 55 | | 700 | | | | | | | | | | |
| 57.0 | (Glacial Till) Silty sand with gravel trace clay dense to very dense Grey | | 13 | SS | 36 | | 690 | | | | | | | | | | |
| | | | 14 | SS | 94 | | 680 | | | | | | | | | | |
| 673.5 | | | 15 | SS | 100/6" | | | | | | | | | | | | |
| 87.0 | End of Borehole | | | | | | | | | | | | | | | | |

+3, x5: Numbers refer to
Sensitivity

20
15
10
5
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 6 (SITE A5)

W P 40-77-00 LOCATION Prop Hwy. 89 Extension & Pefferlaw Brook
Co-ords. N 16 078 020 : E 1 078 825 (Approximate only) ORIGINATED BY KC
DIST 6 HWY 89 Ext'n. BOREHOLE TYPE Hollow Stem Augers COMPILED BY KC
DATUM Geodetic DATE 83 01 28 CHECKED BY 

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|----------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 760.0 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Organic silt of high plasticity Very soft Black | | 1 | SS | 1 | | Artesian Head | | | | | | | | | | |
| 753.0 | | | 2 | TW | PM | | | | | | | | | | | | |
| 7.0 | Fine sand Compact to very dense Brown | | 3 | SS | 20 | | | | | | | | | | | | |
| | | | 4 | SS | 32 | | | | | | | | | | | | |
| | | | 5 | SS | 30 | | | | | | | | | | | | |
| 742.0 | | | | | | | | | | | | | | | | | |
| 18.0 | Silty clay of low to intermediate plasticity Stiff to very stiff Grey | | 6 | SS | 10 | | | | | | | | | | | | |
| | | | 7 | SS | 17 | | | | | | | | | | | | |
| | Increasing amounts of silt | | 8 | TW | PH | | | | | | | | | | | | |
| 723.0 | Hard Some sand | | 9 | SS | 113 | | Artesian Encountered | | | | | | | | | | |
| 37.0 | Probable silty sand | | | | | | | | | | | | | | | | |
| | | | 10 | WS | | | | | | | | | | | | | |
| 710.0 | | | | | | | | | | | | | | | | | |
| 50.0 | End of Borehole | | | | | | | | | | | | | | | | |

+3, x5: Numbers refer to 20
Sensitivity 15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7 (SITE A5)

Prop Hwy. 89 Extension & Pepperlaw Brook

W P 40-77-00 LOCATION Co-ords. N. 16 078 035 : E 1 078 945 (Approximate Only) ORIGINATED BY KC

DIST 6 HWY 89 Ext'n. BOREHOLE TYPE Hollow Stem Augers COMPILED BY KC

DATUM Geodetic DATE 83 01 31 CHECKED BY CP

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|--|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 763.0 | Ground Level | | | | | | | | | | | | | | | | GR SA SI CL |
| 0.0 | With wood fragments Very loose | | 1 | SS | 3 | | 760 | | | | | | | | | | |
| | | | 2 | SS | 15 | | | | | | | | | | | | |
| | Fine sand Compact to dense Brown-Grey | | 3 | SS | 34 | | | | | | | | | | | | 0 93 6 1 |
| | | | 4 | SS | 22 | | | | | | | | | | | | |
| | | | 5 | SS | 26 | | 750 | | | | | | | | | | |
| | | | 6 | SS | 42 | | | | | | | | | | | | |
| 739.5 | | | | | | | 740 | | | | | | | | | | |
| 23.5 | Silty clay of low to intermediate plas- ticity Very stiff to hard Grey | | 7 | SS | 18 | | | | | | | | | | | | 0 0 53 47 |
| | | | 8 | SS | 17 | | 730 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 720.0 | | | 9 | SS | 39 | | 720 | | | | | | | | | | 0 7 72 21 |
| 43.0 | Probable silty sand | | | | | | 710 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 705.0 | | | | | | | | | | | | | | | | | |
| 58.0 | (Glacial Till) Sandy silt, trace of clay and gravel Very dense Grey | | 10 | SS | 100/6" | | 700 | | | | | | | | | | |
| 696.5 | | | 11 | SS | 100/6" | | | | | | | | | | | | 5 35 51 9 |
| 66.5 | End of Borehole | | | | | | | | | | | | | | | | |

+3, x⁵: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 8 (SITE A6)

W P 40-77-00 LOCATION Prop Hwy. 89 Extension & Uxbridge Brook
 Coords. N 16 081 650 ; E 1087 745 (Approximate Only) ORIGINATED BY KC
 DIST 6 HWY 89 Ext.'n BOREHOLE TYPE Hollow Stem Augers COMPILED BY KC
 DATUM Geodetic DATE 83 02 07 CHECKED BY SP.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 780.0 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | (Peat) | | | | | | | | | | | | | | | | |
| 777.0 | Black Organics, V. Soft | | 1 | SS | 27 | | | | | | | | | | | | |
| 775.0 | Sand & Gravel, Compact | | 2 | SS | 8 | | | | | | | | | | | | |
| 773.0 | Sandy Silt, Loose, Grey | | 3 | SS | 14 | | | | | | | | | | | | |
| 770.0 | Silty Clay of low plasticity, with random Layers of Silt, Stiff to Very Stiff, Grey | | 4 | SS | 30 | | | | | | | | | | | | |
| 768.0 | | | | | | | | | | | | | | | | | |
| 12.0 | Silt, trace of Sand | | 5 | SS | 56 | | | | | | | | | | | | |
| | Dense | | | | | | | | | | | | | | | | |
| | Grey | | 6 | SS | 47 | | | | | | | | | | | | |
| 756.5 | (Glacial Till) | | | | | | | | | | | | | | | | |
| 23.5 | Het. mixture of Silty Clay, Some Sand, trace of Gravel | | 7 | SS | 100/ 9" | | | | | | | | | | | | |
| | Hard | | | | | | | | | | | | | | | | |
| | Grey | | 8 | SS | 100/ 8" | | | | | | | | | | | | |
| 744.1 | | | | | | | | | | | | | | | | | |
| 35.9 | End of Borehole | | 9 | SS | 100/ 5" | | | | | | | | | | | | |

+3, x5 : Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 9 (SITE A7)

York Rd. 32 & Vrooman Creek

W P 40-77-00 LOCATION Coords. N 16 089 750; 1 099 915 (Approximate Only) ORIGINATED BY KC

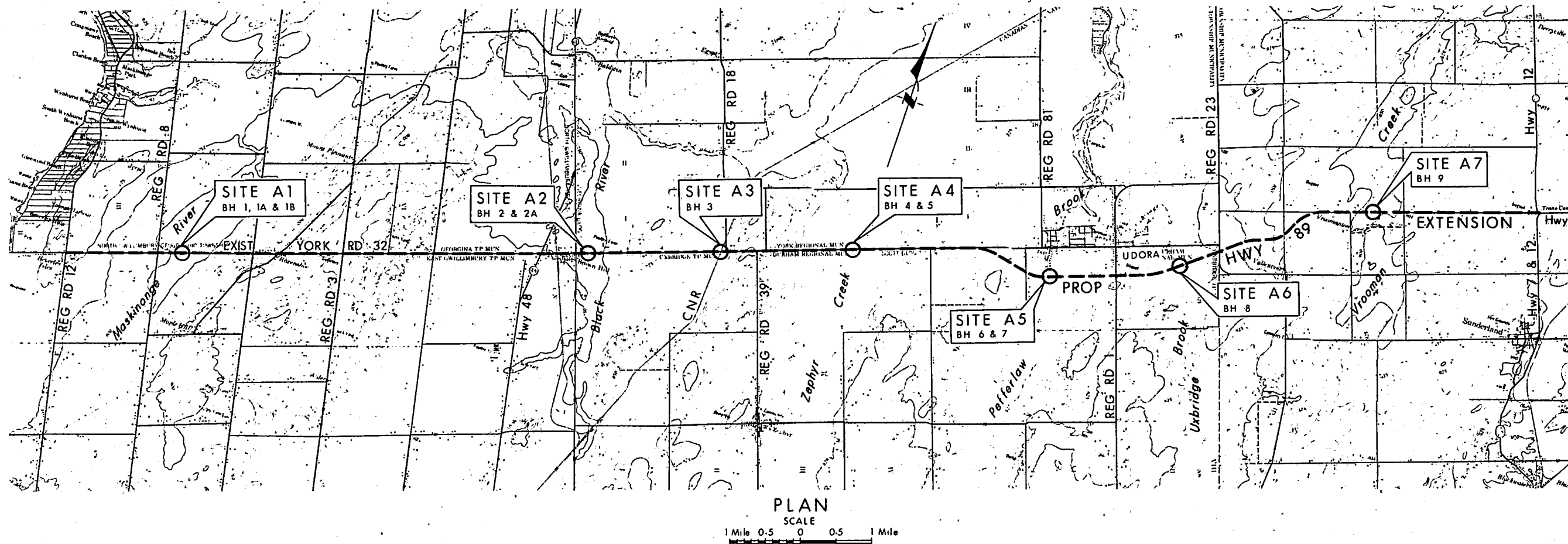
DIST 6 HWY 89 Ext. 'n BOREHOLE TYPE Hollow Stem Augers COMPILED BY KC

DATUM Geodetic DATE 83 02 07 CHECKED BY *CP*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 855.0 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Black organics (peat) | | 1 | SS | 2 | | 850 | | | | | | | | | | 38 32 28 2 |
| 848.0 | With sand and gravel | | 2 | SS | 1 | | | | | | | | | | | | |
| 7.0 | Sandy silt, trace of gravel | | 3 | SS | 6 | | | | | | | | | | | | |
| 842.0 | Loose to compact Grey | | 4 | SS | 14 | | | | | | | | | | | | 10 17 69 4 |
| 13.0 | (Glacial Till) | | | | | | | | | | | | | | | | |
| | heterogeneous mixture of silty clay, sand and trace of gravel | | 5 | SS | 42 | | 840 | | | | | | | | | | |
| | Hard | | 6 | SS | 42 | | | | | | | | | | | | 4 13 63 20 |
| | Grey | | 7 | SS | 73 | | 830 | | | | | | | | | | |
| | | | 8 | SS | 100/10" | | | | | | | | | | | | 9 40 38 13 |
| 818.7 | | | 9 | SS | 100/10" | | 820 | | | | | | | | | | |
| 36.3 | End of Borehole | | | | | | | | | | | | | | | | |

+3, x5 : Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



PLAN

SCALE
1 Mile 0.5 0 0.5 1 Mile

NOTE

Subsurface conditions are summarized on the Record of Borehole and Foundation Data sheets

STRUCTURE SITES

- SITE A1 — York Road 32 at Maskinonge River (Norris Creek)
- SITE A2 — York Road 32 at Black River
- SITE A3 — York Road 32 at C N R Crossing
- SITE A4 — York Road 32 at Zephyr Creek
- SITE A5 — Prop Hwy 89 Extension at Pepperlaw Brook
- SITE A6 — Prop Hwy 89 Extension at Uxbridge Brook
- SITE A7 — Prop Hwy 89 Extension at Vrooman Creek

CONT No
WP No 40-77-00



PRELIMINARY STUDY
HWY 89 EXTENSION
(From York Road 12 to Hwy 12)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

YORK RD 12 to HWY 12

KEY PLAN

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- "N" Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- ↓ WL at time of investigation
1983 01 and 1983 02
WL for BH 1A & 1B 1960 04
WL for BH 2 & 2A 1972 08

| No | ELEVATION | CO-ORDINATES | |
|----|-----------|--------------|----------|
| | | NORTH | EAST |
| 1 | 743.5 | | |
| 1A | 743.6 | | |
| 1B | 743.8 | | |
| 2 | 749.0 | | |
| 2A | 749.3 | | |
| 3 | 760.5 | 16 072 660 | 1055 140 |
| 4 | 767.0 | 16 075 630 | 1064 340 |
| 5 | 767.0 | 16 075 600 | 1064 430 |
| 6 | 760.0 | 16 078 020 | 1078 825 |
| 7 | 763.0 | 16 078 035 | 1078 945 |
| 8 | 780.0 | 16 081 650 | 1087 745 |
| 9 | 855.0 | 16 089 750 | 1099 915 |

-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 31D-300
HWY No 89 EXTENSION DIST 6
SUBMD K C CHECKED DATE Mar 25, 1983 SITE
DRAWN [initials] CHECKED APPROVED DWG 407700-A