

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-138

DIST. 6 REGION                     

W.P. No. 27-78-02

CONT. No. 81-67

W. O. No.                     

STR. SITE No. 10-312

HWY. No. 401

LOCATION James Snow Parkway  
Underpass

No of PAGES -                     

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     

REMARKS:

LIST OF DRAWINGS :

- 10-312-1. GENERAL LAYOUT
2. BOREHOLE LOCATIONS & SOIL STRATA
3. FOUNDATION LAYOUT
4. NORTH ABUTMENT LAYOUT
5. SOUTH ABUTMENT LAYOUT
6. WINGWALL DETAILS
7. PIER AND BEARING DETAILS
8. DECK SCREED ELEVATIONS
9. DECK REINFORCEMENT DETAILS
10. LONGITUDINAL CABLES LAYOUT
11. TRANSVERSE CABLES LAYOUT
12. PRESTRESSING AND REINFORCEMENT DETAILS I
13. PRESTRESSING AND REINFORCEMENT DETAILS II
14. BARRIER WALL WITH SIDEWALK
15. RAILING FOR BARRIER WALL
16. 20 FT. APPROACH SLAB
17. DETAILS OF CONCRETE SLOPE PAVING
18. STANDARD DETAILS I
19. STANDARD DETAILS II
20. STANDARD DETAILS III
21. STANDARD DETAILS IV
22. BRIDGE DATE & SITE NUMBER DATA
23. AS CONSTRUCTED ELEVATION & DIMENSION

GENERAL NOTES

CLASS OF CONCRETE

|                           |        |
|---------------------------|--------|
| DECK & PIER COLUMNS       | 35 MPa |
| BARRIER WALLS & ABUTMENTS | 30 MPa |
| REMAINDER                 | 20 MPa |

REINFORCING STEEL

ALL REINFORCING STEEL SHALL BE GRADE 400.

CLEAR COVER ON REINFORCING STEEL

|                               |        |
|-------------------------------|--------|
| FOOTINGS                      | 3"     |
| PIER, ABUTMENTS & WINGWALLS   | 2"     |
| DECK TOP                      | 2"     |
| DECK BOTTOM (TO SUPPORT BARS) | 1 1/2" |
| APPROACH SLABS & SIDEWALKS    | 2"     |
| AND/OR AS NOTED ON DRAWINGS   |        |

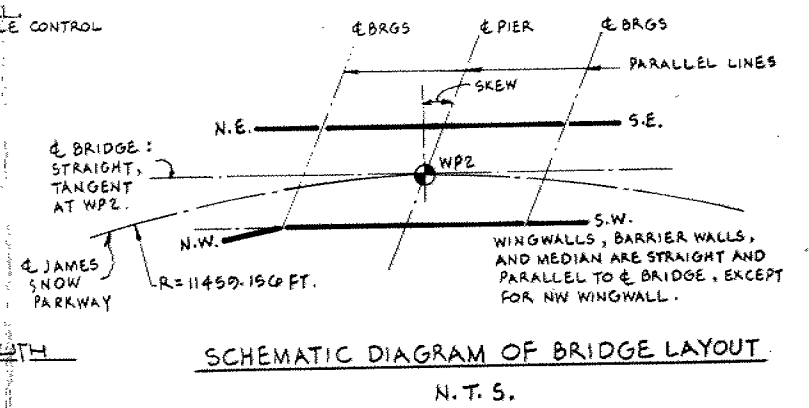
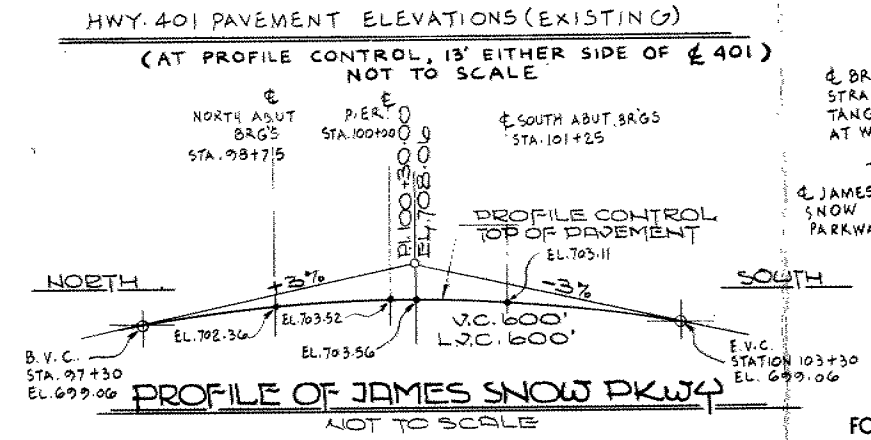
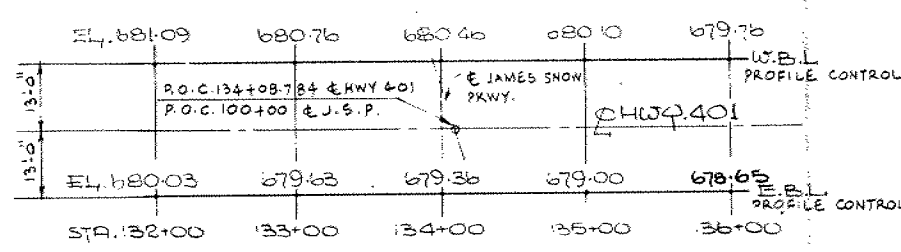
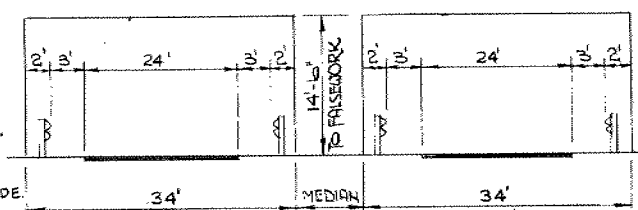
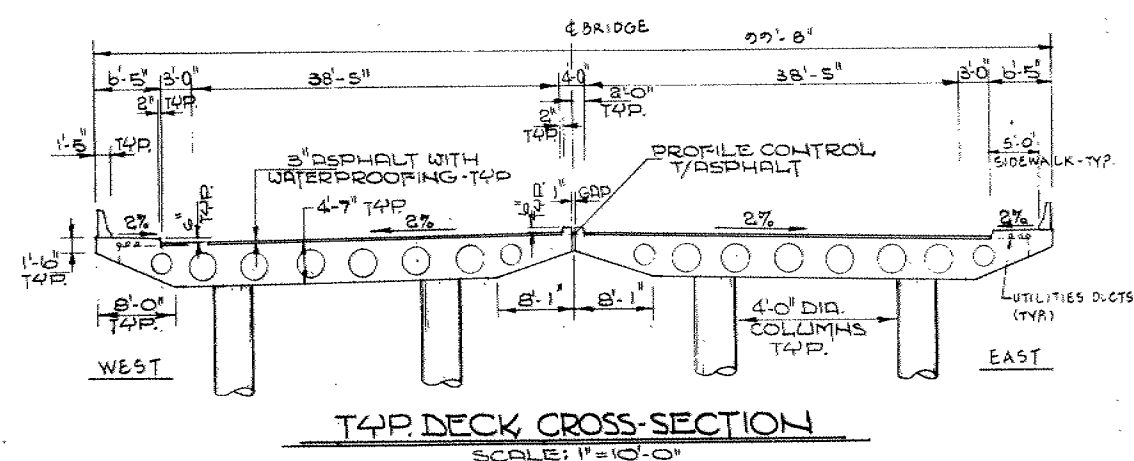
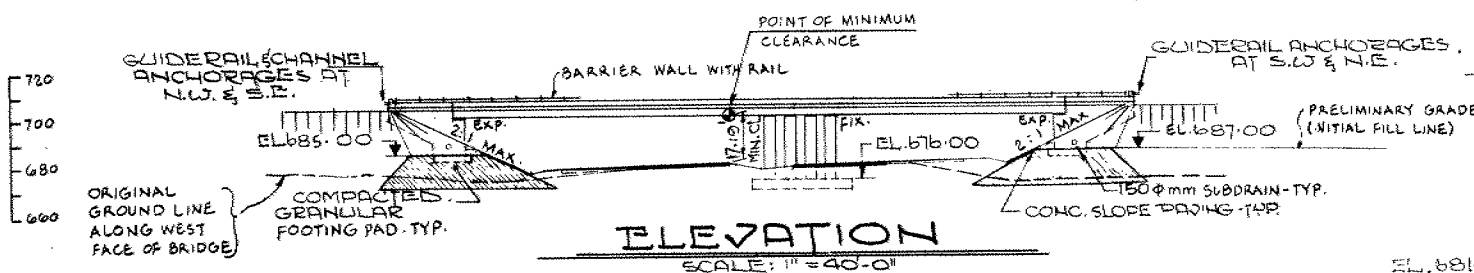
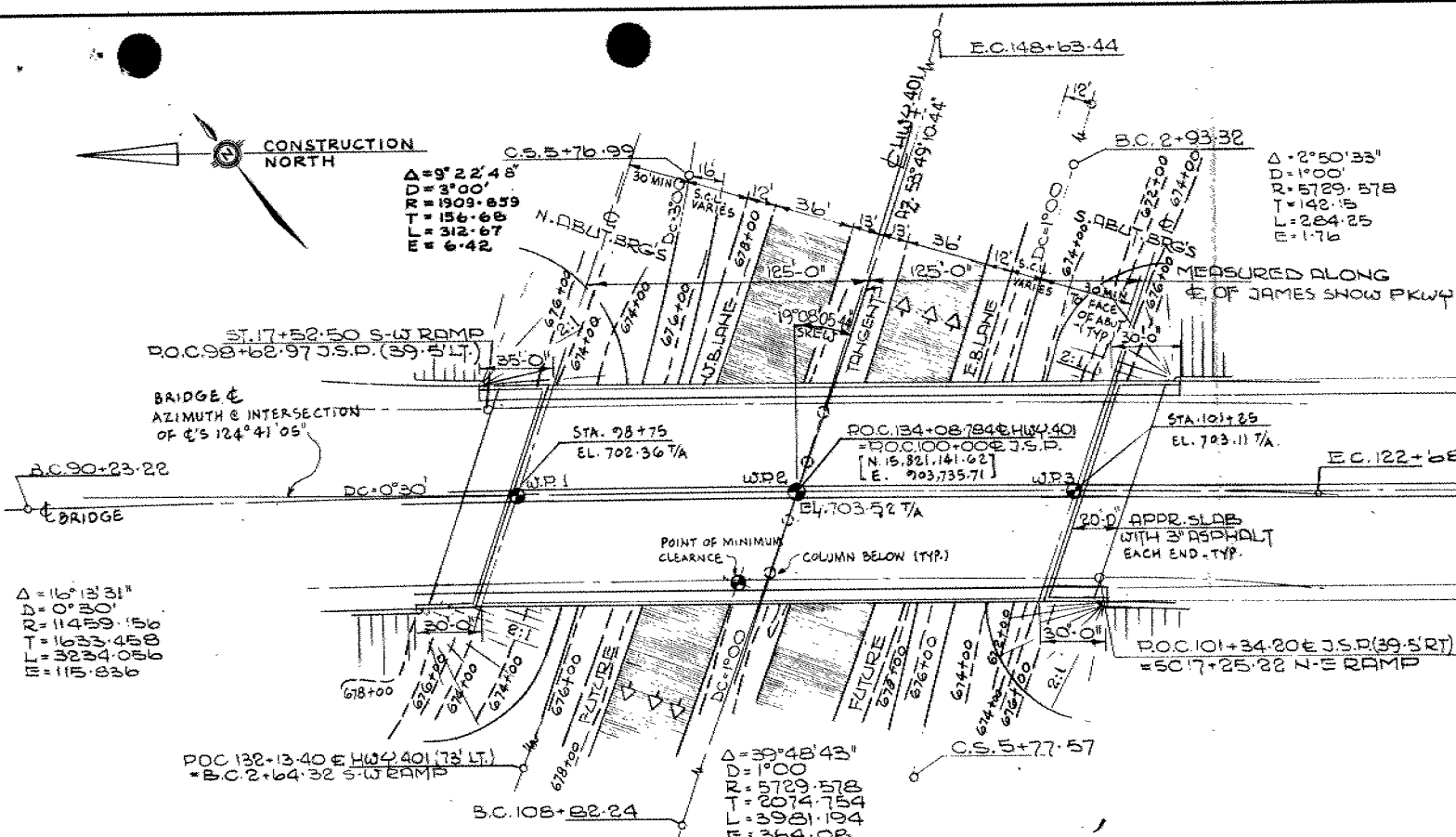
CONSTRUCTION NOTES

- THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF  $\pm 1/8"$ .
- NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, STRESSED AND GROUTED.
- TO ACHIEVE THE MINIMUM CLEAR COVER OF 2" SPECIFIED, THE TOP LAYER OF DECK STEEL SHALL BE PLACED PRIOR TO CONCRETING WITH A CLEAR COVER OF  $2 1/2" \pm 1/2"$  TOLERANCE.
- REINFORCING BARS WITH THE DESIGNATION "C" AT THE END OF BAR MARKS SHALL BE COATED BARS.

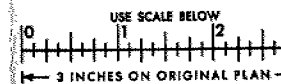
CONCRETE QUANTITIES :

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE LUMP SUM TENDER ITEMS.

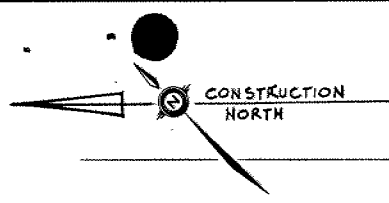
- CONCRETE IN PIERS, ABUTMENTS & WINGWALLS 493 C.Y.
- PRESTRESSED CONCRETE BRIDGE DECK 2923 C.Y.
- CONCRETE IN BARRIER WALLS 47 C.Y.
- CONCRETE IN APPROACH SLABS 120 C.Y.
- CONCRETE IN SLOPE PAVINGS 97 C.Y.



FOR REDUCED PLAN



| REVISIONS    | DATE       | BY              | DESCRIPTION  |
|--------------|------------|-----------------|--------------|
| DESIGN A.C.  | CHECK A.T. | LOADING H520-44 | DATE 14-3-80 |
| DRAWING M.O. | CHECK A.C. | SITE No 10-312  | DWG 1        |



| CO-ORDINATES OF WORKING POINT & COLUMN C'S |         |                   |                  |
|--|---------|-------------------|------------------|
| W.P.                                       | STATION | NORTH CO-ORDINATE | EAST CO-ORDINATE |
| 1  | 98+75   | 15,821,212.754    | 903,632.924      |
| 2  | 100+00  | 15,821,141.621    | 903,735.711      |
| 3  | 101+25  | 15,821,070.488    | 903,838.498      |
| COL. 1                                     | —       | 15,821,164.949    | 903,767.607      |
| COL. 2                                     | —       | 15,821,149.484    | 903,746.462      |
| COL. 3                                     | —       | 15,821,133.758    | 903,724.960      |
| COL. 4                                     | —       | 15,821,118.293    | 903,703.815      |

DIST. No 4  
CONT No  
WP No 27-78-02

SHEET

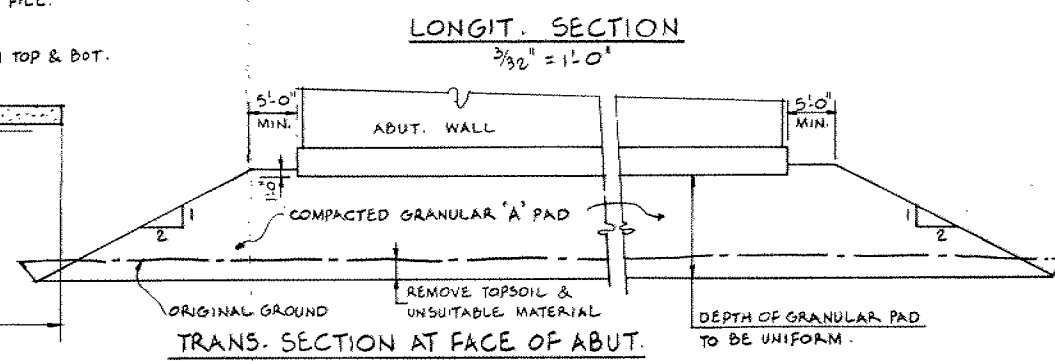
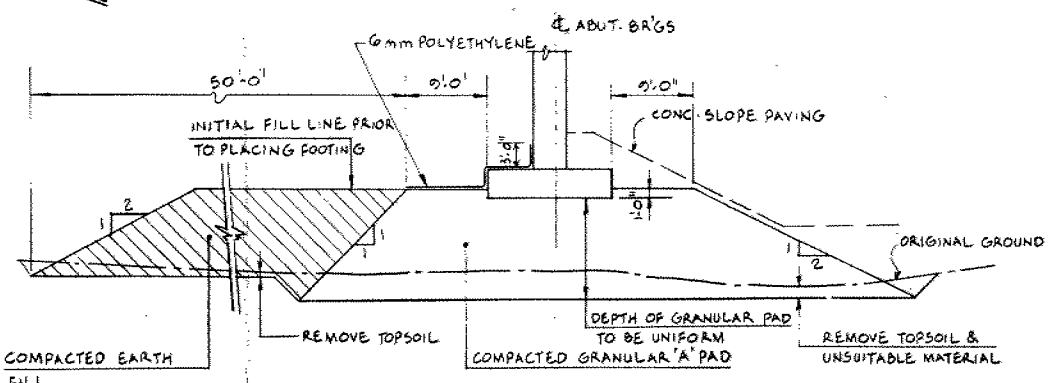
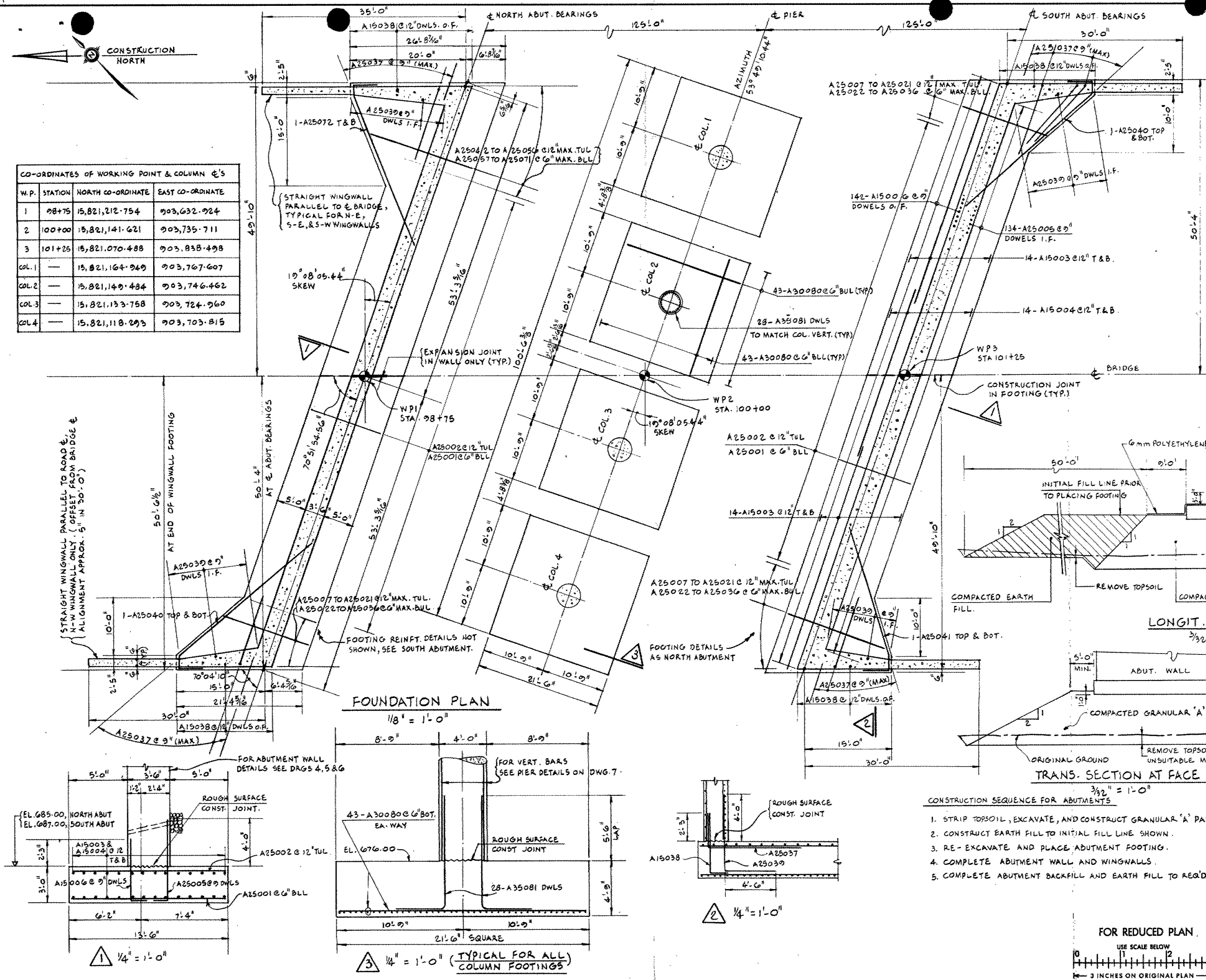
JAMES SNOW PARKWAY BRIDGE  
AT HIGHWAY 401  
FOUNDATION LAYOUT

Morrison, Hershfield,  
Burgess & Huggins, Limited  
Consulting Engineers

MHBH



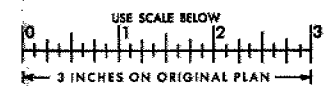
- NOTES:
- I. F. DENOTES INSIDE FACE.
  - O. F. DENOTES OUTSIDE FACE.
  - BOTTOM AND SIDES OF FOOTINGS TO BE CAST AGAINST UNDISTURBED SOIL.
  - FOR ABUTMENT AND WINGWALL DETAILS, SEE DRAWINGS 4, 5 AND 6.
  - FOR PIER DETAILS, SEE DRAWING 7.
  - TUL DENOTES TOP UPPER LAYER.
  - TLL DENOTES TOP LOWER LAYER.
  - BUL DENOTES BOTTOM UPPER LAYER.
  - BLL DENOTES BOTTOM LOWER LAYER.
  - UNLESS OTHERWISE NOTED, MINIMUM LAP LENGTHS FOR REINF. BARS:  
15 M = 2'-3"  
20 M = 2'-9"  
25 M = 4'-0"



- CONSTRUCTION SEQUENCE FOR ABUTMENTS
1. STRIP TOPSOIL, EXCAVATE, AND CONSTRUCT GRANULAR 'A' PAD.
  2. CONSTRUCT EARTH FILL TO INITIAL FILL LINE SHOWN.
  3. RE-EXCAVATE AND PLACE ABUTMENT FOOTING.
  4. COMPLETE ABUTMENT WALL AND WINGWALLS.
  5. COMPLETE ABUTMENT BACKFILL AND EARTH FILL TO REQ'D GRADE.

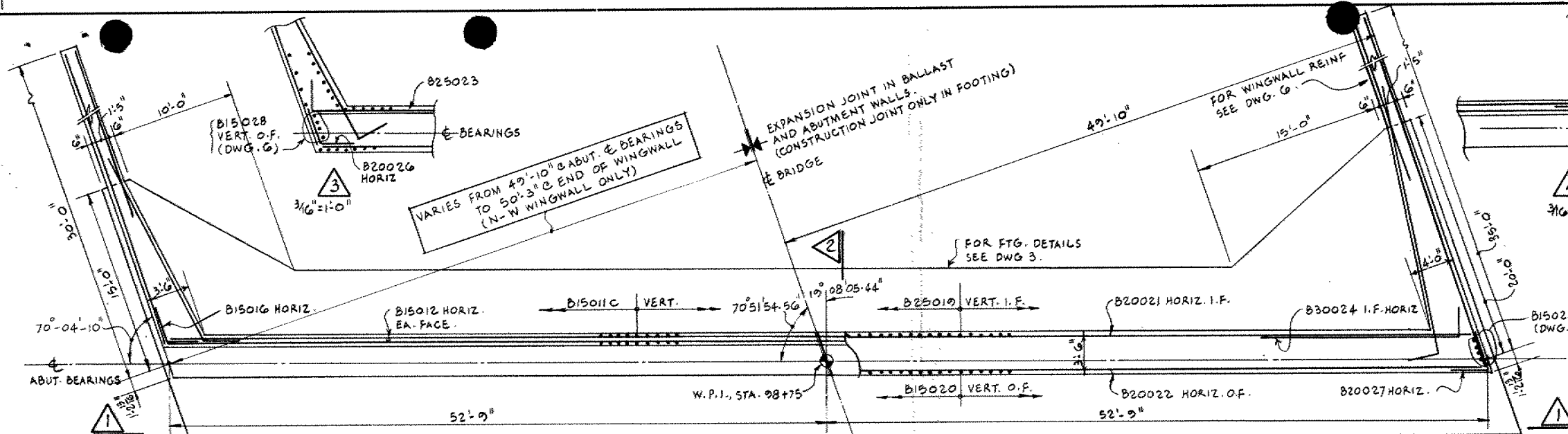
DETAILS OF GRANULAR 'A' PAD

FOR REDUCED PLAN



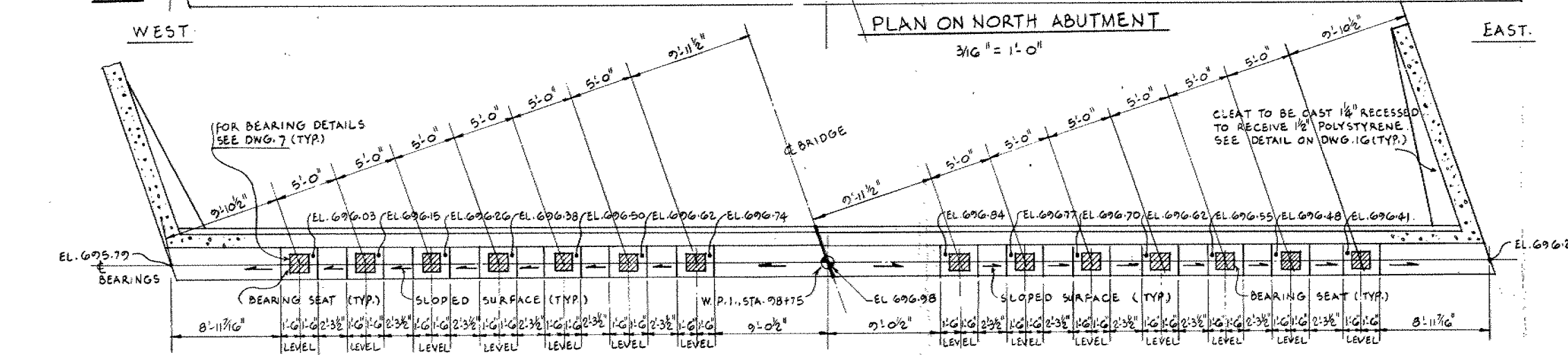
| REVISIONS | DATE    | BY          | DESCRIPTION     |
|-----------|---------|-------------|-----------------|
| 1         | 14.3.80 | DESIGN A.C. | LOADING H520-44 |
| 2         |         | CHECK A.T.  |                 |
| 3         |         | CHECK A.C.  | SITE No 10-312  |

DWG 3



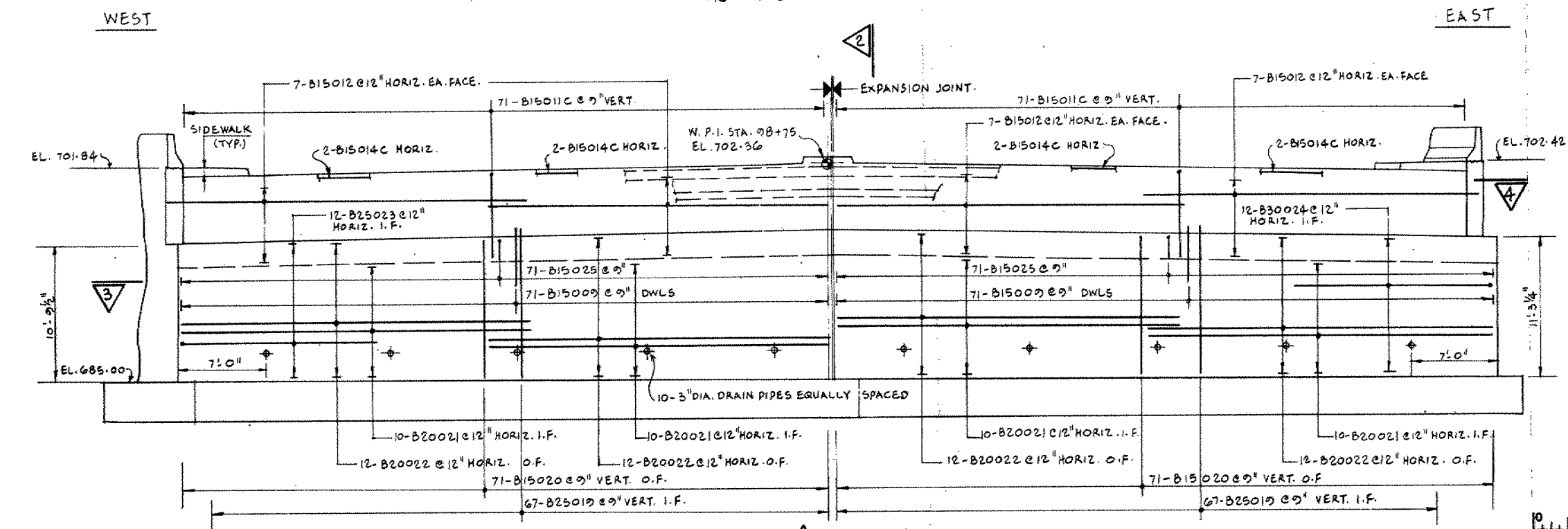
PLAN ON NORTH ABUTMENT

3/16" = 1'-0"

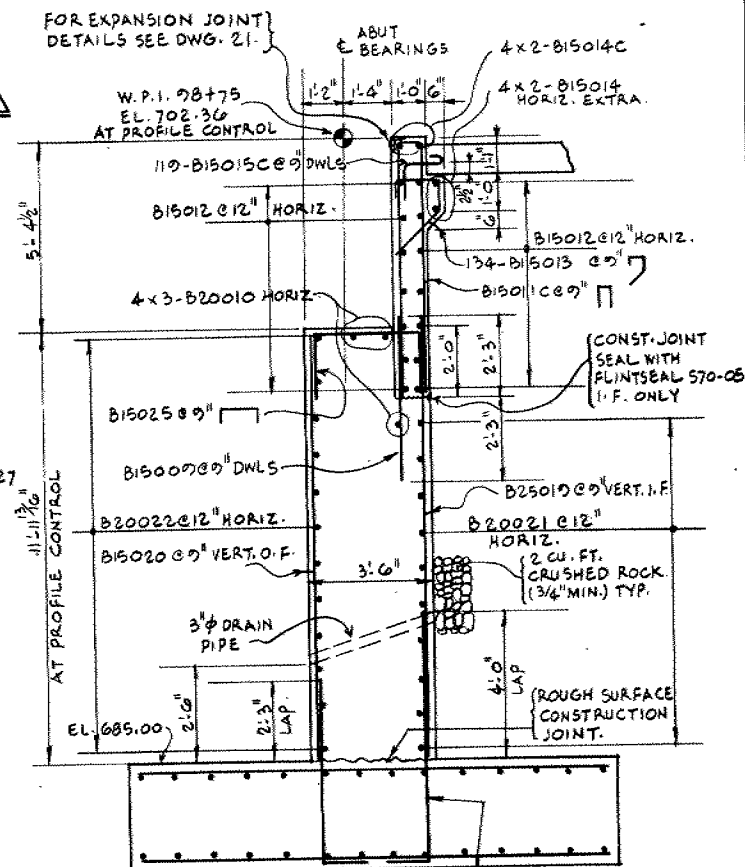


PLAN ON BEARING SEATS

3/16" = 1'-0"



3/16" = 1'-0"

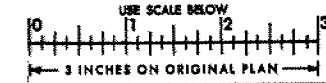


3/8" = 1'-0"

NOTES:

- E.F. DENOTES EACH FACE.
- I.F. DENOTES INSIDE FACE.
- O.F. DENOTES OUTSIDE FACE.
- CONSTRUCTION JOINT WITH 1" VEE GROOVE CAULKED WITH FLINTSEAL 570-05 ALONG INSIDE FACE (SEE DWG. 19).
- UNLESS OTHERWISE NOTED, MINIMUM LAP LENGTHS FOR REINF. BARS:
- 15 M = 2'-3"
- 20 M = 2'-9"
- 25 M = 4'-0"
- FOR LAYOUT OF WINGWALLS, SEE DWGS. 3 & 6

FOR REDUCED PLAN



| REVISIONS      | DATE       | BY               | DESCRIPTION  |
|----------------|------------|------------------|--------------|
| DESIGN A.C.    | CHECK A.T. | LOADING H5 20-44 | DATE 14-3-80 |
| DRAWING P.M.C. | CHECK A.C. | SITE No 10-312   | DWG 4        |

ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

WP 27-78-02 DIST 6  
HWY 401 STR SITE 10-312  
James Snow Parkway Underpass

DISTRIBUTION

G.C.E. Burkhardt (3)  
R.D. Gunter  
M.R. Ernesaks  
D.E. Thrasher (2)

C. Grebski  
G.A. Wrong  
B.J. Giroux

R. Hore

R. Fitzgibbon )  
J. Anderson ) cover only  
G. Sloan )

Files ✓

| SAMPLE DISPOSITION NOTICE |               |            |
|---------------------------|---------------|------------|
| TYPE                      | DISCARD AFTER | RECOMM. BY |
| JARS                      | 79 15 31      | M-2        |
| TUBES                     | -             | -          |
| ROCK<br>CORES             | -             | -          |

# FOUNDATION INVESTIGATION REPORT

For

James Snow Parkway Underpass  
W.P. 27-78-02, Site 10-312  
Hwy. 401, District 6, Toronto

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## INTRODUCTION

This report contains the results of a foundation investigation program carried out at the above mentioned project site during the period of April 17 and April 18, 1979. The fieldwork consisted of three sampled boreholes advanced by means of a continuous flight auger machine equipped with hollow stem augers. These boreholes ranged in depth from 31.5 feet to 51.5 feet below ground surface.

## SITE DESCRIPTION AND GEOLOGY

The site is located approximately one mile northeast of the intersection of Hwy. 401 and Steeles Avenue in the Town of Milton, Regional Municipality of Halton.

The topography in the immediate area is level to gently undulating with the predominant land use being agriculture.

Physiographically, the site is situated in the 'Peel Plain' region which is characterized by a modified veneer of clay underlain by glacial till containing large amounts of Palaeozoic shale. Underlying the glacial deposit are the red (Queenston) shales from which the till's reddish colour is derived.

## SUBSURFACE CONDITIONS

### General

The site is underlain by a uniform deposit of clayey silt, some sand and trace of gravel which was explored to a maximum depth of 51.5 feet. Bedrock was not encountered in any of the borings.

The boundaries between the various soil types are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, is shown on Drawing No. 277802-A.

The major subsoil type encountered is described in the following paragraphs.

Clayey Silt, Some Sand, Trace Gravel (Glacial Till)

Underlying the site and explored to depths ranging from 31.5 to 51.5 is a cohesive glacial till deposit consisting of clayey silt, some sand, trace of gravel with occasional weathered shale partings. Grain size analysis for this cohesive stratum are shown in envelope form on the grain size distribution chart, Figure No. 2. Typical Atterberg Limits and identity indices performed on selected representative samples are summarized in the following table and plotted on the plasticity chart, Figure 2.

|                  |                     | <u>Range</u> | <u>Average</u> |
|------------------|---------------------|--------------|----------------|
| Moisture Content | (W) %               | 9-18         | 10             |
| Liquid Limit     | (W <sub>L</sub> ) % | 16-29        | 23             |
| Plastic Limit    | (W <sub>P</sub> ) % | 13-19        | 16             |
| Plasticity Index | (I <sub>P</sub> ) % | 3-10         | 6              |

These results indicate the glacial deposit to be generally a clayey silt of low plasticity (CL).

Standard Penetration Test 'N' values range from 21 to in excess of 100 blows per foot but generally averaging 40 blows per foot. The consistency of the cohesive glacial till deposit based on visual classification and the 'N' values may be considered as very stiff to hard in nature.

Groundwater

During boring operations groundwater was encountered in two boreholes at depths of 20 and 21 feet corresponding to elevation 652<sup>+</sup>. No overnight groundwater level readings were obtained due to free water influx into the boreholes from the highway ditches.

## DISCUSSION AND RECOMMENDATIONS

As part of the future widening of Hwy. 401 west to Hwy. 25, it is proposed to construct a two span post-tensioned concrete underpass structure in order to carry the existing Halton 4th Line (Dorval Drive) over Hwy. 401. The planned structure will have a combined span length of 240 feet and a deck width of 95 feet. At the proposed intersection the profile grade of Hwy. 401 will be at elevation 680<sub>+</sub> and that of J.S. Parkway will be at elevation 703<sub>+</sub>. With the existing ground at elevation 676<sub>+</sub>, the required earth work will entail approach fills up to 27<sub>+</sub> feet above the existing ground for the J.S. Parkway.

In summary, a uniform glacial till deposit consisting of clayey silt, some sand, trace of gravel with a consistency ranging from very stiff to hard extends over the site.

Our recommendations for the foundations of the structure and related earth works are as follows.

### Structure Foundations

Abutments: In consideration of the competent nature of the subsoils and the anticipated fill heights, a perched-type abutment founded on spread footings within the approach fills on a zone composed of well compacted Granular 'A' material can be designed using an allowable bearing pressure of 3.0 t.s.f.

Alternatively, assuming a closed-type of abutment is more desirable, spread footings founded at or below elevation 670 can be designed for an allowable bearing capacity of 3.0 t.s.f.

In order to resist lateral forces acting on the abutment foundations, frictional forces between the footing bases and foundation soil can be calculated using a coefficient of friction of 0.7 for the granular 'A' pad or concrete mat and an adhesion value of 2,000 p.s.f. against sliding for the natural ground conditions. Backfill behind the abutments should be composed of well compacted free-draining granular material with provisions made for



adequate drainage. The lateral earth pressure exerted on the abutment walls by the granular backfill can be computed assuming a unit weight of 130 pcf for the backfill and a coefficient of earth pressure of:

$K_a = 0.35$  for the "active" case where rotation about the base is allowed

$K_o = 0.5$  for the "at rest" case where no rotation or translation about the base is permitted

Piers: Foundations for the center pier can be supported on spread footings founded at or below elevation 672. At this elevation the soil can be expected to support an allowable design bearing pressure of up to 3.0 tsf.

#### Other Considerations

In view of the overconsolidated nature of the glacial subsoil, spread footings founded at or below the recommended elevations and designed for the maximum allowable bearing pressure, should undergo less than one inch of differential settlement with the majority of this settlement occurring during or shortly after construction.

Abutment and pier spread footings should be placed on undisturbed natural ground, or, due to construction activity or weather conditions, on a well compacted granular 'A' pad or low strength concrete mat. The underside of all footings or pile caps should have a minimum of four feet of earth cover for frost protection purposes.

No major dewatering problems are anticipated for footings in the cohesive glacial deposit. However, if wet conditions prevail at the time of construction, pumping from sumps may be required to control seepage at the bottom of the excavation.

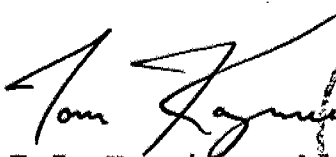
#### Approaches


The approach fills, in the order of 27 feet for the James Snow Parkway, can be constructed safely with standard 2:1 side slopes. Prior to placement of the earth fills, the topsoil should be sub-excavated to their full depth for a minimum distance of 50 feet behind the abutments and replaced with compacted earth fill.


MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. T.J. Kazmierowski, Project Engineer. The equipment used was owned and operated by Master Soil Investigation Ltd., Toronto.

This report was written by Mr. T.J. Kazmierowski and reviewed by Mr. M. Devata, Supervising Engineer.

  
T.J. Kazmierowski, P. Eng.  
Project Engineer



  
M. Devata, P. Eng.  
Supervising Engineer

May, 1979

## APPENDIX



RECORD OF BOREHOLE No 1

W P 27-78-02 LOCATION Coords. N 15 821 095; E 903 855 ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Continuous Flight Auger Hollow Stem Augers COMPILED BY T.K.  
DATUM Geodetic DATE April 17, 1979 CHECKED BY *ef.*

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 672.1         | Ground Surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 0.0           | Weathered Firm  |            |         |      |            |                            | 670             |   |    |    |    |     |                                    |                                     |                                   |                     | 22 19 49 10                                       |
|               | Clayey Silt<br>Some Sand<br>Trace Gravel<br>(Glacial Till)                      |            | 1       | SS   | 42         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 2       | SS   | 50         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Hard  |            | 3       | SS   | 56         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | 20 20 47 13                                       |
|               | Red   |            | 4       | SS   | 32         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 29         |                            | 660             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 31         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Silty Sand  |            | 7       | SS   | 53         |                            | 650             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 8       | SS   | 41         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Weathered Shale Partings  |            | 9       | SS   | 121        |                            | 640             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 635.6         |   |            | 10      | SS   | 60         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 36.5          | End of Borehole<br>Note: Water Table<br>Encountered During<br>Boring Operations |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\div$  5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 2

W P 27-78-02 LOCATION Coords. N 15 821 117; E 903 726 ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Continuous Flight Auger Hollow Stem Augers COMPILED BY T.K.  
DATUM Geodetic DATE April 18, 1979 CHECKED BY erj

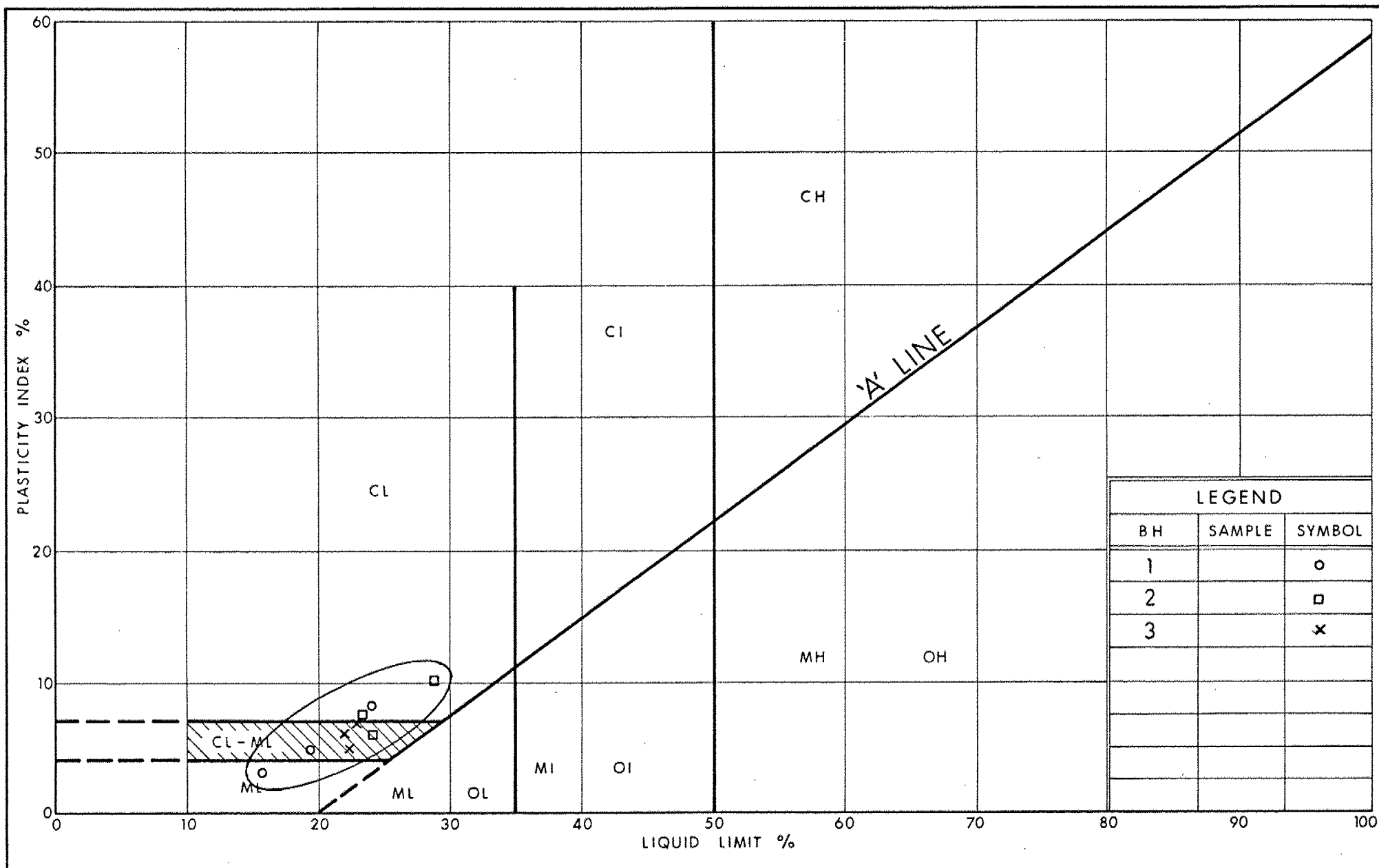
| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE $\sigma_{10}$ |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>$\gamma$ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|--|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|----------------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20   | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                            |  |
| 678.2         | Ground Surface   |            |         |      |            |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
| 0.0           | Granular Roadway<br>Fill   |            |         |      |            |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
| 2.0           | Occasional<br>Cobbles<br><br>Sand<br>Seams<br><br>Clayey Silt<br>Some Sand<br>Trace Gravel<br>(Glacial Till)<br>Very Stiff to Hard<br>Red<br><br><br><br><br>Clayey Silt Layer |            | 3       | SS   | 34         |                            | 670             |  |    |    |    |     |                                    |                                     |                                   |                            | 11 22 51 16  |
|               |  |            | 4       | SS   | 36         |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
|               |  |            | 5       | SS   | 46         |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            | 11 22 49 18  |
|               |  |            | 6       | SS   | 36         |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
|               |  |            | 7       | SS   | 26         |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
|               |  |            | 8       | SS   | 35         |                            | 660             |  |    |    |    |     |                                    |                                     |                                   |                            |  |
|               |  |            | 9       | SS   | 21         |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
|               |  |            | 10      | SS   | 45         |                            | 650             |  |    |    |    |     |                                    |                                     |                                   |                            |  |
| 646.7         |  |            |         |      |            |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |
| 31.5          | End of Borehole  |            |         |      |            |                            |                 |  |    |    |    |     |                                    |                                     |                                   |                            |  |



RECORD OF BOREHOLE No 3

W P 27-78-02 LOCATION Coords. N 15 821 218; E 903 655 ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY T.K.  
DATUM Geodetic DATE April 18, 1979 CHECKED BY edj.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                  |              |            |          | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ  | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|------------------|--------------|------------|----------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | SHEAR STRENGTH                              |                  |              |            |          | WATER CONTENT (%)                  |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED                                | ● QUICK TRIAXIAL | + FIELD VANE | x LAB VANE | 10 20 30 |                                    |                                     |                                   |  |  |
| 672.9         | Ground Surface  |            |         |      |            |                            |                 |   |                  |              |            |          |                                    |                                     |                                   |  |  |
| 0.0           | Weathered Firm<br><br>Clayey Silt<br>Some Sand<br>Trace of Gravel<br>(Glacial Till)<br>Hard<br>Red<br><br><br>Cobbles and<br>Boulders |            |         |      |            | 670                        |                 |   |                  |              |            |          |                                    |                                     |                                   | 6 23 56 15<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><b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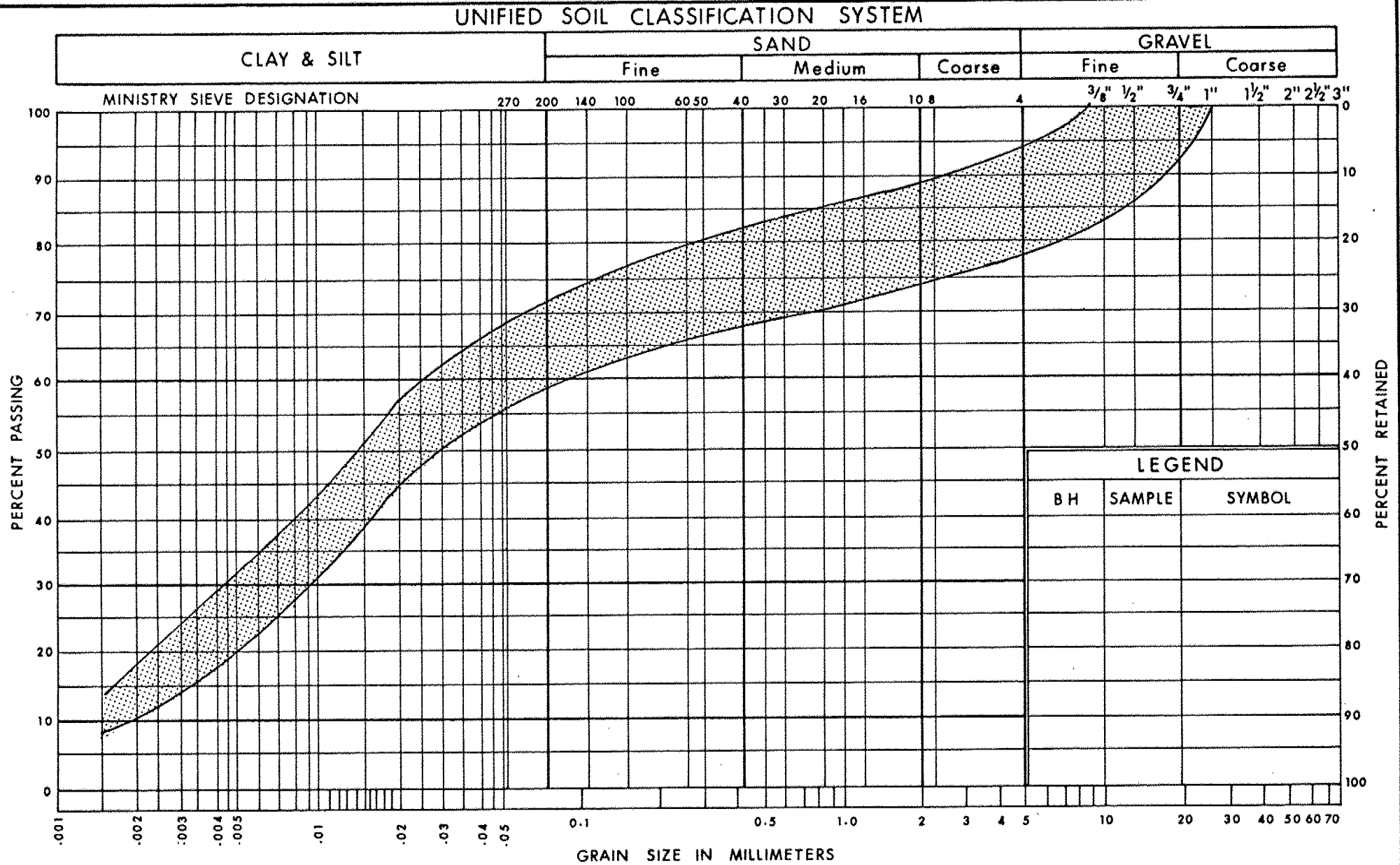


Ministry of  
Transportation and  
Communications  
Ontario  
ENGINEERING SERVICES BRANCH

PLASTICITY CHART  
GLACIAL TILL  
CLAYEY SILT SOME SAND TRACE OF GRAVEL

FIG No 1

W P 27-78-02





# 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   |

**DENSENESS:** 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.  $\bar{C}\bar{U}$  = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

### FIELD SAMPLING

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

### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  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  
 $\beta$  ANGLE OF SLOPE  
 $N_y, N_q, N_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  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 =  $\frac{I_P \text{ of soil}}{I_P \text{ of } \mu m \text{ Soil Fraction}}$   
 $Om$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  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  
 $s_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  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

### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  COEFFICIENT OF VISCOSITY  
 $k$  COEFFICIENT OF HYDRAULIC CONDUCTIVITY  
 $k_h$   $k$  IN HORIZONTAL DIRECTION  
 $k_v$   $k$  IN VERTICAL DIRECTION  
 $m_v$  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  
 $O_r$  OVERCONSOLIDATION RATIO (OCR)

**NOTE:** EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, OTTAWA

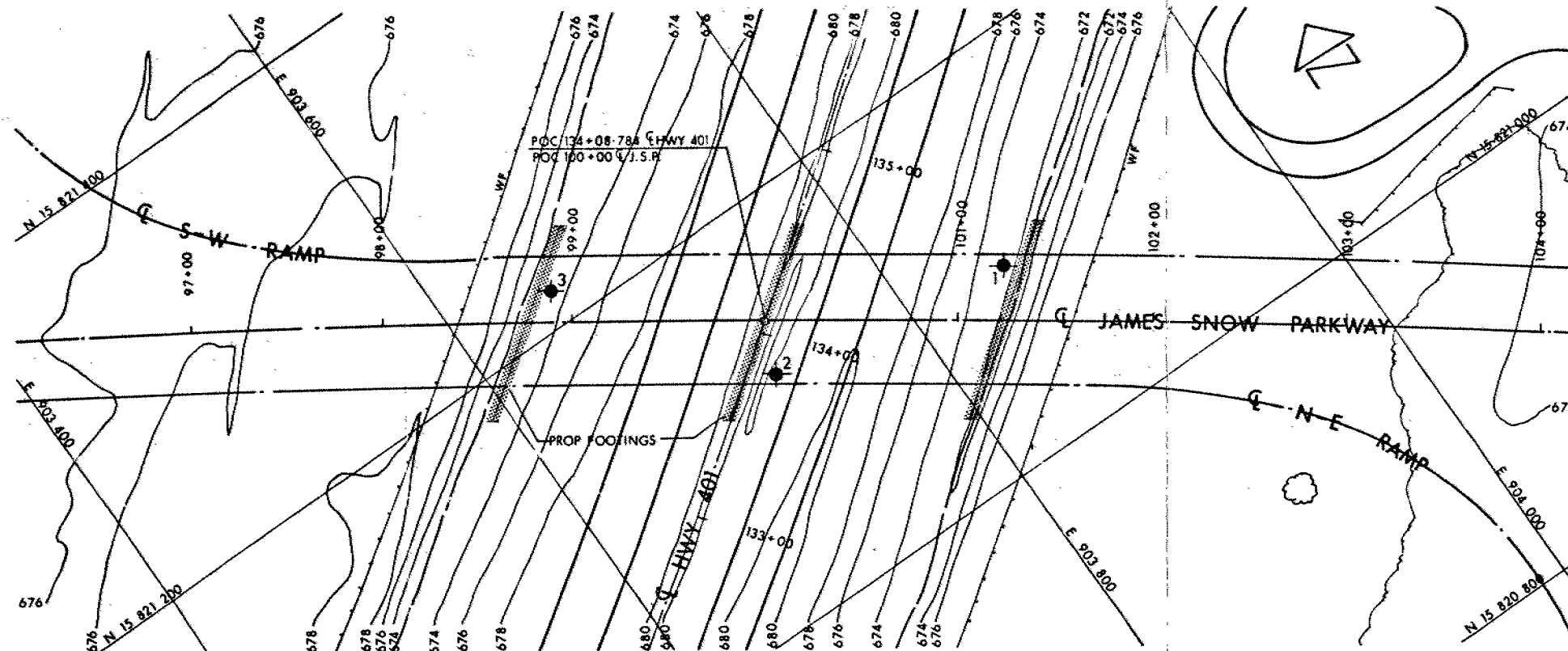
CONT No  
WP No 27-78-02

JAMES SNOW PARKWAY UNDERPASS

BORE HOLE LOCATIONS & SOIL STRATA

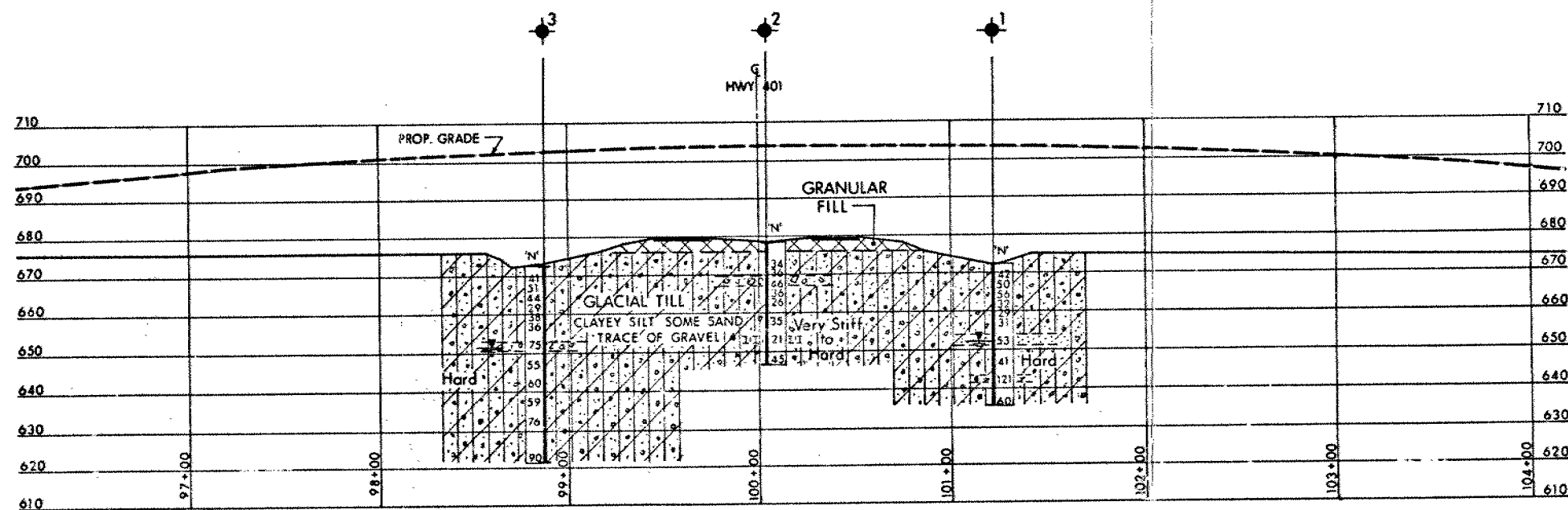


SHEET



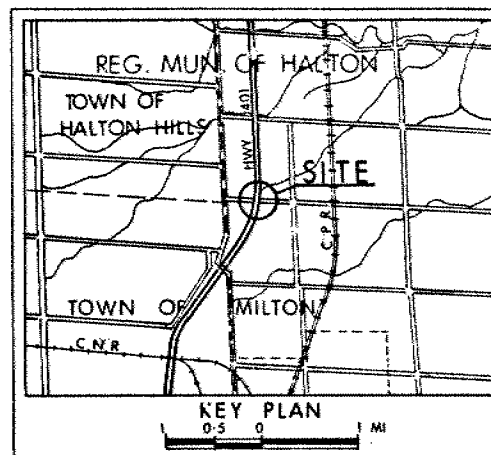
PLAN

SCALE  
40 20 0 40 FT.



PROFILE J.S.P.

SCALE  
VERT. 40 20 0 40 FT.  
HOR. 20 10 0 20



KEY PLAN  
0 0.5 1 MI

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 APR 1979  
NO WL Established BH No 2

| No | ELEVATION | CO-ORDINATES |         |
|----|-----------|--------------|---------|
|    |           | NORTH        | EAST    |
| 1  | 672.1     | 15 821 095   | 903 855 |
| 2  | 678.2     | 15 821 117   | 903 726 |
| 3  | 672.9     | 15 821 218   | 903 655 |

-NOTE-

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

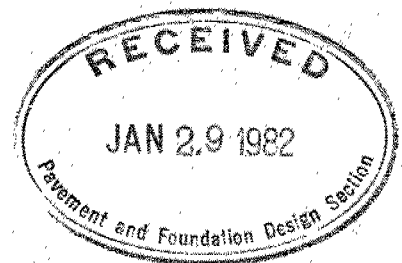


| REVISIONS | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
|           |      |    |             |
|           |      |    |             |
|           |      |    |             |

HWY No JAMES SNOW PARKWAY DIST 6  
SUBMIT K CHECKED DATE 79 05 15 SITE 10-312  
DRAWN J. CHECKED DATE 79 05 15 SITE 10-312  
DWG 277802-A

# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 81-67



Ministry of  
Transportation and  
Communications

INDEX

| <u>Page No.</u> | <u>Description</u>                            |
|-----------------|---|
| 1               | Index   |
| 2               | Abbreviations & Symbols                       |
| 3- 21           | Foundation Investigation Reports              |
|                 | James Snow Parkway Underpass<br>W.P. 27-78-02 |
|                 | C.N.R. Overhead Widening<br>W.P. 146-75-05    |

NOTE: For purposes of the contract these reports  
supercede all other foundation reports prepared  
by or for the Ministry in connection with the  
above mentioned projects.

'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   |

DENSENESS: 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) E.G.  $C_{IU}$  = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

##### FIELD SAMPLING

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

##### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  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  
 $\beta$  ANGLE OF SLOPE  
 $N_\gamma, N_q, N_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

##### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  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

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  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  
 $s_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  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

##### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  COEFFICIENT OF VISCOSITY  
 $k$  COEFFICIENT OF HYDRAULIC CONDUCTIVITY  
 $k_h$   $k$  IN HORIZONTAL DIRECTION  
 $k_v$   $k$  IN VERTICAL DIRECTION  
 $m_v$  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  
 $O_r$  OVERCONSOLIDATION RATIO (OCR)

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

## FOUNDATION INVESTIGATION REPORT

For

James Snow Parkway Underpass  
W.P. 27-78-02, Site 10-312  
Hwy. 401, District 6, Toronto

---

INTRODUCTION

This report contains the results of a foundation investigation program carried out at the above mentioned project site during the period of April 17 and April 18, 1979. The fieldwork consisted of three sampled boreholes advanced by means of a continuous flight auger machine equipped with hollow stem augers. These boreholes ranged in depth from 31.5 feet to 51.5 feet below ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located approximately one mile northeast of the intersection of Hwy. 401 and Steeles Avenue in the Town of Milton, Regional Municipality of Halton.

The topography in the immediate area is level to gently undulating with the predominant land use being agriculture.

Physiographically, the site is situated in the 'Peel Plain' region which is characterized by a modified veneer of clay underlain by glacial till containing large amounts of Palaeozoic shale. Underlying the glacial deposit are the red (Queenston) shales from which the till's reddish colour is derived.

SUBSURFACE CONDITIONSGeneral

The site is underlain by a uniform deposit of silty clay of low plasticity, some sand and trace of gravel which was explored to a maximum depth of 51.5 feet. Bedrock was not encountered in any of the borings.

The boundaries between the various soil types are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, is shown on Contract Drawing No. 10-312-2.

The major subsoil type encountered is described in the following paragraphs.

Silty Clay, Some Sand, Trace Gravel (Glacial Till)

Underlying the site and explored to depths ranging from 31.5 to 51.5 ft. is a cohesive glacial till deposit consisting of silty clay of low plasticity, some sand, trace of gravel with occasional weathered shale partings. Grain size analysis for this cohesive stratum are shown in envelope form on the grain size distribution chart, Figure No. 2. Typical Atterberg Limits and identity indices performed on selected representative samples are summarized in the following table and plotted on the plasticity chart, Figure 1.

|                  |                     | <u>Range</u> | <u>Average</u> |
|------------------|---------------------|--------------|----------------|
| Moisture Content | (W) %               | 9-18         | 10             |
| Liquid Limit     | (W <sub>L</sub> ) % | 16-29        | 23             |
| Plastic Limit    | (W <sub>p</sub> ) % | 13-19        | 16             |
| Plasticity Index | (I <sub>p</sub> ) % | 3-10         | 6              |

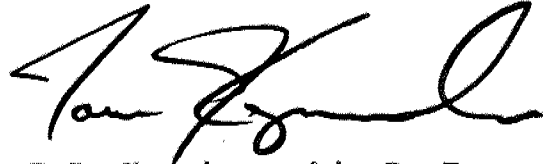
These results indicate the glacial deposit to be generally a silty clay of low plasticity (CL).

Standard Penetration Test 'N' values range from 21 to in excess of 100 blows per foot but generally averaging 40 blows per foot. The consistency of the cohesive glacial till deposit based on visual classification and the 'N' values may be considered as very stiff to hard in nature.

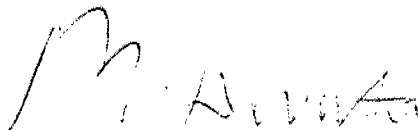
Groundwater

During boring operations groundwater was encountered in two boreholes at depths of 20 and 21 feet corresponding to elevation

652+. No overnight groundwater level readings were obtained due to free water influx into the boreholes from the highway ditches.



T.J. Kazmierowski, P. Eng.  
Foundations Engineer



M. Devata, P. Eng.  
Senior Foundations Engineer



## APPENDIX



RECORD OF BOREHOLE No 1

7

W P 27-78-02 LOCATION Coords. N 15 821 095; E 903 855 ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Continuous Flight Auger Hollow Stem Augers COMPILED BY  
DATUM Geodetic DATE April 17, 1979 CHECKED BY

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT<br>20 40 60 80 100<br>SHEAR STRENGTH<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 |  |                                    |                                     |                                   |                     |  |
| 672.1         | Ground Surface   |            |         |      |            |                            |                 |  |                                    |                                     |                                   |                     |  |
| 0.0           | Weathered Firm   |            |         |      |            |                            | 670             |  |                                    |                                     |                                   |                     | 22 19 49 10  |
|               | Silty Clay of Low Plasticity                           |            | 1       | SS   | 42         |                            |                 |  |                                    |                                     |                                   |                     |  |
|               | Some Sand  |            | 2       | SS   | 50         |                            |                 |  |                                    |                                     |                                   |                     |  |
|               | Trace Gravel (Glacial Till)                            |            | 3       | SS   | 56         |                            |                 |  |                                    |                                     |                                   |                     | 20 20 47 13  |
|               | Hard   |            | 4       | SS   | 32         |                            |                 |  |                                    |                                     |                                   |                     |  |
|               | Red  |            | 5       | SS   | 29         |                            | 660             |  |                                    |                                     |                                   |                     |  |
|               |  |            | 6       | SS   | 31         |                            |                 |  |                                    |                                     |                                   |                     |  |
|               | Silty Sand   |            | 7       | SS   | 53         |                            | 650             |  |                                    |                                     |                                   |                     |  |
|               |  |            | 8       | SS   | 41         |                            |                 |  |                                    |                                     |                                   |                     |  |
|               | Weathered Shale Partings                               |            | 9       | SS   | 121        |                            | 640             |  |                                    |                                     |                                   |                     |  |
| 635.6         |  |            | 10      | SS   | 60         |                            |                 |  |                                    |                                     |                                   |                     |  |
| 36.5          | End of Borehole  |            |         |      |            |                            |                 |  |                                    |                                     |                                   |                     |  |
|               | Note: Water Table Encountered During Boring Operations |            |         |      |            |                            |                 |  |                                    |                                     |                                   |                     |  |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 2

8

W P 27-78-02 LOCATION Coords. N 15 821 117; E 903 726 ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Continuous Flight Auger Hollow Stem Augers COMPILED BY TK  
DATUM Geodetic DATE April 18, 1979 CHECKED BY e/f

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                    |          | PLASTIC<br>LIMIT | NATURAL<br>MOISTURE<br>CONTENT | LIQUID<br>LIMIT | UNIT<br>WEIGHT<br><br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----------|------------------|--------------------------------|-----------------|-------------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100  |          | W <sub>p</sub>   | W                              | W <sub>L</sub>  |                         |  |
|               |   |            |         |      |            |                            |                 | SHEAR STRENGTH   |          |                  |                                |                 |                         |  |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED    + FIELD VANE<br>● QUICK TRIAXIAL    x LAB VANE | 10 20 30 |                  |                                |                 |                         |  |
| 678.2         | Ground Surface  |            |         |      |            |                            |                 |  |          |                  |                                |                 |                         |  |
| 0.0           | Granular Roadway Fill   |            |         |      |            |                            |                 |  |          |                  |                                |                 |                         |  |
| 2.0           | Occasional<br>Cobbles<br><br>Sand<br>Seams<br><br>Silty Clay<br>of low Plasticity<br>Some Sand<br>Trace Gravel<br>(Glacial Till)<br>Very Stiff to Hard<br>Red<br><br><br><br><br>Silty Clay Layer |            | 3       | SS   | 34         |                            |                 |  |          | ○                |                                |                 |                         | 11 22 51 16  |
|               |   |            | 4       | SS   | 36         |                            | 670             |  |          |                  |                                |                 |                         |  |
|               |   |            | 5       | SS   | 46         |                            |                 |  |          | ○                |                                |                 |                         | 11 22 49 18  |
|               |   |            | 6       | SS   | 36         |                            |                 |  |          |                  |                                |                 |                         |  |
|               |   |            | 7       | SS   | 26         |                            |                 |  |          |                  |                                |                 |                         |  |
|               |   |            |         |      |            |                            | 660             |  |          |                  |                                |                 |                         |  |
|               |   |            | 8       | SS   | 35         |                            |                 |  |          |                  |                                |                 |                         |  |
|               |   |            |         |      |            |                            |                 |  |          |                  |                                |                 |                         |  |
|               |   |            | 9       | SS   | 21         |                            |                 |  |          | ○                |                                |                 |                         |  |
|               |   |            |         |      |            |                            | 650             |  |          |                  |                                |                 |                         |  |
| 646.7         |   |            | 10      | SS   | 45         |                            |                 |  |          |                  |                                |                 |                         |  |
| 31.5          | End of Borehole   |            |         |      |            |                            |                 |  |          |                  |                                |                 |                         |  |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 3

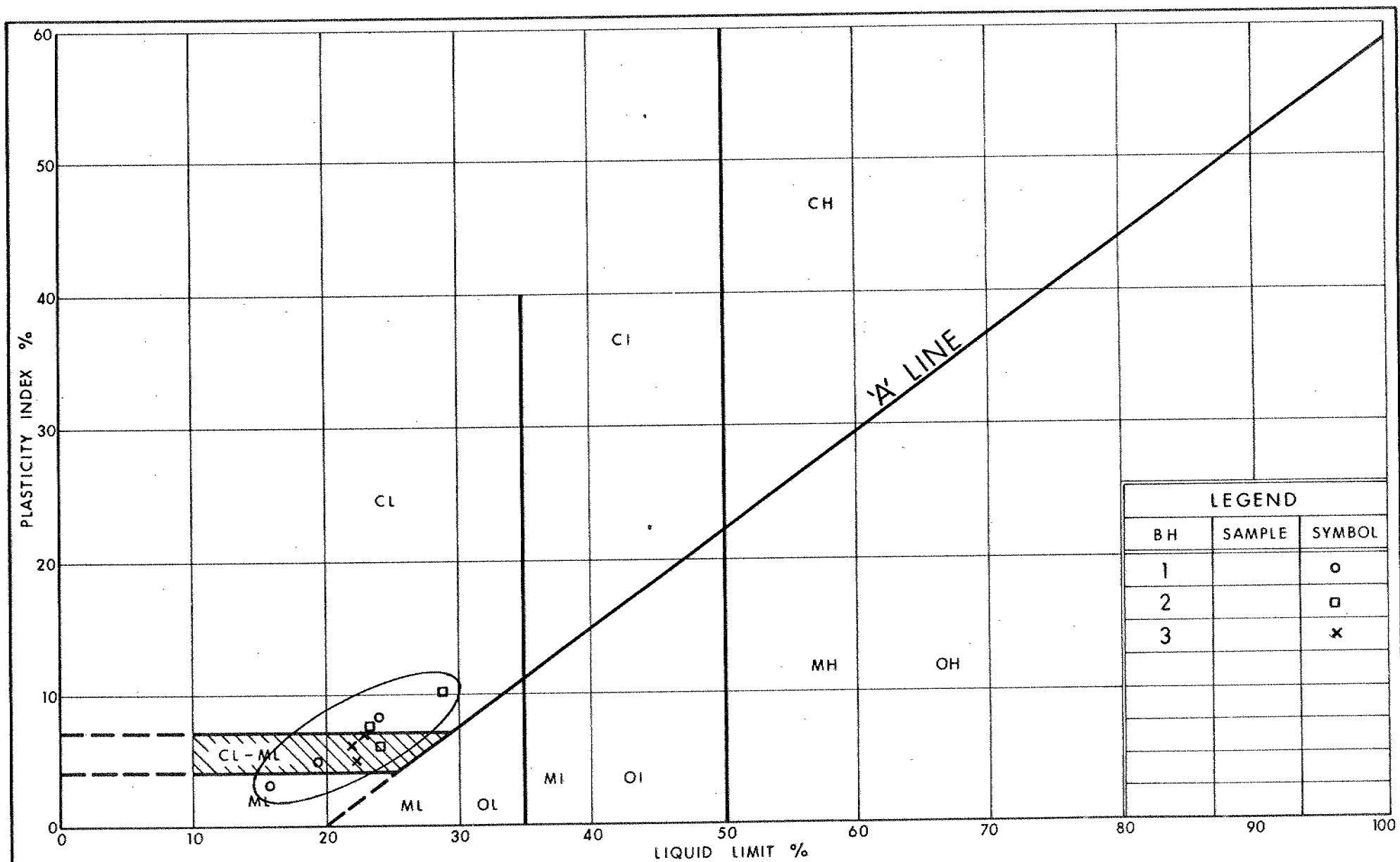
9

W P 27-78-02 LOCATION Coords. N 15 821 218; E 903 655 ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY J.K.  
DATUM Geodetic DATE April 18, 1979 CHECKED BY J.K.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 672.9         | Ground Surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | Weathered Firm  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               | Silty Clay of Low Plasticity  |            | 1       | SS   | 41         |                            | 670                |   |    |    |    |     |                                    |                                     |                                   |                     | 6 23 56 15   |
|               | Some Sand   |            | 2       | SS   | 51         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               | Trace of Gravel (Glacial Till)  |            | 3       | SS   | 44         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     | 10 24 51 15  |
|               | Hard Red  |            | 4       | SS   | 29         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 5       | SS   | 38         |                            | 660                |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 6       | SS   | 36         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               | Cobbles and Boulders  |            | 7       | SS   | 75/        | 2"                         | 650                |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 8       | SS   | 55         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 9       | SS   | 60         |                            | 640                |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 10      | SS   | 59         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 11      | SS   | 76         |                            | 630                |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 621.4         |   |            | 12      | SS   | 90         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 51.5          | End of Borehole<br>Note: Water Table<br>Encountered During<br>Boring Operations |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



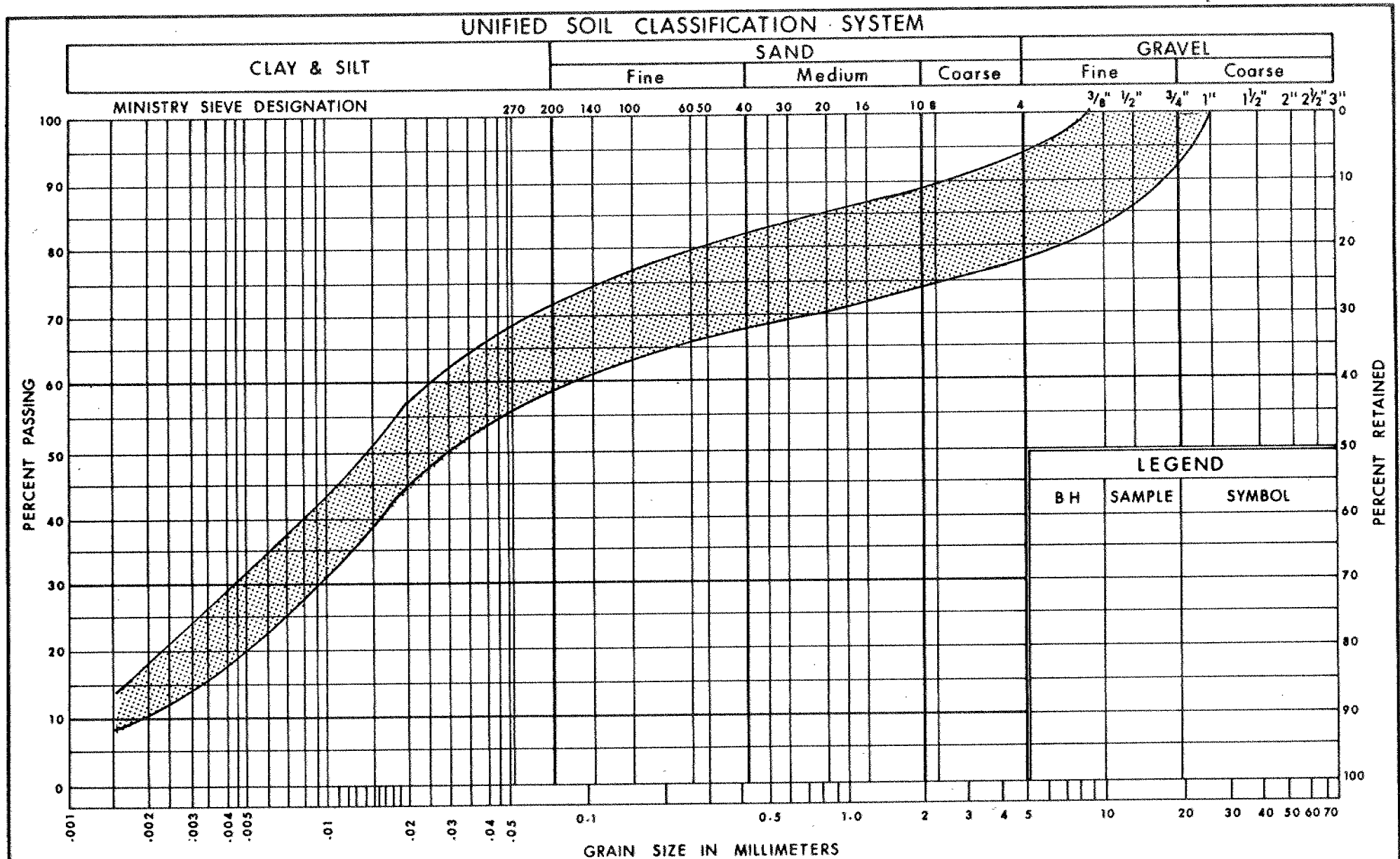
Ministry of  
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PLASTICITY CHART  
GLACIAL TILL  
SILTY CLAY SOME SAND TRACE OF GRAVEL

FIG No 1

W P 27-78-02



**Ministry of  
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GRAIN SIZE DISTRIBUTION  
GLACIAL TILL  
SILTY CLAY SOME SAND TRACE OF GRAVEL

FIG No 2

W P 27-78-02

## FOUNDATION INVESTIGATION REPORT

For

C.N.R. Overhead Widening  
0.5 Mile East of Hwy. 25  
Site 10-57, W.P. 146-75-05  
District 6, Toronto, Hwy. 401

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INTRODUCTION

We have completed our foundation investigation for the proposed widening of the above mentioned structure and related approach slopes.

The fieldwork was carried out on December 15, 1977 and consisted of a total of two sampled boreholes, one accompanied by a dynamic cone penetration test. The borings were advanced by means of hollow stem augers to depths of up to 52 feet below the ground surface. The borings were located within the highway median set back 12 feet from the west median retaining wall and 9 feet from the east median wall. In addition, two test pits were dug with a backhoe. Both pits were located south of Hwy. 401 and east of the east retaining wall. One pit was dug 9 feet into the embankment fill and one pit was dug at the toe of the slope and advanced 13 feet into the parent subsoil.

The boundaries between the various soil types encountered, laboratory test results, and groundwater conditions are shown on the attached Record of Borehole Sheets. In addition, a record of the logged test pits are also appended. A plan of the site showing the locations of the boreholes and test pits is shown on Contract Drawing No. 10-57-2.

SUBSOIL CONDITIONS

The borings indicated that behind the median retaining walls subsoil consists of up to 30 feet of moderately compacted fill material. The fill material is generally composed of sand with some gravel and silt; however, in one boring the upper 5 feet is comprised of sand, some silt and a trace of clay. Typical grain size distribution curves for the deposit are shown on Figure 1 attached.

Below this fill material is a 3 to 4 foot stiff to very stiff deposit composed of silty clay of low to medium plasticity, some sand. The upper  $\frac{1}{2}$  foot of this thin layer is black and contains a trace of organic material; this zone is the parent topsoil. The results of Atterberg Limit testing on two samples from this deposit are plotted on the Plasticity Chart, Figure 2 and are summarized below.

|                                      | <u>B.H. 1, Sample 10</u> | <u>B.H. 2, Sample 18</u> |
|--------------------------------------|--------------------------|--------------------------|
| Natural Moisture Content (W) %       | 25                       | 21                       |
| Liquid Limit (W <sub>L</sub> ) %     | 31                       | 38                       |
| Plastic Limit (W <sub>p</sub> ) %    | 20                       | 21                       |
| Plasticity Index (I <sub>p</sub> ) % | 11                       | 17                       |

These results indicate that the material is inorganic and of low to intermediate plasticity (CL-CI zone).

Immediately below this silty clay deposit is a stratum of cohesive glacial till. The deposit is composed of a heterogeneous mixture of silty clay, sand and gravel. In one borehole the upper 4 feet of this deposit was found to be in a reworked condition and based on Standard Penetration Test 'N' values it is estimated to have a stiff consistency. Below this reworked zone the 'N' values indicate that the deposit was a hard consistency. The results of grain size distribution testing are shown in an envelope form on Figure 3 of the Appendix. The results of Atterberg Limit Testing are plotted on the Plasticity Chart, Figure 2 and also are summarized below.

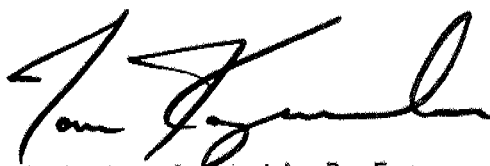
|                                      | <u>Range</u> | <u>Average</u> |
|--------------------------------------|--------------|----------------|
| Natural Moisture Content (W) %       | 10-15        | 13             |
| Liquid Limit (W <sub>L</sub> ) %     | 22-27        | 25             |
| Plastic Limit (W <sub>p</sub> ) %    | 12-19        | 15             |
| Plasticity Index (I <sub>p</sub> ) % | 9-11         | 10             |

The above results indicate that the material is inorganic and of low plasticity (CL zone).

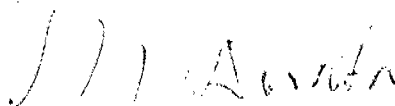
Groundwater was encountered in only one borehole at a depth of some five feet below the existing ground elevation within the median which corresponds to elevation 711.0.



The test pits indicate that the roadway fill material consists of up to 2 feet of topsoil overlying dense sand and gravel fill.



T.J. Kazmierowski, P. Eng.  
Foundations Engineer



M. Devata, P. Eng.  
Senior Foundations Engineer

## APPENDIX

RECORD OF TEST PITS

For

C.N.R. Overhead, Hwy. 401  
Site 10-57, W.P. 146-75-05  
District 6, Toronto

Test Pit #1

Date: December 15, 1977

Location: South of Hwy. 401, 10' East of East  
Retaining Wall

Embankment Cut

0-2' Silty clay with sand and gravel (Topsoil)  
2-7' Sand and gravel, dense  
7-9' Silty clay, some sand and gravel, very hard  
(Parent Subsoil)

Test Pit #2

Date: December 15, 1977

Location: South of Hwy. 401, 15' East of East  
Retaining Wall

Toe Cut

0-2' Silty clay with sand and gravel (Fill)  
2-3' Silty clay with sand and organics (Topsoil)  
3-4' Silty clay hard  
4-7' Silty clay with sand and gravel (Reworked Glacial Till)  
7-13' Silty clay with sand and gravel (Hard Glacial Till)

Note: 1. Seepage from 3' below top of T.P. 2

2. Top of T.P. 2 level with R/R tracks



RECORD OF BOREHOLE No 1

17

W P 146-75-05 LOCATION E 9 Feet E. of E. Median Retaining Wall ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MM  
DATUM Geodetic DATE Dec 15, 1977 CHECKED BY

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |     |                   |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-----|-------------------|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 |                                    |                                     |                                   |                     |   | 100 | WATER CONTENT (%) |
| 716.0         | Ground Level   |            |         |      |            |                            |                 |   |    |    |    |                                    |                                     | 10                                | 20                  | 30  |     |                   |
| 0.0           | FILL Sand, Some<br>Silt, Trace<br>Of Clay                  |            | 1       | SS   | 40         |                            |                 |   |    |    |    |                                    |                                     | ○                                 |                     |   |     | 0 74 17 9         |
|               |  |            | 2       | SS   | 30         |                            |                 |   |    |    |    |                                    |                                     | ○                                 |                     |   |     | 22 64 (14)        |
|               |  |            | 3       | SS   | 10         |                            |                 |   |    |    |    |                                    |                                     | ○                                 |                     |   |     | 22 66 (12)        |
|               |  |            | 4       | SS   | 17         |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |
|               | Sand, Some<br>Gravel, Some<br>Silt                         |            | 5       | SS   | 34         |                            |                 |   |    |    |    |                                    |                                     | ○                                 |                     |   |     |                   |
|               |  |            | 6       | SS   | 24         |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |
|               |  |            | 7       | SS   | 28         |                            |                 |   |    |    |    |                                    |                                     | ○                                 |                     |   |     |                   |
|               |  |            | 8       | SS   | 14         |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |
| 686.0         |  |            | 9       | SS   | 19         |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |
| 30.0          | Silty Clay Organic   |            | 10      | SS   | 14         |                            |                 |   |    |    |    |                                    |                                     | ○                                 | —                   | ○   |     | 0 16 65 19        |
| 683.0         | Stiff Some Sand,   |            | 11      | SS   | 8          |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |
| 33.0          | Het. Mixture<br>Silty Clay<br>Some Sand.<br>(Glacial Till) | Stiff      | 12      | SS   | 14         |                            |                 |   |    |    |    |                                    |                                     | ○                                 | —                   | ○   |     | 0 36 44 20        |
|               |  | Hard       | 13      | SS   | 33         |                            |                 |   |    |    |    |                                    |                                     | ●                                 | —                   | —   |     | 0 20 60 20        |
| 669.5         |  |            | 14      | SS   | 43         |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |
| 46.5          | End Of Borehole  |            |         |      |            |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |     |                   |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 2

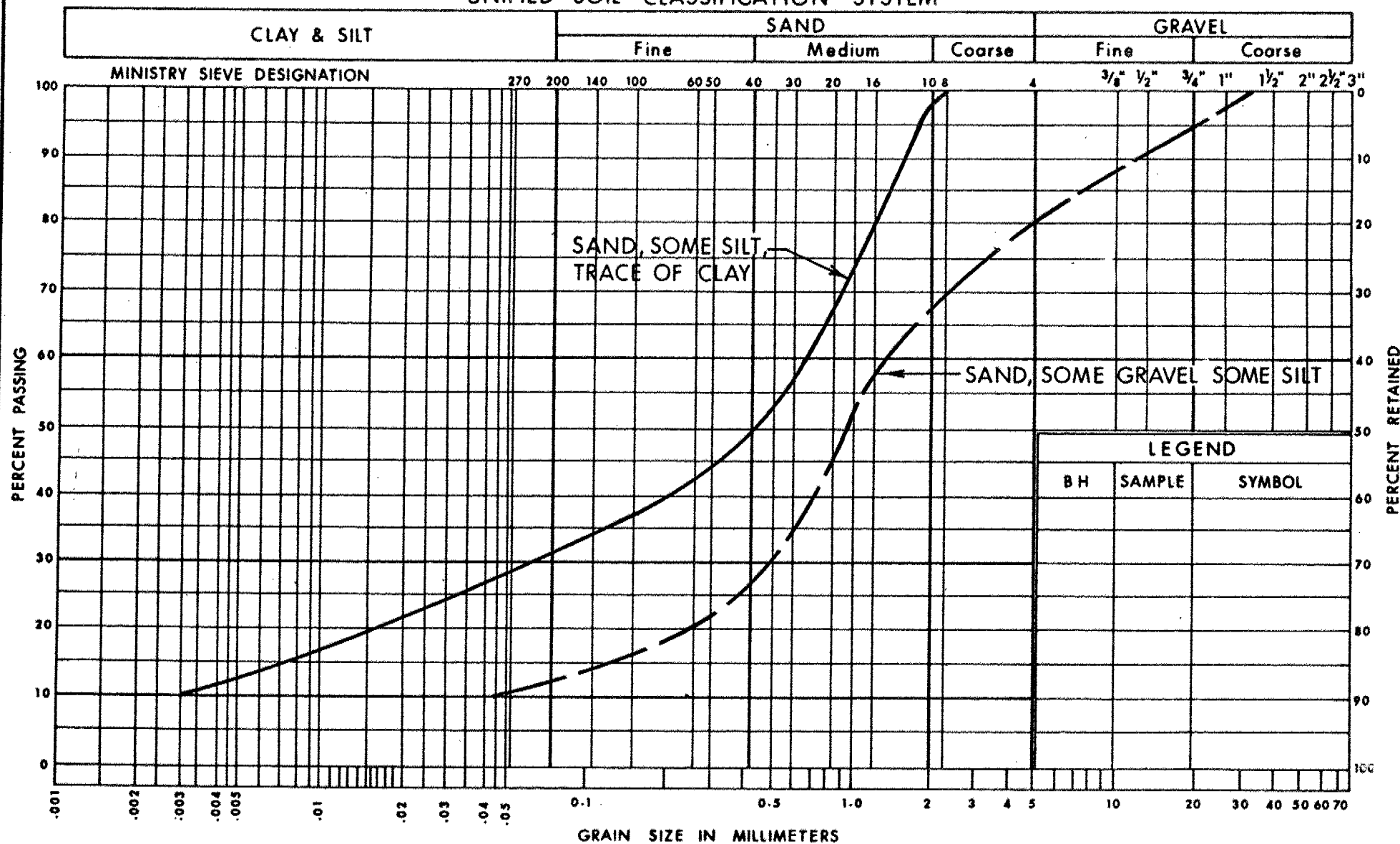
18

W P 146-75-05 LOCATION E 12 Feet W. OF West Median Retaining Wall ORIGINATED BY TK  
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem Augers & Dynamic Cone Test COMPILED BY MM  
DATUM Geodetic DATE Dec. 15, 1977 CHECKED BY

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | SHEAR STRENGTH   |                                    |                                     |                                   |                     |   |
| 716.0         | Ground Level   |            |         |      |            |                            |                 |   | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL x LAB VANE |                                    |                                     |                                   |                     |   |
| 0.0           |  |            | 1       | SS   | 35         |                            | 710             |   |  |                                    |                                     |                                   |                     | 21 64 (15)  |
|               |  |            | 2       | SS   | 20         |                            |                 |   |  |                                    |                                     |                                   |                     | 9 84 (7)  |
|               |  |            | 3       | SS   | 4          |                            |                 |   |  |                                    |                                     |                                   |                     |   |
|               | FILL<br>Sand, Some<br>Gravel, Some<br>Silt                                 |            | 4       | SS   | 19         |                            | 700             |   |  |                                    |                                     |                                   |                     |   |
|               |  |            | 5       | SS   | 48         |                            |                 |   |  |                                    |                                     |                                   |                     | 17 71 (12)  |
|               |  |            | 6       | SS   | 25         |                            | 690             |   |  |                                    |                                     |                                   |                     |   |
| 686.0         | Organic  |            | 7       | SS   | 18         |                            |                 |   |  |                                    |                                     |                                   | 2.1%                | 10 19 45 26                                       |
| 30.0          | Silty Clay   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |                     |   |
| 682.0         | Some Sand Some Gravel  |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |                     |   |
| 34.0          | Very Stiff   |            | 8       | SS   | 49         |                            | 680             |   |  |                                    |                                     |                                   |                     | 3 23 53 21  |
|               | Heterogenous Mixture<br>Silty Clay Some<br>Sand.<br>(Glacial Till)<br>Hard |            | 9       | SS   | 83         |                            |                 |   |  |                                    |                                     |                                   |                     | 4 23 52 21  |
| 664.5         |  |            | 10      | SS   | 75         |                            | 670             |   |  |                                    |                                     |                                   |                     |   |
| 51.5          | End of Borehole  |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |                     |   |
|               | Note: Ground Water<br>Not Encountered                                      |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



## Ontario

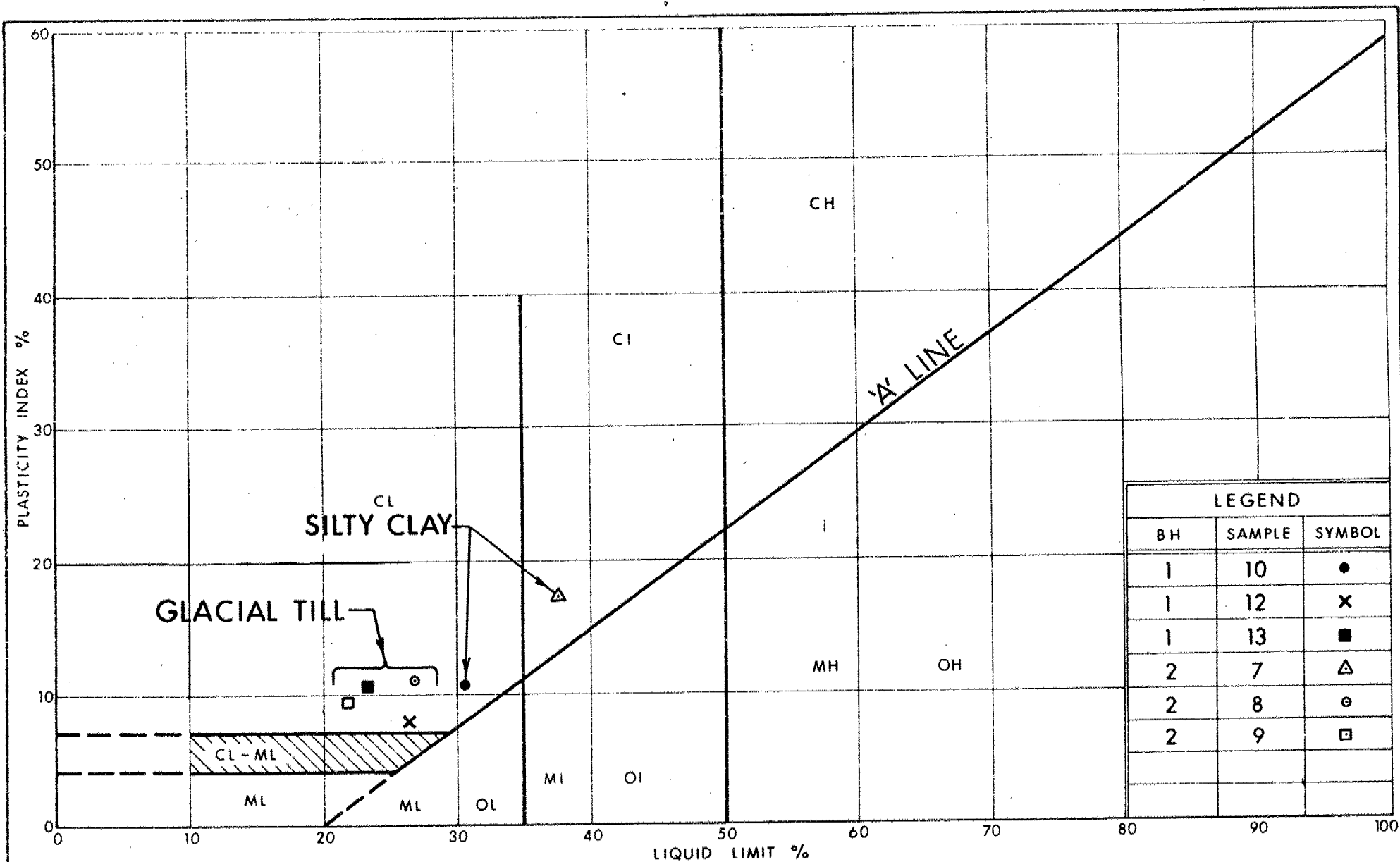
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# GRAIN SIZE DISTRIBUTION

## FILL

FIG No 1

W P 146 - 75 - 05



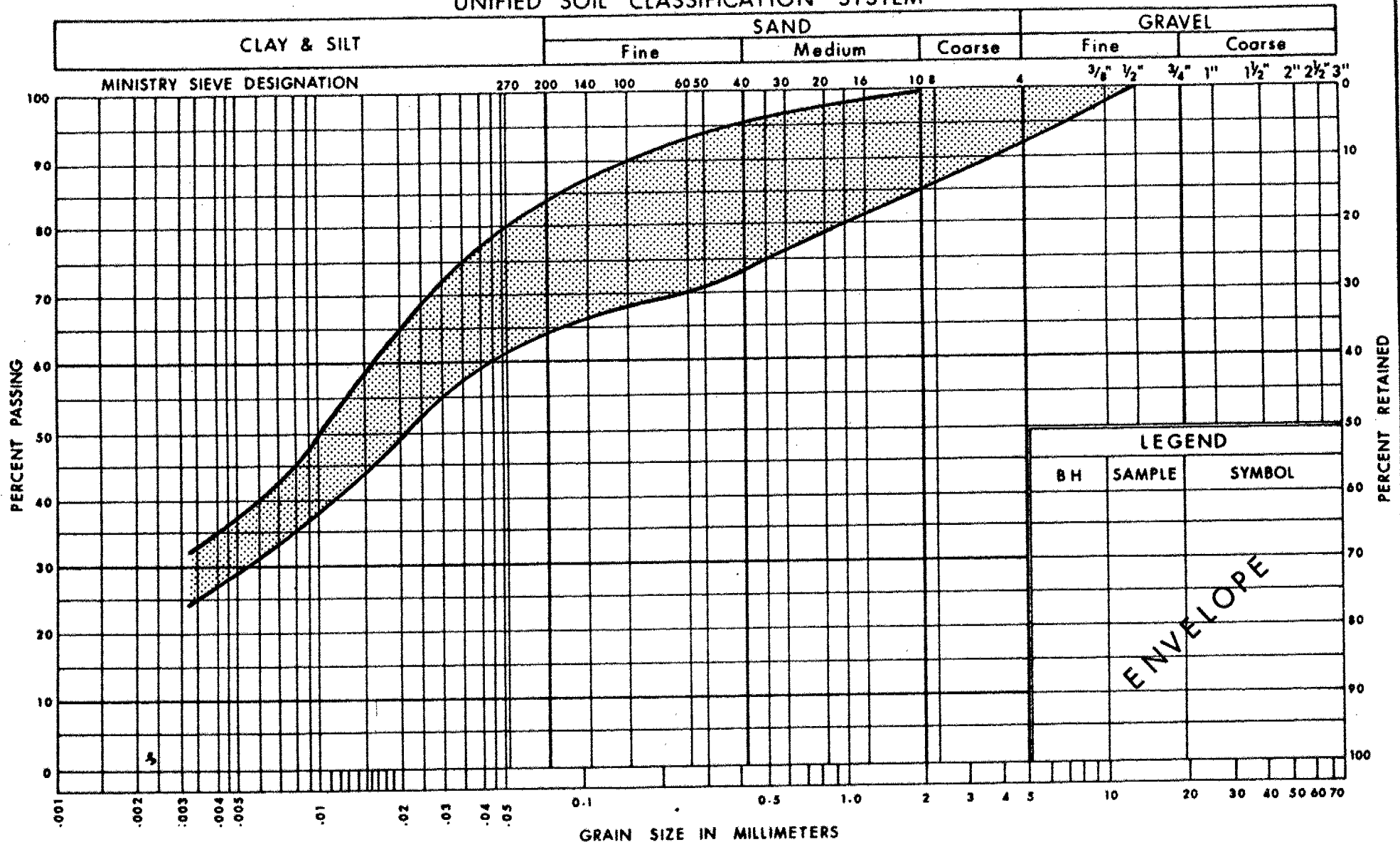
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## PLASTICITY CHART

FIG No 2

W P 146-75-05

## UNIFIED SOIL CLASSIFICATION SYSTEM



**Ontario**

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## GRAIN SIZE DISTRIBUTION GLACIAL TILL

HETEROGENEOUS MIXTURE SILTY CLAY, TR. OF GRAVEL

FIG No 3

W P 146 - 75 - 05



Mr. W.L. Lin  
A/Head, Central Section  
Structural Office  
West Building

1980-04-08

From: Pavement & Foundation Design Section  
Room 313, Central Building

Subject: James Snow Parkway Bridge  
W.P. 27-78-02, Site 10-312  
Hwy. 401, District #4 (Hamilton)

We submit the following comments with regard to the final bridge drawing for the above mentioned project.

The earth grading for the future E.B. and W.B. lanes of Hwy. 401, including ditching, should be completed in the vicinity of the structure.

This Section would like to monitor the settlements of the abutment footing constructed on compacted Granular 'A' material. In order to carry out the necessary instrumentation work, a special provision to bidders should be included in the contract and this should be very similar to our project carried out under Contract 78-49 (Hwy. 404 and 19th Ave. structure).

MD:ea

M. Devata  
Senior Foundations Engineer

cc: G.C.E. Burkhardt  
R.P. Northwood

Mr. C.S. Grebski  
Head, Central Section  
Structural Office  
2nd Floor, West Building

Soil Mechanics Section  
Engineering Materials Office  
Room 315, Central Building

1979 07 06

Re: James Snow Parkway Underpass  
W.P. 27-78-02, Site 10-312  
District 6, Toronto

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We have reviewed the Preliminary Bridge Plan Drawing 10-312-P1 for the above mentioned structure and have noted that the deck length has been increased some 20 feet from our previous information. In consideration of the uniform subsoil conditions over the site, we feel the existing subsurface information as contained in the foundation investigation and design report is sufficient and the recommendations applicable. All topsoil should be subexcavated to its full depth within the planned limits of the compacted granular core and for a minimum distance of 50 feet behind the abutment and then replaced with compacted earth fill. We have no other comments at this time with regards to foundation details of the structure.

T. Kazmierowski  
Project Engineer

TK/gs

cc: Files ✓