DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M13-70

DIST. 6 REGION

W.P. No. 137-87-02

CONT. No. 90-18

W. O. No.

STR. SITE No. 37-1172

HWY. No. 400/407

LOCATION Hwy 400/407 IC
Bridge #8, Hwy 407 EBL

No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO
Pw-B-1188 87-04

METRIC

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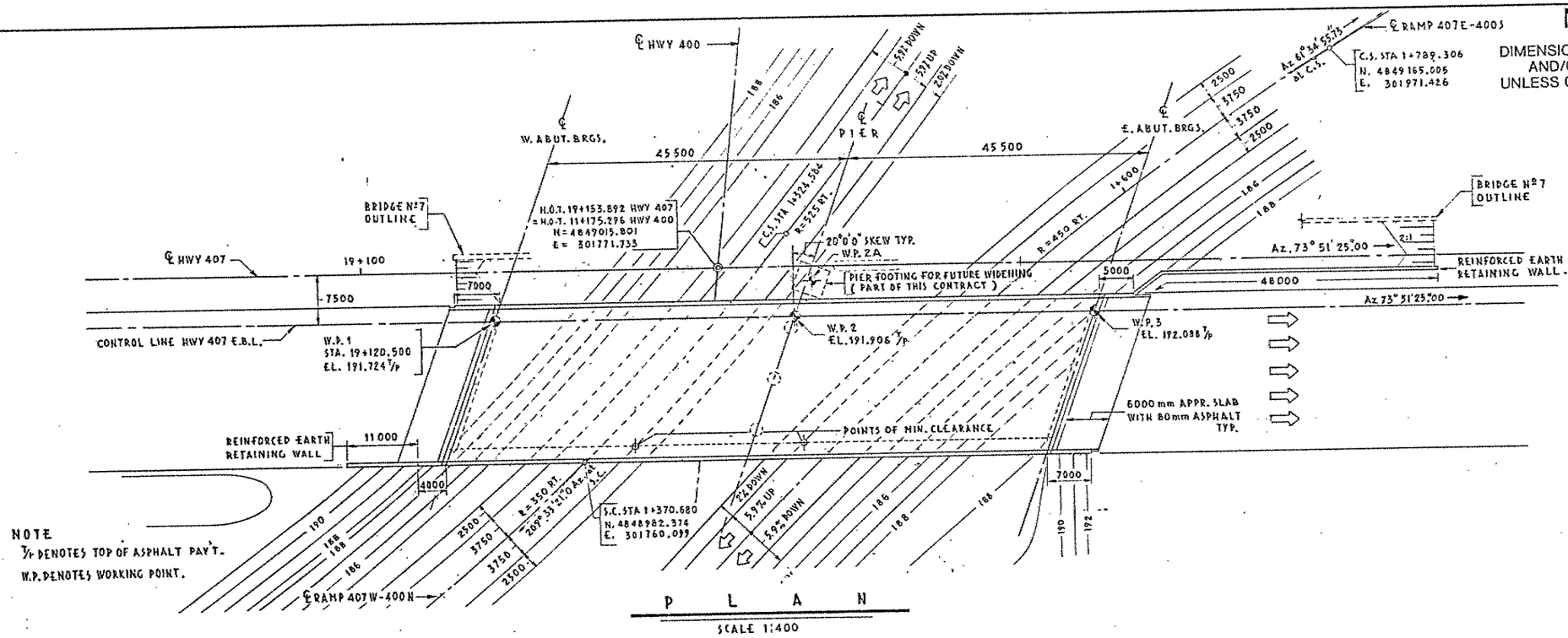
DIST, 6
CONT No
WP No 137-87-02

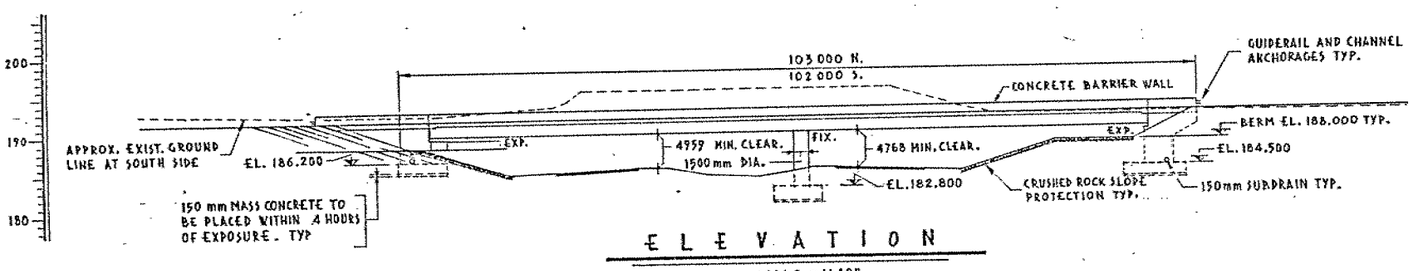
HWY 407 E.B.L. OVER 407 W-400N & 407E-400S RAMPS (BRIDGE Nº8)
GENERAL ARRANGEMENT

SHEET

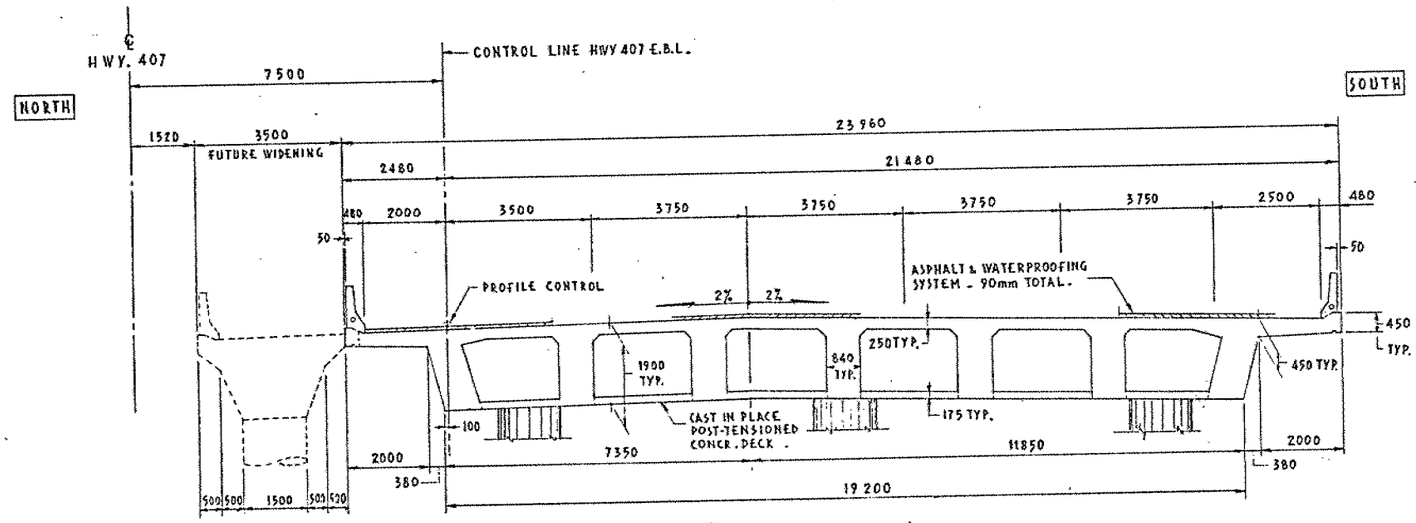


NOTE
T/P DENOTES TOP OF ASPHALT PAV'T.
W.P. DENOTES WORKING POINT.

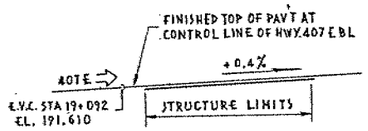
P L A N
SCALE 1:400



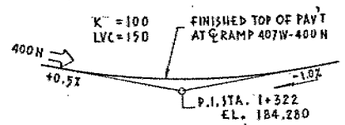
E L E V A T I O N
SCALE = 1:400



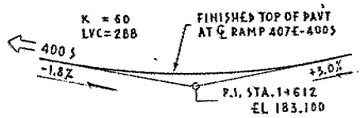
TYP. DECK SECTION
SCALE 1:75



PROFILE OF HWY. 407
N.T.S.



PROFILE OF RAMP 407W-400N
N.T.S.



PROFILE OF RAMP 407E-400S
N.T.S.

GENERAL NOTES

- CLASS OF CONCRETE

DECK & PIERS	35 MPa.
REMAINDER	30 MPa.

- CLEAR COVER TO REINFORCING STEEL.

FOOTINGS	100± 25
ABUTMENT & WINGWALLS :	
FRONT FACE	80± 20
BACK FACE	70± 20
PIERS	80± 20
DECK	
TOP	70± 20
BOTTOM & SIDES	50± 10
REMAINDER	70± 20 UNLESS OTHERWISE SPECIFIED

- REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS.

- CONSTRUCTION NOTES

IF THE ACTUAL BEARING HEIGHTS ARE DIFFERENT FROM THE ASSUMED HEIGHTS GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE BEARING SEAT ELEVATIONS AND THE REINFORCING STEEL TO SUIT THE ACTUAL HEIGHTS.

- LIST OF DRAWINGS

1-GENERAL ARRANGEMENT
2-SITE PLAN
3-BORE HOLE LOCATIONS & SOIL STRATA I
4-BORE HOLE LOCATIONS & SOIL STRATA II
5-FOOTING LAYOUT
6-ABUTMENT FOOTING REINFORCING
7-PIER & PIER FOOTINGS
8-WEST ABUTMENT
9-WEST ABUTMENT WINGWALLS.
10-EAST ABUTMENT
11-EAST ABUTMENT WINGWALLS.
12-BEARING DETAILS
13-DECK DETAILS
14-LONGITUDINAL TENDONS
15-TRANSVERSE TENDONS I
16-TRANSVERSE TENDONS II
17-DECK REINF. I
18-DECK REINF. II
19-DECK REINF. III
20-DECK REINF. IV
21-JOINT ANCHORAGE AND ARMOURING
22-NORTH BARRIER WALL
23-SOUTH BARRIER WALL
24-BARRIER WALL ON S.W. REINF. EARTH RETAINING WALL.
25-6000mm APPROACH SLAB
26-AS CONSTRUCTED ELEV. & DIM.
27-BRIDGE DATE & SITE NUMBER DATA.
28-STANDARD DETAILS
29-QUANTITIES - STRUCTURE I
30-QUANTITIES - STRUCTURE II
31-R.E. RETAINING WALLS - TYPICAL DETAILS.
32- " " " - PLAN & DETAILS.
33- " " " - ELEVATIONS.
34-R.E. RETAINING WALLS - SECTIONS.

APPLICABLE STANDARD DRAWING

PP 3502 - MIN. GRANULAR BACKFILL REQUIREMENTS.
OPSD 508-02 - BRIDGE DECK WATERPROOFING.

REGISTERED PROFESSIONAL ENGINEER H. JAGASIA PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

DESIGN H. K. J.	CHK	CODE 01BDC-85	LOAD "CLASS A"	DATE	MAY '89		
DRAWN G. C.	CHK	SITE 37-1172	STRUCT	SCHEME	DWG	1	

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

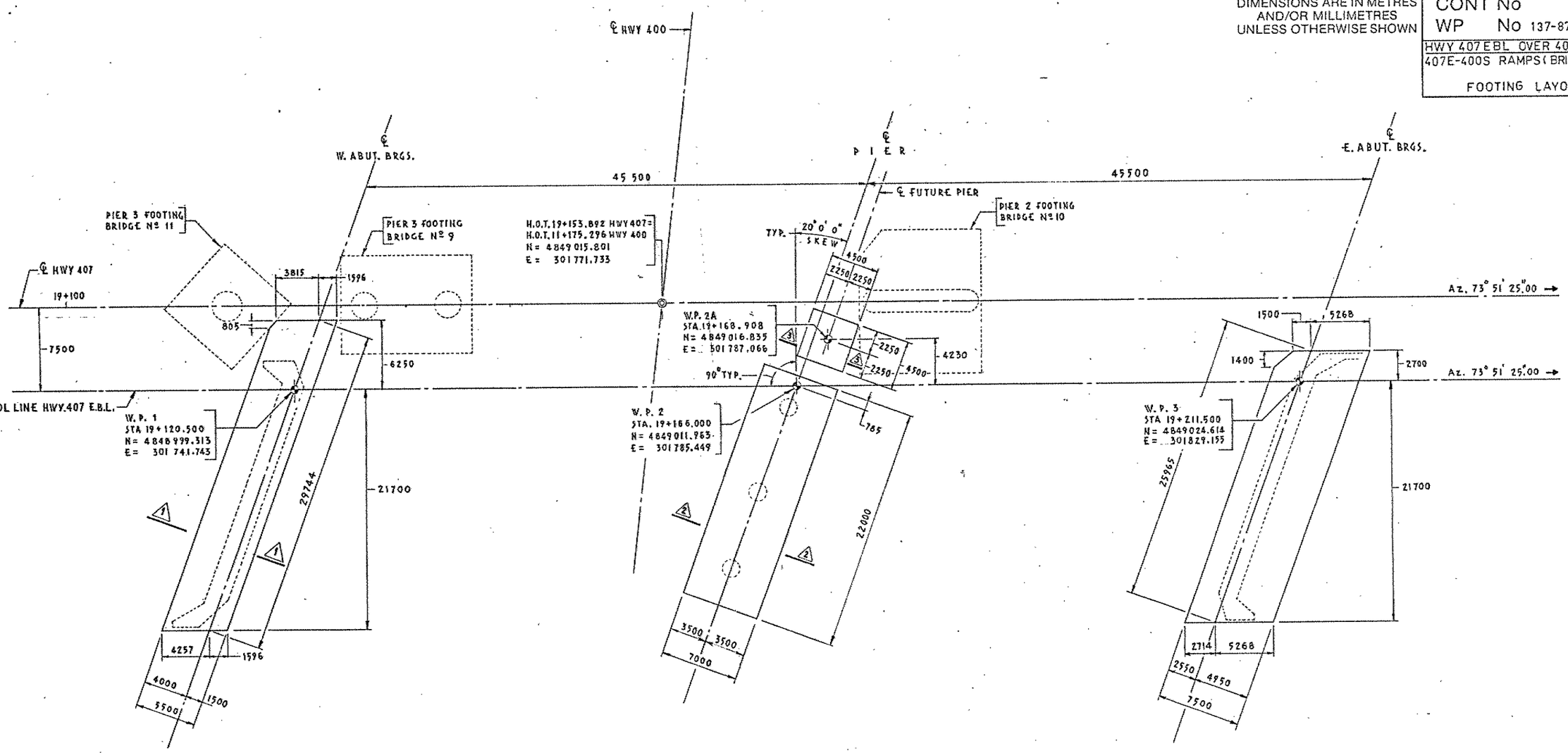
CONT No

WP No 137-87-02

HWY 407 E.B.L. OVER 407W-400N & 407E-400S RAMPS (BRIDGE N° 8)

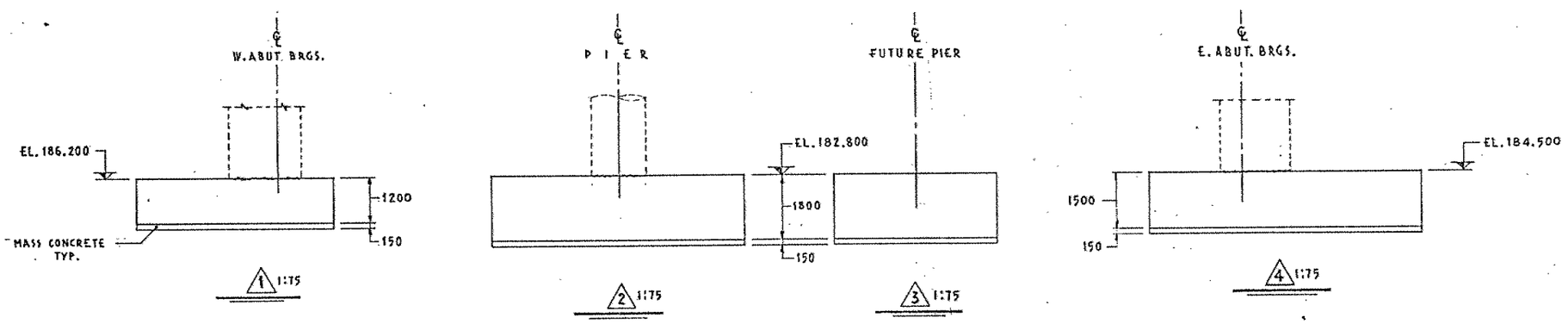
FOOTING LAYOUT

SHEET



P L A N

SCALE 1:200



LICENCED PROFESSIONAL ENGINEER
D. BAGNARIOL
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DATE	BY	DESCRIPTION

DESIG' D.B.	CHK	CODE OHBDC-83	LOAD CLASS A	DATE	MAY 89
DRAWN G.C.	CHK D.B.	SITE 37-1172	STRUCT	SCHEME	DWG 5

FILE COPY

Ministry of
Transportation and
Communications

Ontario

FOUNDATION DESIGN SECTION

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 137-87-02 DIST 6

HWY 400/407 IC STR SITE 37-1172

BRIDGE #8 CONT. 90-18

Hwy. 407 E.B.L.

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GEOCRES 30M13-70

DATE MAR 10 1988

FOUNDATION INVESTIGATION REPORT
FOR
Bridge #8
Hwy. 407 E.B.L.
W.P. 137-87-02, Site 37-1172
Hwy. 400/407 IC, Dist. 6, Toronto

INTRODUCTION

This report summarizes the foundation investigation for the proposed new bridge for Hwy. 407 E.B.L. The report is applicable to the proposed structure, the retaining walls and the approaches within 100 m of the abutments.

SITE DESCRIPTION

The site is located at the proposed Hwy. 400/407 interchange, approximately 0.9 km south of Hwy. 7.

This area is basically a glacial till plain with low local relief except for the existing Hwy. 400 embankment and ditches. The natural ground elevation is at elev. 192.5± m while the Hwy. 400 embankment is at elev. 194.5± m. The till deposits are interbedded with some continuous lacustrine layers and frequent random discontinuous silt to sand pockets. Bedrock was not encountered during the investigation but is reported to be composed of shale with limestone laminations and located below elev. 120± m.

To the east of Hwy. 400, land use is agricultural; to the west, there is a drive-in theatre and the Toronto Star property.

INVESTIGATION PROCEDURES

A foundation investigation for this site was conducted between 87 10 19 and 87 11 27. Continuous-flight auger machines equipped with 82 mm I.D. hollow-stem augers and solid-stem augers, and N and B casing were used.

The investigation for the entire interchange consisted of:

- 54 boreholes

and

- 28 piezometer installations

The portion of the investigation directly related to the Bridge #8 site consisted of:

- 7 sampled boreholes accompanied by dynamic cone penetration tests, and
- 1 sampled borehole

These site specific boreholes are identified as BH #8-1, #8-2, #8-3, #8-4, #8-5, #8-6, #10-4 and #11-5. They extended for depths ranging from 12.5 m to 41.6 m. All boreholes were terminated in overburden.

Survey details were provided by the Central Region Surveys and Plans Section.

The sampling program consisted of split spoon samples collected at 0.8 m to 3.0 m intervals. They provided Standard Penetration Test (N) values for assessment of the in situ state of compaction of the non-cohesive materials, and for an indication of shear strengths of cohesive materials. These samples also provided material for identification purposes.

The laboratory testing program for representative samples consisted of:

- grain size analyses
- natural moisture content determinations
- Atterberg Limit determinations

SUBSURFACE CONDITIONS

The Record of Borehole Sheets in the Appendix illustrate the subsurface conditions at the borehole locations. The locations and elevations of the boreholes, along with stratigraphical profiles based on the borehole data are shown on Drawing No. 1378702 A & B.

The existing Hwy. 400 embankment is composed of compact sand fill extending from the road surface (elev. 194.5± m) to the surface of the native overburden (elev. 192.5± m). The upper portions of this fill are the granular sub-base for the pavement structure.

The native overburden consists of the following generalized layers, in sequence, from the surface down:

Elevation (m)		Material
From	To	
192.5	190	Clayey Silt (Glacial Till)
190	179	Silt/Clayey Silt with random silt and sand pockets (Glacial Till with Lacustrine Interbeds)
179	157	Silty Clay to Clay with thin silt seams (Lacustrine)
157	undetermined	Sandy Silt to Silty Sand (Lacustrine)

The properties of the glacial till deposits are variable across the site in both the horizontal and vertical dimensions, and the boundaries between the soil strata are transitional.

Sand (Fill)

This non-cohesive material is fill for the existing Hwy. 400 embankment. It has been described as sand, but is a typical granular sub-base material.

At the Bridge #8 site, it was encountered at BH #8-3 and #10-4 where it extended, from the surface, for a thickness of 1.5 m.

Based on the results of Dynamic Cone Penetration Tests for the Bridge #8 site, the material is considered to be in a compact state.

Clayey Silt (Glacial Till)

This cohesive material has been described as clayey silt, some sand, trace gravel.

At the Bridge #8 site the material was encounterd at all boreholes. At BH #8-3 and #10-4 it underlies sand fill. At all other boreholes it is the surface material. Thicknesses of this deposit ranged from 2.1 m to 3.7 m at the borehole locations. At BH #8-3 and #10-4, the upper 0.3 m to 0.5 m of this deposit contained organics.

Based on the results of Standard Penetration Tests (N = 9 to 36), for the Bridge #8 site, the material is in a stiff to hard state.

Typical properties of the material, as determined by laboratory tests of representative samples from the entire interchange site, are summarized as follows:

	Range	Average
Water Content (w)	9.0-15.5%	13.0%
Liquid Limit (w_L)	17.0-23.5%	20.8%
Plastic Limit (w_P)	10.0-12.5%	11.4%

Figure 1 illustrates a typical plasticity envelope for this material, based on representative samples from the entire interchange site.

Figure 2 illustrates a typical grain size distribution for this material, based on representative samples from the entire interchange site.

Silt/Clayey Silt (Glacial Till)

The silt/clayey silt (glacial till) deposit has been described as silt/clayey silt, some sand, trace gravel, with random silt and sand pockets and occasional boulders. The main component of this deposit varies randomly from non-plastic silt (ML), to slightly plastic silt (CL-ML), to clayey silt (CL). Within this deposit there are frequent random discontinuous pockets of silts and sands, typically 1 m thick. A semi-continuous layer of lacustrine silt to sand, varying in thickness from 1.5 m to 2.5 m was encountered at elev. 189± m, at all boreholes except BH #10-4.

At the Bridge #8 site, this material was encountered at all borehole locations where it extended for thicknesses varying from 8.0 m to 12.0 m.

Based on 'N' values which ranged from 11 to over 100 for Bridge #8, the denseness of this deposit can be described as compact to very dense (for the non-cohesive zones) while the consistency is stiff to hard (for the cohesive zones). Generally, the deposit may be considered to be dense to very dense (non-cohesive component) or hard (cohesive component).

Typical properties of the basic cohesive material matrix, as determined by laboratory tests of representative samples from the entire interchange site, are summarized as follows:

	Range	Average
Water Content (w)	6.5-23.0%	12.1%
Liquid Limit (w_L)	13.5-32.5%	19.8%
Plastic Limit (w_P)	9.0-17.5%	12.6%

Figure 3 illustrates a typical plasticity envelope for this material, based on representative samples from the entire interchange site.

Figure 4 illustrates a typical gran size distribution for this material based on representative samples from the entire interchange site.

Silty Clay to Clay (Lacustrine)

The silty clay to clay (lacustrine) deposit has been described as silty clay to clay, with thin silt seams. The thickness of this deposit was explored at the Bridge #8 site, at BH #8-3 where its thickness was 20.9 m. Within this deposit there are occasional sand pockets, generally up to 1.5 m thick. However, at BH #8-2 the sand layers are more extensive and up to 5.3 m in thickness.

Based on 'N' values ranging from 15 to over 100 at the Bridge #8 site, the consistency of this deposit ranges from stiff to hard, but is generally hard. The sand pockets are generally very dense.

Typical properties of the material, as determined by laboratory tests of representative samples from the entire site, are summarized as follows:

	Range	Average
Water Content (w)	12.0-24.0%	17.1%
Liquid Limit (w_L)	26.0-61.5%	35.6%
Plastic Limit (w_P)	11.5-21.0%	16.0%

Figure 5 illustrates a typical plasticity envelope for this material, based on representative samples from the entire interchange site.

Figure 6 illustrates a typical grain size distribution for this material, based on representative samples from the entire interchange site.

Sandy Silt to Silty Sand (Lacustrine)

This non-cohesive material has been described as sandy silt to silty sand.

Based on BH #8-3, the material underlies the silty clay to clay deposit at elevation 157± m. Its thickness was not determined. The material is in a very dense state with N values in excess of 100.

Groundwater

The groundwater was measured in open boreholes and also in piezometer installations (at various locations across the site for this project and related projects) that measured groundwater conditions in isolated zones at approximately 3 m, 6 m, 9 m, 12 m, 15 m, and 18 m below the surface. Based on these measurements, the groudwater elevation is generally between elev. 190 m and 192 m. However, the measurements of some of the piezometers over 12 m deep have required a considerable period of time to stabilize (in the order of weeks), indicating that there are zones of

very low permeability within the silt/clayey silt (glacial till) deposit and silty clay to clay (lacustrine) deposit. Although the initial readings in these zones measured groundwater at elevations ranging from 187.5 m to 189.5 m, the depth to groundwater has slowly been decreasing with time and had not completely stabilized by January 6, 1988.

There are pockets of silt and sand within the overburden which are water bearing and exhibit a tendency to flow or boil under conditions of unbalanced hydrostatic head.

DISCUSSION

The recommendations in this report apply to the structure, the retaining walls, and the approaches within 100 m of the abutments.

Bridge #8 is for Hwy. 8 E.B.L. A 2-span structure with related retaining walls is proposed. This structure will be at Level 2 of this 4 level interchange. The proposed deck elevation is 192.5 ± m, which is approximately the same as the existing natural ground surface. Cuts for Level 1 of this interchange will be to elevation 183 ± m.

STRUCTURE FOUNDATIONS

The survey locations of Bridge #8 footings are referenced to Bridge #8 PCL chainage.

There are some uncertainties in the footing locations in the present proposal. Consequently, the recommendations for structure foundations are subject to revision when the proposal has been finalized and fully detailed.

In addition, there is a possibility of footing interference with other interchange footings. The effect of footing interference cannot be fully assessed until footing locations are finalized, but deep foundations may be required for footings that are affected.

The following interchange footings may interfere with Bridge #8 footings.

Bridge #8 Footing	Location	Possible Interference Footings
West Abutment	Sta. 19 + 115± and elev. 187± m	- Bridge #9 North Centre Pier at Sta. 21 + 174+ (Bridge #9 PCL chainage)* and elev. 185± m. - Bridge #11 West Centre Pier at Sta. 1 + 751± (Bridge #11 PCL chainage)* and elev. 191± m.
Centre Pier	Sta. 19 + 160± and elev. 184± m	- Bridge #10 Centre Pier at Sta. 21 + 176± (Bridge #10 PCL chainage) and elev. 184 ± m. - Bridge #11 South Centre Pier at Sta. 1 + 701± (Bridge #11 PCL chainage) and elev. 184± m

*There is an inconsistency in station designations between the plan and profile. Bridge #9 PCL chainage may be either 21 + or 31 +.

The abutments and related retaining structures, and the pier may be founded on spread footings on native overburden.

The following chart indicates recommended footing elevations and O.H.B.D.C. bearing capacities for spread footings at each footing element. If the assumed highest possible footing elevation is incorrect, these recommendations will require revision. Also, these recommendations apply only to footings in which the underside of the footing is a minimum of 3 m from a slope. Otherwise, a reduction in bearing capacity may be necessary.

Footing Element	Location	Assumed Highest Footing Elev.	Recommended Footing Elev.	Factored Bearing Capacity at U.L.S.	Bearing Capacity at S.L.S Type II
West Abutment and Retaining Structures	Sta. 19 + 115±	187± m	187 m	1000 kPa	*
Centre Pier	Sta. 19 + 160±	184± m	184 m	1000 kPa	*
East Abutment and Retaining Structures	Sta. 19 + 211±	188± m	188 m or 187 m	450 kPa 750 kPa	300 kPa 500 kPa

*The foundation is considered to be unyielding, and S.L.S. Type II will not govern design.

Consideration should also be given to the application of earth reinforcement principles for the retaining structures. Both 'Reinforced Earth', which uses metal strips within the embankment to provide lateral resistance to prefabricated concrete panels, and 'Geo-crete Products Ltd.' which applies the same concept but substitutes geo-grids for metal strips, may provide more economical alternatives than conventional cantilever walls, for retaining structures in a fill situation. Anchored walls should be considered as an alternative for retaining structures in a cut situation. The alternatives should be evaluated and the least expensive option should be adopted.

If more details are required regarding these alternatives, this office can provide details.

Earth Pressure

Backfill to structures should consist of granular material in accordance with Ministry of Transportation Standard Special Provision #121 (83 10).

Computation of earth pressures should be in accordance with Section 6-6.1.2.1 of the O.H.B.D.C. The active condition will govern earth pressure design for the yielding condition while the at-rest condition will govern earth pressure design for the unyielding condition. The following properties for backfill are recommended for design:

Material	ϕ	γ	K_A	K_O
Granular 'A'	35°	22.8 kN/m^3	0.27	0.43
Granular 'B'	30°	21.2 kN/m^3	0.33	0.50

Lateral Resistance

Sliding resistance between concrete and foundation soil should be calculated in accordance with Section 6-7.3.3.2 of the O.H.B.D.C. assuming an unfactored ϕ value of 30° for noncohesive foundation soils or an unfactored adhesion value of 75 kPa for cohesive foundation soils. In view of the variable nature of the foundation soils, both the noncohesive and cohesive conditions should be considered for calculation of sliding resistance, and the worst case should be adopted in the design.

Sliding resistance of footings can be supplemented by keying into the soil, in which case the passive resistance below the frost penetration depth can be considered in the design. In this case, keys should be formed against undisturbed native overburden. Alternatively, soil anchors could be considered to resist lateral loads. If this option is considered, pre-contract soil anchor testing would be required to determine design anchor bond stresses.

The resistance to lateral load for piles should be calculated in accordance with Section 6-8.3.8 of the O.H.B.D.C. The horizontal component of battered piles may be used to resist lateral loads.

Frost Protection

A minimum earth cover of 1.2 m, or equivalent, to the base of footings or pile caps is required for frost protection.

Slope Stability

For fills above the prevailing groundwater elevation, temporary slopes will be stable at 1.5H:1V, and permanent slopes will be stable at 2H:1V, for embankments up to 9 m high.

The proposal for this interchange requires cuts in the order of 9 m deep. This cut will expose numerous random pockets and some distinct zones of fine-grained granular soils that are susceptible to disturbance when the water table is lowered. Therefore slope protection and drainage measures will be required to ensure their long-term surficial stability. These measures are required to lower the groundwater table below the frost penetration depth to prevent the softening of material due to freeze-thaw cycles, and to dissipate excess pore water pressures that could contribute to surficial slope failures.

Four cut geomety-surface treatment-drainage conditions variations, for a 9 m deep cut, have been analysed utilizing Bishop's effective stress method.

(1) An analysis assuming a 2H:1V slope (Figure 7), resulted in a factor of safety of less than unity.

(2) An analysis assuming a 2H:1V slope treated with a 1.2 m thick granular blanket (Figure 8), resulted in a marginal but unacceptable factor of safety.

(3) An analysis assuming a 2.5H:1V slope treated with a 0.6 m thick granular blanket and a 1.2 m deep toe drain (Figure 9), resulted in an acceptable factor of safety.

(4) An analysis assuming a 2H:1V slope with a 1.2 m wide bench located at a depth of 4.5 m from the top of the cut, a 1.2 m deep bench drain and a 1.2 m deep toe drain, and 0.6 m thick granular blankets on both the upper and lower slopes (Figure 10), resulted in an acceptable factor of safety.

Based on these analyses, cut slopes deeper than 4.5 m, should be constructed in accordance with the treatments described in either #3 or #4. These alternatives are illustrated in Figure 11. For cuts less than 4.5 m deep, the slope treatment should consist of a 2H:1V slope treated with a 0.6 m thick granular blanket and a 1.2 m deep toe drain. This recommended cut slope treatment is illustrated in Figure 12. The granular blanket should consist of free-draining material such as Ministry of Transportation Granular 'A'. Alternatively, Granular 'B' with appropriate gradation limits would be suitable. If Granular 'B' is proposed, typical gradations of the material should be submitted to this office for assessment. The drain trenches should be lined with a suitable geotextile filter fabric, such as Class 1 non-woven geotextile with EOS of 75 to 150 um. The perforated pipes should be 150 mm minimum diameter and should be surrounded by a minimum of 150 mm of granular backfill. The drains should be connected to an appropriate permanent drainage system. In addition all slopes should be provided with an interceptor ditch at the top of the slope.

Normal slope vegetation should be established as soon as possible after completion of the cut in order to control surficial erosion.

Settlement

Total and differential settlements will be negligible for structure foundations and embankments constructed in accordance with the recommendations provided.

Dewatering

As the groundwater elevation is at 190 m to 191 m, both a temporary (during construction) dewatering scheme and a permanent drainage system will be required.

The temporary dewatering scheme should lower the prevailing groundwater table a minimum of 1 m below excavations and should be designed to prevent disturbance of the foundation soil or cut slopes. The dewatering scheme should also take into consideration the presence of silt and sand pockets within the overburden. These materials are susceptible to disturbance under conditions of unbalanced hydrostatic head.

Although the dewatering of some shallow excavations may be possible by an oversized perimeter ditch/sump pumping system, the deep cut will probably require a larger scale scheme, such as excavating a pilot trench, to facilitate dewatering while the required cut geometry is constructed. A typical design would involve construction of a pilot trench prior to the excavation of the proposed cut geometry. The pilot trench would be excavated below the prevailing cut excavation level and would be located, in plan, at the central portion of the proposed cut.

The slope drainage system should be connected to an appropriate permanent drainage system.

Consideration should be given to establishing the existing groundwater conditions in the area surrounding the site, and the effects of both temporary dewatering and permanent drainage, particularly in those areas where there is a potential for claims.

Construction Considerations

The bearing surfaces of spread footing excavations should be protected by a 15 cm pad of mass concrete within 4 hours of exposure.

MISCELLANEOUS

The field work for this project was carried out under the supervision of D. Dundas, Senior Foundations Engineer, T. Sangiuliano, Foundations Engineer, K. Zasitko, Foundation Field Technician, and M. Schnarr, Engineering Student.

The equipment used was owned and operated by Dominion Soil Investigiation Inc., Malone's Soil Samples and Master Soil Investigation Ltd.

The report was written by D. Dundas, and reviewed by M. Devata, Chief Foundations Engineer (East).

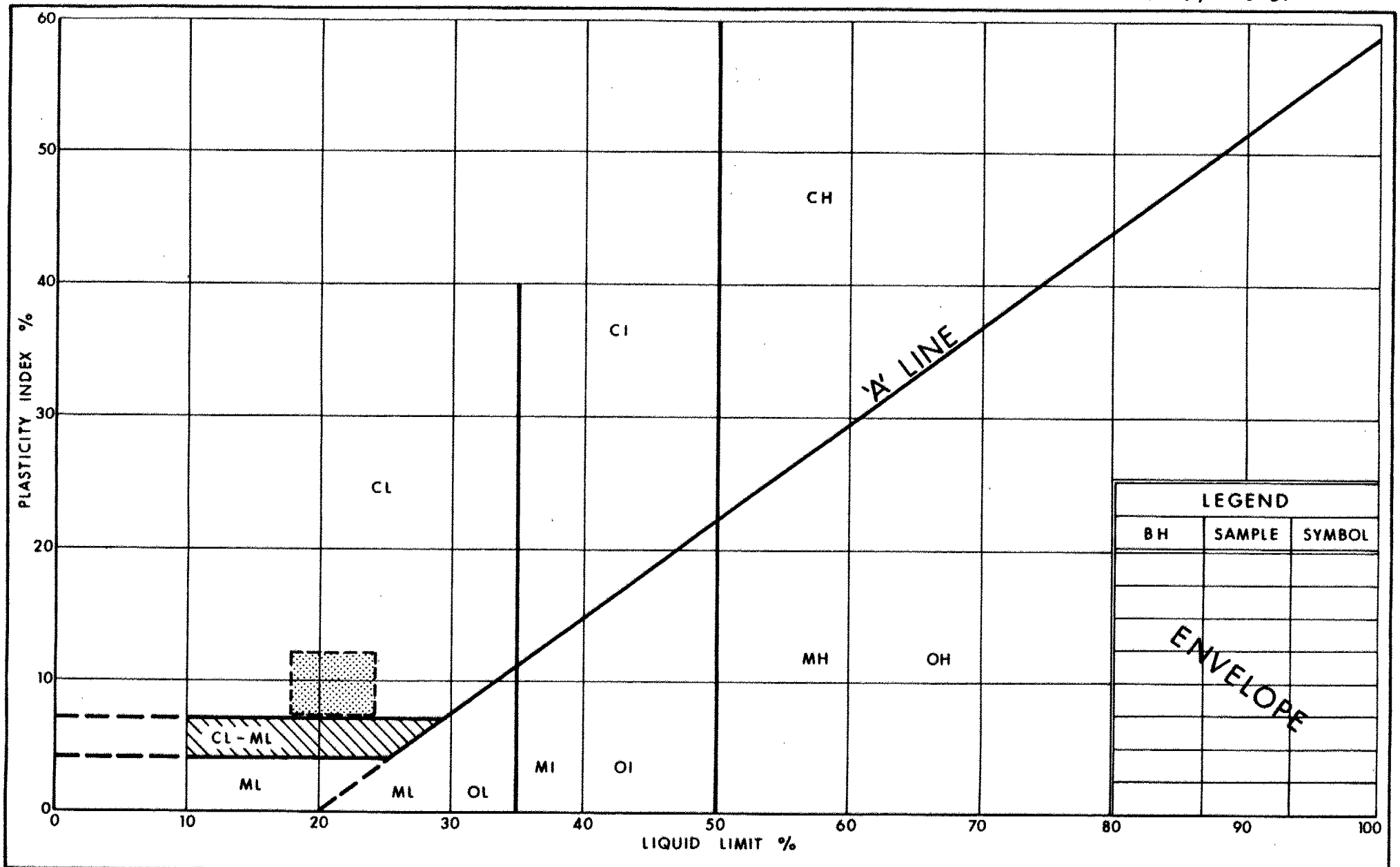
D. H. Dundas

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

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

APPENDIX

Oct 75, FF-S-21



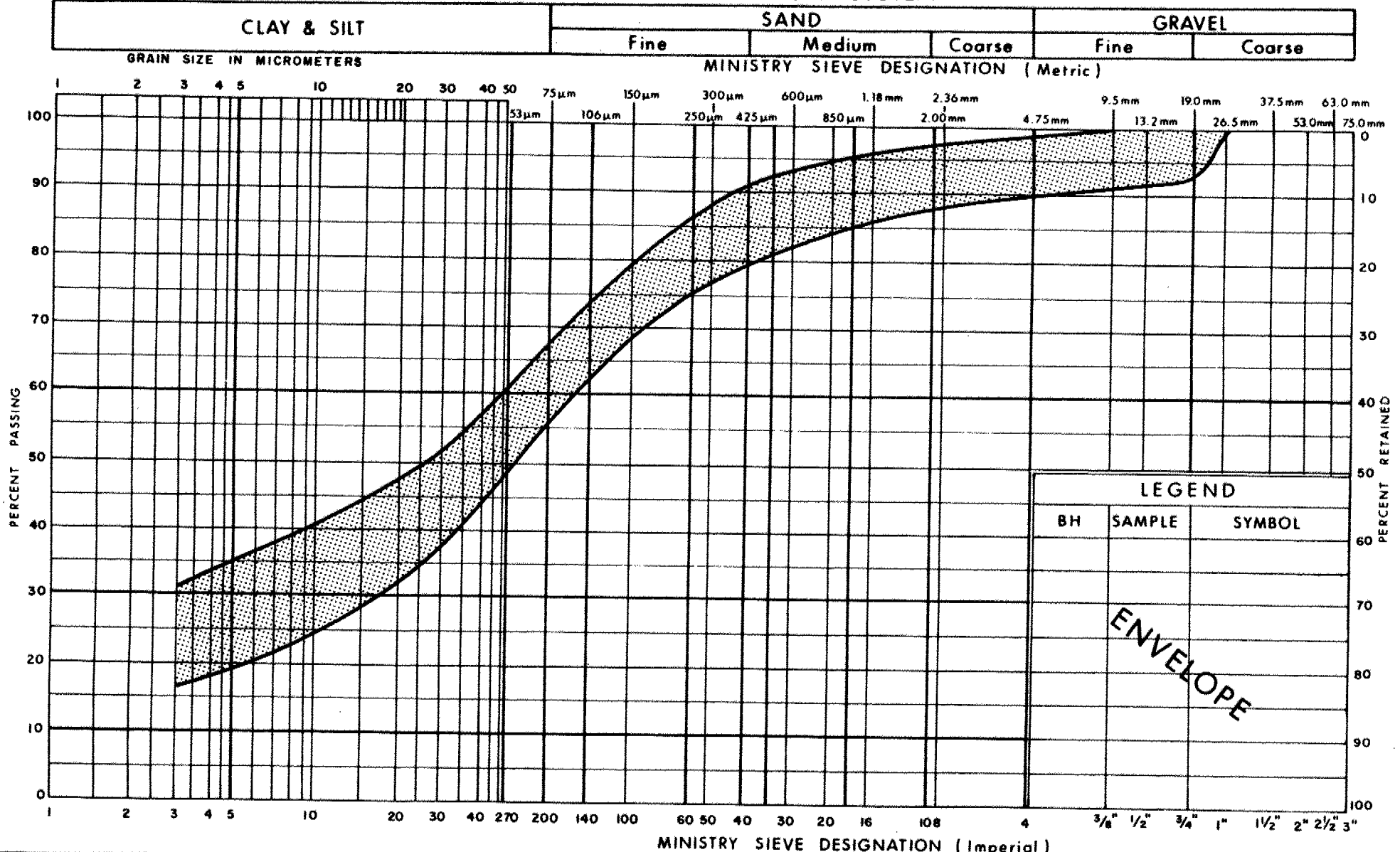
Ministry of Transportation
Ontario

PLASTICITY CHART
CLAYEY SILT (Glacial Till)

FIG No 1
WP 137-87-02

78 12 M

UNIFIED SOIL CLASSIFICATION SYSTEM



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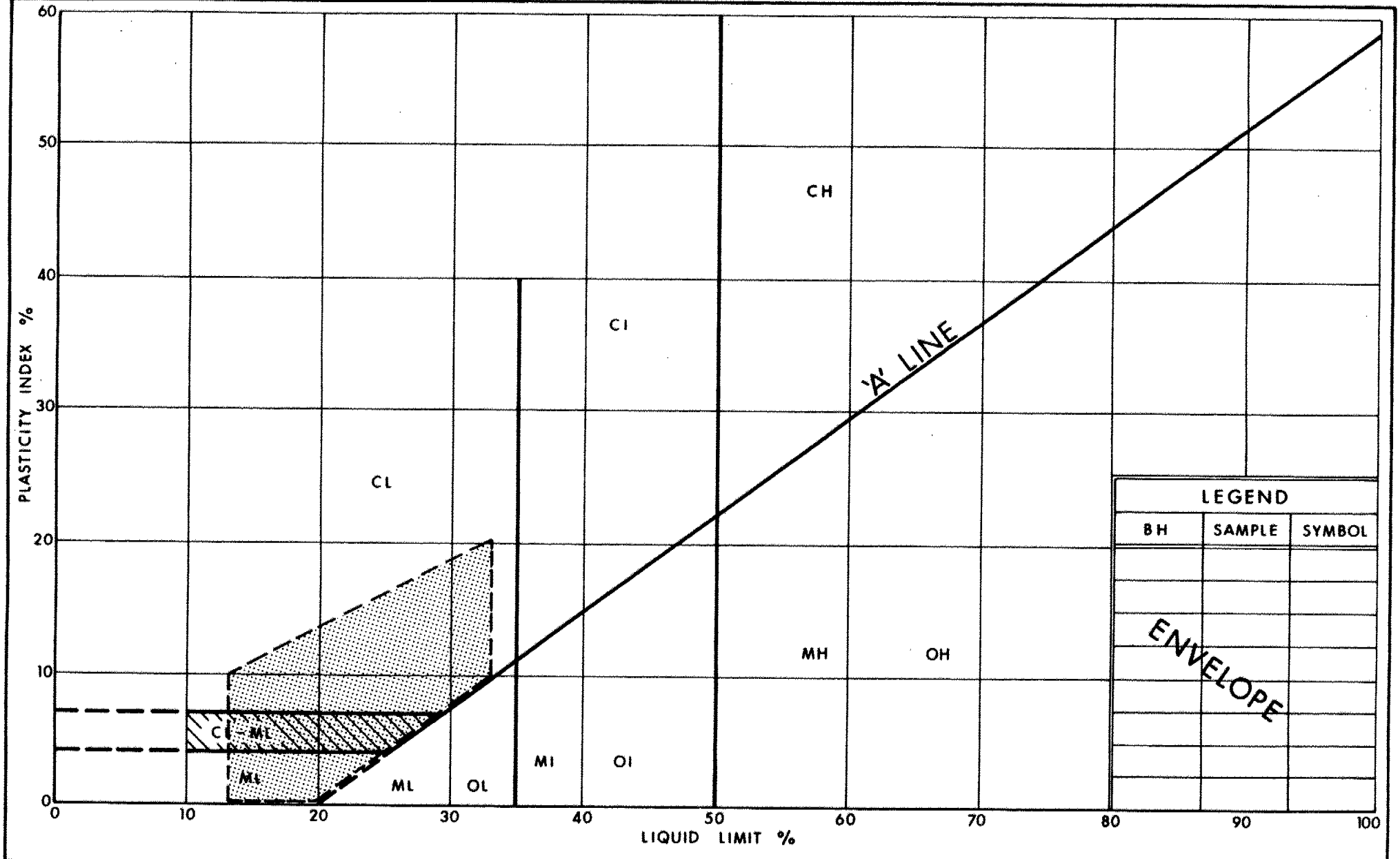
GRAIN SIZE DISTRIBUTION
CLAYEY SILT (Glacial Till)

FIG No 2
W P 137-87-02



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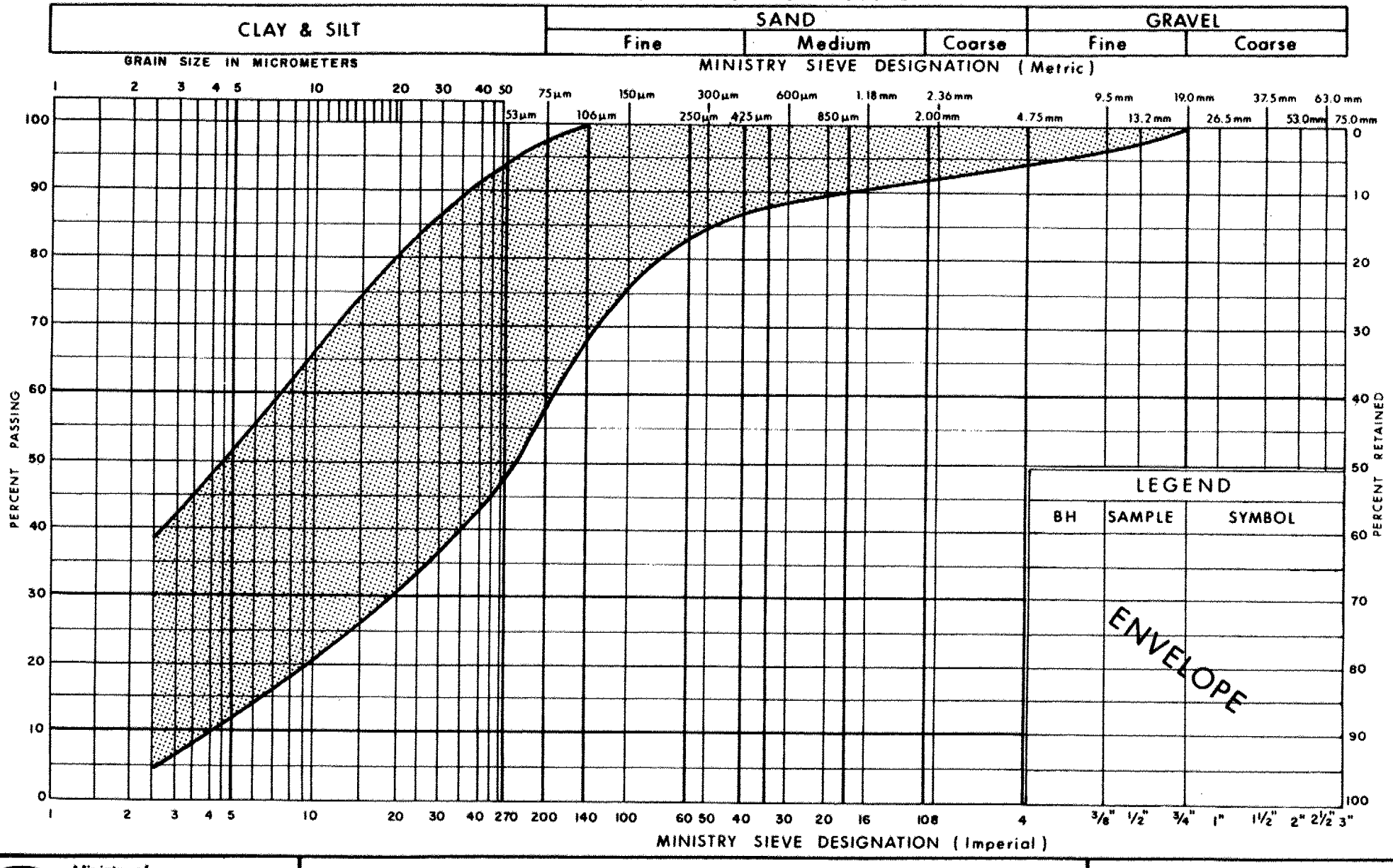
Ontario

PLASTICITY CHART
SILT / CLAYEY SILT (Glacial Till)

FIG No 3
WP 137-87-02

UNIFIED SOIL CLASSIFICATION SYSTEM



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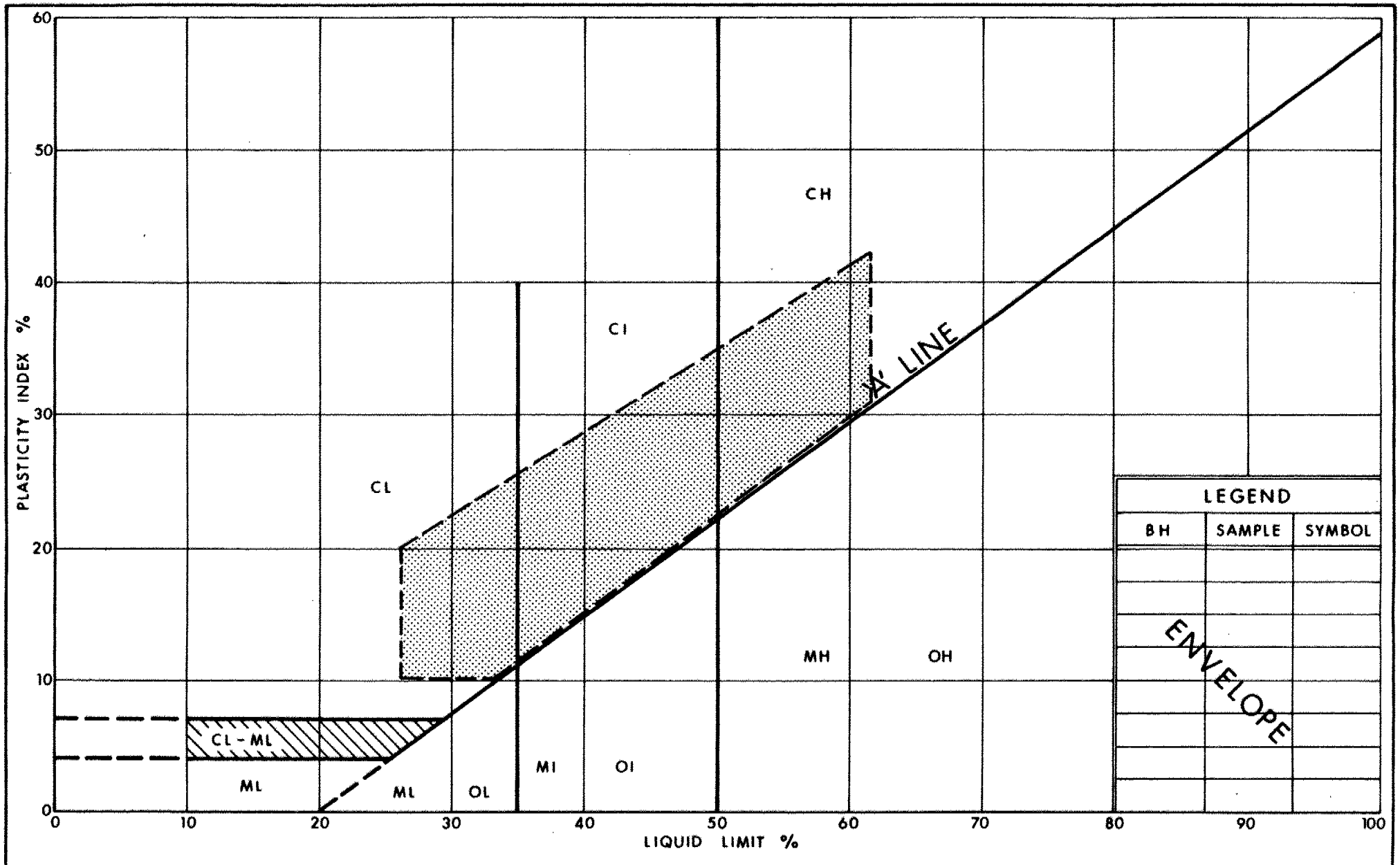
GRAIN SIZE DISTRIBUTION

SILT/ CLAYEY SILT (Glacial Till)

FIG No 4

W P 137-87-02



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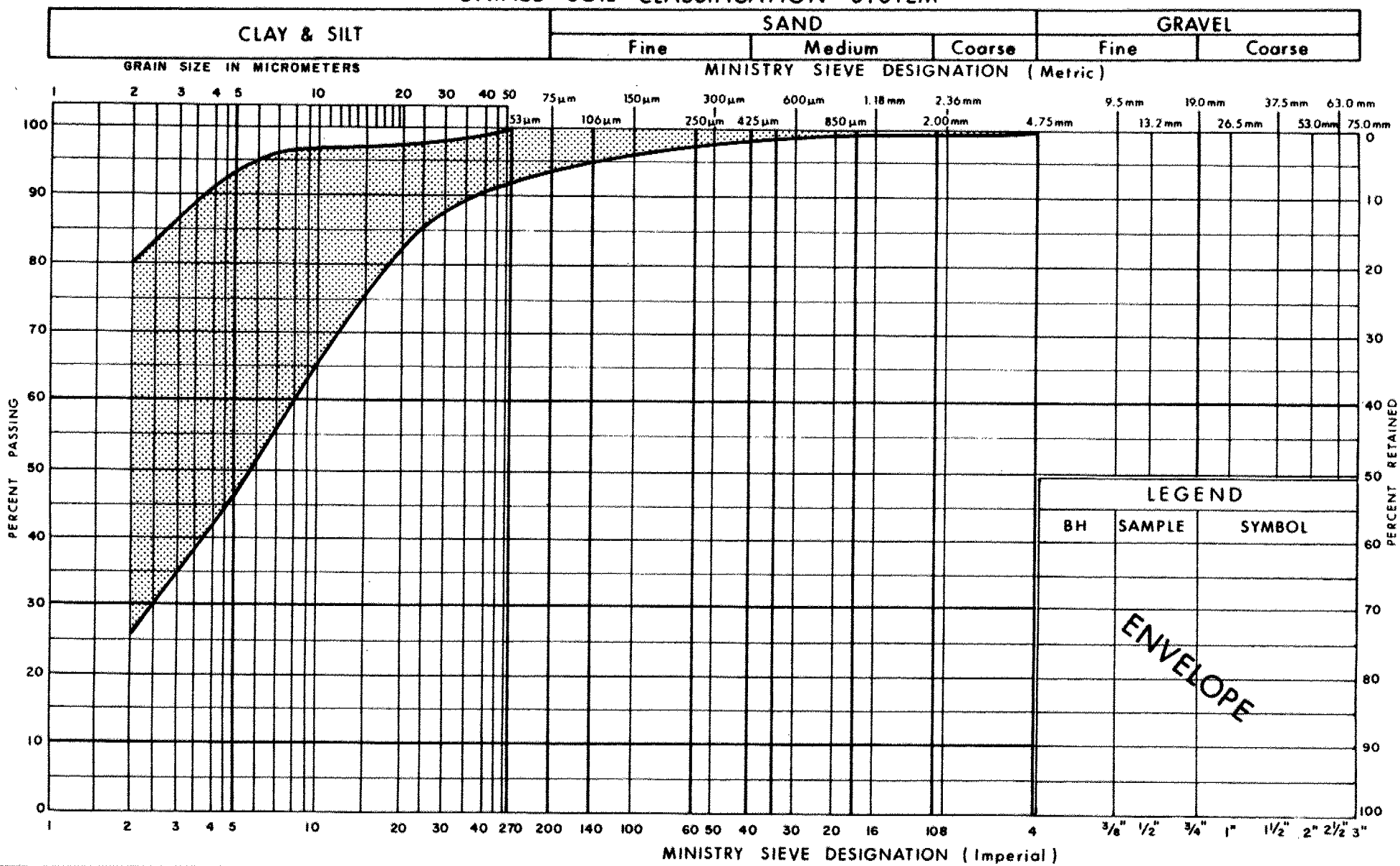
PLASTICITY CHART
SILTY CLAY TO CLAY (LACUSTRINE)

FIG No 5
W P 137-87-02

UNIFIED SOIL CLASSIFICATION SYSTEM



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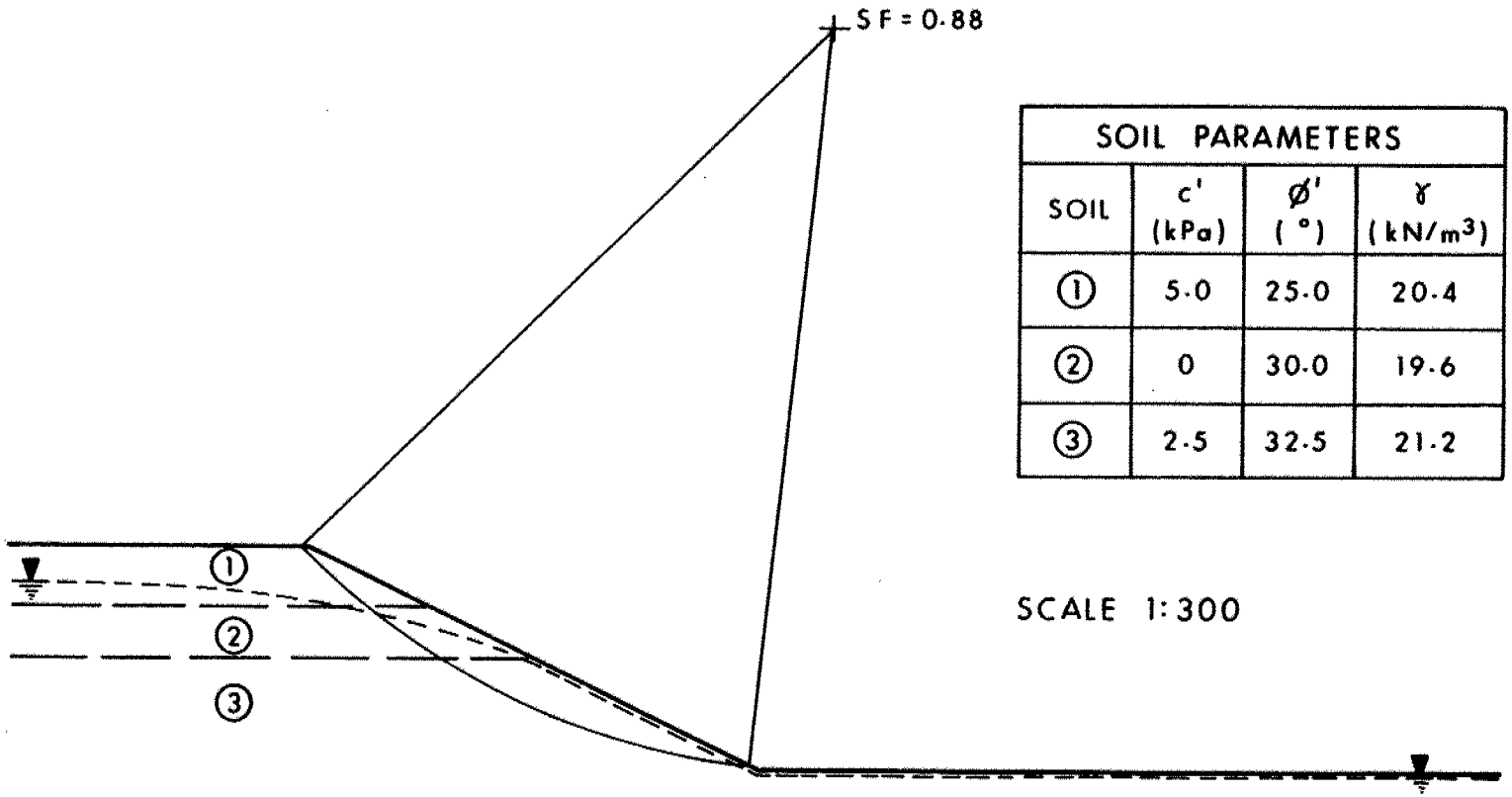
GRAIN SIZE DISTRIBUTION

SILTY CLAY TO CLAY (LACUSTRINE)

FIG No 6

W P 137-87-02



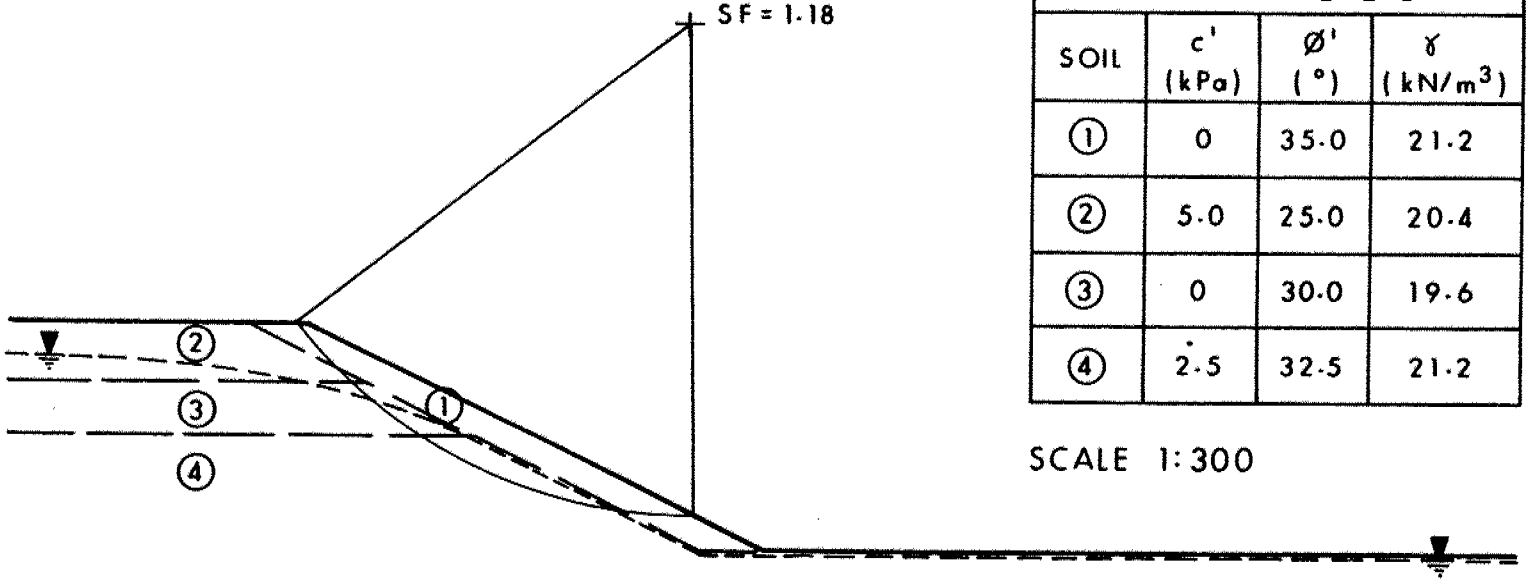
SOIL PARAMETERS			
SOIL	c' (kPa)	Ø' (°)	γ (kN/m³)
①	5.0	25.0	20.4
②	0	30.0	19.6
③	2.5	32.5	21.2

SCALE 1:300

EFFECTIVE STRESS ANALYSIS (2H : 1V SLOPE)

Fig 7

WP 137-87-02



SOIL PARAMETERS			
SOIL	c' (kPa)	Ø' (°)	γ (kN/m³)
①	0	35.0	21.2
②	5.0	25.0	20.4
③	0	30.0	19.6
④	2.5	32.5	21.2

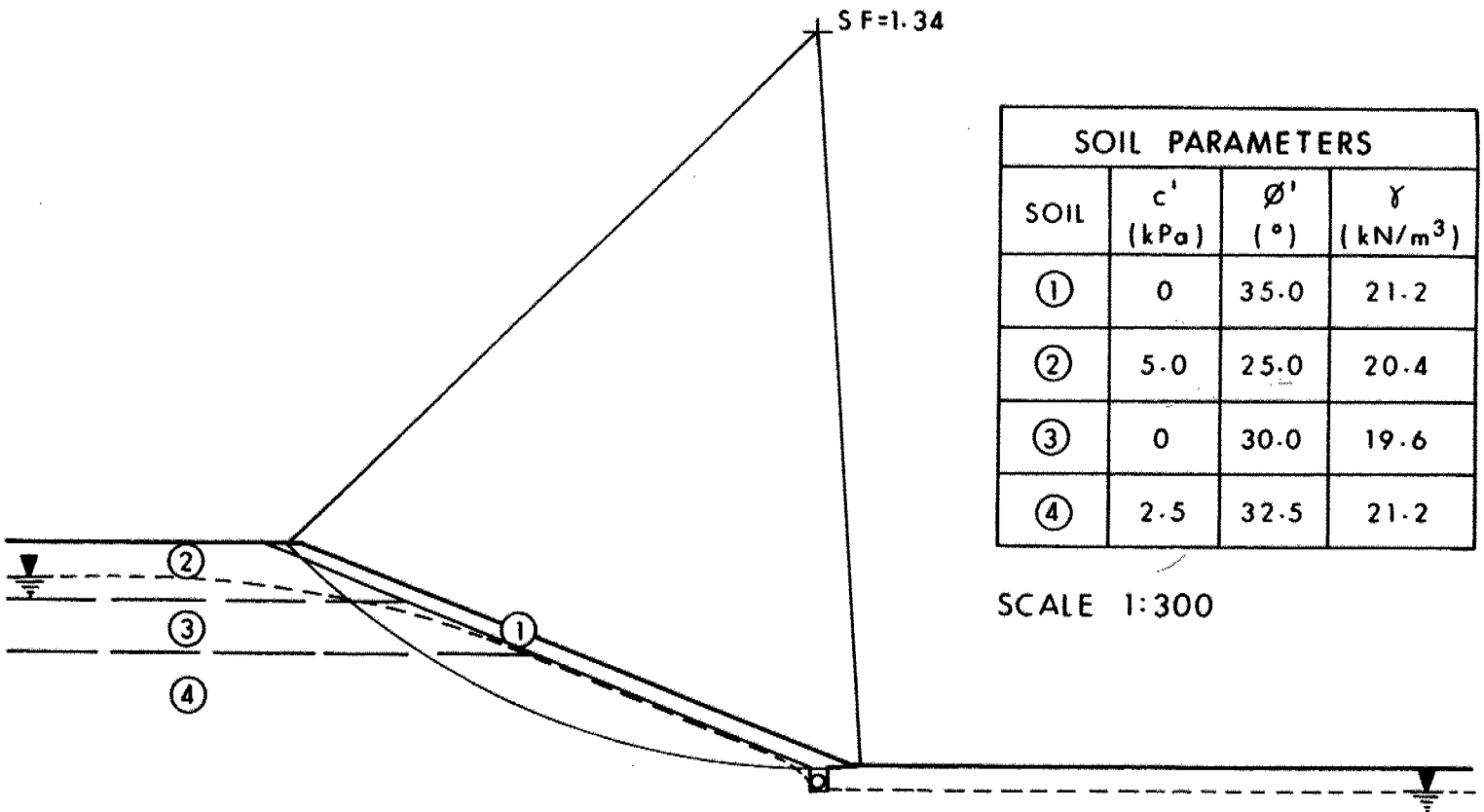
SCALE 1:300

EFFECTIVE STRESS ANALYSIS (2H:1V SLOPE)

WITH 1.2m THICK GRANULAR BLANKET

Fig 8

WP 137-87-02



SOIL PARAMETERS			
SOIL	c' (kPa)	ø' (°)	γ (kN/m³)
①	0	35.0	21.2
②	5.0	25.0	20.4
③	0	30.0	19.6
④	2.5	32.5	21.2

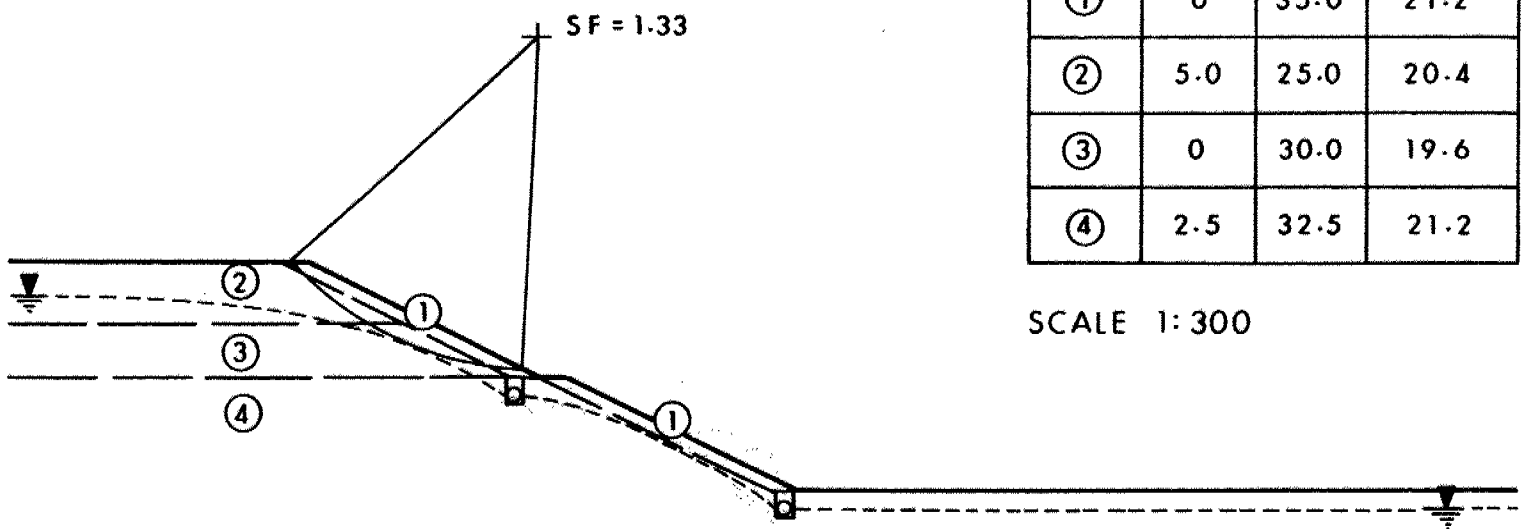
SCALE 1:300

EFFECTIVE STRESS ANALYSIS (2.5H:1V SLOPE)

WITH 0.6m THICK GRANULAR BLANKET AND TOE DRAIN

Fig 9

WP 137-87-02



SOIL PARAMETERS			
SOIL	c' (kPa)	Ø' (°)	γ (kN/m³)
①	0	35.0	21.2
②	5.0	25.0	20.4
③	0	30.0	19.6
④	2.5	32.5	21.2

SCALE 1:300

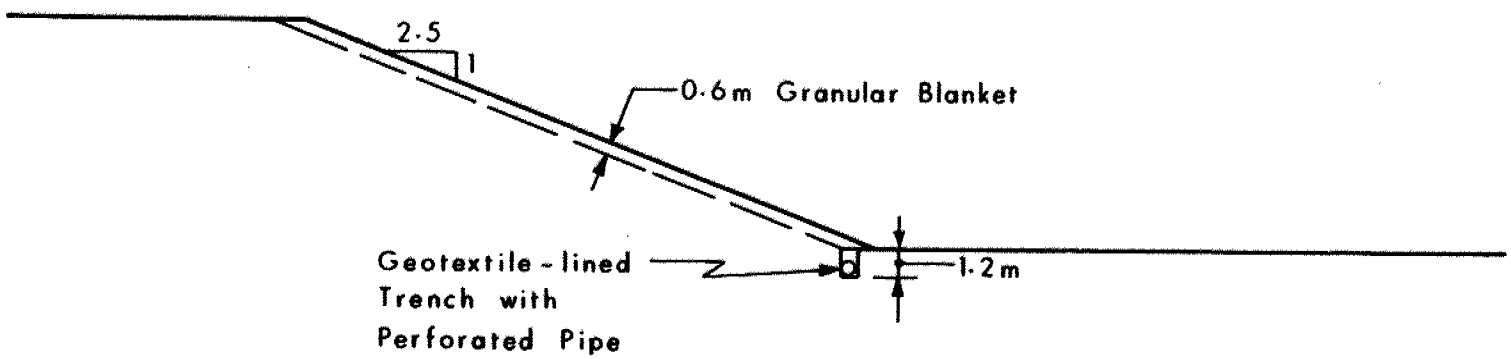
EFFECTIVE STRESS ANALYSIS (2H : 1V SLOPE)

WITH 0.6m THICK GRANULAR BLANKET AND BENCH AND TOE DRAINS

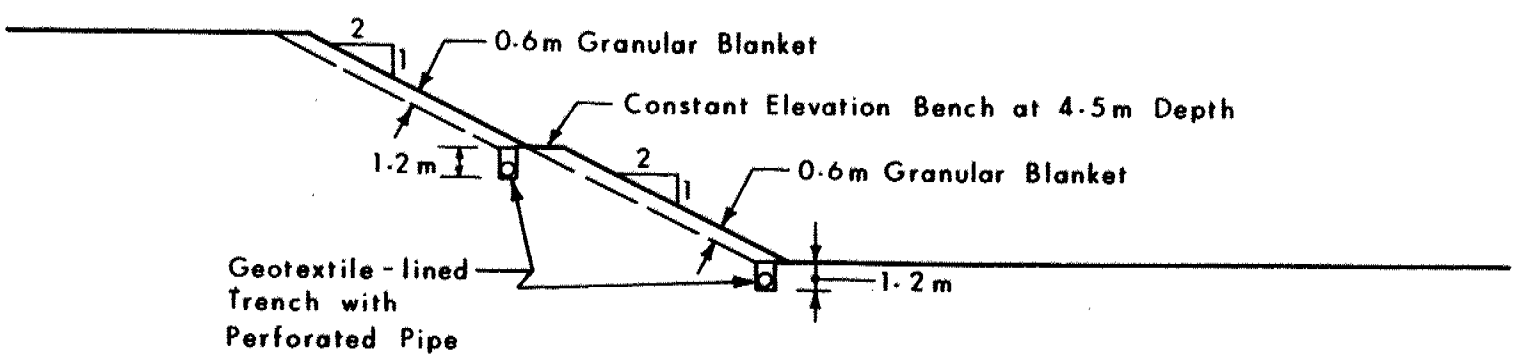
Fig 10

WP 137-87-02

Alternative No 1



Alternative No 2

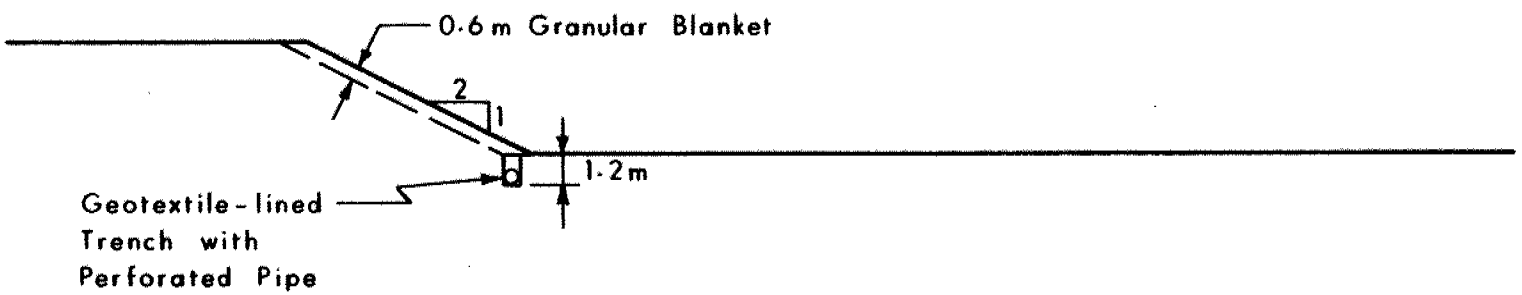


SCALE 1:300

RECOMMENDED CUT SLOPE TREATMENT FOR CUTS OVER 4.5m DEEP

Fig 11

WP 137-87-02



SCALE 1:300

RECOMMENDED CUT SLOPE TREATMENT FOR CUTS UNDER 4·5 m DEEP

Fig 12

WP 137-87-02

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

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

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

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-1 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 848 985.0; E 301 724.0 ORIGINATED BY TS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY TS
DATUM Geodetic DATE 87 11 18 CHECKED BY MS

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.8	Ground Surface										
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff to Hard (Glacial Till)		1	SS	36	▼	192				1 14 36 49
			2	SS	28						
189.8			3	SS	26		190				
3.0			4	SS	12						
			5	SS	12						
	Silt Compact (Lacustrine)		6	SS	23		188				0 5 80 15
			7	SS	11						0 0 86 14
			8	SS	78						0 14 72 14
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense		9	SS	110		186				
			10	SS	90		184				
	Stiff to Hard (Glacial Till)		11	SS	100/23 cm		182				
180.3			12	SS	90/23 cm						
12.5	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-2 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 848 976.0; E 301 737.0 ORIGINATED BY TS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY TS
DATUM Geodetic DATE 87 11 20 CHECKED BY MS

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.2	Ground Surface						192				
0.0	Clayey Silt Some Sand Trace Gravel Stiff to Hard		1	SS	33						
190.1	(Glacial Till)						190				
2.1	Silt Very Dense (Lacustrine)		2	SS	55						
			3	SS	86		188				0 6 83 11
	Silt/Clayey Silt Some Sand Trace Gravel		4	SS	110		186				1 24 60 15
	Random Silt and Sand Pockets		5	SS	102/27 cm						
	Occ. Boulders		6	SS	95/25 cm		184				
	Very Dense/Hard (Glacial Till)		7	SS	100/25 cm						1 4 (95)
181.5			8	SS	100/25 cm		182				
10.7			9	SS	80						
			10	SS	10						0 67 32 1
	Sand to Sandy Gravel		11	SS	40		180				
	Compact to Very Dense		12	SS	9						0 81 18 1
	(Lacustrine)		13	SS	86						
			14	SS	60/12 cm		178				
							176				
	Silty Clay to Clay With Thin Silt Seams Hard		15	SS	103/22 cm						1 27 (72)
173.6	(Lacustrine)		16	SS	110/23 cm		174				
18.6	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-3 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 848 995.7; E 301 793.0 ORIGINATED BY KZ
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY KZ
DATUM Geodetic DATE 1987 11 10 - 13 CHECKED BY MS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
194.6	Ground Surface						
0.0	Sand Compact (Fill)						
193.1							
1.5	With Organics		1	SS	15		
	Clayey Silt Some Sand Trace Gravel Stiff to Very Stiff (Glacial Till)		2	SS	13		
189.4			3	SS	22		5 27 48 20
5.2	Silt to Sandy Silt Very Dense (Lacustrine)		4	SS	86		0 21 70 9
			5	SS	85		0 13 68 19
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Very Dense/Hard (Glacial Till)		6	SS	230/15 cm		
			7	SS	80/15 cm		2 46 (52)
			8	SS	142/20 cm		
			9	SS	101/25 cm		1 5 67 27
			10	SS	63		2 17 59 22
			11	SS	62		
			12	SS	88/20 cm		2 7 57 34
177.4			13	SS	109/28 cm		
17.2			14	SS	38		
			15	SS	88		
			16	SS	84		
	Silty Clay to Clay With Thin Silt Seams Very Stiff to Hard (Lacustrine)		17	SS	55		
			18	SS	46		
			19	SS	50		
			20	SS	34		
164.4							
30.2	Continued						Continued

ELEVATION SCALE: 194, 192, 190, 188, 186, 184, 182, 180, 178, 176, 174, 172, 170, 168, 166

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

PLASTIC LIMIT Wp | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L
WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-3 Continued METRIC

W P 137-87-02 LOCATION Co-ords. N 4 848 995.7; E 301 793.0 ORIGINATED BY KZ
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY KZ
DATUM Geodetic DATE 87 11 10-13 CHECKED BY MS

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
164.4	Continued										
30.2	Silty Clay to Clay With Thin Silt Seams Very Stiff to Hard (Lacustrine)		21	SS	23		164				
							162				
			22	SS	32		160				
156.5							158				
38.1	Sandy Silt to Silty Sand Very Dense (Lacustrine)		23	SS	95/15 cm		156				
							154				
153.0			24	SS	110						
41.6	End of Borehole										

+3, x5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-4 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 849 004.0; E 301 832.0 ORIGINATED BY TS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY TS
DATUM Geodetic DATE 87 10 22 CHECKED BY MS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.6	Ground Surface										
0.0	Clayey Silt Some Sand Trace Gravel Stiff (Glacial Till)		1	SS	9	▼	192				
190.2											
2.4	Silt to Sand Compact to Dense (Lacustrine)		2	SS	49		190				
			3	SS	43						
			4	SS	26		188				
			5	SS	45						
			6	SS	58		186				
			7	SS	102						
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense/ Very Stiff to Hard		8	SS	102						
			9	SS	75		184				
			10	SS	70						
			11	SS	43		182				
			12	SS	38		180				1 20 62 17
179.2											
13.4	Silty Clay to Clay With Thin Silt Seams Stiff to Hard (Lacustrine)		13	SS	15						0 1 70 29
			14	SS	85		178				0 0 41 59
			15	SS	101/25 cm		176				
173.9			16	SS	107/25 cm		174				
18.7	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-5 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 849 030.0; E 301 836.0 ORIGINATED BY DD
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY MS
DATUM Geodetic DATE 87 10 22, 23 CHECKED BY MS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.5	Ground Surface										
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		1	SS	22	▼	192				
190.1											
2.4	Silt to Sand Dense to Very Dense (Lacustrine)		2	SS	42		190				
			3	SS	89						
			4	SS	66		188				
			5	SS	55						
			6	SS	100		186		OH		2 21 61 16
			7	SS	140						
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Dense to Very Dense/ Hard (Glacial Till)		8	SS	100						
			9	SS	100		184		OH		2 22 48 28
			10	SS	100/16 cm				OH		1 31 60 8
			11	SS	100/27 cm		182				
			12	SS	51		180				
178.8											
13.7	Silty Clay to Clay With Thin Silt Seams Very Stiff to Hard (Lacustrine)		13	SS	23		178		OH		0 0 88 12
			14	SS	46				OH		
			15	SS	94/25 cm		176				
173.9											
			16	SS	120		174				
18.6	End of Borehole										

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

$\frac{20}{15}\diamond\frac{}{10}$-5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-6 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 849 021.0; E 301 848.0 ORIGINATED BY MS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY MS
DATUM Geodetic DATE 87 10 22 CHECKED BY MS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.4	Ground Surface						192				
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		1	SS	31	▼					
190.0							190				
2.4	Silt Dense to Very Dense (Lacustrine)		2	SS	41						
			3	SS	100/25 cm		188				
			4	SS	90						0 6 (94)
			5	SS	54						2 16 63 19
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Very Dense/Hard (Glacial Till)		6	SS	100/22 cm		186				2 31 58 9
			7	SS	100/27 cm						
			8	SS	100/22 cm						1 19 (80)
			9	SS	100/17 cm		184				
			10	SS	100/12 cm						
			11	SS	100		182				
180.5											
11.9	Sand Very Dense		12	SS	90		180				
			13	WS	-						
	Silty Clay to Clay With Thin Silt Seams Hard (Lacustrine)		14	SS	100		178				
176.8	*		15	SS	100/22 cm						
15.6	End of Borehole										

* Sand and Gravel Very Dense

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 10-4 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 849 020.0; E 301 788.6 ORIGINATED BY TS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY TS
DATUM Geodetic DATE 87 11 11 - 13 CHECKED BY MS

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
194.6	Ground Surface										
0.0	Sand Compact (Fill)										
193.1											
1.5	With Organics		1	SS	16						
	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		2	SS	23						
190.0											
4.6			3	SS	22						1 24 51 24
			4	SS	60						0 9 83 8
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Very Stiff to Hard/ Compact to Very Dense (Glacial Till)		5	SS	66						1 18 64 17
			6	SS	74						
			7	SS	110/25 cm						
			8	SS	100/28 cm						
			9	SS	88						
180.1			10	SS	58						
14.5			11	SS	47						0 2 (98)
			12	SS	26						0 1 (99)
			13	SS	95						13 40 (47)
	Occ. Clayey Silt Zones		14	SS	60/10 cm						
			15	SS	70/15 cm						
			16	SS	110/23 cm						
			17	SS	95/23 cm						
	Silty Clay to Clay With Thin Silt Zones Very Stiff to Hard (Lacustrine)		18	SS	90						
171.3			19	SS	105						
23.3	End of Borehole										

ELEVATION SCALE: 194, 192, 190, 188, 186, 184, 182, 180, 178, 176, 174, 172

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

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 11-5 METRIC

W P 137-87-02 LOCATION Co-ords. N 4 849 007.0; E 301 735.5 ORIGINATED BY MS
DIST 6 HWY 400/407 BOREHOLE TYPE H-S Auger COMPILED BY MS
DATUM Geodetic DATE 87 11 24 - 26 CHECKED BY MS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.0	Ground Surface							
0.0	Clayey Silt, Some Sand, Trace Gravel, Very Stiff (Glacial Till)		1	SS	24		190	
189.0			2	SS	34			0 22 73 5
3.0	Silt, Dense (Lacustrine)						188	
	Silt/Clayey Silt, Some Sand, Trace Gravel, Random Silt and Sand Pockets, Occ. Boulders, Dense to Very Dense/Hard (Glacial Till)		3	SS	100			0 10 71 19
			4	SS	60/10 cm		186	
			5	SS	90/8 cm			1 27 59 13
			6	SS	90/15 cm		184	
181.0	Boulder		7	SS	120/0 cm		182	
11.0							180	
			8	SS	60	10 cm	178	1 92 5 2
			9	SS	100	20 cm		1 92 6 1
	Sand, Very Dense						176	
			10	SS	100			
	Silty Clay to Clay *						174	
173.4			11	SS	100			
18.6	End of Borehole							

* With Thin Silt Seans Hard (Lacustrine)

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT Wp | NATURAL MOISTURE CONTENT W | LIQUID LIMIT WL
WATER CONTENT (%) 20 40 60

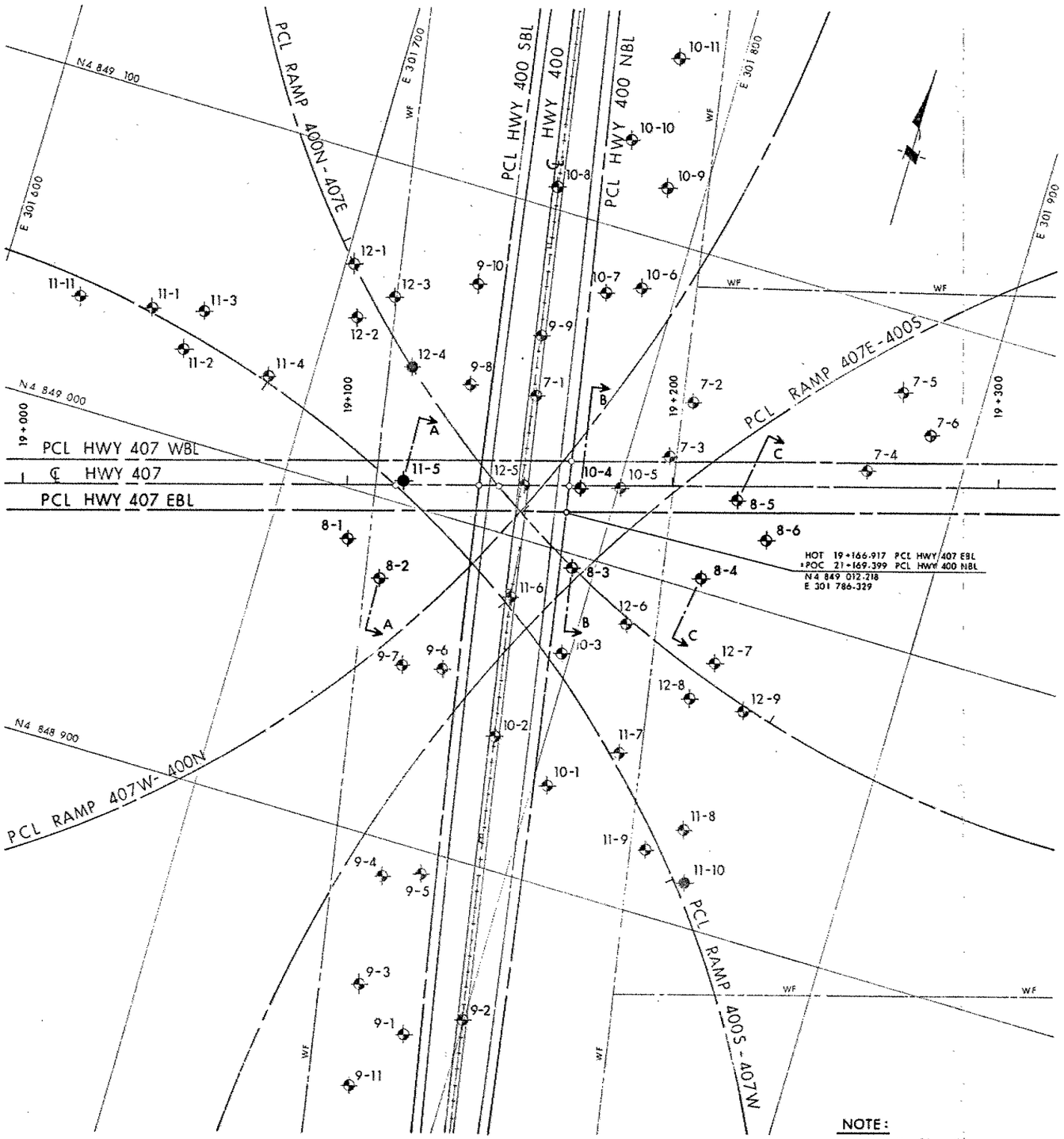
UNIT WEIGHT γ

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

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO PH-D-207 82 04



PLAN
SCALE
20m 10 0 10 20m

NOTE:
For Profile, Sections and Subsoil Stratigraphy refer to Dwg No 1378702-B

METRIC

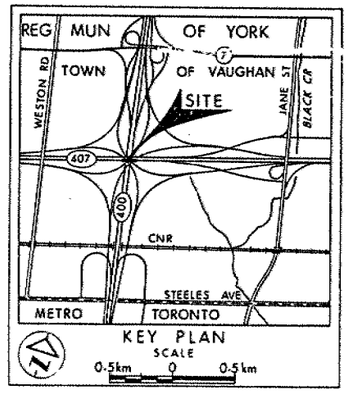
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

No	ELEVATION	CO-ORDINATES NORTH	EAST
7-1	194.6	4 849 043.3	301 767.3
7-2	192.6	4 849 055.0	301 814.5
7-3	192.6	4 849 037.0	301 812.0
7-4	192.3	4 849 050.0	301 871.5
7-5	192.3	4 849 076.0	301 875.5
7-6	192.3	4 849 066.0	301 887.5
8-1	192.8	4 848 985.0	301 724.0
8-2	192.2	4 848 976.0	301 737.0
8-3	194.6	4 848 995.7	301 793.0
8-4	192.6	4 849 004.0	301 832.0
8-5	192.5	4 849 030.0	301 836.0
8-6	192.4	4 849 021.0	301 848.0
9-1	194.3	4 848 844.3	301 782.9
9-2	194.3	4 848 853.7	301 799.0
9-3	191.6	4 848 855.5	301 765.5
9-4	191.8	4 848 889.0	301 763.0
9-5	194.4	4 848 893.0	301 774.5
9-6	194.6	4 848 955.0	301 763.1
9-7	191.9	4 848 952.5	301 751.0
9-8	194.6	4 849 040.7	301 747.0
9-9	194.6	4 849 061.7	301 764.0
9-10	194.6	4 849 071.3	301 740.9
9-11	191.5	4 848 825.0	301 771.0
10-1	194.0	4 848 929.9	301 804.4
10-2	194.5	4 848 939.9	301 784.6
10-3	194.6	4 848 969.8	301 797.3
10-4	194.6	4 849 020.0	301 788.6
10-5	192.6	4 849 023.5	301 800.5
10-6	192.8	4 849 084.0	301 789.5
10-7	194.5	4 849 079.7	301 779.2
10-8	194.4	4 849 106.9	301 755.8
10-9	192.1	4 849 116.0	301 788.0
10-10	194.3	4 849 127.0	301 773.5
10-11	191.8	4 849 155.0	301 780.5
11-1	192.8	4 849 036.0	301 646.0
11-2	191.6	4 849 026.5	301 659.0
11-3	193.4	4 849 039.5	301 662.0
11-4	193.1	4 849 026.0	301 686.5
11-5	192.0	4 849 007.0	301 735.5
11-6	194.6	4 848 982.0	301 777.5
11-7	192.1	4 848 945.5	301 823.0
11-8	192.4	4 848 928.5	301 848.5
11-9	192.2	4 848 919.5	301 839.0
11-10	192.0	4 848 913.0	301 853.0
11-11	192.9	4 849 033.0	301 623.5
12-1	193.3	4 849 066.5	301 702.5
12-2	193.4	4 849 051.0	301 708.0
12-3	193.5	4 849 060.0	301 717.5
12-4	192.2	4 849 041.0	301 728.5
12-5	194.6	4 849 016.0	301 771.8
12-6	192.4	4 848 984.0	301 814.0
12-7	192.4	4 848 980.0	301 843.5
12-8	192.7	4 848 967.5	301 839.0
12-9	192.3	4 848 968.5	301 856.0

CONT No
WP No 137-87-02

HWY 407 EBL
(BRIDGE - 8)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



KEY PLAN
SCALE
0·5km 0 0·5km

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0·3m (Std Pen Test, 475 J/blow)
- CONE Blows/0·3m (60° Cone, 475 J/blow)
- WL at time of investigation

No	ELEVATION			

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION

Geocres No 30M13-70

HWY No 400 & 407			DIST 6
SUBM'D DD	CHECKED	DATE 1988 02 22	SITE 37-1172
DRAWN D T	CHECKED	APPROVED	DWG 1378702-A

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO PH-D-207 82 04

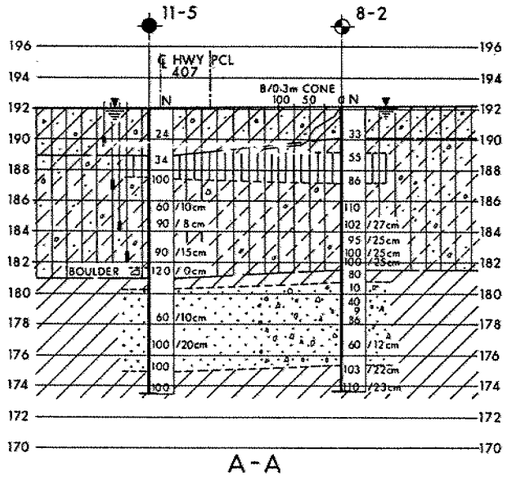
METRIC

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

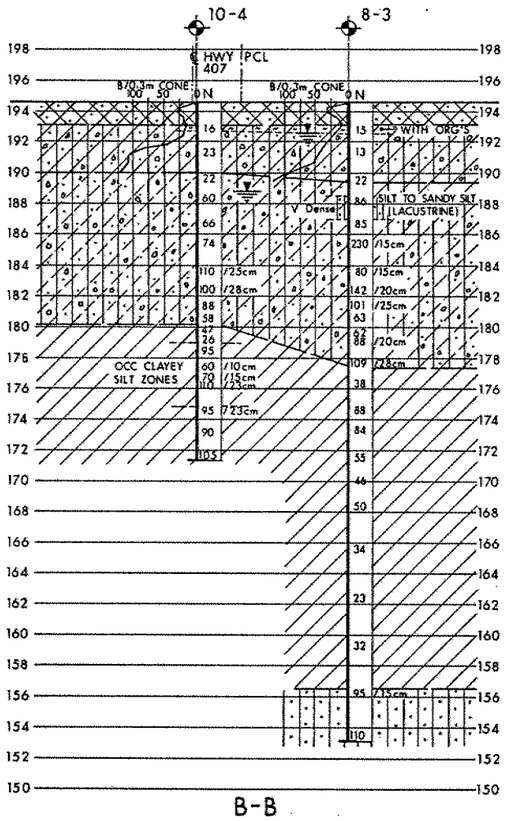
CONT No
WP No 137-87-02

HWY 407 EBL
{ BRIDGE - 8 }
BORE HOLE LOCATIONS & SOIL STRATA

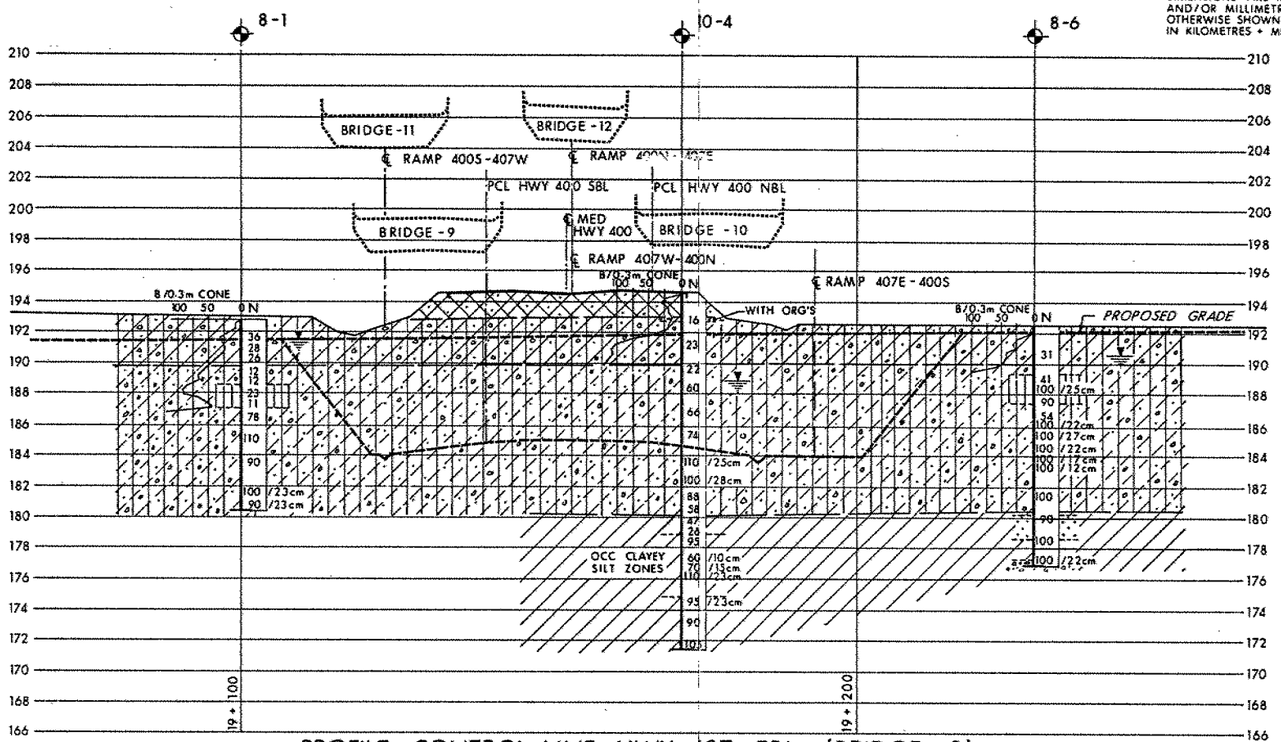
SHEET



A-A

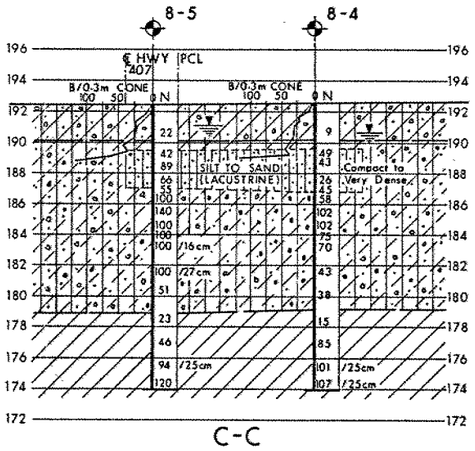


B-B



PROFILE CONTROL LINE HWY 407 EBL (BRIDGE - 8)

SCALE
10m 5 0 10m Hor
4m 2 0 4m Vert



C-C

SECTIONS
SCALE
10m 5 0 10m Hor
4m 2 0 4m Vert

SOIL STRATIGRAPHY LEGEND

- SAND (FILL) Compact
- CLAYEY SILT SOME SAND, TRACE GRAVEL Firm to Very Stiff (GLACIAL TILL)
- SILT / CLAYEY SILT SOME SAND, TRACE GRAVEL RANDOM SILT & SAND POCKETS OCCASIONAL BOULDERS Compact to Very Dense/ Stiff to Hard (GLACIAL TILL)
- SILTY CLAY TO CLAY WITH THIN SILT SEAMS Very Stiff to Hard (LACUSTRINE)
- SANDY SILT TO SILTY SAND Very Dense (LACUSTRINE)
- SILT Compact to Very Dense (LACUSTRINE)
- SAND TO SANDY GRAVEL Compact to Very Dense (LACUSTRINE)
- SAND Very Dense

Note :
For Plan Refer to Dwg No 1378702-A

SEE DWG 1378702-A

KEY PLAN
SCALE

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation 87 10 and 87 11
- WL in Piezometer
- Piezometer

No	ELEVATION	CO-ORDINATES NORTH	EAST
8-1	192.8	4 848 985.0	301 724.0
8-2	192.2	4 848 976.0	301 737.0
8-3	194.6	4 848 995.7	301 793.0
8-4	192.6	4 849 004.0	301 832.0
8-5	192.5	4 849 030.0	301 836.0
8-6	192.4	4 849 021.0	301 848.0
10-4	194.6	4 849 020.0	301 788.6
11-5	192.0	4 849 007.0	301 735.5

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION

Geocres No 30M13-70

HWY No 400 & 407			DIST 6
SUBM'D DD	CHECKED	DATE 88 03 07	SITE 37-1172
DRAWN DT	CHECKED	APPROVED	DWG 1378702-B

memorandum

Ontario

To: H.K. Jagasia
Design Engineer
Structural Office

Date: 1989 07 17

From: Foundation Design Section
Room 315, Central Building

RE: Final Review
Bridge #8, Hwy. 407 E.B.L.
W.P. 137-87-02, Site 37-1172
Hwy. 400/407 IC, District 6, Toronto

We have reviewed the final drawings and documents for this project and our comments are as follows:

Drawing No. 1: General Arrangement

- The equation for H.O.T. relates to ramp 407W - 400N instead of the P.C.L. for 407 E.B.L. and therefore is inconsistent with the Foundation Drawing.

- The requirements for cut slope geometry and slope treatment include slope drains and granular blankets. These requirements have not been indicated in the contract. Reference is made to Figure 11 in the Foundation Investigation and Design Report for the requirements that should be included.

Special Provisions

- A reference to Unwatering Structure Excavations as per OPSS 902.10.02 is not sufficient at this site. An SP should be included indicating that the soil is susceptible to boiling and disturbance under conditions of unbalanced hydrostatic head and that it is the responsibility of the contractor to lower the groundwater elevation a minimum of 0.5 m below any excavation and to construct the footings without disturbing the foundation soil. A drainage channel will be in place prior to this contract which may facilitate dewatering by perimeter ditching and sump pumping. Another alternative would be well points. However, the SP should indicate that the proposed method is the responsibility of the contractor and should be submitted for review.

...../2

- An additional SP should be included advising the contractor that hard and very dense ground containing cobbles and boulders, and in general difficult excavating conditions, are anticipated at this site.

- An SP for the Reinforced Earth Retaining Walls is required. Please submit this SP to our office for review.

If there are any questions, please advise.

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

for

M. Devata, P. Eng.
Chief Foundation Engineer

MD/DHD/sp

memorandum

Telephone #235-3731

Ontario

To: Distribution Date: 1988 11 23

FROM: Foundation Design Section

RE: Reinforced Earth Retaining Walls and Abutments
Bridge #7
WP 137-87-01, Site 37-1171
and Bridge #8
WP 137-87-02, Site 37-1172
Hwy 400/407 IC, District 6, Toronto

Following is a summary of a meeting held on 88 11 09 at the Foundation Design Section attended by G. Al-Bazi and H. Jagasia of the Structural Office, and M. Devata and D. Dundas of the Foundation Design Section. Proposals for Reinforced Earth retaining walls and abutments at Bridges #7 and #8 of the 400/407 IC were discussed.

- Reinforced Earth retaining walls could be located for the initial structure configuration, or alternatively at a location which would accommodate future widening. Since the construction of retaining walls at some future time (when widening is required) would require shoring and cause traffic problems, it was agreed that the retaining wall should be positioned to accommodate the ultimate widening configuration.

- Three alternatives for future abutment widening were discussed.

  a) do nothing at the present time

     Widening of the abutments would be technically feasible in the future although considerable shoring would be required.

  b) construct a Reinforced Earth retaining wall that will act as an abutment for future widening.

     The Foundation Design Section expressed concern about differential settlements between the conventional spread footing abutments and the Reinforced Earth abutments. Also it was agreed that while the Reinforced Earth abutment concept should be explored by MTO it would be more appropriate to demonstrate this technology at an independent structure location other than this complex interchange.

.....2/

c) during construction of the initial abutments, construct the widened portion as a conventional spread footing, and bury the footing until widening is required.

In this case the Reinforced Earth retaining walls would be curved to retain the soil until the abutment was widened. At that time, that portion of the retaining wall would be buried behind the abutment.

If there are any questions or clarifications required, please advise.

D. H. Dundas

D. H. Dundas, P.Eng.
Senior Foundation Engineer

DHD:st

cc: K. Bassi
G. Al-Bazi
H. Jagasia
G. Burkhardt

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-7 METRIC

W P 137-87-02 LOCATION Co-ORDS: N 4849 024.4; E 301 826.6 ORIGINATED BY BD
DIST 6 HWY 400/407 BOREHOLE TYPE CONE TEST, H-S AUGER COMPILED BY FP
DATUM GEODETIC DATE 88 11 07 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) / PLASTIC LIMIT W_p NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.6 0.0	GROUND SURFACE						192			
	Probable Silt/Clayey Silt						190			
186.5 6.1	Silt/Clayey Silt some sand trace gravel random silt and sand pockets occ. boulders dense to very dense/hard (GLACIAL TILL)		1	SS	35		188			
			2	SS	130/25cm		186			
			3	SS	67					
			4	SS	82		184	SLS 450 ULS 675		
			5	SS	111/25cm					
			6	SS	60/8cm		182			
			7	SS	61		180			
178.9 13.7			8	SS	33					
	Silty Clay to Clay with thin silt seams hard (LACUSTRINE)		9	SS	82		178			
			10	SS	81		176			
174.1 18.5	END OF BOREHOLE		11	SS	60/8cm					

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

20
15 ⊕ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Additional Bill done for charge purposes

Not included in report or contract package because subscriber information is essentially the same.

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 8-8 METRIC

W P 137-87-02 LOCATION Co-ORDS : N 4849 029.8 ; E 301 827.1 ORIGINATED BY BB

DIST 6 HWY 400/407 BOREHOLE TYPE CONE TEST, H-S AUGER COMPILED BY LNS

DATUM GEODETIC DATE 88 11 09 CHECKED BY DD.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS
192.5 / 0.0	GROUND SURFACE					
	Probable Silt/Clayey Silt					
184.9 / 7.6	Silt & layey Silt some sand trace gravel random silt and sand pockets occ. boulders dense to very dense/hard (GLACIAL TILL)		1	SS	60	
			2	SS	86	
			3	SS	64	
			4	SS	35	
			5	SS	53	
179.4 / 13.1			6	SS	30	
	Silty Clay to Clay with thin silt seams hard (LACUSTRINE)		7	SS	56	
			8	SS	47	
			9	SS	102	
			10	SS	115	
174.8 / 17.7	END OF BOREHOLE		11	SS	98	

ELEVATION SCALE: 192, 190, 188, 186, 184, 182, 180, 178, 176, 174

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

SLS ULS
400 kPa

PLASTIC LIMIT Wp | NATURAL MOISTURE CONTENT W | LIQUID LIMIT WL
WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

+3, ×5 : Numbers refer to Sensitivity

STRAIN AT FAILURE (%) 5 (10, 15, 20)

OFFICE REPORT ON SOIL EXPLORATION

Additional BH done for geo-
purposes

Not included in report or
Contract package because subsurface
information is essentially the same.

memorandum

Ontario

Tel: 3731

To: G. Al-Bazi
Design Engineer
Structural Office
3501 Dufferin Street

Date: 1988 08 29

From: Foundation Design Section
Room 315, Central Building

RE: Preliminary Drawing Review
Bridge #8
Hwy. 407 E.B.L.
W.P. 137-87-02, Site 37-1172
Hwy. 400/407 IC, District 6, Toronto

Further to your memo dated 88 05 30, we have reviewed the preliminary drawing for this project.

Our comments which were provided verbally in our meeting of 88 07 21, are as follows:

1) Recommended bearing capacities for each footing element are provided in the attached table.

2) The bearing surfaces of excavations on natural ground should be protected by a 15 cm pad of mass concrete within 4 hours of exposure.

3) For design purposes, it can be assumed that the unfactored fricitional resistance is equivalent to tan 28°.

4) Within cuts, there should be no slope higher than 4.5 m that is not benched with a minimum 1.2 m bench. Bench and toe drains, as well as granular blankets are required for stability. Details are provided in the Foundation Report for this project.

5) It is our understanding that a stepped footing is proposed at the east abutment with the north side based at 182.8, the centre at 183.3 and the south side at 184.0.

If the recommended bearing capacities for the east abutment are insufficient for your design, deep foundations may be considered. Design recommendations are provided in the attached table.

If there are any questions, please advise.

D.H. Dundas

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

DHD/mmj

Attach.

WP 137-87-02

BRIDGE #8

FOOTING	FOUNDATION TYPE	BASE OF FOOTING	BASE OF GRANULAR PAD	BEARING CAPACITY Factored ULS	BEARING CAPACITY SLS Type II
West Abut. Sta. 191+20.5	spread ftg. on native ground	185.0	N/A	1000 kPa	*
Centre Pier Sta. 191+66.0	spread ftg. on native ground	180.7	N/A	750 kPa	500 kPa
East Abut. Sta. 191+211.5	spread ftg. on native ground	STEPPED N. side 182.8 Centre 183.3 S. Side 184.0	N/A N/A N/A	450 kPa 450 kPa 750 kPa	300 kPa 300 kPa 500 kPa
					* will not govern design
OR					
	36"Ø, 42"Ø or 48"Ø caissons to	174.0 m	N/A	4500 kPa	3000 kPa
OR					
	310 HP 110	piles equipped with driving shoes 175.0 m	N/A	1200 kN per pile	800 kN per pile

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M13-70

DIST. 6 REGION

W.P. No. 48-71-17

CONT. No. 90-32

W. O. No.

STR. SITE No.

HWY. No. 427

LOCATION Retaining Walls at Bridge #8

No. of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

OVERSIZE DRAWING

Mr. C.S. Grabski,
Structural Design Engineer,
West Bldg., Downsview.

Soil Mechanics Section,
Geotechnical Office,
West Bldg., Downsview.

January 30th/75.

Retaining Walls 1A & 1B
Site #37RW 1A & B,
District #6, Toronto
W.P. 48-71-17.

As previously discussed with you and Mr. W. Lin on December 12th, 1974, at your Office, with regard to final structural drawings for the abovementioned retaining walls, we have outlined our recommendations at the recent monthly review meeting held on January 24th, 1975 at McCormick, Rankin & Assoc. Ltd., Consulting Engineers, Mississauga.

The members present at the meeting were all in agreement with the alternative proposal for the foundation of the retaining walls and requested that the design consultant should prepare the necessary cost estimates and drawings for the revised scheme. Recommendations pertaining to the alternative foundation requirements for the Retaining Structures 1A & 1B have already been submitted in a memo dated July 24th, 1972 to Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer and a copy to your office. Since the W.P. has been changed from W.P. 404-65 to W.P. 48-71-17 for these retaining structures this memo might not have been filed in the appropriate project.

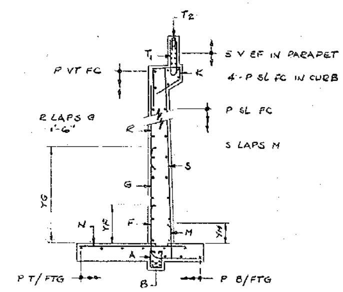
At this meeting we suggested that consideration be given for 2:1 slopes rather than 3:1 slopes for the embankment construction in the area of retaining walls and thereby minimize the length of the Retaining Wall #1A as well as Parapet wall. (ref. Dwg. #37-RW1A & 1B-1). It is understood that this aspect also will be reviewed by the design consultant.

M. Devata,
Supervising Engineer.

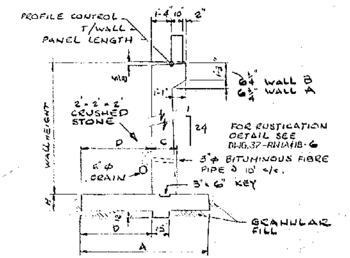
MD/ma
c.c. G.C.E. Burkhardt
W. Lin
D. MacDonald
McCormick, Rankin
Files
Record Services

PANEL DESCRIPTION			DATA AT STATIONS					SECTION DIMENSIONS AT STATIONS	
				ELEVATIONS		PANELS			
PAN. NO.	PANEL LENGTH	SECT. TYPE	STATION	T/FTG.	T/WALL	WALL HEIGHT	JT. TYPE	C	LINE "B"
B1	19.77	FILL	370+12.43	528.0	549.78	21.78	EXP	2'-1"	
			369+92.66	-"-	548.88	20.88	CON	2'-0½"	
			-"-	530.0	-"-	18.88		1'-11½"	
B2	19.77		369+72.89	-"-	548.08	18.08		1'-11¼"	
			-"-	532.0	-"-	16.08		1'-10⅛"	
B3	19.77		369+53.12	-"-	547.27	15.27		1'-9¾"	
			-"-	534.0	-"-	13.27	↓	1'-8¾"	
B4	19.78		369+33.34	-"-	546.57	12.57	EXP	1'-8⅜"	540.2
			-"-	536.0	-"-	10.57	EXP	1'-7⅜"	-"-
B5	19.80		369+13.54	-"-	545.87	9.87	CON	1'-7"	540.6
			-"-	-"-	-"-	9.87		1'-7"	-"-
B6	29.73		368+83.81	-"-	544.78	8.78		1'-6½"	541.0
			-"-	536.5	-"-	8.28	↓	1'-6¼"	-"-
B7	29.76		368+54.05	-"-	543.72	7.22	EXP	1'-5¾"	541.3
			-"-	-"-	-"-	7.22	EXP	1'-5¾"	-"-
B8	29.79		368+24.26	-"-	542.69	6.19	CON	1'-5¼"	541.5
			-"-	537.0	-"-	5.69	CON	1'-5"	-"-
B9	29.84		367+94.44	537.0	541.74	4.74		1'-4½"	541.5
A1	27'	FILL		529.0	551.55	22.55	EXP	2'-1⅜"	
				529.0	550.97	21.97		2'-1⅛"	

SECTION DIMENSIONS AT STATIONS			REINFORCING STEEL FOR PANEL														SHEAR KEY		CURB	PARAPET WALL	
							@10"	@10"	@18"				#5 @18"								
A	D	H		YF	YG	YM	F	G	M	R	S	N	P T/FTG.	P B/FTG.	P SL FC	P VT FC	A	B	K	T	V
13'-0"	7'-0"	2'-0"	B1	6'-0"	12'-6"	2'-6"	#9	#9	#5	#5@10"	#5@18"	#11@7"	7	5	17	15					
10'-10"	5'-5½"	2'-0"	B2	5'-0"	9'-6"	2'-3"	#8	#8	#5	#5@10"		#10@10"	5	4	15	13					
9'-2"	4'-5"	2'-0"	B3	4'-6"	6'-6"	2'-3"	#7	#7	#5	#5@10"		#7@10"	5	3	13	11					
7'-9"	3'-7½"	2'-0"	B4	–	5'-6"	2'-3"	–	#8	#5	#5@10"		#6@10"	5	3	11	9					
6'-4"	2'-10"	2'-0"	B5	–	3'-6"	2'-3"	–	#6@12"	#5	#5@12"		#5@12"	4	3	10	8					
6'-4"	2'-10"	2'-0"	B6	–	3'-6"	2'-6"	–	#6@12"	#5	#5@12"		#5@12"	4	3	9	7					
5'-4"	2'-3"	2'-0"	B7	–	3'-6"	2'-6"	–	#5@12"	#5	#5@12"		#5@12"	4	2	8	6					
5'-0"	2'-1½"	1'-6"	B8	–	3'-6"	2'-6"	–	#5@12	#5	#5@12"		#5@12"	4	2	8	6					
4'-6"	1'-10"	1'-6"	B9	–	3'-0"	2'-6"	–	#5@12"	#5	#5@12"		#5@12"	4	2	7	5					
13'-0"	6'-6"	2'-0"	A1	9'-0"	13'-0"	2'-3"	#10	#8	#5	#5@10"	↓	#10@6"	7	4	18	16					

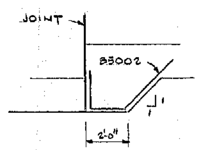


TYPICAL SECTION

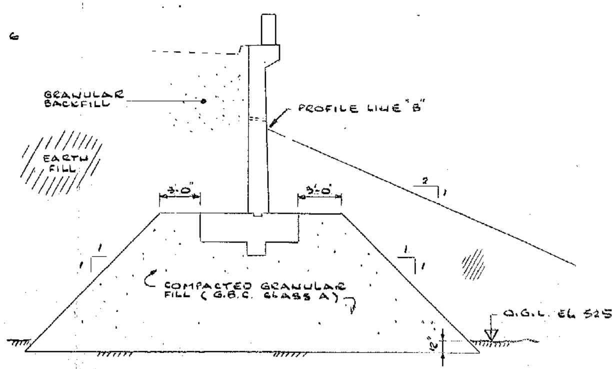


TYPICAL SECTION

NOTE
FOR LIGHTING POLE BASES PANELS B1 & B6 SEE SHEET 6



FOOTING STEP



GRANULAR FILL

NOTES:

REINFORCING STEEL CLEAR COVER 3" EXCEPT PARAPET
G,R,S,M,BT BARS TO START & FINISH 3" FROM JOINTS OR ENDS OF WALL.
HORIZONTAL STEEL IS NOT CONTINUOUS THROUGH EXPANSION & CONSTRUCTION JOINTS.
R&S TO HAVE MIN. 1'-9" LAP WITH G & M
FOR LOCATION OF PARAPET RAIL SEE ELEVATIONS.
FOOTINGS TO BE POURED AGAINST UNDISTURBED GROUND.
FOR ARCHITECTURAL DETAIL SEE DWG. D-37-RW1A&1B-5
CLASS OF CONCRETE @ 28 DAYS - 4000 PSI PARAPET
" 3000 P.S.I. OTHER

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

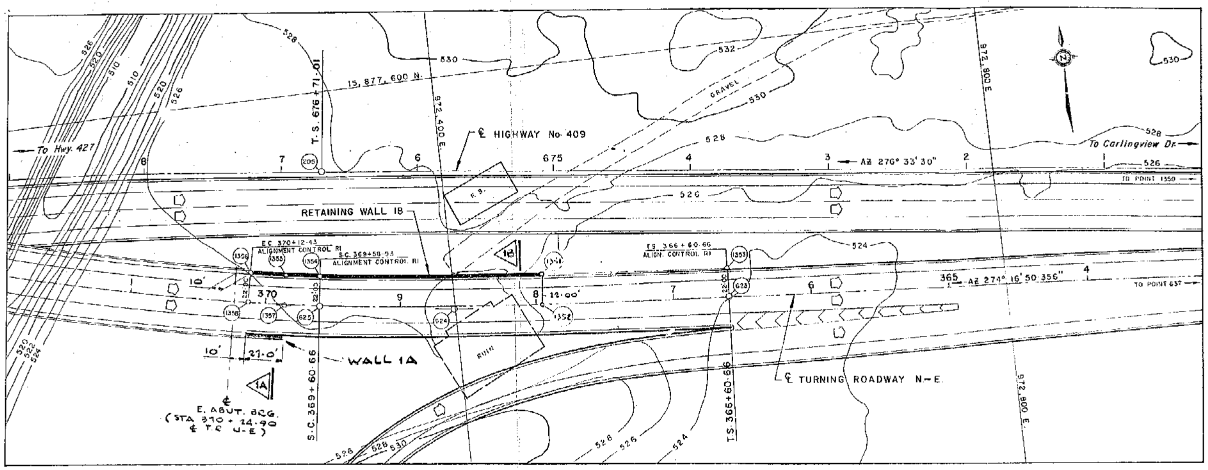
DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

RETAINING WALLS 1A & 1B

KING'S HIGHWAY No. 427 & 409 DIST. No. 6
CO. YORK
TWP. ETOBICOKE LOT CON.

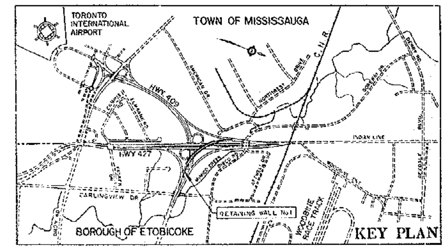
REINF. DETAILS RET. WALLS 1A, 1B

APPROVED	BRIDGE ENGINEER	SITE No. 37-RW 1A&1B	W.P. No. 48-71-17
DESIGN —	CHECK	CONTRACT Nos.	
DRAWING JB	CHECK		
DATE JUN 75	LOADING HS20-44	DRAWING No.	37-RW 1A&1B-3

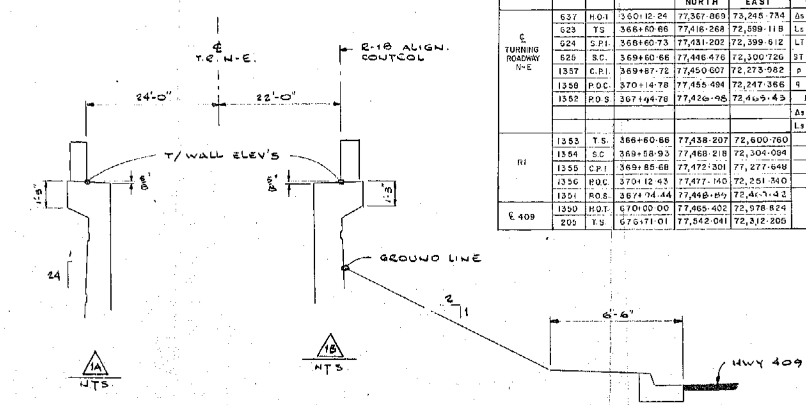


PLAN

SCALE : 1 in. = 40 ft.



LOCATION OF LIGHTING POLE BASES
STA. 368+90 & 370+05 ℄ T.R. N-E.
(WALL 1B)



RETAINING WALL No. 1A & 1B									
CONTROL	No.	POINT	STATION	CO-ORDINATES		CURVE DATA			
				NORTH	EAST	623 – 625		625 – 1358	
℄ TURNING ROADWAY N-E	637	H.O.T.	360+12·24	77,367·869	73,245·734	Δs	4° 30' 00"	Δ	1° 37' 24·804"
	623	TS	366+60·66	77,416·268	72,599·118	Ls	300·000'	D	3° 00' 00"
	624	S.P.I.	368+60·73	77,431·202	72,399·612	LT	200·065'	R	1909·859'
	625	S.C.	369+60·66	77,446·476	72,300·726	ST	100·059'	T	27·061'
	1357	C.P.I.	369+87·72	77,450·607	72,273·982	p	1·963'	L	54·119'
	1358	P.O.C.	370+14·78	77,455·494	72,247·366	q	149·969'	E	0·192'
	1352	P.O.S.	367+44·78	77,426·98	72,465·43	1353 – 1354		1354 – 1356	
						Δs	4° 30' 00"	Δ	1° 37' 24·004"
						Ls	298·269'	D	3° 02' 05·856"
R1	1353	T.S.	366+60·66	77,438·207	72,600·760			R	1887·859'
	1354	S.C.	369+58·93	77,468·218	72,304·094		OFFSET SPIRAL 22.00	T	26·749'
	1355	C.P.I.	369+85·68	77,472·301	77, 277·648			L	53·495'
	1356	P.O.C.	370+12·43	77,477·140	72,251·340			E	0·109'
	1351	P.O.S.	367+04·44	77,448·64	72,467·42				
℄ 409	1350	H.O.T.	670+00·00	77,465·402	72,978·824				
	205	T.S.	676+71·01	77,542·041	72,312·205				

LIST OF DRAWINGS

SHEET 1 GENERAL LAYOUT
2 BOREHOLE LOCATION
3 REINFORCING DETAILS
4 PARAPET WALL
5 PARAPET RAIL
6 STANDARD DETAILS

CONCRETE QUANTITIES

1. RETAINING WALL 183 CU. YD. (3 KSI)
2. PARAPET WALL 15 " " (4 KSI)

NOTE

B.M. EL. 522.49 PLATE SET IN S. WESTERLY CONCRETE HANDRAIL OF BRIDGE OVER MIMICO CREEK AT CARLINGVIEW DRIVE 205' RT. OF STA. 660+24 ℄ HWY 409.

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO

McCORMICK, RANKIN & ASSOCIATES LIMITED
PORT CREDIT CONSULTING ENGINEERS OTTAWA

KING'S HIGHWAY No. 427 & 409 DIST. No. 6
MUNICIPALITY OF METROPOLITAN TORONTO
BOROUGH OF ETOBICOKE LOT CON.

GENERAL LAYOUT

APPROVED .... STRUCTURAL ENGINEER				CONTRACT No.	
DESIGN		CHECK	J.D.E.	W.P. No.	48-71-17
DRAWING	V.C.	CHECK	J.D.E.	SITE No. 37-RW-1A&1B	SHEET 1
DATE	27/3/75	LOADING			