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DIST. 6/7 REGION

W.P. No. 663-89-00

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 407

LOCATION Preliminary Design
Oshawa Limit, Hwy 407 to Hwy 401

No of PAGES - 1

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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REMARKS Borehole logs : Computer : A

BH #1 — 66389-1

BH #2 — 66389-2

BH #12 — 66389-12

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FOUNDATION DESIGN SECTION

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP	663-89-00	DIST	7
HWY	401	STR SITE	-

Feasibility Study of Freeway Link
Between Hwy 401 and Hwy 407
Oshawa/Clarington Freeway Link

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GEOCRES 30M15-83

DATE AUG 29 1994

FOUNDATION INVESTIGATION REPORT
For
Feasibility Study of Freeway Link
Between Hwy. 401 and Hwy. 407
Oshawa/Clarington Freeway Link
W.P. 663-89-00
District 7, Toronto

INTRODUCTION

A request, dated April 2, 1993 to review the feasibility study of Oshawa/Clarington Freeway Link between Hwy. 401 and Hwy. 407 for 26 structures and 3 culverts sites, was received from Central Region Structural Section.

Based on the above request, the Phase II study report issued by Geocon Inc. has been reviewed by the Foundation Design Section (Geocon Report T11707B, July, 1992). This technical report presents a preliminary geotechnical route analyses of the alignments, for each study corridor, proposed by the transportation consultants.

Five major alignments have been proposed to link Hwy. 401 and the proposed Hwy. 407 within the Oshawa Link. Five connector junctions have been established at Hwy. 401 and four at the proposed Hwy. 407 to link the two highways. Underpass structures will be proposed along the link alignments at the crossing of Hwy. 2, Bloor Street, Nash Road, Pebblestone Road, and Regional Road No. 4 (Taunton Road). Interchange structures will also be established at Hwy. 401 and Hwy. 407 at the respective connector junctions.

The proposed major link alignments are located between existing north-south roadways and primarily within the central zone of the study corridor. Generally, the alignments encountered few existing properties and developed areas. Since the location of the proposed Hwy. 407 is tentative, several other alternative alignments for Hwy. 407 have been proposed further north of the current technically preferred alignment. Correspondingly, the proposed links between Hwy. 401 and Hwy. 407 have been extended to connect at the alternate proposed

Highway routes. Details of the route locations may be referenced from the Hwy. design consultant drawings (McCormick and Rankin, 1991).

The technically preferred freeway link is located in the western portion of the study corridor as shown on Drawing 6638900A. Twenty six (26) new bridge structures and three (3) culverts are proposed along this Oshawa Link as shown on Figure 1. Table 1 in the Appendix shows a chart listing the various structures, their locations and a brief description of the sites.

Based on the above request and our review, twelve boreholes (B.H. 1 to B.H. 12) were advanced and sampled between 93 12 06 and 93 12 13 as a part of the project by means of solid or hollow stem augers with washboring techniques. These boreholes extended down to depth of 7.0 m at B.H. 3 and 29.4 m at B.H. 9 below the existing ground surface.

This report contains factual information together with discussion and recommendations pertaining to the subsurface conditions, structure foundations, approach embankments and cuts and related earthworks for the sites as shown on Drawing No. 6638900A.

SITE DESCRIPTION AND GEOLOGY

The proposed structure sites extend from Hwy. 401 Interchange northerly 14 km to the proposed Hwy.407 interchange (Drawing No. 6638900A). The sites are located in the Municipality of Clarington, Region of Durham.

The portion of the Oshawa Link Corridor under investigation is flanked by mosaic of urban land uses on the periphery of area municipal core also which includes major new residential and industrial subdivision development by traditional agricultural operations as well as specialty crop systems.

The topography of the area is generally flat to gently undulating, generally sloping down toward Lake Ontario from the north to the south.

Physiographically, the area is located in the region referred to as the "South

Slope and Iroquois Plain" (Chapman and Putnam, 1984). This is the lowland bordering Lake Ontario which was inundated in the Pleistocene time by Lake Iroquois. Subsoils in these areas generally are characterized by a mosaic of till plains, drumlins, and areas of glacial lacustrine deposits of silt, sand and clayey silt.

SUBSURFACE CONDITIONS

The subsoil encountered at these sites can be divided into seven deposits as follows:

i) fill material
ii) topsoil
iii) clayey silt
iv) sandy silt to silty sand
v) sand to sand and gravel
vi) heterogeneous mixture of silt, sand and gravel (non-cohesive glacial till)
vii) heterogeneous mixture of clayey silt, sand and gravel (cohesive glacial till)

The maximum thickness of these deposits vary with the location and depths. A detailed description of the subsurface conditions encountered is given below.

Fill Material

This material was encountered at five borehole locations along the existing road. The material consists of a brown sand and gravel. The thickness of this layer varies from 1.0 metre at B.H. 3 to 1.6 metres at B.H. 1 as shown on the Record of Boreholes. No laboratory tests were carried out on the fill material. However, through visual observation, it can be classified as a sand and gravel.

Topsoil

Organic topsoil was found from the ground surface or just underneath the sand and gravel fill at nine (9) borehole locations out of twelve (12) borehole. The thickness of the topsoil varies from 0.1 metres at B.H.1 to 1.1 metres at B.H.7.

Clayey Silt

This stratum was encountered in five (5) boreholes (B.H.'s 2, 3, 6, 7 and 9). This material consists of a clayey silt ranging in thickness between 0.5 metres at B.H. 3 and 9.8 m at B.H. 7.

Atterberg Limit tests were performed on these samples and the results are plotted on Figure 2 and summarized as follows:

Property		Range
Natural Moisture Content	(W)	13.0 - 30.0
Liquid Limit	(WL)	16.0 - 31.0
Plastic Limit	(Wp)	10.0 - 16.0
Plasticity Index	(Ip)	6.0 - 15.0

From the plasticity chart it is evident that the layer can be classified as an inorganic clayey silt with low plasticity (CL).

Undrained shear strengths of the soil were determined by in-situ vane tests. The results are plotted on the Record of Boreholes in the Appendix and summarized as follows:

Undrained Shear Strength (cu)	kPa	Sensitivity
Field Vane	25 - 80	2 - 6

As shown on the above table, recommended shear strength for this deposit can be assumed to be within the range of 25 to 80 kPa. Based on this conclusion, the soil has generally a firm to stiff consistency. The sensitivity of the soil is generally low to moderate.

Sandy Silt to Silty Sand

Sandy silt to silty sand was encountered above or below the clayey silt layer in seven (7) boreholes. The thickness of this layer ranges from 0.5 metres at B.H. 3 to 8.6 metres at B.H. 9.

The deposit contains minor variations in gravel content throughout its thickness.

Generally the deposit contains some gravel. Grain size distribution analysis indicates that the soil varies between a sandy silt to silty sand. This layer is basically non-plastic. Figure 3 in the Appendix shows the result of grain size distribution tests.

In this stratum, the 'N' values ranged from 6 to over 100 blows/0.3 m indicating a state of compaction described as loose to very dense.

Sand to Sand and Gravel

These stratum were encountered above or in between non-cohesive glacial till at five (5) borehole locations. The thickness of this layer ranges from 1.4 metres at B.H. 11 to 5.3 metres at B.H. 4.

No laboratory tests were carried out on this material. However, through visual observation, this material can be classified as a sand to sand and gravel.

In this stratum, the 'N' values ranged from 26 to over 100 blows/0.3 m indicated a state of compaction described as compact to very dense.

Heterogeneous Mixture of Silt, Sand and Gravel (Non-cohesive Glacial Till)

Underlying the sandy silt to silty sand and sand and gravel layers, a heterogeneous mixture of silt, sand and gravel of glacial origin was encountered at 11 boreholes. The proven thickness of this stratum ranges from 3.7 metres at B.H. 5 to greater than 11.9 metres at B.H. 9. Most of the samples recovered from the site investigation has a grey colour.

Grain size distribution analyses indicate that this layer can be classified as heterogeneous mixture of silt, sand and gravel (non-cohesive glacial till). Gradation limits for these soils are presented in an envelope form on Figure 4. This layer is basically non-plastic.

In the stratum, the 'N' values ranged from 21 to over 100 blows/0.3 m indicated a state of compaction described as compact to very dense.

Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Cohesive Glacial Till)

A cohesive glacial till deposit was found immediately below the fill material at one borehole location. This material consists of a cohesive heterogeneous mixture of clayey silt, sand and gravel with a thickness of greater than 14 m at B.H. 8.

Atterberg Limit Test was performed on this sample and the result is plotted on Figure 5 and summarized as follows:

Property		Range (10)
Natural Moisture Content	(W)	6
Liquid Limit	(WL)	15
Plastic Limit	(WP)	9
Plasticity Index	(Ip)	6

From the plasticity chart as shown on Figure 4, it is evident that the deposit can be classified as an inorganic clayey silt to silt with low plasticity (CL or CL-ML).

A grain size distribution analysis was carried out on this material. Figure 6 in Appendix shows the result.

Standard penetration test 'N' values between 60 and over 100 blows/0.3 m indicated that the soil can be interpreted as being hard.

Groundwater Conditions

Groundwater conditions were observed through the measurement of water level in the open boreholes. The depth of groundwater level after completion ranged from 0.6 metres at B.H. 5 to 6.2 metres at B.H. 9 below the existing ground surface. At two borehole locations (B.H.'s 8 and 12), groundwater in the boreholes was dry after completion. However it should be noted that a perched water was encountered at a depth of about 3.0 m in Borehole 8 below the ground surface. The following groundwater levels were observed during the field investigation.

B.H.No.	Ground Elevation (m)	Groundwater Elevation (m)	Depth (m)
1	104.5	101.6	2.9
2	105.0	99.2	5.8
3	108.5	105.0	3.5
4	126.8	123.8	3.0
5	134.0	133.4	0.6
6	139.6	137.7	2.1
7	140.4	137.0	3.4
8	153.3	Dry	3.0 (perched water)
9	152.1	145.9	6.2
10	152.6	151.0	1.6
11	180.3	175.9	4.4
12	214.3	Dry	-

DISCUSSION AND RECOMMENDATIONS

At present the planning and design staff is involved in the preliminary design phase for the Oshawa Link. This report contains the geotechnical aspect of the Oshawa Link from the proposed Hwy. 407 to the existing Hwy. 401 east of Courtice Road in the Municipality of Clarington, Region of Durham for various structures and culverts. Twenty six (26) bridge structures and three (3) culverts including seven (7) creek crossings were reviewed for this program (see Figure 1)

In general, subsurface conditions over the site are uniform and competent for structure foundation and embankment loadings.

Our comments from the feasibility, design and construction of the various structures and culverts are given on the Foundation Data Sheets included in the Appendix. A data sheet is provided for each of the 12 areas; the area location is described on these sheets and is also shown on Drawing No. 6638900A. An explanation of information provided on the data sheet is outlined below.

1. The structure number given (i.e. 1, 2, 3.....26, culvert 1.....etc.) is a numbering system developed for the purpose of the feasibility study. The area is the location of boreholes drilled for this study (1, 2,.....12). The actual location is shown on Drawing No. 6638900A and Figure 1.

2. The original ground elevation is based on the survey result for the proposed Oshawa Link profile.

3. The grades of roadway given is based on the proposed grades of Oshawa Link at the respective sites.

4. Subsurface conditions are described very briefly and are based on generally not more than one boring per area.

5. Recommendation - Structure

The recommendations are discussed separately for the structural elements (abutments and piers). The options for structure foundations are given in preferential order based on geotechnical/economical considerations. Further elaboration of structure recommendations made on the data sheets are given below.

Compacted Granular 'A' Core (Engineered Fill) - This option is for abutments only where subsurface conditions are competent. This option is not recommended for water crossings. The minimum requirements of a compacted granular 'A' core are shown on Figure 7 in the Appendix. Furthermore, the footing for this scheme could be designed using the following parameters:

Factored Bearing Capacity at U.L.S.:		900 kPa
Bearing Capacity at S.L.S.	:	350 kPa

Spread Footings - This option is given for abutments and piers where subsurface conditions are competent. The maximum elevation and corresponding maximum design load is given. It is to be noted the spread footings should be provided with a minimum of 1.2 m of earth cover for frost protection purposes. In addition, where the spread footing is to be founded on a cohesive deposit, subject to softening upon exposure to construction or weather conditions, it would be necessary to protect the base of the footing excavation from softening by placing a working slab of lean concrete immediately upon completion of the footing excavation. Also, where the footing is located in a granular deposit and the water table is at or above the footing founding level, it will be necessary to prevent the base of the footing from "boiling" due to an unbalanced excess hydrostatic head. In this case a dewatering scheme would be required. Two alternative dewatering schemes are shown on Figure 8 and Figure 9.

End-Bearing Piles - This founding scheme is recommended for the abutments and piers where appropriate. The recommendation gives the estimated pile tip elevation. Generally, the end-bearing piles can be designed for the

factored axial capacity at U.L.S. and the axial capacity at S.L.S. which is dependent on the pile section chosen. The following design parameters are recommended for the pile foundation:

Pile Type	Factored Axial Capacity at U.L.S. (kN)	Axial Capacity at S.L.S. (kN)
310 HP 79	1150	900
310 HP 110	1600	1150

It is generally assumed steel 'H' piles will be used, however, if a certain pile section is not suitable at the specific area, this fact is mentioned in the data sheet. Pile driving would be field controlled by the Hiley Formula unless it is being driven to the bedrock surface or in clayey subsoil.

6. Recommendation - Approaches

The recommendations for fill slopes, cut slopes and berm requirements, are based on the proposed preliminary grades assuming fills are constructed of acceptable earth borrow according to current M.T.O. Specifications. Any changes in profile grade would require a reassessment of these recommendations. Also discussed under this heading is special treatment, i.e. benching, slope protection, etc., that is anticipated at this location. No excessive settlements of embankments at the proposed fill heights are anticipated at this stage.

7. Other Considerations

The granular 'A' or 'B' backfill should be in accordance with Special Provision No. 109F03 (dated March, 1988). The following parameters are recommended for the granular backfill"

	Gran. 'A'	Gran. 'B'
Angle of Internal Friction: ϕ	35^0	30^0
Unit Weight (kN/m^3): γ	22.80	21.20
Coefficient of Active Earth Pressure (Ka)	0.27	0.33
Coefficient of Earth Pressure at Rest (Ko)	0.43	0.50

The earth pressure coefficient at rest is to be used when the design of abutment walls are rigid and unyielding. All foundation elements should have a minimum of 1.2 m earth cover for frost protection.

The concrete for the footings should be formed 'In The Dry'. Consequently a dewatering scheme will be required if the concrete is poured below the prevailing water level.

8. Remarks

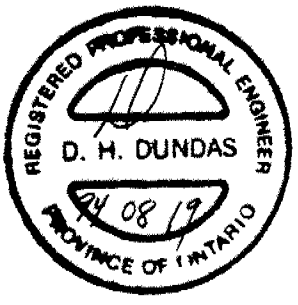
In this column assumptions made and geotechnical preference of schemes if appropriate, are discussed, as well as other options or considerations to be evaluated during this stage of design.

MISCELLANEOUS

The various comments outlined in this report are for feasibility study purposes based on limited field data. It will be necessary to carry out a detailed subsurface investigation at each of the structure sites when the design details and geometries are finalized and approved. In some areas, surface and groundwater studies for stormwater detention ponds and special in-situ field testing may be warranted.

This report was prepared by Mr. T.C. Kim, Sr. Foundation Engineer and reviewed by Mr. D. Dundas, Chief Foundation Engineer (Acting).

T.C. Kim, P. Eng.
Sr. Foundation Engineer



D. Dundas, P. Eng.
Chief Foundation Engineer
(Acting)

APPENDIX

TABLE 1 : LIST OF STRUCTURES

AREA	STRUCTURE REF.No.	DESCRIPTION
1	1	Freeway Link W-N ramp over relocated Courtice Rd. (Regional Rd. 34)/Hwy 401 interchange N/S-E ramp
	2	Relocated Courtice Rd. (Regional Rd. 34)/Hwy 401 interchange E-N/S ramp over Freeway Link N-W ramp
	3	Freeway Link W-N ramp over Highway 401
	4	Freeway Link N-E ramp over Highway 401
	5	Freeway Link N-E ramp over Freeway Link W-N ramp
2	6	Freeway Link N-W ramp over CP Rail
	7	Freeway Link N-E ramp over CP Rail
	8	Freeway Link W-N ramp over CP Rail
	9	Freeway Link E-N ramp over CP Rail
3	10	Freeway Link N-W ramp over Baseline Road
	11	Freeway Link N-E ramp over Baseline Road
	12	Freeway Link W-N ramp over Baseline Road
	13	Freeway Link E-N ramp over Baseline Road
4	14	Bloor Street over Freeway Link
5	Culvert-1	Freeway Link crossing North of Bloor Street
6	15	Highway 2 over Freeway Link
7	16	Nash Road over Freeway Link
	17	Freeway Link over Black Creek
8	18	Hancock Road over Freeway Link
9	Culvert-2	Freeway Link crossing South of Pebblestone Road
	Culvert-3	Freeway Link S-E/W ramp crossing South of Pebblestone Road
	19	Pebblestone Road over Freeway Link
10	20	Freeway Link over Farewell Creek
11	21	Regional Road 4 (Taunton Road) over Freeway Link
12	22	Freeway Link E-S ramp over Freeway Link S-W ramp
	23	Freeway Link S-W ramp over proposed Highway 407
	24	Freeway Link E-S ramp over proposed Highway 407
	25	Freeway Link S-E ramp over Farewell Creek
	26	Freeway Link E-S ramp over Farewell Creek

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 1 **STRUCTURE Nos.** 1, 2, 3, 4 and 5 **LOCATION** Oshawa Link at HWY 401 Interchange

ORIGINAL GROUND ELEV. 100.0 - 106.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** Varied
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 1 (Gr.Elev. 104.5 m) 0.0 - 1.6 : Sand and Gravel Fill compact to dense 1.6 - 15.4: Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) compact to very dense GROUNDWATER Water level at 2.9 m below ground surface.	ABUTMENTS AND PIERS 1. ABUTMENTS a) A perched-type abutments founded on spread footings on Granular "A" core - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S. : 350 kPa b) Spread footings on the very dense glacial till at an elevation below 101.5 m - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S. : Not governed 2. PIERS Spread footings founded on the very dense glacial till - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S. : Not governed	1)Fill height up to 8.0 m will be stable with 2:1 side and forward slopes 2)Fill height greater than 8.0 m will be required a mid-height safety berm 3)Unsuitable material within the plan limit should be fully removed and replaced with well compacted material	1. No serious foundation problems are anticipated 2. No major dewatering problems are anticipated for excavation of footings

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 2 **STRUCTURE Nos.** 6, 7, 8 and 9 **LOCATION** Oshawa Link ramps over CP Rail

ORIGINAL GROUND ELEV. 105.0 - 109.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 113.0 - 120.0 m

Reference:

SUBSURFACE CONDITIONS

REFERENCE BOREHOLE

BH 2 (Gr.Elev. 105.0 m)

0.0 - 1.4 : Clayey Silt
stiff

1.4 - 2.1 : Silty Sand
compact

2.1 - 8.1 : Heterogeneous
Mixture of Silt, Sand
and Gravel
(Glacial Till)
very dense

GROUNDWATER

Water level at 5.8 m below ground surface

RECOMMENDATIONS

STRUCTURE

ABUTMENTS AND PIERS

1. ABUTMENTS

a) A perched-type abutments founded on spread footings on Granular "A" core

- Factored bearing Capacity at U.L.S. : 900 kPa
- Bearing Capacity at S.L.S. : 350 kPa

b) Spread footings on the very dense glacial till at an elevation below 102.9 m

- Factored bearing Capacity at U.L.S. : 1,000 kPa
- Bearing Capacity at S.L.S. : Not governed

2. PIERS

Spread footings founded on the very dense glacial till

- Factored bearing Capacity at U.L.S. : 1,000 kPa
- Bearing Capacity at S.L.S. : Not governed

APPROACHES

1)Fill height up to 8.0 m will be stable with 2:1 side and forward slopes

2)Fill height greater than 8.0 m will be required a mid-height berm

3)Unsuitable material within the plan limit of the proposed embankment should be fully removed and replaced with well compacted material

REMARKS

1. No serious foundation problems are anticipated
2. No major dewatering problems are anticipated for excavation of footings
3. Some railway protection would be required

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 3 **STRUCTURE Nos.** 10, 11, 12 and 13 **LOCATION** Oshawa Link ramps over Baseline Rd.

ORIGINAL GROUND ELEV. 106.0 - 108.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 112.0 - 116.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 3 (Gr.Elev. 108.5 m) 0.0 - 0.1 : Pavement 0.1 - 1.0 : Sand and Gravel Fill compact 1.0 - 1.9 : Clayey Silt trace of organics 1.9 - 2.4 : Silty Sand compact to very dense 2.4 - 7.0 : Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense GROUNDWATER Water level at 3.5 m below ground surface	ABUTMENTS AND PIERS 1. ABUTMENTS a) A perched-type abutments founded on spread footings on Granular "A" core - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S. : 350 kPa b) Spread footings on the very dense glacial till at an elevation below 106.5 m - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S. : Not governed 2. PIERS Spread footings founded on the very dense glacial till - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S. : Not governed	1)Fill height up to 8.0 m will be stable with 2:1 side and forward slopes 2)Fill height greater than 8.0 m will be required a mid-height berm 3)Unsuitable material within the plan limit should be fully removed and replaced with well compacted material prior to fill placement	1. No serious foundation problems are anticipated 2. No major dewatering problems are anticipated for excavation of footings

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 4 **STRUCTURE Nos.** 14 **LOCATION** Oshawa Link - Bloor St. over Freeway Link

ORIGINAL GROUND ELEV. 125.5 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 129.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 4 (Gr.Elev. 126.8 m) 0.0 - 0.1 : Pavement 0.1 - 1.4 : Sand and Gravel Fill dense 1.4 - 5.6 : Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense 5.6 - 10.9: Fine to medium Sand dense 10.6 - 11.6: Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense GROUNDWATER Water level at 3.0 m below ground surface	ABUTMENTS AND PIERS 1. ABUTMENTS a) A perched-type abutments founded on spread footings on Granular "A" core - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S : 350 kPa b) For a closed-type abutments, spread footing on dense fine to medium sand at an elevation below 121.0 m - Factored bearing Capacity at U.L.S. : 800 kPa - Bearing Capacity at S.L.S. : 340 kPa 2. PIERS Spread footings founded on the dense fine to medium sand at an elevation below 121.0 m - Factored bearing Capacity at U.L.S. : 800 kPa - Bearing Capacity at S.L.S. : 340 kPa	1)Fill height up to 3.0 m will be stable with side slope of 2:1 2)Cuts to a depth of 3.5 m will be stable with 2:1 slopes 3)Overall slope of 6.5 m (3m fill and 3.5 m cuts) will be stable with 2:1 forward slopes 4)Unsuitable material within the plan limit should be fully removed and replaced with well compacted material prior to fill placement	1. No serious foundation problems are anticipated 2. Dewatering scheme would be required for foundation excavation.

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 5 **STRUCTURE Nos.** Culvert - 1 **LOCATION** Oshawa Link Crossing Tooley Creek

ORIGINAL GROUND ELEV. 135.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 137.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 5 (Gr.Elev. 134.0 m) 0.0 - 0.4 : Top Soil 0.4 - 4.1 : Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) dense to very dense 4.1 - 8.5 : Fine to medium Sand very dense GROUNDWATER Water level at 0.6 m below ground surface	1. BOX CULVERT a) Mat foundation founded on a 0.3 m Granular "A" pad b) Rigid concrete Box Culvert: Size is not known - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S. : 350 kPa 2. A temporary earth dyke or stream diversion is required 3. Excavation below the water table require a positive dewatering system	1)Fill height up to 2.5 m will be stable with forward and side slopes of 2:1 2)Cuts to a depth of 2.0 m will be stable with 2:1 side slope 3)Unsuitable material within the plan limit should be fully removed and replaced with well compacted material prior to fill placement.	1. Some positive dewatering system will be required 2. But no major foundation problems were anticipated.

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 6 **STRUCTURE Nos.** 15 **LOCATION** Oshawa Link Under HWY 2

ORIGINAL GROUND ELEV. 139.0 m **PROPOSED HWY** 2/401/407 **GRADE ELEV.** 146.0 m

Reference:

SUBSURFACE CONDITIONS

REFERENCE BOREHOLE

BH 6 (Gr.Elev. 139.6 m)

0.0 - 1.4 : Sand and Gravel Fill
dense

1.4 - 2.5 : Sandy Silt
trace of organics
compact

2.5 - 10.1: Clayey Silt
firm to very stiff

10.1- 12.0: Sand and Gravel
compact

12.0- 15.5: Heterogeneous
Mixture of Silt, Sand
and Gravel
(Glacial Till)
very dense

GROUNDWATER

Water level at 2.1 m below ground surface

RECOMMENDATIONS

STRUCTURE

ABUTMENTS AND PIERS

1. ABUTMENTS

a) A perched-type abutments founded on spread footings on Granular "A" core
- Factored bearing Capacity at U.L.S. : 900 kPa
- Bearing Capacity at S.L.S : 350 kPa

b) Alternatively, deep foundations founded on steel "H" piles driven to a very dense glacial till at a tip elevation below 126.0 m

Type	Factored axial capacity at U.L.S.	Axial capacity at S.L.S.
310H110	1600 kN	1150 kN
310H79	1150 kN	900 kN

2. PIERS

Deep foundations founded on steel "H" piles driven to a very dense glacial till at a tip elevation below 126.0 m
- Pile capacity is the same as above

APPROACHES

1)Fill heights up to 7.0 m will be stable with forward and side slopes of 2:1

2)Unsuitable material within the plan limit of the proposed embankment should be fully removed and replaced with well compacted material prior to the fill placement.

REMARKS

1. No foundation problems are anticipated

2. No major dewatering problems are anticipated

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 7 **STRUCTURE Nos.** 16 and 17 LOCATION Oshawa Link Under Nash Rd. and over Black Creek

ORIGINAL GROUND ELEV. 139.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 138.0 - 145.0 m
Reference:

SUBSURFACE CONDITIONS

REFERENCE BOREHOLE

BH 7 (Gr.Elev. 140.7 m)

0.0 - 0.1 : Pavement
0.1 - 1.1 : Organic Silt
1.1 - 2.1 : Sandy Silt
compact
2.1 - 11.9: Clayey Silt
trace of Gravel
firm to stiff

11.9- 13.2: Sandy Silt
trace of Gravel
compact

13.2- 15.7: Heterogeneous
Mixture of Silt, Sand
and Gravel
(Glacial Till)
very dense

GROUNDWATER

Water level at 3.4 m below ground surface

RECOMMENDATIONS

STRUCTURE

1. NASH ROAD UNDERPASS

ABUTMENTS AND PIERS

a) Deep foundations founded on steel "H" piles driven to a very dense glacial till at a tip elevation below 127.0 m

Type	Factored axial Capacity at U.L.S.	Axial Capacity at S.L.S.
310H110	1600 kN	1150 kN
310H79	1150 kN	900 kN

2. BLACK CREEK CROSSING

BOX CULVERT

a) Mat foundation founded on a 0.3 m Granular "A" pad

b) Rigid concrete box culvert: size not known
- Factored bearing Capacity at U.L.S. : 225 kPa
- Bearing Capacity at S.L.S. : 150 kPa

APPROACHES

NASH ROAD UNDERPASS

1)Fill height up to 5.0 m will be stable with 2:1 side and forward slopes

2)Cuts to a depth of 2 m will be stable with 2:1 side slope

REMARKS

1. A temporary earth dyke or stream diversion is required for Black Creek crossing

2. Some positive dewatering scheme will be required

3. But no major foundation problems are anticipated

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 8 **STRUCTURE Nos.** 18 **LOCATION** Hancock Road over Oshawa Link

ORIGINAL GROUND ELEV. 160.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 158.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 8 (Gr.Elev. 153.3 m) 0.0 - 1.4 : Sand and Gravel Fill compact 1.4 - 15.4: Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) hard GROUNDWATER Borehole dry after completion. Perched water at 3.0 m below the ground surface.	ABUTMENTS AND PIERS Spread footings founded in the hard cohesive glacial till - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S. : Not governed	Cut slope to a depth of 8.0 m will be stable with 2:1 side slope.	1. No serious foundation problems are anticipated 2. No dewatering problems are expected during the excavation

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 9 **STRUCTURE Nos.** 19, Culverts 2 and 3 **LOCATION** Oshawa Link near Pebblestone Road

ORIGINAL GROUND ELEV. 145.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 145.0 - 152.0 m
Reference:

SUBSURFACE CONDITIONS

REFERENCE BOREHOLE

BH 9 (Gr.Elev. 151.2 m)

0.0 - 8.8 : Silty Sand
compact to very dense

8.8 - 10.1: Clayey Silt
firm

10.1- 17.5: Sandy Silt
trace of Clay
loose to compact

17.5- 29.4: Heterogeneous
Mixture of Silt, Sand and Gravel
(Glacial Till)
dense to very dense

GROUNDWATER

Water level at 6.2 m below the ground surface

RECOMMENDATIONS

STRUCTURE

1. BRIDGE ABUTMENTS AND PIERS

Deep foundations founded on steel "H" piles driven to a very dense glacial till at a tip elevation of approximately 130.0 m.

Type	Factored axial Capacity at U.L.S.	Axial Capacity at S.L.S.
310H110	1000 kN	800 kN
310H79	720 kN	630 kN

2. FAREWELL CREEK (TRIBUTARY) CROSSINGS

a) Mat foundation on a 0.3 m Granular "A" pad

b) Rigid concrete box culvert: size not known

- Factored bearing Capacity at U.L.S. : 150 kPa
- Bearing Capacity at S.L.S. : 250 kPa

APPROACHES

1)Fill height up to 7.0 m will be stable with side and forward slopes

2)Unsuitable material within the plan limit of the proposed embankment should be fully removed and replaced with well compacted material prior to the fill placement

REMARKS

1. A temporary earth dyke or stream diversion is required for Farewell crossings

2. Some positive dewatering scheme will be required.

3. But no major foundation problems are anticipated.

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 10 **STRUCTURE Nos.** 20 **LOCATION** Oshawa Link over Farewell Creek

ORIGINAL GROUND ELEV. 146.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 149.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 10 (Gr.Elev. 152.6 m) 0.0 - 0.4 : Organic Topsoil 0.4 - 1.4 : Silty Sand trace of gravel compact 1.4 - 2.9 : Sand and Gravel trace of Silt very dense 2.9 - 9.6 : Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense GROUNDWATER Water level at 1.6 m below the ground surface	BRIDGE ABUTMENTS a) A perched-type abutments founded on spread footings on Granular "A" core - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S : 350 kPa Organic material should be fully removed and replaced with well compacted Granular "A" pad b) Spread footing on the very dense glacial till - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S. : Not governed	1)Fill height up to 4.0 m will be stable with 2:1 side and forward slopes. 2)Unsuitable material within the plan limit should be fully removed and replaced with well compacted material.	1.A temporary earth dyke or stream diversion is required 2.Some positive dewatering scheme will be required. 3.But no major foundation problems are anticipated.

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 11 **STRUCTURE Nos.** 21 **LOCATION** Regional Road 4 over Oshawa Link

ORIGINAL GROUND ELEV. 181.0 m **PROPOSED HWY** 401 / 407 **GRADE ELEV.** 180.0 - 187.0 m

Reference:

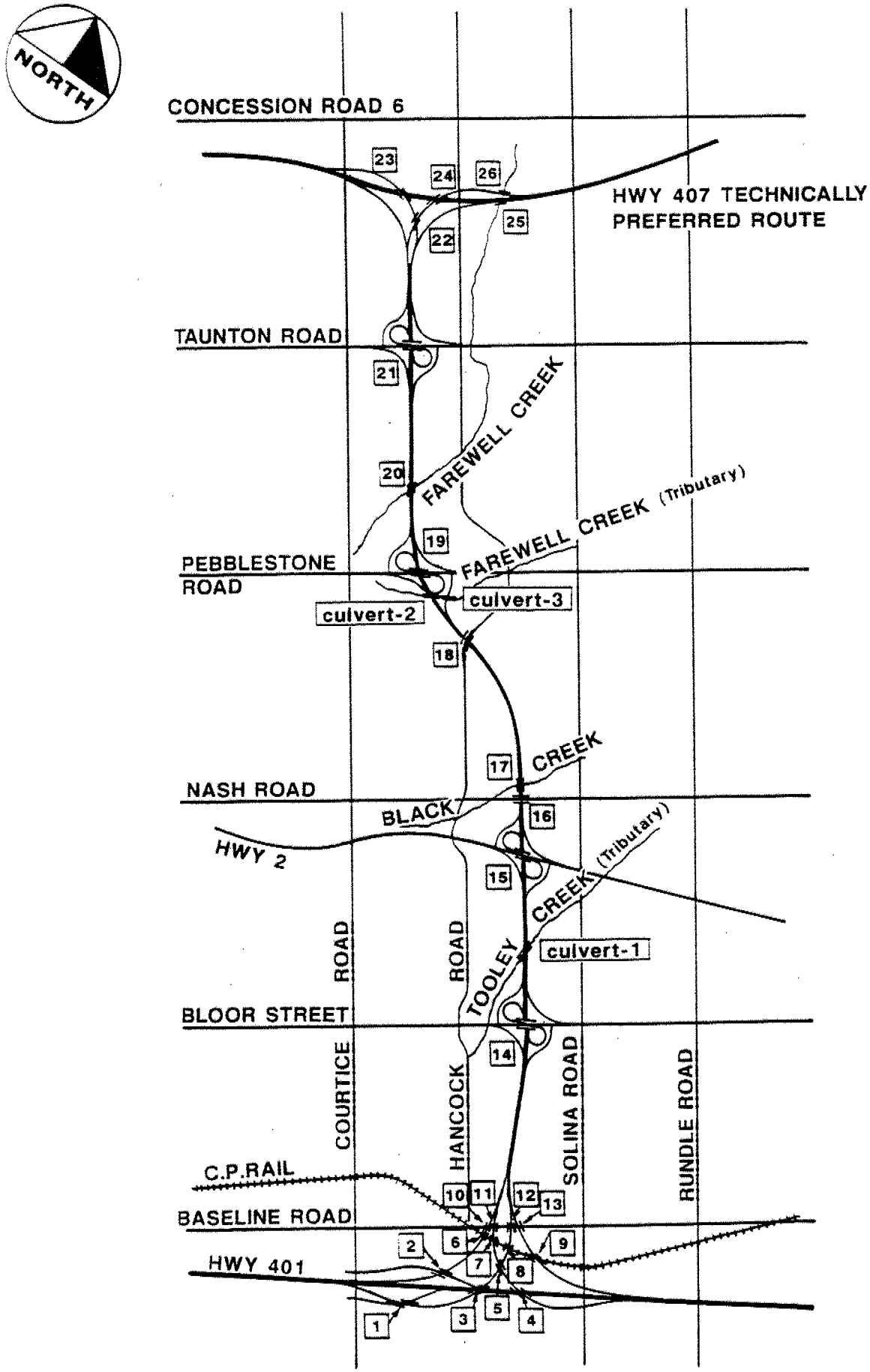
SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 11 (Gr.Elev. 180.3 m) 0.0 - 0.4 : Organic Top Soil 0.4 - 4.2 : Sandy Silt to Silty Sand compact to dense 4.2 - 5.6 : Sand and Gravel some Silt very dense 5.6 - 9.5 : Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense GROUNDWATER Water level at 4.4 m below the ground surface	ABUTMENTS AND PIERS 1. ABUTMENTS a) A perched-type abutments founded on spread footings on Granular "A" core (minimum thickness of 3 m) - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S. : 350 kPa b) A closed-type abutments founded on spread footings on Sandy Silt to Silty Sand material - Factored bearing Capacity at U.L.S. : 560 kPa - Bearing Capacity at S.L.S. : 220 kPa 2. PIERS a) Spread footings on compact Silty Sand - Factored bearing Capacity at U.L.S. : 560 kPa - Bearing Capacity at S.L.S. : 220 kPa b) Alternatively, excavate down to 177.5 m and backfilled with Granular "A" pad - Factored bearing Capacity at U.L.S. : 900 kPa - Bearing Capacity at S.L.S. : 350 kPa	1)Fill height up to 7.0 m will be stable with forward and side slopes of 2:1 2)Unsuitable organic material within the plan limit should be fully removed and replaced with well compacted material.	1.No serious foundation problems are anticipated 2.No major dewatering problems are anticipated for excavation of footings.

FOUNDATION DATA SHEET

W.P. 663-89-00 **AREA** 12 **STRUCTURE Nos.** 22, 23, 24, 25 and 26 **LOCATION** Oshawa Link at HWY 407 Interchange

ORIGINAL GROUND ELEV. 215.0 m **PROPOSED HWY** 407/401 **GRADE ELEV.** **202.0 m**
Reference:

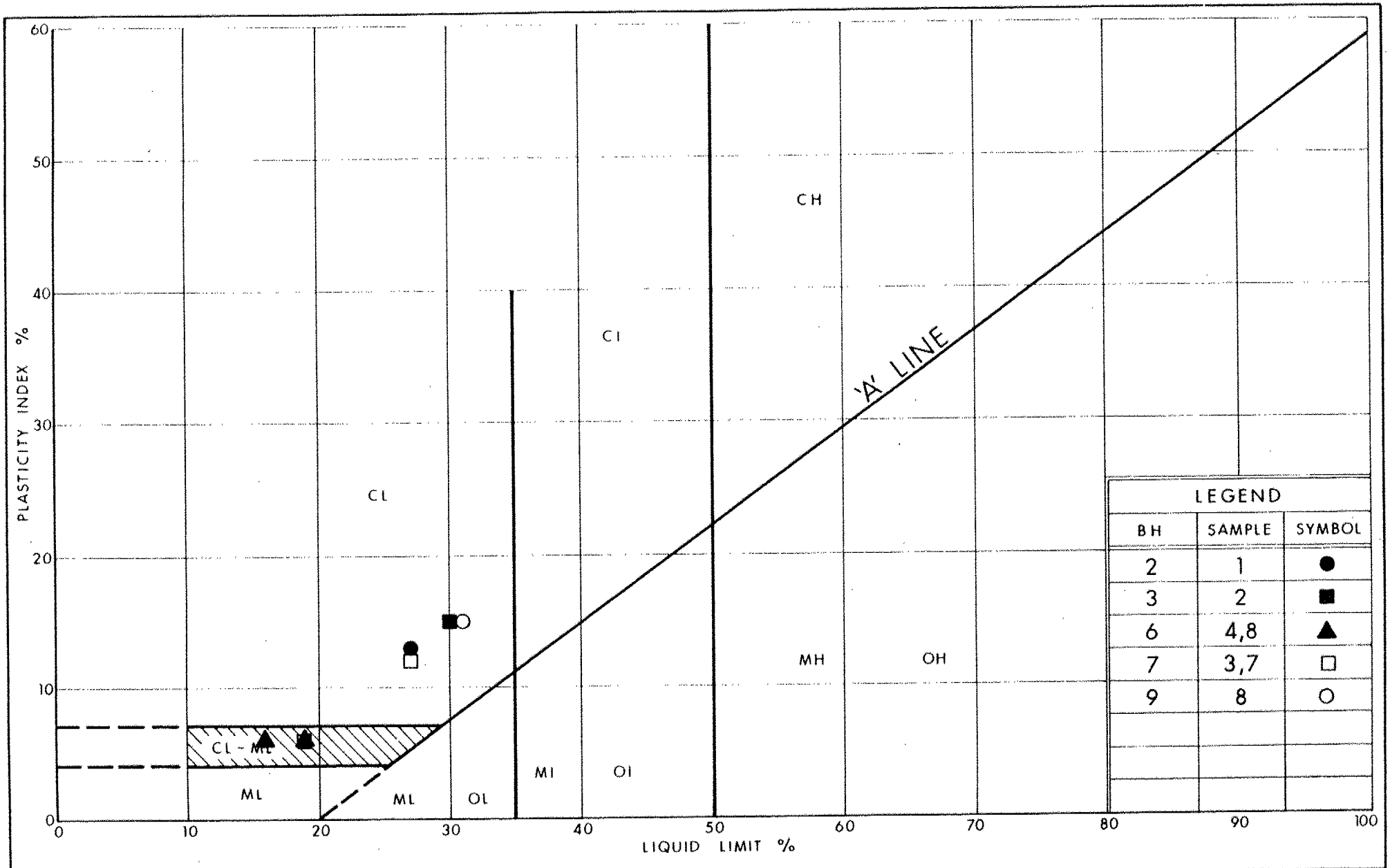
SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE BH 12 (Gr.Elev. 214.3 m) 0.0 - 0.5 : Organic Top Soil 0.5 - 15.4: Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) compact to very dense GROUNDWATER Borehole dry upon completion	1. FOR STRUCTURES 22, 23 AND 24 a) ABUTMENTS AND PIERS Spread footings on the very dense glacial till at an elevation below 211.0 m - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S : Not governed 2. FOR STRUCTURES 25 AND 26 a) ABUTMENTS Spread footings on the dense glacial till at an elevation below 213.0 m - Factored bearing Capacity at U.L.S. : 1,000 kPa - Bearing Capacity at S.L.S : 500 kPa	1)Fill height up to 8.0 m will be stable with forward and side slopes of 2:1. 2)Cuts to a depth of approximately 7.0 m will be stable with 2:1 side slope. 3)Cut depths greater than 7.0 m will be required a mid-height safety berm with proper drainage trench. 4)Unsuitable material within the plan limit should be fully removed and replaced with well compacted material prior to the fill placement.	1.A temporary earth dyke or stream diversion is required for structures 25 and 26. 2.Accordingly, some positive dewatering scheme will be required for Farewell Creek crossing. 3.No serious foundation problems are anticipated. 4.No major dewatering problems are anticipated for excavation of footings for structures 22, 23 and 24.



STRUCTURAL REFERENCE PLAN

Fig No 1

WP 663-89-00



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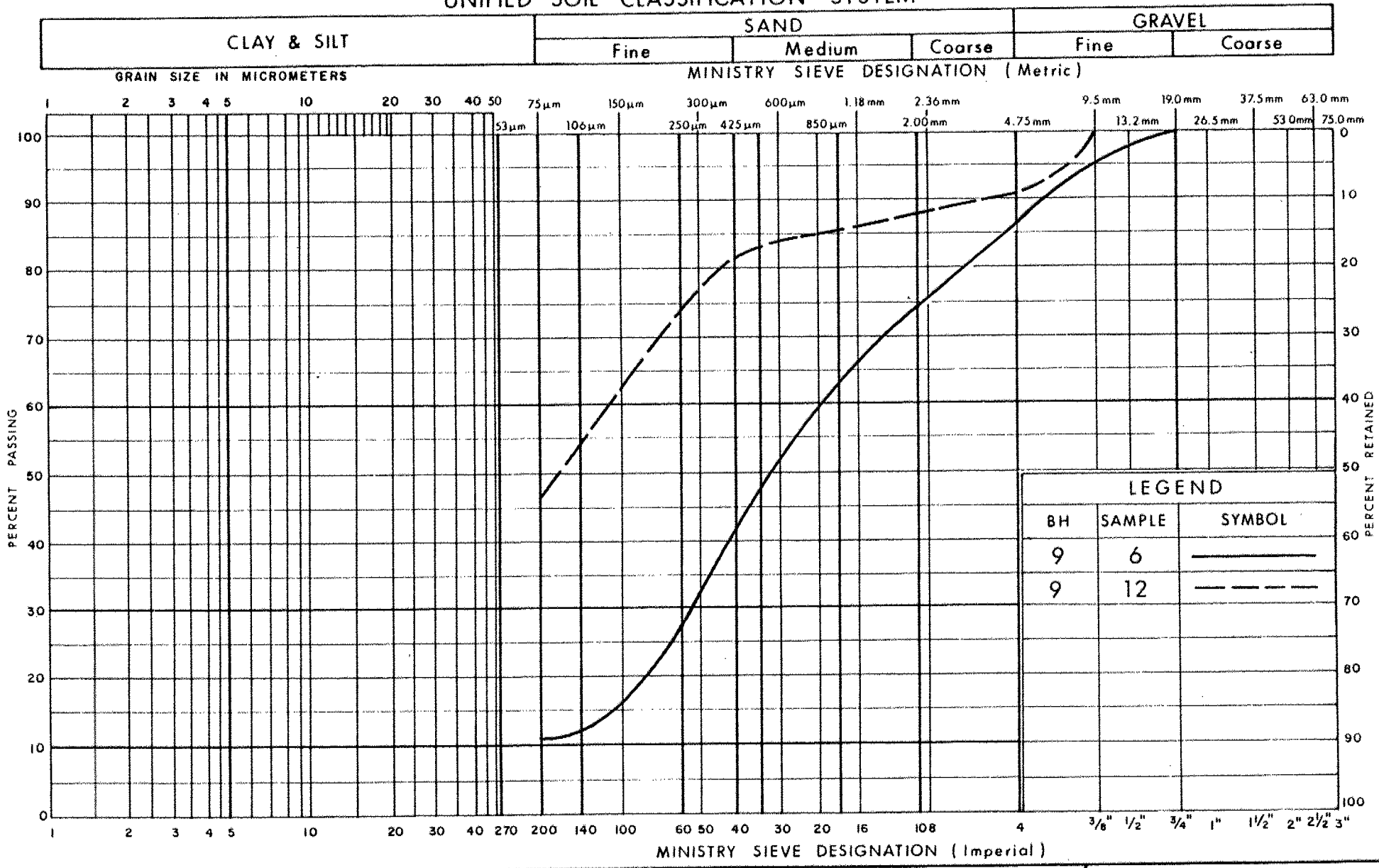
PLASTICITY CHART
CLAYEY SILT

FIG No 2
W P 663-89-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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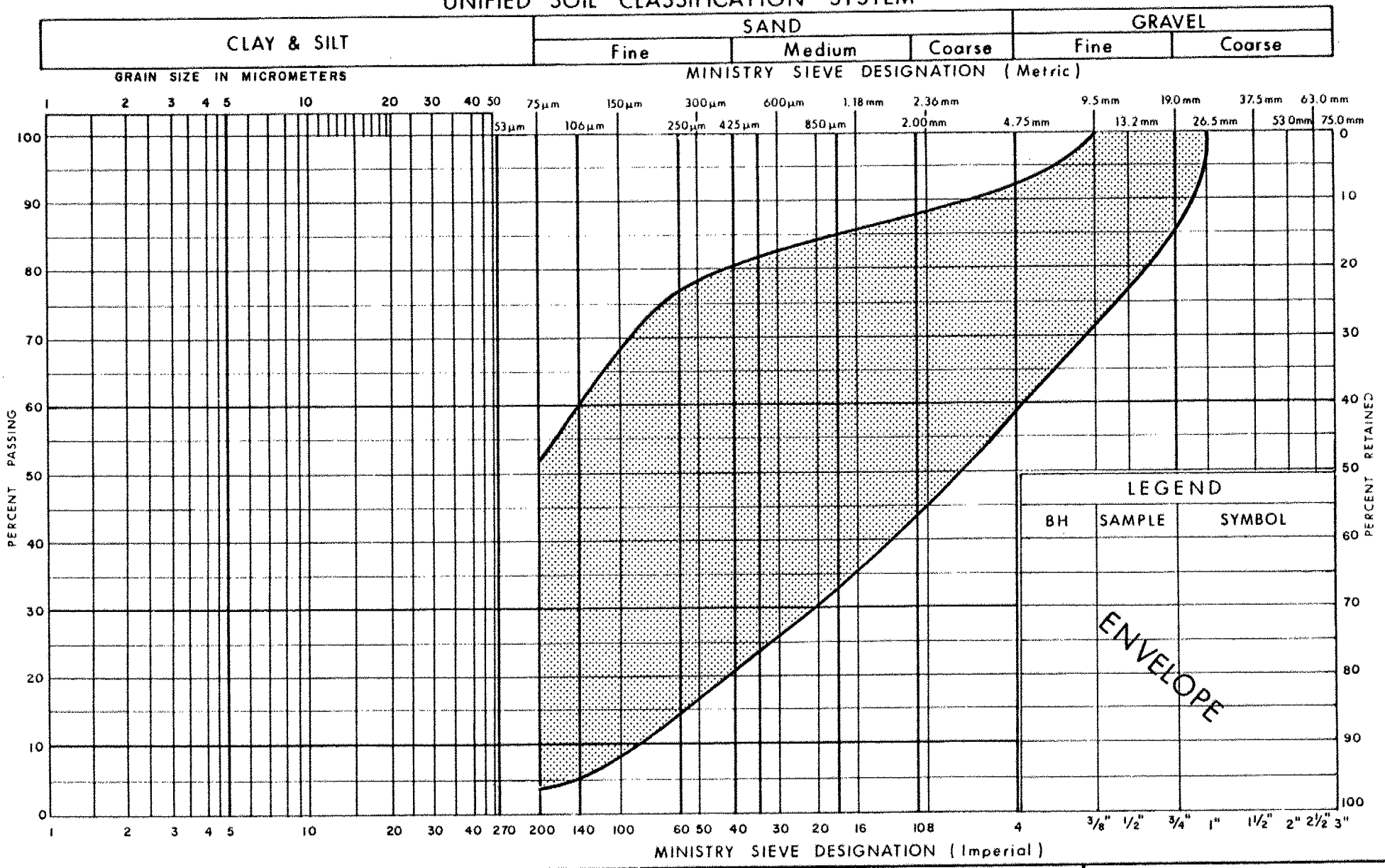
GRAIN SIZE DISTRIBUTION
SANDY SILT TO SILTY SAND

FIG No 3

W P 663-89-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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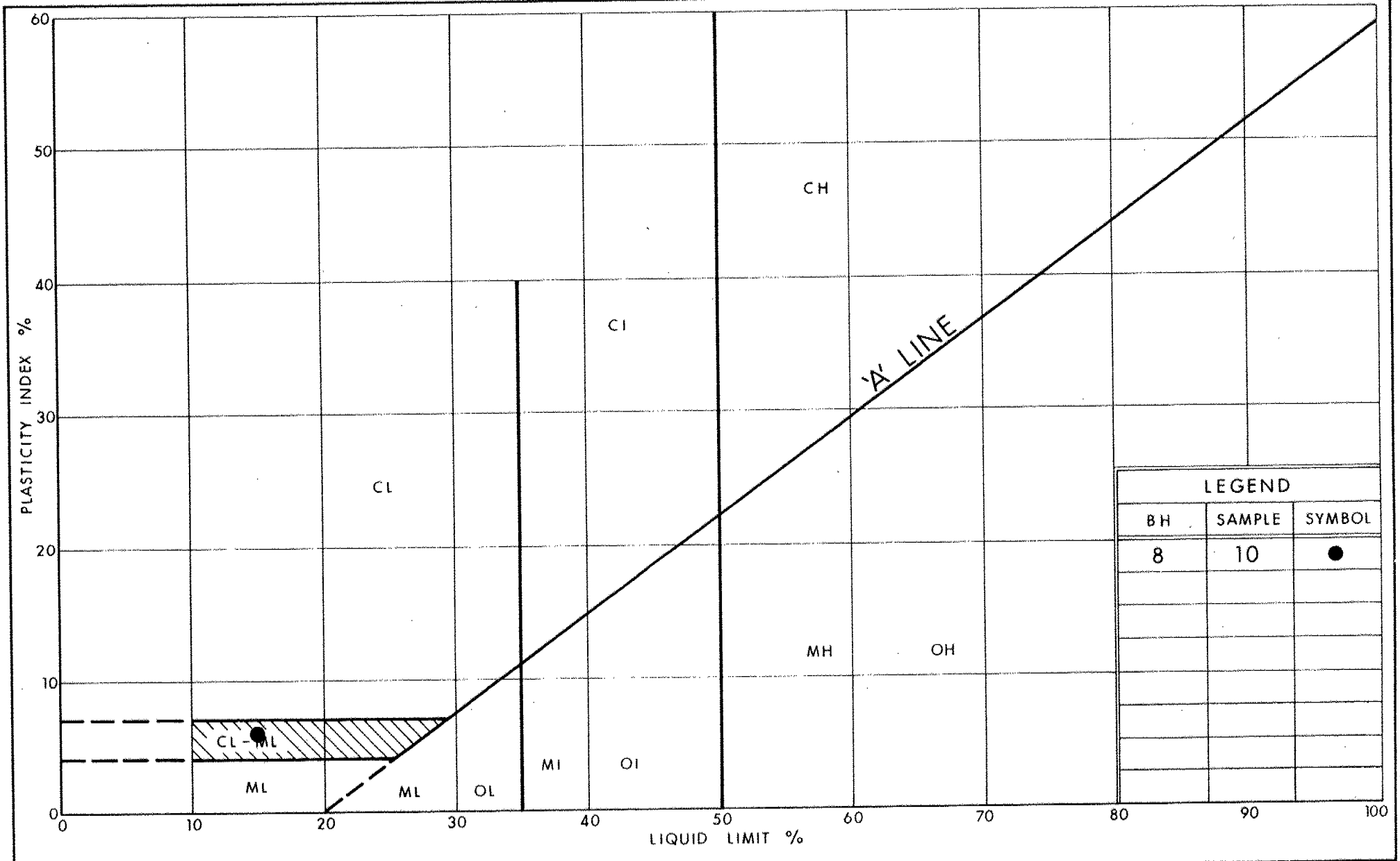
GRAIN SIZE DISTRIBUTION
HET MIXTURE OF SILT, SAND & GRAVEL
(NON-COHESIVE GLACIAL TILL)

FIG No 4

W P 663-89-00



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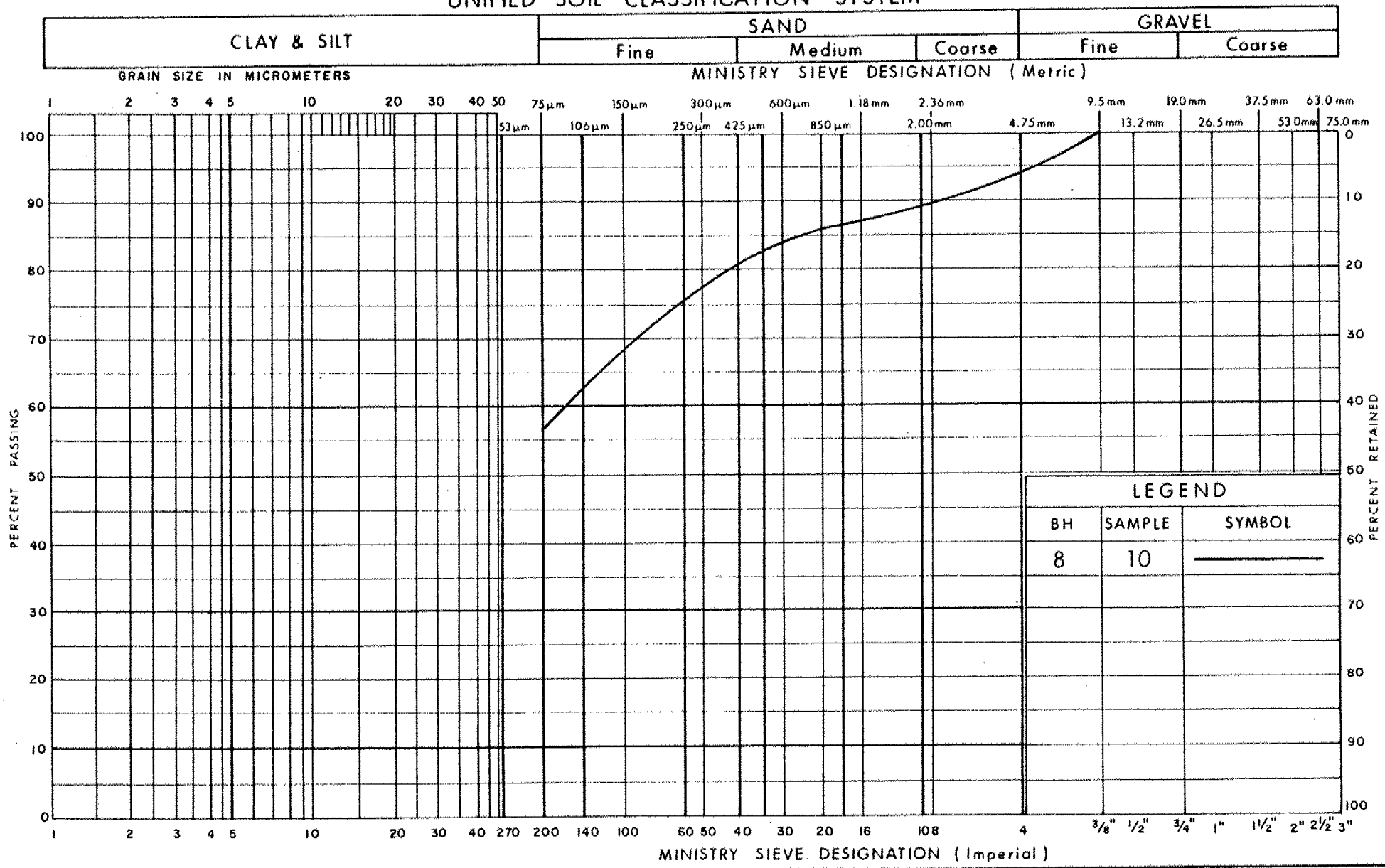
PLASTICITY CHART
HET MIXTURE OF CLAYEY SILT, SAND & GRAVEL
(COHESIVE GLACIAL TILL)

FIG No 5
W P 663-89-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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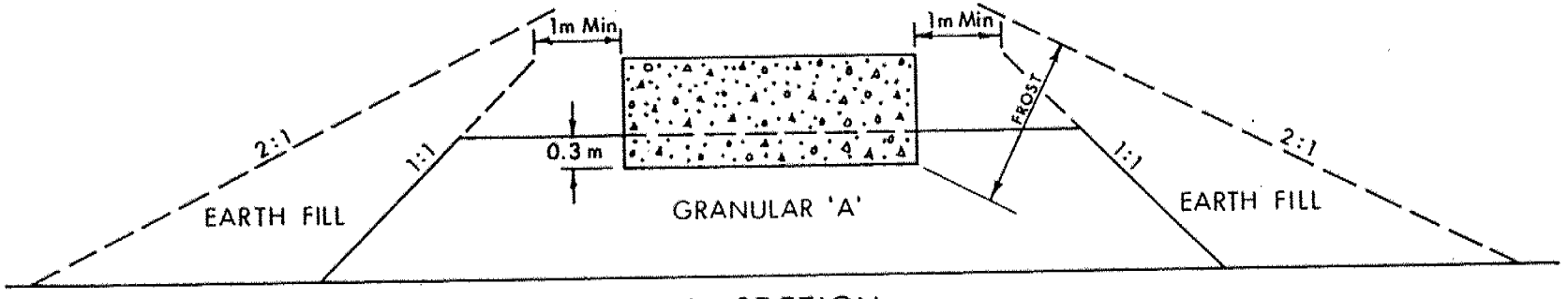
GRAIN SIZE DISTRIBUTION

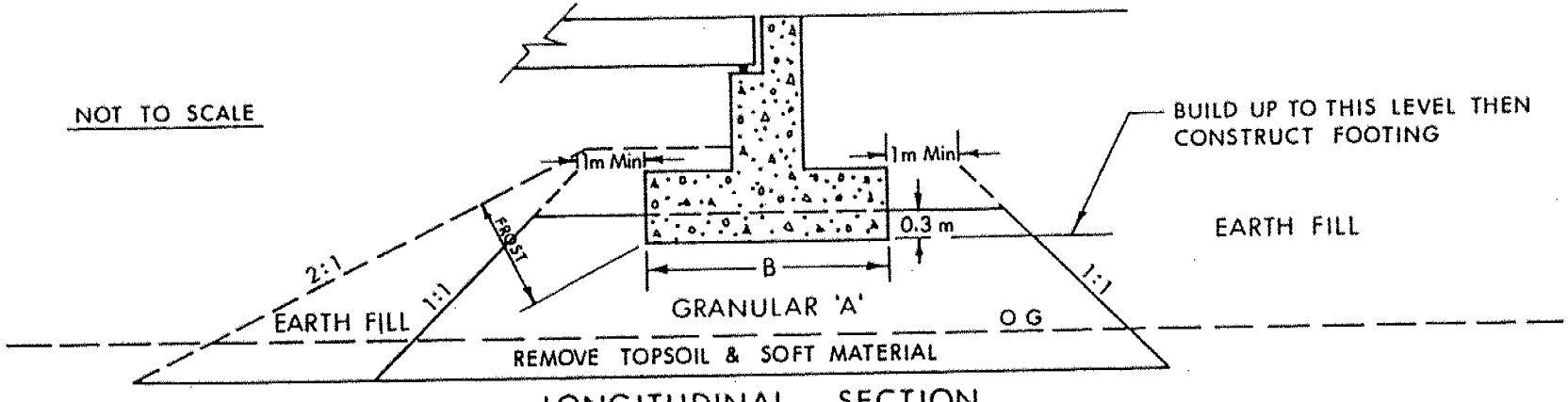
HET MIXTURE OF CLAYEY SILT, SAND & GRAVEL
(COHESIVE GLACIAL TILL)

FIG No 6

W P 663-89-00



X SECTION



LONGITUDINAL SECTION

NOTES:

1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.

2 - PLACE GRANULAR 'A' & EARTH FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M T O STANDARDS.

3 - CONSTRUCT CONCRETE FOOTING.

4 - PLACE REMAINDER OF GRANULAR 'A' & EARTH FILL AS REQUIRED.

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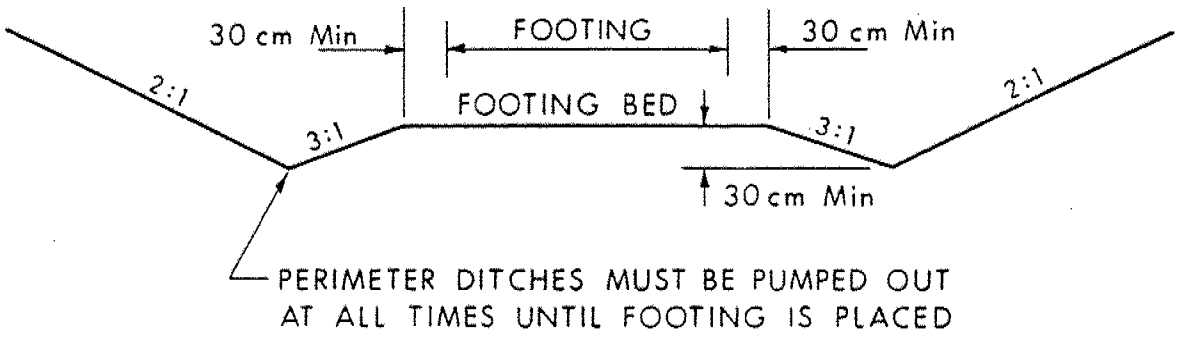
ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE

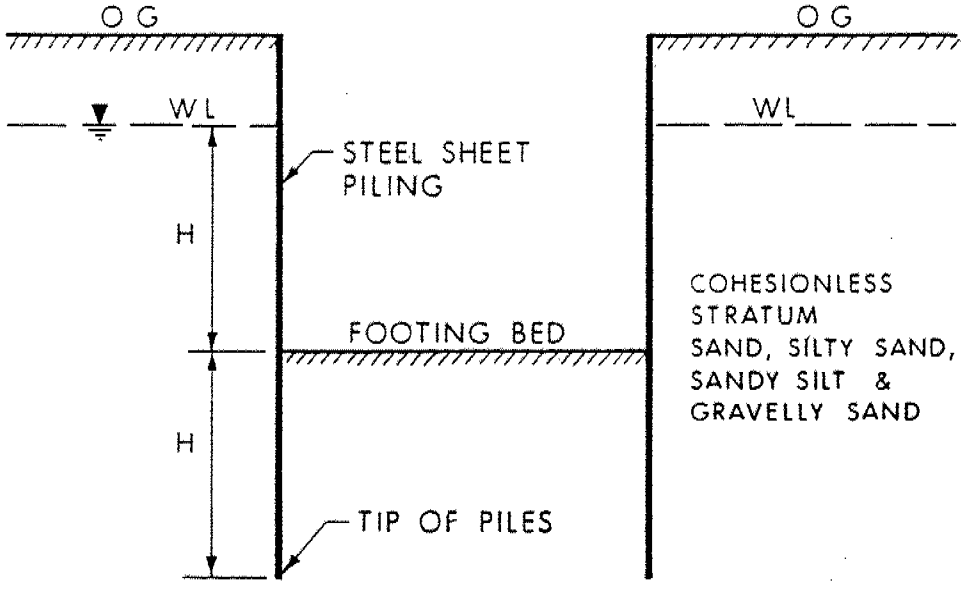
FIG No 7

W P 663-89-00



OVERSIZE EXCAVATION WITH PERIMETER DRAINS

FIG No 8



STEEL SHEET PILING

FIG No 9

WP 663-89-00

RECORD OF BOREHOLE No 1 — 1 OF 1 — METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 860 046.5 ; E 364 817.7 ORIGINATED BY DO & TK

DIST 6 HWY 401/407 BOREHOLE TYPE SOLID STEM AUGER COMPILED BY D O

DATUM GEODETIC DATE 93 12 07 CHECKED BY T K

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 kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
104.5	Ground Surface										
0.0	Sand and Gravel (Fill) occ. Silt layers brown		1	SS	34		104				
102.9											
1.6	Organic Silt d. brown — grey		2	SS	13						
			3	SS	38	▼	102				21 43 (36)
			4	SS	100/15cm						
			5	SS	100/15cm		100				
			6	SS	106/20cm						
	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) compact to very dense		7	SS	68		98				
			8	SS	17		96				8 41 (51)
			9	SS	37						
			10	SS	75		94				
			11	SS	100/15cm		92				
89.1			12	SS	125/15cm		90				
15.4	End of Borehole										

+³, ×⁵ : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 2 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 860 257.7 ; E 364 725.3 ORIGINATED BY DO & TK

DIST 6 HWY 401/407 BOREHOLE TYPE SOLID STEM AUGER COMPILED BY D O

DATUM GEODETIC DATE 93 12 07 CHECKED BY T K

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; 20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
105.0	Ground Surface										
0.0 / 103.6	Clayey Silt, trace of Sand, stiff		1	SS	9		104				
1.4 / 102.9	Silty Sand, compact		2	SS	16						
2.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till), very dense; brown grey		3	SS	105		102				13 39 (48)
			4	SS	100/15cm						
			5	SS	100/30cm	▼	100				
			6	SS	120/15cm		98				
96.9			7	SS	120						8 41 (51)
8.1	End of Borehole				/15cm						

+³, ×⁵ : Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No 3 — 1 OF 1 — METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 860 513.1 ; E 364 906.0 ORIGINATED BY T K

DIST 6 HWY 401/407 BOREHOLE TYPE HOLLOW STEM AUGER COMPILED BY D O

DATUM GEODETIC DATE 93 12 13 CHECKED BY T K

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (o UNCONFINED, + FIELD VANE, • QUICK TRIAXIAL, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
108.5	Ground Surface							20 40 60 80 100	10 20 30		
0.0 / 107.5	Pavement Sand and Gravel (Fill) brown		1	SS	15		108				
1.0 / 106.6	Organic Silt d. brown Clayey Silt, trace of organics		2	SS	14						
106.1	Silty Sand, some Gravel compact to very dense brown		3	SS	110/25cm						
2.4	grey		4	SS	101/8cm	▼	106				
	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense		5	SS	103/15cm		104				
			6	SS	103/13cm						
101.5			7	SS	106/15cm		102				
7.0	End of Borehole										

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

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

RECORD OF BOREHOLE No 4 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 862 364.1 ; E 364 504.3 ORIGINATED BY T K

DIST 6 HWY 401/407 BOREHOLE TYPE HOLLOW STEM AUGER COMPILED BY D O

DATUM GEODETIC DATE 93 12 13 CHECKED BY T K

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 kPa o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
126.8	Ground Surface									
0.0 / 125.4	Pavement Sand and Gravel (Fill), dense		1	SS	30		126			
1.4	brown / grey Heterogeneous Mixture of Silt, Sand and Gravel, (Glacial Till), very dense		2	SS	121					
			3	SS	103/36cm		124			
			4	SS	103/23cm	▼				6 39 (55)
121.2			5	SS	68		122			
5.6	Fine to medium Sand, dense		6	SS	31					
			7	SS	31		120			
			8	SS	43		118			
115.9			9	SS	87		116			40 51 (9)
10.9 / 115.2	Heterogeneous Mixture of Silt, Sand and Gravel, very dense		10	SS	304/23cm					
11.6	End of Borehole									

+^{3}, ×^{5} : Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No 5 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 862 915.5 ; E 363 863.7 ORIGINATED BY DO & TK

DIST 6 HWY 401/407 BOREHOLE TYPE SOLID STEM AUGER COMPILED BY D O

DATUM GEODETIC DATE 93 12 08 CHECKED BY T K

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
134.0	Ground Surface										
0.0	Top Soil					▼	133				
	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) dense to very dense brown		1	SS	45						
			2	SS	100						
			3	SS	120/15cm						
			4	SS	120/15cm		131				
129.9											
4.1	grey										
	Fine to medium Sand, very dense		5	SS	110/20cm		129				
			6	SS	120/15cm						
			7	SS	130/8cm		127				
125.5											
8.5	End of Borehole at probable Boulders or Bedrock										

+³, ×⁵ : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 6 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 863 745.6 ; E 364 092.7 ORIGINATED BY M V

DIST 6 HWY 401/407 BOREHOLE TYPE HOLLOW STEM AUGER AND VANE TESTS COMPILED BY M V

DATUM GEODETIC DATE 93 12 10 CHECKED BY T K

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
139.6	Ground Surface										
0.0 / 138.2	Sand and Gravel (Fill), dense brown		1	SS	43		139				
1.4 / 137.1	Organics & brown Sandy Silt, compact grey		2	SS	20	▼					
			3	SS	11		137				
2.5			4	SS	38						
			5	SS	27		135				
	Clayey Silt, firm to very stiff		6	SS	12		133				
			7	SS	3						
							131	+2			
129.5	trace of Gravel		8	SS	4						
10.1 / 127.6	Sand and Gravel, compact		9	SS	26		129				
12.0			10	SS	81						29 38 (33)
	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense						127				
124.1			11	SS	139 /23cm		125				
15.5	End of Borehole										

+³, ×⁵ : Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No 7 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 864 452.1 ; E 363 821.5 ORIGINATED BY DO & TK

DIST 6 HWY 401/407 BOREHOLE TYPE SOLID AND HOLLOW STEM AUGER, VANE TESTS COMPILED BY D O

DATUM GEODETIC DATE 93 12 09 CHECKED BY T K

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS
140.4	Ground Surface					
0.0	Pavement, base material					
139.3	Organic Silt dark brown		1	SS	17	
1.1	Sandy Silt, brown					
138.3	compact brown		2	SS	29	
2.1	grey		3	SS	20	
			4	SS	26	▼
			5	SS	4	
	Clayey Silt,		6	SS	3	
	trace of Gravel		7	SS	3	
	firm to stiff		8	SS	5	
			9	SS	6	
128.5						
11.9	Sandy Silt,		10	SS	23	
127.2	trace of Gravel, compact					
13.2	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		11	SS	106/30cm	
	very dense					
124.7			12	SS	120	
15.7	End of Borehole				30cm	

ELEVATION SCALE: 140, 138, 136, 134, 132, 130, 128, 126

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m³

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

+3, ×5 : Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No 8 — 1 OF 1 — METRIC

W.P. 663 - 89 - 00 — LOCATION Co-ords: N 4 865 492.3 ; E 363 005.9 — ORIGINATED BY M V

DIST 6 — HWY 401/407 — BOREHOLE TYPE SOLID STEM AUGER — COMPILED BY M V

DATUM GEODETIC — DATE 93 12 08 & 09 — CHECKED BY T K

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, + FIELD VANE, • QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
153.3	Ground Surface										
0.0 / 151.9	Sand and Gravel (Fill), compact		1	SS	21	*	152				
1.4	brown / grey		2	SS	60						
			3	SS	128/20cm						
			4	SS	100/10cm		150				
			5	SS	100/25cm						
			6	SS	120/13cm		148				
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till), hard		7	SS	128/15cm						
			8	SS	120/15cm		146				
			9	SS	100/15cm						
			10	SS	140/23cm		144		o		6 37 (57)
			11	SS	133/23cm						
137.9			12	SS	130/20cm		142				
15.4	End of Borehole						140				
							138				

* Perched water around 3.0 m, Borehole dry on completion

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

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

RECORD OF BOREHOLE No 9 — 1 OF 1 — METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 866 233.5 ; E 362 462.8 ORIGINATED BY M V

DIST 6 HWY 401/407 BOREHOLE TYPE HOLLOW STEM AUGER COMPILED BY M V

DATUM GEODETIC DATE 93 12 07 & 08 CHECKED BY T K

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
151.2	Ground Surface					
0.0	Top Soil		1	SS	6	
			2	SS	15	
	Clayey Silt, brown grey		3	SS	19	
			4	SS	26	
	Silty Sand, compact to very dense		5	SS	64	
			6	SS	33	▼
142.4			7	SS	20	
8.8	Clayey Silt, firm		8	SS	5	
141.1						
10.1	Sandy Silt, trace of Clay, loose to compact		9	SS	6	
			10	SS	12	
			11	SS	14	
			12	SS	8	
			13	SS	31	
133.7						
17.5	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) dense to very dense		14	SS	48	
			15	SS	37	
			16	SS	54	
			17	SS	58	
			18	SS	40	
			19	SS	33	
			20	SS	63	
121.8			21	SS	60	
29.4	End of Borehole					

ELEVATION SCALE: 150, 148, 146, 144, 142, 140, 138, 136, 134, 132, 130, 128, 126, 124, 122

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	13	77	(10)	
	9	45	(46)	
	15	41	(44)	
	14	38	(48)	

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

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

RECORD OF BOREHOLE No 10 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 866 651.9 ; E 361 767.8 ORIGINATED BY M V

DIST 6 HWY 401/407 BOREHOLE TYPE HOLLOW STEM AUGER COMPILED BY M V

DATUM GEODETIC DATE 93 12 07 CHECKED BY T K

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
152.6	Ground Surface										
0.0	Organics										
151.2	Silty Sand, trace of Gravel compact brown		1	SS	29	*	152				
1.4	Sand and Gravel, trace of Silt very dense grey		2	SS	68						
149.7			3	SS	95		150				
2.9	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) very dense		4	SS	118						
			5	SS	121/15cm		148				
			6	SS	106/13cm						
			7	SS	128		146				9 85 (6)
143.0			8	SS	108		144				
9.6	End of Borehole										

* Perched Water at 1.6 m

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

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

RECORD OF BOREHOLE No 11 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 868 176.4 ; E 361 751.9 ORIGINATED BY M V

DIST 6 HWY 401/407 BOREHOLE TYPE SOLID STEM AUGER COMPILED BY M V

DATUM GEODETIC DATE 93 12 06 CHECKED BY T K

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
180.3	Ground Surface										
0.0	Organics						180				
	Sandy Silt to Silty Sand, compact to dense		1	SS	15						
			2	SS	14						
			3	SS	10		178				
			4	SS	46						
176.1						▼					
4.2	Sand and Gravel, some Silt very dense brown		5	SS	91/15cm		176				
174.7											
5.6	grey Heterogeneous Mixture of Silt, Sand and Gravel, occ. Clayey Silt layers, (Glacial Till) very dense		6	SS	141/15cm		174				
			7	SS	106/15cm						
	Clayey Silt						172				
170.8			8	SS	153/23cm						4 10 (86)
9.5	End of Borehole										

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

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 12 1 OF 1 METRIC

W.P. 663 - 89 - 00 LOCATION Co-ords: N 4 869 492.6 ; E 361 267.5 ORIGINATED BY M V

DIST 6 HWY 401/407 BOREHOLE TYPE SOLID STEM AUGER COMPILED BY M V

DATUM GEODETIC DATE 93 12 06 CHECKED BY T K

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
214.3	Ground Surface											
0.0	Top Soil						214					
			1	SS	21	*						
			2	SS	39							
			3	SS	54		212					
			4	SS	94/15cm							
	brown / grey		5	SS	117/15cm		210					
			6	SS	121/15cm							
	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) compact to very dense		7	SS	144/15cm		208					
			8	SS	114/15cm							
			9	SS	126/15cm		206					
			10	SS	113/15cm							
			11	SS	139/15cm		204					
198.9			12	SS	126/13cm		202					
15.4	End of Borehole						200					

* Borehole dry on completion

+³, ×⁵ : Numbers refer to Sensitivity

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

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

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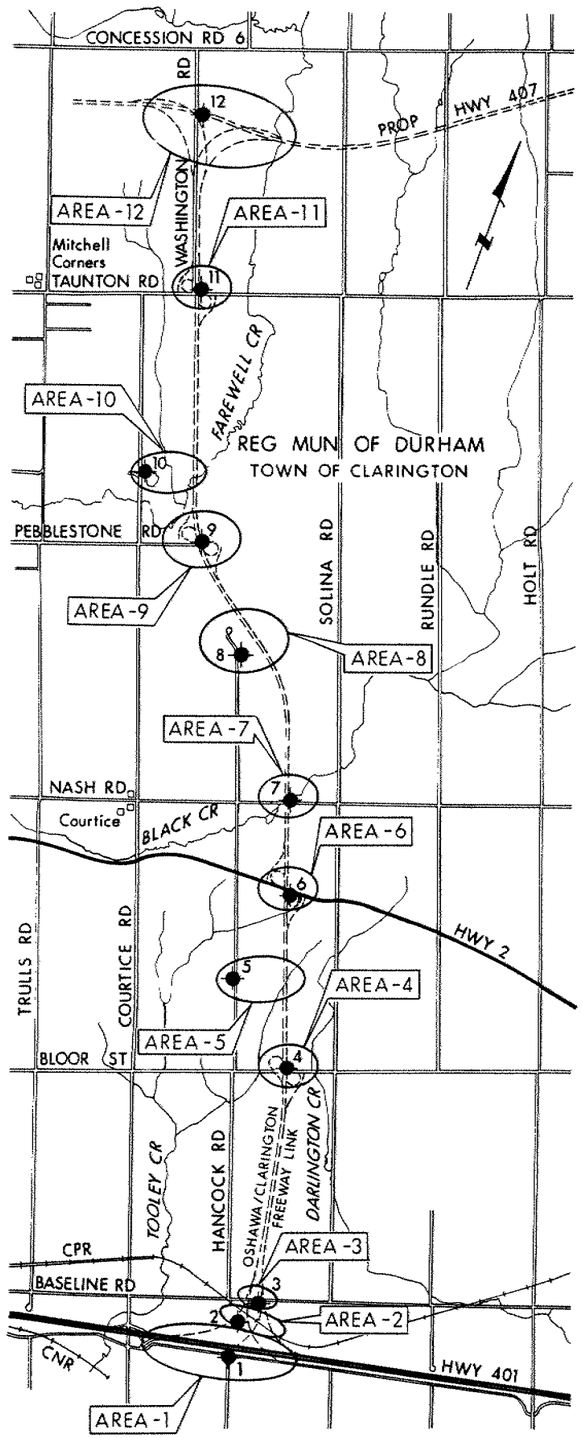

PLAN
SCALE
500m 0 500m

AREA & BOREHOLE No	STRUCTURAL REFERENCE No	DESCRIPTION
1	1	Freeway Link W-N ramp over relocated Courtice Rd / Hwy 401 interchange N/S-E ramp
	2	Relocated Courtice Rd / Hwy 401 interchange E-N/S ramp over Freeway Link N-W ramp
	3	Freeway Link W-N ramp over Hwy 401
	4	Freeway Link N-E ramp over Hwy 401
	5	Freeway Link N-E ramp over Freeway Link W-N ramp at Freeway Link / Hwy 401 interchange
2	6	Freeway Link N-W ramp over CP Rail
	7	Freeway Link N-E ramp over CP Rail
	8	Freeway Link W-N ramp over CP Rail
	9	Freeway Link E-N ramp over CP Rail
3	10	Freeway Link N-W ramp over Baseline Rd
	11	Freeway Link N-E ramp over Baseline Rd
	12	Freeway Link W-N ramp over Baseline Rd
	13	Freeway Link E-N ramp over Baseline Rd
4	14	Bloor St over Freeway Link
6	15	Hwy 2 over Freeway Link
7	16	Nash Rd over Freeway Link
	17	Freeway Link over Black Creek
8	18	Hancock Rd over Freeway Link
9	19	Pebblestone Rd over Freeway Link
10	20	Freeway Link over Farewell Creek
11	21	Taunton Rd over Freeway Link
12	22	Freeway Link E-S ramp over Freeway Link S-W ramp at Freeway Link / Hwy 407 interchange
	23	Freeway Link S-W ramp over proposed Hwy 407
	24	Freeway Link E-S ramp over proposed Hwy 407
	25	Freeway Link S-E ramp over Farewell Creek
	26	Freeway Link E-S ramp over Farewell Creek
5	Culvert - 1	Freeway Link crossing north of Bloor St
9	Culvert - 2	Freeway Link crossing south of Pebblestone Rd
	Culvert - 3	Freeway Link S-E/W ramp crossing south of Pebblestone Rd

NOTE
For Soil details refer to Record of Borehole Sheets

REF No NTS Maps 30M/15f, 30M/15g & 30M/15b 1976; & PLAN (Technically Preferred Route) 1992 02

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

CONT No
WP No 663-89-00

OSHAWA/CLARINGTON FREEWAY LINK
HWY 401 TO PROP HWY 407
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

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)
- W L at time of investigation 93 12

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	104.5	4 860 046.5	364 817.7
2	105.0	4 860 257.7	364 725.3
3	108.5	4 860 513.1	364 906.0
4	126.8	4 862 364.1	364 504 3
5	134.0	4 862 915.5	363 863.7
6	139.6	4 863 745.6	364 092.7
7	140.4	4 864 452.1	363 821.5
8	153.3	4 865 492.3	363 005.9
9	151.2	4 866 233.5	362 462.8
10	152.6	4 866 651.9	361 767.8
11	180.3	4 868 176.4	361 751.9
12	214.3	4 869 492.6	361 267.6

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 GC 2.01 of OPS Gen Cond

LICENSED PROFESSIONAL ENGINEER T.C. KIM PROVINCE OF ONTARIO

REV	DATE	BY	DESCRIPTION

Geocres No 30M15-83

HWY No 401/407 OSHAWA FREEWAY LINK			DIST 6
SUBM'D TCK	CHECKED	DATE 1994 01 18	SITE
DRAWN DT	CHECKED	APPROVED	DWG 6638900-A