DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-160

DIST. 6 REGION

W.P. No. 127-66-69

CONT. No. 82-107

W. O. No.

STR. SITE No. 24-81-463

HWY. No. 403

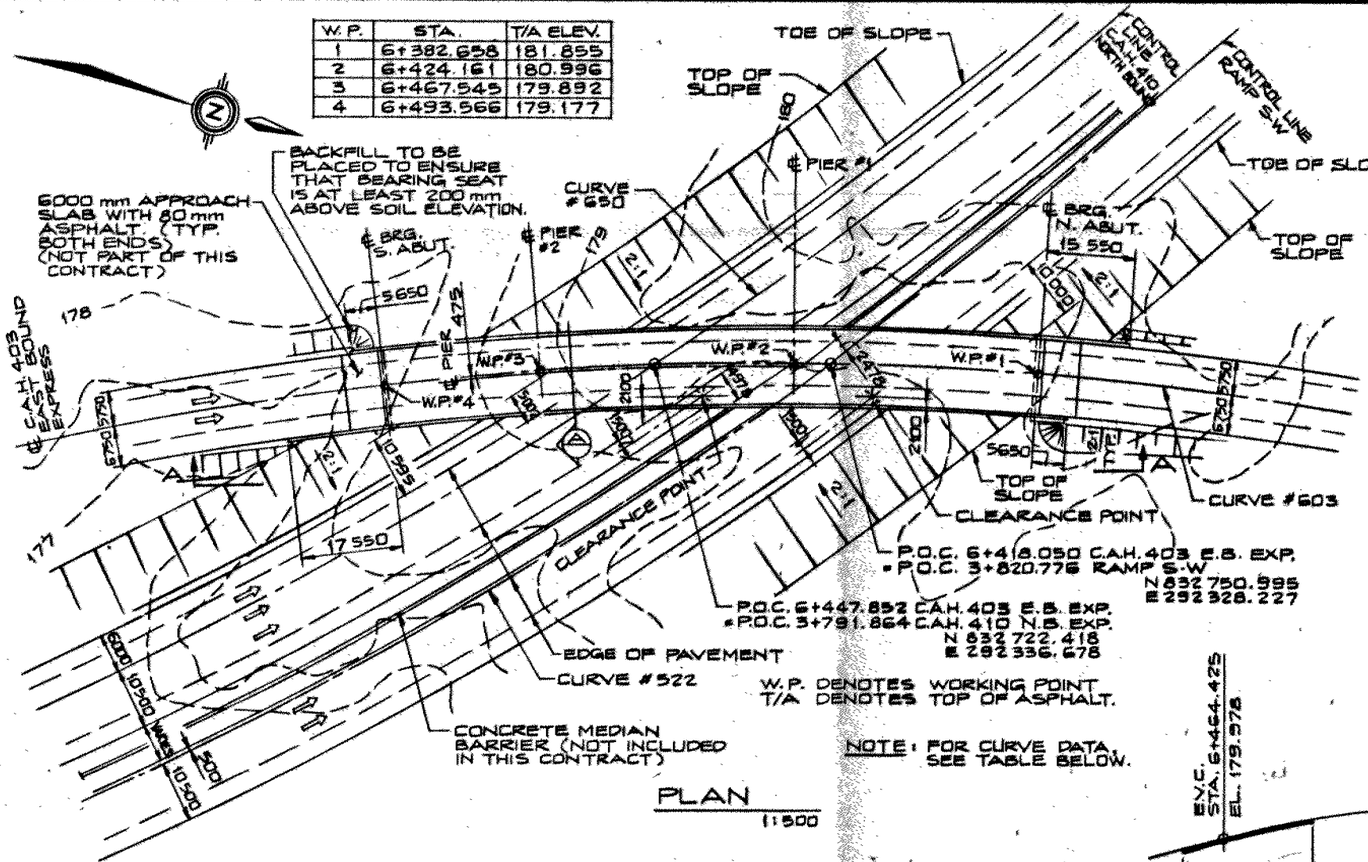
LOCATION Bridge #35, Hwy 403 EB Expressway over Hwy 410 & Ramp S-W

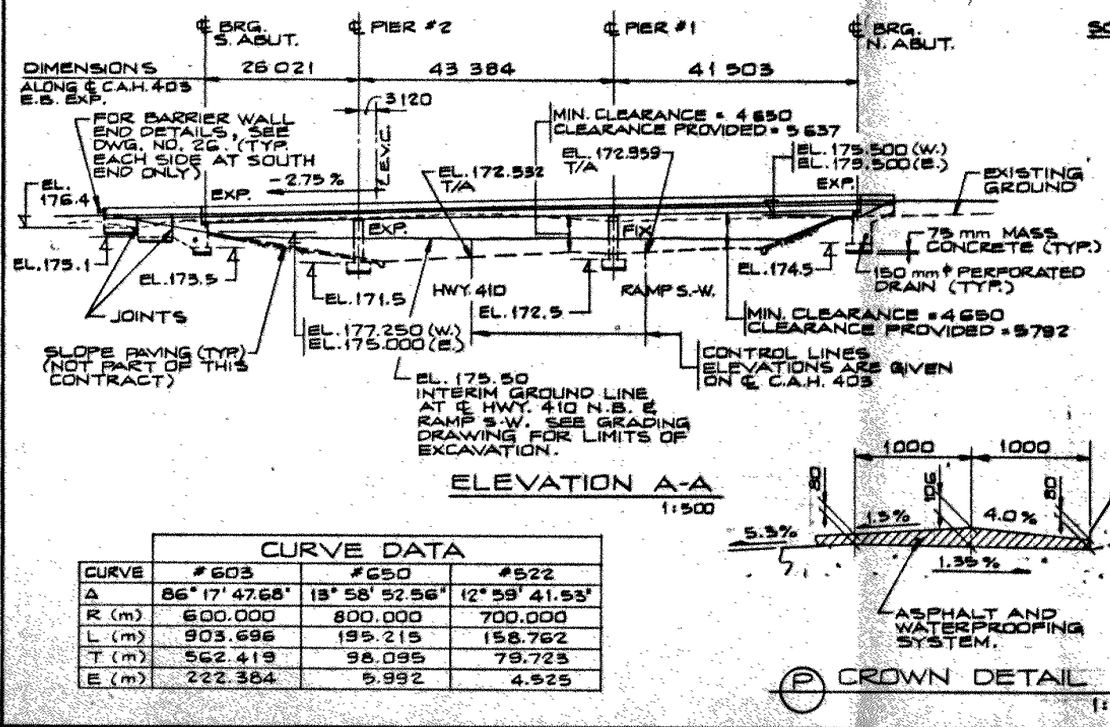
No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

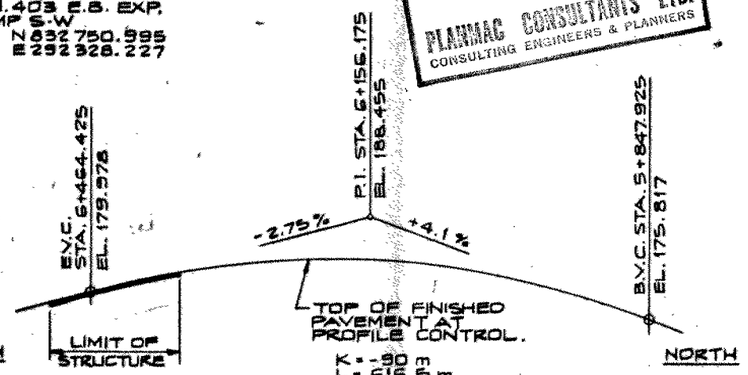
REMARKS:

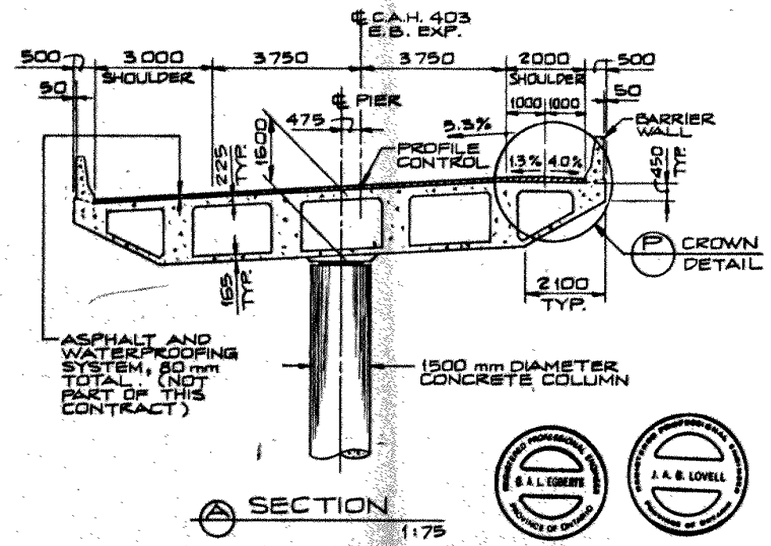
W.P.	STA.	T/A ELEV.
1	6+382.658	181.855
2	6+424.161	180.996
3	6+467.545	179.892
4	6+493.566	179.177





CURVE DATA			
CURVE	#603	#650	#522
Δ	86° 17' 47.68"	13° 58' 52.56"	12° 59' 41.53"
R (m)	600.000	800.000	700.000
L (m)	903.696	195.215	158.762
T (m)	562.419	98.095	79.725
E (m)	222.384	5.992	4.525





METRIC

DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

CONCRETE QUANTITIES FOR LUMP SUM TENDER ITEMS

ABUTMENTS	173 m³
WINGWALLS & RETAINING WALLS	97 m³
PIERS	23 m³
DECK	1229 m³
BARRIER WALLS	81 m³
APPROACH SLABS	35 m³
SLOPE PAVING	77 m³

DIST No. 6
CONT No.
WP No. 127-66-69

HWY. 403 E.B. EXPRESS
OVER HWY. 410 N.B. & RAMP S-W
(BRIDGE No. 35)
GENERAL ARRANGEMENT

SHEET

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GENERAL NOTES

CLASS OF CONCRETE

- DECK AND PIERS — 35 MPa
- ABUTMENTS, WINGWALLS, RETAINING WALLS AND BARRIER WALLS — 30 MPa
- REMAINDER — 20 MPa

CLEAR COVER TO REINFORCING STEEL

- FOOTINGS — 100 ± 25 mm
- ABUTMENTS, WINGWALLS AND RETAINING WALLS
  - OUTSIDE FACE — 80 ± 20 mm
  - INSIDE FACE — 70 ± 20 mm
- PIERS — 80 ± 20 mm
- DECK: TOP SLAB
  - TOP — 70 ± 20 mm
  - BOTTOM — 40 ± 10 mm
  - BOTTOM SLAB
    - TOP — 40 ± 10 mm
    - BOTTOM — 40 ± 10 mm
  - WEBS — 40 ± 10 mm
- BARRIER WALLS AND APPROACH SLABS — 70 ± 20 mm

EXCEPT AS OTHERWISE NOTED.

REINFORCING STEEL

- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BARS MARKED WITH THE SUFFIX 'C' SHALL BE COATED BARS.

CONSTRUCTION NOTE

- THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3 mm.

LIST OF DRAWINGS

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DATE	BY	DESCRIPTION	

DESIGN	JABL	CHECK	G.E.	LOADING	CHBDC-A-78	DATE	MAY 82
DRAWING	J.N.	CHECK	JABL	SITE	24-81-463	DWG	1

DIST	No. 6
CONT	No.
WP	No. 127-66-69

HWY. 403 E.B. EXPRESS
OVER HWY. 410 N.B. & RAMP S-W
(BRIDGE No. 35)
FOOTING LAYOUT

SHEET

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METRIC

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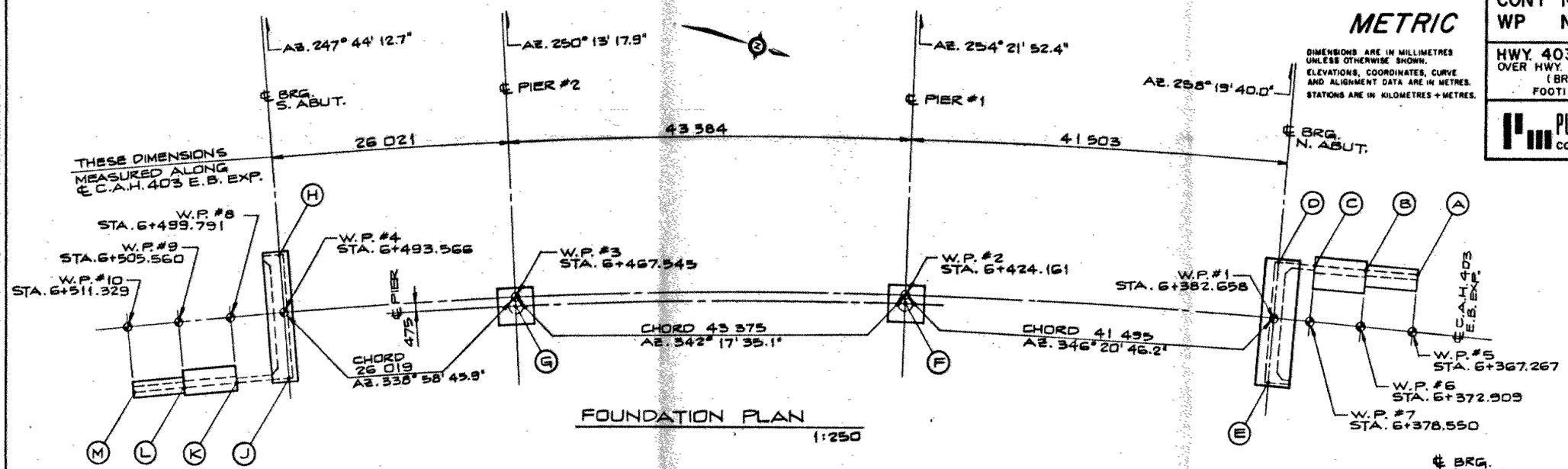
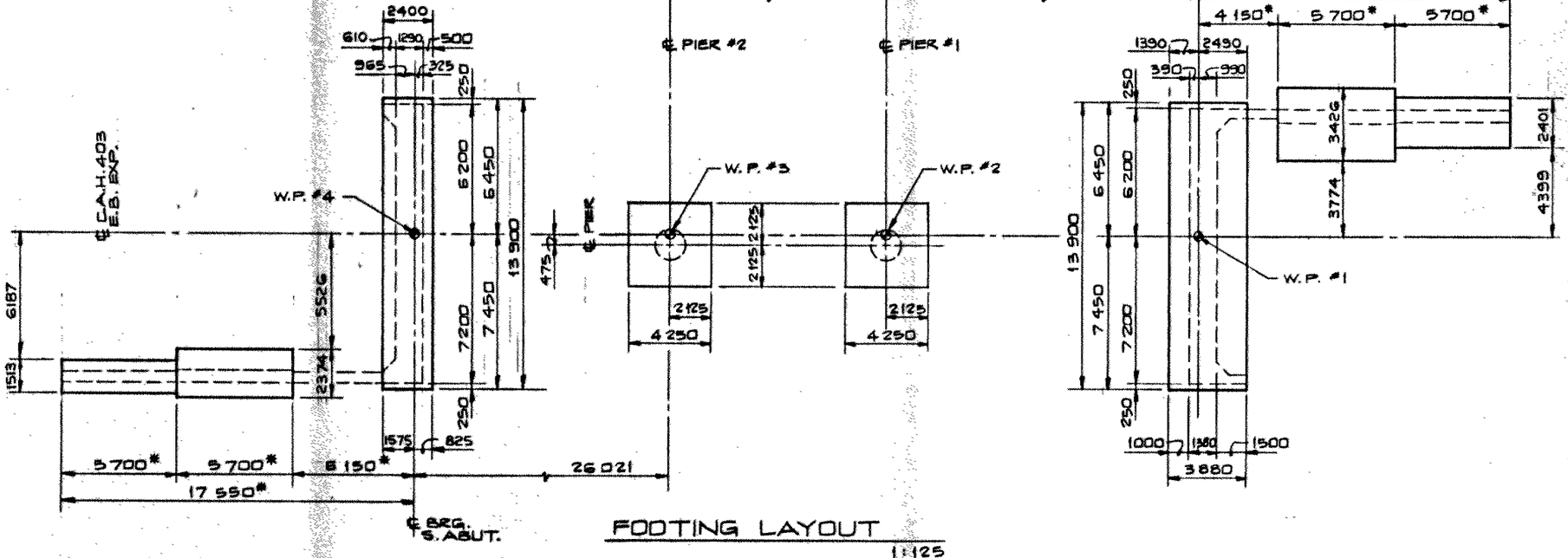


FOUNDATION PLAN
1:250

POINT	CO-ORDINATES NORTH	EAST
W.P. #5	832 800.554	292 317.129
A	832 799.436	292 311.027
W.P. #6	832 794.986	292 318.155
B	832 793.831	292 312.063
W.P. #7	832 789.448	292 319.232
C	832 788.235	292 313.152
W.P. #1	832 785.423	292 320.050
D	832 784.169	292 313.978
E	832 786.880	292 327.101
W.P. #2	832 745.101	292 329.845
F	832 745.229	292 330.302
W.P. #3	832 703.781	292 343.037
G	832 703.942	292 343.484
W.P. #4	832 679.494	292 352.370
H	832 677.145	292 346.632
J	832 682.222	292 359.033
W.P. #8	832 673.745	292 354.758
K	832 676.542	292 361.393
W.P. #9	832 668.440	292 357.025
L	832 671.300	292 363.632
W.P. #10	832 663.157	292 359.342
M	832 666.081	292 365.922



FOOTING LAYOUT
1:125

* DIMENSIONS MEASURED ON OUTSIDE FACE OF WALL

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

G. & L. ROBERTS — PROVINCE OF ONTARIO
J. A. B. LOVELL — PROVINCE OF ONTARIO

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN G.E.	CHECK JABL	LOADING CHBDC-W/S	DATE MAY 82
DRAWING J.N.	CHECK JABL	SITE 24-81-465	DWG 5

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO DB-SP1 1984 01-86

DIST No. 6	
CONT No.	
WP No. 127-66-69	
HWY. 403 E.B. EXPRESS OVER HWY. 410 N.B. & RAMP S-W (BRIDGE No. 35) FOOTING REINFORCING	SHEET

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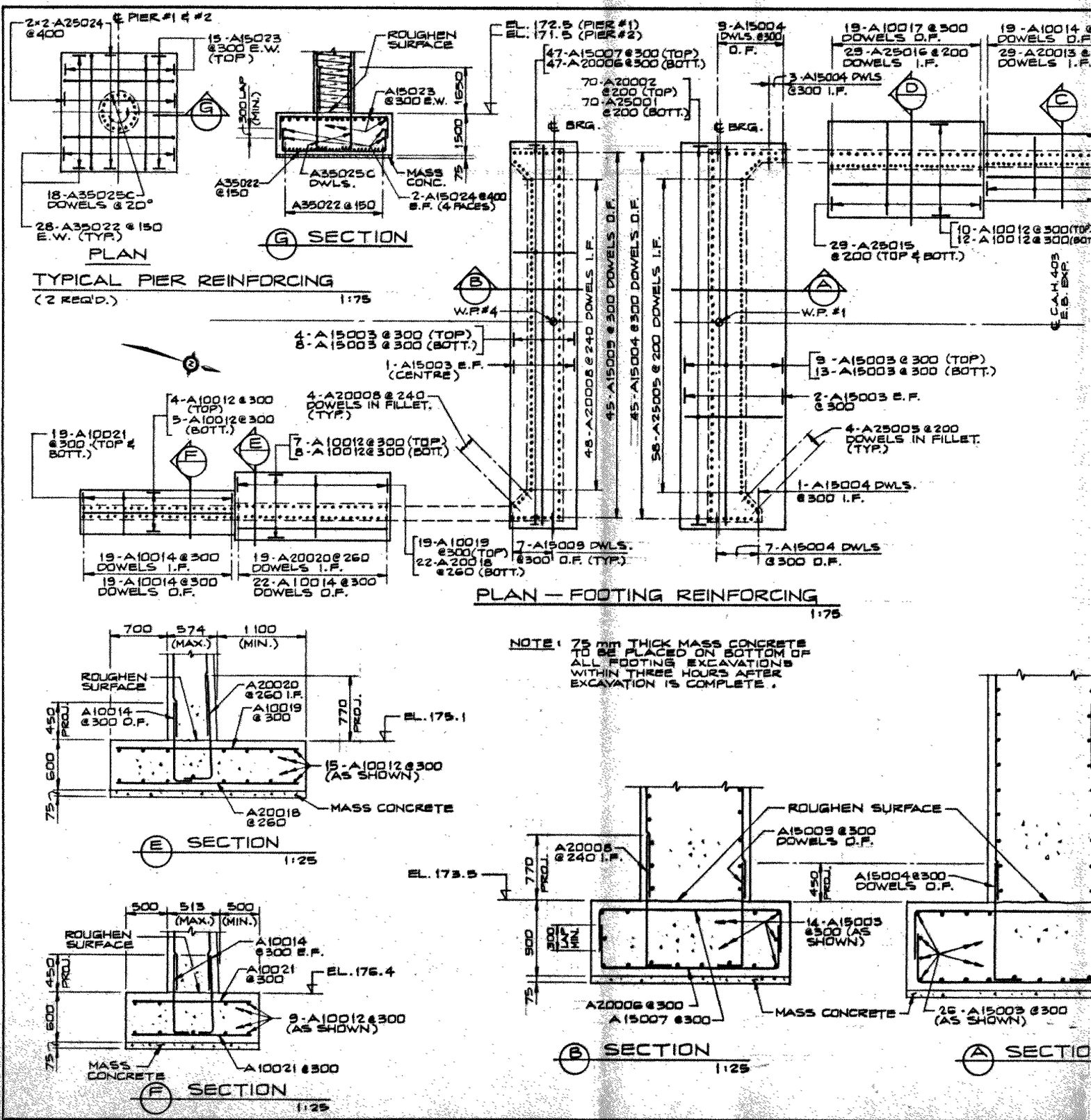
METRIC

DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.



ABBREVIATIONS
O.F. - OUTSIDE FACE
I.F. - INSIDE FACE
E.F. - EACH FACE
BOTT. - BOTTOM
E.W. - EACH WAY

G.A.L. ROBERTS — PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO
J.A.B. LOWELL — PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN G.E.	CHECK J.A.B.L.	LOADING CHBDC 4/78	DATE MAY 82
DRAWING J.N.	CHECK G.E.	SITE 24-61-465	DWG 4

Ontario

Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 127-66-69 DIST 6

HWY 403 STR SITE 24-81-463

Bridge #35, Hwy. 403 E.B. Expressway Over Hwy. 410 N.B. Expressway and Ramp S-W

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GEOCRES 30M12-160 DATE MAY - 5 1982

FOUNDATION INVESTIGATION REPORT

For

Bridge #35

Hwy. 403 E.B. Expressway Over

Hwy. 410 N.B. Expressway and

Ramp S-W

W.P. 127-66-69, Site 24-81-463

Hwy. 403, District 6, Toronto.

INTRODUCTION:

This report summarizes the factual information obtained from a foundation investigation program performed at the above-mentioned structural site and provides detailed recommendations pertaining to the structure foundations and related earthworks.

The fieldwork was carried out between 82 03 19 and 82 03 22, and consisted of advancing 4 sampled boreholes using solid stem continuous flight augers with bedrock being cored in two of the borings. The depth of borings ranged from 2.7 metres to 10.7 metres terminating within the shale bedrock.

Site Description and Geology

The structure site is located southeast of the existing Hwy. 403 W.B. Collector structure (Bridge #43) over Hwy. 410 which was constructed under Contract 75-16 as part of the Hwy. 401/403 Interchange complex.

Land use in the area is changing from predominately farming to industrial subdivision development. Topography across the site is generally flat to gently undulating with ground surface sloping gradually towards Lake Ontario.

The site is located in the physiographic region known as the "Peel Plain". The characteristic deposit, in the vicinity of the area under investigation, is composed of cohesive glacial till, whose thickness varies from nil to 15 metres. The overburden is underlain by shale bedrock of the Meaford-Dundas Formation, Ordivician Period.

Subsurface Conditions

Borings carried out at the structure site indicates generally uniform subsurface conditions. The overburden consists of a shallow deposit of cohesive glacial till underlain by shale bedrock. The upper portion of the shale was found to be weathered.

The boundaries between the various soil types, insitu and laboratory test results, as well as stabilized ground water levels, are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with a profile showing an estimated soil stratigraphy based on borehole data, are shown on Drawing No. 1276669-A.

The various soil types encountered are briefly described in the following paragraphs.

Silty Clay, Gravel and Sand (Glacial Till)

The surficial deposit overlying the site consists of a shallow deposit of glacial till composed of a silty clay of low to intermediate plasticity with varying amounts of gravel and some sand. Typical grain size distribution curves for representative samples from this deposit are shown in envelope form on Figure 1. An increasing frequency of fragments, and detached slabs of weathered shale and limestone were encountered within the lower portion of this till.

Results of limited water content and Atterberg Limit testing are plotted on the Plasticity Chart (Figure 2) and summarized as follows:

		Range	Average
Water Content	(w) %	9-16	13
Liquid Limit	(W_L) %	28-40	35
Plastic Limit	(W_p) %	14-21	18
Plasticity Index	(I_p) %	14-19	17

These results indicate the cohesive matrix of the glacial till consists of an inorganic silty clay of low to intermediate plasticity (CL-CI).

Based on interpretation of Standard Penetration Test 'N' values ranging from 20 to in excess of 100 blows per 0.3 metres, the consistency of this deposit ranges from very stiff to hard.

Bedrock

The shale bedrock was encountered immediately beneath the glacial till deposit across the site. The upper 0.4 to 0.9 metres of the bedrock is in a weathered condition. The bedrock surface varies between elevations 176.0 to 176.7 corresponding to depths of 2.3 to 3.2 metres below natural ground surface.

Bedrock surface is sloping gently across the site, and can be expected to exhibit minor fluctuations across the footing locations.

The rock is described as a dark grey, fine textured, soft shale interbedded with thin layers of light grey, fine to medium texture, medium hard limestone. This formation is generally weathered in the upper layers and frequently transitional with the overlying till layer containing fragments and detached slabs of shale and limestone. The badly weathered zone of shale near the top of bedrock grades through a zone of moderate weathering into intact bedrock.

Groundwater Conditions

No natural groundwater level was encountered during augering operations in the borings. Upon completion of rock coring, the induced drill water remained perched within the borings, indicating a low permeability for both the till and shale strata. The existing Hwy. 403 E.B. and W.B. Collector cuts effectively drains the immediate structure site.

DISCUSSION AND RECOMMENDATION

As part of the upgrading of Highways 401 and 403 to a collector/core network, East and West Bound Expressway Overpass structures are required at the proposed crossing of Hwy. 410 N.B. Expressway. The proposed E.B. structure (Bridge #35) will consist of a 3 span (26 - 43 - 41 metre) continuous post-tensioned voided concrete structure some 20 metres wide. A proposed Hwy. 403 profile grade of 181, proposed Hwy. 410 N.B. Expressway grade of 172.5, and average natural ground surface elevation of 179 will necessitate maximum approach fill heights in the order of 2.0 metres and cut depths of 8.5 metres.

In consideration of the proximity of competent shale bedrock to ground surface across the site, recommendations pertaining to the foundations of the new structure and related earthworks are summarized as follows:

The design of shallow foundations founded on an unyielding medium such as shale bedrock will not be governed by settlement since the bearing capacity at the S.L.S. Type II is much larger than the factored capacity at U.L.S.

Perched abutments and pier elements can be supported on shallow spread footings located within the intact shale at or below elevation 175.0 for a factored capacity at the U.L.S. of 1500 kPa.

The stepped approach retaining walls can be supported on shallow spread footings located in the weathered shale for a factored bearing capacity at the U.L.S. of 1,000 kPa. Alternatively for retaining wall footings founded at or below elevation 175.0 in the intact shale, a factored bearing capacity at the U.L.S. of 1500 kPa may be used. For spread footings founded at or below elevation 177 within the glacial till deposit, a factored bearing capacity at the U.L.S. of 800 kPa and a capacity at the S.L.S. Type II of 350 kPa may be used.

A minimum earth cover of 1.25 metres should be provided to the underside of the footings, since the shale is considered susceptible to frost action.

The base of all footing excavations should be covered immediately upon exposure with a working slab of lean concrete to protect the exposed shale from weathering and softening.

Earth pressures against the abutment walls should be computed as per Subsection 6.6.1.2.2 of the O. H. B. D. C. Manual with provisions made from adequate drainage behind the abutment.

Provided backfill to the abutments consists of free draining granular material and adequate provisions are made for an appropriate drainage scheme, the following equivalent fluid pressures may be assumed for compution of earth pressures.

a) At ultimate limit state

- active condition	8.0 kPa/m
- at rest condition	10.0 kPa/m

b) At serviceability limit state

- active condition	6.5 kPa/m
- at rest condition	8.5 kPa/m

All surficial organics and softened material should be stripped from within the plan limits of the immediate approach embankments prior to placement of any fill.

A constraint on the use of heavy vibratory equipment within a restricted distance to the back of abutment wall should be included as per current MTC directives.

Resistance to sliding of the abutment footings can be calculated assuming a coefficient of friction of 0.8 between the underside of the concrete footing and the rough shale surface.

No major dewatering difficulties are anticipated for footing excavations in consideration of the relatively low permeability of the shale bedrock. Localized seepage into excavations can be controlled by perimeter ditches and pumping from corner sumps.

Provided Bridge #35 is constructed prior to roadway excavations for Hwy. 410 N.B. Expressway and an interim ground line is specified, the site should be properly graded and ditched to allow for free drainage of runoff in order to prevent ponding of water around the structure and possible softening of the founding shale.

No stability problems are anticipated for permanent embankment and cut slopes constructed to a 2:1 geometry. Exposed shale in cut slopes should be protected with adequate earth/topsoil cover and sodded.

Temporary cut slopes will stand at a 1:1 geometry or steeper, however, these slopes will weather rapidly and show signs of surficial distress if not protected in a reasonable length of time.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. V. Parker, Field Technician, utilizing equipment owned and operated by Atcost Drilling Co., Toronto. This report was written by Mr. T. J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.

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

M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 127-66-69 LOCATION N 4 832 783.1; E 292 311.3 ORIGINATED BY V.P.
DIST 6 HWY 403 BOREHOLE TYPE Solid Stem Augers; BXL Rock Core COMPILED BY V.P.
DATUM Geodetic DATE 82 03 19 CHECKED BY

SOIL PROFILE			SAMPLES			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 (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
179.9	Ground Surface										
0.0	Grey (Glacial Till) Brown, Silty Clay, some Sand & Gravel Very Stiff to Hard		1	SS	20	*					
			2	SS	35		178				6 10 52 32
	Shale fragments		3	SS	50/ 13 cm						
176.7											
3.2	Grey weathered		4	SS	50/ 5 cm		176				
	Shale Bedrock with thin layers of Limestone		5	SS	50/ 2 cm						
			6	SS	50/ 3 cm						
			7	BXL RC	REC 100%		174				
			8	BXL RC	REC 100%		172				
			9	BXL RC	REC 100%		170				
169.2											
10.7	End of Borehole										
	Note: Refusal to augers at 5.9 m										
	* Water Level not Established										

+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 2 METRIC

W P 127-66-69 LOCATION N 4 832 744.5; E 292 338.0 ORIGINATED BY V.P.

DIST 6 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.

DATUM Geodetic DATE 82 03 22 CHECKED BY

SOIL PROFILE			SAMPLES			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 (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
178.6	Ground Surface										
0.0	Grey (Glacial Till) Brown Silty Clay, some Sand and Gravel		1	SS	40	*	178				
176.5	Hard		2	SS	40/ 15 cm				○		3 14 51 32
2.1											
175.9	Weathered Shale Bedrock		3	SS	50/ 8 cm		176				
2.7	End of Borehole Refusal to Augers										
	Note: Ground Water not Encountered at Time of Investigation										

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

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3 METRIC

W P 127-66-69 LOCATION N 4 832 700.8; E 292 351.1 ORIGINATED BY V.P.

DIST 6 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.

DATUM Geodetic DATE 82 03 22 CHECKED BY

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 o UNCONFINED + FIELD VANE • QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
178.3	Ground Surface										
0.0	Grey (Glacial Till) Brown Silty Clay, some Sand & Gravel		1	SS	30	*	178				
176.0	Hard		2	SS	61				o		11 9 47 33
2.3	Weathered		3	SS	50/ 15 cm		176				
175.2	Shale Bedrock										
3.1	Refusal to Augers End of Borehole		4	SS	50// 5 cm						

* Note: Ground Water not Encountered at time of Investigation

+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 4 METRIC

W P 127-66-69 LOCATION N 4 832 682.8; E 292 382.4 ORIGINATED BY V.P.

DIST 6 HWY 403 BOREHOLE TYPE Solid Stem Augers, BXL Rock Core COMPILED BY V.P.

DATUM Geodetic DATE 82 03 22 CHECKED BY

SOIL PROFILE			SAMPLES			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 (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
178.1	Ground Surface										
0.0	Grey (Glacial Till) Brown Silty Clay, some Sand & Gravel, Hard					*	178				
			1	SS	34						
176.3			2	SS	50/8 cm						GR 4 SA 25 SI 48 CL 23
1.8	Weathered Grey Shale Bedrock with thin layers of Limestone		3	BXL RC	REC 100%		176				
			4	BXL RC	REC 100%						
			5	BXL RC	REC 100%		174				
			6	BXL RC	REC 100%						
			7	BXL RC	REC 100%		172				
170.7											
7.4	End of Borehole										

Note: Refusal to Augers at 2.0 m

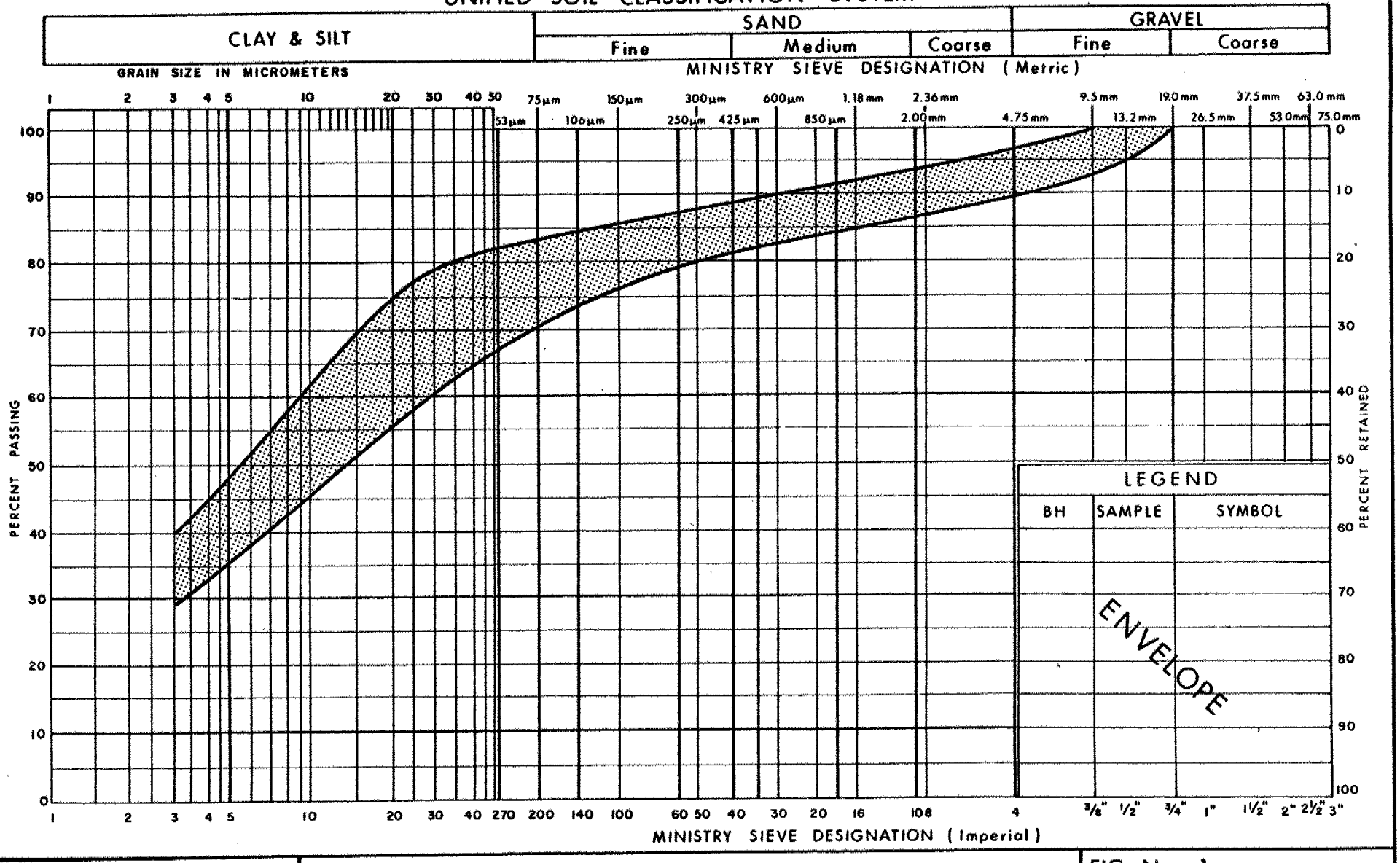
* Note: Water Level not Established

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



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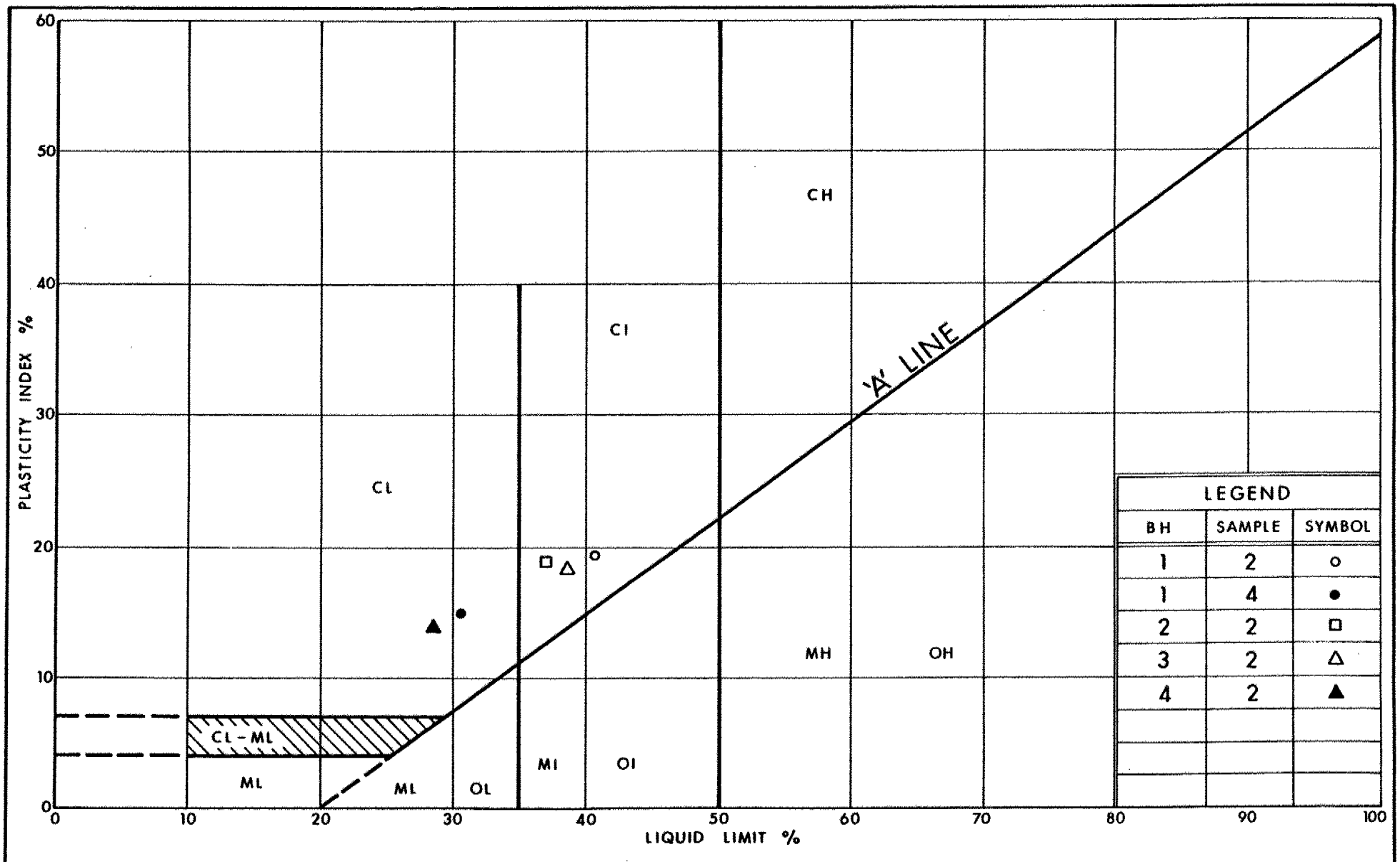
GRAIN SIZE DISTRIBUTION

SILTY CLAY, SOME SAND & GRAVEL (Glacial Till)

FIG No 1

W P 127-66-69



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PLASTICITY CHART
(Glacial Till Matrix)
SILTY CLAY (OF LOW TO INTERMEDIATE PLASTICITY)

FIG No 2
W P 127-66-69

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 (RQD), FOR MODIFIED RECOVERY, IS:

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

JOINTING AND BEDDING:

SPACING	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

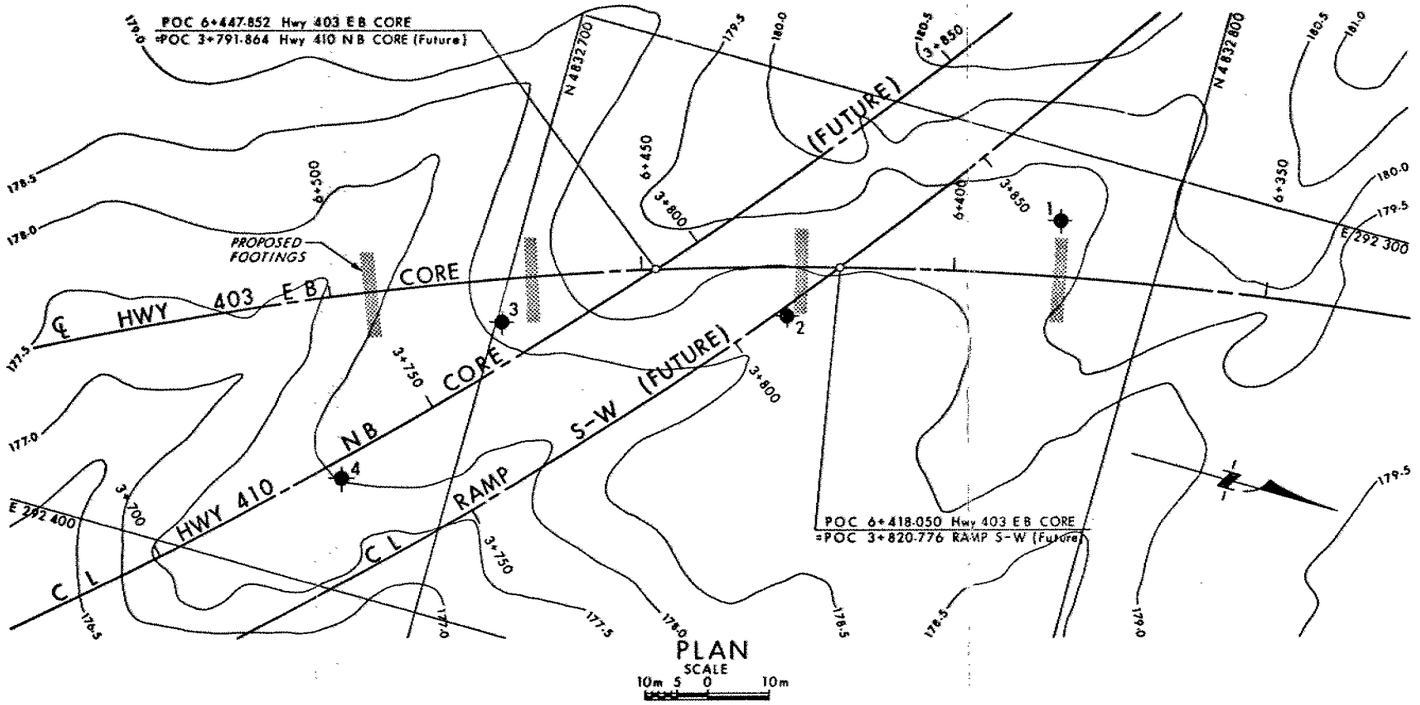
METRIC

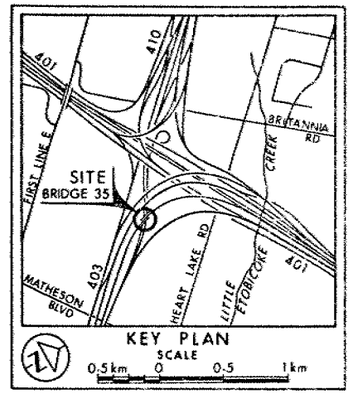
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS ARE IN KILOMETRES + METRES.

CONT No
WP No 127-66-69

HWY 403 E B CORE OVER 410 NB CORE & RAMP S-W (BRIDGE 35)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

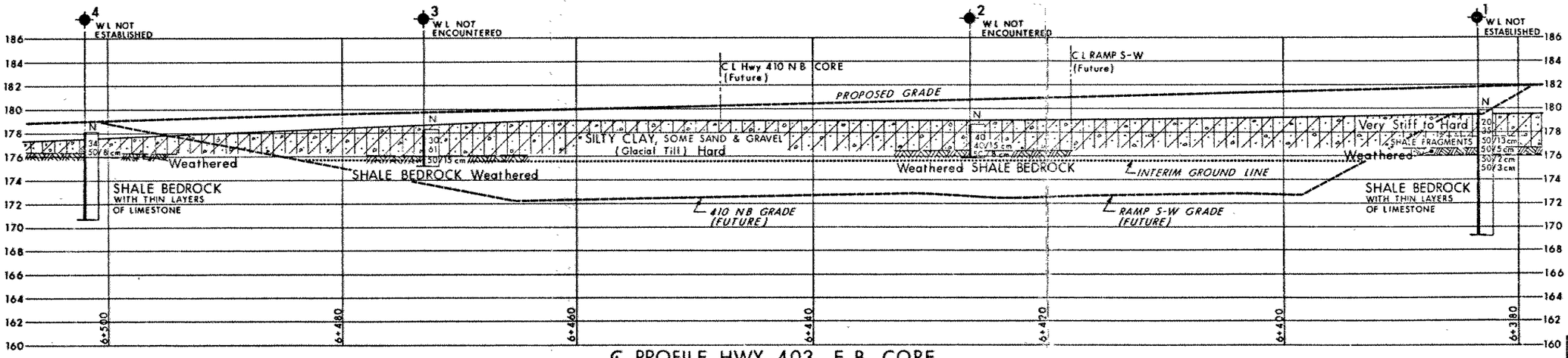




LEGEND

- 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
  Water Level Not Established

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	179.9	4 832 783.1	292 311.3
2	178.6	4 832 744.5	292 338.0
3	178.3	4 832 700.8	292 351.1
4	178.1	4 832 682.8	292 382.4



℄ PROFILE HWY 403 E B CORE
SCALE
4m 2 0 4m

NOTE

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

REGISTERED PROFESSIONAL ENGINEER T. J. KAZIMIERowski PROVINCE OF ONTARIO

REVISIONS

DATE	BY	DESCRIPTION

Geocres No 30M12-160

HWY No 403			DIST 6
SUBMTD TJK	CHECKED	DATE 1982 04 29	SITE 24-81-463
DRAWN GP	CHECKED	APPROVED	DWG 1276669-A

REF PLANMAC CONSULTANTS DWG P1 ; 1982 01