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DIST. 6 REGION

W.P. No. 49-71-07

CONT. No. 82-51

W. O. No.

STR. SITE No. 37-633

HWY. No. 427

LOCATION Hwy 427 SB/NB Lanes

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry of
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foundation investigation and design report

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WP 49-71-07

DIST 6

HWY 427

STR SITE 37-1087

N-E, W Ramp Structure over the
West Humber River

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FOUNDATION INVESTIGATION REPORT

For

N-E, W Ramp Structure over the West Humber River
W.P. 49-71-07, Site 37-1087
Hwy. 427, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation carried out at the abovementioned site from August 10 to August 16, 1979 by the Pavement and Foundation Design Section. The fieldwork consisted of augering four sampled boreholes to depths ranging from 35 feet to 45 feet below ground surface. Each boring was also accompanied by a dynamic cone penetration test.

SITE AND GEOLOGY

The site is on Indian Line about 1½ miles north of Rexdale Blvd., in the Borough of Etobicoke, Metro Toronto.

The surrounding terrain is gently undulating, but generally sloping down towards the West Humber River. The river, which is approximately 50 feet wide and 2 feet deep, flows gently in an easterly direction from a reservoir at the Clairville Conservation area, which is located about 1000 feet upstream of the site. The riverbed is strewn with cobbles and boulders. Indian Line at this location is in a shallow cut, and it traverses the West Humber River by means of a single lane Bailey bridge. The surrounding land is an open field, except the southeastern quadrant of the site which is thickly covered with mixed mature trees.

Geologically, the site is in a physiographic region known as the Peel plain. The till plains in this region are often covered with a thin mantle of clay which was left over when the region was inundated during the Peel ponding period in the Pleistocene epoch. The underlying bedrock is a grey shale of the Meadford-Dundas formation.

SUBSURFACE CONDITIONS

The location and elevation of the boreholes are shown in Drawing No. 497107-A, which also contains an estimated subsoil profile. The subsoil stratigraphy is rather complex, consisting of recent alluvial, glacial and interstadial deposits. In view of this, reference should be made to the individual borehole record sheets for a detailed description of the various subsoil strata. In general, six subsoil deposits were intercepted in our borings: namely,

- sandy silt to silty sand
- upper clayey silt till
- upper silty sand till
- lower clayey silt till
- lower silty sand till
- silty clay

A brief description of each of the deposits is as follows:

Sandy Silt to Silty Sand

This surficial deposit was encountered in the riverbanks and has a thickness of up to 7 feet. It is composed of sandy silt to silty sand, with trace of gravel. A grain size distribution curve obtained from a representative sample is shown in Figure 1. The material is slightly cemented and occasionally stratified, suggesting an alluvial origin. The 'N' values ranged from 8 to 31 blows/ft. Accordingly, the relative density of the deposit is classified as compact to dense, but mostly compact.

Upper Clayey Silt Till

This deposit was encountered in the high ground north of the river. It extends immediately below the ground surface to elevation 518.2 for a thickness of about 12 feet. The upper 7 feet or so of the deposit is brown; below that, it is grey. The glacial till is a heterogeneous mixture of clay, silt, sand and gravel. A typical grain size distribution curve for the glacial till is shown in Figure 2. The geotechnical identity indices of the glacial till as determined from two

samples are tabulated below:

Moisture Content	9 and 11%
Plastic Limit	15 and 14%
Liquid Limit	23 and 18%

The Atterberg limits are also plotted on a Plasticity Chart, Figure 3. The results indicate that the till is inorganic and has a low plasticity. The 'N' values of 15 to 33 blows per foot suggest that the cohesive glacial till has a very stiff to hard consistency.

Upper Silty Sand Till

Underlying the abovementioned surficial alluvial or cohesive glacial deposit is a stratum of basically non-cohesive glacial till which is about 10 to 15 feet thick and is composed of a heterogeneous mixture of sand, silt and gravel. Grain size distribution curves obtained from representative samples of this stratum are shown in Figure 4 in an envelope form. Based on 'N' values ranging from 34 to generally over 100 blows per foot, it is inferred that the relative density of the non-cohesive glacial till is dense to generally very dense.

Lower Clayey Silt Till

This lower cohesive glacial till deposit was encountered only in the northern portion of the site, underlying the above-mentioned silty sand till stratum. It has a thickness of about 3 feet, is dark grey in colour and has the following engineering properties:

Moisture Content	(w%)	11 and 8
Plastic Limit	(w _p %)	11 and 14
Liquid Limit	(w _L %)	25 and 21

The Atterberg limits are also plotted on a Plasticity Chart, Figure 3. The results indicate that the clayey silt till has a low plasticity. The two 'N' values recorded are in excess of 100 blows/ft. Accordingly, the consistency of this lower clayey silt till stratum is classified as hard.

Lower Silty Sand Till

This deposit was intercepted also only in the norther portion of the site immediately beneath the lower clayey silt till stratum. It has a thickness of up to 4 feet and is composed of a heterogeneous mixture of sand, silt and gravel, with a trace of clay. Typical grain size distribution curves are shown in Figure 5. Because of the clay binder, the matrix of the glacial till sometimes exhibits slight plasticity, with a plasticity index of up to 5%. The glacial till has a very dense relative density, which is inferred from 'N' vlaues of in excess of 100 blows per foot.

Silty Clay

Underlying the upper silty sand till deposit in the southern portion of the site or under the lower silty sand till deposit in the northern portion of the site is a stratum of reddish silty clay containing trace and seams of sand. The silty clay stratum extends to bedrock surface for a thickness varying from 7 to 12 feet. In the upper portion of the silty clay stratum, a distinct 3 foot thick layer of sand with rounded gravel, the grain size distribution curves of which are shown in Figure 6, was encountered. At one location north of the river, a pocket of sand with angular to subrounded gravel was also found sandwiched between the clay and the bedrock. The silty clay has the following engineering properties:

Moisture Content (w%)	10 to 14
Plastic Limit (w _p %)	12 to 15
Liquid Limit (w _L %)	17 to 30

The results of the Atterberg limit testing are also plotted on Figure 2, which indicate that the silty clay has a slight to generally low plasticity. The consistency of the silty clay is classified as hard, which is based on 'N' values of 58 to over 100 blows per foot.

Shale Bedrock

Bedrock surface at this site slopes down gently in a northerly direction from elevation 498 \pm to elevation 494 \pm . Bedrock is a grey fine textured shale containing occasional thin limestone bands. The shale is soft, fissile and weathered within the depths of investigation.

Groundwater Conditions

The groundwater level was found to correspond very closely to the river water level. During the time of investigation, the river water level was at elevation 520.5 and the groundwater level varied between elevation 520 and 521 approximately.

DISCUSSION AND RECOMMENDATIONS

At the crossing of Hwy. 427 and the West Humber River, a three span (75' - 85' - 75') structure is proposed to carry the N-E/W Ramp. This structure will have approach fills which are about 30 feet high. Our recommendations for the design and construction of the foundations and the approaches are as follows:

Structure Foundations

The recommendations for the structure foundations are tabulated below:

<u>Footing Location</u>	<u>Recommendations</u>
South Abutment	Perched abutment on spread footings founded on a compacted Granular 'A' pad with an allowable bearing pressure of 2.5 tsf.
South Pier	Spread footings founded in the silty sand till below elevation 519. An allowable bearing pressure of 4 tsf can be assumed for design purposes.
North Pier	Same as for South Pier.
North Abutment	Same as for South Abutment.

The underside of all footing elements should have a minimum of 4 feet of earth cover for frost protection purposes. In addition, the pier footings should be placed below the scour depth as per hydrology requirements.

Because the silty sand till would behave as a granular soil, a dewatering scheme would be required for the excavation for the pier footings. Dewatering can be achieved by means of the method of oversized excavation which incorporates an impervious earth dyke to exclude the river water. As an alternative to constructing the pier footings 'in the dry', they can be excavated under water with the foundations poured using 'tremie concrete' method.

Lateral Earth Pressure and Lateral Resistance

Backfill to the abutments should be composed of free draining granular type of material which should be kept drained by means of weep holes. To compute the lateral earth pressure exerted on the abutments by the granular backfill, the following parameters can be assumed:

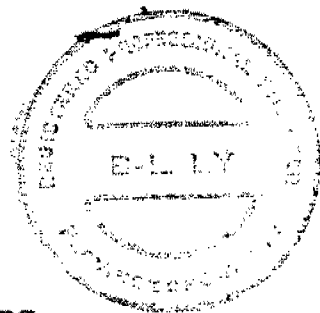
Coefficient of lateral earth pressure (K) = 0.4

Bulk unit weight of the backfill (γ) = 135 pcf

Resistance to the lateral forces can be derived from the friction between the base of the concrete footing and the granular sub-soil or the Granular 'A' material, depending on whether the footing is placed on the silty sand till or on the compacted Granular 'A' pad. In either case, a coefficient of friction equal to 0.65 can be assumed.

Approaches

The required 30 foot high approach fills can be constructed with side slope and forward slope of 2:1. The forward slopes, however, should be protected with rip-rap against erosion and scouring up to the high water level, as per hydrology requirements.



B. Ly
B. Ly, P. Eng.
Foundation Engineer.

M. Devata
M. Devata, P. Eng.
Senior Foundation Engineer.

October, 1979.

APPENDIX

RECORD OF BOREHOLE No 1

W P 49-71-07 LOCATION Co-ords: N15,891,900; E966,035 ORIGINATED BY BRL
 DIST 6 HWY 427 BOREHOLE TYPE 3 1/2" Diam. HSA and Cone Test COMPILED BY BL
 DATUM Geodetic DATE August 10, 1979 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
528.0	Ground Level															
0.0	Sandy silt, dark grey to grey, compact and slightly cemented.		1	SS	22											
521.0			2	SS	8											
7.0	Glacial Till Silty sand, some gravel, very dense		3	SS	34											
			4	SS	40											
			5	SS	117	6"										
			6	SS	126	6"										
			7	SS	130	6"										
506.0			8	SS	146	9"										
22.0			9	SS	150											
	Sand with gr., v. dense		10	SS	122	9"										
	Silty clay, some sand, reddish, hard.		11	SS	58											
497.5			12	SS	100	5"										
30.5	Shale bedrock, fine texture and fissile, weathered.		13	SS	128	10"										
			14	SS	100	4"										
			15	SS	110	4"										
487.0			16	SS	125	6"										
41.0	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 2

W P 49-71-07 LOCATION Co-ords: N15,891,975; E966,042 ORIGINATED BY BRL
 DIST 6 HWY 427 BOREHOLE TYPE 3 1/2" Diam. HSA and Cone Test COMPILED BY BL
 DATUM Geodetic DATE August 13, 1979 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
526.3	Ground Surface																GR SA SI CL
0.0	Silty sand, brown to dark brown, laminated and slightly cemented. Compact		1	SS	19		520										5 61 (34)
519.3	Glacial Till		2	SS	11												
7.0	Silty sand, some gravel, very dense		3	SS	58												50 38 (12)
			4	SS	138												
			5	SS	146												
509.3			6	SS	167		510										
17.0	Silty clay, Sand with gravel, very dense		7	SS	100												30 65 (5)
	Some sand, reddish, hard		8	SS	59												
			9	SS	76												
497.3			10	SS	50		500										
			11	SS	98												
29.0	Shale bedrock, fine textured fissile with occasional limestone bands		12	SS	140/11"												
			13	SS	100/5"		490										
			14	BX	-												
481.3			15	BX	-												
45.0	End of Borehole																



RECORD OF BOREHOLE No 3

W.P. 49-71-07 LOCATION Co-ords: N15,892,066; E966,032 ORIGINATED BY BRL
DIST 6 HWY 427 BOREHOLE TYPE 3 1/2" Diam. BSA and Cone Test COMPILED BY BL
DATUM Geodetic DATE August 16, 1979 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
527.4	Ground Surface																
0.0	Silty fine sand, slightly cemented, compact to dense		1	SS	31												
520.4			2	SS	20												
7.0	Glacial Till Silty sand, some gravel, very dense		3	SS	112/	9"	520										23 48 (29)
			4	SS	87												
			5	SS	37												
510.4			6	SS	148/	11"	510										
17.0	Glacial Till, clayey silt, dark grey, hard		7	SS	128												
507.9																	
19.5	Glacial Till, gravelly sand, very dense		8	SS	160/	11"											22 53 (25)
505.4																	
22.0	Sand and gravel		9	SS	56												
			10	SS	74												
498.4	Silty clay, some sand seams, reddish, hard						500										
29.0	Sand with angular to sub-round gravel, very dense		11	SS	182/	9"											
493.9																	
33.5	Shale bedrock, weathered		12	SS	100/	4"											
490.9																	
36.5	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

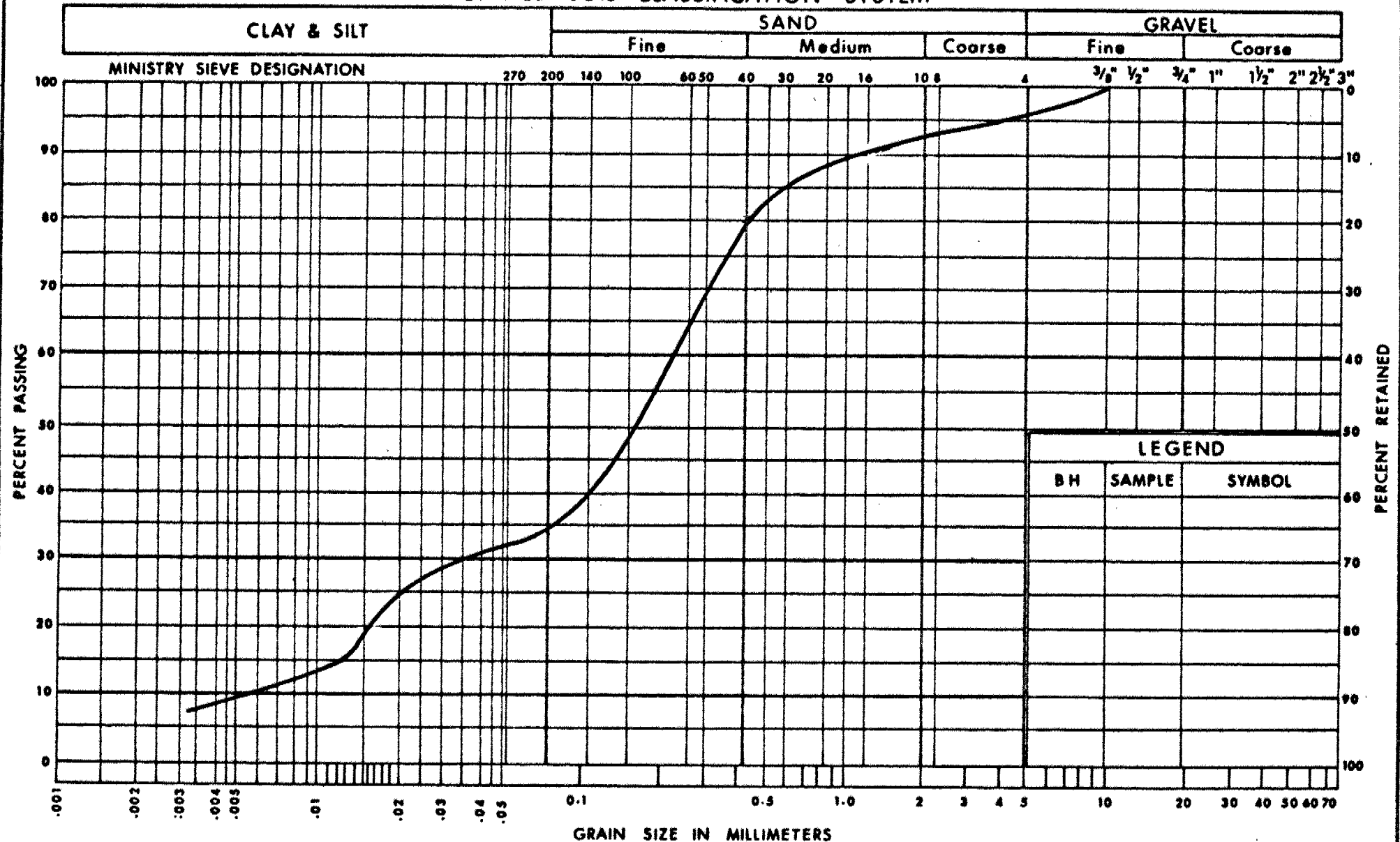
20
15 + 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4

W.P. 49-71-07 LOCATION Co-ords: N15,892,142; E966,033 ORIGINATED BY BRL
 DIST 6 HWY 427 BOREHOLE TYPE 3 1/2" Diam. HSA and Cone Test COMPILED BY BL
 DATUM Geodetic DATE August 15, 1979 CHECKED BY PS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
530.2	Ground Surface							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	10 20 30					
0.0	Glacial Till Clayey silt, with fine gravel, very stiff — Brown Grey		1	SS	33		530							30 30 (40)
			2	SS	33									
			3	SS	15									
518.2			4	SS	22		520							
12.0	Glacial Till Silty sand, some gravel, very dense		5	SS	151									15 54 (31)
			6	SS	100/	5"								
			7	SS	115/	6"								
508.2			8	SS	100/	5"	510							
22.0	Glacial Till, clayey silt, dark grey, hard		9	SS	100/	4"								23 56 (21)
505.2			10	SS	100/	5"								
25.0	Glacial Till, silty sand, gravelly, very dense													
501.2														
29.0	Silty clay, some sand, reddish, hard		11	SS	100/	4"	500							
494.2			12	SS	156/	2"								
36.0	Shale bedrock, weathered													
488.7			13	SS	100/	3"	490							
41.5	End of Borehole													

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION SILTY SAND

FIG No 1

W P 49-71-07



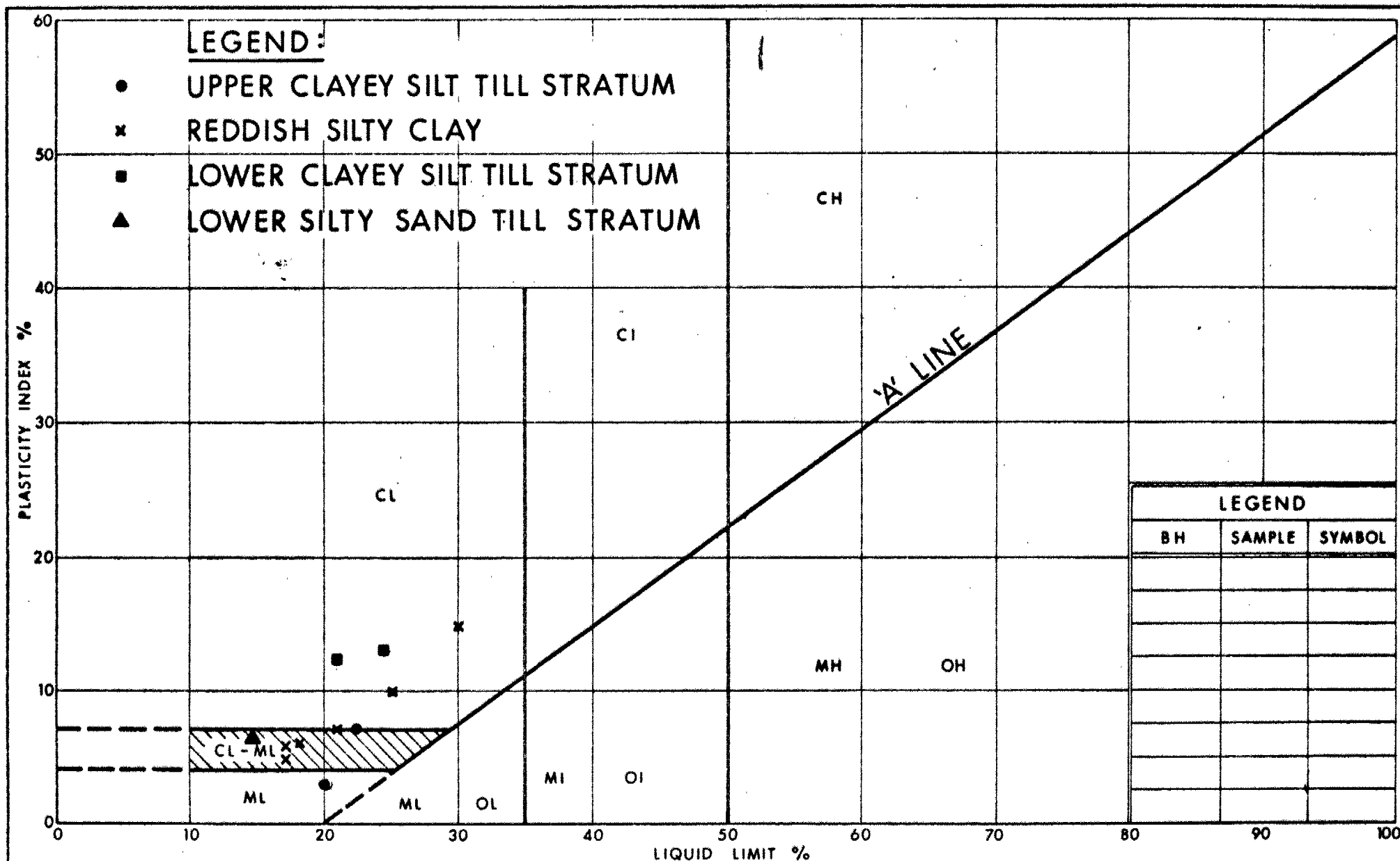
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GRAIN SIZE DISTRIBUTION

UPPER CLAYEY SILT TILL STRATUM

FIG No 2

WP 49 - 71 - 07



Ontario

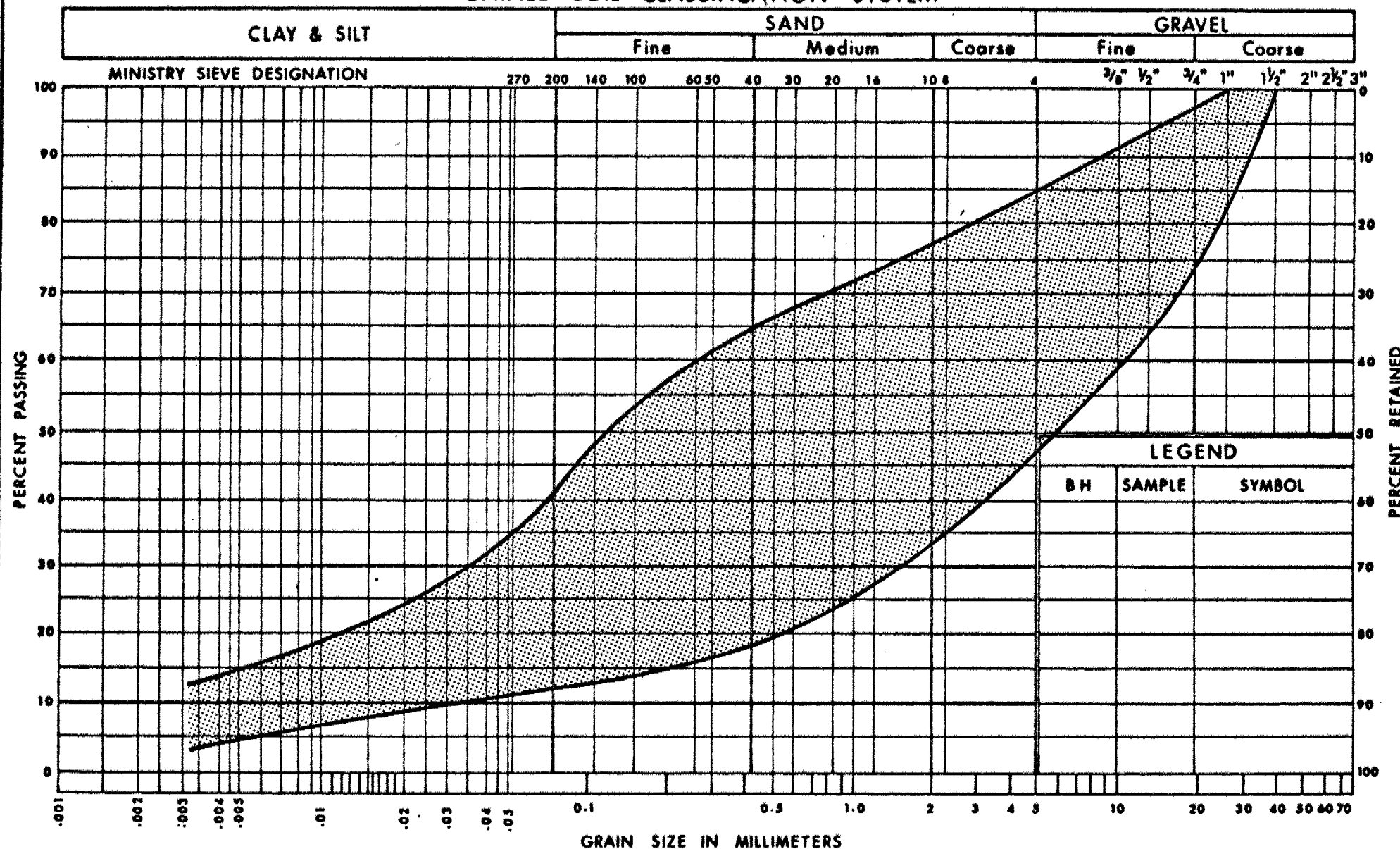
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PLASTICITY CHART

FIG No 3

W P 49-71-07

UNIFIED SOIL CLASSIFICATION SYSTEM

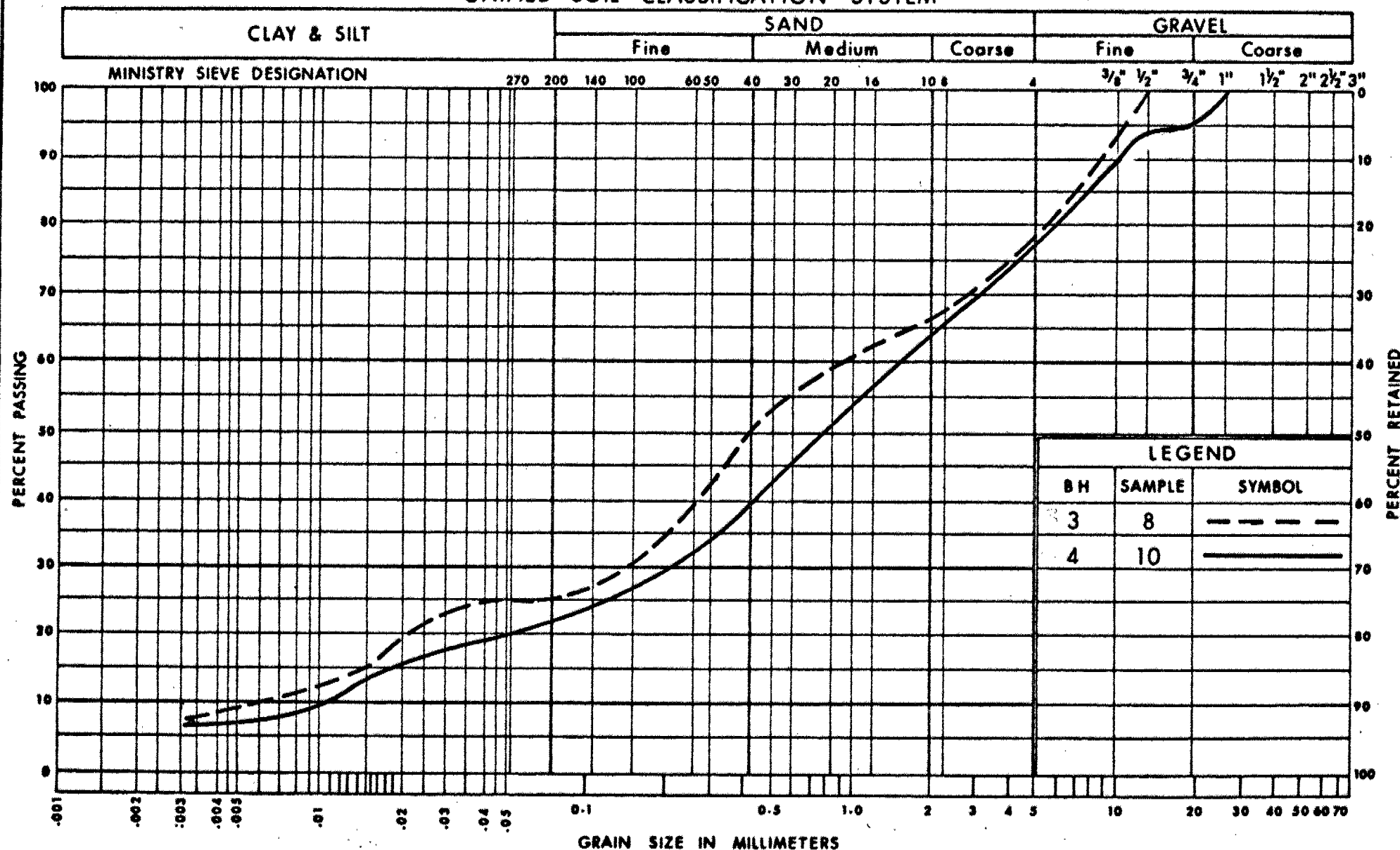
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GRAIN SIZE DISTRIBUTION
UPPER GLACIAL TILL STRATUM
SILTY SAND, SOME GRAVEL

FIG No 4

W P 49 - 71 - 07

UNIFIED SOIL CLASSIFICATION SYSTEM



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Communications

GRAIN SIZE DISTRIBUTION
LOWER SILTY SAND TILL STRATUM

FIG No 5

W P 49-71-07



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Transportation and
Communications**

GRAIN SIZE DISTRIBUTION SAND & GRAVEL

FIG No 6

WP 49-71-07

EXPLANATION OF TERMS USED IN REPORT

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

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

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

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

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

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

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

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

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

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

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

JOINTING AND BEDDING:

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

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

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_0 COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE
 ω SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 $\gamma, \gamma_q, \gamma_c$ BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_0 INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_P PLASTIC LIMIT
 w_S SHRINKAGE LIMIT
 I_p PLASTICITY INDEX = $w_L - w_P$
 I_L LIQUIDITY INDEX = $\frac{w - w_P}{w_L - w_P}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{w_L - w_P}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

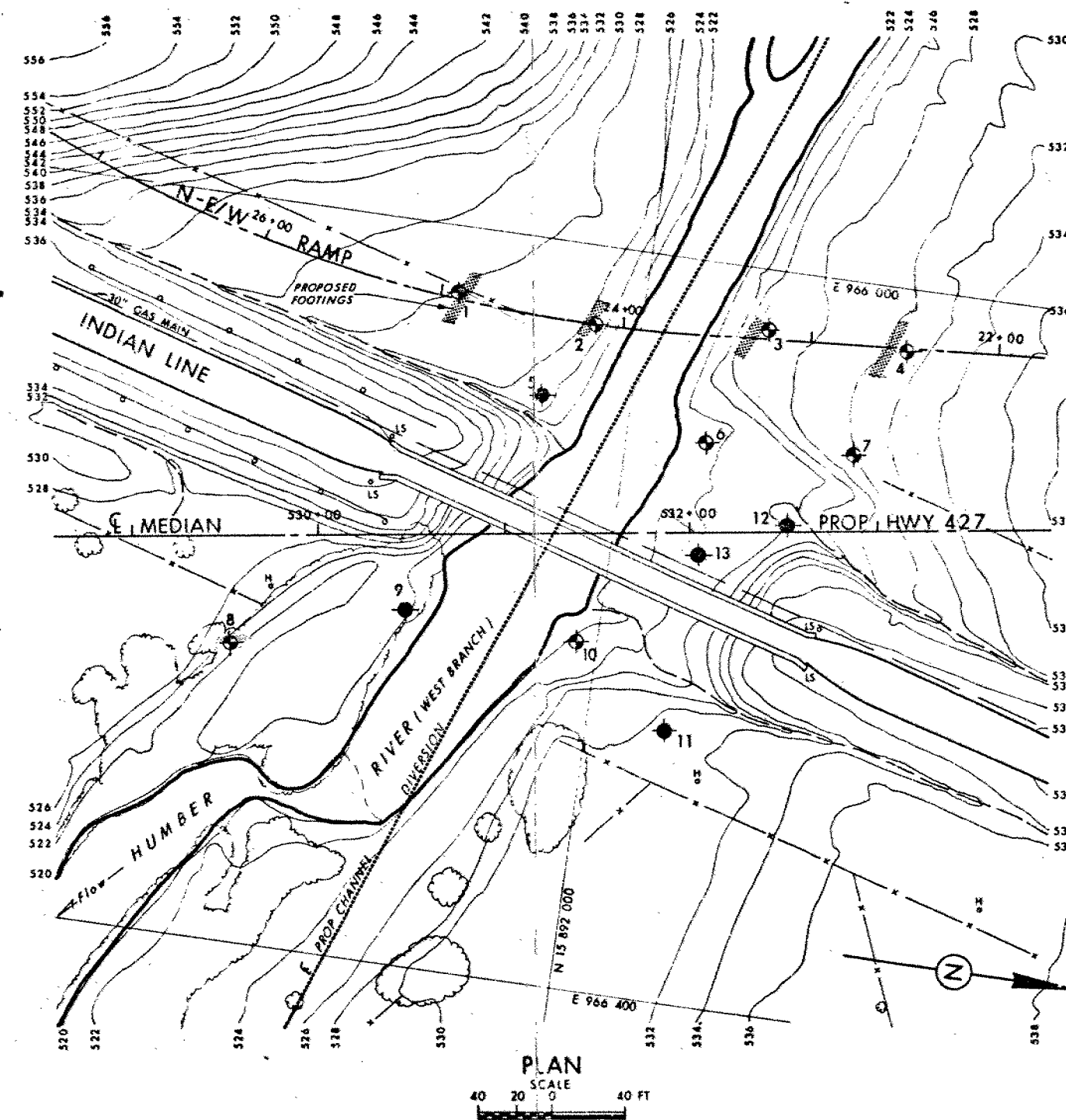
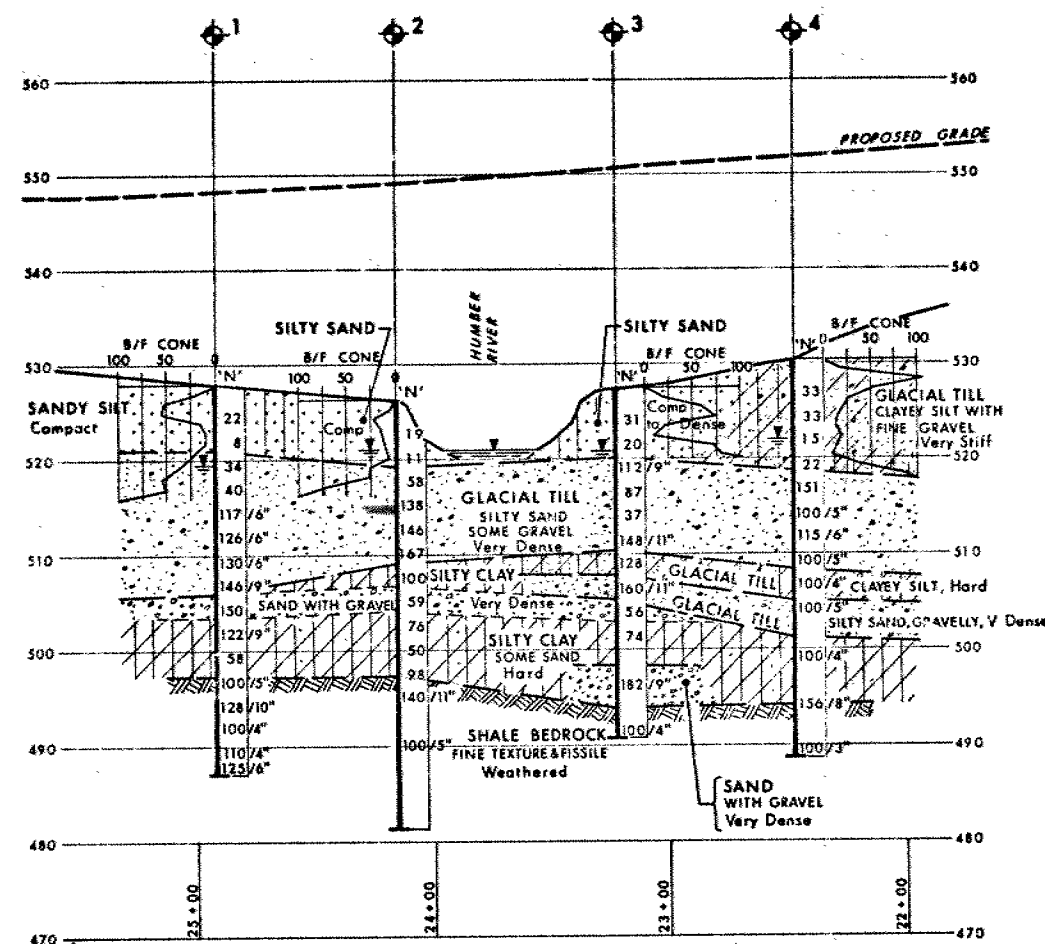
STRENGTH PARAMETERS

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

HYDRAULIC TERMS

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

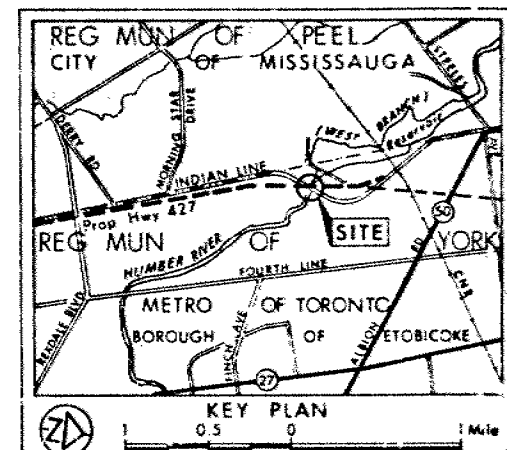
NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 σ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ_n' = EFFECTIVE NORMAL STRESS



NOTE:
FOR BORE HOLES 5 TO 13
SEE REPORT WP 49-71-05 & 06

CONT No
WP No 49-71-07

HUMBER RIVER
BORE HOLE LOCATIONS & SOIL STRATA



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- WL at time of investigation Aug 1979

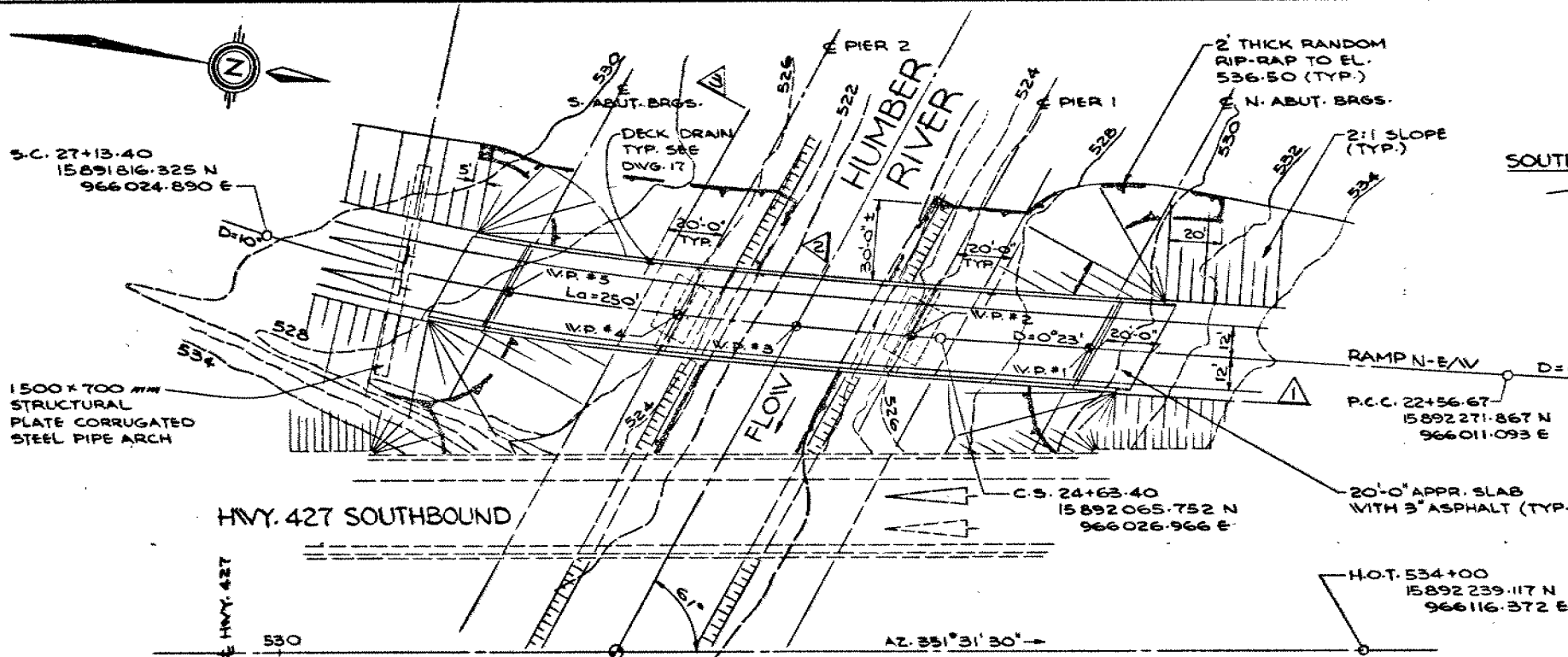
No	ELEVATION	CO-ORDINATES NORTH	EAST
1	528.0	15 891 900	966 035
2	526.3	15 891 975	966 042
3	527.4	15 892 066	966 032
4	530.2	15 892 142	966 033
5	525.0	15 891 951	966 084
6	520.3	15 892 042	966 097
7	530.0	15 892 121	966 093
8	522.0	15 891 803	966 240
9	522.1	15 891 895	966 208
10	522.6	15 891 989	966 213
11	530.6	15 892 042	966 254
12	524.0	15 892 091	966 135
13	523.0	15 892 047	966 157

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

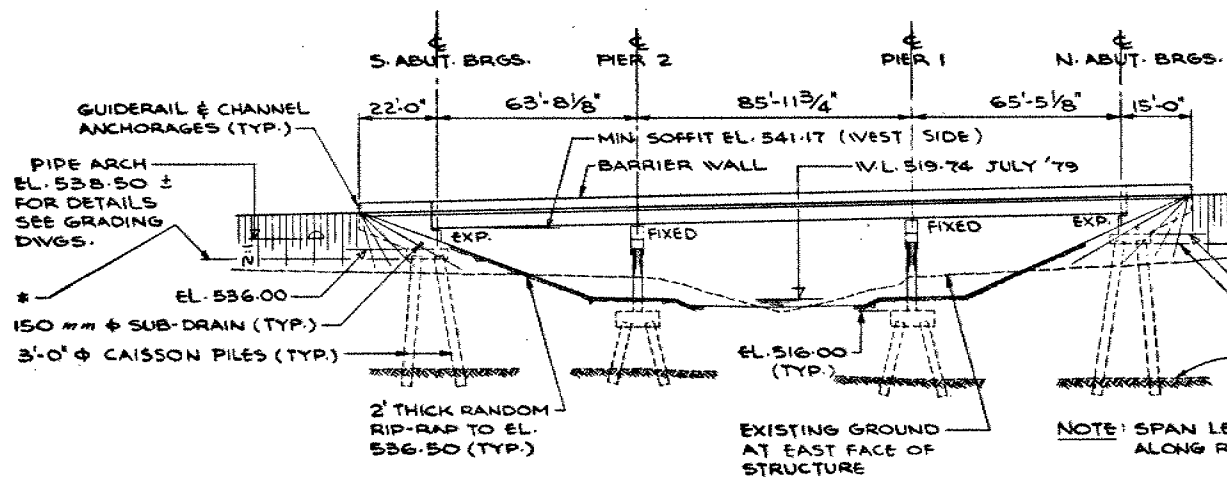
REVISIONS

DATE	BY	DESCRIPTION

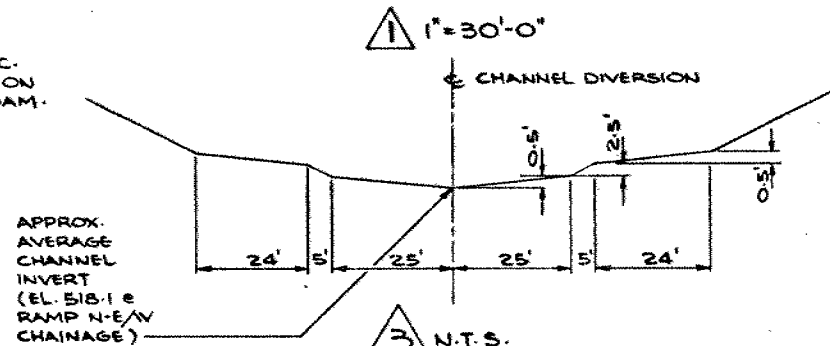
GEOCRE No 30M12-143
HWY No 427 N-E/W RAMP
S. B. G. B. L. CHECKED BY DATE OCT 26, 1979
DRAWN R. S. CHECKED BY DATE OCT 26, 1979
SITE 37-1087
TOWG 497107-A



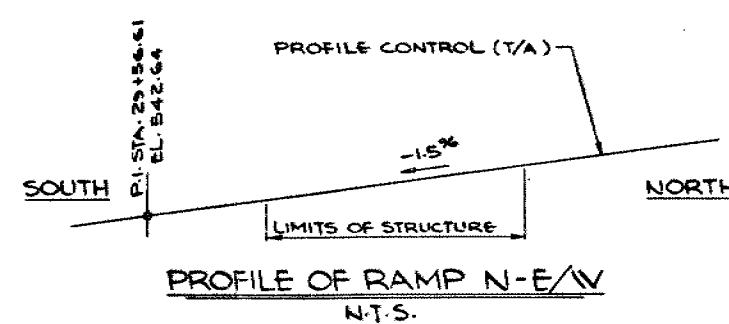
V.P.	STATION	ELEVATION
1	24+06.16	550.90
2	24+71.59	549.92
3	25+14.75	549.27
4	25+57.57	548.63
5	26+21.25	547.67



BENCH MARK
564.824
TABLET ON TOP OF CONC. WALL 30' N. OF S. END ON E. SIDE OF CLAIRVILLE DAM.



NOTE:
* FIRST FILL STAGE (COMPACTED FILL, MAX. PARTICLE SIZE: 2" MAX.)
* ALL DIMENSIONS ARE PERPENDICULAR TO CHANNEL DIVERSION.
* CHANNEL DIVERSION SLOPES AT 0.001'/FT. IN FLOW DIRECTION.
* MIN. SOFFIT EL. 541.17



CONC. QUANTITIES LISTED BELOW ARE FOR THE APPROPRIATE CONC. LUMP SUM TENDER ITEMS:
1 PIERS, ABUTMENTS & WINGWALLS = 245 cu yd.
2 DECK & DIAPHRAGMS = 225 cu yd
3 BARRIER WALLS = 52 cu yd
4 APPROACH SLABS = 41 cu yd

DIST. 6	CONT No	SHEET
WP No	49-71-07	
HUMBER RIVER (WEST BRANCH) AT RAMP N-E/W, HWY. 427		
GENERAL ARRANGEMENT		

GENERAL NOTES

CLASS OF CONCRETE

GIRDERS : 35 MPa
ABUTMENTS, PIERS, DIAPHRAGMS, DECK SLAB & BARRIER WALLS : 30 MPa
REMAINDER : 20 MPa
CAISSON PILES (TREMBIE) : 30 MPa

CLEAR COVER TO REINF. STEEL

FOOTINGS, ABUTMENTS & WINGWALLS : 3"
PIERS : 2 1/2"
DECK SLAB: TOP = 2"; BOTTOM = 1 1/2"
APPROACH SLABS : 2"
BARRIER WALLS : 2" EXCEPT AS NOTED
CAISSONS : 3"

REINFORCING STEEL

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

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF $\pm 1/8"$.

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

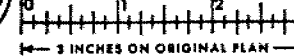
LIST OF DRAWINGS

- 1 GENERAL ARRANGEMENT
- 2 BORE HOLE LOCATIONS & SOIL STRATA
- 3 FOOTING LAYOUT
- 4 FOOTING DETAILS
- 5 NORTH ABUTMENT & WINGWALLS
- 6 SOUTH ABUTMENT & WINGWALLS
- 7 PIER DETAILS
- 8 PRESTRESSED GIRDERS
- 9 DECK DETAILS
- 10 DECK REINFORCING
- 11 EXPANSION JOINTS
- 12 BARRIER WALLS
- 13 20 FT. APPROACH SLAB
- 14 AS CONSTRUCTED ELEV. & DIM.
- 15 BRIDGE DATE & SITE NUMBER DATA
- 16 STANDARD DETAILS I
- 17 STANDARD DETAILS II
- 18 STANDARD DETAILS III



FOR REDUCED PLAN

USE SCALE BELOW



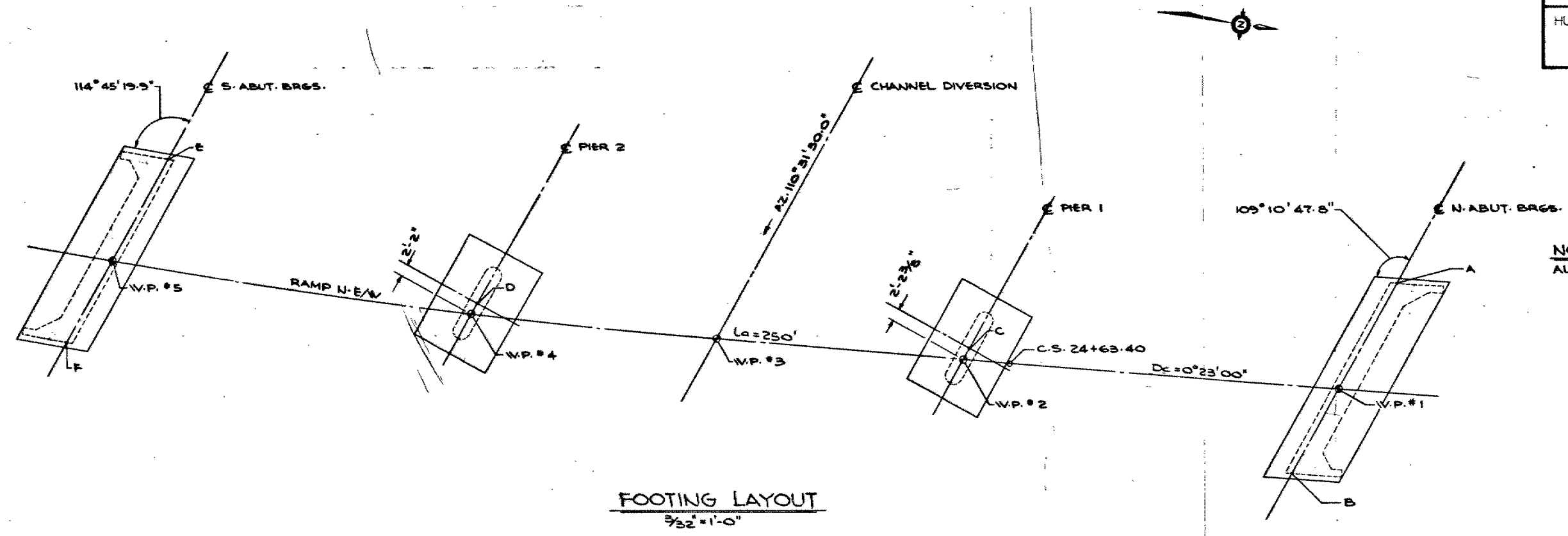
REVISIONS	DATE	BY	DESCRIPTION
DESIGN		CHECK	LOADING
DRAWING		CHECK	SITE No 37-1087 DWG

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO 3115 DUMFRIES

CONT No
WP No 49-71-07

HUMBER RIVER (WEST BRANCH)
AT RAMP N-E/W, HWY. 427
FOOTING LAYOUT

SHEET



NOTE
ALL CENTRE LINES ARE PARALLEL.

POINT	STATION	CO-ORDINATES	
		N	E
A	23+97.28	15892130.27	966003.00
W.P. #1	24+06.16	15892122.84	966022.85
B	24+13.19	15892116.95	966038.58
C	24+70.68	15892058.35	966025.48
W.P. #2	24+71.59	15892057.58	966027.53
W.P. #3	25+14.75	15892014.51	966030.31
D	25+56.74	15891972.50	966030.29
W.P. #4	25+57.57	15891971.74	966032.32
E	26+14.41	15891915.22	966013.66
W.P. #5	26+21.25	15891908.06	966032.77
F	26+26.46	15891902.41	966047.87



FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
1/4" = 3 INCHES ON ORIGINAL PLAN

REVISIONS		DATE		BY		DESCRIPTION	
DESIGN	CHECK	LOADING	DATE	DESIGN	CHECK	LOADING	DATE
DRAWING	CHECK	SITE No	37-187	DWG	3		

Mr. K. Bassi
Head, Operating Section
Structural Office
West Building

1980-09-26

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

Re: N-E/W Ramp Hwy. 427 Over Humber River
W.P. 49-71-07, Site 37-1087
District 6, Toronto

A review of the final structural plans for this bridge leads to comments similar to those made under W.P. 49-71-05 & 06. They consist of the following:

- 1) The wall thickness of the permanent caisson liners should be increased from $3/8$ of an inch to $1/2$ inch due to the density of the till to be penetrated and the need for the caissons to be battered.
- 2) The caisson liners should terminate at the rock surface with only enough penetration to seal the liner against the entry of sand.
- 3) To alert the contractor that churn drilling techniques may be required in the overburden the amendment of subsection 903.08.01 in the Special Provisions should read as follows:

The contractor shall if necessary, employ churn drilling techniques to advance the steel casing to bedrock the estimated elevation of which is shown on the drawings. However, the steel casing shall maintain contact with the surrounding soil during installationetc.



P.J. Stuart
Foundations Engineer
For:

M. Devata
Senior Foundations Engineer

PJS:ea

memorandum



To: Mr. W.L. Lin
A/Head, Central Section
Structural Design Office
Downsview

Date: 1980-03-03

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

Re: Humber River (West Branch)
of Ramp N-E/W, Hwy. 427,
W.P. 49-71-07, Site 37-1087
District 6, Toronto

Further to your request of 80 02 14 our comments on the preliminary structural design are as follows.

The preliminary plan shows the abutments and piers to be founded on 3'0" \emptyset caissons socketted into the bedrock. From the geotechnical point of view it will not be necessary to socket the caissons into bedrock. Because of the high water table and pervious subsoil conditions a temporary liner may be required to advance the caisson. A caisson founded on the bedrock can be designed for a maximum allowable load of 250 tons and should, for practical reasons, be restricted to a batter of 5:1.

The pier footings are to be located in a granular type of glacial till some 9 feet below the creek water level. A temporary dewatering scheme will be necessary to construct the pier footings in the dry. This can be most economically accomplished by constructing oversize excavations and pumping from sumps. Temporary impervious earth dykes may be required to minimize the flow of creek water into the pier footing excavation.

The spacing and batter of the caissons should be designed in such a manner as to avoid interference of the temporary caisson liner used for adjacent caissons.

M. MacLean

MM:MD:ea

cc: G.C.E. Burkhardt

M. MacLean
For:
M. Devata
Senior Foundations Engineer