DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M13-53

DIST. 6 REGION

W.P. No. 88-78-23

CONT. No.

W. O. No.

STR. SITE No. 37-80-1116

HWY. No. 407

LOCATION Ramp 427S to 407E Overpass (at Steeles Ave)

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 88-78-23 DIST 6

HWY 427/407 STR SITE 37-80-1116

Ramp Structure 427S-407E Over Steeles Avenue
Bridge # 13

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30M13-53

GEOCRES [redacted] DATE SEP 21 1982

FOUNDATION INVESTIGATION REPORT

For

Ramp Structure 427 S - 407 E

Over Steeles Avenue

Bridge #13

W.P. 88-78-23 Site: 37-80-1116

Hwy. 427/407, 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 06 28 and 82 06 30 consisting of 3 sampled boreholes, 2 accompanied by dynamic cone penetration tests, advanced by means of hollow and solid stem continuous flight augers. Borings were advanced for depths ranging from 10.8 metres to 13.9 metres.

Site Description and Geology

The site is located at the crossing of the proposed Hwy. 427 S off-ramp to Hwy. 407 E over widened Steeles Ave. in the Borough of Etobicoke, Municipality of Metropolitan Toronto.

The existing topography around the site is flat and level. The land is clear of vegetation and is currently in use as farm land. At present, Steeles Ave. is a 2 lane paved roadway with narrow gravel shoulders and side ditch drainage.

Physiographically, the site is located in the Halton-Peel till plain which was spread over the area by the advance and retreat of the Wisconsinan ice sheet during the Pleistocene epoch (over 5,000 years ago). The till plain occupies the area east of the Niagara Escarpment and north of the Lake Iroquois shoreline. It consists of a bevelled till plain with a gently undulating rolling surface and limited relief. In places the till is overlain by thin deposits of varved clay.

Indications are that there are four till sheets present. The uppermost material is described as a stony clay. The till sheets are usually separated from one another by a bed of stratified silt or sand of variable thickness. The middle till is a grey to brown, dense sandy till which appears sandier than the surficial till. Bedrock has been found in the area at depths of 25 to 30 metres below ground surface, and consists of interbedded shale and limestone of the Dundas Formation, Ordivician Period.

SUBSURFACE CONDITIONS

In general, reasonably competent and uniform subsurface conditions were encountered across the site. The surficial deposit extending to a maximum depth of 7.2 metres is a very stiff to hard cohesive deposit consisting of silty clay with sand and a trace of gravel. Occasional cobbles and boulders were encountered within this deposit.

Underlying the surficial deposit and explored for a maximum thickness of 6.5 metres is a compact to very dense silty sand with gravel to gravelly sand with some cobbles. A hard cohesive glacial till was encountered below this granular deposit.

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 a simplified stratigraphical summary are shown on Drawing No. 887823-A.

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

Silty Clay With Sand

The surficial deposit encountered across the site for depths ranging from 5.8 metres to 7.2 metres is composed of silty clay with sand and a trace of gravel, probably of glacial origins. Towards this deposit's base, a higher proportion of sand as well as occasional cobbles and boulders were encountered. Typical grain size distribution curves for representative samples from this deposit are plotted on Figure 1 in the appendix.

The results of Atterberg Limit and water content testing are plotted on the Plasticity Chart, Figure 2, and summarized as follows:

	Range	Average
Water Content (w) %	9-17	13
Liquid Limit (w_L) %	21-32	25
Plastic Limit (W_p) %	12-17	14
Plasticity Index (I_p) %	9-16	11

These results indicate the fine grained matrix of this deposit to consist of an inorganic silty clay of low plasticity (CL).

Based on interpretation of Standard Penetration Test 'N' values and augering operations, the consistency of this silty clay deposit is assessed as ranging from very stiff to hard.

Silty Sand to Gravelly Sand

The surficial cohesive deposit is underlain by a granular stratum ranging from a silty sand with gravel in the upper portion to a coarser gravelly sand with some cobbles towards the lower portion. Three grain size distribution curves illustrating the varied gradation of this deposit are shown on Figure 3.

Interpretation of Standard Penetration Test 'N' values ranging from 16 to in excess of 100 blows/0.3 metres, indicates a denseness for this deposit ranging from compact to very dense but generally dense throughout.

Silty Clay, Sand and Gravel (Glacial Till)

Underlying the granular deposit and explored for a maximum thickness of 3.7 metres is a glacial till deposit composed of a silty clay matrix with high percentages of sand and gravel. Two gradation curves from this deposit are plotted on Figure 4.

Based on interpretation of 'N' values in excess of 100 blows per foot and very difficult augering operations, the consistency for this deposit is assessed as hard.

Groundwater Condition

Based on stabilized water level readings taken in open boreholes at the time of investigation and additional subsurface data obtained from a previous investigation in the immediate area, the groundwater level should approximate elevation 170.5, ie. some 3.5 metres below ground surface. Seasonal fluctuations of the groundwater level are anticipated.

DISCUSSION AND RECOMMENDATIONS

As part of the planned Hwy. 427/407 interchange, it is proposed to construct a 30 x 12 metre single span ramp structure to carry 427S-407E alignment over the widened Steeles Ave. A proposed ramp elevation of 182.0 and average ground surface elevation of 174.0 will necessitate approach fill heights in the order of 8.0 metres.

In consideration of the reasonably competent cohesive deposit overlying the dense silty sand to gravelly sand deposit across the site, recommendations pertaining to the foundations of the new structure and related earthworks are summarized as follows:

Structure Foundations

Major consideration should be given to founding abutments on spread footings located on a well compacted Granular 'A' core beneath the embankment approaches as per current M.T.C. Standards. All surficial softened and/or organic material within the planned limits of the granular core must be subexcavated prior to placement of the granular core. For spread footings founded on a Granular 'A' core and constructed to current M.T.C. Standards, an allowable capacity at the S.L.S. Type II of 280 kPa and a factored capacity at the U.L.S. of 850 kPa may be used for design purposes.

Resistance to sliding of the abutment footings can be calculated assuming a coefficient of friction of 0.7 between the underside of the concrete footing and the Granular 'A' core.

Alternatively, abutment elements can be founded on shallow spread footings located within the competent silty clay deposit. For footings located at sufficient depth for frost protection purposes, the following O.H.B.D.C. parameters are applicable.

Factored capacity at U.L.S.	650 kPa
Allowable capacity at S.L.S. Type II	240 kPa

An adhesional value of 95 kPa can be used in calculating resistance to sliding between the base of the footing and the founding soil.

Other Considerations

All softened and/or organic material within the planned limits of the immediate approaches should be excavated for their full depth and backfilled prior to fill placement.

The underside of all abutment footings should be provided with a minimum 1.25 metres of earth cover for frost protection purposes.

Earth pressures against the back of the abutment wall should be computed as per Subsection 6.6.1.2.2 of the O.H.B.D.C. Manual, with provisions made for adequate drainage.

Vibratory compaction equipment for use behind abutment walls must be restricted in size as per current MTC specifications.

No major dewatering difficulties are anticipated for pile cap or footing excavations in consideration of the relatively low permeability of the cohesive surficial deposit. Localized seepage into excavations can be controlled by perimeter ditches and pumping from corner sumps.

No stability problems are anticipated for permanent embankment slopes constructed to a 2:1 geometry.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. Dave Wismath, Student Technician, utilizing equipment owned and operated by Master Soil Drilling, Toronto. This report was written by Mr. T. J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.

REGISTERED PROFESSIONAL ENGINEER
T. J. KAZMIEROWSKI
PROVINCE OF ONTARIO

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

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

APPENDIX

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 1

METRIC

W P 88-78-23 LOCATION Co-ords. N 4 845 590.0; E 294 364.8 ORIGINATED BY D.W.

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY D.W.

DATUM Geodetic DATE 82 06 28 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	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
174.0	Ground Surface										
0.0	Silty Clay with Sand										
	Trace of Gravel		1	SS	30						3 15 47 35
			2	SS	31		172				
			3	SS	43	*		50/15 cm			
			4	SS	85/25 cm						
	Brown / Grey		5	SS	28		170				5 32 43 20
	Occasional Cobbles and Boulders		6	SS	33						
	Boulder						168				
166.8	Very Stiff to Hard		7	SS	44						
7.2	Grey		8	SS	34		166				25 37 33 5
	Silty Sand with Gravel to Gravelly Sand		9	SS	36						
	Some Cobbles						164				
	Dense to Very Dense						162				
			10	SS	90/15 cm						59 36 (5)
160.3											
13.7	End of Borehole										

*NOTE: Borehole caved at 6.1 m depth

SHEAR STRENGTH: o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE

$+^3$, $\times^5$: 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 88-78-23 LOCATION Co-ords. N 4 845 573.1; E 294 354.2 ORIGINATED BY D.W.
DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger COMPILED BY D.W.
DATUM Geodetic DATE 82 06 30 CHECKED BY CP.

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
173.6	Ground Surface						
0.0	Silty Clay with Sand	1	SS	24			3 3 44 50
	Trace of Gravel	2	SS	35		172	
		3	SS	91			
		4	SS	110/23 cm	*		
	Brown					170	
	Grey	5	SS	44			12 26 37 25
	Very Stiff to Hard	6	SS	95			
						168	
167.3		7	SS	67/15 cm			
6.3	Grey						
	Silty Sand	8	SS	26		166	4 44 (52)
	Trace of Gravel to Gravelly Sand	9	SS	27		164	
	Some Cobbles						
	Compact to Dense	10	SS	42		162	
161.7							
11.9	Grey (Glacial Till)	11	AS				12 49 29 10
	Silty Clay with excess of Sand and Gravel	12	SS	130/18 cm		160	
158.0	Hard	13	SS	90/15 cm			32 33 29 6
15.6	End of Borehole						

*NOTE: Borehole caved at 5.3 m depth

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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

PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ

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

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

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3

METRIC

W P 88-78-23 LOCATION Co-ords. N 4 845 548.8; E 294 342.0 ORIGINATED BY D.W.

DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY D.W.

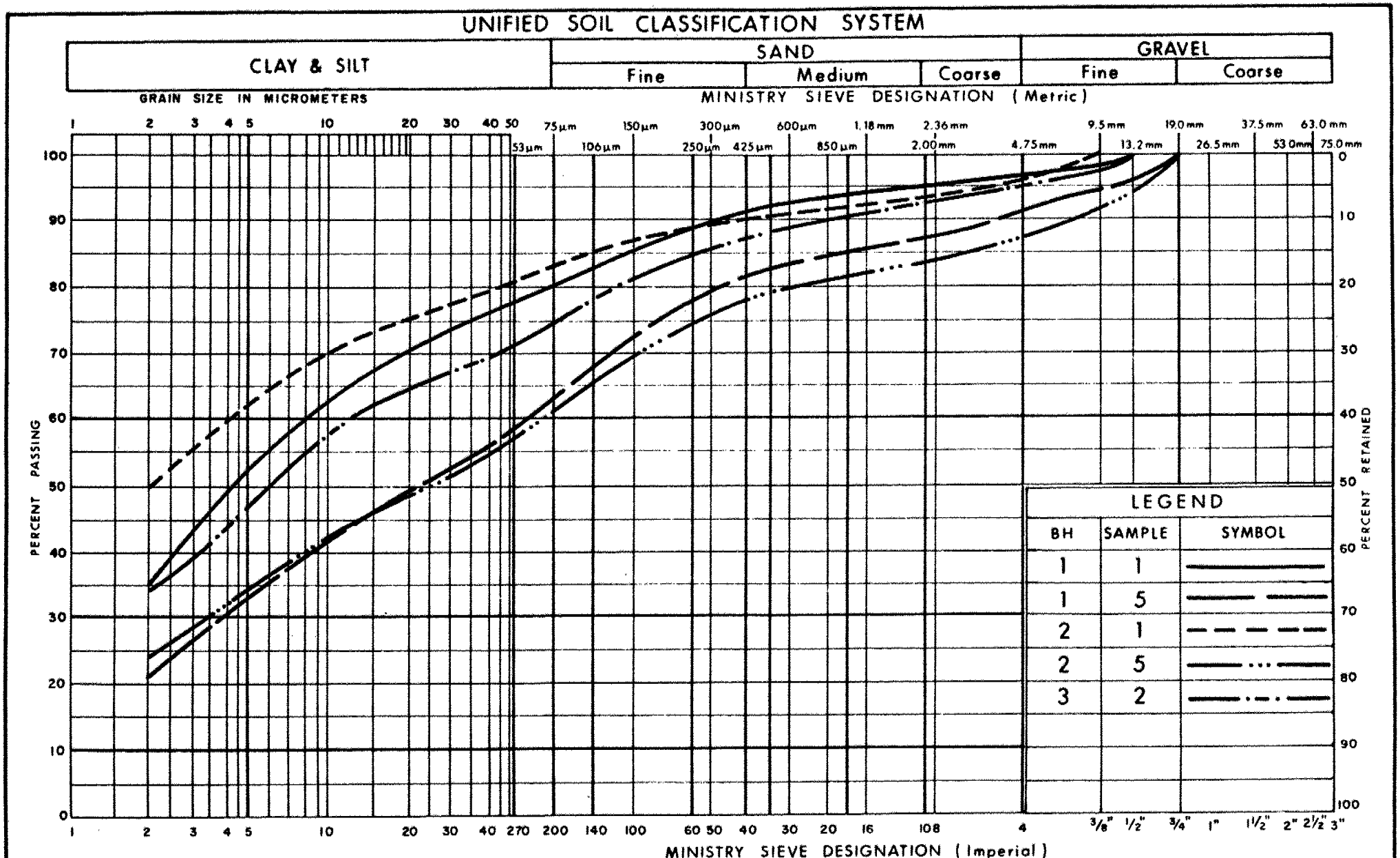
DATUM Geodetic DATE 82 06 30 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o 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
174.3	Ground Surface										
0.0	Silty Clay with Sand						174				
	Trace of Gravel		1	SS	29	*					
			2	SS	22						4 19 42 35
			3	SS	54		172				
	Brown		4	SS	57			50/14 cm			
	Grey		5	SS	36		170				
	Occasional Cobbles and Boulders		6	SS	63						
168.5	V. Stiff to Hard										
5.8	Grey		7	SS	59		168				
	Silty Sand with Gravel to Gravelly Sand						166				
	Some Cobbles		8	SS	33	15 cm					
	Compact to V. Dense		9	SS	16						
							164				
			10	SS	55						
161.8			11	SS	130		162				
12.5	Grey (Glacial Till)										
	Silty Clay with excess of Sand and Gravel		12	SS	50	3 cm	160				
158.9	Hard		13	SS	100	11 cm					
15.4	End of Borehole										

*NOTE: Water level not established

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

20 15 ⊕ 5 10 (%) STRAIN AT FAILURE



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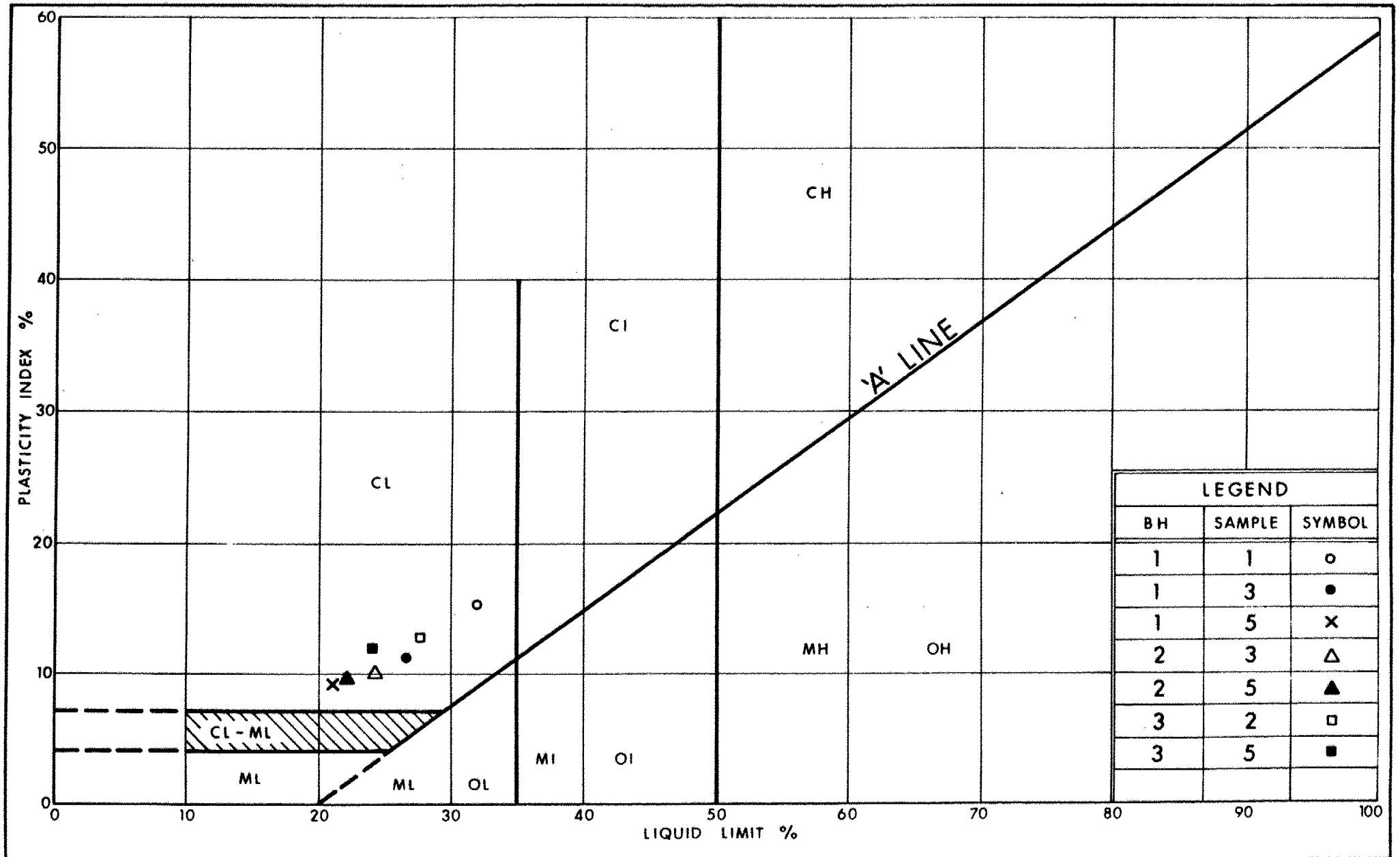
GRAIN SIZE DISTRIBUTION

SILTY CLAY, WITH SAND TRACE OF GRAVEL

FIG No 1

W P 88-78-23

Oct 75, FF-S-21



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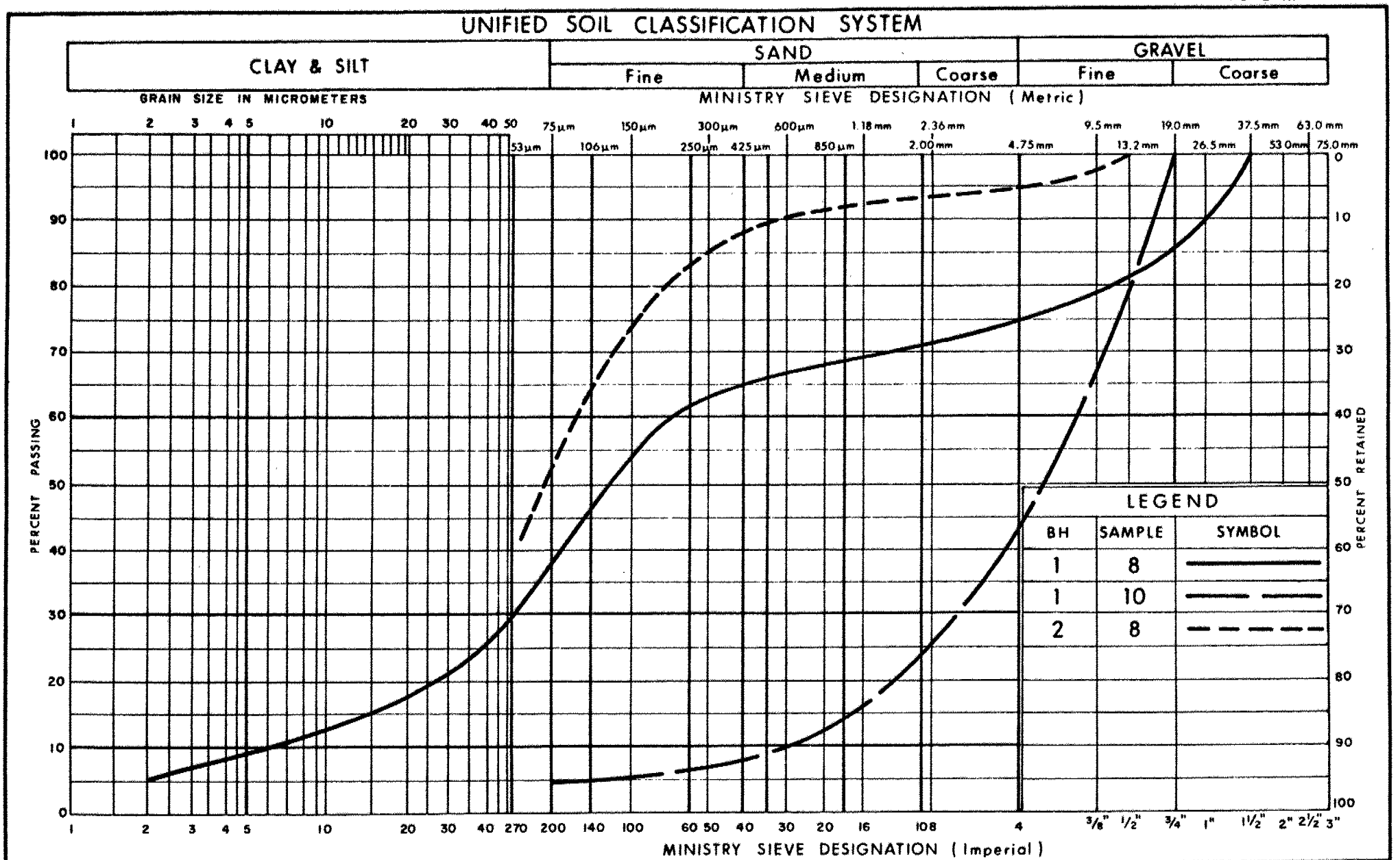
PLASTICITY CHART

SILTY CLAY, WITH SAND TRACE OF GRAVEL

FIG No 2

W P 88-78-23



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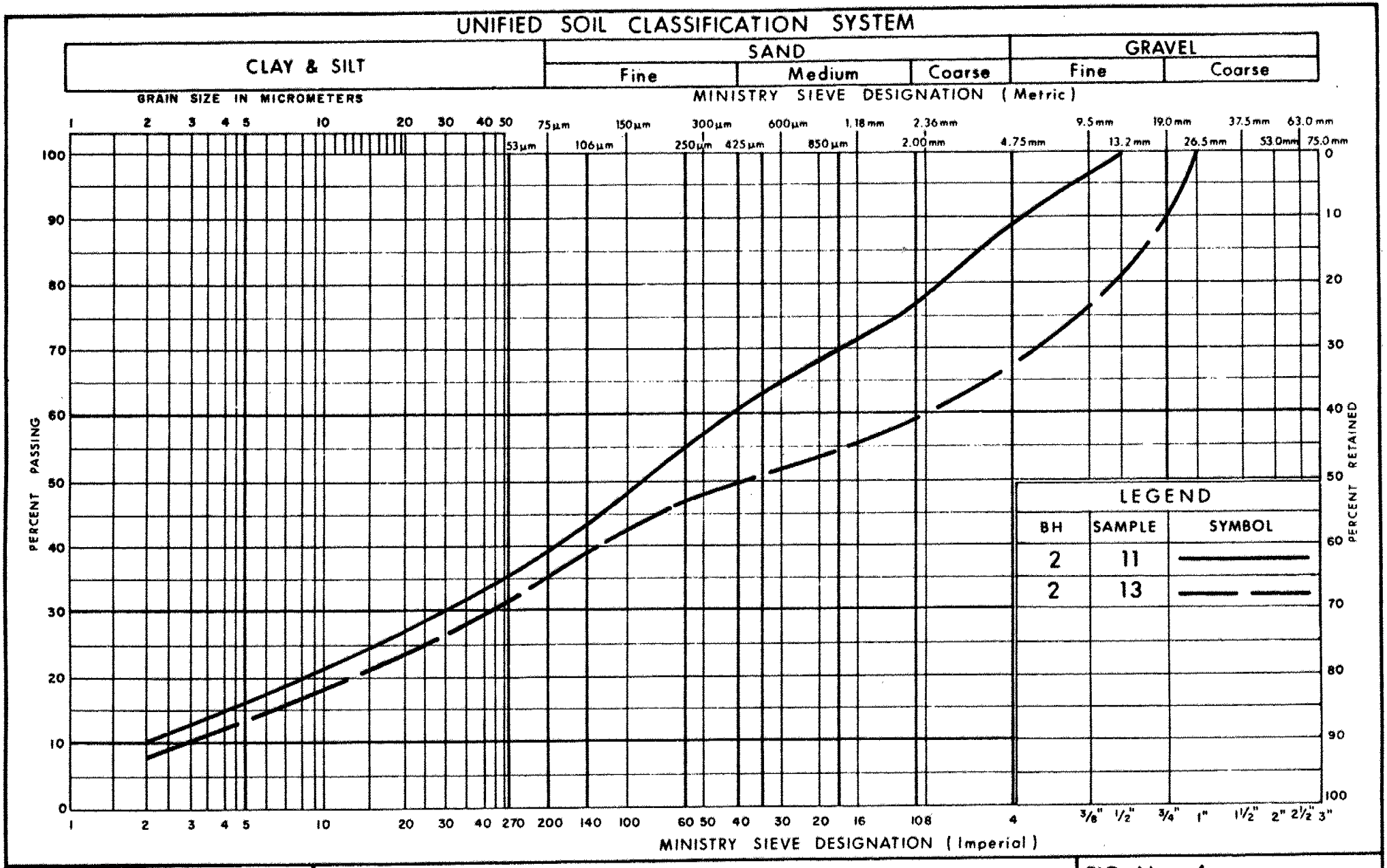
GRAIN SIZE DISTRIBUTION
SILTY SAND WITH GRAVEL TO GRAVELLY SAND

FIG No 3
WP 88-78-23



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GRAIN SIZE DISTRIBUTION
SILTY CLAY WITH EXCESS OF SAND & GRAVEL (Glacial Till)

FIG No 4
WP 88-78-23

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

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

MECHANICAL PROPERTIES OF SOIL

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

PHYSICAL PROPERTIES OF SOIL

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

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

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

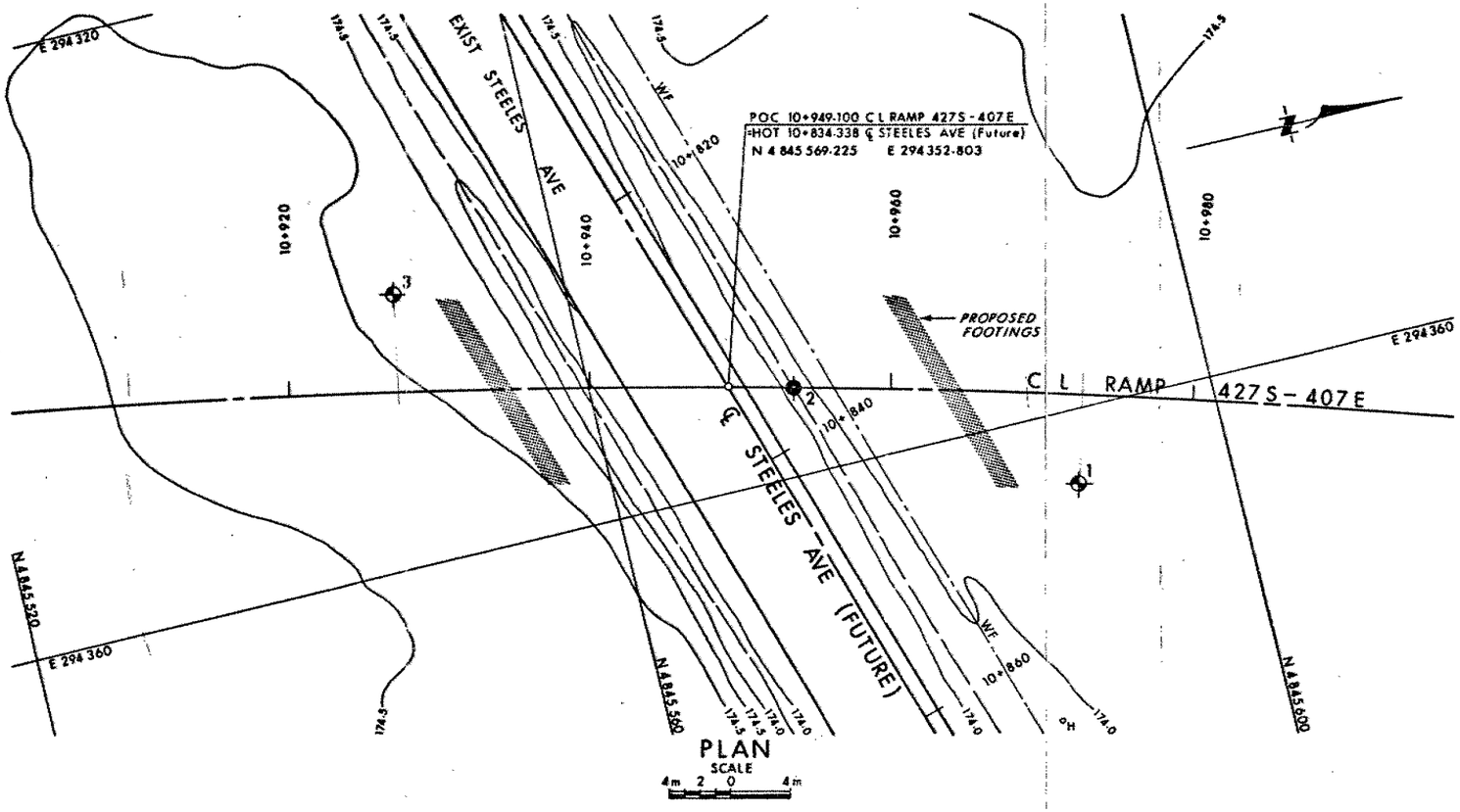
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO PH-0-207 82 04

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

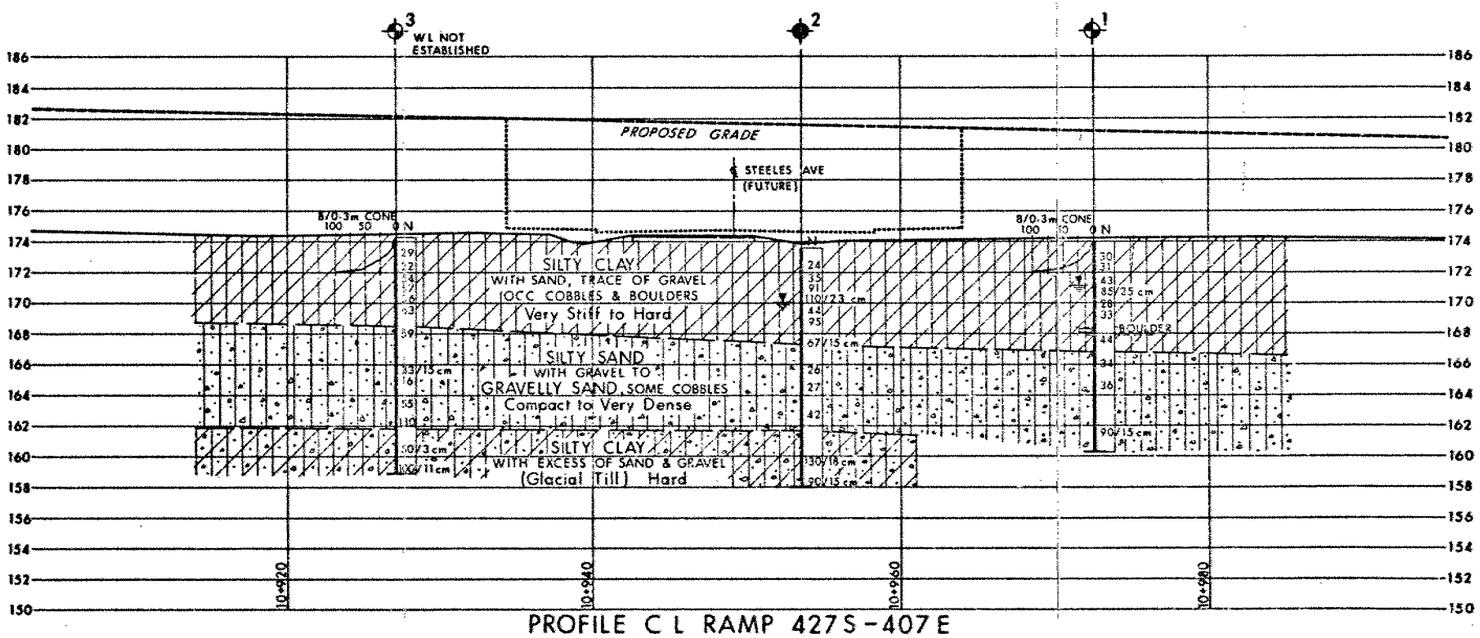
CONT No
WP No 88-78-23

RAMP 427 S - 407 E
OVER STEELES AVE (BRIDGE 13)
BORE HOLE LOCATIONS & SOIL STRATA

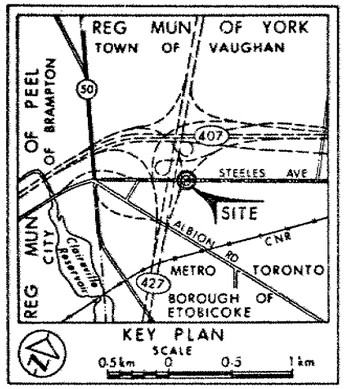
SHEET



PLAN
SCALE
4m 2 0 4m



PROFILE C L RAMP 427S-407E
SCALE
4m 2 0 4m



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N — Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE — Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation 1982 06
  WL Not Established in BH 3

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	174.0	4 845 590.0	294 364.8
2	173.6	4 845 573.1	294 354.2
3	174.3	4 845 548.8	294 342.0

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

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

REGISTERED PROFESSIONAL ENGINEER T J KAZMIEPOWSKI PROVINCE OF ONTARIO

REV	DATE	BY	DESCRIPTION

Geocres No 30M12-169

REF COLE SHERMAN & ASSOC LTD
DWG No 1982-53F ; 1982 08 23

HWY No 427			DIST 6
SUBMITTD TJK	CHECKED	DATE 1982 08 20	SITE 37-1116
DRAWN	CHECKED	APPROVED	DWG 887823-A

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO DR-BR 1962 8-68

DISTRICT No 6
CONT No
WP No 88-78-23

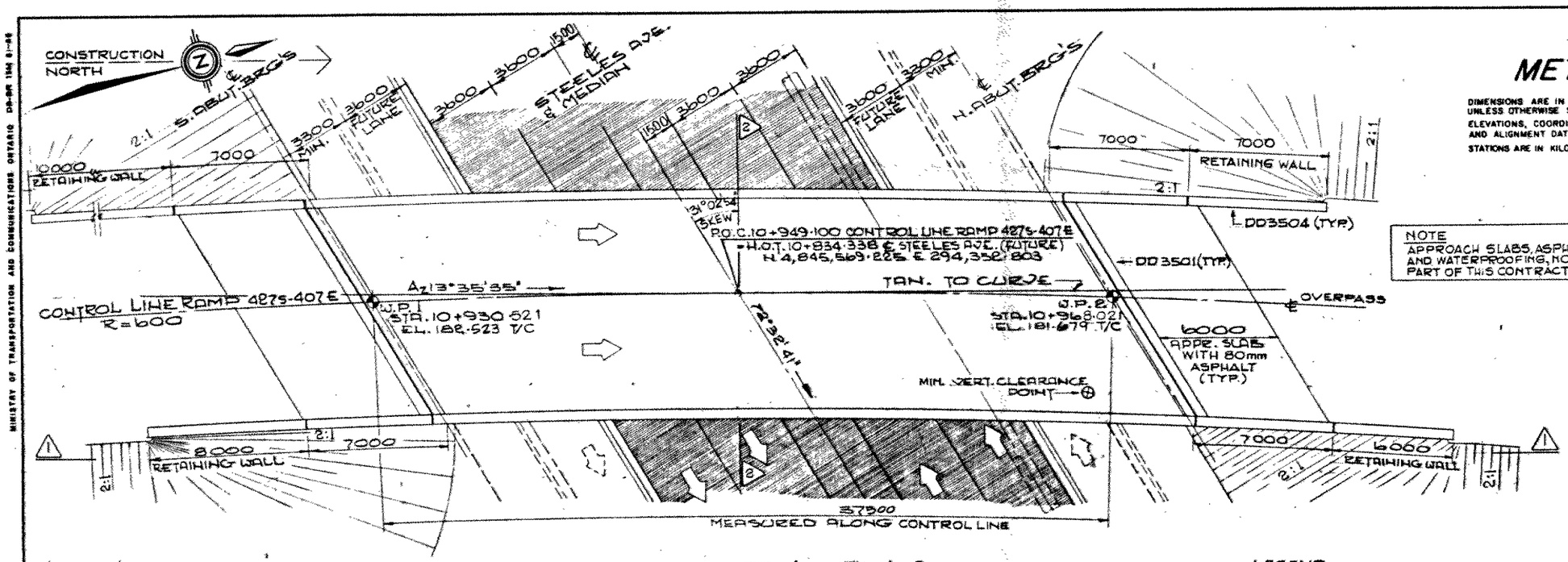
SHEET

RAMP 427S-407E OVERPASS
OVER
STEELES AVENUE
GENERAL ARRANGEMENT

PARKER CONSULTANTS — Consulting Professional Engineers — Hamilton · London · Ottawa

METRIC

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



NOTE
APPROACH SLABS, ASPHALT AND WATERPROOFING, NOT PART OF THIS CONTRACT.

PLAN
SCALE 1:125

LEGEND
W.P. - WORKING POINT
T/C - TOP OF CONCRETE DAM

NOTES

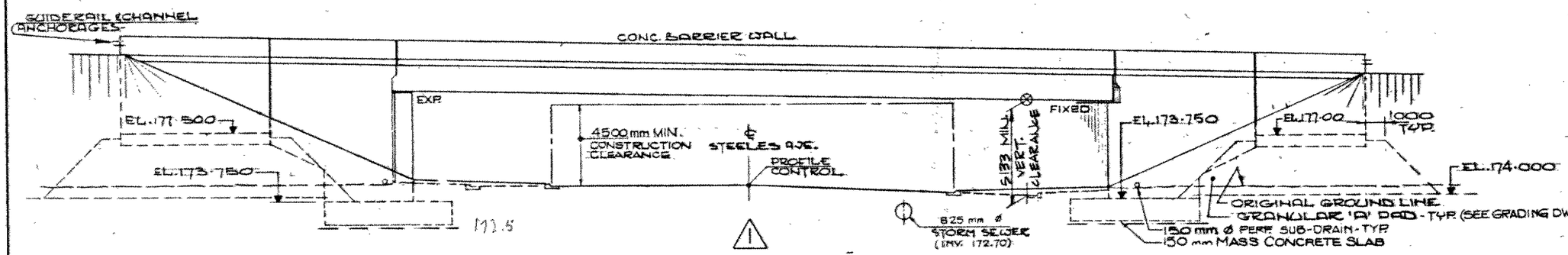
CLASS OF CONCRETE
MASS CONCRETE - 20 MPa
ALL OTHER CONCRETE - 30 MPa

CLEAR COVER TO REINFORCING STEEL

-FOOTINGS		100±25 mm
-ABUTMENTS, WINGWALLS & RETAINING WALLS	FRONT FACE	80±20 mm
	BACK FACE	70±20 mm
-DECK	TOP	70±20 mm
	BOTTOM	40±10 mm
-REMAINDER UNLESS OTHERWISE NOTED		70±20 mm

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

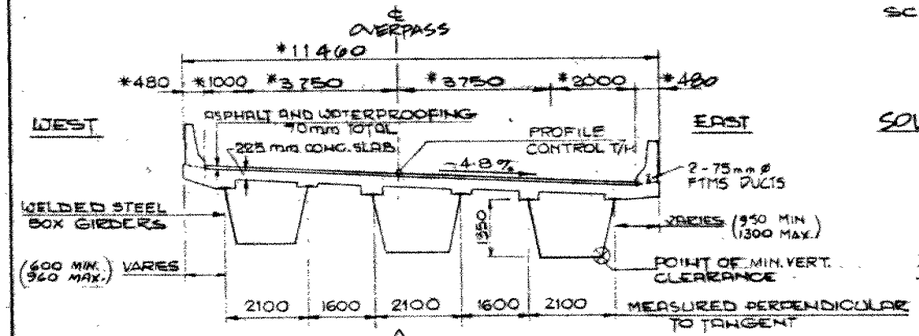
CONSTRUCTION NOTES
- CONCRETE BARRIER WALLS ON RETAINING WALLS SHALL NOT BE CAST UNTILL THE RETAINING WALL BACKFILL HAS BEEN COMPLETED.
- BEARING SEATS SHALL BE FINISHED LEVEL AND TO THE SPECIFIED ELEVATIONS.



SCALE 1:125

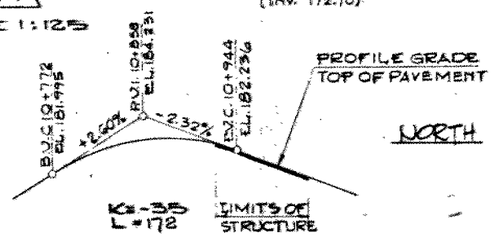
STANDARD DRAWINGS
DD 3501 MINIMUM GRANULAR BACKFILL REQUIREMENTS
DD 3504 RETAINING WALLS BACKFILL
DD 4603 FALSEWORK CLEARANCES
OPSD 508.02 BRIDGE DECK WATERPROOFING

DRAWING LIST
1 GENERAL ARRANGEMENT
2 BOREHOLE LOCATIONS & SOIL STRATA
3 FOOTING LAYOUT AND REINFORCING
4 SOUTH ABUTMENT DETAILS
5 SOUTH ABUTMENT WINGWALL DETAILS
6 NORTH ABUTMENT DETAILS
7 NORTH ABUTMENT WINGWALL DETAILS
8 RETAINING WALL DETAILS
9 STRUCTURAL STEEL DETAILS - I
10 STRUCTURAL STEEL DETAILS - II
11 DECK REINFORCING - I
12 DECK REINFORCING - II
13 WEST BARRIER WALL
14 EAST BARRIER WALL
15 JOINT ANCHORAGE AND ARMOURING
16 6000 mm APPROACH SLAB
17 BRIDGE DATE & SITE NUMBER DATA
18 AS CONSTRUCTED ELEV. & DIM.
19 QUANTITIES - STRUCTURE
20 ELECTRICAL EMBEDDED WORK

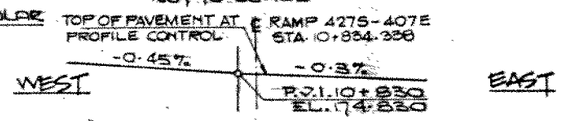


SCALE 1:75

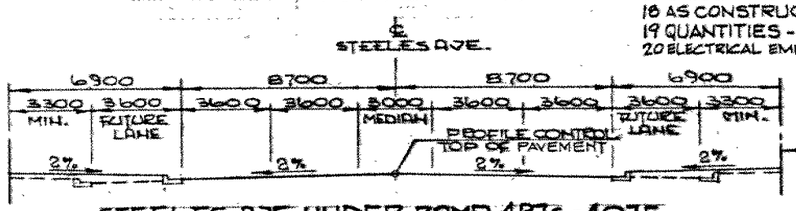
✱ — DENOTES RADIAL DIMENSIONS



PROFILE OF RAMP 427S-407E
NOT TO SCALE



PROFILE OF STEELES AVE.
NOT TO SCALE



STEELES AVE. UNDER RAMP 427S-407E
SCALE 1:125
PERPENDICULAR TO STEELES AVE.

REGISTERED PROFESSIONAL ENGINEER D. C. CRAMM PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J. C. LOW PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN J.C.L.	CHECK J.D.S	LOADING OHBDC-A-83	DATE AUG 88
DRAWING G.S.N.	CHECK J.C.L.	SITE 37-1116	DWG 1

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO OB-BR 1984 01-06

NOTES FOR FOUNDATIONS
PLACE MASS CONCRETE WITHIN 6 HOURS OF EXCAVATION

LEGEND
O.F OUTSIDE FACE
I.F INSIDE FACE
E.S EACH SIDE
T/PTG TOP OF FOOTING

METRIC

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

CONT No
WP No 88-78-23

RAMP 427S-407E OVERPASS OVER STEELES AVENUE
FOOTING LAYOUT AND REINFORCING

SHEET

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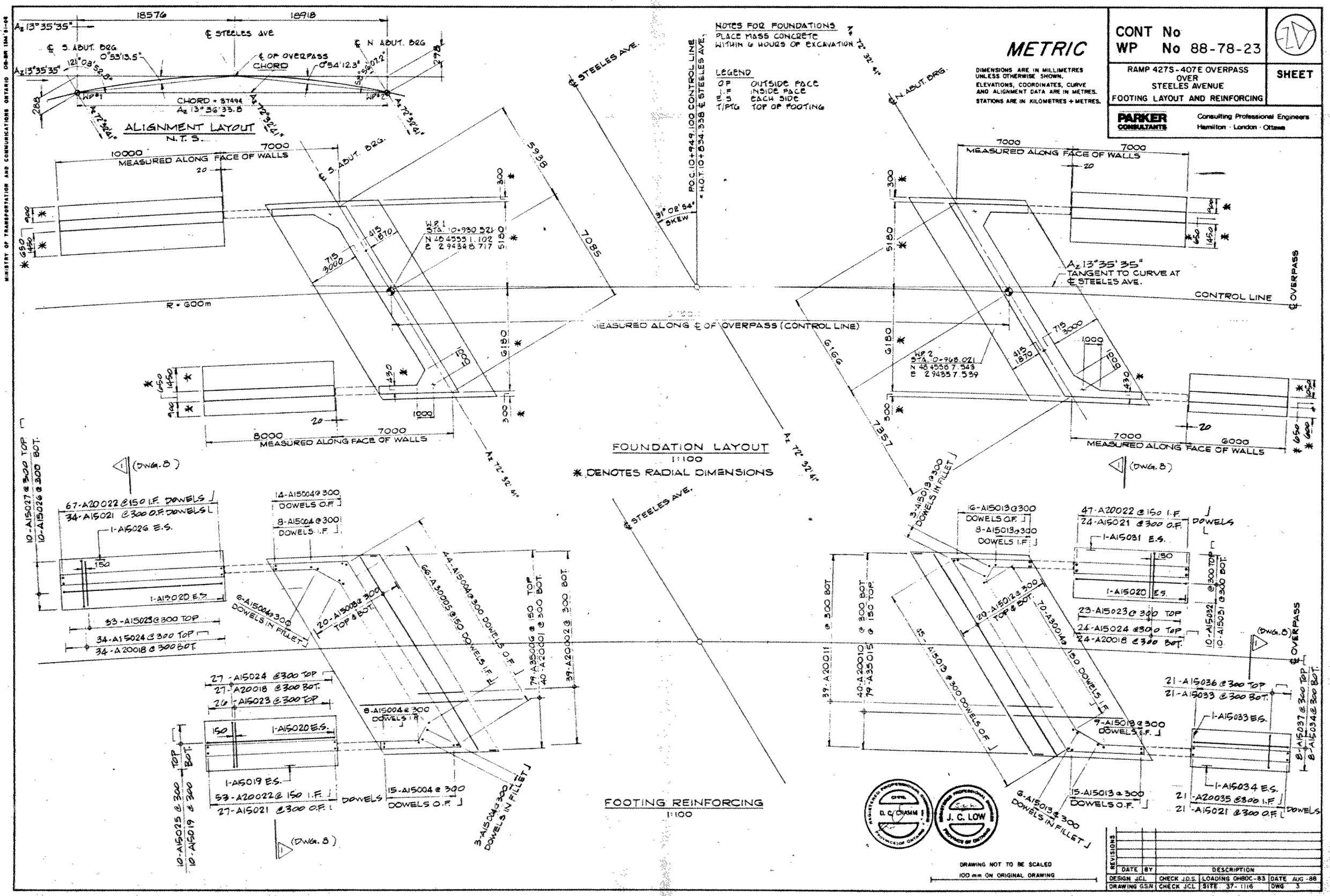

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN JCL	CHECK J.D.S.	LOADING OHBDC-83	DATE AUG-88
DRAWING G.S.N	CHECK JCL	SITE 37-1116	DWG 3

memorandum

Ontario

235-3731

To: G.Al-Bazi
Design Engineer
Structural Office

Date: 88 12 06

Attention: I. Husain

From: Foundation Design Section
Room #315, Central Building

RE: Ramp 4275-407E Underpass over Steeles Avenue
WP 88-78-23, Site 37-1116
Hwy 427/407 IC, District 6, Toronto

We have reviewed the final drawings and documents for the project and have no comment..

D. H. Dundas

DHD:st

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

for

M. Devata, P.Eng.
Chief Foundation Engineer

7540-1318 (10/78)

memorandum

Ontario

To: K. Bassi
Head, Design Section
Structural Section
3501 Dufferin Street

Date: 87 12 23

Atten: G. Al-Bazi, Design Engineer

From: Foundation Design Section
Room 315, Central Building

RE: Ramp 427S-407E Overpass
Over Steeles Avenue
W.P. 88-78-23, Site 37-1116
District 6

Further to your memorandum dated 87 12 09, we have reviewed the preliminary general arrangement drawing No. 37-1116-P1 for the above-mentioned project and have no additional comments at this stage of design.

for T.C. Kim, P. Eng.
Foundations Engineer

c.c. - G.C.E. Burkhardt

memorandum

Ontario

Tel: 3731

To: G.C.E. Burkhardt
Head, Structural Section
5000 Yonge Street

Date: 1987 10 27

Atten: W. Young

From: Foundation Design Section
Room 315, Central Building

RE: Ramp Structure 427S - 407 E O'Pass
at Steeles Avenue Bridge #13
W.P. 88-78-23, Site 87-1116
District 6, Toronto

Further to your memorandum on 87 10 09 with the final geometrics for the ramp structure, this letter summarizes our review on our previous investigation and recommendations for the ramp 427 S - 407 E O'Pass at Steeles Avenue Bridge #13.

Based on the telephone conversation between your W. Young and our T. Kim on 87 10 27, it is understood that a single span structure is proposed to carry 427S-407E ramp over widened Steeles Avenue. It is also understood that the scheme of a two span structure with the middle pier, which is shown on the plan (your Drawing No. E-6078-1), is no longer required for this ramp structure and that the space between North and South abutments across Steeles Avenue is increased from original 29.6 m to 31.2 m as shown on the final geometrics (your Drawing No. E-60784).

Based on the updated bridge site plan for the proposed single span structure, it is our opinion that the original recommendations are still applicable for this ramp structure.

As you are aware, the Foundation Design Section submitted a detailed Foundation Investigation Report for this structure. W.P. 88-78-23, 1982 08 21, which included our recommendations for the single span structure. However, it should be noted that during late 1982, due to the change in span geometry and elimination of skewed abutments, additional review was carried out for this structure. The additional recommendations pertaining to the design and construction of the structure foundations were submitted in our memorandum dated 82 11 09, W.P. 88-78-23. As mentioned in our previous recommendations, the most viable alternative is to construct the abutments on a well compacted Granular 'A' material as per the standard included. For spread footings founded on a Granular 'A' core and constructed as per our standard, the following design parameters can be used:

	Factored Capacity at U.L.S. (kPa)	Allowable Capacity at S.L.S. Type II (kPa)
Spread Footings	900	350

Resistance to sliding of the abutment footings can be calculated assuming a coefficient of friction of 0.7 between the underside of the concrete footing and the Granular 'A' core.

.....2

The Granular 'A' or 'B' backfill to the abutments should be in accordance with Special Provision No. 121 (dated Oct. 1983).

The following parameters are recommended for the granular backfill:

	Granular 'A'	Granular 'B'
Angle of Internal Friction	ϕ = 35°	30°
Unit Weight (kN/m^3)	γ = 22.8	21.2
Coefficient of Active Earth Pressure (K_A)	0.27	0.33
Coefficient of Earth Pressure at Rest (Ko)	0.43	0.5

If the proposed single span structure is a rigid unyielding type, the earth pressure at rest should be used in computing lateral pressures.

The footings should be placed so as to have a minimum earth cover of 1.2 m to allow for frost protection.

Based on our review, it is our opinion that except for the above-mentioned changes, our other previous recommendations are appropirate for your present design purposes.

We believe that this memorandum meets with your present requirements. If you have any questions, please contact us.

Taechul Kim
T.C. Kim, P. Eng.
Project Foundations Engineer

for

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

TCK/MD/mmj

c.c. - R.D. Gunter
A. Wittenberg
J. Smrcka
K. Bassi
J. Klowak
B. Steeves

memorandum

Ontario

To:

Mr. M. Devata
Chief Foundation Eng. - East
Foundation Design Section, Rm 315
Central Building
Downsview

Date:

1987-10-09
Central Region

ATTENTION: T.C. Kim

RE: Hwy. 407/427 Interchange

Ramp 427 S - 407 E W Overpass at Albion Road
W.P. 88-78-21, Site 37-1114

Ramp 407 E W - 427 S Overpass at Albion Road
W.P. 88-78-22, Site 37-1115

Ramp 427 S - 407 E Overpass at Steeles Avenue
W.P. 88-78-23, Site 37-1116

Ramp 407 E - 427 S Overpass at Steeles Avenue
W.P. 88-78-24, Site 37-1117

Ramp 407 E - 427 S Overpass at Hwy. 427 & 407
W.P. 88-78-25, Site 37-1118

Please find attached one copy of updated bridge Site Plans (Final Geometrics) prepared by Cole, Sherman & Associates. We have shown approximate footing locations in red on the plans.

Regional Planning & Design has informed us that the geometrics are unchanged from the most recent plans developed in 1982 - 1983 with the exception of:

a) A decrease of 10 mm in vertical clearance due to the increase in the depth of asphalt and waterproofing from 80 mm to 90 mm. The finished profile has been maintained which therefore increases the total depth of the bridge.

b) Offsets from the edge of pavement to the face of abutments revised to 3.3 m as shown on the plans. Previously, the abutments were set back further from the roadway.

Hopefully, this will have a minor effect on your previously completed investigations.

To clarify matters however, we have the following comments:

i) Site 37-1114 to Site 37-1117

- As a result of b) above, the spans have been reduced by approximately 3.5 m max.

ii) Site 37-1118

This structure was originally planned as a five span bridge. As recommended in your Foundation Investigation Report dated 82-12-06, the structure was lengthened to 7 spans in order to provide 11.5m berms in the approach fills. This was premissed on possible slope instabilities in the 2:1 slopes which consists of 16m± fills for the ramp structure in addition to 7 m ± cuts for Highway 407.

We are still proceeding on the basis of the previously developed 7 span arrangement. However, as mentioned in your memo dated 1983-09-15, the 11.5 m berms may be reduced to 5 m. We may therefore be considering a revision in the span lengths during detailed design.

Please call if you have any questions.

W. Young
Structural Engineer
for:
G.C.E. Burkhardt
Head, Structural Section

WY/jf

attachment

c.c. J. Klowak
B. Steeves
B. Hurd (Cole, Sherman)

memorandum

Ontario

To: Mr. W.L. Lin
Design Engineer (Central)
Design Section
Structural Office
3501 Dufferin St., 4th Floor

Date: 82 11 09

From: Pavement & Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Ramp Structure 427S-407E Over Steeles Avenue
Bridge #13
W.P. 88-78-23, Site 37-80-1116
District 6, Toronto

We have reviewed the preliminary general arrangement drawing for the above-mentioned structure and have noted the change in span geometry and elimination of skewed abutments.

Our comments are as follows:

1) The existing subsoil information is sufficient in scope to encompass the proposed revision, hence no additional field investigation is warranted.

2) For abutment footings located at or below elevation 172.0, an allowable capacity at the S.L.S. Type II of 280 kPa and a factored capacity at the U.L.S. of 700 kPa may be used for design purposes.

3) The base of the footing excavation should be covered with a working slab of lean concrete immediately upon exposure.

Tom Kazmierowski, P. Eng.
Foundations Engineer

TK:syc

cc: G.C.E. Burkhardt